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Dynamics in Online Communities – A Macro Level Investigation of Community Success

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Summary

Various types of online communities, where people meet each other in a virtual space and share their knowledge and experiences, have spread over the internet. The "social revolution" has changed people's way of communication and interaction. It opens up new perspectives for both individuals and organizations. Individuals can easily get access to various sources of information and get into dialogue with others. Operators of online communities earn money through the individuals' presence and activity on these platforms. However, due to the growing number of communities, the competition among these social platforms is steadily increasing. While some communities are successful and sustaining, others disappear from the market.

Prior research has already identified factors that contribute to the success of online communities. However, a comprehensive study of the dynamics between these factors and their effects at different stages of a community life cycle is still missing. Using a unique longitudinal dataset from a number of regional online communities, this thesis examines the interdependence between online community success factors at different life cycle stages and identifies ways to understand and anticipate the evolution of online communities.

Project 1 focuses on the interdependence of community success factors – such as aspects of network structure, community participation, as well as community growth – and examines them over time and community life cycle phases. It addresses the questions whether and which success factors interdepend at all, how they interdepend, and when they interdepend. Drawing from social capital theory and the theory of structuration, a theoretical framework is built and tested by a panel vector autoregressive (PVAR) approach. Results show that, regardless of the communities' life cycle phase, network structure influences participation and vice versa. Especially, positive reciprocal effects between network structure in the form of average degree and different participation variables, such as active interpersonal participation and overall participation, are detected. Results further reveal that all these effects mainly last for several months. Hence, average degree and participation contribute to the guarantee of a lively and successful community. However, network structure in the form of average degree, degree centralization, share of networkers, and network clustering coefficient does not directly influence community growth. Concerning the remaining relationships, a distinction between established and new communities is necessary because the results show that interdependencies between success factors differ over time and community life cycle phase: In addition to the general effects discussed above, in the case of established regions, positive reciprocal effects between the share of networkers and all of the three participation variables, i.e. active interpersonal participation, active platform participation, and overall participation, are detected. Moreover, degree centralization exerts a negative impact on all participation variables. However, this effect is counterbalanced by a positive effect of platform participation and overall participation on degree centralization. In contrast, only the network clustering coefficient exerts no significant effects on participation. Taken together, in established regions, community members should be interconnected and the network should not become too central. Regarding the interdependence between participation and community growth, results show that, in established regions, all participation variables exert a positive impact on community growth. These effects often last for several months. Reversed effects are rather unusual. Hence, community growth can be directly stimulated by participation, which is directly stimulated by average degree and the share of networkers. Finally, community growth has a significant negative influence on average degree and the share of networkers. Thus, positive effects between average degree or the share of networkers, participation, and community growth are counterbalanced. This means that communities do not grow endlessly. In the case of new regions, results reveal – in addition to the already discussed positive reciprocal effects between average degree and participation – a positive influence of degree centralization on all participation variables, which lasts for several months. Moreover, there are even positive reciprocal effects between degree centralization and active platform participation. Other variables representing network structure such as the share of networkers and the network clustering coefficient play a minor role. As a consequence, new regional communities require a central network as opposed to established regions. Further, the network should be dense in the form of average degree. Finally, in new regions, community growth is not affected by participation and there are also no effects between community growth and network structure. Thus, community growth in new regions is neither stimulated by participation nor by network structure. Hence, other factors contributing to community growth in new regions need to be identified. Based on these results, recommendations for community management can be derived regarding the correct focus, application and timing of measures for managing a successful community.

Project 2 sheds light on the diffusion process of online communities. It investigates which factors contribute to the growth of online communities, how these factors influence community growth, and which modelling approaches perform best in explaining and predicting community growth. Using theories from social sciences on diffusion processes and group formation, a theoretical basis is formed and tested by methods from diffusion research and econometrics such as Bass, autoregressive moving average (ARMA), autoregressive distributed lag (ADL), and vector autoregressive (VAR) models. At the same time, these models are evaluated regarding their capability in modelling and predicting community growth in order to identify the most suitable approach. Thereby, all analyses are based on data reflecting the diffusion process of six regional communities since their foundation. The results show that people having already joined a community play a central role in the diffusion process of online communities because of their positive influence on community growth. This finding is confirmed for all regional communities by all models. Moreover, also people making contributions to the community, so-called posters, as well as contributions per se, i.e. participation in general, play a role in the diffusion process: In particular, overall positive effects of the number and the growth rate of posters as well as of the number and the growth rate of contributions, i.e. participation, are detected, although they diminish over time in some instances. However, in most cases effects of participation variables are not significant in contrast to the poster variables, which are significant in all but one instance. Hence, posters play a superior role in explaining community growth than participation in general. Moreover, in some cases significant reciprocal effects between the poster variables and community growth are detected, whereby negative effects of community growth on the number and growth rate of posters serve as counterbalancing effects to the positive effects going out from the poster variables. Furthermore, results reveal that personal selling in the form of a team growth rate does not contribute to the diffusion of online communities because of its mostly insignificant and in two cases negative effects on community growth. Taking these findings together, people having already joined a community as well as posters play a major role in understanding the communities' diffusion process. This is also verified by the results gained from the comparison of Bass, ARMA, ADL, and VAR models regarding their modelling and forecasting performance: ADL models, which examine the influence of people having already joined a community in the form of past new sign-ups and the number or growth rate of posters on community growth, perform by far best. However, for forecasting issues, the model including the growth rate of posters should be preferred.

Additionally, also the ARMA model, which considers only the influence of people having already joined a community out of the variables of interest, produces good forecasts. Finally, the lowest performance is provided by VAR models, especially those including the participation variables. Based on these results, community managers are able to select the most appropriate forecasting tools for a timely anticipation of their communities' future development and to choose ways, which ensure community growth.

In summary, this thesis provides an understanding of the dynamics in online communities with respect to the communities' evolution process and the relationship between success factors of online communities. From a theoretical perspective, it contributes to current research by investigating the effects between various success factors and how these effects differ regarding a community's life cycle. Additionally, it sheds light on the community's evolution process. From a managerial perspective, this thesis supports managers in taking the optimal measures at the right time for achieving the community's goals and in providing them tools which timely inform about the future development of their communities.

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List of Abbreviations

AC	Autocorrelation
ACF	Autocorrelation function
AIC	Akaike Information Criterion
ADF	Augmented Dickey-Fuller
ADL	Autoregressive distributed lag
AR	Autoregressive
ARMA	Autoregressive moving average
dof adj.	Degree of freedom adjusted
e.g.	Exempli gratia (for example)
et al.	Et alii (and others)
etc.	Et cetera (and so on)
GMM	Generalized method of moments
H	Hypothesis
i.e.	Id est (that is)
IRF	Impulse response function
MA	Moving average
MAE	Mean absolute error
n.s.	Not significant
p.	Page
PAC	Partial autocorrelation
PACF	Partial autocorrelation function
Prob	Probability

PVAR	Panel vector autoregressive / autoregression
RMSE	Root mean squared error
RP	Research proposition
SC	Schwarz Information Criterion
S. D.	Standard deviation
S. E. / Std. Error	Standard error
VAR	Vector autoregressive
WOM	Word of mouth

1. Introduction

"*Only engaged and enlisted customers can help us to drive our business goals. Online communities give us the greatest opportunity to engage and enlist.*"

(Lithium 2012b, p. 3)

The technological development, that has taken place during the past years, opens up new ways of communication and interaction between the members of our society. Together with the increasing digitalization, people's behavior and lifestyle change. Daily life often takes place in front of the computer or smartphone screen. Individuals transfer more and more activities from the offline to the online world. They meet and interact in virtual communities, make new friends, exchange ideas and knowledge, etc. (Preece 2000). Latest figures show that in 2012 the number of worldwide social network users added up to 1.41 billion users and is estimated to exceed the 2.00 billion mark in 2016 (eMarketer 2013). Moreover, nearly half of the internet users spend more than one hour per day on social media sites, while 18% spend even more than three hours per day on such sites (GlobalWebIndex 2014).

To this day, various types of online communities have spread over the internet. There are communities for hobby gardeners, computer enthusiasts, sick people or leisure activities – just to name a few of them (Armstrong and Hagel 1996). Moreover, social platforms like Facebook, Twitter, Pinterest, Tumblr, Google+ constantly emerge and have become increasingly popular during the last years (GlobalWebIndex 2013a, 2013b). Hence, new business areas such as the provision of online communities gain more and more importance. Most of these community firms earn their money through advertising revenues, which are generated as a result of the community users' presence and actions on the community sites (Trusov, Bodapati, and Bucklin 2010).

As a consequence of the "social revolution" (Lithium 2011c, p. 7), also companies across all industries have to find new ways to get in contact with their customers. Thereby, the communication between a company and its customers changes more and more from a one way to a two way communication, from which both parties can profit (Lithium 2011c). Through social platforms such as online brand communities, customers enter into a dialogue with their brand instead of only passively consuming traditional advertising. They talk about their experience with the brand, help each other by solving problems, and expect support through the community. Companies can profit from this development in various ways: They can save costs, enhance sales, and benefit from satisfied and loyal customers (Algesheimer and Dholakia 2006; Algesheimer, Dholakia, and Herrmann 2005; Armstrong and Hagel 1996; Lithium 2011b; Stephen and Galak 2012).

Regardless of whether a community is designed to manage customer relationships or to earn money with the provision of a community, all communities share a common need: They must be successful and healthy in order to persist and fulfill their goals. Success factors for online communities are discussed from many perspectives. From business practice, Lithium, a leading provider for online brand community platforms (Forrester 2010), emphasizes the need for the calculation of community performance metrics such as membership growth or the number of posts in order to measure community health and success (Lithium 2011b, 2011c, 2012a). Furthermore, Lithium (2011a) views social network analysis, which helps to detect the characteristics of a network, as an important tool for competing successfully in the market.

From an academic point of view, research provides a vast body of literature on the success of online communities (e.g. Cothrel 2000; Cothrel and Williams 1999; Iriberri and Leroy 2009; Leimeister, Sidiras, and Krcmar 2006; Lin 2008; Preece 2001; Toral et al. 2009; Williams and Cothrel 2000; see also Chapter 2.2). Despite various factors influencing the success of an online community, community operators can control most of these. Especially the analysis of community size or growth, participation behavior, and social network analysis take an essential part (e.g. Cothrel and Williams 1999; Iriberri and Leroy 2009; Seraj 2012; Toral et al. 2009; Trusov, Bodapati, and Bucklin 2010; Williams and Cothrel 2000). However, existing studies on community success are rather static in nature and focus predominantly on the identification of success factors (e.g. Leimeister, Sidiras, and Krcmar 2006; Lin 2008; Preece 2001). Although researchers emphasize the dynamics in the evolution of communities and in the communities' needs (Andrews 2002; Hagel and Armstrong 1997; Iriberri and Leroy 2009; Toder-Alon, Berger, and Weinberg 2010), a comprehensive investigation of the dynamics between success factors and their effects at different stages of a community life cycle is still missing.

The present thesis closes this gap by providing detailed analyses of the interrelationship between success factors of online communities in general and across community life cycle phases. Furthermore, this thesis focuses on the dynamic investigation and prediction of the evolution of online communities. Drawing from a unique dataset of a number of online communities this thesis offers a comprehensive macro level view on community dynamics. Hence, the present thesis contributes to existing research and practice in various ways:

First, building on social capital theory (e.g. Bourdieu 1986; Coleman 1988) and the theory of structuration (Giddens 1984), this thesis is the first to examine the interdependence between online community success factors over time and across community life cycle phases. Thereby the thesis follows the claim of Iriberri and Leroy (2009, p. 25), who note that "future research should focus on the dynamic nature of online communities and test [...] whether the order [...] in which factors should be implemented leads to more or less success, and if and how these factors interact to promote success." Although community success factors are widely discussed and are in the mind of researchers and practitioners (e.g. Cothrel 2000; Leimeister, Sidiras, and Krcmar 2006; Lin 2008; Lithium 2011b; Preece 2001; Williams and Cothrel 2000), a comprehensive dynamic investigation is still missing. Therefore, this thesis uncovers whether and which success factors interdepend at all, how they interdepend, and when they interdepend. Thus, recommendations for community management can be derived regarding the correct focus on and timing of measures for managing a successful community.

Second, this thesis is unique in the way it sheds light on the diffusion process of online communities. Although research is aware of the dynamic process of community evolution (e.g. Andrews 2002; Hagel and Armstrong 1997; Iriberri and Leroy 2009; Toder-Alon, Berger, and Weinberg 2010), a broader understanding of methods and factors contributing to the explication and prediction of community growth is still missing. This is also pointed out by Toder-Alon, Berger, and Weinberg (2010, p. 33), who recognize that "a challenge for practitioners in building successful virtual communities has been understanding the dynamics of an online community with respect to growth, and [...] predicting the potential equity of an electronic community." The present thesis closes this gap by applying different techniques from diffusion research and econometric time series analysis on modeling and predicting community diffusion processes. Using theories from social sciences on diffusion processes and group formation, factors contributing to community growth are identified. Further, this thesis supports community managers by selecting the most appropriate forecasting tools for a timely anticipation of their community's future development and by showing them ways to ensure community growth.

The thesis proceeds as illustrated in Figure 1. After this introduction, Chapter 2 outlines the conceptual basis underlying the thesis. Thereby, I present a definition of online communities, describe community types, expose factors for ensuring online community success, and provide an overview of current research on this field. Chapters 3 and 4 include the two empirical projects of this thesis. Each project starts with an introduction, which is followed by the presentation of the theoretical background. Then, data and methodology are described. After the presentation of results, I close both chapters with a discussion of findings gained through the respective project. Finally, Chapter 5 combines the key findings of both projects, demonstrates theoretical and managerial implications in a general discussion, and concludes the thesis with an outlook on further research.

Figure 1 Structure of the Thesis

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2. Conceptual Basis

In the following chapter, I give a brief introduction into the terminology of online communities and related terms. Then, current knowledge about factors leading to community success is discussed.

2.1. Definition and Types of Online Communities

Literature comes with various definitions of the term "online community". According to Preece (2000, p. 10) "an online community consists of:

- *People*, who interact socially as they strive to satisfy their own needs or perform special roles, such as leading or moderating.
- A shared *purpose*, such as an interest, need, information exchange, or service that provides a reason for the community.
- *Policies*, in the form of tacit assumptions, rituals, protocols, rules, and laws that guide people's interactions.
- *Computer systems*, to support and mediate social interaction and facilitate a sense of togetherness."

This definition combines the two main perspectives of online communities: the social view expressed through *people*, *purpose*, and *policies* as well as a more technological view expressed through *computer systems*. In a similar way, Lithium (2011b, p. 3), a leading provider for online brand community platforms, considers that "an online community is at once both a technology platform and a group of people working together for a common goal". This definition also clearly reflects both the technological and the social component. Besides the term online community, research often also reverts to the term "virtual community", which is linked to social and technological aspects as well. According to Rheingold (1993, p. 5) "virtual communities are social aggregations that emerge from the Net when enough people carry on those public discussions long enough, with sufficient human feeling, to form webs of personal relationships in cyberspace". Moreover, in the context of online and virtual communities, sometimes also the term social network site is used. However, this notion is more focused on the relationships between people as becomes clear from Trusov, Bucklin, and Pauwels (2009, p. 92): "Typical social networking sites allow a user to build and maintain a network of friends for social or professional interaction." Similarly, Boyd and Ellison (2007, p. 211) "define social network sites as web-based service that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system". Hence, these definitions show that social networking sites represent a subarea of online or virtual communities, but online or virtual communities are more than just social networking sites.

Conforming to the definition of online communities presented above, the idea of communities in general owes its origins in sociological research and has been associated with technology since the period between the 1960s and 1980s, when new technologies enabled the formation of the first communities in an online environment (Armstrong and Hagel 1996; Preece 2001; Wellman et al. 1996). From this time, various community types such as simple mailing lists, Usenet newsgroups, or chat groups have emerged (Preece 2001; Wellman et al. 1996). Armstrong and Hagel (1996) for example distinguish between communities of transaction, interest, fantasy, and relationship, which can all coincide and cover a broad area. Thereby, communities of transaction are designed for the trade of goods or services and the provision of information regarding these subjects. Communities of interest are created for the exchange of information about certain topics such as cooking and gardening, for instance. Communities of fantasy, such as Second Life®, enable the formation of a fictional environment. Finally, communities of relationship create the conditions for the establishment of strong personal relationships in connecting people sharing similar experiences.

2.2. Success Factors of Online Communities – Current Knowledge

As the previous discussion already suggests, the field of online communities is broad. This is also reflected in the various perspectives on community success. In general, a community is successful if its objectives are met (Cothrel 2000). Nevertheless, both empirical and conceptual studies try to identify concrete requirements or factors, which describe or lead to the success of an online community. Table 1 provides an overview of relevant literature on this field.

Similar to the definition of online or virtual communities (e.g. Lithium 2011b; Preece 2000; Rheingold 1993), social and technological aspects, such as the amount of user-generated content, attraction of new members, relationships among community members, trustworthiness or ease of use and system stability, take a central role in literature on community success (e.g. Chen 2013; Iriberri and Leroy 2009; Leimeister, Sidiras, and Krcmar 2006; Lin 2008; Preece 2001). In addition to that, Bughin and Hagel (2000) as well as Cothrel (2000) bring a more managerial perspective on community success into play by emphasizing the importance of the community’s financial performance.

Preece (2001), one of the most often cited authors in the context of community success, builds a conceptual framework of community success by focusing on aspects of both sociability and usability. Thereby, similar to her definition of online communities (Preece 2000) sociability refers to the community’s *purpose*, *people*, and *policy*. For example, the amount of activity or the engagement of community members indicates whether the purpose of a community is met. Further, the role of people in determining community success can be reflected in the number of community members. Finally, for example the amount of violations against the community’s policies indicates the respect or non-respect of rules and policies, which constitute another basic requirement for community success. In contrast, usability refers to *dialogue and social support*, *information design*, *navigation*, and *access*. Hence, in order to be successful, the community platform should be easy to use and avoid errors of technical nature.

Furthermore, Lithium (2012a) focuses more on the aspect of sociability in characterizing community health. According to the experiences of Lithium (2012a) in management practice, healthy and successful communities require a growing number of members, enough and useful content, traffic, short response times, many users involved in topic interaction, a lively community characterized by a high number of posts, and finally trust and respectful interaction among members. Similarly, also Cothrel (2000) emphasizes the importance of community health – besides ROI and topic measures – for the measurement of community success. Furthermore, Williams and Cothrel (2000) identify 1) member development in the form of achieving a critical mass of members, 2) asset management by facilitating the creation of content and providing a good technological infrastructure, as well as 3) relations among members as important factors for a successful and sustaining community. These aspects are also treated in a study of Toral et al. (2009), who detect a positive influence of network cohesion, core users, and community composition regarding member types on community success, which is represented by community size and activity.

In summary, all these studies treat community success from a rather static point of view. Since communities are dynamic and evolving (Iriberri and Leroy 2009), also community success should be regarded from a dynamic perspective. In accordance with this view, Toder-Alon, Berger, and Weinberg (2010) claim for a dynamic investigation of community success factors such as membership size or activity in order to identify possible interdependencies between these variables. Similarly, Iriberri and Leroy (2009) propose a community life cycle model, according to which community success factors are identified. While they think that it is important to attract members and to ensure the creation of content or trust at the growth stage, for example, they belief that it is important to focus on the organization of events and the establishment of a reward system at the maturity stage in order to compete successfully. Additionally, Iriberri and Leroy (2009) claim for a comprehensive investigation of community success factors by taking into account the dynamic relationships between these factors and their effects at different life cycle stages.

The following two empirical projects try to fill this gap by focusing on the most often cited success factors such as members or community growth and content provision in the form of activity or participation (see Table 1). Furthermore, since online communities are by definition a social phenomenon (e.g. Preece 2000; Rheingold 1993) and network effects play an important role in the context of online communities (e.g. Katona, Zubcsek, and Sarvary 2011; Trusov, Bodapati, and Bucklin 2010; Wasko and Faraj 2005), also the relationships between community members are often mentioned in determining community success (e.g. Hinds and Lee 2008; Iriberri and Leroy 2009; Kraut and Resnick 2011; Leimeister, Sidiras, and Krcmar 2006; Seraj 2012; Toral et al. 2009; Williams and Cothrel 2000). Therefore, this thesis additionally includes various forms of social network structure into the dynamic investigation of community success factors.

Table 1 Review of Relevant Literature on Online Community Success Factors

Study	Type of Study	Success Factors
Bughin and Hagel (2000)	empirical	Cost-effectiveness; member acquisition and retention
Casaló, Flavián, and Guinalíu (2013)	empirical	Perceived reciprocity and similarity; new members' integration; satisfaction; participation
Chan et al. (2004)	empirical	Identification; expertise; tangible recognition; self-esteem; self-efficacy; sense of obligation; sense of community; participation
Chen (2013)	empirical	Social presence; ease of use; extroversion; enjoyment; site access; site use; internet risk perception, privacy abuse concern, and perceived risk as inhibitors of success
Cothrel (2000)	conceptual	In general success depends on the business goals to be defined; measurement of community ROI, health, and insight
Cothrel and Williams (1999)	empirical	Amount and quality of participation
Ginsburg and Weisband (2004)	empirical	Trust; reputation; identity; economic infrastructure; member acquisition and retention
Hinds and Lee (2008)	conceptual/empirical	Social network structure
Iriberri and Leroy (2009)	conceptual	Success factors depend on the community's life cycle stage; At the inception stage: purpose, focus, codes of conduct, trademark, funding/revenue sources; At the creation stage: user-centered design and evolution, interface usability, security and privacy, anonymity, identity persistence, reliability, performance; At the growth stage: attracting members, growth management, integration of new members, up-to-date content, content quality, interaction support, trust building, neutrality/non-partisan offers, reaching critical mass, transparency, personalization of portal, personalization of offers, offline events and meetings; At the maturity stage: regular online events, sales and offers, user tools, permeated management and control, recognition of contributions, subgroup management, recognition of loyalty, member satisfaction management
Koh and Kim (2004)	empirical	Knowledge sharing activity; member-initiated community promotion (e.g. WOM); loyalty
Kraut and Resnick (2011)	conceptual	Content; attracting and socializing new members; encouraging members' commitment and contribution; rules and policies
Leimeister, Sidiras, and Krcmar (2006)	empirical	Technical performance; security; content; privacy; moderate intervention in community life; limited number of real-life events; integration of members into decision regarding community layout and functionalities; facilitate the formation of a network among members and provide status symbols
Lin (2008)	empirical	Information quality; system quality; trust; member satisfaction; sense of belonging; member loyalty
Lin and Lee (2006)	empirical	Information quality; system quality; service quality; user satisfaction; behavioral intention; member loyalty
Lithium (2012a)	conceptual	Community growth; content; traffic; responsiveness; topic interaction; liveliness; trust; civil behavior
Ma and Agarwal (2007)	empirical	Virtual co-presence; persitent labeling; self-presentation; deep profiling; perceived identity verification; satisfaction; knowledge contribution
Preece (2001)	conceptual	Purpose; people; policy; dialogue and social support; information design; navigation; access
Rothaermel and Sugiyama (2001)	conceptual	Membership size and level of site management as both promoters and inhibitors of success
Seraj (2012)	empirical	Co-creation of knowledge; content quality; platform interactivity through social ties; self-governed community culture
Toder-Alon, Berger, and Weinberg (2010)	conceptual	Dynamics in membership size, activity/interaction, content quality, and motivation
Toral et al. (2009)	empirical	Network cohesion; core of the community; community composition regarding member types; community size; activity
Trusov, Bodapti, and Bucklin (2010)	empirical	Community size; activity
Williams and Cothrel (2000)	conceptual	Member development; asset management; community relations

3. Interdependence of Online Community Success Factors – Evidence from Panel VAR

3.1. Introduction

Although Facebook still occupies a strong position in the social media market (GlobalWebIndex 2013a), the trend shows that new platforms emerge continuously, whereas other platforms disappear. Some communities are successful, some communities fail (Ma and Agarwal 2007; Seraj 2012). While at the end of the year 2012 Twitter is counting among the fastest growing platforms (GlobalWebIndex 2013b), in 2013 Pinterest and also Tumblr have reached the top (GlobalWebIndex 2013a). In contrast, previously successful (comScore 2007), the German social community studiVZ has faced a steady decline for the last years (GlobalWebIndex 2013b). All these facts reflect the dynamic environment, in which online community operators act. Once entered the market, social platforms face a permanent competition. Since the market for social media is still growing and new online communities constantly emerge (Nielsen 2012), community providers need to strengthen their position in order to compete successfully. As online communities live on their members, one of the most important goals of communities is to be followed by a certain amount of members in order to remain attractive and to keep the community alive (Iriberri and Leroy 2009; Preece 2000). Community growth and an active community constitute the key for a healthy and successful community (e.g. Bughin and Hagel 2000; Iriberri and Leroy 2009; Lithium 2012a; Preece 2001; Seraj 2012; Trusov, Bodapati, and Bucklin 2010; Williams and Cothrel 2000). Further, many authors stress also the importance of relationships within the discussion of community success (e.g. Hinds and Lee 2008; Iriberri and Leroy 2009; Kraut and Resnick 2011; Leimeister, Sidiras, and Krcmar 2006; Seraj 2012; Toral et al. 2009; Williams and Cothrel 2000). Hence, community growth, activity or participation, and network structure are of particular interest in the context of community success.

A few studies empirically address the relationship between these variables. Toral et al. (2009) measure community success in the form of community size, number of active developers, and number of threads. Through structural equation modelling they identify network cohesion as antecedent of community success. Further, Butler (2001) detects a positive influence of communication activity on community growth in a study on mailing lists. Although these studies investigate effects between success factors, a comprehensive analysis of the interplay of success factors over time is still missing (Iriberri and Leroy 2009; Toder-Alon, Berger, and Weinberg 2010). It is unclear whether each success factor can be maximized independently from the other factors or whether the factors should be considered simultaneously. Further, insights about the interdependence of success factors along different life cycle phases are still missing. It is unknown whether each life cycle phase requires different efforts for ensuring community success. Especially for community management, it is important to understand how community growth and different types of participation can be enhanced and which consequences result from an enhancement of these variables. Additionally, community managers need to know how network structure must look like in order to facilitate community success. They must also be aware of whether all communities can be managed similarly or whether established and new communities require different efforts. In view of the above, this research project is the first to investigate the interdependence of network structure, community participation, and community growth over time and community life cycle phases. In this way, valuable propositions for a successful community management are derived. Drawing from social capital theory and Giddens' (1984) theory of structuration the present project elaborates a framework of the interplay of online community success factors.

This project contributes to marketing literature in different ways. First, I analyze the interdependence of online community success factors regarding community growth, participation, and network structure on a macro level. Thereby I examine data of 13 regional online communities over a time span of up to 45 months by the help of Panel Vector Autoregression (PVAR). This method considers all variables of interest as endogenous and allows a simultaneous analysis of the different communities. Through the integration and investigation of various variables for participation and network structure, precise recommendations for action can be provided to community management in order to ensure the communities' success. Finally, I distinguish between established and new regional communities in order to identify different effects depending on the communities' life cycle phase.

The project is organized as follows: First, the theoretical background is provided. After the description of data and methodology, the results of the project are presented. Then, results are summarized and theoretical as well as managerial implications are drawn. I close with directions for further research.

3.2. Theoretical Background

3.2.1. Social Networks

Algesheimer and Wangenheim (2006) emphasize the importance of social network effects when studying the behavior of customers. Against this background, many studies show that social networks influence the individuals' behavior (e.g. Katona, Zubcsek, and Sarvary 2011; Nitzan and Libai 2011; Wasko and Faraj 2005). Social networks draw an image of social relations between individuals. According to Barnes (1954, p. 43) a network constitutes "a set of points some of which are joined by lines". In this context, points represent people or groups and lines show which people are interrelated, for example, through friendship, work or other social relations. In a similar way, Wasserman and Faust (1994, p. 20) describe social networks as "a finite set or sets of actors and the relation or relations defined on them". In online communities, relationships between people are often manifested in so called "friends lists", through which users announce with whom they are connected or with whom they are "friends". Thereby, online communities offer some important insights into the social networks of people.

3.2.2. Social Capital Theory

Definition and Characteristics of Social Capital

Social network analysis is closely related to social capital theory because social capital theory explains the value arising from social networks. This is apparent in various definitions of social capital. Bourdieu (1986, p. 248) defines social capital as "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition". Coleman (1988, p. S98) uses the following definition: "Social capital is defined by its function. It is not a single entity but a variety of different entities, with two elements in common: they all consist of some aspect of social structures, and they facilitate certain actions of actors – whether persons or corporate actors – within the structure." Finally, Nahapiet and Ghoshal (1998, p. 243) describe "social capital as the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit". All these definitions focus on social relationships as a prerequisite for the development of social capital and they underline the value of social structures. This value appears, for example, in the fact that network members have access to diverse sources of information through the connections to other individuals.

Moreover, Coleman (1988) states that social capital is not present in the individuals themselves, but in the relationships between individuals. Thus, according to Burt (1992) social capital is not in possession of a single individual, it is in joint possession of all parties of a relationship. If one retires, then social capital is lost. Therefore, it is also difficult to transfer social capital from one entity to another (Nahapiet and Ghoshal 1998). Additionally, it is not possible to enhance social capital endlessly by continuously adding individuals to the network because at the same time the costs of maintaining relationships increase with network size (Nahapiet and Ghoshal 1998). Thus, some limits may occur.

Further, authors agree that relationships serve as a basis for social action (Bourdieu 1986; Coleman 1988; Nahapiet and Ghoshal 1998). Burt (2000) even states that people having better relationships perform better: Imagine for example two competing teams where all team members have the same skills. Although equipped with the same abilities, the team which has better and more trustful relationships within and beyond the team will be more successful because they can trust each other and have access to various sources of information.

Three Dimensions of Social Capital

In addition to the above mentioned characteristics, Nahapiet and Ghoshal (1998) propose a detailed view of social capital. They distinguish between a structural, a relational, and a cognitive dimension of social capital, which are all tremendously coherent.

The structural dimension describes the pattern of the linkages between individuals or social units. In this context it is very important how the network appears. This means for example: where are connections between network members, where are no connections, or which picture do the ties show concerning network measures such as density, connectedness, and hierarchy (Krackhardt 1994; Wasserman and Faust 1994).

In contrast, the relational dimension focuses on the type of relationship between individuals or social units. Especially trust and trustworthiness, norms, expectations, and identification play a decisive role for the type of relationship (Burt 1992; Coleman 1988; Granovetter 1985; Merton 1968; Putnam 1993). The difference between the structural and the relational dimension of social capital becomes clear from the following example: Two individuals having the same position in a network, i.e. similar structural dimension of social capital, and faced with the same decision whether to leave their environment (e.g. work, town, etc.) or not, may decide differently because of the different kinds of relationships towards their network members. One would decide to stay because of the strong and trustworthy relations to other network members. The other one having no deep relations towards other network members would decide to leave because nothing detains him or her from leaving.

Finally, the cognitive dimension is manifested in resources offering shared representations, interpretations, and systems of meaning among entities (Cicourel 1973). Especially shared language and codes as well as shared narratives play a decisive role because a common language, for example, facilitates the communication between different parties and opens the way for gaining access to social units and their resources (e.g. knowledge) (Nahapiet and Ghoshal 1998).

Individual and Collective Facets of Social Capital

Coming back to the various definitions of social capital introduced at the beginning of Chapter 3.2.2 one states a high congruence of all these definitions at a first glance. Although they seem to be quite similar, they reveal two different views of social capital. Social capital can be obtained at an individual or at a collective level (see the following authors for various views: Adler and Kwon 2002; Bourdieu 1986; Burt 1992, 1997; Coleman 1988; Mathwick, Wiertz, and Ruyter 2008).

At an individual level, a focal user and the value he or she gains through his or her position in the network, i.e. his or her relationship towards other network members, take center stage. By referring to the focal actor's or group's relationships to other network members, this point of view helps to explain why the focal actor or group outperforms other competitors. Thus, this facet of social capital refers to an egocentric view, which, according to Adler and Kwon (2002), becomes clear, for example, in Bourdieu's (1986) definition of social capital. At an individual level, social capital can be measured by centrality measures indicating the actor's position within the network or by prestige measures (Nooy, Mrvar, and Batagelj 2011; Wasserman and Faust 1994).

In contrast, the other facet of social capital represents a more sociocentric one (Sandefur and Laumann 1998). On a collective level social capital is regarded as a public good, which is in possession of the whole community and from which all community members can benefit (Coleman 1988). It is produced, preserved and used by the community (Mathwick, Wiertz, and Ruyter 2008). This kind of interpretation of social capital becomes especially clear in Putnam's (1995, p. 67) definition of social capital as "features of social organization such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit". Social capital as public good is operationalized by measures, which refer to the network as a whole, such as centralization, density, transitivity or connectedness of a network (Nooy, Mrvar, and Batagelj 2011; Wasserman and Faust 1994).

Nevertheless, both the individual and the collective facet of social capital need not be regarded separately from each other. Sometimes a combination of both aspects is appropriate such as in the definition of Nahapiet and Ghoshal (1998) mentioned at the beginning of this chapter.

Network Structure and Social Capital

In this project, I focus on the structural and collective dimensions of social capital, i.e. on the structure of the network as a whole. According to the definitions of social capital, it is obvious that social relationships and structures constitute the source of social capital (e.g. Coleman 1988; Nahapiet and Ghoshal 1998). Coleman (1988) argues that social capital emerges from network closure. Networks characterized by closure are comparable with dense networks, where each network member is connected (Burt 2000; Coleman 1988). Network closure creates more transparency in the network because every network member has the possibility to get access to all kinds of information in the network. If, for example, actor A is connected to actors B and C, and B and C are not connected with each other (network without closure), actor A can mistreat actors B and C without actors B and C noticing that they were harmed by actor A. If actor A is connected to actors B and C, and B and C are also connected with each other (network with closure), actors B and C can join forces in order to sanction A. Hence, network closure facilitates the presence of norms, reputation and trust within the network (Coleman 1988), from which solidarity as a benefit of social capital can arise (Adler and Kwon 2002). Krackhardt and Hanson (1993) note that trust results in enhanced openness of network members and enhanced information flow and thus increases network performance.

Burt (1992), however, points out one drawback of network closure, which lies in the inefficiency of dense networks. In dense networks, the access to new resources such as new ideas, knowledge and information is limited compared to more scattered networks. Burt

(2000) emphasizes the importance of structural holes and bases his argumentation on Granovetter's (1973) work on the strength of weak ties. Structural holes are "disconnections between nonredundant contacts in a network" (Burt 1997, p. 339). They provide the opportunity to bring individuals from both sides of the hole together and facilitate the exchange of information. Hence, social capital also arises through the bridging of structural holes, whereby different sources of information inherent in the clusters around the hole are combined (Burt 2000).

Although, in summary, social capital theory provides general insights into the role of network structure in conjunction with social action, it does not explicitly consider the dynamical aspects that occur with the simultaneous consideration of these variables. At this point, Giddens' (1984) theory of structuration, which is discussed in the following Chapter 3.2.3., comes into play.

3.2.3. The Duality of Structure in Giddens' Theory of Structuration

A Dynamic Process

In his work on the theory of structuration, Giddens (1984) emphasizes the importance of the temporal and spatial ordering of social practices in social sciences. In this way, a dynamic aspect comes into play. He points out the recursivity of social activities in a sense that social activities "are not brought into being by social actors but continually recreated by them via the very means whereby they express themselves as actors" (Giddens 1984, p. 2). The prerequisites of these activities are continually regenerated through the activities. Thus, we face a process, not a state. This process, which Giddens (1984, p. 16) calls the "duality of structure", is the central idea of Giddens' theory with "structure as the medium and outcome of the conduct it recursively organizes" (Giddens 1984, p. 374). The process-orientation of his theory is also expressed by the term structuration itself, which emphasizes the procedure of structure building.

Structure as Rules and Resources

In order to better understand the term "structure" in this context, its meaning has to be studied more closely. Giddens (1984, p. 377) defines structure as "rules and resources, recursively implicated in the reproduction of social systems. Structure exists only as memory traces, the organic basis of human knowledgeability, and as instantiated in action." According to Giddens (1984), structure exists in the memory or brains of humans and when it is put into action. Structure has a "virtual" (Giddens 1984, p. 17) property. Further, social systems such as societies or communities are constituted by social activities, which are reproduced by the recurrent implementation of structures (Sewell 1992).

Since structure is regarded as virtual, also rules and resources should by definition be virtual. Giddens (1984, p. 21) defines rules as "techniques or generalizable procedures applied in the enactment/reproduction of social practices". Concerning the rules, which Sewell (1992, p. 8) calls "schemas" in his theory of structure, Sewell agrees with Giddens' (1984) idea of virtuality because of their generalizability. Generalizability means that rules can be adopted in or transferred to various situations.

However, concerning resources, he disagrees: According to Giddens (1979, p. 92) "resources are the media whereby transformative capacity is employed as power in the routine course of social interaction". Sewell (1992, p. 9) reformulates this definition as "resources are anything that can serve as a source of power in social interactions". Further, Giddens (1979) distinguishes between authoritative and allocative resources in the sense that authoritative refers to persons and allocative refers to objects. Authoritative resources should be interpreted as human resources such as knowledge, skills, and also physical power, whereas allocative resources should be nonhuman resources including material objects such as arms, factories or land (Sewell 1992). Both authoritative and especially allocative resources can hardly be classified as virtual (Sewell 1992). Thus, at a first glance, resources, which are not virtual in contrast to Giddens' view of structure, should not be part of structure, but should be treated as effects of structures (Sewell 1992). However, in order to preserve Giddens' central idea of the theory of structuration, structure should be defined as virtual rules and non-virtual resources (Sewell 1992). Rules, which are regenerated over time by resources, become apparent in the resources (Sewell 1992).

The idea of the duality of structure can also be found in Bourdieu's (1977) theory of practice. Bourdieu (1977, p. 91) states that "the mental structures which construct the world of objects are constructed in the practice of a world of objects constructed according to the same structures.[…] The mind is a metaphor of the world of objects which is itself but an endless circle of mutually reflecting metaphors." By interpreting mental structures as schemas and the world of objects as resources, Sewell (1992) refers to the reflexive relationship between schemas or rules and resources as a durable process. In this way, the similarity between Bourdieu's (1977) and Giddens' (1984) work becomes apparent.

Hence, Giddens' (1984) and Bourdieu's (1977) thoughts play a decisive role in the theoretical conceptualization of network or community dynamics, although their work is also criticized (concerning Giddens see e.g. Bryant and Jary 1991; Held and Thompson 1989; concerning Bourdieu see e.g. Brubaker 1985; DiMaggio 1979; Wacquant 1989).

In summary, the structure of a network, e.g. in the form of density, hierarchy, and connectivity, plays a decisive role in the context of social capital und thus in its function as a basis for social action (Coleman 1988; Nahapiet and Ghoshal 1998). At the same time, interaction is important for the evolution and perpetuation of social capital (Bourdieu 1986). Otherwise social relationships can gradually regress. As a result, one faces a series of mutually dependent processes, where on the one hand social capital results from exchange and on the other hand social capital forms the base for exchange (Nahapiet and Ghoshal 1998). These kinds of reciprocal processes constitute the heart of Giddens (1984) idea of a duality of structure, where structure is both media and outcome of social action. Similarly, individuals who trust each other tend to cooperate in future activities through which again more trust can be formed. Therefore, according to Putnam (1993) social capital augments any time it is used. However, social capital cannot be enhanced endlessly by expanding the network because the costs of maintaining relationships increase with network size (Nahapiet and Ghoshal 1998).

Based on the insights gained from social capital theory and Giddens' (1984) theory of structuration, I derive the following research propositions[1]:

Research Proposition 1 (RP1): There is an interrelationship between social structure and social action, i.e. network structure influences participation and vice versa.

Research Proposition 2 (RP2): Network structure forms the base for social action, i.e. network structure exhibits a positive influence on participation.

Research Proposition 3 (RP3): Social capital augments any time it is used, i.e. participation exhibits a positive influence on network structure.

Research Proposition 4 (RP4): Social capital is constrained through a growing number of network members, i.e. community growth has a negative impact on network structure.

[1] Since research is basic and mostly of conceptual nature, I formulate research propositions instead of concrete hypotheses.

3.3. Data

I use data from a European online social community with focus on leisure activities. The observed community is set up in several regional districts and the platform is organized on a regional level. Community members of all regions can use the same free platform functionalities like getting connected to other members registered in the same region or in any other region, sending messages, writing guest book entries, joining groups of interests, rating user profiles and pictures. The dataset comprises monthly data over a time period of 45 months starting in November 2008 and ending in July 2012. From originally 33 regional communities I have chosen the ones that are best suited for the analyses of this project: By selecting the regions it must be ensured that community members are sufficiently linked in the region in which they are registered to guarantee that the selected regions can be considered as relatively closed unit. In order to meet this requirement, only regions which are characterized by a share of internal contacts of 30% or more are chosen. Further, I only include regions that are set up and maintained by the community operator itself. This means that I do not use regions that have been installed and maintained by another operator until the actual operator annexed them. Thus, an appropriate comparability of the selected regional communities is ensured. Finally, 13 regions are selected and included into the analyses. Five of them count among the first regions that have been set up by the community operator since 2003 and are called established regions. The other eight regions were installed in the year 2009 and therefore count among the newer regions. Furthermore, the average number of registered members per regional community ranges from 1,598 for the smallest community to 35,183 for the biggest one.

Table 2, Table 3, and Table 4 present an overview of some important descriptive statistics of the selected samples, which are divided into a sample including only established regions (see Table 2), into a sample including only new regions (see Table 3), and into a sample including all regions (see Table 4). The variables presented in the tables are described in the following sections 3.3.1, 3.3.2, and 3.3.3.

Table 2 Descriptive Statistics; Established Regions

	N	Mean	Standard Deviation	25th Percentile	50th Percentile	75th Percentile	Minimum	Maximum
New Sign-Ups	225	233.70	222.59	76.00	155.00	317.00	16.00	1256.00
Average Degree	225	16.58	22.86	1.80	6.09	15.62	0.55	77.85
Degree Centralization	225	0.04	0.03	0.02	0.03	0.06	0.01	0.13
Share of Networkers	225	0.34	0.17	0.22	0.32	0.42	0.13	0.67
Network Clustering Coefficient	225	0.17	0.03	0.15	0.18	0.19	0.11	0.25
Active Interpers. Participation	225	5.33	11.56	0.11	0.72	3.05	0.00	53.38
Active Platform Participation	225	0.35	0.56	0.03	0.11	0.44	0.00	3.13
Act. Interp. and Platf. Participation	225	5.68	12.10	0.14	0.88	3.44	0.00	56.52

Table 3 Descriptive Statistics; New Regions

	N	Mean	Standard Deviation	25th Percentile	50th Percentile	75th Percentile	Minimum	Maximum
New Sign-Ups	288	206.40	166.55	85.00	163.50	269.75	2.00	944.00
Average Degree	288	0.69	0.45	0.32	0.59	1.02	0.00	1.67
Degree Centralization	287	0.04	0.03	0.01	0.03	0.05	0.00	0.20
Share of Networkers	288	0.15	0.06	0.11	0.14	0.18	0.00	0.50
Network Clustering Coefficient	275	0.17	0.10	0.10	0.14	0.22	0.00	0.60
Active Interpers. Participation	288	1.49	6.11	0.07	0.15	0.65	0.00	74.53
Active Platform Participation	288	0.42	0.80	0.08	0.14	0.35	0.00	5.01
Act. Interp. and Platf. Participation	288	1.92	6.54	0.17	0.28	1.09	0.00	78.80

Table 4 Descriptive Statistics; All Regions

	N	Mean	Standard Deviation	25th Percentile	50th Percentile	75th Percentile	Minimum	Maximum
New Sign-Ups	514	217.96	193.45	80.00	161.00	293.25	2.00	1256.00
Average Degree	514	7.64	17.05	0.55	0.94	4.98	0.00	77.85
Degree Centralization	513	0.04	0.03	0.01	0.03	0.05	0.00	0.20
Share of Networkers	514	0.23	0.15	0.13	0.18	0.29	0.00	0.67
Network Clustering Coefficient	501	0.17	0.08	0.12	0.16	0.19	0.00	0.60
Active Interpers. Participation	514	3.17	9.10	0.07	0.25	1.37	0.00	74.53
Active Platform Participation	514	0.39	0.71	0.06	0.13	0.37	0.00	5.01
Act. Interp. and Platf. Participation	514	3.56	9.56	0.17	0.41	1.81	0.00	78.80

3.3.1. Measurement of Community Growth

According to Trusov, Bucklin, and Pauwels (2009) community growth is measured by the number of new sign-ups.[2] Customer acquisition plays an important role for community success (Bughin and Hagel 2000; Iriberri and Leroy 2009; Lithium 2012a) because new members have to be acquired in order to keep up the community. Since time series (e.g. Diebold 2007; Wooldridge 2006) and variables in PVAR models (e.g. Alecke, Mitze, and Untiedt 2010; Drakos and Konstantinou 2011) are usually logarithmized, I take

[2] In the present setting, the number of new sign-ups is an appropriate measure for community growth because the number of users who officially deregister from the platform is very small (less than 1%). Thus, similar to Trusov, Bucklin, and Pauwels (2009), community or member growth can be deducted from the number of new sign-ups.

the natural logarithm of the number of new sign-ups in region *i* at month *t* in order to reduce variance.

$$ln\_new\_signups_{it} = \ln(new\_signups_{it}) \tag{1}$$

3.3.2. Measurement of Network Structure

For the measurement of network structure four different variables, namely average degree, degree centralization, share of networkers, and network clustering coefficient are used (e.g. Nooy, Mrvar, and Batagelj 2011; Wasserman and Faust 1994). Although further variables such as betweenness centralization and the Watts-Strogatz clustering coefficient are also considered, I do not discuss the effects related to these variables because effects are similar to those of degree centralization and the network clustering coefficient respectively.

Network variables are calculated by using the software package Pajek, which was developed for social network analysis (Nooy, Mrvar, and Batagelj 2011). Social network analysis gives researchers support in learning more about the composition and characteristics of groups or networks by providing tools and methods that help to examine the relationship between individuals (Nooy, Mrvar, and Batagelj 2011; Preece 2000; Wasserman and Faust 1994).

Average Degree

In a simple undirected network, where network lines connecting individuals do not show in a certain direction and the relationship between individuals is symmetric, degree refers to the number of contacts of a person (Nooy, Mrvar, and Batagelj 2011). This view is equivalent to the definition of degree centrality by Freeman (1978/79). Thus, degree (centrality) is described as (Wasserman and Faust 1994):

$$C_D(n_k) = d(n_k) = \sum_m x_{km} \tag{2}$$

The degree *d* of the focal actor n_k is defined as the sum of all lines between the focal actor n_k and all actors n_m, that are connected to the focal actor. Thereby, $x_{km}=1$ if n_k and n_m are connected, otherwise $x_{km}=0$.

For this project, I determine the number of average degree per month *t* and per region *i*. Average degree is used as a measure of structural cohesion (Nooy, Mrvar, and Batagelj

2011). If individuals have more ties the network gets denser. Thus, average degree is an indicator for network density. To calculate average degree, I sum up the degrees of each individual registered in region i at month t and then divide this value by the number of individuals r_{it} registered in region i at month t. Then, I take the logarithm:

$$ln\_average\_degree_{it} = \ln\left(\frac{\left(\sum_k d(n_k)\right)_{it}}{r_{it}}\right) \quad (3)$$

Degree Centralization

While centrality measures refer to the position of individuals in the network, centralization measures describe the entire network (Freeman 1978/79). Thus, centralization measures enable the comparison of different networks. In the present research project, the focus lies on degree centralization instead of other centralization measures such as betweenness centralization because degree is linked to the potential for "communication activity" (Freeman 1978/79, p. 221). Individuals with high degree can serve as providers of information because they have diverse contacts and access to different information sources. Since communication activity is related to the present project's concept of community participation, a relationship between degree-related variables and community participation is supposed. Degree centralization indicates the variation in the degrees of individuals compared to the maximum possible variation and is expressed by (Freeman 1978/79):

$$C_D = \frac{\sum_{k=1}^{r}\left[C_D(n^*) - C_D(n_k)\right]}{\max \sum_{k=1}^{r}\left[C_D(n^*) - C_D(n_k)\right]}, \quad (4)$$

where r is the number of individuals in the network, $C_D(n_k)$ is the degree (centrality) of actor n_k and $C_D(n^*)$ is the highest value for degree among all r actors. The sum of all the r differences between highest value and the other values is divided by the maximum possible sum of differences in degree (centrality) for a network of r actors. Thus, degree centralization can only take on values between 0 and 1. The degree centralization of a star network for example accounts for 1, because the actor in the center holds maximum degree and the other actors around hold minimum degree.[3] A star network shows maximal variation in the degrees of the individuals. Hence, it is obvious that centralization is strongly related with hierarchy in networks. I calculate degree centralization for each region i at month t and define it by $C_{D,it}$. Then, the logarithm of one plus the value of degree centralization is computed because this is a common way to reduce variance and normalize distributions when values to be logarithmized are close to zero (Acito and Jain 1980; Ansari, Mela, and Neslin 2008; Winer 1971; Wooldridge 2006):

$$ln\_degree\_centralization_{it} = \ln(1 + C_{D,it}) \quad (5)$$

Share of Networkers

According to Nahapiet and Ghoshal (1998) connectedness or connectivity is an important feature of network structure. Relationships between individuals are indispensable for the existence of social capital (e.g. Bourdieu 1986; Coleman 1988; Nahapiet and Ghoshal 1998). In disconnected networks with two or more disconnected components, information cannot flow between some pairs of individuals (Wasserman and Faust 1994). In the online community to be investigated, there are also community members who are not connected to other community members. They just come to the platform in order to have a look at the latest party pictures or consume other content. In the present project, this group of community members is called “Non-Networkers”. The other group of community members, who have at least one contact, is called “Networkers”. Since networkers are by definition more interested in social networking and hence in the social aspects of communities they are supposed to take actively part in the community (Hennig-Thurau et al. 2004). Therefore, the share of networkers might play an important role in the interplay of success factors. Although previous research does not concentrate on this variable, I include this variable as a further aspect of network structure into the analyses. I compute the logarithmized share of networkers for each region i at month t by summarizing all networkers per region i and per month t, dividing this sum by the number of members registered in region i at month t, and then taking the logarithm of one plus the quotient of networkers and registered members.

[3] Assume a star network of six actors: The actor in the center has five contacts. Each of the other actors has one contact. Degree centralization is calculated by (5 x (5-1) + 1 x (5-5)) / (5 x (5-1) + 1 x (5-5)) = 1.

$$ln\_networker\_share_{it} = \ln\left(1+\frac{\left(\sum_k n_k\right)_{it}}{r_{it}}\right); \qquad (6)$$

$$with\ n_k = 1\ if\ d(n_k) \geq 1,\ otherwise\ n_k = 0$$

Network Clustering Coefficient

The clustering coefficient of a network, also called transitivity, relates to the extent to which two contacts of a focal actor are directly connected. It measures "the proportion of all two-paths in the network that are closed" (Nooy, Mrvar, and Batagelj 2011, p. 342). Hence, the network clustering coefficient is an indicator for network density or closure. Networks that consist of individuals being highly interconnected and thus are characterized by high transitivity, are a source of solidarity or community spirit (Bott 1964) and loyalty (Cappelli 2000). Therefore, the network clustering coefficient should be considered in the analysis of the interrelationship between success factors. The network clustering coefficient or transitivity is expressed as follows (Kolaczyk 2009):

$$Cl_T(G) = \frac{3\tau_\Delta(G)}{\tau_3(G)}, \qquad (7)$$

where $\tau_\Delta(G)$ equals the number of triangles in the graph G and $\tau_3(G)$ equals the number of connected triples. While triangles are formed by three members of whom each member is connected to the other two members, in connected triples only one member is directly linked with each of the other two members. I calculate the network clustering coefficient Cl_T for each region i at month t, then take the logarithm of one plus the value of the clustering coefficient:

$$ln\_network\_cc_{it} = \ln(1 + Cl_{T,it}) \qquad (8)$$

3.3.3. Measurement of Community Participation

In the present project, I differentiate between different forms of participation namely active interpersonal participation, active platform participation, and active interpersonal and platform participation.

Active Interpersonal Participation

In the variable of active interpersonal participation all activities which take place between individuals are combined. For this kind of participation a partner or contact is needed. The activities of an actor n_k include number of sent messages, number of gifts made, number of user profile ratings made, and number of guest book entries written:

$$\begin{aligned} partintact\,(n_k) &= messagesout(n_k) + giftsout(n_k) + userratingsout(n_k) + \\ &+ guestbookout(n_k) \end{aligned} \tag{9}$$

The participation behavior of all individuals registered in region i at month t is aggregated by determining the average participation behavior in region i at month t, then, the logarithm is taken. Thus, active interpersonal participation in region i at month t equals to:

$$ln\_partintact_{it} = \ln\left(1 + \frac{\left(\sum_k partintact(n_k)\right)_{it}}{r_{it}}\right) \tag{10}$$

Active Platform Participation

Active platform participation comprises all activities that community members can carry out on their own, i.e. without a partner or contact. These are activities such as the number of photo ratings made, number of group ratings made, number of place ratings made, number of magazine comments made, number of place video comments made, number of group thread articles made, number of events joined, and number of nameplates for highlighting oneself on a photo:

$$\begin{aligned} partplatact\,(n_k) &= photoratings(n_k) + groupratings(n_k) + placeratings(n_k) + \\ &+ magazinecomments(n_k) + placevideocomments(n_k) + \\ &+ groupthreadarticles(n_k) + eventjoins(n_k) + nameplatesactive(n_k) \end{aligned} \tag{11}$$

Again, the participation behavior of all individuals registered in region i at month t is aggregated and the logarithm is taken. This results in:

$$ln\_partplatact_{it} = \ln\left(1 + \frac{\left(\sum_k partplatact(n_k)\right)_{it}}{r_{it}}\right) \tag{12}$$

Active Interpersonal and Platform Participation

Finally, variables of active interpersonal participation and active platform participation are combined to the variable of active interpersonal and platform participation, i.e. overall participation, by summing up the two variables:

$$partintactplat(n_k) = partintact(n_k) + partplatact(n_k) \qquad (13)$$

Aggregation and taking the logarithm leads to the overall participation behavior in region i at month t:

$$ln\_partintactplat_{it} = \ln\left(1 + \frac{\left(\sum_k partintactplat(n_k)\right)_{it}}{r_{it}}\right) \qquad (14)$$

3.4. Methodology

The research objective of this project requires a methodology that is able to analyze the dynamic interplay between the discussed success factors without imposing too many restrictions on the model. At the same time, this technique should allow the simultaneous analysis of different regions to avoid the setup of different case studies. All these requirements are met by panel vector autoregression.

3.4.1. Vector Autoregression

In order to capture the interdependencies between different variables, the vector autoregressive (VAR) approach proposed by Sims (1980) is a suitable technique. VAR models offer a relatively flexible way to analyze effects between endogenous variables over time. A VAR(p) model is generally specified as

$$z_t = \alpha + A_1 z_{t-1} + A_2 z_{t-2} + ... + A_p z_{t-p} + e_t, \qquad (15)$$

where z_t is a ($K \times 1$) vector containing K variables, A_i is a ($K \times K$) matrix of coefficients, α is a ($K \times 1$) vector containing the intercept terms, and e_t is a ($K \times 1$) vector of error terms (Lütkepohl 2007).

For example, a VAR(p) model of lag order p=4 with two endogenous variables y and x would be specified as VAR(4):[4]

$$\begin{aligned} y_t &= a_{11,1}\, y_{t-1} + a_{11,2}\, y_{t-2} + a_{11,3}\, y_{t-3} + a_{11,4}\, y_{t-4} + \\ &\quad a_{12,1}\, x_{t-1} + a_{12,2}\, x_{t-2} + a_{12,3}\, x_{t-3} + a_{12,4}\, x_{t-4} + e_{1t} \\ x_t &= a_{21,1}\, y_{t-1} + a_{21,2}\, y_{t-2} + a_{21,3}\, y_{t-3} + a_{21,4}\, y_{t-4} + \\ &\quad a_{22,1}\, x_{t-1} + a_{22,2}\, x_{t-2} + a_{22,3}\, x_{t-3} + a_{22,4}\, x_{t-4} + e_{2t} \end{aligned} \quad (16)$$

With $z_t = (y_t, x_t)'$ and $e_t = (e_{1t}, e_{2t})'$:

$$\begin{aligned} &z_t = A_1 L\, z_t + A_2 L^2\, z_t + A_3 L^3\, z_t + A_4 L^4\, z_t + e_t; \\ &\left(I - A_1 L - A_2 L^2 - A_3 L^3 - A_4 L^4\right) z_t = e_t; \\ &A(L)\, z_t = e_t \end{aligned} \quad (17)$$

Each variable is explained by an equation that contains lagged variables of the focal variable and lagged variables of the other variable. All coefficients can be estimated on the base of multivariate least squares estimation (Lütkepohl 2007). However, because of the mutual dependencies between the variables, it is not possible to interpret the coefficients of a VAR. Tools helping to deal with this problem are impulse response functions (IRFs). They describe how the system reacts over time to exogenous impulses. In order to be able to illustrate IRFs, the stationary VAR process has to be transformed into a moving average (MA) representation. For a VAR(1) the following equation is obtained:

$$A(L)\, z_t = e_t \rightarrow\; z_t - A_1 z_{t-1} = e_t \rightarrow\; z_t = A_1 z_{t-1} + e_t \quad (18)$$

Repeated substitution leads to:

$$z_t = e_t + A_1 e_{t-1} + A_1^2 e_{t-2} + A_1^3 e_{t-3} + \ldots \quad (19)$$

$$z_t = [A(L)]^{-1} e_t = \left(I + A_1 L + A_1^2 L + A_1^3 L + \ldots\right) e_t = \left[\sum_{i=0}^{\infty} A_1^i L^i\right] e_t; \quad (20)$$

$$z_t = \left[\sum_{i=0}^{\infty} F^i L^i\right] e_t \quad (21)$$

Accordingly, each stationary VAR(p) process can be transformed into a MA(∞) process.

[4] For purposes of presentation, the intercept terms are neglected in the following.

The effect of an impulse e_t spreads through the whole system and influences z_t, z_{t+1}, z_{t+2}, etc. The relationship between z_{t+i} and e_t is described by IRFs.

$$\begin{aligned}
z_t &= e_t + F^1 e_{t-1} + F^2 e_{t-2} + F^3 e_{t-3} + F^4 e_{t-4} + \ldots \\
z_{t+1} &= e_{t+1} + F^1 e_t + F^2 e_{t-1} + F^3 e_{t-2} + F^4 e_{t-3} + \ldots \\
z_{t+2} &= e_{t+2} + F^1 e_{t+1} + F^2 e_t + F^3 e_{t-1} + F^4 e_{t-2} + \ldots \\
z_{t+3} &= e_{t+3} + F^1 e_{t+2} + F^2 e_{t+1} + F^3 e_t + F^4 e_{t-1} + \ldots \\
z_{t+4} &= e_{t+4} + F^1 e_{t+3} + F^2 e_{t+2} + F^3 e_{t+1} + F^4 e_t + \ldots
\end{aligned} \tag{22}$$

However, in practice, error terms are likely to be correlated. That means an impulse in one variable is usually combined with an impulse in the other variable. To solve this problem and to ensure a clear allocation of shocks, error terms need to be orthogonalized. MA representation of the VAR and Cholesky decomposition of matrix $\Sigma_e = PP'$, where P is a lower triangular matrix, lead to:

$$z_t = \sum_{i=0}^{\infty} F^i e_{t-i} = \sum_{i=0}^{\infty} F^i P P^{-1} e_{t-i} \tag{23}$$

$$z_t = \sum_{i=0}^{\infty} W^i u_{t-i}; \qquad with\ W^i = F^i P;\ u_{t-i} = P^{-1} e_{t-i} \tag{24}$$

After this transformation error terms u_i are uncorrelated and have unit variance:

$$\Sigma_u = E(u_t u_t') = E(P^{-1} e_t e_t' P^{-1}{}') = P^{-1} E(e_t e_t') P^{-1}{}' = P^{-1} \Sigma_e P^{-1}{}' = P^{-1} P P' P^{-1}{}' = I \tag{25}$$

Hence, IRFs should be calculated based on the transformed system. Yet, the orthogonalization of error terms implies a recursive causal structure. Elements in z_t are dependent from preceding elements: the first element in z_t is independent, the second element is dependent from the first element, the third element is dependent from the first and the second element, etc. This can easily be demonstrated by multiplying the original VAR model with P^{-1} in order to get a VAR process with orthogonalized structure:

$$\begin{aligned}
z_t &= A_1\, z_{t-1} + A_2\, z_{t-2} + \ldots + A_p\, z_{t-p} + e_t; \\
P^{-1} z_t &= P^{-1} A_1\, z_{t-1} + P^{-1} A_2\, z_{t-2} + \ldots + P^{-1} A_p\, z_{t-p} + u_t;
\end{aligned} \tag{26}$$

Because of the lower triangular matrix P^{-1}, contemporary dependencies between the elements of z_t arise (for more details see Lütkepohl 2007). However, one can deal with this problem by considering theoretical or practical explanations for the chosen order of variables (Love and Zicchino 2006; Lütkepohl 2007). Another method is to check the results of IRFs after changing the order of variables (Sims 1981). All in all, VAR models constitute a relatively flexible method to capture linear interdependencies between variables without imposing too many restrictions. However, the number of variables, which can be included into traditional VAR models and simultaneously analyzed, is constrained because of the high number of parameters to be estimated based on a usually limited time series length (Kirchgässner and Wolters 2007; Lütkepohl 2007).

3.4.2. Panel Vector Autoregression

Since the traditional VAR model is not constructed for the estimation of pooled data, the classic VAR approach needs to be extended to a model that is able to examine the interplay of success factors in different regional communities at the same time. Love and Zicchino (2006) propose a model that applies the VAR approach on panel data. They call this approach panel VAR (PVAR). Thus, one profits from the advantage of VAR models in describing the interrelationship between success factors and at the same time permitting unobserved heterogeneity. Furthermore, the PVAR approach can overcome a problem of traditional VAR models, which lies in the usual high number of parameters to be estimated: By combining different time series, the number of observations is increased. Therefore, the problem of missing degrees of freedom can be contained and parameter estimates become more efficient (Horváth et al. 2005). Hence, a first-order PVAR model, PVAR(1), is specified as follows:

$$z_{it} = A_1 z_{it-1} + f_i + e_{it}\,, \tag{27}$$

where, in this project, z_{it} is a vector of community success variables, A_1 is a matrix of coefficients, f_i describes unobserved regional community effects, e_{it} is a vector containing error terms. Since, in practice, differences between regional communities are not unlikely, fixed effects f_i are added to the model in order to take into account individual heterogeneity. Including the lagged dependent variable as a regressor z_{it-1} and fixed effects f_i, one faces a dynamic panel data approach. However, as a result of the inclusion of the lagged dependent variable as regressor, the within estimator, which is frequently employed for panel models with fixed effects, is inconsistent because of the correlation between regressor and error term (Cameron and Trivedi 2005; Nickell 1981). The elimination of fixed effects by within transformation would lead to:

$$\left(z_{it}-\bar{z}_i\right)=A_1\left(z_{it-1}-\bar{z}_{i,-1}\right)+\left(e_{it}-\bar{e}_i\right) \tag{28}$$

Through equation (27), z_{it} is correlated with e_{it}, z_{it-1} is correlated with e_{it-1} and therefore with $\bar{e}_i$. Hence, regressor $(z_{it-1}-\bar{z}_{i,-1})$ and error $(e_{it}-\bar{e}_i)$ are correlated. To avoid this problem, forward orthogonal deviations transformation (Arellano and Bover 1995) is used in order to eliminate the fixed effects. This procedure removes from each of the first *T-1* observations the mean of the future observations left in the sample. Then, the (untransformed) lagged regressors can serve as instruments and coefficients can be estimated by system generalized method of moments (GMM). Results of the estimation are interpreted by means of IRFs, which are based on the transformed system with Cholesky decomposition (see Chapter 3.4.1) such that error terms become orthogonal. Then, the response of one variable to a one standard deviation shock in another variable can be analyzed. Further, confidence intervals for IRFs are created by using Monte Carlo simulations.

3.4.3. Models

I estimate PVAR models for x=1) established regions, x=2) new regions, and x=3) all regions in order to understand the interrelationship between success factors at different community life cycle phases. The models are designed as follows:

Network Structure – Participation

First of all, only the relationship between network structure and participation is analyzed. For this purpose, the four variables for network structure and the three variables for community participation discussed above, as well as fixed effects f_i and error terms e_{it} are included into the PVAR specification, which is set up for the established, new and all regions' sample. Hence, twelve different versions of PVAR(1)[5] models are obtained:

$$\begin{pmatrix} ln\_average\_degree \\ ln\_partintact \end{pmatrix}_{it} = A_1 \begin{pmatrix} ln\_average\_degree \\ ln\_partintact \end{pmatrix}_{it-1} + f_i + e_{it} \qquad \text{(model x.1.1.1)}$$

[5] PVAR of lag order 1 is preferred because in empirical works usually PVAR(1) is used (e.g. Alecke, Mitze, and Untiedt 2010; Drakos and Konstantinou 2011; Koutsomanoli-Filippaki and Mamatzakis 2009; Love and Zicchino 2006). Further, a PVAR of lag order 1 helps to save degrees of freedom. Nevertheless, to compare results and their robustness, I additionally estimate PVAR specifications up to lag order 4, which is the maximum lag order for the present amount of data. Determining a certain lag order by SC is not recommended in this project, because I am not interested in finding the best forecasting model, but in uncovering the effects between the variables of interest.

$$\begin{pmatrix} ln\_degree\_centralization \\ ln\_partintact \end{pmatrix}_{it} = A_1 \begin{pmatrix} ln\_degree\_centralization \\ ln\_partintact \end{pmatrix}_{it-1} + f_i + e_{it} \quad \text{(x.1.1.2)}$$

$$\begin{pmatrix} ln\_networker\_share \\ ln\_partintact \end{pmatrix}_{it} = A_1 \begin{pmatrix} ln\_networker\_share \\ ln\_partintact \end{pmatrix}_{it-1} + f_i + e_{it} \quad \text{(x.1.1.3)}$$

$$\begin{pmatrix} ln\_network\_cc \\ ln\_partintact \end{pmatrix}_{it} = A_1 \begin{pmatrix} ln\_network\_cc \\ ln\_partintact \end{pmatrix}_{it-1} + f_i + e_{it} \quad \text{(x.1.1.4)}$$

$$\begin{pmatrix} ln\_average\_degree \\ ln\_partplatact \end{pmatrix}_{it} = A_1 \begin{pmatrix} ln\_average\_degree \\ ln\_partplatact \end{pmatrix}_{it-1} + f_i + e_{it} \quad \text{(x.1.2.1)}$$

$$\begin{pmatrix} ln\_degree\_centralization \\ ln\_partplatact \end{pmatrix}_{it} = A_1 \begin{pmatrix} ln\_degree\_centralization \\ ln\_partplatact \end{pmatrix}_{it-1} + f_i + e_{it} \quad \text{(x.1.2.2)}$$

$$\begin{pmatrix} ln\_networker\_share \\ ln\_partplatact \end{pmatrix}_{it} = A_1 \begin{pmatrix} ln\_networker\_share \\ ln\_partplatact \end{pmatrix}_{it-1} + f_i + e_{it} \quad \text{(x.1.2.3)}$$

$$\begin{pmatrix} ln\_network\_cc \\ ln\_partplatact \end{pmatrix}_{it} = A_1 \begin{pmatrix} ln\_network\_cc \\ ln\_partplatact \end{pmatrix}_{it-1} + f_i + e_{it} \quad \text{(x.1.2.4)}$$

$$\begin{pmatrix} ln\_average\_degree \\ ln\_partintactplat \end{pmatrix}_{it} = A_1 \begin{pmatrix} ln\_average\_degree \\ ln\_partintactplat \end{pmatrix}_{it-1} + f_i + e_{it} \quad \text{(x.1.3.1)}$$

$$\begin{pmatrix} ln\_degree\_centralization \\ ln\_partintactplat \end{pmatrix}_{it} = A_1 \begin{pmatrix} ln\_degree\_centralization \\ ln\_partintactplat \end{pmatrix}_{it-1} + f_i + e_{it} \quad \text{(x.1.3.2)}$$

$$\begin{pmatrix} ln\_networker\_share \\ ln\_partintactplat \end{pmatrix}_{it} = A_1 \begin{pmatrix} ln\_networker\_share \\ ln\_partintactplat \end{pmatrix}_{it-1} + f_i + e_{it} \quad \text{(x.1.3.3)}$$

$$\begin{pmatrix} ln\_network\_cc \\ ln\_partintactplat \end{pmatrix}_{it} = A_1 \begin{pmatrix} ln\_network\_cc \\ ln\_partintactplat \end{pmatrix}_{it-1} + f_i + e_{it} \quad \text{(x.1.3.4)}$$

Similarly to other studies (e.g. Drakos and Konstantinou 2011; Koutsomanoli-Filippaki and Mamatzakis 2009; Love and Zicchino 2006), all variables are included in levels since the presented PVAR approach allows for a loosening of the time stationarity assumption (Holtz-Eakin, Newey, and Rosen 1988). Nevertheless, I additionally conduct several panel unit root tests in order to find out whether the series are indeed stationary (see Appendix 1, Appendix 2, Appendix 3). For the sample including all regions and for the sample including only new regions, Im-Pesaran-Shin (Im, Pesaran, and Shin 2003) and Fisher-type tests (Choi 2001) are conducted. Both test types do not require strongly balanced data. The null hypothesis of all the individual series containing unit roots can be rejected at a significance level of 5% by at least one test type. For the sample including only established regions, I additionally conduct a Levin-Lin-Chu test (Levin, Lin, and Chu 2002) testing the null hypothesis that all the individual series contain unit roots. This kind of test only works for strongly balanced data, as is the case for the sample of established regions. Mostly, the null hypothesis is rejected at a significance level of 5% by at least one of the test types. Only for the variables of *ln_average_degree*, *ln_networker_share*, and *ln_partintactplat* the null hypothesis is not rejected at a significance level of 5%. However, because of the relaxation of the time stationarity assumption and for better comparison I do not transform the variables.

I consider the network variables to appear at the first position of the system. This ordering is chosen because Coleman (1988) states that social capital, which lies in the connection to other members, serves as a basis for action, i.e. participation. Therefore, there is an initial theoretical indication that network structure is probably more exogenous than participation. Further, in a case study, Toral et al. (2009) found that network variables affect participation or activity as an integral part of community success. Taking these arguments together I assume that network variables are little more exogenous than participation variables and therefore appear at the first position of the system.

Community Growth – Network Structure – Participation

In the next step, community growth is added to the analysis. This proceeding helps to find out which position community growth adopts in the interrelationship between success factors and whether the inclusion of community growth changes the relationship between network structure and participation. In this project, community growth, which is represented by the number of new sign-ups, is mentioned earlier in the system than network structure and participation because new sign-ups are a prerequisite for the development of a community. Only after individuals have registered for the community platform, a network can be built and participation can evolve. The community growth variable is included in levels because of the results of panel unit root tests (see Appendix 1, Appendix 2, Appendix 3) and the possibility to loosen the time stationarity assumption discussed above. Thus, by adding community growth to the network-participation-models, the following models for a first-order PVAR with fixed effects f_i, and error terms e_{it} are obtained:

$$\begin{pmatrix} ln\_new\_signups \\ ln\_average\_degree \\ ln\_partintact \end{pmatrix}_{it} = A_1 \begin{pmatrix} ln\_new\_signups \\ ln\_average\_degree \\ ln\_partintact \end{pmatrix}_{it-1} + f_i + e_{it} \qquad \text{(model x.2.1.1)}$$

$$\begin{pmatrix} ln\_new\_signups \\ ln\_degree\_centralization \\ ln\_partintact \end{pmatrix}_{it} = A_1 \begin{pmatrix} ln\_new\_signups \\ ln\_degree\_centralization \\ ln\_partintact \end{pmatrix}_{it-1} + f_i + e_{it} \qquad \text{(x.2.1.2)}$$

$$\begin{pmatrix} ln\_new\_signups \\ ln\_networker\_share \\ ln\_partintact \end{pmatrix}_{it} = A_1 \begin{pmatrix} ln\_new\_signups \\ ln\_networker\_share \\ ln\_partintact \end{pmatrix}_{it-1} + f_i + e_{it} \qquad \text{(x.2.1.3)}$$

$$\begin{pmatrix} ln\_new\_signups \\ ln\_network\_cc \\ ln\_partintact \end{pmatrix}_{it} = A_1 \begin{pmatrix} ln\_new\_signups \\ ln\_network\_cc \\ ln\_partintact \end{pmatrix}_{it-1} + f_i + e_{it} \qquad \text{(x.2.1.4)}$$

$$\begin{pmatrix} ln\_new\_signups \\ ln\_average\_degree \\ ln\_partplatact \end{pmatrix}_{it} = A_1 \begin{pmatrix} ln\_new\_signups \\ ln\_average\_degree \\ ln\_partplatact \end{pmatrix}_{it-1} + f_i + e_{it} \qquad \text{(x.2.2.1)}$$

$$\begin{pmatrix} ln\_new\_signups \\ ln\_degree\_centralization \\ ln\_partplatact \end{pmatrix}_{it} = A_1 \begin{pmatrix} ln\_new\_signups \\ ln\_degree\_centralization \\ ln\_partplatact \end{pmatrix}_{it-1} + f_i + e_{it} \qquad \text{(x.2.2.2)}$$

$$\begin{pmatrix} ln\_new\_signups \\ ln\_networker\_share \\ ln\_partplatact \end{pmatrix}_{it} = A_1 \begin{pmatrix} ln\_new\_signups \\ ln\_networker\_share \\ ln\_partplatact \end{pmatrix}_{it-1} + f_i + e_{it} \qquad \text{(x.2.2.3)}$$

$$\begin{pmatrix} ln\_new\_signups \\ ln\_network\_cc \\ ln\_partplatact \end{pmatrix}_{it} = A_1 \begin{pmatrix} ln\_new\_signups \\ ln\_network\_cc \\ ln\_partplatact \end{pmatrix}_{it-1} + f_i + e_{it} \qquad \text{(x.2.2.4)}$$

$$\begin{pmatrix} ln\_new\_signups \\ ln\_average\_degree \\ ln\_partintactplat \end{pmatrix}_{it} = A_1 \begin{pmatrix} ln\_new\_signups \\ ln\_average\_degree \\ ln\_partintactplat \end{pmatrix}_{it-1} + f_i + e_{it} \qquad \text{(x.2.3.1)}$$

$$\begin{pmatrix} ln\_new\_signups \\ ln\_degree\_centralization \\ ln\_partintactplat \end{pmatrix}_{it} = A_1 \begin{pmatrix} ln\_new\_signups \\ ln\_degree\_centralization \\ ln\_partintactplat \end{pmatrix}_{it-1} + f_i + e_{it} \qquad \text{(x.2.3.2)}$$

$$\begin{pmatrix} ln\_new\_signups \\ ln\_networker\_share \\ ln\_partintactplat \end{pmatrix}_{it} = A_1 \begin{pmatrix} ln\_new\_signups \\ ln\_networker\_share \\ ln\_partintactplat \end{pmatrix}_{it-1} + f_i + e_{it} \qquad \text{(x.2.3.3)}$$

$$\begin{pmatrix} ln\_new\_signups \\ ln\_network\_cc \\ ln\_partintactplat \end{pmatrix}_{it} = A_1 \begin{pmatrix} ln\_new\_signups \\ ln\_network\_cc \\ ln\_partintactplat \end{pmatrix}_{it-1} + f_i + e_{it} \qquad \text{(x.2.3.4)}$$

3.5. Results

In the following, results of the estimated PVAR models are presented. I use the pvar-routine provided by Inessa Love[6] for the estimation of PVAR models with Stata.

3.5.1. Established Regions

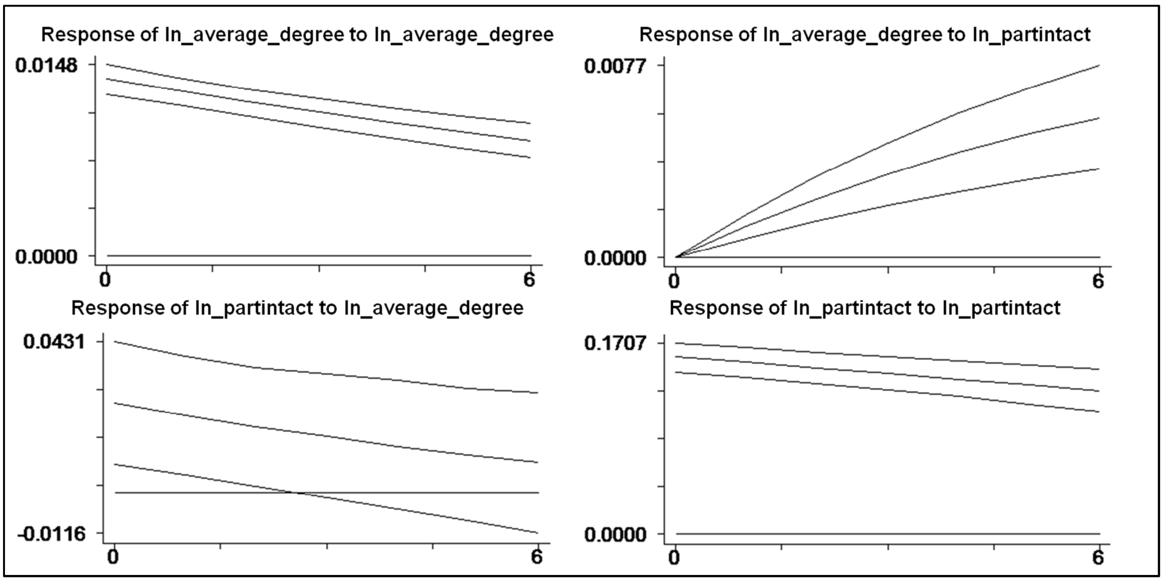
Network Structure – Participation

Starting with the sample including the established regions, I estimate the models presented above. First of all, the relationship between network structure and participation is investigated. The results of model 1.1.1.1, which captures the interrelationship between average degree and active interpersonal participation in established regions, are illustrated in Figure 2. A shock to average degree leads to a positive response of interpersonal participation, which lasts nearly up to three months. Conversely, a shock to interpersonal participation increases average degree. In order to check the robustness of the results, I estimate PVAR models of higher lag order, i.e. PVAR(2), PVAR(3), PVAR(4). The results confirm the findings from PVAR(1) and are displayed in Appendix 4. PVAR(3) and PVAR(4) even reveal a positive response of active interpersonal participation to a shock in average degree, that lasts for nearly six months and four months respectively.[7]

[6] See Love and Zicchino (2006)

[7] Own-variable IRFs are not discussed because they are not of interest in this project.

Figure 2 Impulse Response Functions, PVAR(1) ln_average_degree ln_partintact, errors are 5% on each side generated by Monte-Carlo (1000 reps); Established Regions



In model 1.1.1.2, I investigate the relationship between degree centralization and active interpersonal participation in established regions. IRFs of PVAR(1) show that a shock in degree centralization is followed by a negative response of active interpersonal participation, which is, however, not significant (see Figure 3). In order to verify the results, I additionally estimate PVAR(2), PVAR(3), and PVAR(4) (see Appendix 5). All models confirm a negative relationship, which is significant in PVAR(2) and PVAR(4). Further, a shock in active interpersonal participation leads to a positive response of degree centralization. This finding is not in accordance with models of higher lag order because these models do not show any significant effects.

IRFs of model 1.1.1.3 imply that a shock in the share of networkers has no significant consequences on active interpersonal participation (see Figure 4). Conversely, a shock in active interpersonal participation increases the share of networkers. These results are also confirmed by models of higher lag order (see Appendix 6).

Figure 3 Impulse Response Functions, PVAR(1) ln_degree_centralization ln_partintact, errors are 5% on each side generated by Monte-Carlo (1000 reps); Established Regions

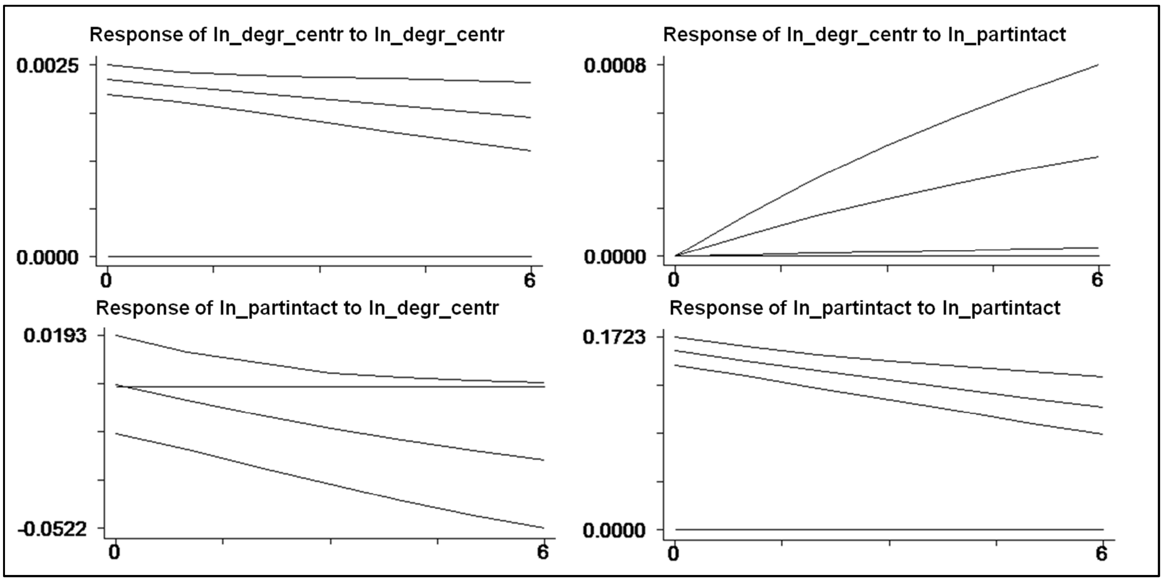
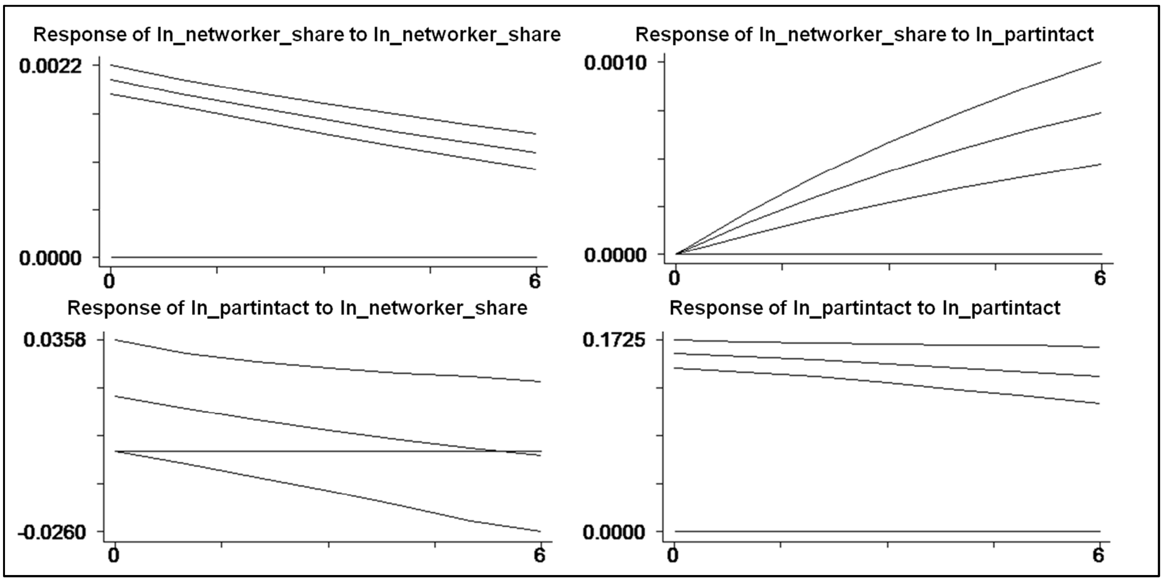
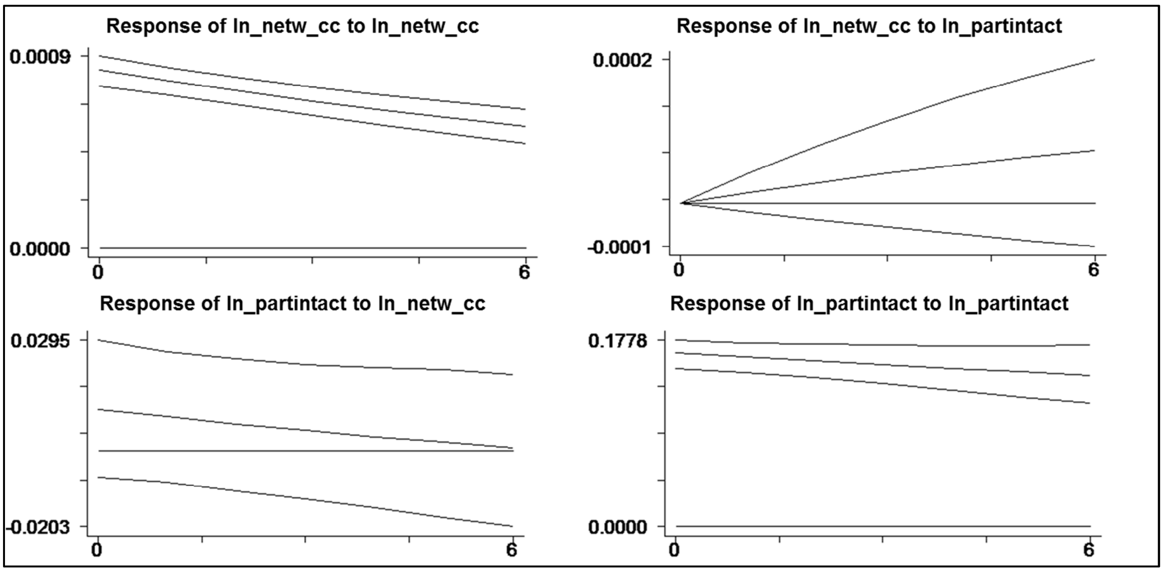


Figure 4 Impulse Response Functions, PVAR(1) ln_networker_share ln_partintact, errors are 5% on each side generated by Monte-Carlo (1000 reps); Established Regions



Model 1.1.1.4 investigates the interrelationship between the network clustering coefficient and active interpersonal participation. There are no significant relationships between these variables (see Figure 5). This is also supported by PVAR(2), PVAR(3), and PVAR(4) (see Appendix 7).

Figure 5 Impulse Response Functions, PVAR(1) ln_network_cc ln_partintact, errors are 5% on each side generated by Monte-Carlo (1000 reps); Established Regions



IRFs of model 1.1.2.1, which captures the interrelationship between average degree and active platform participation by the help of PVAR(1), do not show any significant response of active platform participation to a shock in average degree. However, an impulse in active platform participation is followed by an increase in average degree that lasts over months (see Figure 6). These findings are also supported by models of higher lag order (see Appendix 8).

I estimate model 1.1.2.2 in order to investigate the interrelationship between degree centralization and active platform participation. IRFs of PVAR(1) indicate that a shock in degree centralization causes a negative, but non-significant response of active platform participation (see Figure 7). Yet, IRFs of PVAR(2), PVAR(3), and PVAR(4) revise this result. They illustrate a significant negative response of active platform participation to an impulse in degree centralization, which comes with a delay of about one period (see Appendix 9). Looking at the other direction, I detect that a shock in active platform participation significantly increases degree centralization. This positive effect is also apparent from PVAR models of higher lag order and is significant after estimation of PVAR(3).

Figure 6 Impulse Response Functions, PVAR(1) ln_average_degree ln_partplatact, errors are 5% on each side generated by Monte-Carlo (1000 reps); Established Regions

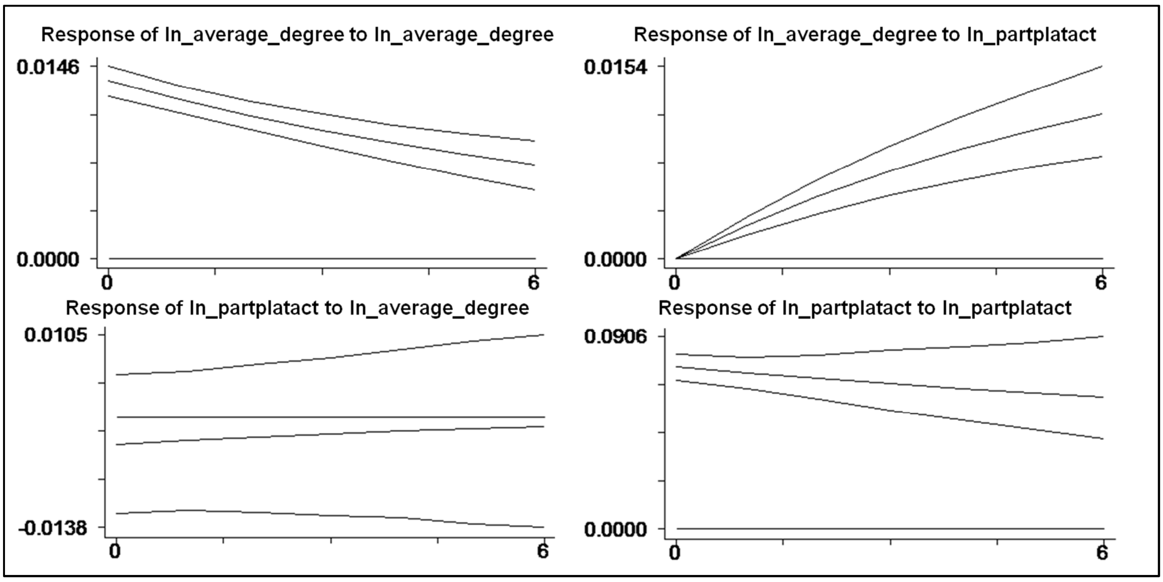
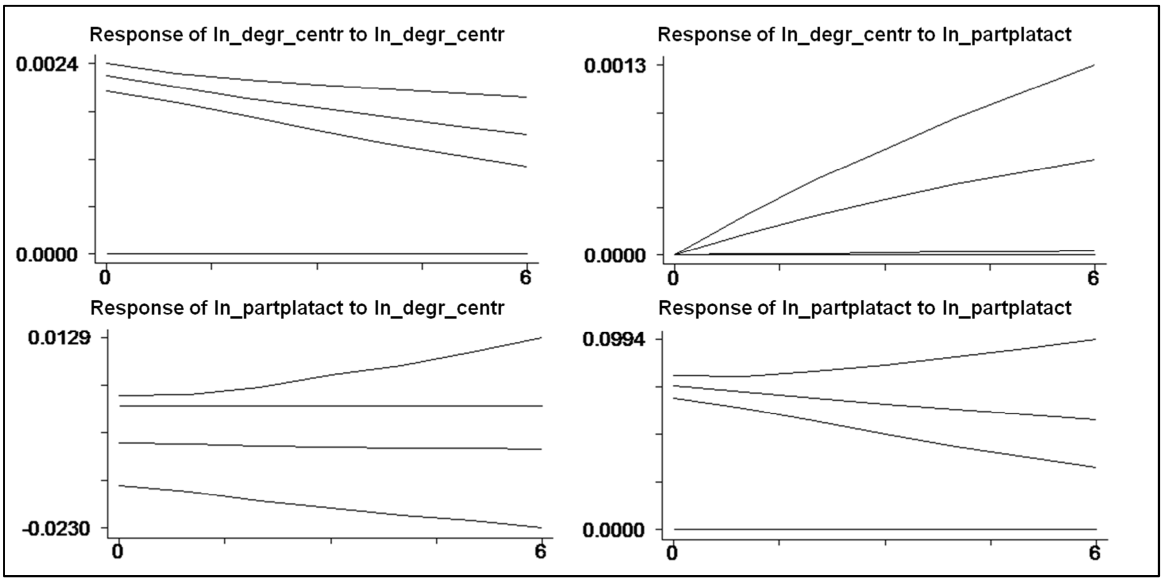


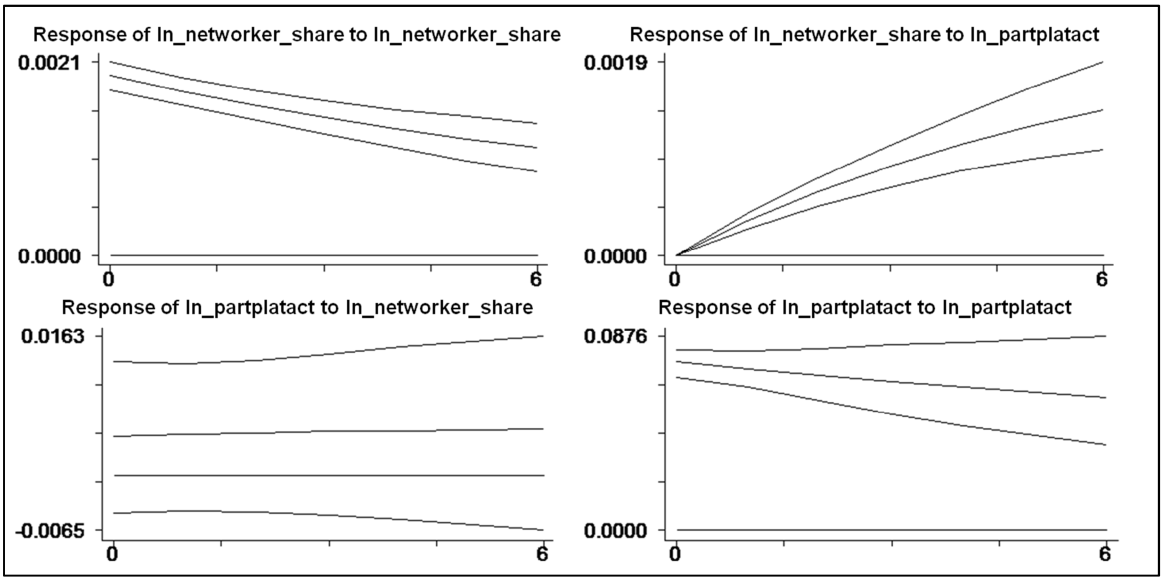
Figure 7 Impulse Response Functions, PVAR(1) ln_degree_centralization ln_partplatact, errors are 5% on each side generated by Monte-Carlo (1000 reps); Established Regions



Model 1.1.2.3 describes the interrelationship between the share of networkers and active platform participation. After the estimation of PVAR(1) I find a positive, but non-significant response of active platform participation to a shock in the share of networkers (see Figure 8). However, this result is enhanced by the results of PVAR(2), PVAR(3),

and PVAR(4). IRFs of these models show that a shock in the share of networkers leads to a positive and significant response of active platform participation (see Appendix 10). Reversely, a shock in active platform participation increases the share of networkers, which is confirmed by PVAR(2), PVAR(3), and PVAR(4).

Figure 8 Impulse Response Functions, PVAR(1) ln_networker_share ln_partplatact, errors are 5% on each side generated by Monte-Carlo (1000 reps); Established Regions



IRFs of model 1.1.2.4, which describe the reaction of active platform participation to a shock in the network clustering coefficient and vice versa through the estimation of PVAR(1), do not show any significant responses (see Figure 9). Also PVAR models of higher lag order do not uncover any significant effects (see Appendix 11).

By model 1.1.3.1, I estimate a PVAR(1) specification that examines the interrelationship between average degree and overall participation, i.e. the sum of active interpersonal and active platform participation. The results of IRFs, which are displayed in Figure 10, show that an impulse in average degree is followed by a positive response of overall participation, which lasts for about one and a half months. PVAR models of higher lag order confirm this finding (see Appendix 12). With PVAR(3) and PVAR(4), I even find effects that last for about four and a half and for about three months. Looking at the other direction, results show that a shock in active interpersonal and platform participation increases average degree, which is confirmed by PVAR(2), PVAR(3), and PVAR(4).

Figure 9 Impulse Response Functions, PVAR(1) ln_network_cc ln_partplatact, errors are 5% on each side generated by Monte-Carlo (1000 reps); Established Regions

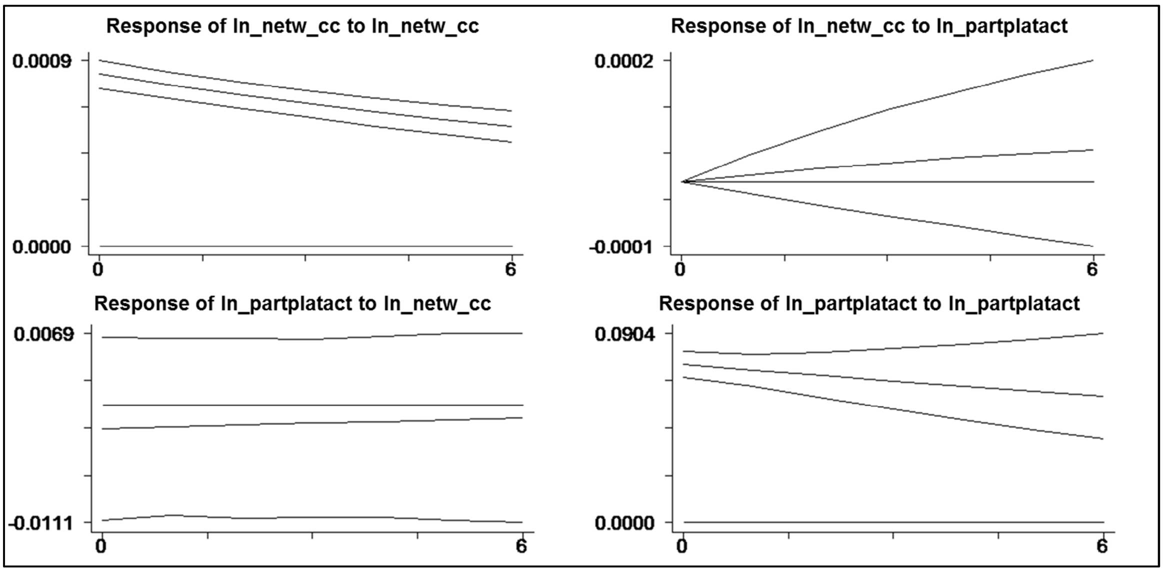
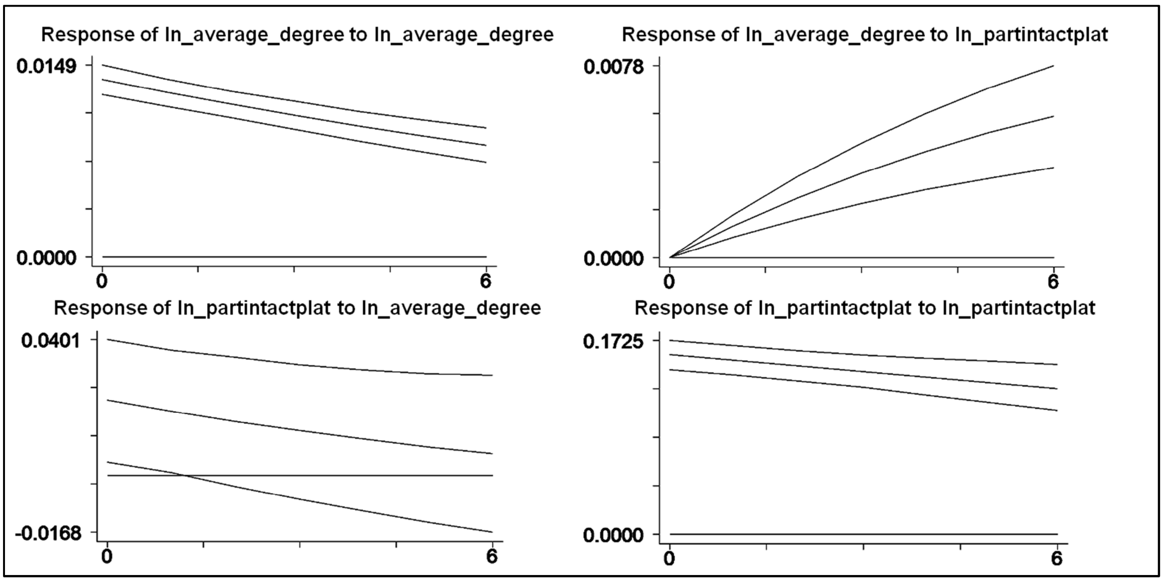
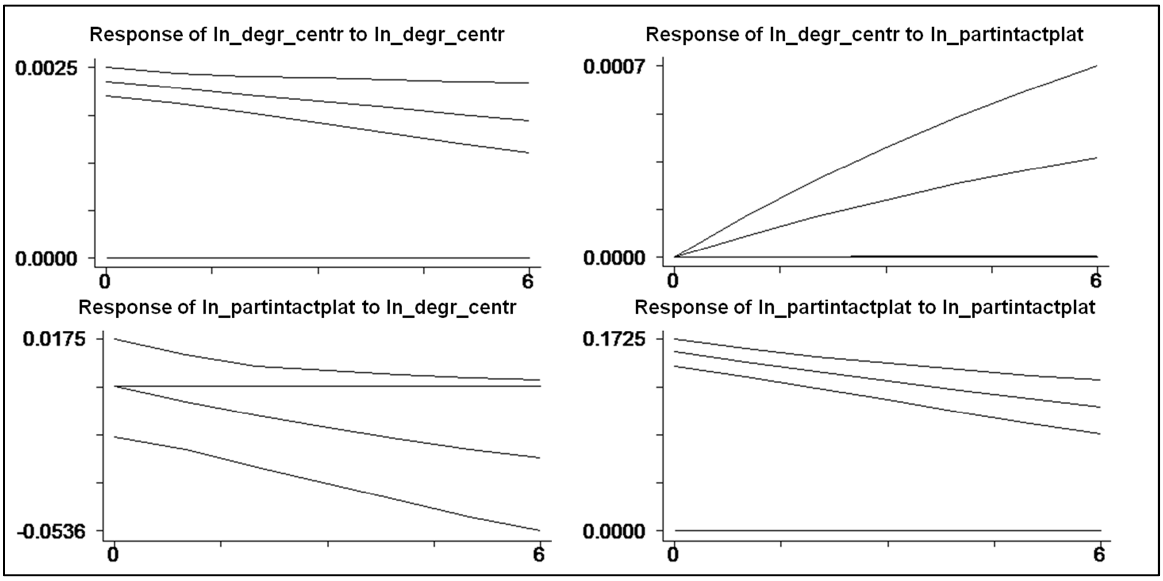


Figure 10 Impulse Response Functions, PVAR(1) ln_average_degree ln_partintactplat, errors are 5% on each side generated by Monte-Carlo (1000 reps); Established Regions



IRFs of model 1.1.3.2, which describes the interrelationship between degree centralization and overall participation by PVAR(1), reveal that a shock in degree centralization leads to a negative response of overall participation, which is not significant in PVAR(1) (see Figure 11). Yet, IRFs of PVAR(2) and PVAR(4) demonstrate a significant negative effect (see Appendix 13). Conversely, with estimation of PVAR(1) I do not detect any significant effect of overall participation on degree centralization, which is also supported by PVAR(2), PVAR(3), and PVAR(4).

Figure 11 Impulse Response Functions, PVAR(1) ln_degee_centralization ln_partintactplat, errors are 5% on each side generated by Monte-Carlo (1000 reps); Established Regions



By the help of model 1.1.3.3, it becomes apparent that, in established regions, a shock in the share of networkers does not have any significant consequences on overall participation (see Figure 12). This is also supported by all PVAR models of higher lag order (see Appendix 14). Reversely, a shock in active interpersonal and platform participation increases the share of networkers, which is also true for PVAR(2), PVAR(3), and PVAR(4).

Model 1.1.3.4 investigates the interrelationship between the network clustering coefficient and overall participation. There are no significant effects in both directions (see Figure 13). These findings are also supported by models of higher lag order (see Appendix 15).

Figure 12 Impulse Response Functions, PVAR(1) ln_networker_share ln_partintactplat, errors are 5% on each side generated by Monte-Carlo (1000 reps); Established Regions

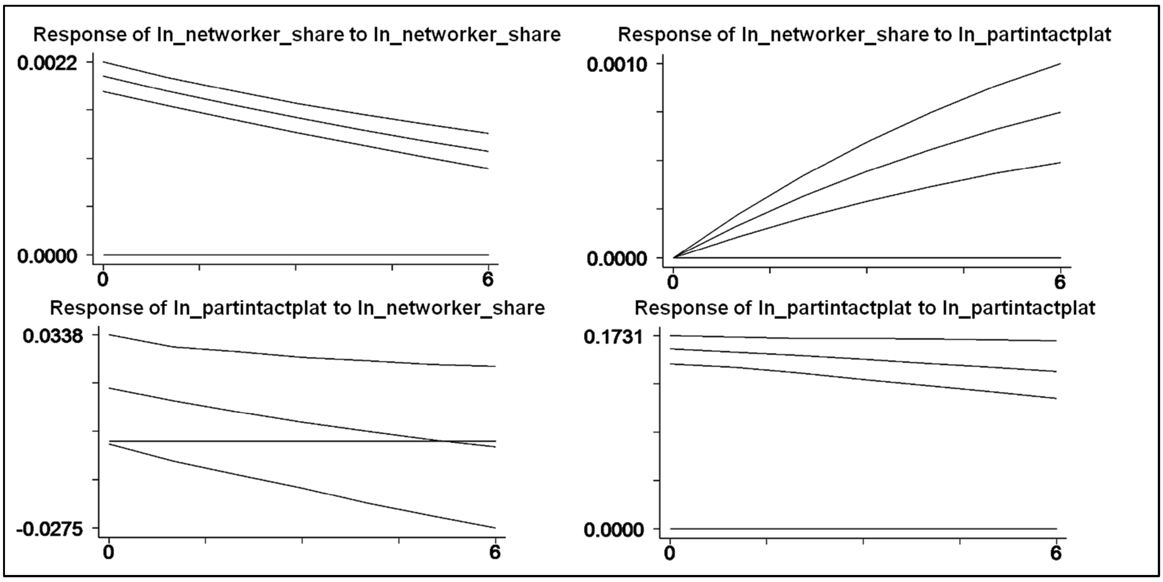
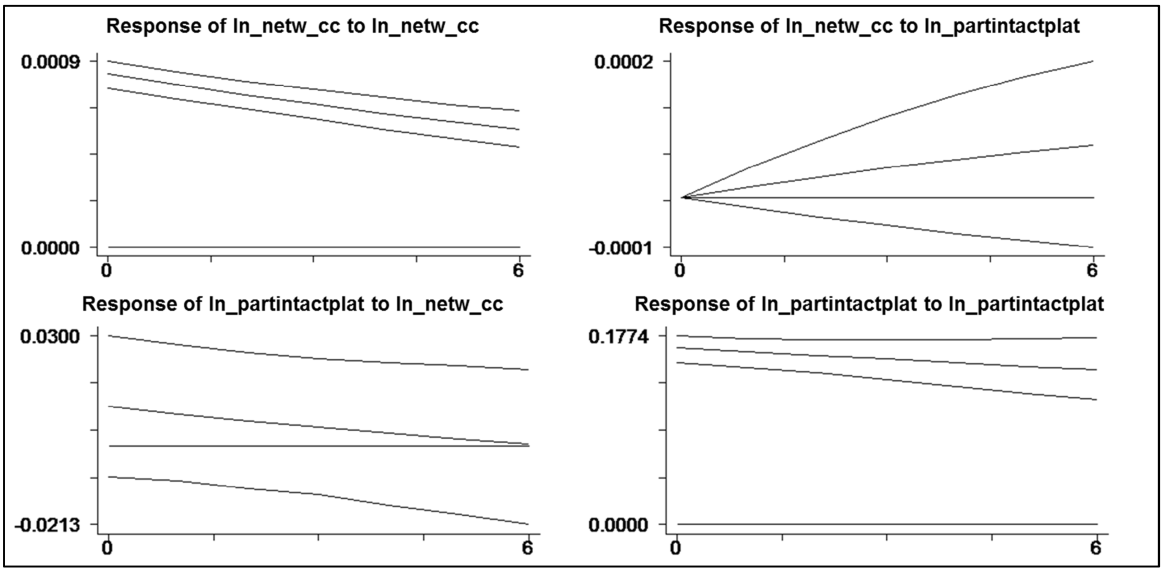


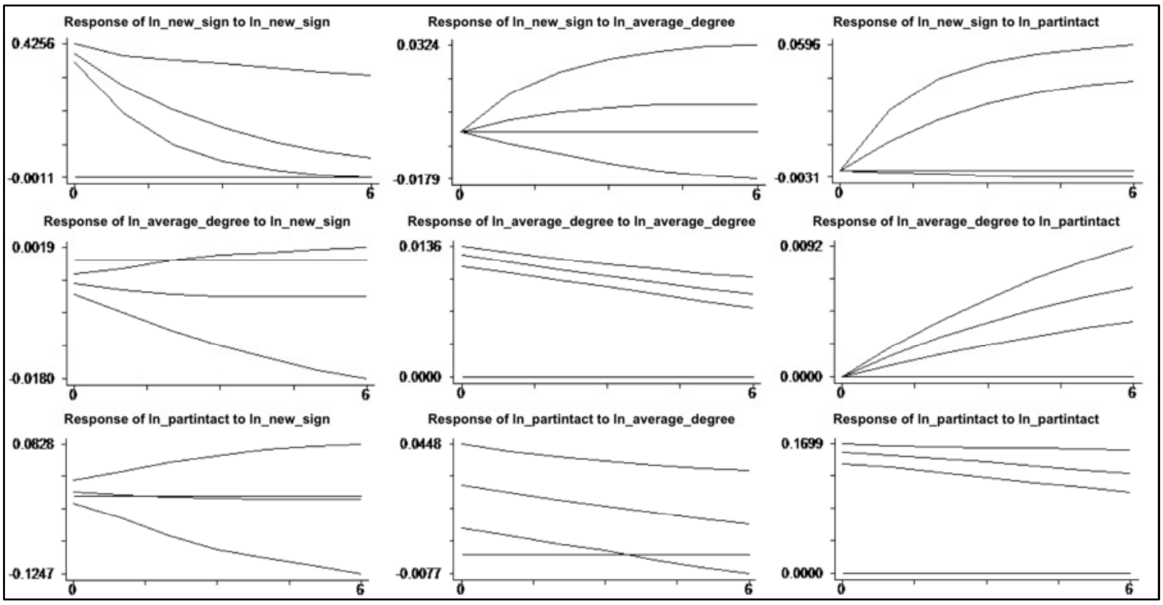
Figure 13 Impulse Response Functions, PVAR(1) ln_network_cc ln_partintactplat, errors are 5% on each side generated by Monte-Carlo (1000 reps); Established Regions



Community Growth – Network Structure – Participation

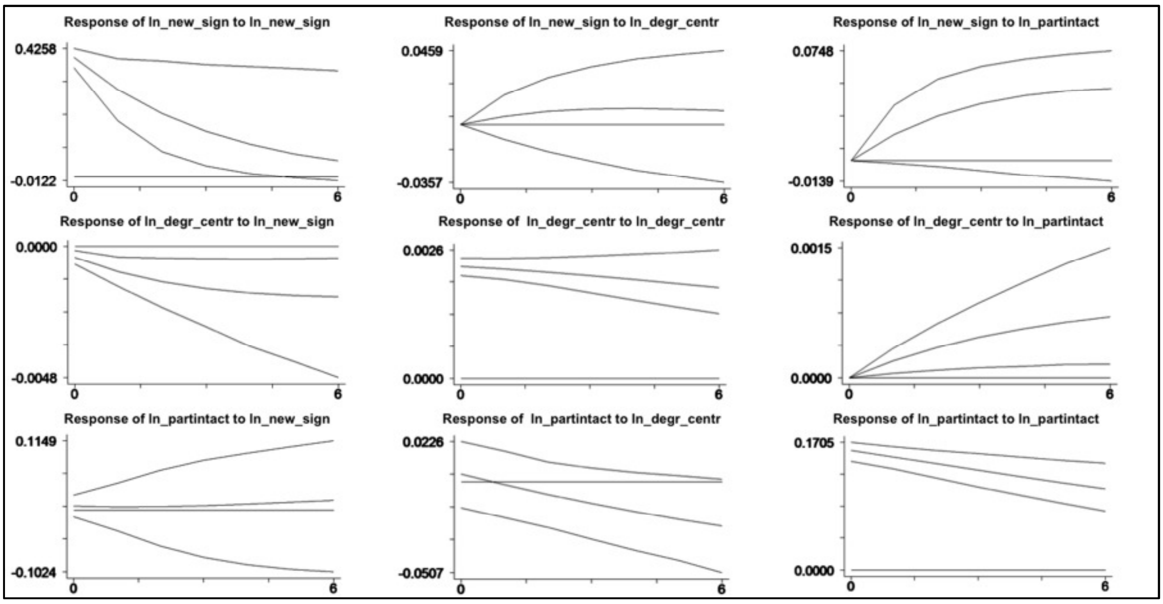
In the following section, I add the number of new sign-ups, which serves as an index for community growth, to the models. Model 1.2.1.1 investigates the interrelationship between new sign-ups, average degree, and active interpersonal participation. The IRFs, which are displayed in Figure 14, show that a shock in average degree leads to a positive response of active interpersonal participation, which lasts about three months. A shock in participation increases average degree. These findings are supported by robustness tests (see Appendix 16) and are in line with model 1.1.1.1, where new sign-ups are excluded. Further, a shock in new sign-ups is followed by a negative response of average degree, which is also supported by PVAR models of higher lag order. Finally, an impulse in active interpersonal participation increases the number of new sign-ups, which is not significant in PVAR(1), but in PVAR(3) and PVAR(4) after about two months.

Figure 14 Impulse Response Functions, PVAR(1) ln_new_signups ln_average_degree ln_partintact, errors are 5% on each side generated by Monte-Carlo (1000 reps); Established Regions



The results of model 1.2.1.2, which captures the interrelationship between new sign-ups, degree centralization, and active interpersonal participation, are illustrated in Figure 15. When degree centralization gets an impulse, one observes a negative response of participation, which is not significant in PVAR(1). However, in PVAR(2) and PVAR(4), this relationship gets significant after about one month (see Appendix 17). Effects of participation and new sign-ups on degree centralization are significant in the PVAR(1) model, but are not supported by robustness tests. Thus, I am able to show that the inclusion of new sign-ups does not change the interrelationship between degree centralization and active interpersonal participation. Finally, a shock in participation leads to a positive response of new sign-ups, which is insignificant in PVAR(1), but significant in PVAR(3) and PVAR(4).

Figure 15 Impulse Response Functions, PVAR(1) ln_new_signups ln_degree_centralization ln_partintact, errors are 5% on each side generated by Monte-Carlo (1000 reps); Established Regions



IRFs of model 1.2.1.3, which helps to describe the relationship between new sign-ups, share of networkers, and active interpersonal participation by PVAR(1), reveal that an impulse in the share of networkers is followed by a positive reaction of participation (see Figure 16), which is different from the model excluding new sign-ups (model 1.1.1.3 and robustness tests). Reversely, a shock in participation increases the share of networkers. These findings are supported by robustness tests (see Appendix 18). Additionally, an impulse in participation is followed by a positive response of new sign-ups, which is also confirmed by robustness tests. Finally, IRFs of PVAR(1), PVAR(2), PVAR(3), and PVAR(4) models show that a shock in new sign-ups leads to a negative reaction of the share of networkers.

Model 1.2.1.4 investigates the interrelationship between new sign-ups, network clustering coefficient, and active interpersonal participation. IRFs of all estimated PVAR models do not show any significant effect between network clustering coefficient and participation (see Figure 17 and Appendix 19), which is in line with the results of model 1.1.1.4. In addition, results of PVAR(1) reveal that a shock in participation is followed by a positive reaction of the number of new sign-ups, which is, however, not supported by robustness tests.

Figure 16 Impulse Response Functions, PVAR(1) ln_new_signups ln_networker_share ln_partintact, errors are 5% on each side generated by Monte-Carlo (1000 reps); Established Regions

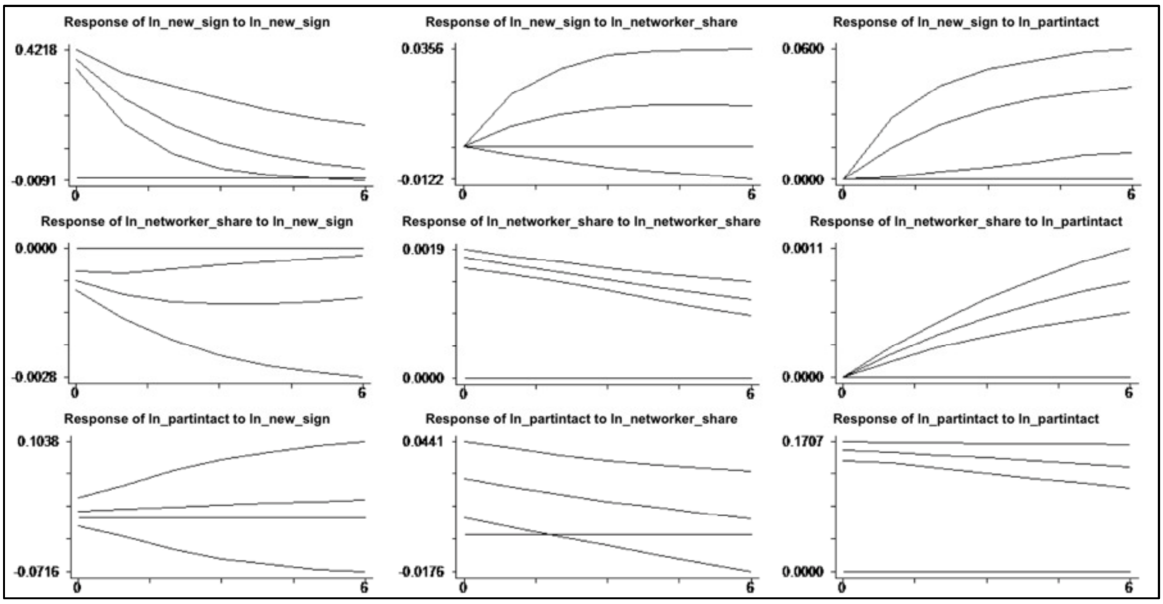
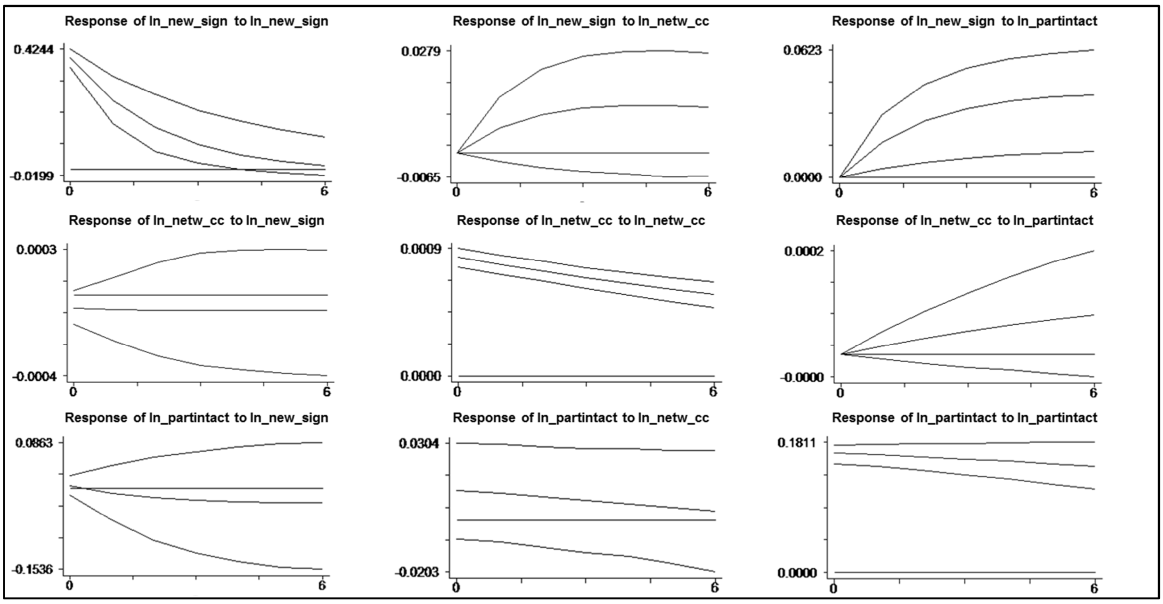
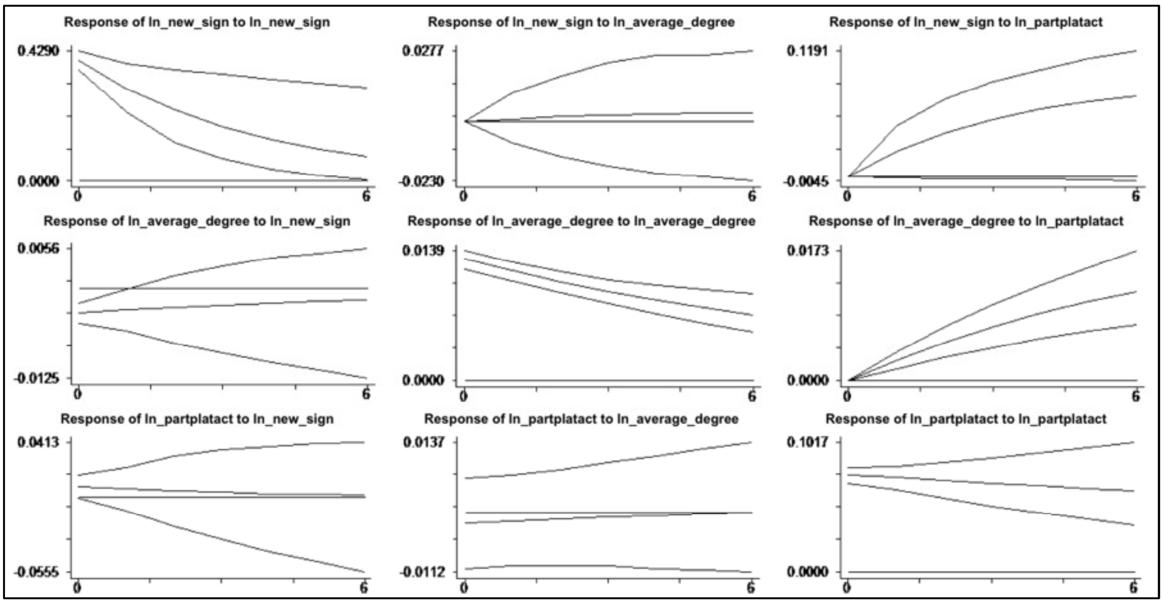


Figure 17 Impulse Response Functions, PVAR(1) ln_new_signups ln_network_cc ln_partintact, errors are 5% on each side generated by Monte-Carlo (1000 reps); Established Regions



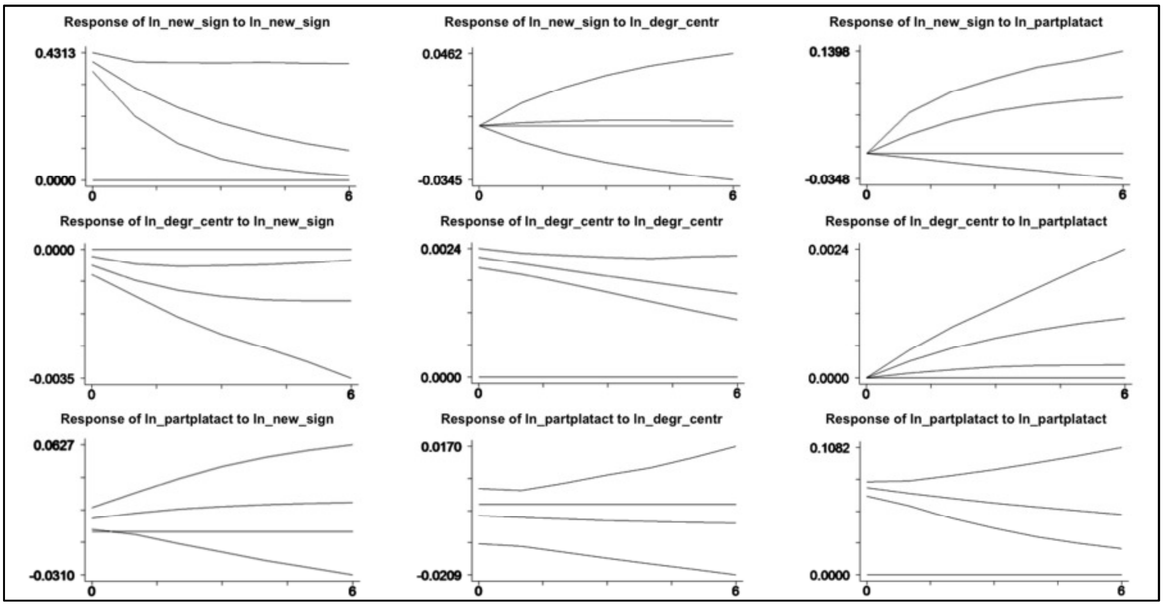
The results of model 1.2.2.1, which describes the interrelationship between the number of new sign-ups, average degree, and active platform participation by PVAR(1) are displayed in Figure 18. IRFs of PVAR(1) imply that a shock in average degree has no significant effects on active platform participation, whereas a shock in active platform participation increases average degree. These findings are in line with the model excluding new sign-ups and are supported by PVAR models of higher lag order (see Appendix 20). Further, a shock in new sign-ups leads to a negative response of average degree and lasts about one and a half months until it turns insignificant. This effect is also confirmed by PVAR(2), PVAR(3), and PVAR(4). Finally, IRFs of PVAR(1) reveal a positive, but insignificant response of new sign-ups to a shock in participation. However, this effect turns significant with estimation of PVAR(3) and PVAR(4).

Figure 18 Impulse Response Functions, PVAR(1) ln_new_signups ln_average_degree ln_partplatact, errors are 5% on each side generated by Monte-Carlo (1000 reps); Established Regions



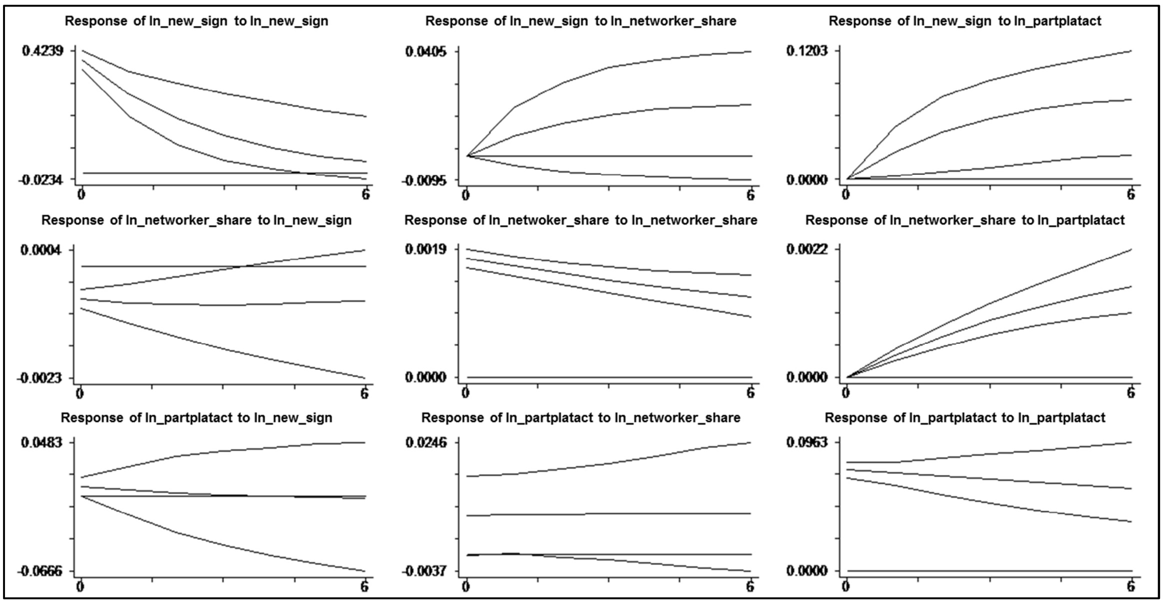
I estimate model 1.2.2.2 in order to investigate the interrelationship between the number of new sign-ups, degree centralization, and active platform participation. The results of the IRFs of PVAR(1) show that a shock in participation leads to a positive response of degree centralization (see Figure 19). Further, a shock in the number of new sign-ups is followed by a negative response of degree centralization and by a positive response of active platform participation, which is slightly significant. These findings are supported by robustness tests (see Appendix 21). Moreover, an impulse in degree centralization leads to a negative, but insignificant response of participation in the PVAR(1) model. However, with estimation of PVAR(2) and PVAR(4) this effects turns significant after about one month. Thus, the inclusion of new sign-ups does not change the interrelationship between degree centralization and active platform participation. Finally, the positive, but insignificant reaction of new sign-ups to a shock in participation in PVAR(1) turns significant with PVAR(3) and PVAR(4).

Figure 19 Impulse Response Functions, PVAR(1) ln_new_signups ln_degree_centralization ln_partplatact, errors are 5% on each side generated by Monte-Carlo (1000 reps); Established Regions



Results of model 1.2.2.3, which investigates the effects between the number of new sign-ups, share of networkers, and active platform participation, are illustrated in Figure 20. IRFs of PVAR(1) show that a shock in participation increases the share of networkers as well as the number of new sign-ups. Additionally, an impulse in new sign-ups leads to a negative response of the share of networkers, which remains significant for up to three months. These results are confirmed by robustness tests (see Appendix 22). Further, a shock in the share of networkers is followed by a positive response of active platform participation. Although this effect is insignificant in PVAR(1), it gets significant with estimation of PVAR(2), PVAR(3), and PVAR(4) and lasts for up to three months. Thus, the inclusion of new sign-ups does not change the effects between the share of networkers and participation from model 1.1.2.3 and its robustness tests.

Figure 20 Impulse Response Functions, PVAR(1) ln_new_signups ln_networker_share ln_partplatact, errors are 5% on each side generated by Monte-Carlo (1000 reps); Established Regions



IRFs of model 1.2.2.4, which investigates the relationship between the number of new sign-ups, network clustering coefficient, and active platform participation by PVAR(1), do not show any significant effects between the network clustering coefficient and participation (see Figure 21). These findings are equivalent to the results of model 1.1.2.4, that excludes new sign-ups, and are supported by PVAR models of higher lag order (see Appendix 23). Nevertheless, model 1.2.2.4 also reveals one significant relationship: A shock in participation is followed by an increase in the number of new sign-ups, which is supported by robustness tests.

In the next step, I investigate the interrelationship between the number of new sign-ups, average degree, and active interpersonal and platform participation. IRFs of model 1.2.3.1 reveal that an impulse in average degree leads to a positive response of overall participation (see Figure 22). Conversely, a shock in overall participation increases average degree. These findings are in line with model 1.1.3.1 and are supported by robustness tests (see Appendix 24). Additionally, with estimation of PVAR(1), I discover a negative reaction of average degree to a shock in new sign-ups, which is significant up to three months and is confirmed by PVAR(2), PVAR(3), and PVAR(4). Further, results of PVAR(1) indicate a positive response of the number of new sign-ups to an impulse in overall participation, which is not significant in the PVAR(1) model, but gets significant with estimation of PVAR models of higher lag order.

Figure 21 Impulse Response Functions, PVAR(1) ln_new_signups ln_network_cc ln_partplatact, errors are 5% on each side generated by Monte-Carlo (1000 reps); Established Regions

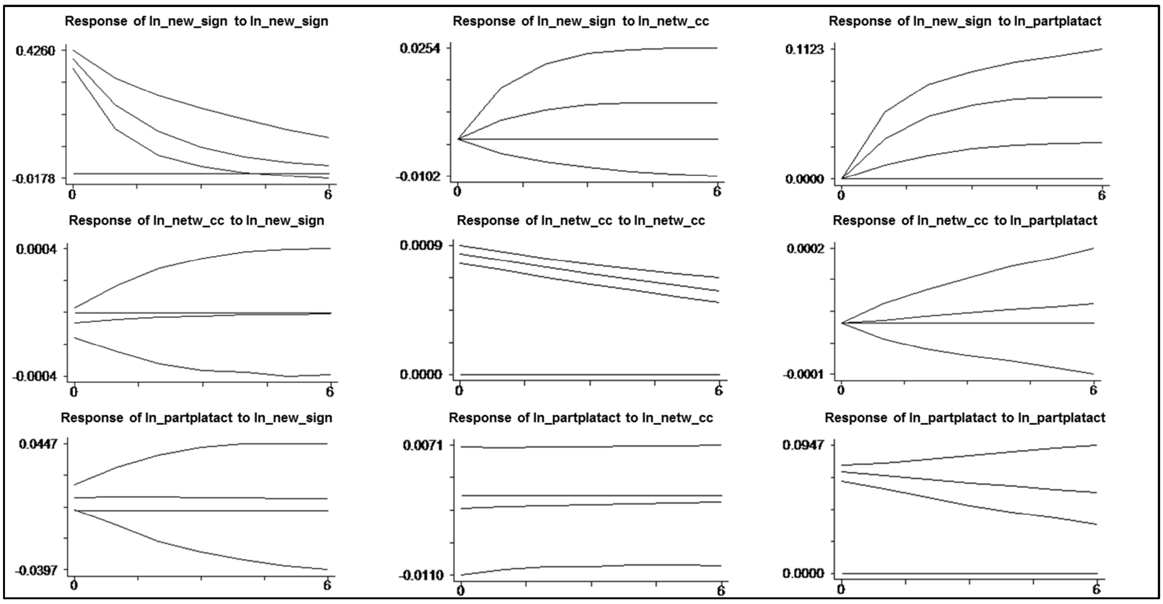
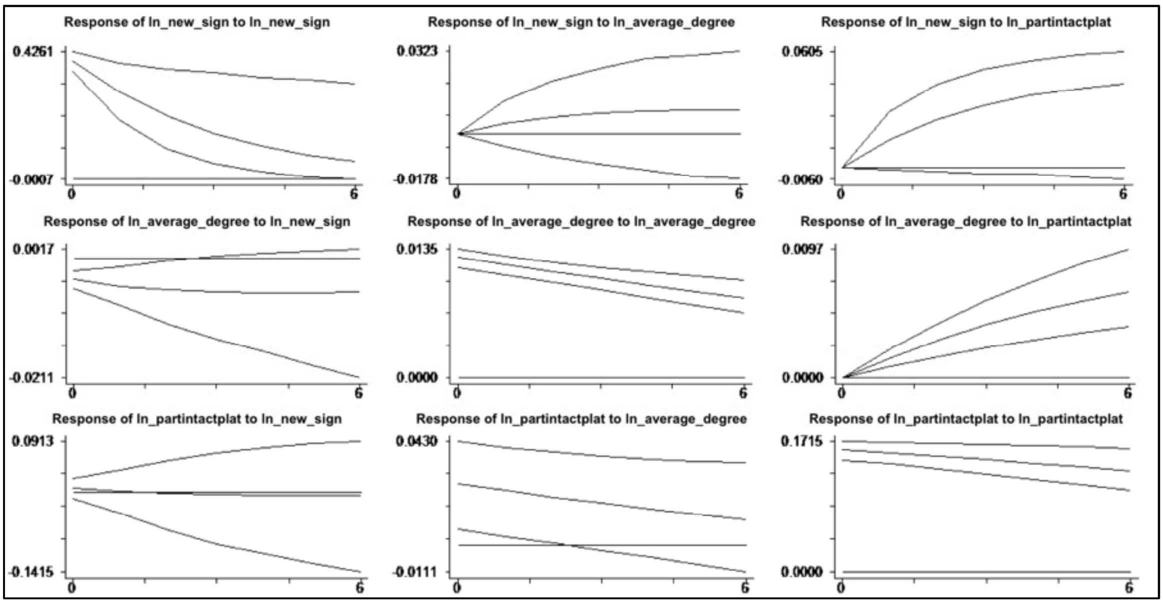
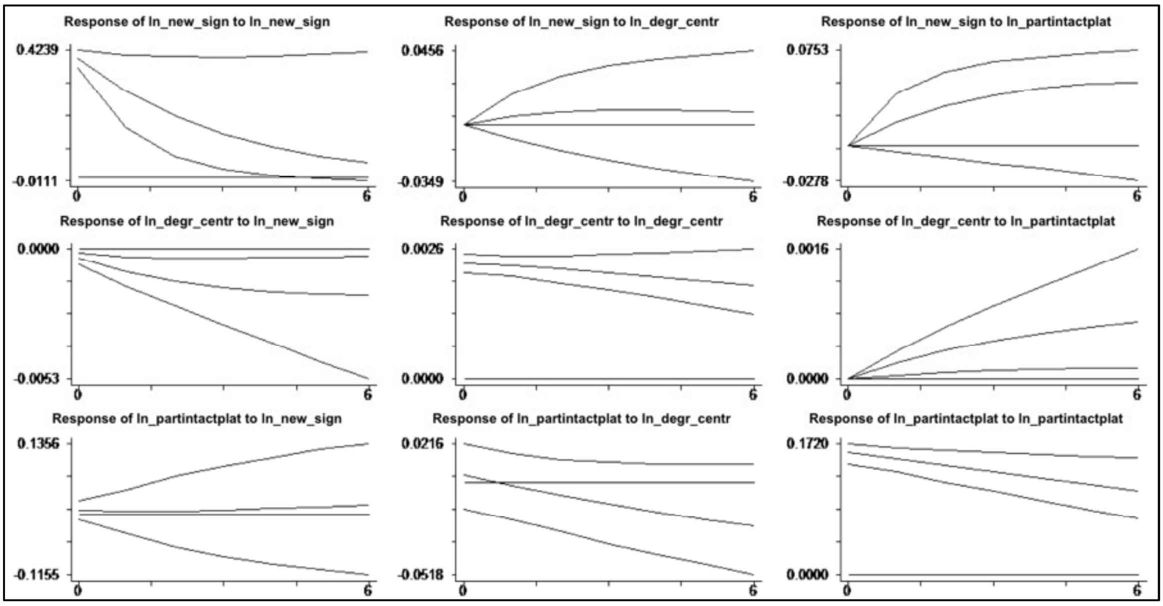


Figure 22 Impulse Response Functions, PVAR(1) ln_new_signups ln_average_degree ln_partintactplat, errors are 5% on each side generated by Monte-Carlo (1000 reps); Established Regions



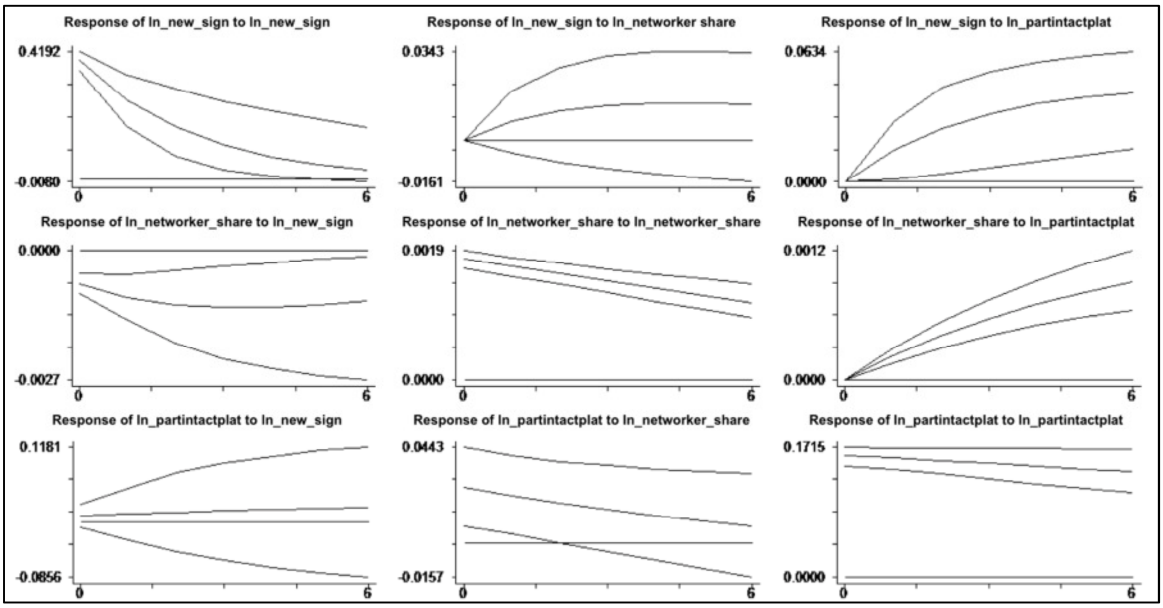
Model 1.2.3.2 investigates the interrelationship between the number of new sign-ups, degree centralization, and active interpersonal and platform participation. The results of the IRFs of PVAR(1), which are displayed in Figure 23, show that an impulse in participation is followed by a significant positive response of degree centralization. This is supported by PVAR models of higher lag order, whereby the effect gets significant after estimation of PVAR(3) (see Appendix 25). However, this finding is different from the model that excludes new sign-ups, where there is no significant effect of overall participation on degree centralization. Further, with estimation of PVAR(1) I detect a significant negative response of degree centralization to a shock in new sign-ups, which is however not significant in the robustness tests. Additionally, an impulse in degree centralization leads to a predominantly negative response of overall participation, which is not significant with estimation of PVAR(1), but gets significant with estimation of PVAR models of higher lag order. This negative effect of degree centralization on overall participation can also be found in the setting that excludes the number of new sign-ups. Further, IRFs of PVAR(1) demonstrate a positive, but insignificant reaction of the number of new sign-ups to a shock in overall participation. However, this effect turns significant with estimation of PVAR models of higher lag order.

Figure 23 Impulse Response Functions, PVAR(1) ln_new_signups ln_degree_centralization ln_partintactplat, errors are 5% on each side generated by Monte-Carlo (1000 reps); Established Regions



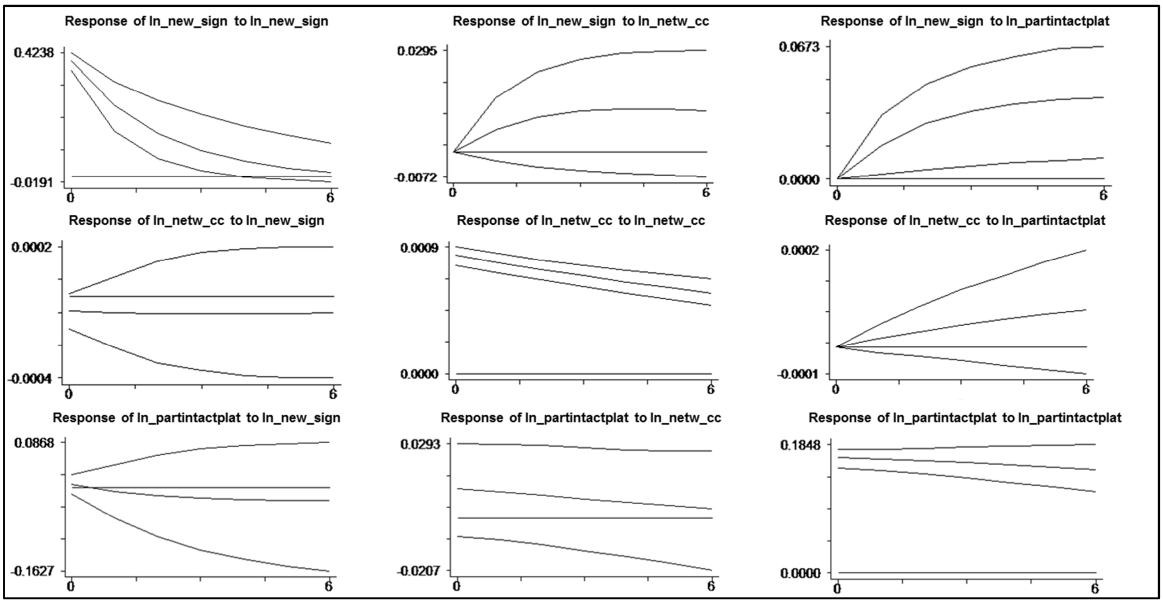
IRFs of model 1.2.3.3, which captures the interrelationship between new sign-ups, share of networkers, and active interpersonal and platform participation by PVAR(1), are displayed in Figure 24. They illustrate a positive reaction of overall participation to a shock in the share of networkers and, reversely, a positive reaction of the share of networkers to a shock in participation. These findings are confirmed by robustness tests (see Appendix 26). Thus, results from this model are slightly different from the model that excludes community growth, where the reaction of overall participation to an impulse in the share of networkers is not significant. Furthermore, a shock in the number of new sign-ups is followed by a negative response of the share of networkers. In PVAR(1), this effect is significant for more than six months. In PVAR(2), PVAR(3), and PVAR(4) this effect lasts for one and a half months. Lastly, an impulse in overall participation increases the number of new sign-ups, which is supported by all PVAR models of higher lag order.

Figure 24 Impulse Response Functions, PVAR(1) ln_new_signups ln_networker_share ln_partintactplat, errors are 5% on each side generated by Monte-Carlo (1000 reps); Established Regions



Finally, results of model 1.2.3.4, which investigates effects between the number of new sign-ups, network clustering coefficient, and active interpersonal and platform participation by PVAR(1), are presented in Figure 25. There is no significant effect between the network clustering coefficient and overall participation. This is confirmed by models of higher lag order (see Appendix 27) and is in line with model 1.1.3.4, that excludes new sign-ups. The only significant relationship, which is revealed by model 1.2.3.4, appears in the positive reaction of the number of new sign-ups to a shock in overall participation. However, this finding is not supported by robustness tests.

Figure 25 Impulse Response Functions, PVAR(1) ln_new_signups ln_network_cc ln_partintactplat, errors are 5% on each side generated by Monte-Carlo (1000 reps); Established Regions

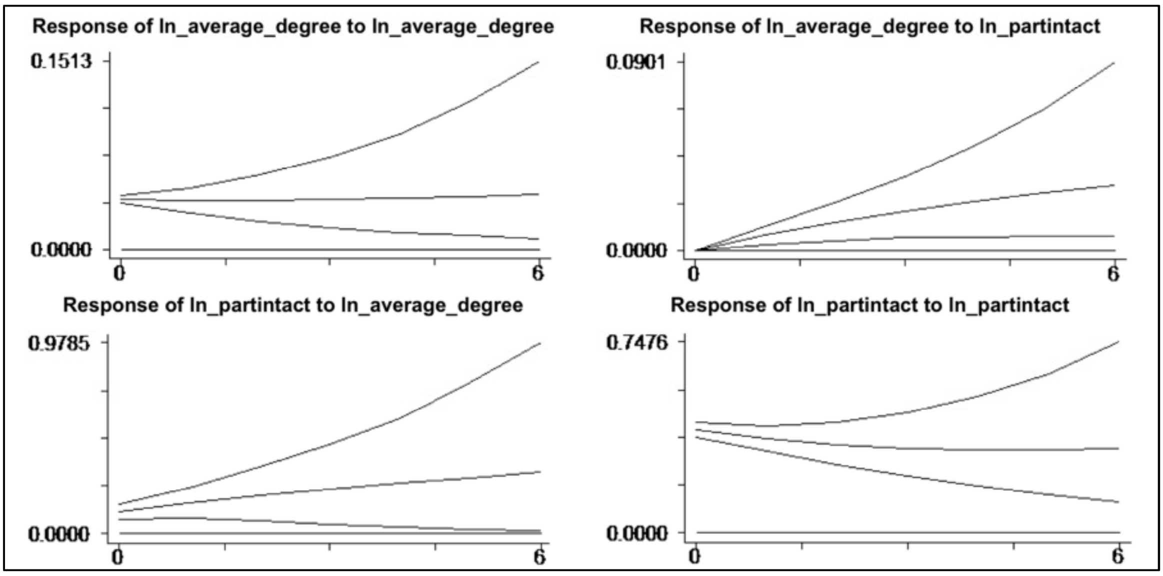


3.5.2. New Regions

Network Structure – Participation

In the next step, I use the sample including the new regions and estimate again the models presented above. First of all, I start again with the analysis of the interrelationship between network structure and participation only. Figure 26 displays the results of the IRFs of model 2.1.1.1, which investigates the relationship between average degree and active interpersonal participation in new regions by the help of PVAR(1). The results show that an impulse in average degree is followed by a significant positive response of participation. Reversely, a shock in participation leads to a positive reaction of average degree. Results of PVAR(1) are supported by robustness tests (see Appendix 28). Thus, the findings of the new regions' model do not differ from model 1.1.1.1 of the established regions.

Figure 26 Impulse Response Functions, PVAR(1) ln_average_degree ln_partintact, errors are 5% on each side generated by Monte-Carlo (1000 reps); New Regions



In model 2.1.1.2, the interrelationship between degree centralization and active interpersonal participation is analyzed. IRFs of PVAR(1) demonstrate a positive response of participation to a shock in degree centralization, that lasts for more than six months (see Figure 27). Effects of participation on degree centralization are not significant. In order to check the robustness of these results, I additionally estimate PVAR(2), PVAR(3), and PVAR(4), which confirm the results of PVAR(1) (see Appendix 29). It is remarkable that, in the sample of new regions, the effect of degree centralization on participation is positive and thus is completely different from the sample of established regions.

IRFs of model 2.1.1.3, which describes the interrelationship between the share of networkers and active interpersonal participation, are illustrated in Figure 28. They do not show any significant effects between these two variables. These findings are also supported by models of higher lag order (see Appendix 30). All in all, effects are slightly different from the model of established regions, where a positive response of the share of networkers is detected.

Figure 27 Impulse Response Functions, PVAR(1) ln_degree_centralization ln_partintact, errors are 5% on each side generated by Monte-Carlo (1000 reps); New Regions

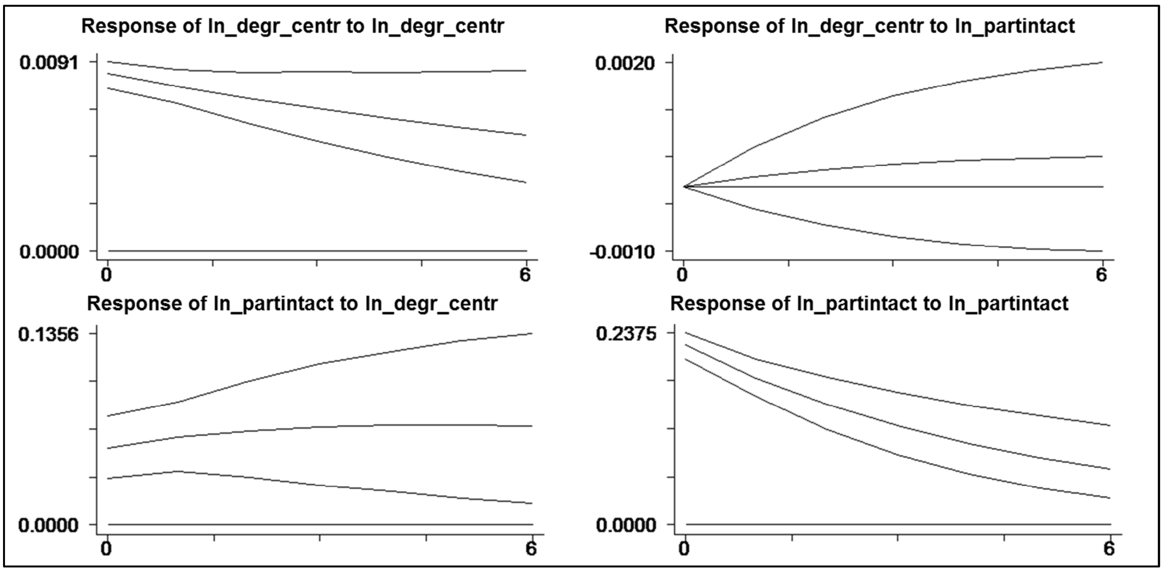
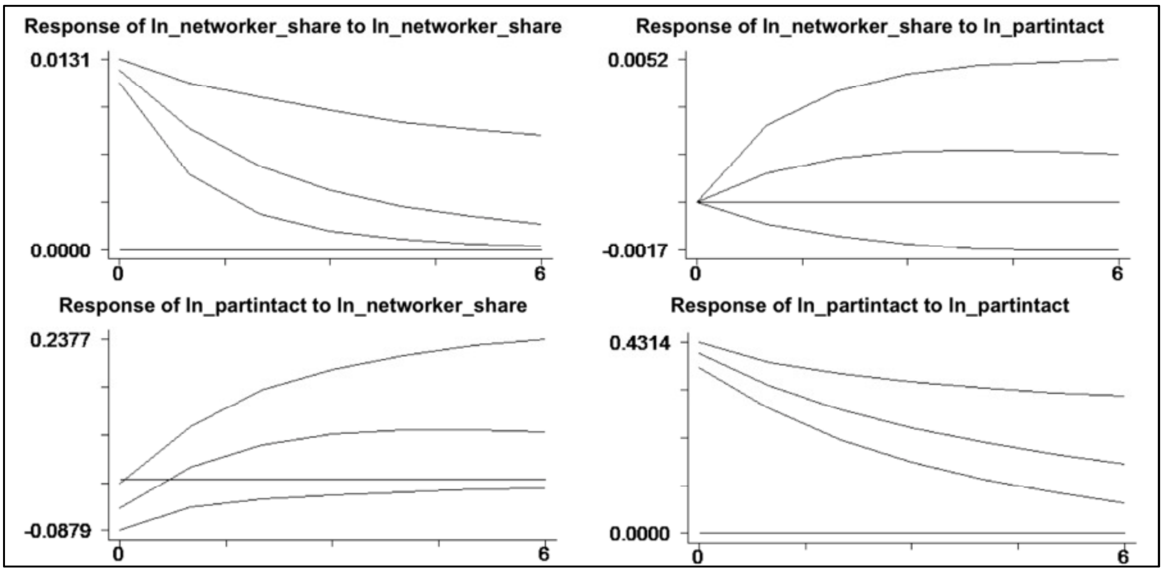
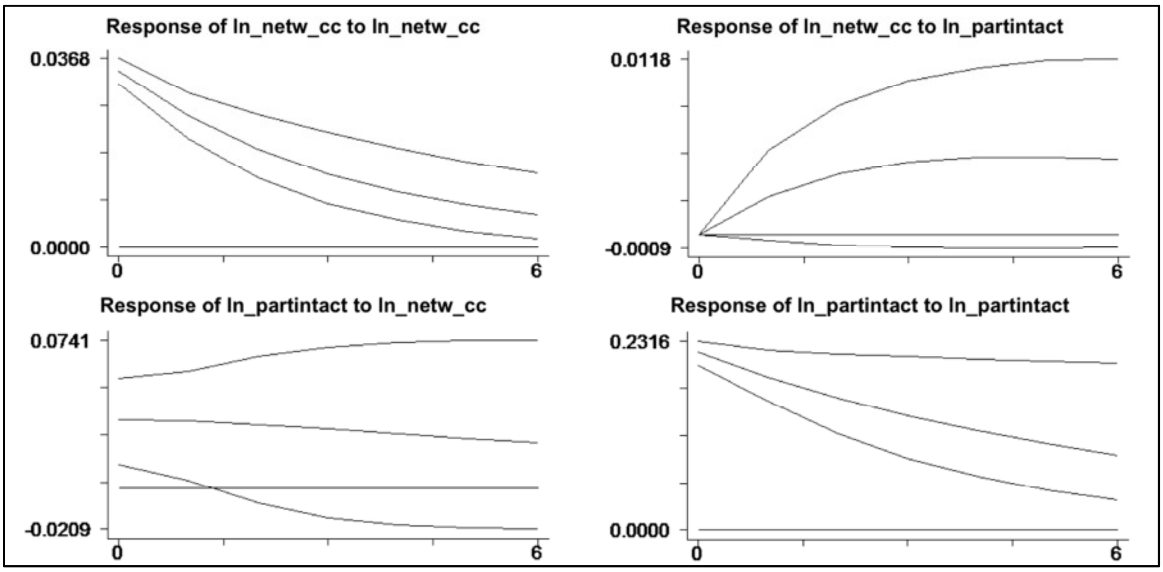


Figure 28 Impulse Response Functions, PVAR(1) ln_networker_share ln_partintact, errors are 5% on each side generated by Monte-Carlo (1000 reps); New Regions



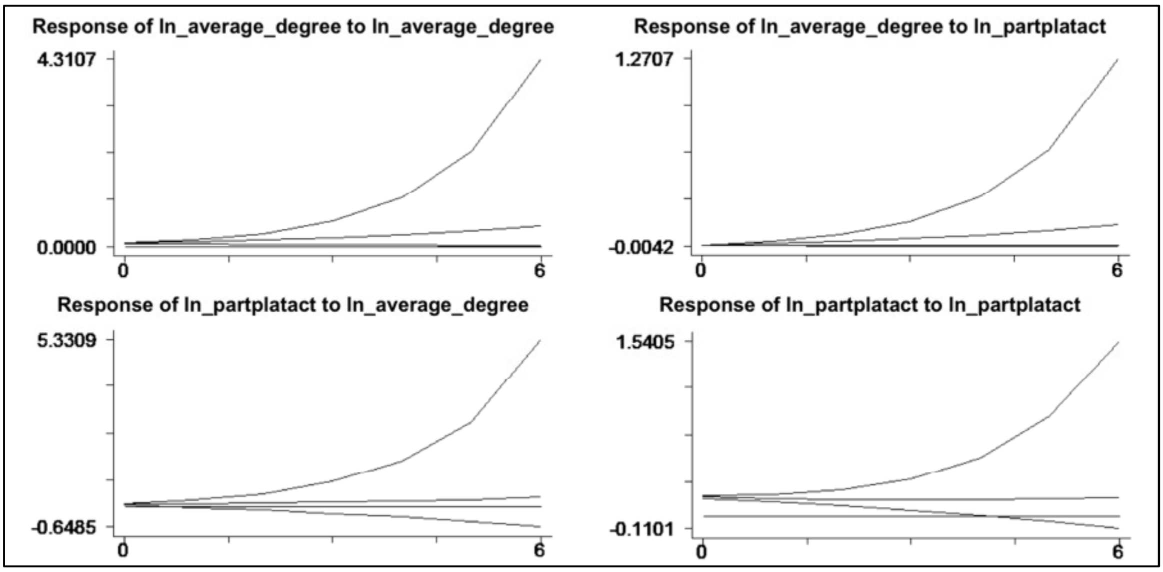
I estimate model 2.1.1.4 in order to study the relationship between the network clustering coefficient and active interpersonal participation. The results of the IRFs of PVAR(1), which are illustrated in Figure 29, indicate that a shock in participation does not have any statistically significant impact on the network clustering coefficient, which is also confirmed by PVAR(2), PVAR(3), and PVAR(4) (see Appendix 31). Further, IRFs of PVAR(1) reveal a positive reaction of participation to a shock in the network clustering coefficient, which is only partly confirmed. PVAR models of higher lag order show an effect that turns from negative into positive over time. This effect is totally insignificant in PVAR(2). However, in PVAR(3) the negative part of the effect is significant and in PVAR(4) the positive part is significant. Thus, we may conclude that there is a tendency towards a positive effect, but negative effects are not completely excluded. Hence, in contrast to the sample of established regions, here, some effects going out from the network clustering coefficient are detected.

Figure 29 Impulse Response Functions, PVAR(1) ln_network_cc ln_partintact, errors are 5% on each side generated by Monte-Carlo (1000 reps); New Regions



In the following, active platform participation replaces active interpersonal participation. IRFs of model 2.1.2.1, which focuses on the interrelationship between average degree and active platform participation by the help of PVAR(1), are displayed in Figure 30. IRFs of PVAR(1) do not show any significant effects. This is supported by PVAR(2), PVAR(3), and PVAR(4) (see Appendix 32). Thus, results differ from the established regions' sample, where a positive reaction of average degree to a shock in active platform participation is observed.

Figure 30 Impulse Response Functions, PVAR(1) ln_average_degree ln_partplatact, errors are 5% on each side generated by Monte-Carlo (1000 reps); New Regions



IRFs of model 2.1.2.2, which investigates the interrelationship between degree centralization and active platform participation in a PVAR(1) model, show that a shock in participation increases degree centralization (see Figure 31). This is also supported by models of higher lag order (see Appendix 33). Reversely, an impulse in degree centralization is followed by a positive response of participation, which lasts for about three months in PVAR(1) and for up to two months in PVAR(2) until it gets insignificant. Thus, the effect from degree centralization on active platform participation is different from the sample of established regions, where a shock in degree centralization is followed by a negative reaction of active platform participation.

I estimate model 2.1.2.3 in order to analyze the interrelationship between the share of networkers and active platform participation. IRFs of PVAR(1) do not detect any significant relationship between these two variables (see Figure 32). PVAR(2), PVAR(3), and PVAR(4) confirm these results (see Appendix 34). Hence, results of this model are totally different from model 1.1.2.3 and its corresponding robustness tests because, there, positive effects in both directions are detected.

Figure 31 Impulse Response Functions, PVAR(1) ln_degree_centralization ln_partplatact, errors are 5% on each side generated by Monte-Carlo (1000 reps); New Regions

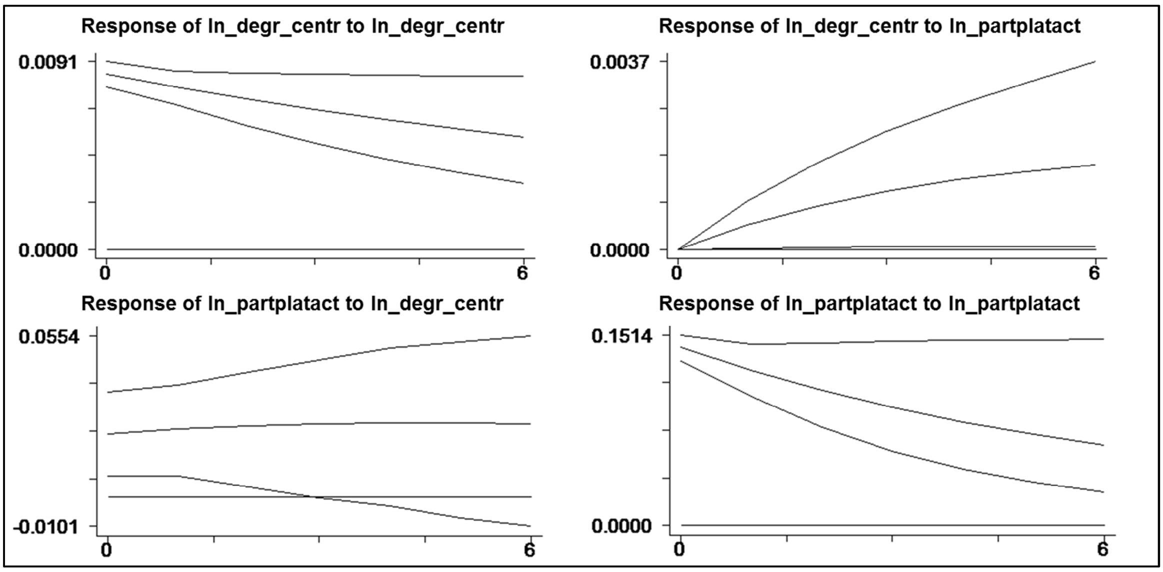
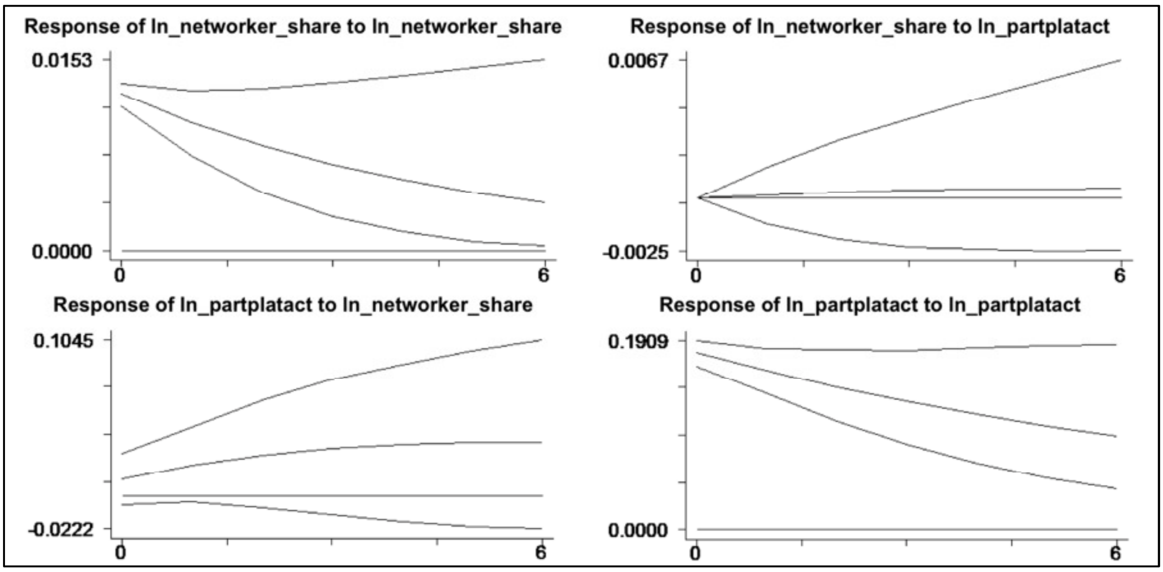


Figure 32 Impulse Response Functions, PVAR(1) ln_networker_share ln_partplatact, errors are 5% on each side generated by Monte-Carlo (1000 reps); New Regions



IRFs of model 2.1.2.4, which examines the relationship between the network clustering coefficient and active platform participation by PVAR(1), are displayed in Figure 33. The graphs reveal that there are no significant effects between the network clustering coefficient and participation. These results are supported by all PVAR models of higher lag order (see Appendix 35) and are in line with results from the corresponding model of the established regions' sample.

Figure 33 Impulse Response Functions, PVAR(1) ln_network_cc ln_partplatact, errors are 5% on each side generated by Monte-Carlo (1000 reps); New Regions

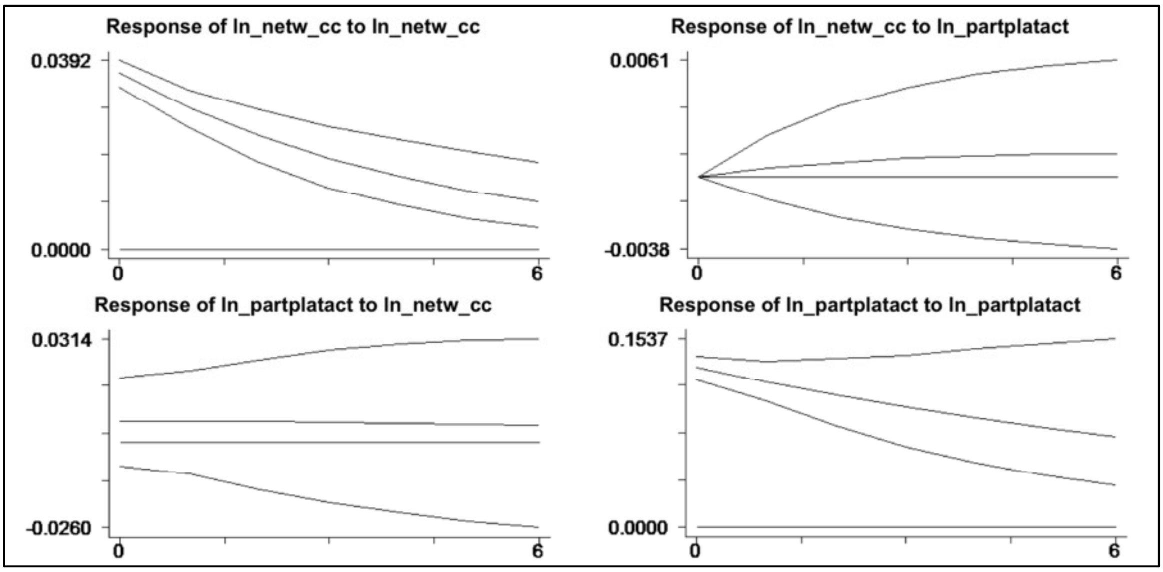


Figure 34 displays the IRFs of model 2.1.3.1, which investigates the effects between average degree and active interpersonal and platform participation by PVAR(1). The graphs indicate a positive response of overall participation to a shock in average degree, that lasts for about four months in the PVAR(1) model. Reversely, a shock in overall participation increases average degree. Positive effects between both variables are also uncovered by robustness tests (see Appendix 36). Therefore, effects are similar to model 1.1.3.1, which is based on the sample of the established regions.

IRFs of model 2.1.3.2, which analyzes the interrelationship between degree centralization and active interpersonal and platform participation by PVAR(1), reveal that a shock in degree centralization is followed by a positive reaction of overall participation, that lasts for more than six months (see Figure 35). Looking at the other direction, no significant effects are detected. Both positive and insignificant effects are also confirmed by PVAR(2), PVAR(3), and PVAR(4) (see Appendix 37). Thus, findings from the new regions' sample are different from the established regions' sample, where the corresponding IRFs demonstrate a negative instead of a positive response of overall participation to an impulse in degree centralization.

Figure 34 Impulse Response Functions, PVAR(1) ln_average_degree ln_partintactplat, errors are 5% on each side generated by Monte-Carlo (1000 reps); New Regions

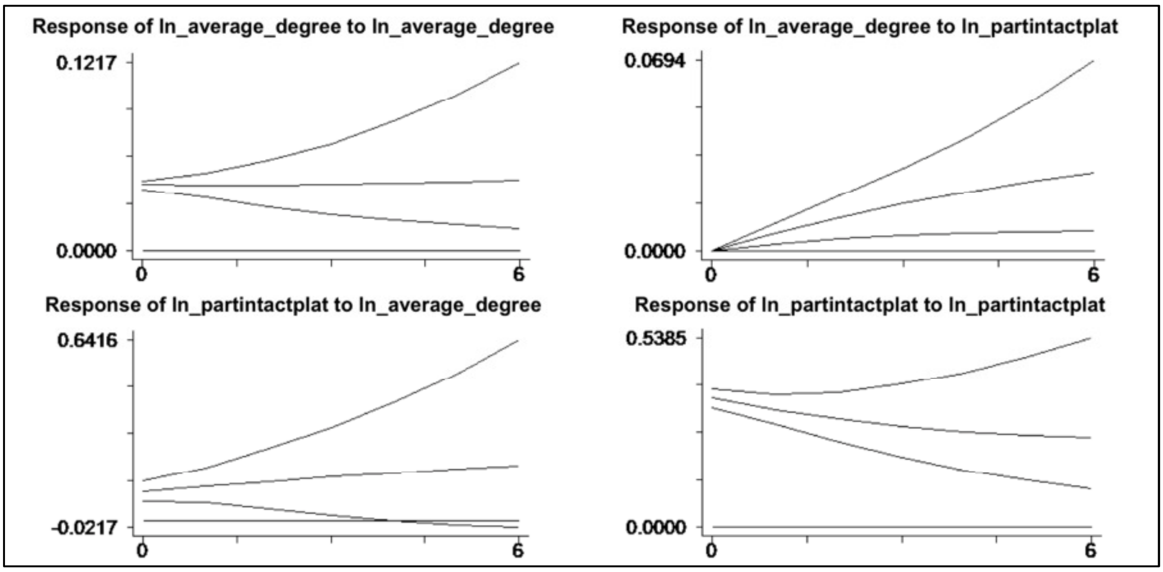
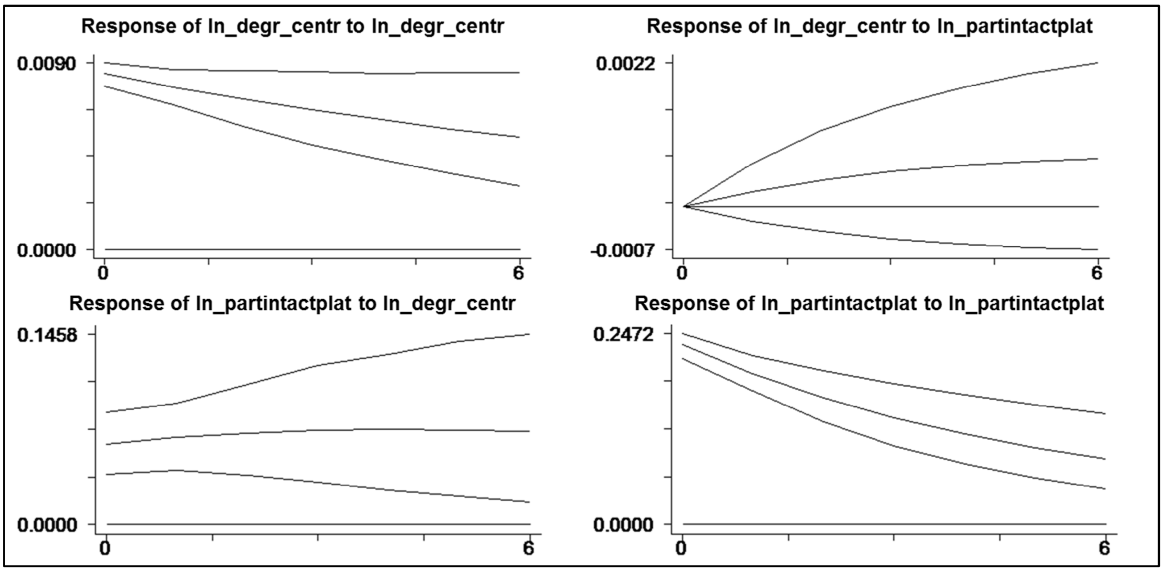


Figure 35 Impulse Response Functions, PVAR(1) ln_degree_centralization ln_partintactplat, errors are 5% on each side generated by Monte-Carlo (1000 reps); New Regions



IRFs of model 2.1.3.3, which captures the interrelationship between the share of networkers and active interpersonal and platform participation by PVAR(1), are illustrated in Figure 36. They show that an impulse in the share of networkers leads to a positive, but slightly insignificant response of overall participation. However, with estimation of

PVAR(2) and PVAR(4) the positive effect turns significant (see Appendix 38). Conversely, the response of the share of networkers to a shock in overall participation is not significant, which is supported by robustness tests. Hence, the positive effect of overall participation on the share of networkers in the established regions' model shows in the case of new regions towards the other direction, i.e. now the positive effects go from the share of networkers to overall participation.

I estimate model 2.1.3.4 in order to investigate the interrelationship between the network clustering coefficient and active interpersonal and platform participation. IRFs of PVAR(1) reveal no significant effects between these two variables (see Figure 37). This is also supported by robustness tests (see Appendix 39) and is in line with model 1.1.3.4, which uses the established regions' sample.

Figure 36 Impulse Response Functions, PVAR(1) ln_networker_share ln_partintactplat, errors are 5% on each side generated by Monte-Carlo (1000 reps); New Regions

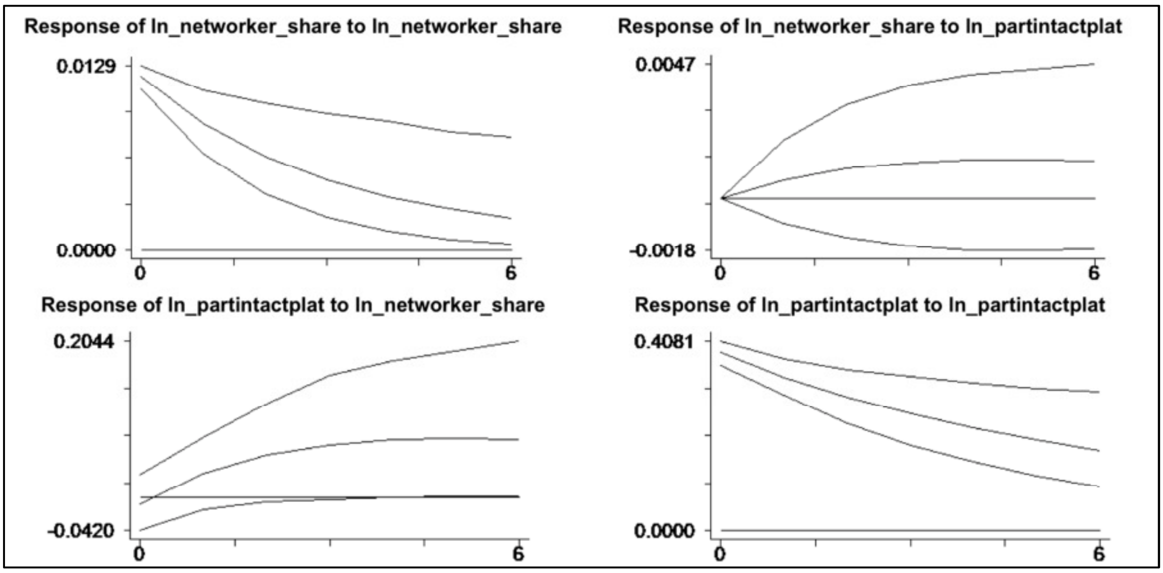
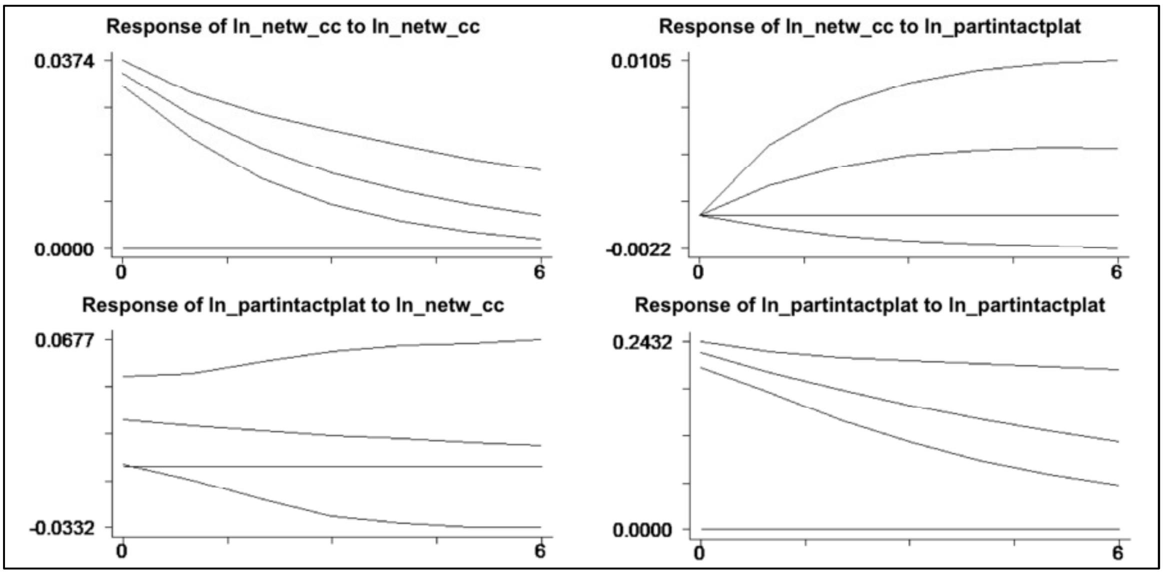


Figure 37 Impulse Response Functions, PVAR(1) ln_network_cc ln_partintactplat, errors are 5% on each side generated by Monte-Carlo (1000 reps); New Regions



Community Growth – Network Structure – Participation

In the following section, I add the number of new sign-ups in order to investigate the role of community growth and check how effects differ. Figure 38 illustrates the IRFs of model 2.2.1.1, which examines the interrelationship between the number of new sign-ups, average degree, and active interpersonal participation by the help of a PVAR(1) model. Results show that a shock in average degree leads to a slightly significant positive response of participation. This positive effect is supported by PVAR(4), where the effect is also significant (see Appendix 40). However, PVAR(2) and PVAR(3) show a negative effect, which is significant only in PVAR(3). In summary, effects on participation might be positive or negative. However, there is more evidence for a positive relationship. All other effects are insignificant. Hence, after the inclusion of new sign-ups, only effects showing in one direction can be identified, i.e. from average degree to participation, and not in both directions as uncovered in model 2.1.1.1.

IRFs of model 2.2.1.2, which analyzes the relationship between the number of new sign-ups, degree centralization, and active interpersonal participation by PVAR(1), reveal that an impulse in degree centralization is followed by a positive response of participation that lasts for several months (see Figure 39). All other effects are insignificant. These results are supported by PVAR models of higher lag order (see Appendix 41). Furthermore, results do not differ from model 2.1.1.2, that excludes the number of new sign-ups.

Figure 38 Impulse Response Functions, PVAR(1) ln_new_signups ln_average_degree ln_partintact, errors are 5% on each side generated by Monte-Carlo (1000 reps); New Regions

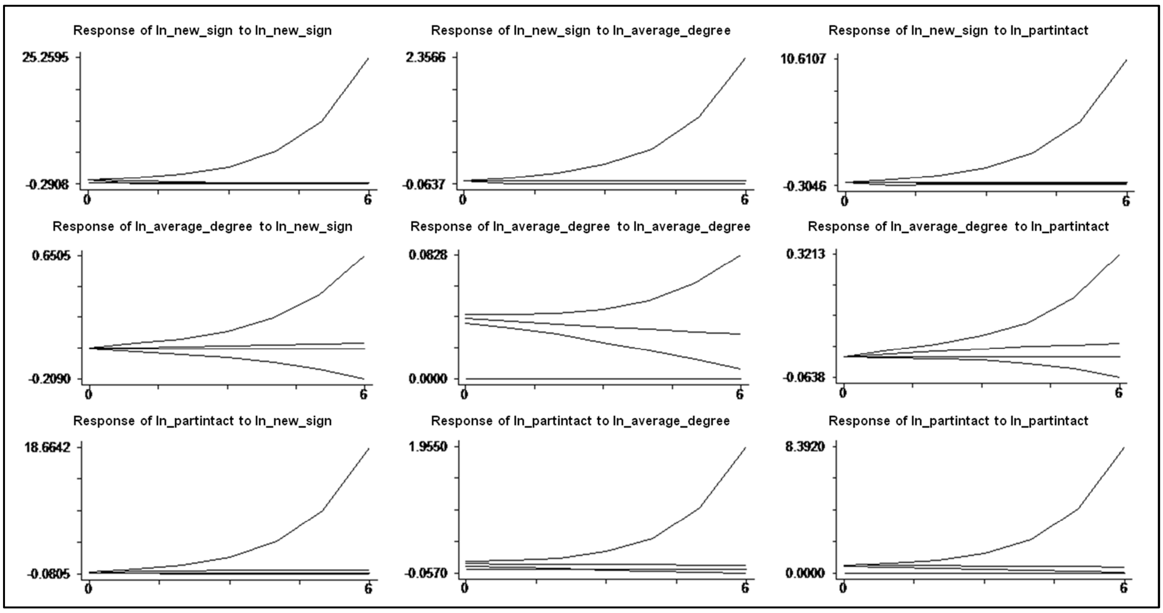
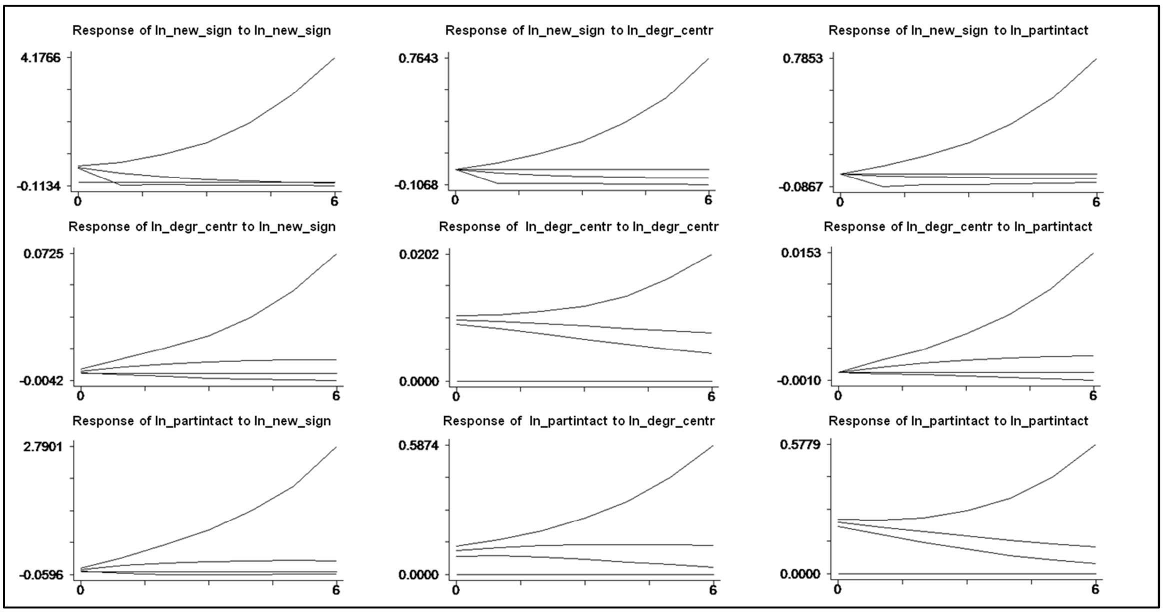


Figure 39 Impulse Response Functions, PVAR(1) ln_new_signups ln_degree_centralization ln_partintact, errors are 5% on each side generated by Monte-Carlo (1000 reps); New Regions



I estimate model 2.2.1.3 in order to capture the interrelationship between the number of new sign-ups, the share of networkers, and active interpersonal participation. IRFs of PVAR(1) do not show any significant effects between the three variables (see Figure 40), which is also supported by IRFs of PVAR(2), PVAR(3), and PVAR(4) (see Appendix 42). In addition, these results are equivalent to the results of model 2.1.1.3. Thus, an inclusion of new sign-ups does not change the relationship between the share of networkers and active interpersonal participation in new regions.

Figure 40 Impulse Response Functions, PVAR(1) ln_new_signups ln_networker_share ln_partintact, errors are 5% on each side generated by Monte-Carlo (1000 reps); New Regions

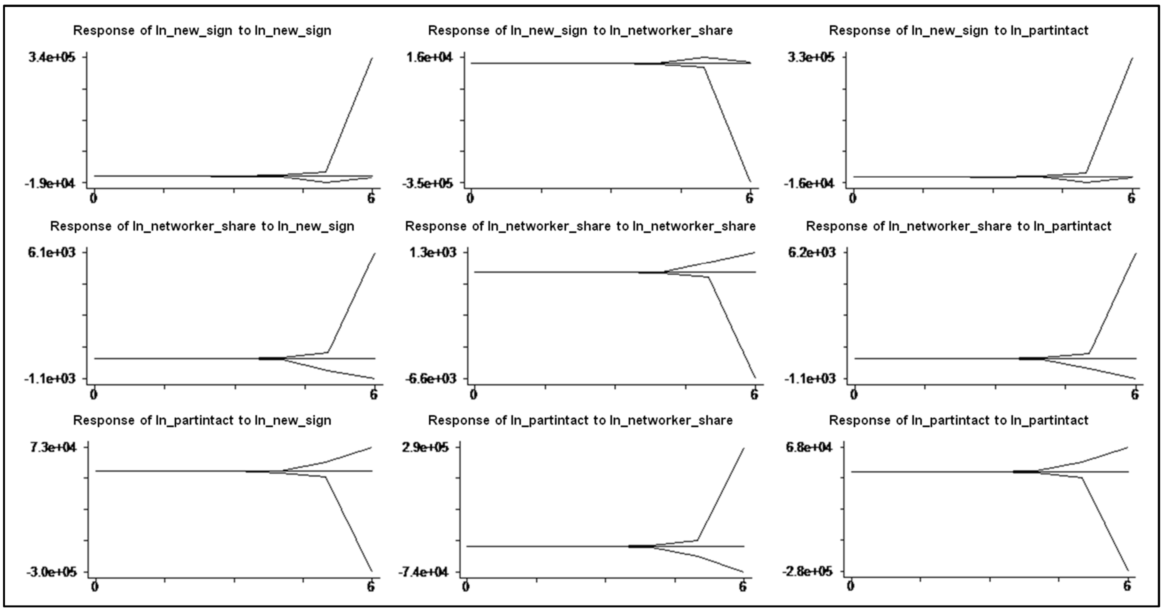
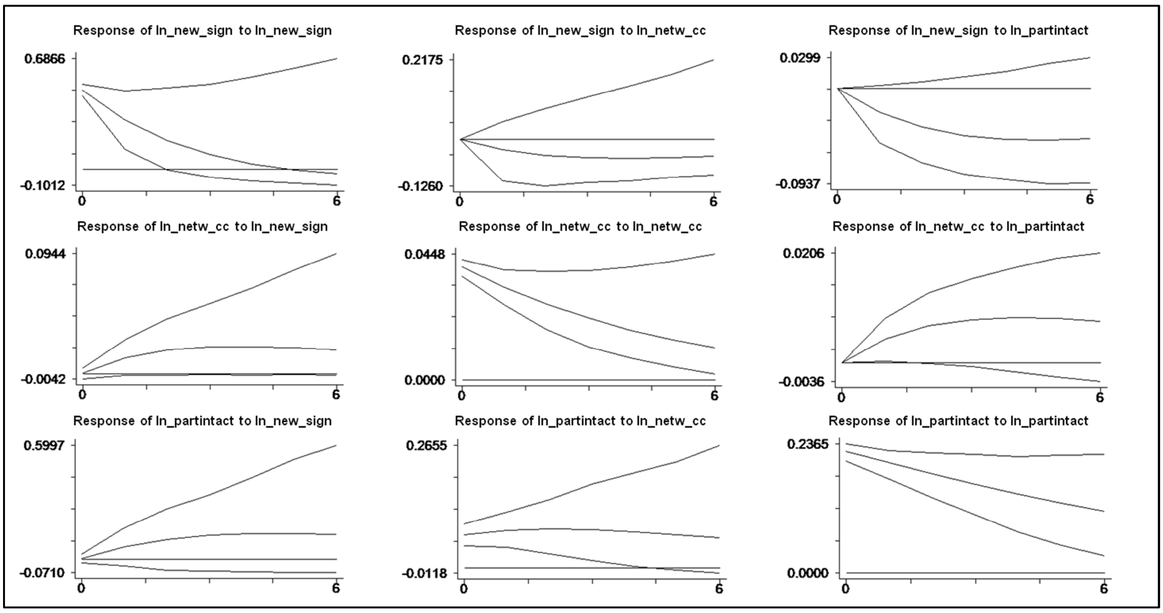


Figure 41 illustrates the results of model 2.2.1.4, which investigates the interrelationship between the number of new sign-ups, the network clustering coefficient, and active interpersonal participation. IRFs of PVAR(1) show that an impulse in the network clustering coefficient leads to a significant positive response of participation, that lasts for about four and a half months. However, this positive effect cannot be supported by robustness tests because it is insignificant in models of higher lag order or even becomes significant negative in PVAR(3) (see Appendix 43). Thus, results of model 2.2.1.4 and its robustness tests are nearly similar to model 2.1.1.4 and its robustness tests. However, model 2.1.1.4 and robustness tests show a tendency towards a positive effect, whereas model 2.2.1.4 and the corresponding models of higher lag order do not show a tendency towards a certain effect, i.e. both positive and negative effects are possible. All other effects between the selected variables of model 2.2.1.4 are insignificant, which is also confirmed by PVAR(2), PVAR(3), and PVAR(4).

Figure 41 Impulse Response Functions, PVAR(1) ln_new_signups ln_network_cc ln_partintact, errors are 5% on each side generated by Monte-Carlo (1000 reps); New Regions



Model 2.2.2.1 analyzes the interrelationship between the number of new sign-ups, average degree, and active platform participation by the help of PVAR(1). Results of IRFs do not detect any significant effects between these variables (see Figure 42). This is also supported by PVAR(2), PVAR(3), and PVAR(4) (see Appendix 44). Thus, the inclusion of new sign-ups does not change the results of model 2.1.2.1.

Figure 43 displays the results of model 2.2.2.2, which captures the effects between the number of new sign-ups, degree centralization, and active platform participation by PVAR(1). IRFs of PVAR(1) reveal a significant positive response of participation to a shock in degree centralization, which is also significant in PVAR(4) (see Appendix 45). Further, there is a positive response of degree centralization to a shock in participation, which is not significant in PVAR(1), but in models of higher lag order. Other effects are not significant. This is also confirmed by robustness tests. Thus, results are similar to model 2.1.2.2 and the corresponding PVAR models of higher lag order, where positive reciprocal effects between degree centralization and active platform participation are detected.

Figure 42 Impulse Response Functions, PVAR(1) ln_new_signups ln_average_degree ln_partplatact, errors are 5% on each side generated by Monte-Carlo (1000 reps); New Regions

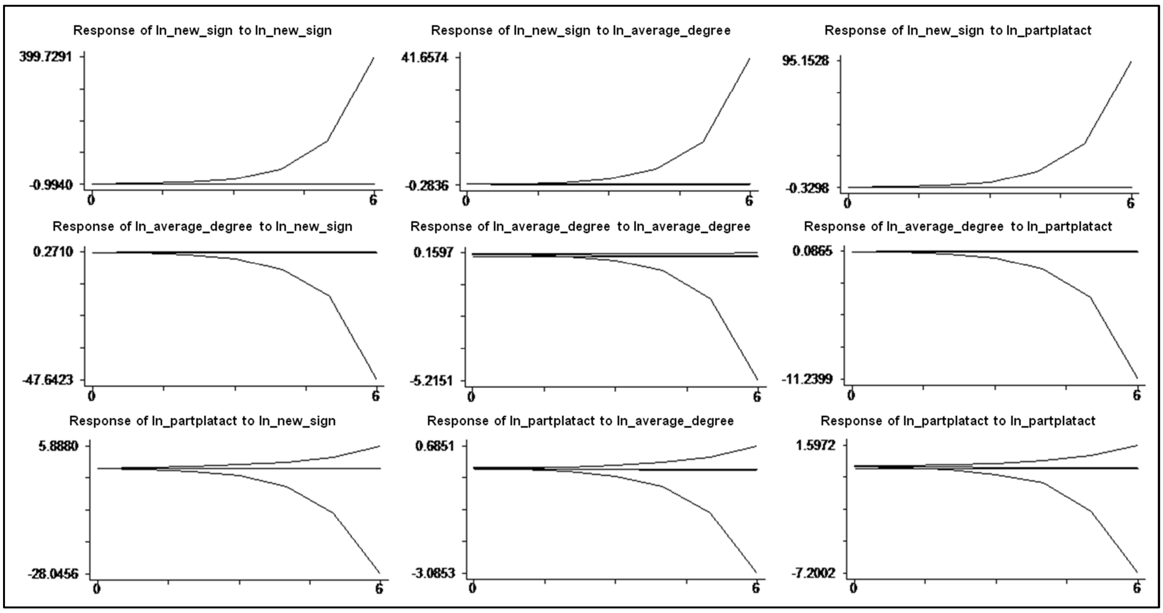
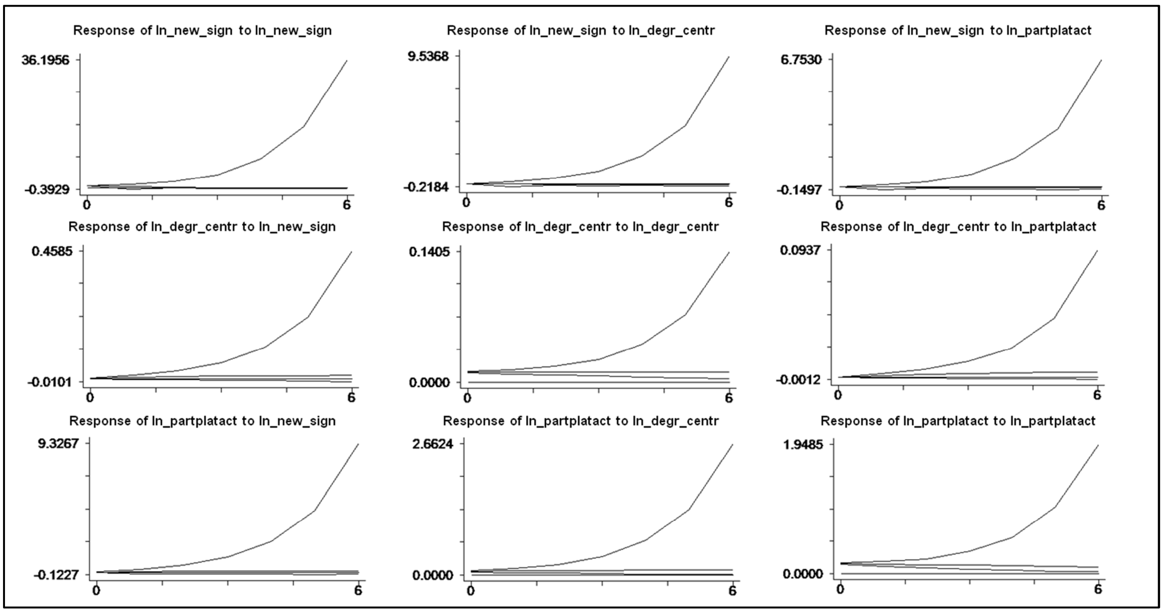
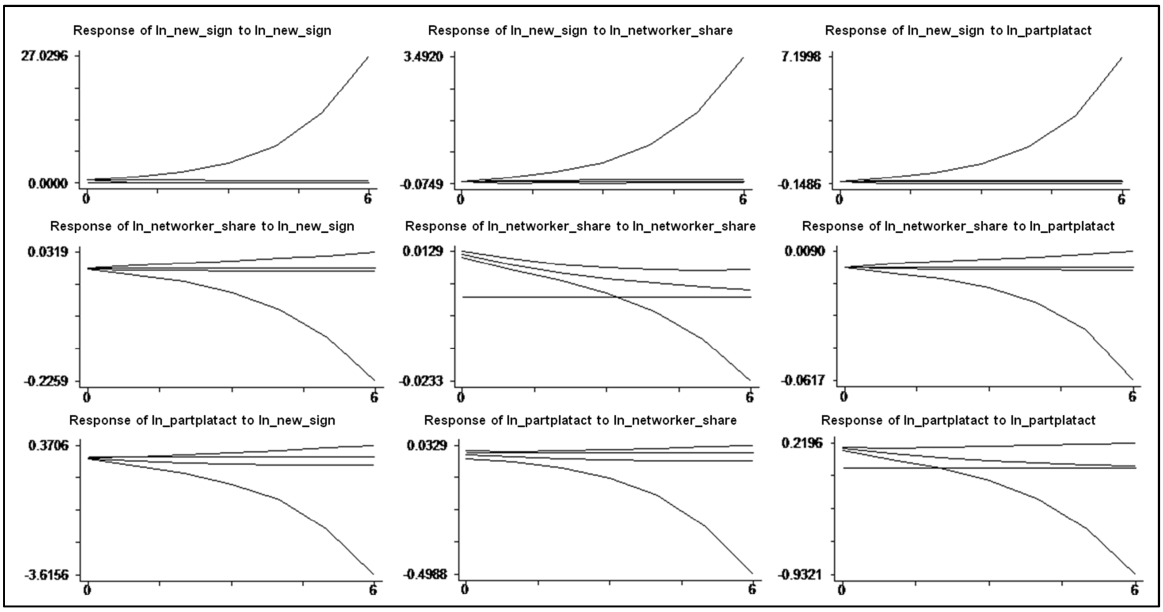


Figure 43 Impulse Response Functions, PVAR(1) ln_new_signups ln_degree_centralization ln_partplatact, errors are 5% on each side generated by Monte-Carlo (1000 reps); New Regions



Results of IRFs of model 2.2.2.3, which examines the relationship between the number of new sign-ups, the share of networkers, and active platform participation by PVAR(1), do not show any significant effects (see Figure 44). This is also confirmed by models of higher lag order (see Appendix 46) and corresponds to model 2.1.2.3, that excludes new sign-ups.

Figure 44 Impulse Response Functions, PVAR(1) ln_new_signups ln_networker_share ln_partplatact, errors are 5% on each side generated by Monte-Carlo (1000 reps); New Regions



I estimate model 2.2.2.4 in order to analyze the interrelationship between the number of new sign-ups, the network clustering coefficient, and active platform participation. The results of PVAR(1) show a slightly significant positive response of participation to an impulse in the network clustering coefficient (see Figure 45). However, this is not supported by robustness tests (see Appendix 47). The effect even becomes slightly significant negative in PVAR(4). Hence, both positive and negative effects are possible. Other effects between the variables of model 2.2.2.4 are not significant, which is confirmed by robustness tests. Thus, findings are different from model 2.1.2.4 and the corresponding models of higher lag order that ignore the number of new sign-ups because, there, effects between the network clustering coefficient and platform participation are not significant.

Figure 46 displays the results of model 2.2.3.1, which analyzes the interrelationship between the number of new sign-ups, average degree, and active interpersonal and platform participation. IRFs of PVAR(1) detect a positive response of overall participation to a shock in average degree that lasts for up to four months. Other effects are insignificant. These findings are also confirmed by models of higher lag order (see Appendix 48), but are slightly different from model 2.1.3.1, which reveals positive reciprocal effects between average degree and overall participation. Thus, the inclusion of new sign-ups is associated with an insignificant response of average degree to a shock in overall participation.

Figure 45 Impulse Response Functions, PVAR(1) ln_new_signups ln_network_cc ln_partplatact, errors are 5% on each side generated by Monte-Carlo (1000 reps); New Regions

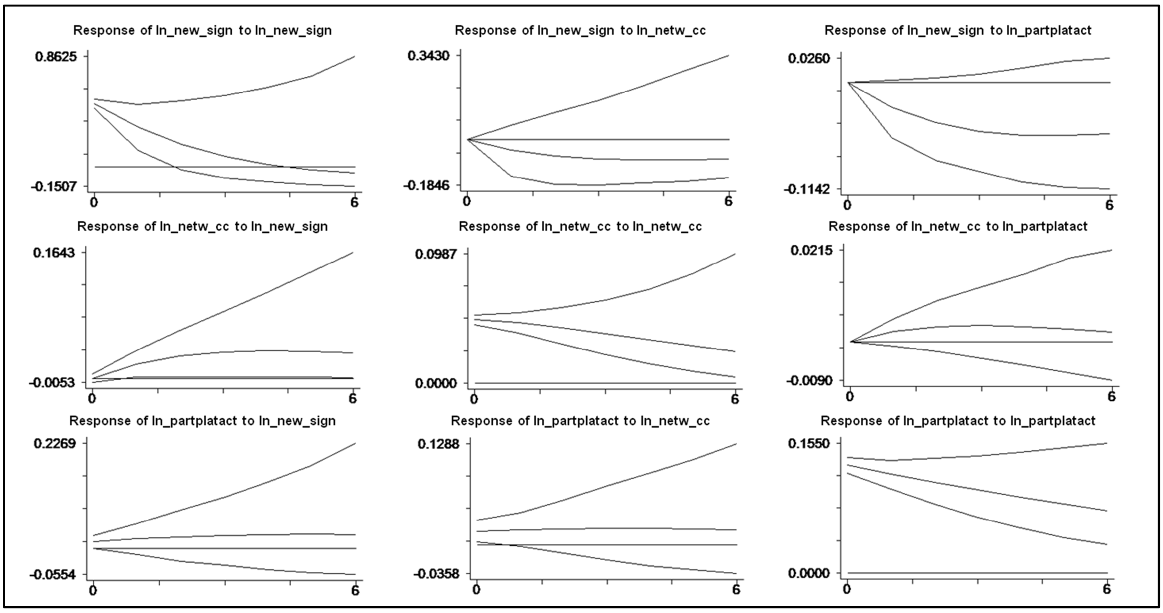
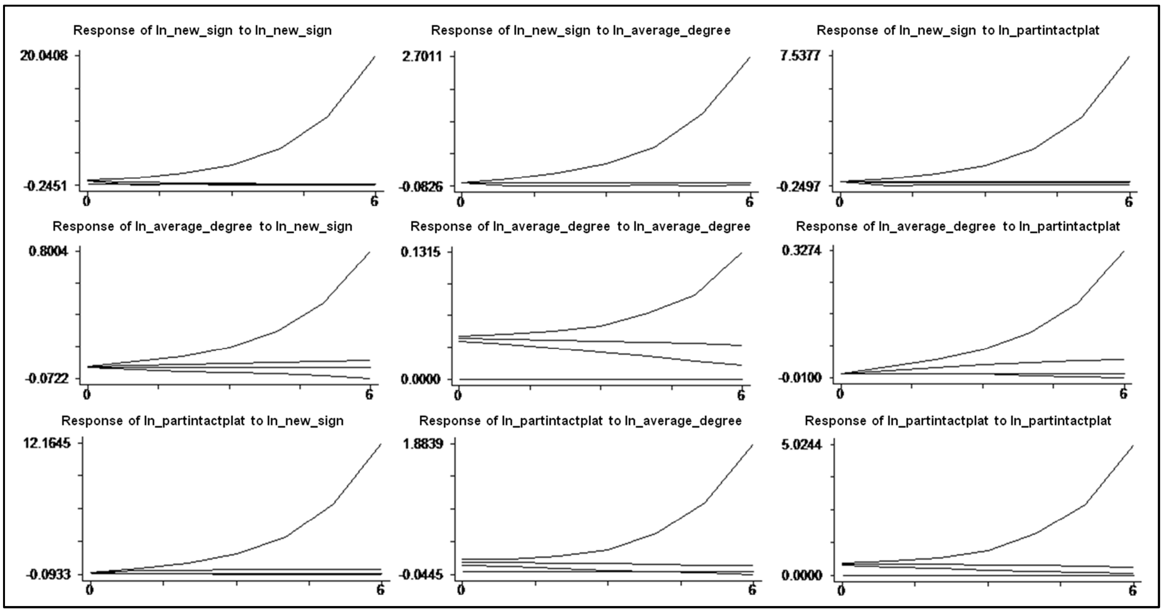
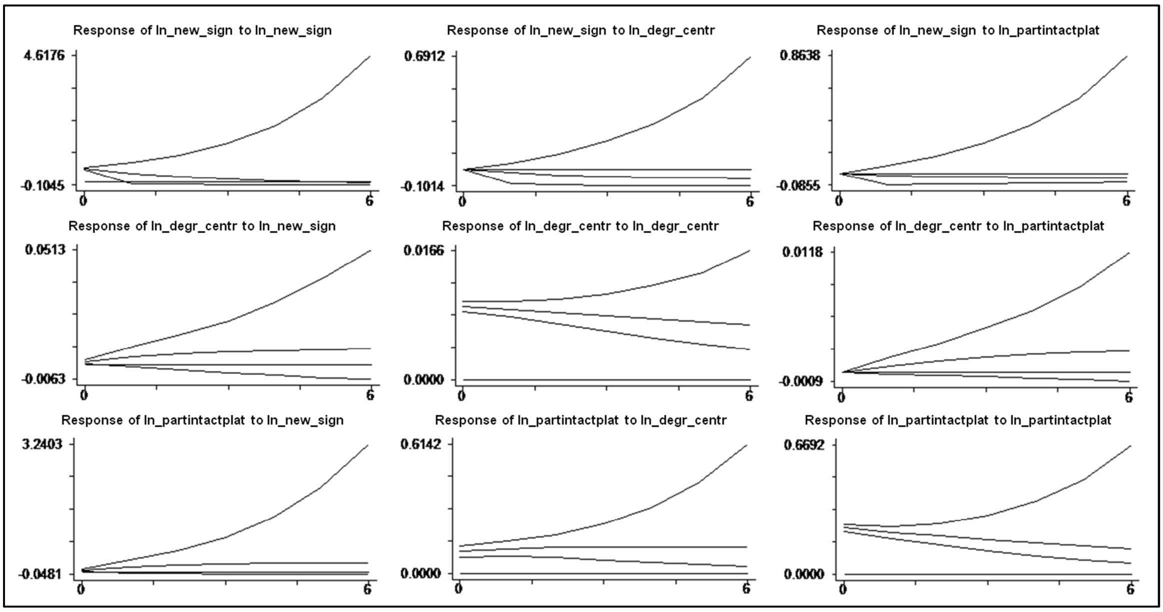


Figure 46 Impulse Response Functions, PVAR(1) ln_new_signups ln_average_degree ln_partintactplat, errors are 5% on each side generated by Monte-Carlo (1000 reps); New Regions



Model 2.2.3.2 examines the effects between the number of new sign-ups, degree centralization, and active interpersonal and platform participation by the help of a PVAR(1). Results of IRFs reveal a positive response of overall participation to an impulse in degree centralization, which lasts for more than six months until it gets insignificant (see Figure 47). A positive effect is also uncovered by PVAR(2), PVAR(3), and PVAR(4) (see Appendix 49). Therefore, an inclusion of new sign-ups in the model leads to the same results as already stated by model 2.1.3.2. Other effects between the variables of model 2.2.3.2 are not significant, which is also confirmed by robustness tests.

Figure 47 Impulse Response Functions, PVAR(1) ln_new_signups ln_degree_centralization ln_partintactplat, errors are 5% on each side generated by Monte-Carlo (1000 reps); New Regions



I estimate model 2.2.3.3 in order to uncover effects between the number of new sign-ups, the share of networkers, and active interpersonal and platform participation. IRFs of PVAR(1) do not detect any significant effects (see Figure 48), which is also supported by robustness tests (see Appendix 50). Hence, results are different from model 2.1.3.3 and the corresponding models of higher lag order, by the help of which a significant positive response of overall participation to a shock in the share of networkers is identified.

Finally, IRFs of model 2.2.3.4, which investigates the relationship between the number of new sign-ups, the network clustering coefficient, and active interpersonal and platform participation by PVAR(1), show a positive response of overall participation to a shock in the network clustering coefficient (see Figure 49). However, in models of higher lag order, this positive effect is no longer significant and even becomes significant negative in PVAR(3) (see Appendix 51). Hence both positive and negative effects are possible. Thus, the inclusion of new sign-ups changes the relationship between the clustering coefficient and overall participation because of potential positive and negative reactions of overall participation to an impulse in the network clustering coefficient. Finally, the positive reaction of overall participation to a shock in new sign-ups, which is not significant in a PVAR(1), becomes significant with estimation of PVAR(3) and PVAR(4) for a very short period of time.

Figure 48 Impulse Response Functions, PVAR(1) ln_new_signups ln_networker_share ln_partintactplat, errors are 5% on each side generated by Monte-Carlo (1000 reps); New Regions

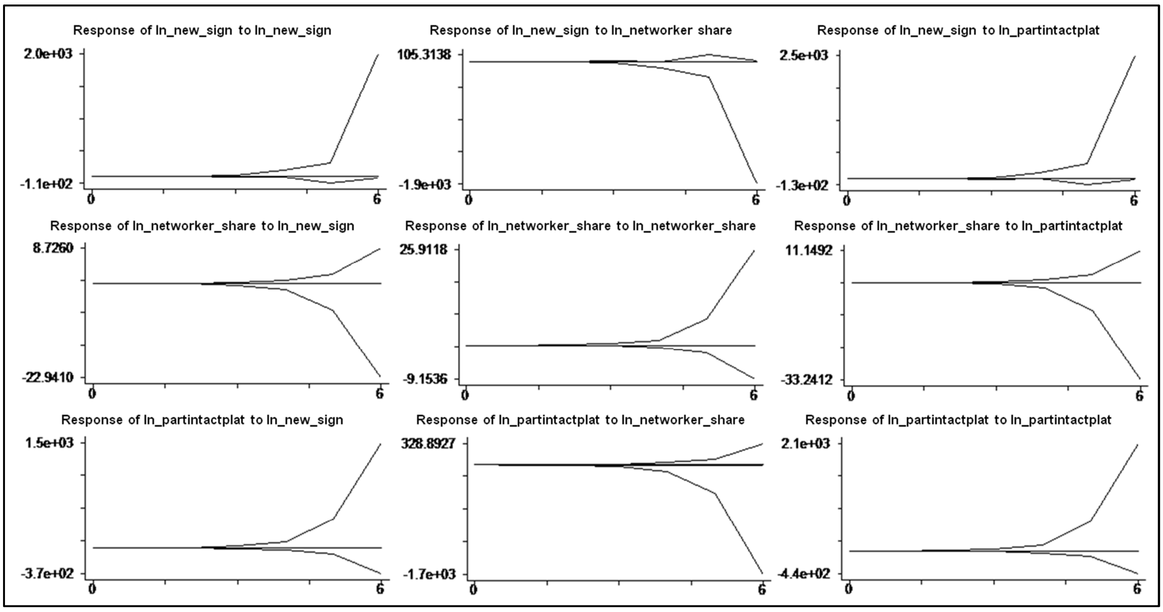
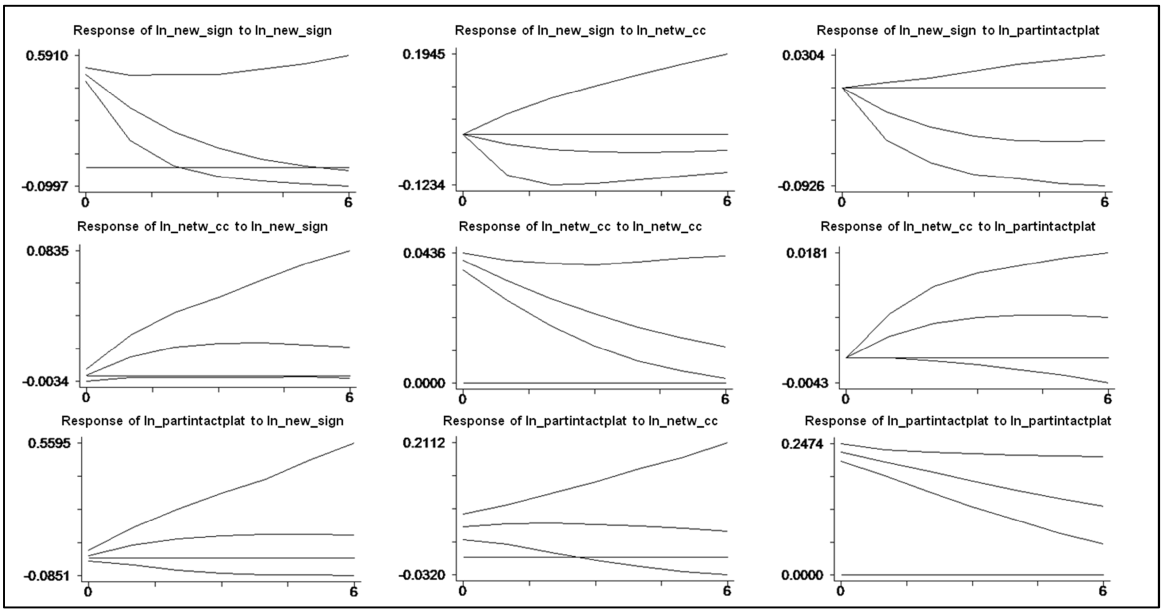


Figure 49 Impulse Response Functions, PVAR(1) ln_new_signups ln_network_cc ln_partintactplat, errors are 5% on each side generated by Monte-Carlo (1000 reps); New Regions



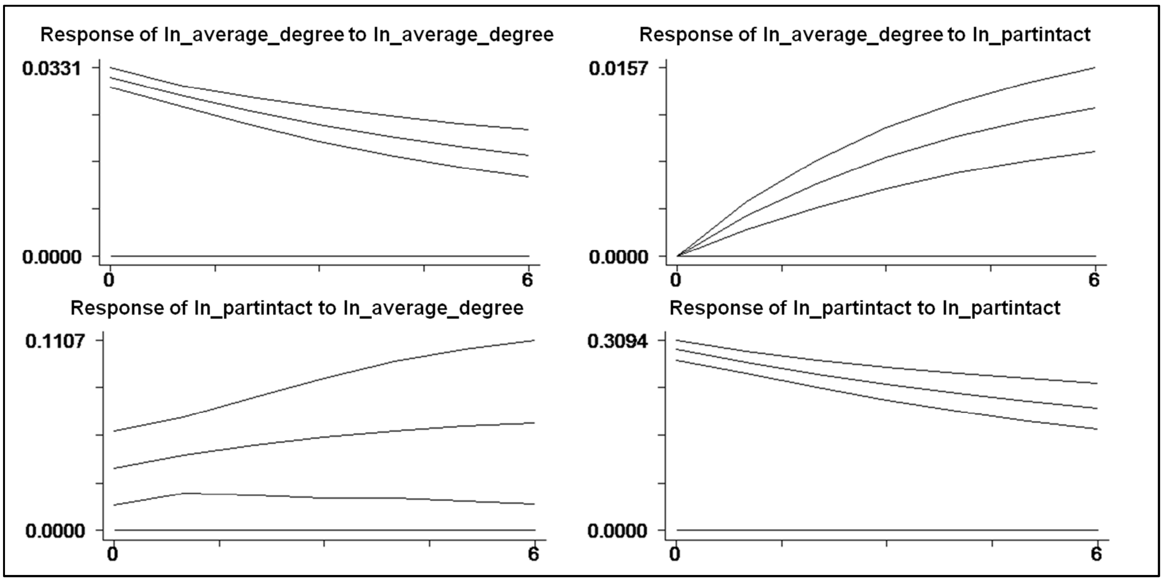
3.5.3. All Regions

Network Structure – Participation

In the next step, I combine the sample of established regions and new regions in order to create a broader base for model estimation. Therefore, general statements about the interrelationship between the discussed variables independently from their life cycle phase are possible.

Again, I start with those models investigating the interrelationship between network structure and participation. Figure 50 illustrates the results of model 3.1.1.1, by which effects between average degree and active interpersonal participation are analyzed. IRFs of PVAR(1) show that a shock in average degree leads to a long lasting positive response of participation. Conversely, a shock in participation increases average degree. These results are also supported by PVAR(2), PVAR(3), and PVAR(4) (see Appendix 52). Furthermore, results correspond to the findings based on the established regions' (model 1.1.1.1 and robustness tests) and on the new regions' (model 2.1.1.1 and robustness tests) sample.

Figure 50 Impulse Response Functions, PVAR(1) ln_average_degree ln_partintact, errors are 5% on each side generated by Monte-Carlo (1000 reps); All Regions



Model 3.1.1.2 examines the interrelationship between degree centralization and active interpersonal participation by the help of PVAR(1) based on the all regions' sample. Results show that an impulse in degree centralization is followed by a positive reaction of participation (see Figure 51). Reversed effects are not significant. This is also supported by PVAR models of higher lag order (see Appendix 53). Moreover, results conform to the findings based on the new regions' sample, but are different from the findings based on the established regions' sample, where a negative effect of degree centralization on participation is detected.

IRFs of model 3.1.1.3, which investigates the interrelationship between the share of networkers and active interpersonal participation, reveal a positive reaction of participation to an impulse in the share of networkers (see Figure 52). Reversed effects are not significant. Robustness tests support the findings of PVAR(1) (see Appendix 54). Hence, the present findings are different from those of the established regions' sample, where a one-sided positive effect of participation on the share of networkers is detected. Moreover, findings are also different from those of the new regions' sample, where significant effects are not detected at all.

Figure 51 Impulse Response Functions, PVAR(1) ln_degree_centralization ln_partintact, errors are 5% on each side generated by Monte-Carlo (1000 reps); All Regions

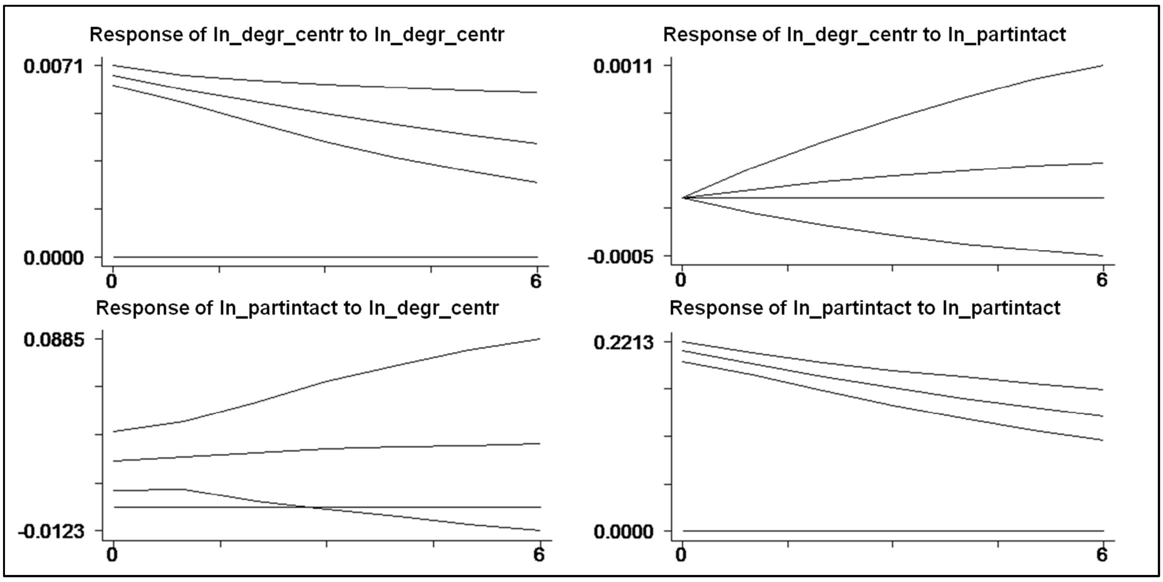
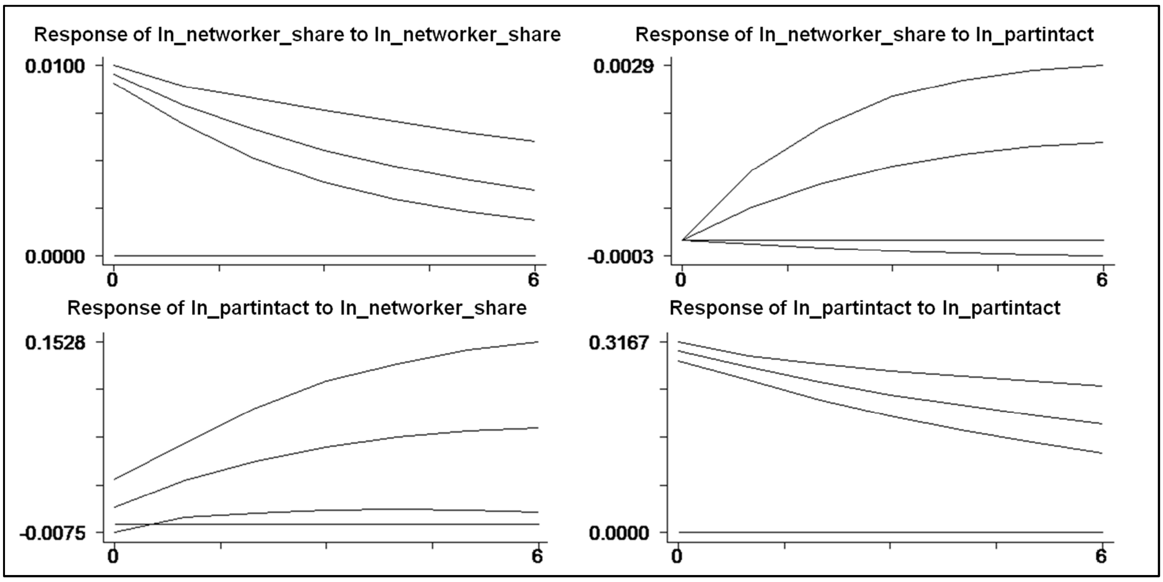
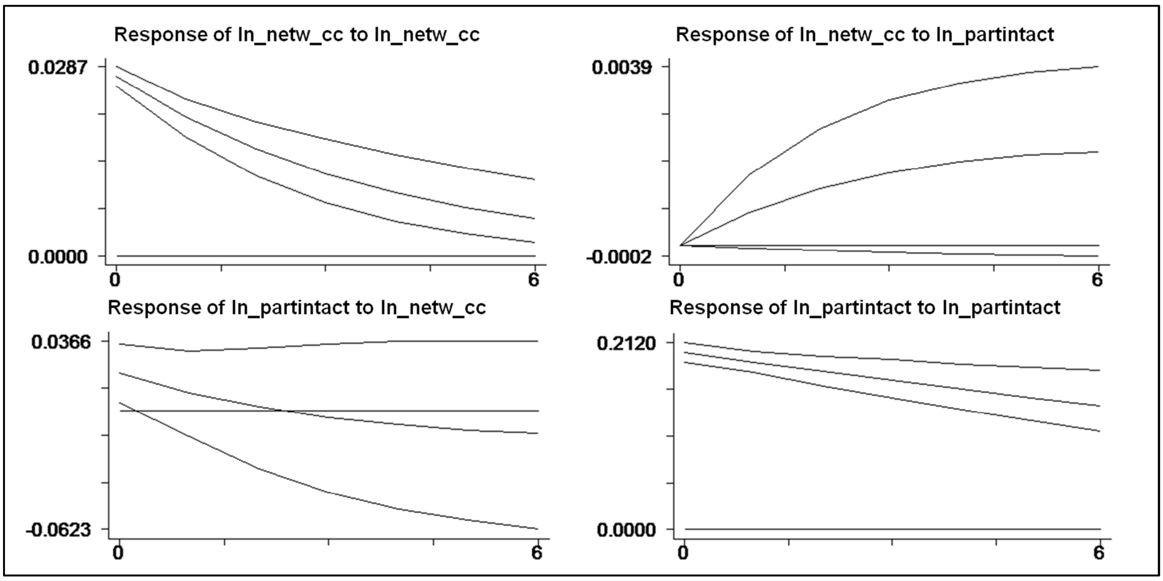


Figure 52 Impulse Response Functions, PVAR(1) ln_networker_share ln_partintact, errors are 5% on each side generated by Monte-Carlo (1000 reps); All Regions



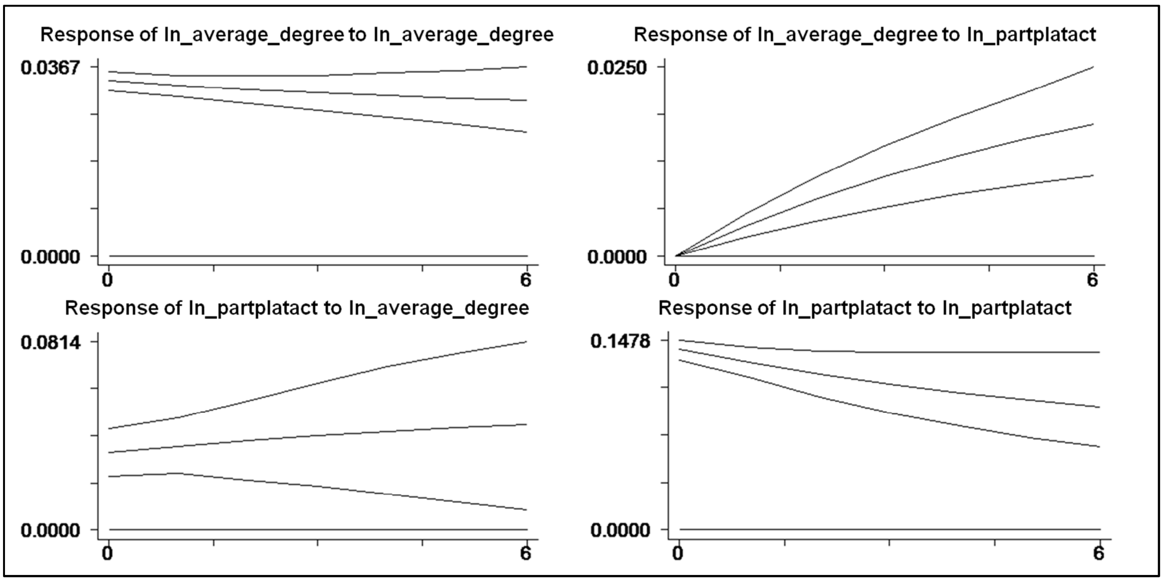
Effects between the network clustering coefficient and active interpersonal participation are analyzed by the help of model 3.1.1.4. Results of PVAR(1) show a significant positive response of participation to a shock in the network clustering coefficient (see Figure 53). However, this effect is no longer significant with estimation of PVAR models of higher lag order. The effect even becomes significant negative with estimation of PVAR(2) and PVAR(3) (see Appendix 55). Thus, there is a tendency towards a negative effect, although positive effects are not completely excluded. Moreover, IRFs of PVAR(1) do not detect any significant reaction of the network clustering effect to an impulse in participation, which is supported by robustness tests. All in all, regarding the response of participation to a shock in the network clustering coefficient, the results differ from the established regions' sample, where no significant effects are detected, and also from the new regions' sample, where a positive response of participation to a shock in the clustering coefficient is identified.

Figure 53 Impulse Response Functions, PVAR(1) ln_network_cc ln_partintact, errors are 5% on each side generated by Monte-Carlo (1000 reps); All Regions



Model 3.1.2.1 examines the relationship between average degree and active platform participation by the help of PVAR(1). Results of IRFs show significant positive reciprocal effects between the two variables (see Figure 54), which is also supported by PVAR(2), PVAR(3), and PVAR(4) (see Appendix 56). However, results differ from the established regions sample because, there, only a positive response of average degree to a shock in participation is detected. Further, there are also differences towards the new regions' sample, where no significant effects are observed.

Figure 54 Impulse Response Functions, PVAR(1) ln_average_degree ln_partplatact, errors are 5% on each side generated by Monte-Carlo (1000 reps); All Regions



I estimate model 3.1.2.2 in order to uncover effects between degree centralization and active platform participation. Results of PVAR(1) show significant positive reciprocal effects between the two variables (see Figure 55), which is also confirmed by PVAR models of higher lag order (see Appendix 57). Thus, results are in line with those of the new regions' sample. However, they are different from the established regions' sample: Although a positive response of degree centralization to a shock in participation is identified, IRFs of the established regions' sample show a negative reaction of participation to a shock in degree centralization.

IRFs of model 3.1.2.3, which captures the interrelationship between the share of networkers and active platform participation by PVAR(1), are displayed in Figure 56. Whereas positive reciprocal effects in the established regions' sample and no significant effects in the new regions' sample are detected, IRFs of model 3.1.2.3 show a mixture of both, i.e. a shock in the share of networkers leads to a positive response of active platform participation, reversed effects are not significant. Robustness tests confirm these results (see Appendix 58).

Figure 55 Impulse Response Functions, PVAR(1) ln_degree_centralization ln_partplatact, errors are 5% on each side generated by Monte-Carlo (1000 reps); All Regions

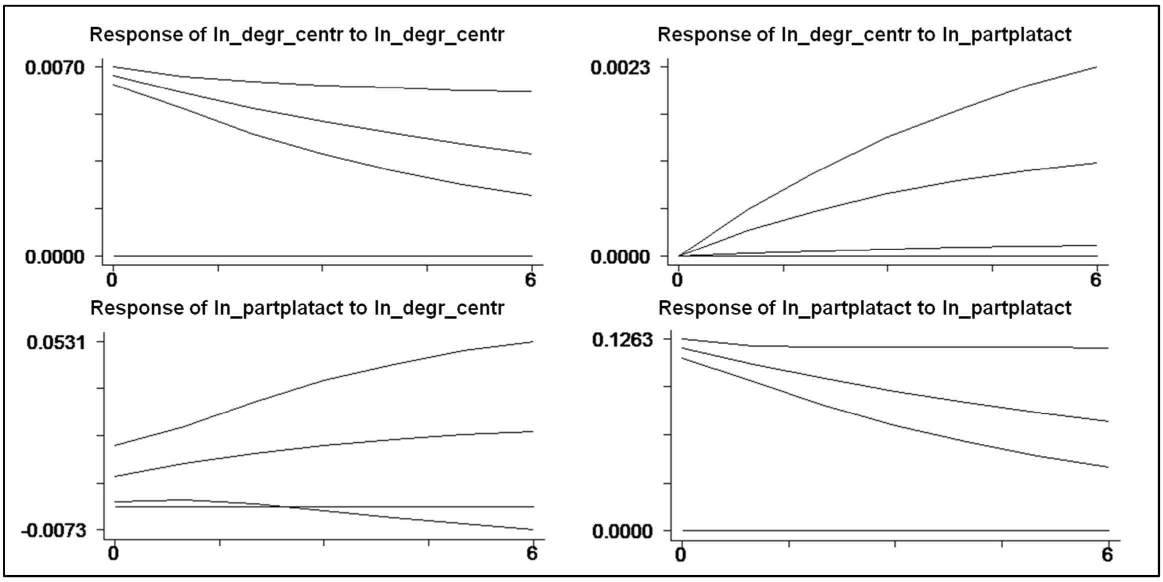
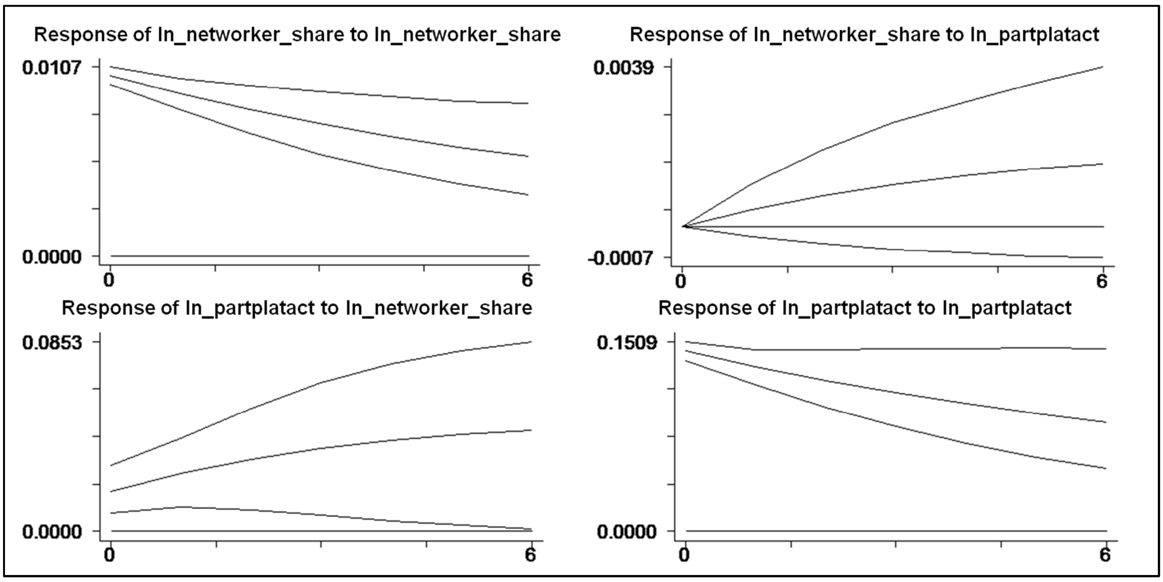
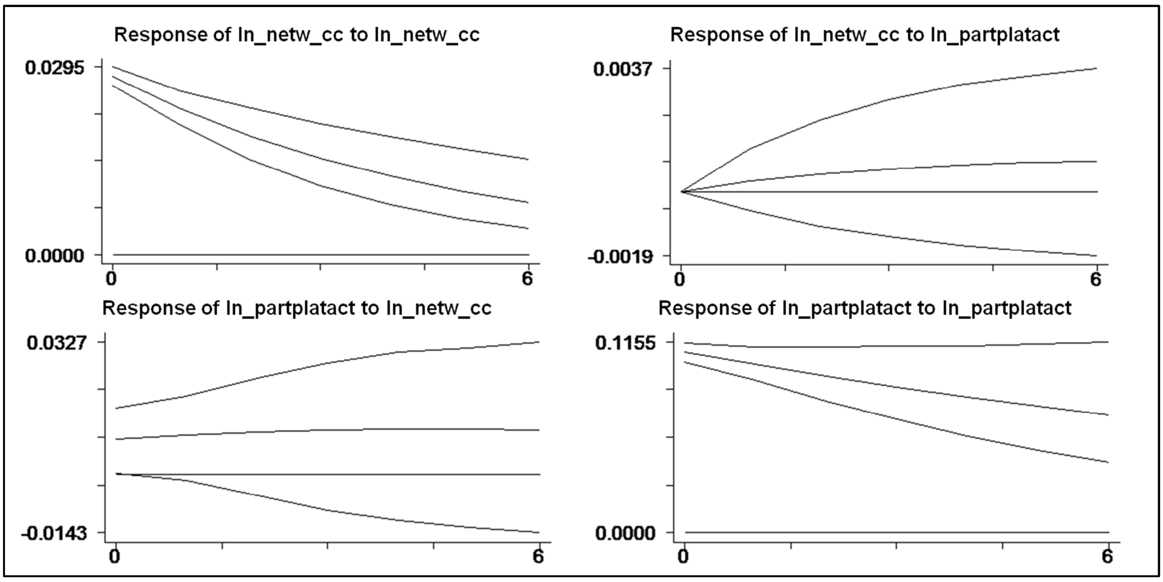


Figure 56 Impulse Response Functions, PVAR(1) ln_networker_share ln_partplatact, errors are 5% on each side generated by Monte-Carlo (1000 reps); All Regions



Results of model 3.1.2.4, which investigates the relationship between the network clustering coefficient and active platform participation, do not demonstrate any significant effects between the variables (see Figure 57), which is also supported by PVAR(2), PVAR(3), and PVAR(4) (see Appendix 59). Thus, results of the sample that combines all regions are equivalent to the findings gained from the established and the new regions' sample.

Figure 57 Impulse Response Functions, PVAR(1) ln_network_cc ln_partplatact, errors are 5% on each side generated by Monte-Carlo (1000 reps); All Regions



Model 3.1.3.1 analyzes the interrelationship between average degree and active interpersonal and platform participation. The results show that a shock in average degree is followed by a long-lasting and significant positive response of overall participation (see Figure 58). Reversely, a shock in overall participation increases average degree. These findings are confirmed by PVAR(2), PVAR(3), and PVAR(4) (see Appendix 60). Moreover, results are in line with the findings gained from the established regions' and new regions' sample.

Effects between degree centralization and active interpersonal and platform participation are analyzed by the help of model 3.1.3.2. IRFs of PVAR(1) reveal a positive response of overall participation to a shock in degree centralization (see Figure 59). However, reversed effects are not significant. These findings are also supported by PVAR models of higher lag order (see Appendix 61). Although results are equivalent to the new regions' sample, they differ from the established regions' sample, where a negative response of overall participation to a shock in degree centralization is uncovered.

Figure 58 Impulse Response Functions, PVAR(1) ln_average_degree ln_partintactplat, errors are 5% on each side generated by Monte-Carlo (1000 reps); All Regions

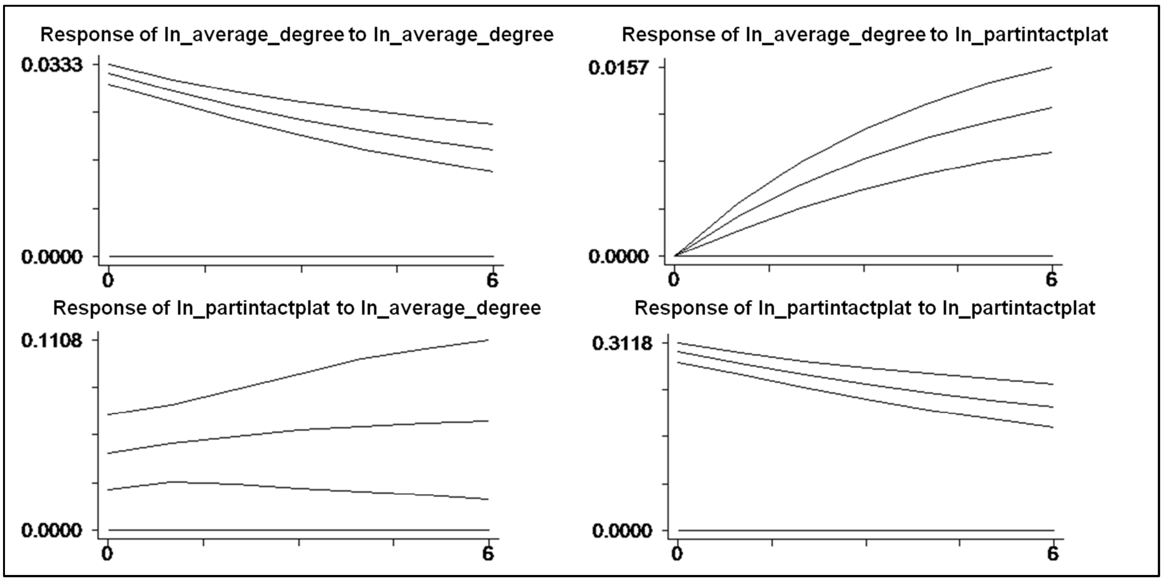
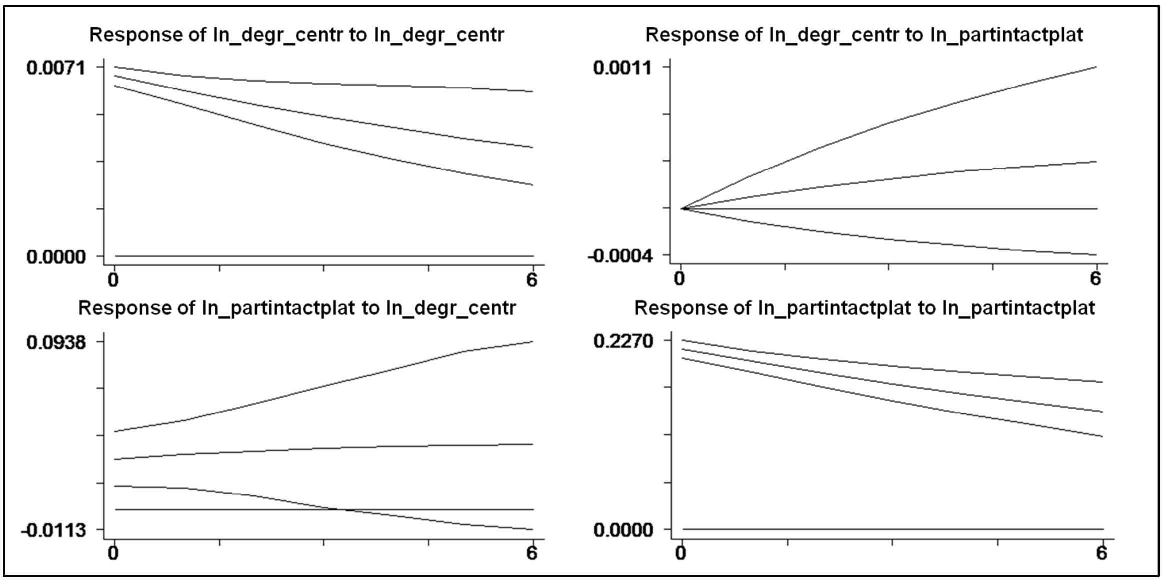


Figure 59 Impulse Response Functions, PVAR(1) ln_degree_centralization ln_partintactplat, errors are 5% on each side generated by Monte-Carlo (1000 reps); All Regions



Results of model 3.1.3.3, which examines the relationship between the share of networkers and active interpersonal and platform participation by the help of a PVAR(1) model, are displayed in Figure 60. IRFs show that an impulse in the share of networkers is followed by a positive response of overall participation. Reversed effects are not significant.

Robustness tests confirm these results (see Appendix 62). Thus, effects are similar to the new regions' sample. In the established regions' sample, however, the unidirectional and positive effect is reversed, i.e. a shock in overall participation is followed by a positive response of the share of networkers.

The interrelationship between the network clustering coefficient and active interpersonal and platform participation is investigated by the help of model 3.1.3.4. The results of PVAR(1) demonstrate a slightly and shortly positive response of overall participation to an impulse in the network clustering coefficient (see Figure 61). However, this effect is not maintained by robustness tests, since it even gets significant negative with estimation of PVAR(2) and PVAR(3) (see Appendix 63). Hence, there is a tendency towards a negative effect. Reversely, a shock in overall participation is not followed by a significant response of the network clustering coefficient. This is also supported by PVAR(2), PVAR(3), and PVAR(4). Taken together, results are different from the new regions' and the established regions' sample, where no significant effects are detected between the variables.

Figure 60 Impulse Response Functions, PVAR(1) ln_networker_share ln_partintactplat, errors are 5% on each side generated by Monte-Carlo (1000 reps); All Regions

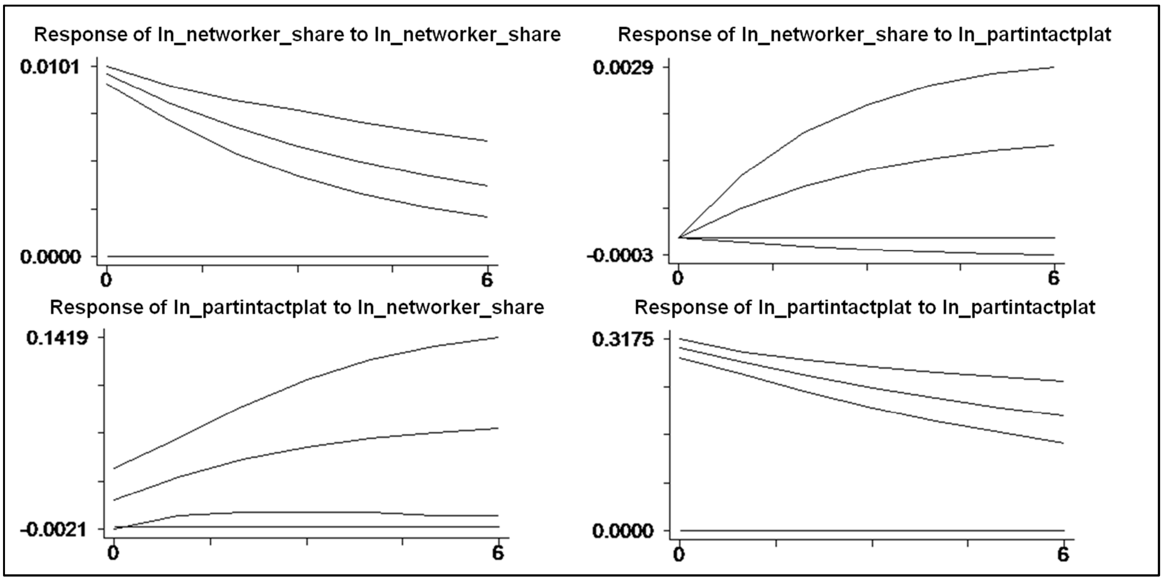
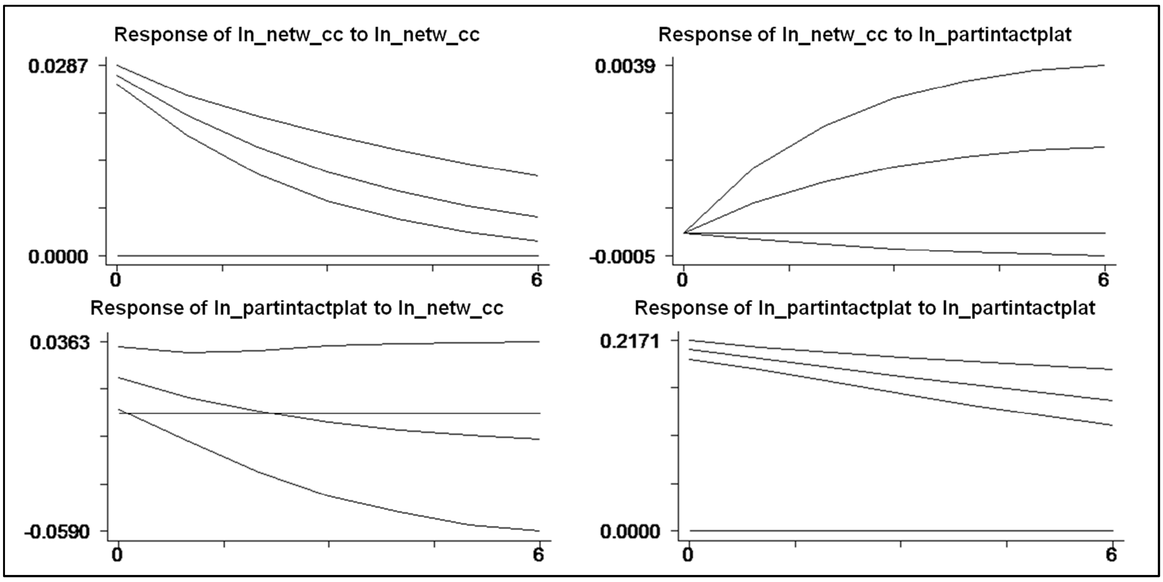


Figure 61 Impulse Response Functions, PVAR(1) ln_network_cc ln_partintactplat, errors are 5% on each side generated by Monte-Carlo (1000 reps); All Regions



Community Growth – Network Structure – Participation

In this section, I include again the number of new sign-ups in order to learn more about the interrelationship between community growth, network structure, and participation. First, I estimate model 3.2.1.1, which investigates the effects between the number of new sign-ups, average degree, and active interpersonal participation by the help of PVAR(1) based on the all regions' sample. IRFs show that a shock in average degree leads to a positive response of participation and, vice versa, a shock in participation increases average degree (see Figure 62). These findings are also supported by PVAR(2), PVAR(3), and PVAR(4) (see Appendix 64). Thus, by comparing models 3.1.1.1 and 3.2.1.1 it is apparent that, in the all regions' sample, the inclusion of new sign-ups does not change the effects between average degree and active interpersonal participation. Further, model 3.2.1.1 reveals a positive reaction of participation to an impulse in the number of new sign-ups, which is also confirmed by robustness tests. Summing up, model results gained from the three different samples (i.e. results around model 1.2.1.1, model 2.2.1.1, model 3.2.1.1, and corresponding robustness tests) are not identical. But, they have one significant effect in common: the positive reaction of participation to a shock in average degree.

Model 3.2.1.2 examines the relationship between the number of new sign-ups, degree centralization, and active interpersonal participation by the help of PVAR(1). The results demonstrate that an impulse in degree centralization leads to a positive response of participation that remains significant up to four months (see Figure 63). Reversed effects are not significant. These results are also confirmed by robustness tests (see Appendix 65) and correspond to model 3.1.1.2, that excludes community growth. Further, PVAR(1) is not able to show a significant reaction of degree centralization to a shock in the number of new sign-ups. However, PVAR(3) identifies a negative effect, which stays significant for a short period of time. PVAR(4) identifies a positive effect, which becomes significant after about five months. Thus, concerning the reaction of degree centralization to an impulse in the number of new sign-ups, both positive and negative effects are not excluded. Comparing the results of the all regions' sample with the results gained from the other two samples, one can state that the effects between degree centralization and active interpersonal participation correspond to the new regions' sample, but not to the established regions' sample.

IRFs of model 3.2.1.3, which analyzes effects between the number of new sign-ups, the share of networkers, and active interpersonal participation by the help of PVAR(1), reveal that an impulse in participation increases the share of networkers (see Figure 64). This effect is also significant with estimation of PVAR(2) (see Appendix 66). Reversely, an impulse in the share of networkers is followed by a positive response of active interpersonal participation, which is not significant in the PVAR(1) model, but turns significant with estimation of PVAR(2), PVAR(3), and PVAR(4). Thus, results of model 3.2.1.3 and the corresponding robustness tests differ only slightly from the findings of model 3.1.1.3 and its robustness tests, where only the effect from the share of networkers on active interpersonal participation is significant. Further, model 3.2.1.3 reveals a significant positive reaction of participation to a shock in new sign-ups. However, this effect is not confirmed by models of higher lag order. Taken together, the findings from the all regions' sample equal the established regions' sample concerning the relationship between the share of networkers and active interpersonal participation. Results concerning all other relationships match with the results gained from the new regions' sample, where no significant effects are detected.

Effects between the number of new sign-ups, the network clustering coefficient, and active interpersonal participation are displayed in Figure 65. IRFs of model 3.2.1.4 show that a shock in the network clustering coefficient is followed by a significant positive response of participation in the PVAR(1) model. However, PVAR models of higher lag order do not confirm this effect (see Appendix 67). In PVAR(2) and PVAR(3) this effect even becomes significant negative. Thus, there is a tendency towards a negative effect. Further, there is no significant response of the network clustering coefficient to an impulse in active interpersonal participation, which is also confirmed by PVAR(2), PVAR(3), and PVAR(4). Hence, results are in line with the results gained from the model that excludes community growth. Furthermore, model 3.2.1.4 reveals a positive response of the network clustering coefficient to a shock in the number of new sign-ups, which is not confirmed by models of higher lag order. However, there is evidence for a positive response of new sign-ups to a shock in active interpersonal participation, which is insignificant in a PVAR(1), but turns significant with estimation of PVAR(3) and PVAR(4). Hence, the results gained from the all regions' sample differ from the established regions' sample, where no effects are significant. Moreover, results gained from the all regions' sample are comparable to the results gained from the new regions' sample concerning the negative reaction of participation to a shock in the network clustering coefficient, which is also possible in the new regions' sample.

Figure 62 Impulse Response Functions, PVAR(1) ln_new_signups ln_average_degree ln_partintact, errors are 5% on each side generated by Monte-Carlo (1000 reps); All Regions

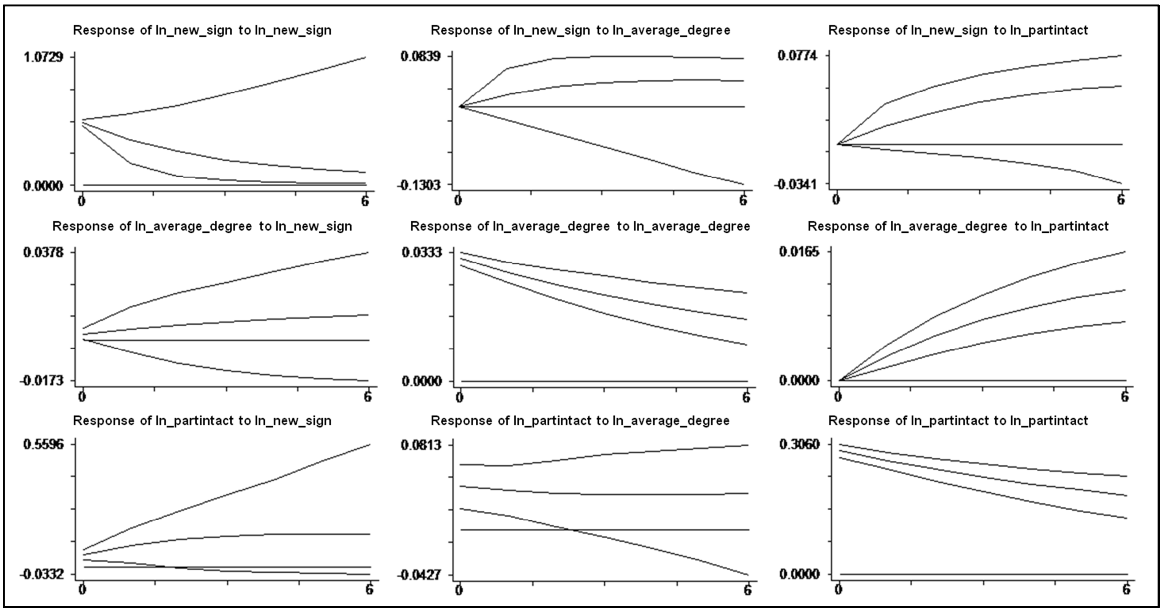


Figure 63 Impulse Response Functions, PVAR(1) ln_new_signups ln_degree_centralization ln_partintact, errors are 5% on each side generated by Monte-Carlo (1000 reps); All Regions

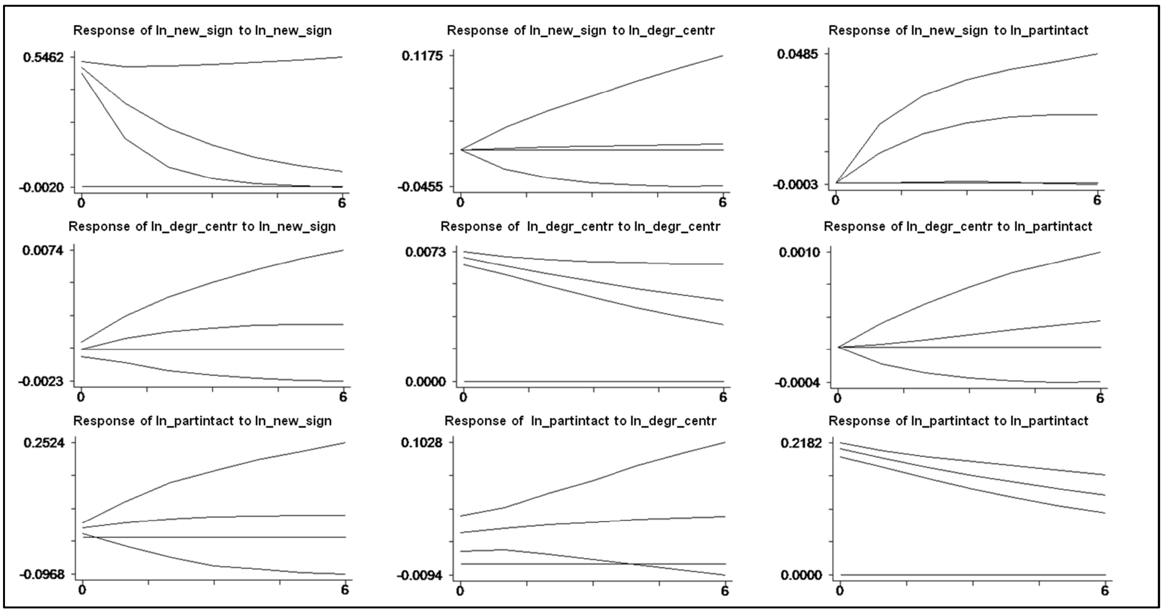


Figure 64 Impulse Response Functions, PVAR(1) ln_new_signups ln_networker_share ln_partintact, errors are 5% on each side generated by Monte-Carlo (1000 reps); All Regions

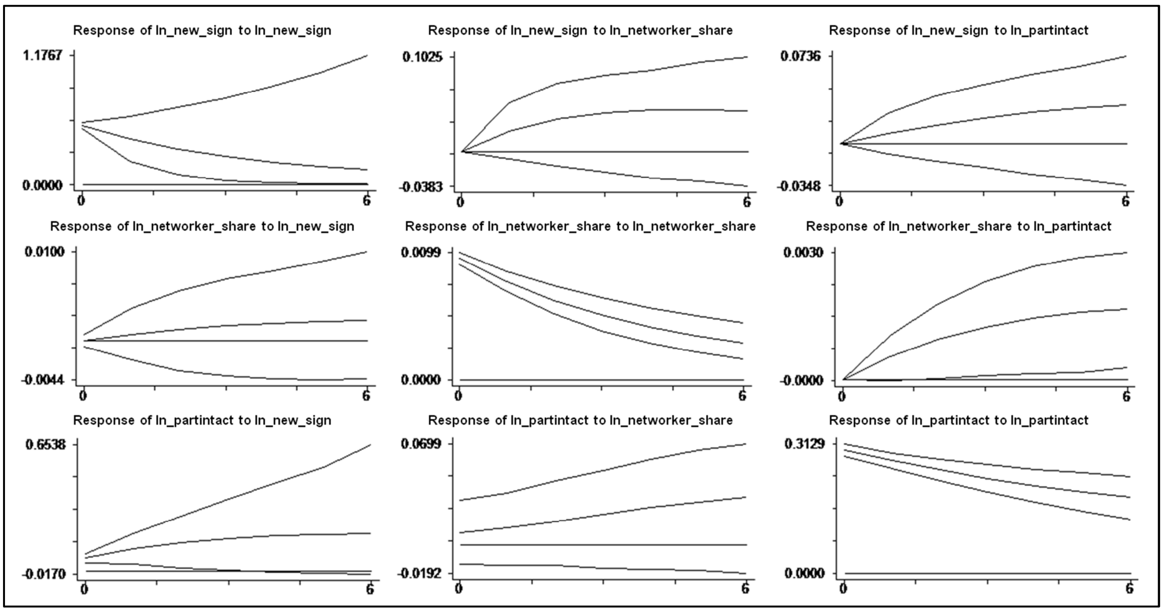
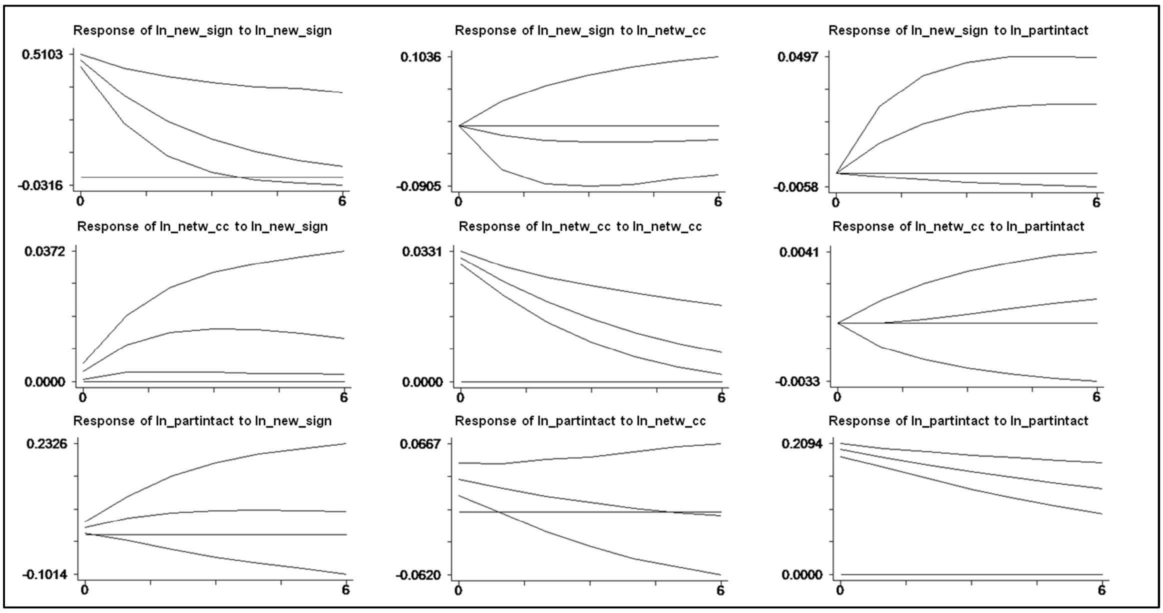


Figure 65 Impulse Response Functions, PVAR(1) ln_new_signups ln_network_cc ln_partintact, errors are 5% on each side generated by Monte-Carlo (1000 reps); All Regions



Model 3.2.2.1 focuses on the interrelationship between the number of new sign-ups, average degree, and active platform participation by the help of PVAR(1). Results of the model reveal positive reciprocal effects between average degree and participation (see Figure 66). These effects are also detected by models of higher lag order (see Appendix 68) and are similar to the model 3.1.2.1, that focuses only on the relationship between average degree and participation. Moreover, a shock in the number of new sign-ups is followed by a positive response of active interpersonal participation, that stays significant for more than six months in the PVAR(1) model. In PVAR models of higher lag order the significant positive effect lasts only for a very short period of time. Further, a shock in new sign-ups leads to a long-lasting increase in average degree, which is also supported by robustness tests. Summing up, the detected effects gained from the all regions' sample are comparable to the established regions' sample concerning the positive effect of active platform participation on average degree, but are totally different from the new regions' sample, where no effects are significant.

I estimate model 3.2.2.2 in order to investigate the effects between the number of new sign-ups, degree centralization, and active platform participation. IRFs of PVAR(1) illustrate a positive response of participation to a shock in degree centralization, that stays significant for about three months (see Figure 67). Reversely, a shock in participation increases degree centralization. The positive reciprocal effects are confirmed by robustness tests (see Appendix 69). Thus, findings are similar to model 3.1.2.2, that excludes the number of new sign-ups. Moreover, model 3.2.2.2 reveals that an impulse in the number of new sign-ups leads to a positive response of active platform participation that remains significant for about five months in a PVAR(1). This positive effect is supported by all PVAR models of higher lag order, but the time period for significant effects is much shorter. Further, the response of degree centralization to a shock in the number of new sign-ups is not significant in the PVAR(1) model, but becomes significant negative with the estimation of PVAR(3) and PVAR(4). In summary, effects of active platform participation on degree centralization and effects of new sign-ups on active platform participation and degree centralization correspond to the established regions' sample. Similarities to the results of the new regions' sample become apparent regarding the positive reciprocal effects between degree centralization and active platform participation.

IRFs of model 3.2.2.3, which examines the interrelationship between the number of new sign-ups, the share of networkers, and active platform participation by the help of PVAR(1), show a positive reaction of participation to an impulse in the share of networkers (see Figure 68). Reversed effects are not significant. These results are also confirmed by PVAR models of higher lag order (see Appendix 70) and comply with the results of the corresponding model 3.1.2.3, that does not consider community growth. Further, a shock in the number of new sign-ups is followed by a positive response of both active platform participation and the share of networkers, which is also confirmed by robustness tests. Hence, results gained from the all regions' sample differ from the new regions' sample, where all effects are insignificant. Regarding the significant effects of the all and the established regions' sample, only the positive response of active platform participation to an impulse in the share of networkers is detected in both samples.

Effects between the number of new sign-ups, the network clustering coefficient, and active platform participation are analyzed by the help of model 3.2.2.4. IRFs of PVAR(1) reveal no significant response of the network clustering coefficient to an impulse in platform participation (see Figure 69). This is confirmed by PVAR(2), PVAR(3), and PVAR(4) (see Appendix 71). Besides, IRFs of PVAR(1) show that an impulse in the network clustering coefficient is followed by a significant positive response of participation. However, this effect becomes significant negative in the PVAR(2) model for a short period of time and it becomes insignificant in the PVAR(3) and PVAR(4) models. Thus, both positive and negative effects are not excluded. Hence, the inclusion of community growth changes to a certain extent the relationship between the clustering coefficient and active platform participation in the all regions' sample because model 3.1.2.4, that excludes community growth, does not reveal any significant effects. Furthermore, the results of PVAR(1) demonstrate that an impulse in the number of new sign-ups leads to a positive response of the network clustering coefficient, that lasts for more than six months, and to a positive response of participation, that lasts for about three months. Also robustness tests detect positive reactions of both variables to a shock in the number of new sign-ups. Summing up, results gained from the all regions' sample differ from the results gained from the established regions' sample. However, they are similar to the results gained from the new regions' sample concerning the possible positive and negative responses of platform participation to a shock in the network clustering coefficient.

Figure 66 Impulse Response Functions, PVAR(1) ln_new_signups ln_average_degree ln_partplatact, errors are 5% on each side generated by Monte-Carlo (1000 reps); All Regions

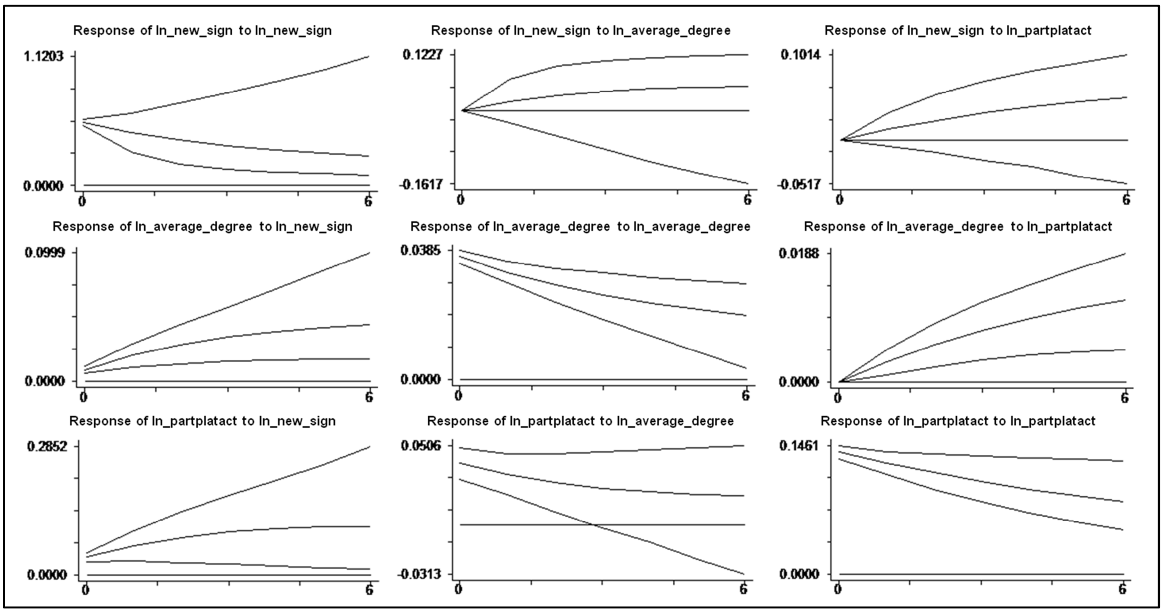


Figure 67 Impulse Response Functions, PVAR(1) ln_new_signups ln_degree_centralization ln_partplatact, errors are 5% on each side generated by Monte-Carlo (1000 reps); All Regions

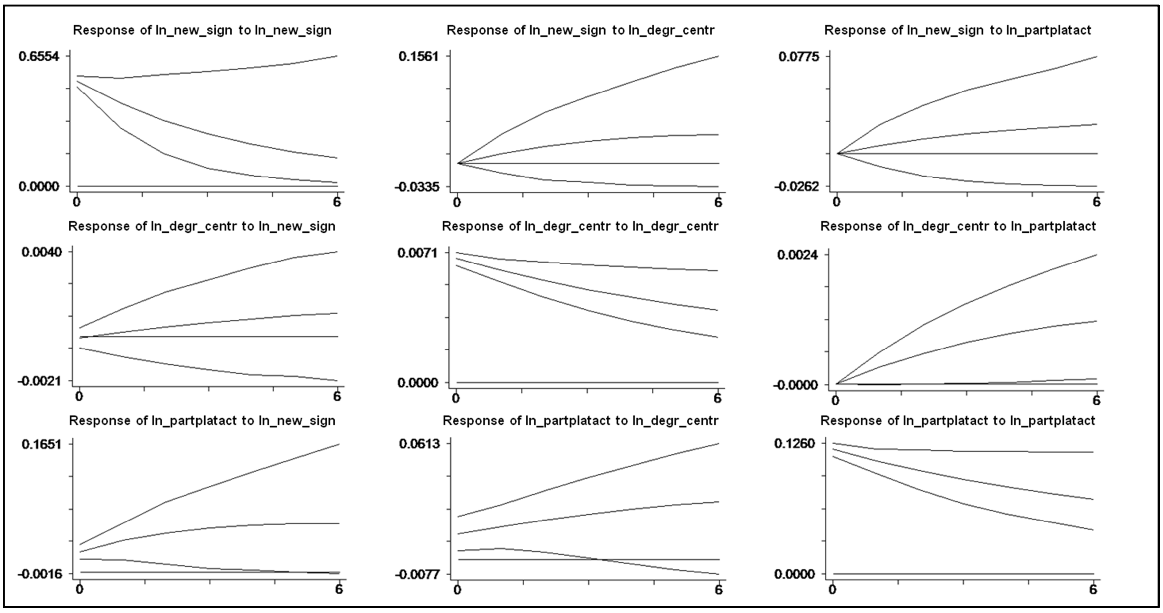


Figure 68 Impulse Response Functions, PVAR(1) ln_new_signups ln_networker_share ln_partplatact, errors are 5% on each side generated by Monte-Carlo (1000 reps); All Regions

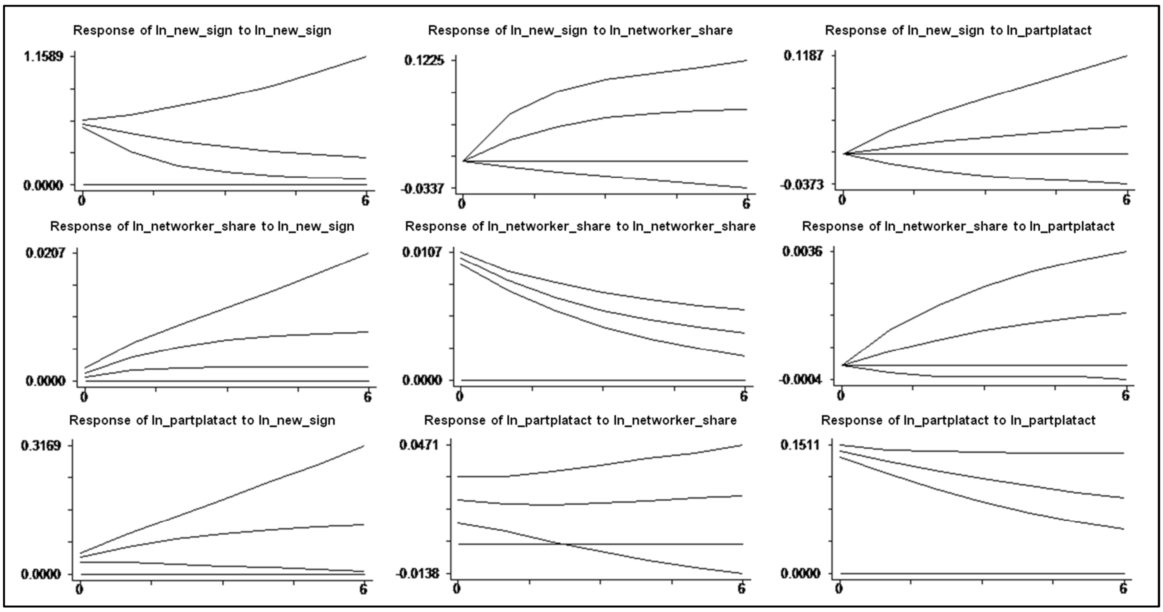
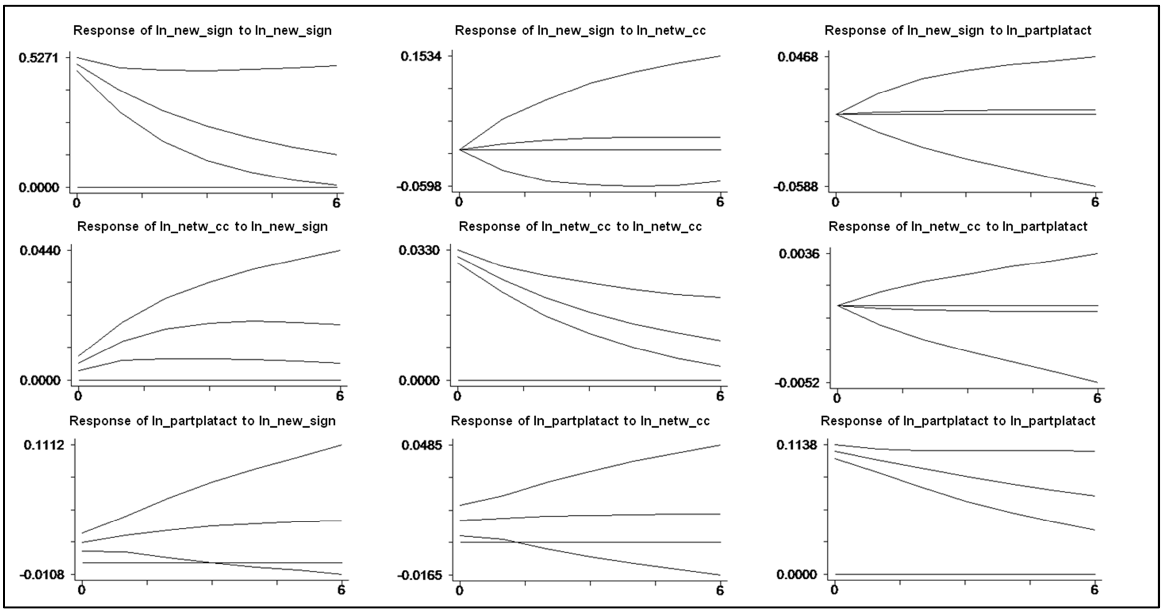


Figure 69 Impulse Response Functions, PVAR(1) ln_new_signups ln_network_cc ln_partplatact, errors are 5% on each side generated by Monte-Carlo (1000 reps); All Regions



Model 3.2.3.1 analyzes the interrelationship between the number of new sign-ups, average degree, and active interpersonal and platform participation. IRFs of PVAR(1) demonstrate that an impulse in average degree leads to a positive response of overall participation, that remains significant up to three months (see Figure 70). Reversely, an impulse in participation increases average degree. Positive reciprocal effects between these two variables are also detected by PVAR(2), PVAR(3), and PVAR(4) (see Appendix 72). Hence, an inclusion of community growth does not change the positive reciprocal effects between average degree and overall participation in the all regions' sample. Results of model 3.2.3.1 also indicate a positive reaction of overall participation to a shock in the number of new sign-ups, which is also confirmed by models of higher lag order. Taken together, results gained from the all regions' sample equal the results gained from the established regions' sample in the positive reciprocal effects between average degree and active interpersonal and platform participation. Further, they equal the results gained from the new regions' sample only in the positive effect from average degree on overall participation.

IRFs of model 3.2.3.2, which investigates the relationship between the number of new sign-ups, degree centralization, and active interpersonal and platform participation, show that in the PVAR(1) model a shock in degree centralization is followed by a positive response of overall participation, that lasts for about four months (see Figure 71). Robustness tests confirm a positive, but shorter effect (see Appendix 73). Reversed effects are not significant, which is confirmed by PVAR(2), PVAR(3), and PVAR(4). Hence, results are similar to model 3.1.3.2, that excludes community growth. Moreover, IRFs of PVAR(1) reveal a significant positive reaction of overall participation to an impulse in the number of new sign-ups, which is also supported by models of higher lag order. Summing up, results gained from the all regions' sample are completely different from the established regions' sample regarding their significant effects. Yet, results gained from the all regions' sample are comparable to the results gained from the new regions' sample regarding the positive effect from degree centralization on overall participation.

I estimate model 3.2.3.3 in order to analyze the interrelationship between the number of new sign-ups, the share of networkers, and active interpersonal and platform participation. Results of PVAR(1) demonstrate a positive response of the share of networkers to a shock in overall participation, which becomes significant with some delay (see Figure 72). This finding is also supported by PVAR(2) (see Appendix 74). Reversely, a shock in the share of networkers is followed by a positive response of participation, which is insignificant in the PVAR(1) model, but gets significant with estimation of PVAR(2), PVAR(3), and PVAR(4). Thus, there are positive reciprocal effects between the two variables. These findings are slightly different from model 3.1.3.3 that excludes community growth, because, there, only a unilateral positive effect from the share of networkers on overall participation is detected. Further, results of PVAR(1) reveal a positive reaction of overall participation to an impulse in the number of new sign-ups, which is also supported by PVAR models of higher lag order. Hence, findings gained from the all regions' sample are totally different from the new regions' sample, where no significant effects are detected. But they conform to the findings gained from the established regions' sample regarding the positive reciprocal effect between the share of networkers and active interpersonal and platform participation.

Finally, effects between the number of new sign-ups, the network clustering coefficient, and active interpersonal and platform participation are investigated in model 3.2.3.4. IRFs of PVAR(1) reveal a significant positive response of overall participation to a shock in the network clustering coefficient (see Figure 73). However, this significant positive effect is not supported by robustness tests. Instead, PVAR(2) and PVAR(3) demonstrate a significant negative response of overall participation, while PVAR(4) does not show any significant effects (see Appendix 75). Thus, there is a tendency towards a negative reaction of overall participation. Reversed effects are not significant, which is confirmed by PVAR(2), PVAR(3), and PVAR(4). Hence, these results are in line with the findings gained from model 3.1.3.4 and its robustness tests, that all exclude community growth. Moreover, results of PVAR(1) indicate a positive response of both the network clustering coefficient and overall participation to an impulse in the number of new sign-ups, whereby only the significant positive reaction of overall participation is supported by robustness tests. Hence, the findings from the all regions' sample are different from the established regions' sample, where no effects are significant. Yet, they correspond to the results gained from the new regions' sample concerning the positive reaction of overall participation to an impulse in the number of new sign-ups and the negative reaction of overall participation to a shock in the network clustering coefficient, which, however, can also be positive in the new regions' sample.

Figure 70 Impulse Response Functions, PVAR(1) ln_new_signups ln_average_degree ln_partintactplat, errors are 5% on each side generated by Monte-Carlo (1000 reps); All Regions

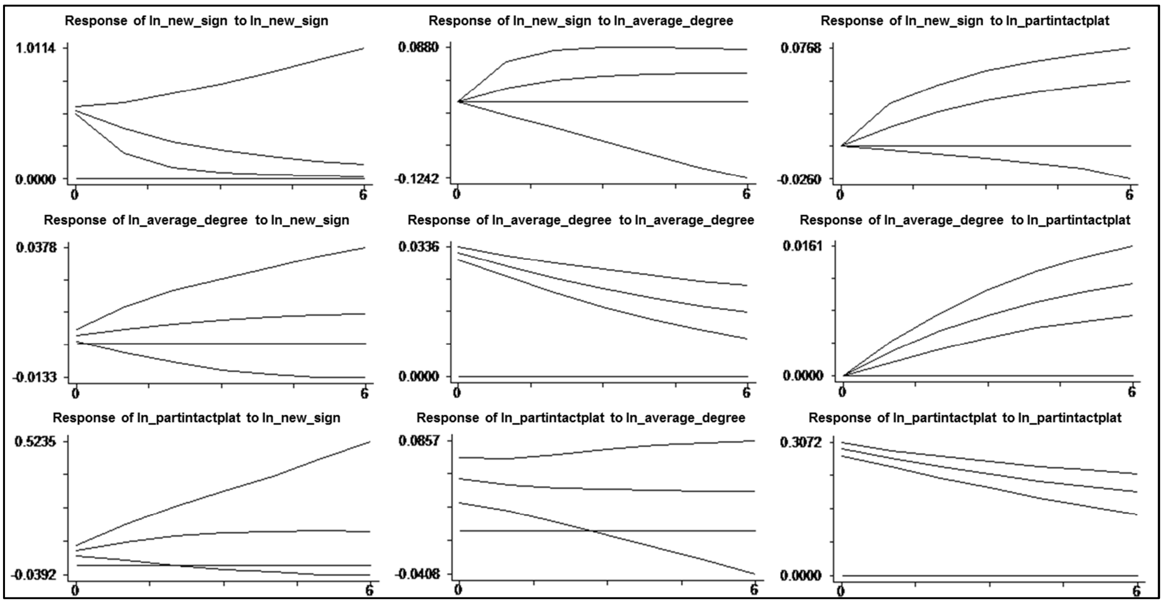


Figure 71 Impulse Response Functions, PVAR(1) ln_new_signups ln_degree_centralization ln_partintactplat, errors are 5% on each side generated by Monte-Carlo (1000 reps); All Regions

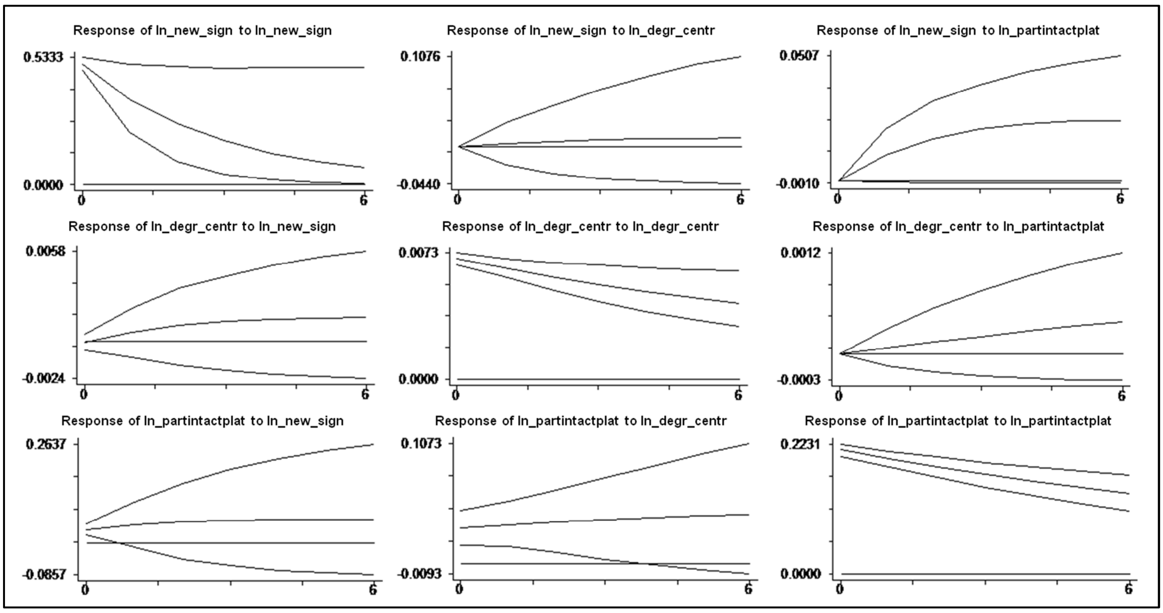


Figure 72 Impulse Response Functions, PVAR(1) ln_new_signups ln_networker_share ln_partintactplat, errors are 5% on each side generated by Monte-Carlo (1000 reps); All Regions

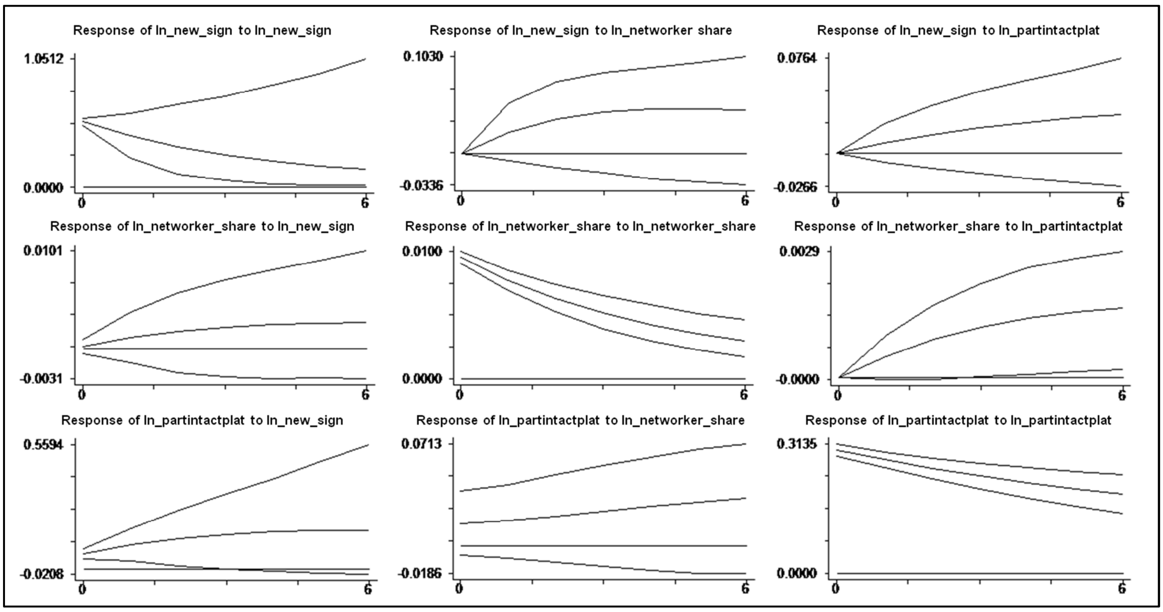
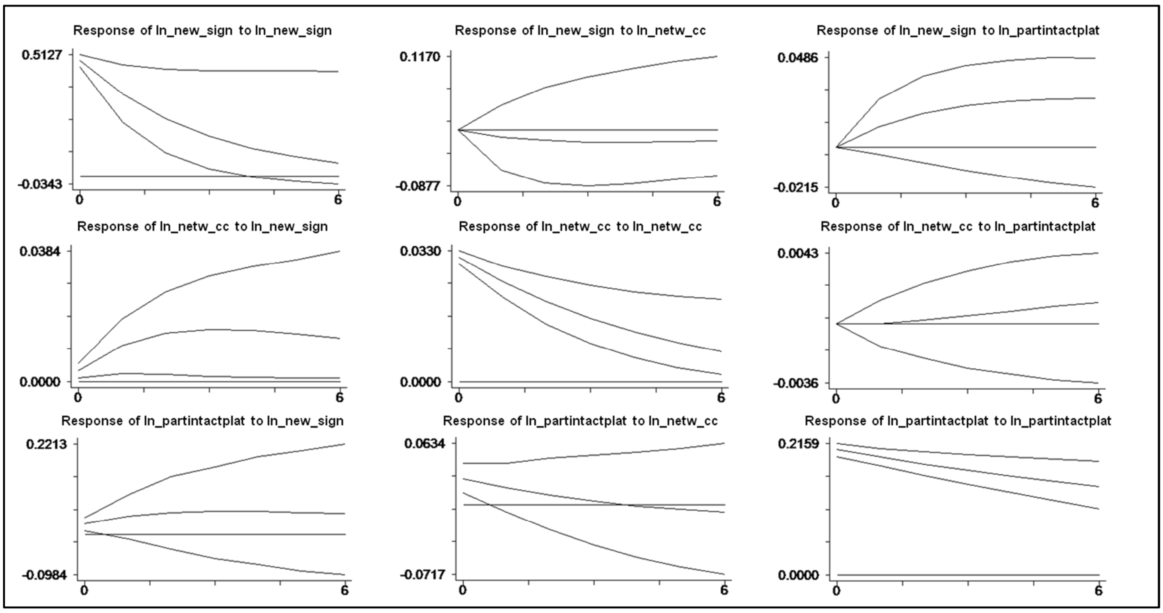


Figure 73 Impulse Response Functions, PVAR(1) ln_new_signups ln_network_cc ln_partintactplat, errors are 5% on each side generated by Monte-Carlo (1000 reps); All Regions



3.6. Discussion

3.6.1. Summary of Results

This research project is the first to investigate the interdependence of community success factors such as network structure, community participation, and community growth over time and community life cycle phases.

Since the results of the analyses show that effects resulting from the interplay of success factors differ between established regions, new regions, and all regions, a separate examination is indispensable. It is delicate to make general statements about the interdependence of community success factors. Conclusions must rather be drawn depending on the communities' life cycle phase. Results reveal that only some general statements are valuable for all communities independently from their life cycle phase:

First, network structure influences participation and vice versa. Hence, they should not be regarded independently. A closer investigation of how and when these variables interact is essential. Second, positive reciprocal effects between average degree and active interpersonal participation as well as positive reciprocal effects between average degree and active interpersonal and platform participation, i.e. overall participation, are detected. All these effects last for several months. Thus, structural cohesion or network density in the form of average degree (Nooy, Mrvar, and Batagelj 2011) obtains a central role in the interaction with participation. Average degree on the one side and interpersonal or overall participation on the other side influence themselves positively. As a consequence, they are important factors for ensuring a lively and successful community. Third, the network clustering coefficient as an indicator for network density or transitivity exerts for the most part no significant influence on active platform participation and vice versa. This finding makes intuitive sense as all activities combined in the variable of platform participation (see Chapter 3.3.3) can be carried out regardless of the state of the network's transitivity. In other words, as network members can practice all activities of platform participation on their own, i.e. without another person, a dense or transitive network should not be required. Fourth, network structure in the form of average degree, degree centralization, share of networkers, and network clustering coefficient does not directly influence community growth. This is at a first glance a surprising finding since social aspects take a central role in the field of online communities (e.g. Iriberri and Leroy 2009; Ridings and Gefen 2004; Toral et al. 2009; Wellman et al. 1996). Nevertheless, the importance of network structure in the context of community success becomes evident from another point of view: from the interdependence between network structure and participation variables as well as from the in some cases indirect effects on community growth, which are discussed right afterwards in the summary of the detailed analysis across community life cycle phases.

Established Regions

In order to get an overview of the interplay of online community success factors throughout a community's life cycle, I summarize the results gained from the different samples in the following figures[8] as well as in Appendix 76. Figure 74, Figure 75, and Figure 76 combine the results gained from the PVAR models concerning the interplay between network structure and participation in established regions.

[8] Effects are displayed in the figures when at least two PVAR models show significant effects.

Figure 74 Overall Effects PVAR(1)-(4), Network Structure – Interpersonal Participation, Established Regions

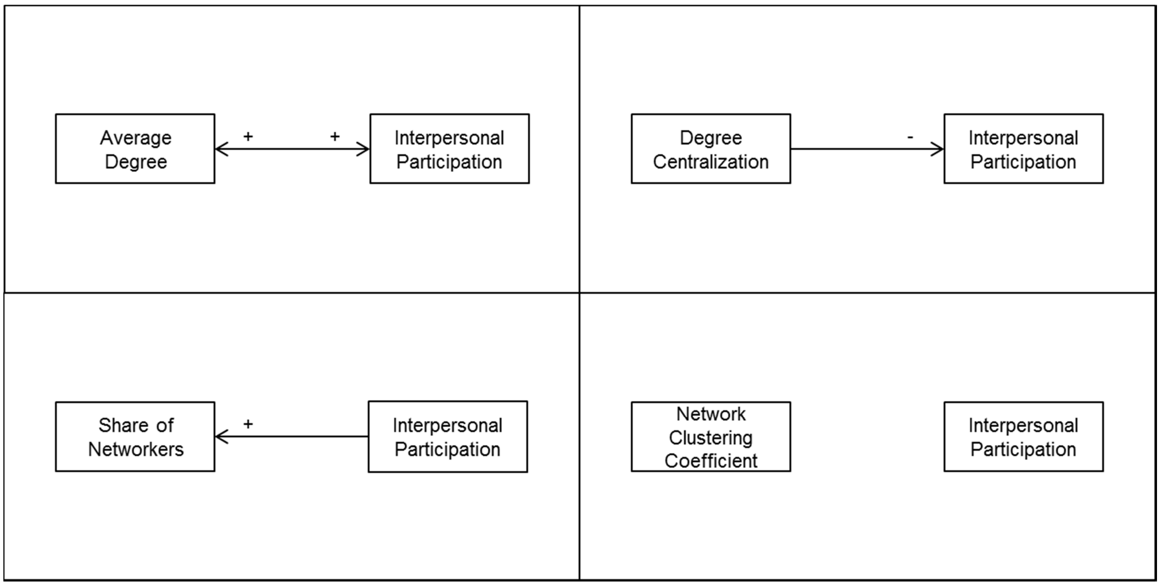


Figure 75 Overall Effects PVAR(1)-(4), Network Structure – Platform Participation, Established Regions

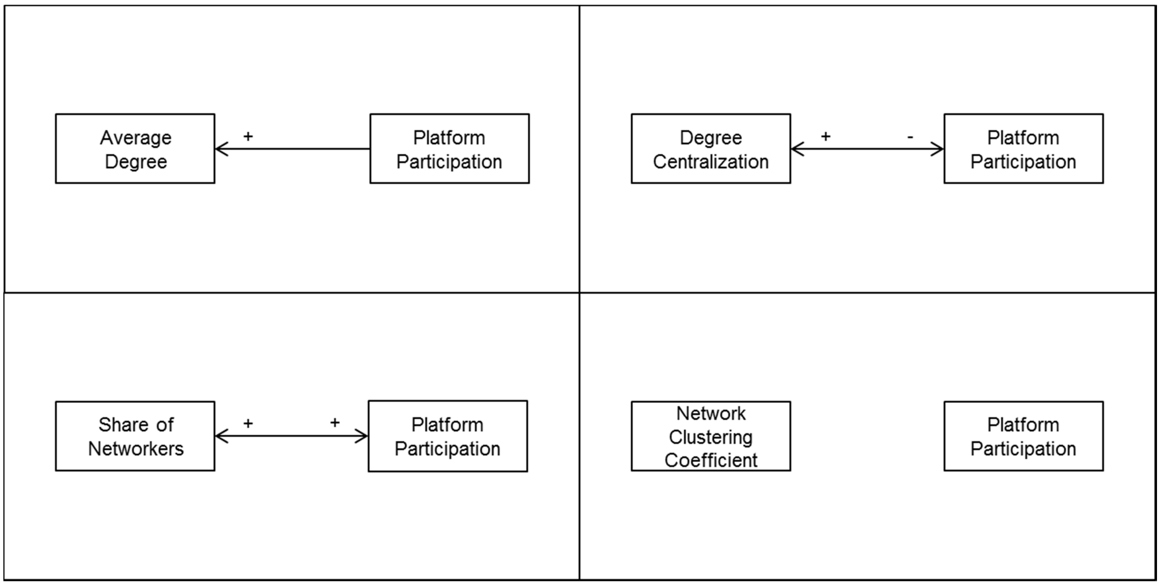
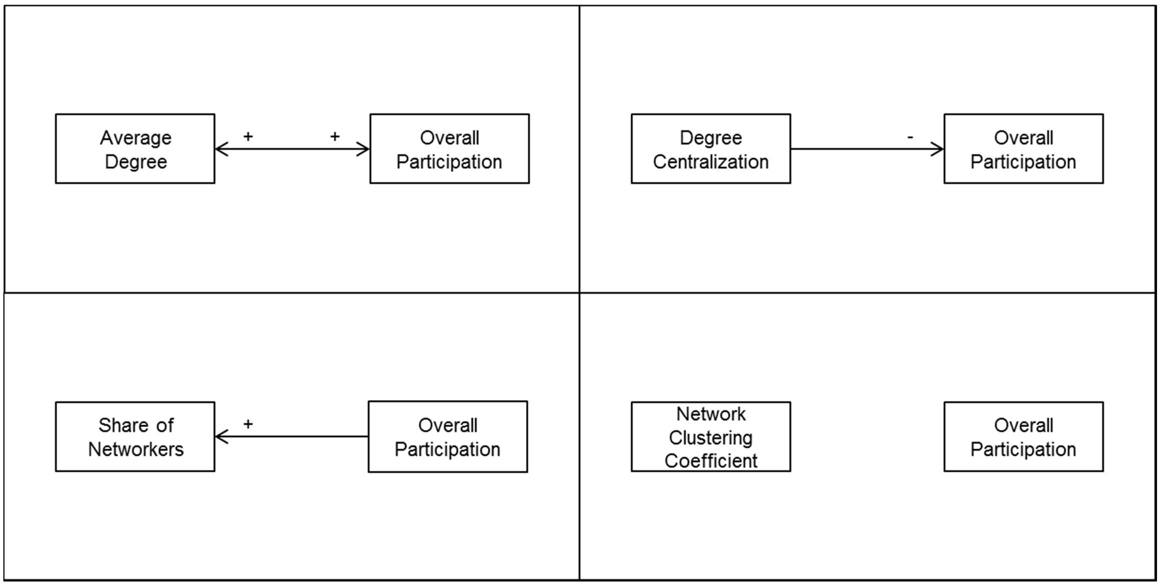


Figure 76 Overall Effects PVAR(1)-(4), Network Structure – Overall Participation, Established Regions



As already mentioned, there are positive reciprocal effects between average degree and interpersonal participation as well as between average degree and overall participation. Further, in established regions, effects between the network clustering coefficient and all three kinds of participation are not significant. Hence, a change in the clustering coefficient has no consequences on participation and vice versa. Thus, in established regions, the network density in the form of the network clustering coefficient does not play a role in the interplay of success factors. Regarding platform participation, also network density in the form of average degree has no impact. These findings suggest that network density does not help to explain platform participation in established regions. This makes sense because network members can carry out all activities of platform participation on their own, i.e. without another person. Hence, a dense network should not be required. However, platform participation is positively influenced by the share of networkers and vice versa, whereby especially the response of the share of networkers lasts for a long time. Thus, the share of networkers plays an important role in the interaction with platform participation. Hence, in order to ensure platform participation, it is sufficient that users are connected, yet a densely connected network is not necessary. This means that platform participation does not require a fully developed and dense network, but a network in which a certain connection among members exists such that the share of non-networkers or "loners" is reduced. Further, unidirectional positive effects of interpersonal and overall participation on the share of networkers are detected. Finally, the sole negative effects, which come with some delay, are detected in the influence of degree centralization on all kinds of participation, namely interpersonal, platform, and overall participation. This means that, in established regions, the network should not become too central, it must be well-balanced. Otherwise participation goes down. In established regions, single leaders are not accepted. The negative effect of degree centralization is only counterbalanced by the positive effect of platform participation. Thus, once centralization increases, platform participation decreases. However, reversely, once platform participation decreases, also degree centralization goes down and thus increases platform participation.

Effects arising after the inclusion of community growth are summarized in Figure 77, Figure 78, and Figure 79. In general, effects between network structure and participation remain the same. Only a few more significant effects appear: A positive effect from overall participation on degree centralization gets significant and thus counterbalancing effects also occur in the interplay of degree centralization and overall participation. Further, results reveal additional positive effects of the share of networkers on interpersonal participation and overall participation. Thus, positive reciprocal effects occur not only between the share of networkers and platform participation, but also between the share of networkers and interpersonal as well as between the share of networkers and overall participation. This means that the share of networkers plays an important role in conjunction with all kinds of participation. Regarding the effects around community growth, the summary of results implies that, in established regions, all participation variables positively influence community growth. These effects predominantly last for several months. Reversed effects are rather unusual. Thus, in established regions, community growth can be enhanced by increasing participation, which is in line with Preece's (2000) point of view and Butler's (2001) findings from a study on mailing lists. As a consequence, on the one hand network structure directly influences participation and on the other hand indirectly influences community growth through the positive relationship between participation and community growth. Hence, in established regions, community growth, participation, and network structure excluding the clustering coefficient should not be considered separately. Additionally, community growth has a negative impact on average degree and the share of networkers. However, because of this negative effect, communities are not growing endlessly as positive effects between average degree or the share of networkers, participation, and community growth would suggest. It makes sense that average degree and the share of networkers are negatively influenced by community growth since it takes time until new users are integrated into the network, i.e. until they make friends. Based on these findings it is important to consider community growth when the interdependence of community success factors in established regions is analyzed.

Figure 77 Overall Effects PVAR(1)-(4), Community Growth – Network Structure – Interpersonal Participation, Established Regions

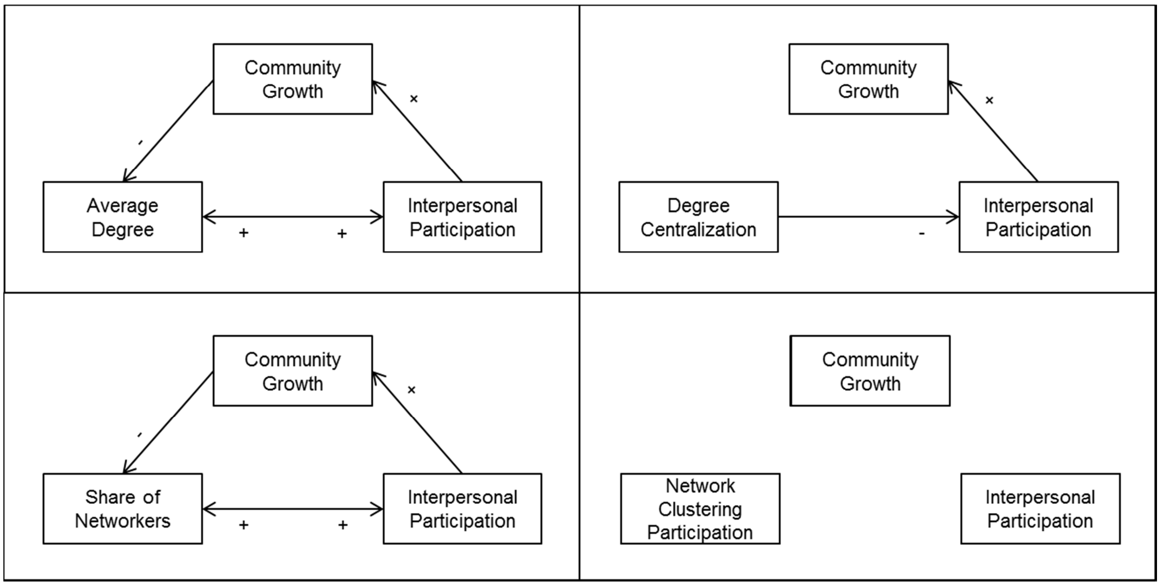


Figure 78 Overall Effects PVAR(1)-(4), Community Growth – Network Structure – Platform Participation, Established Regions

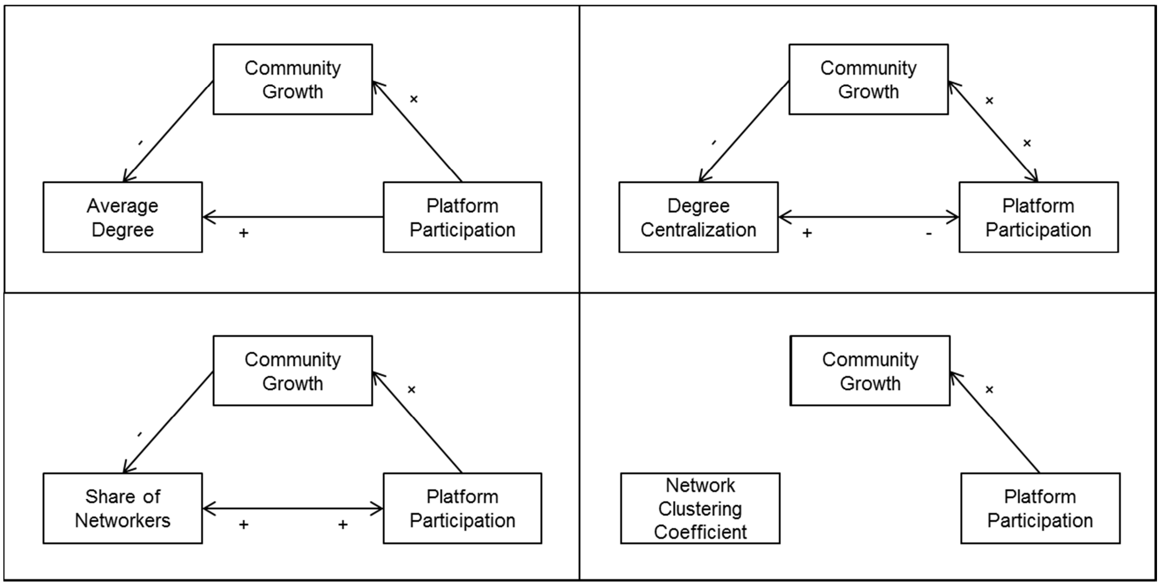
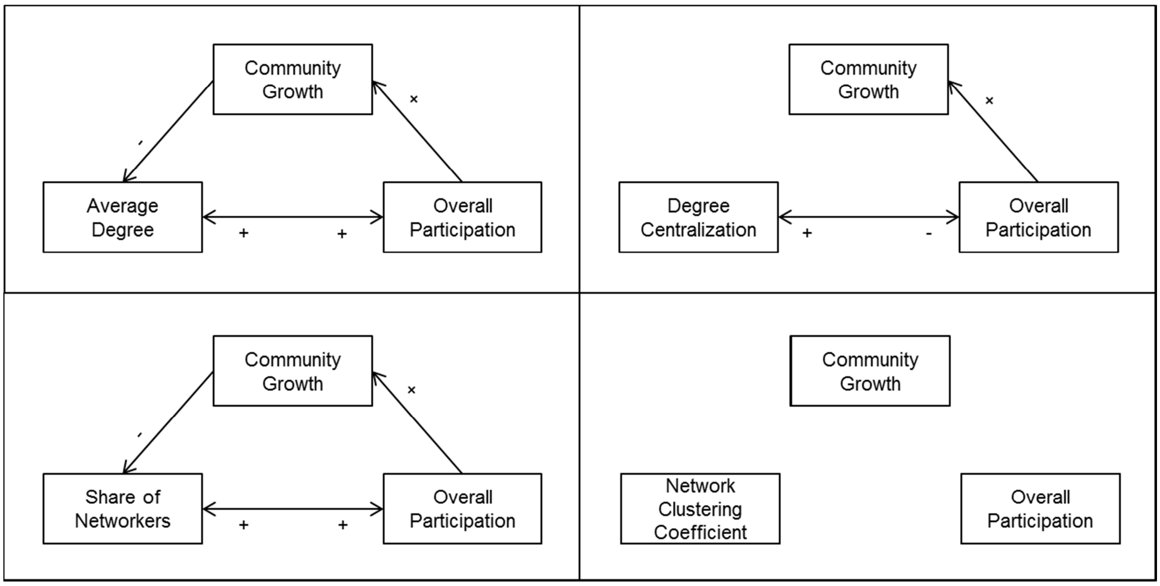


Figure 79 Overall Effects PVAR(1)-(4), Community Growth – Network Structure – Overall Participation, Established Regions



New Regions

Figure 80, Figure 81, and Figure 82 present a summary of the results concerning the interdependence of network structure and participation in new regions. As already mentioned in the beginning of Chapter 3.6.1, there are positive reciprocal effects between average degree and interpersonal participation as well as between average degree and overall participation. Moreover, effects between the network clustering coefficient and platform participation are not significant assuming that network density in the form of the clustering coefficient does not play a role in conjunction with platform participation. Further, in new regions, also average degree and the share of networkers do not play a role in explaining platform participation and are reversely not explained by platform participation. Hence, similar to the established regions, network density in the form of average degree and the network clustering coefficient is not relevant in influencing platform participation. However, contrary to the established regions setting, in new regions, also the share of networkers can be neglected. This shows again the limited importance of network variables in the interplay with platform participation. Only degree centralization exerts a positive effect on platform participation, which lasts up to three months. Conversely, platform participation also positively influences degree centralization. However, the positive reciprocal relationship does not remain endlessly as already shown in the precedent section: When new regions convert into established regions, the positive effect of degree centralization becomes negative and thus counterbalancing effects arise. Besides the positive effect of degree centralization on platform participation in new regions, degree centralization has also a positive and long-lasting impact on interpersonal and overall participation. Hence, in new regions a network should become more central in order to stimulate participation as opposed to established regions. In new regions, central and leading users are necessary to ensure participation because they can enflame and enthuse new users for community participation. Thus, in the beginning of a community life cycle, users must be taken by the hand until some routine develops. Finally, the share of networkers positively influences overall participation and the network clustering coefficient positively influences interpersonal participation. Taken together, also in new regions network structure is important for assuring interpersonal and overall participation. Platform participation can only be enhanced by degree centralization.

Figure 80 Overall Effects PVAR(1)-(4), Network Structure – Interpersonal Participation, New Regions

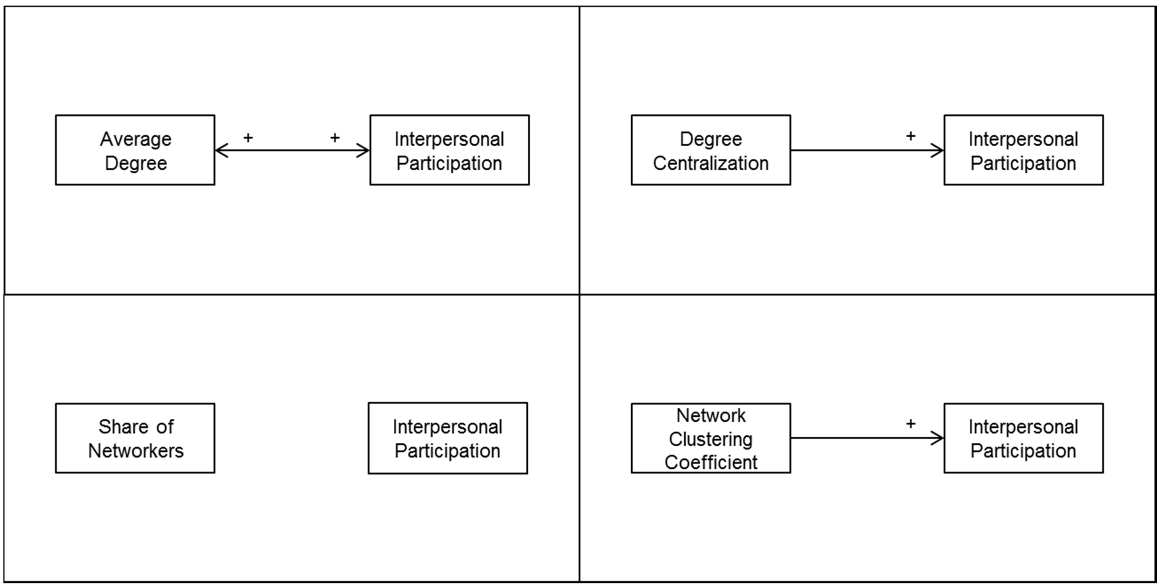


Figure 81 Overall Effects PVAR(1)-(4), Network Structure – Platform Participation, New Regions

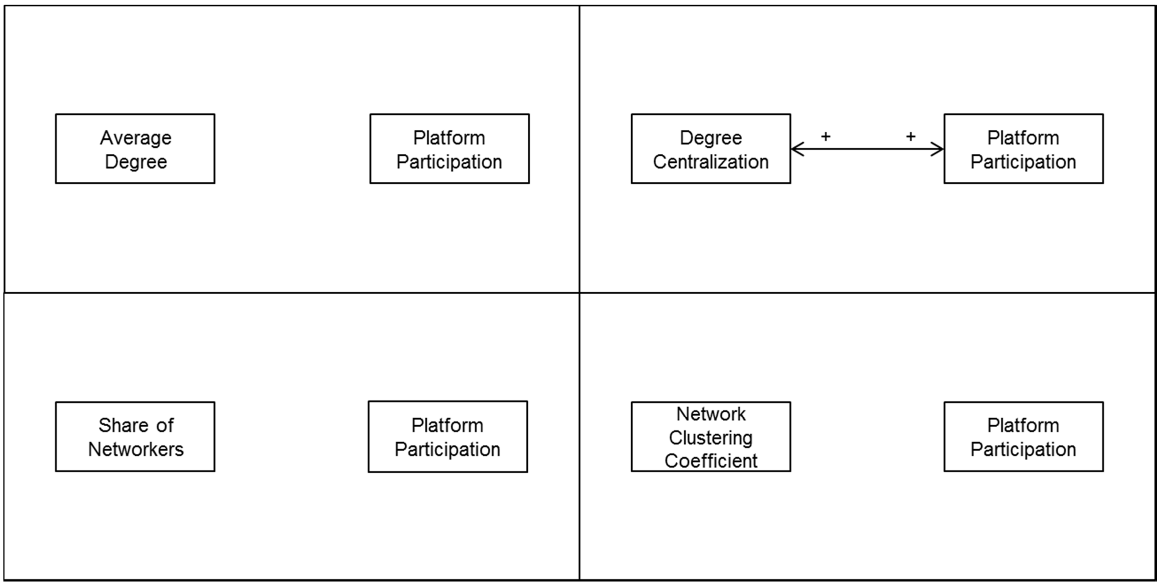


Figure 82 Overall Effects PVAR(1)-(4), Network Structure – Overall Participation, New Regions

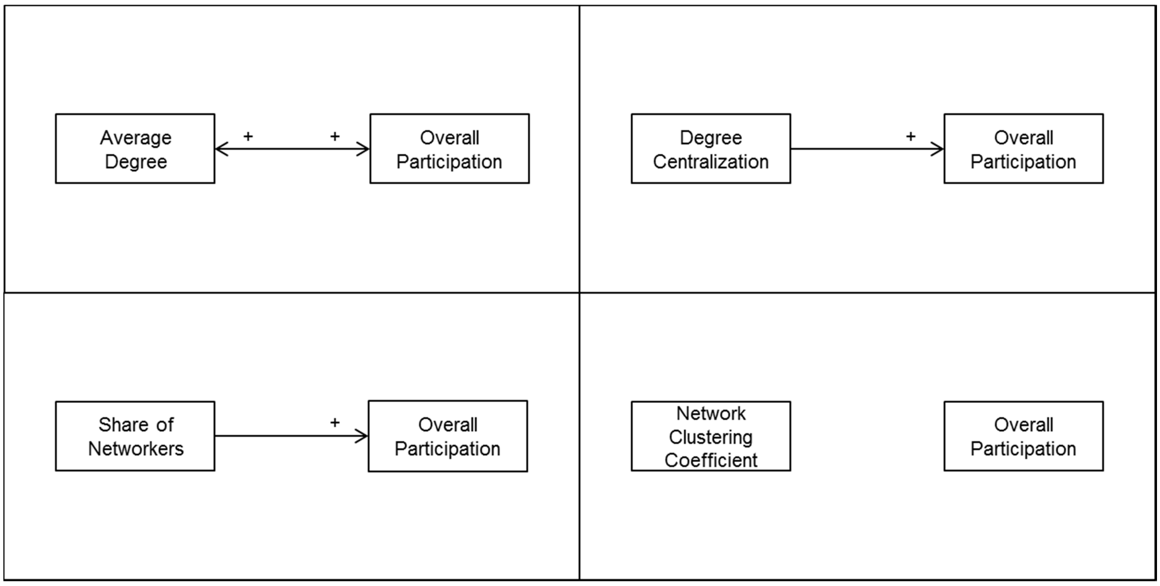


Figure 83, Figure 84, and Figure 85 display the summarized results after the inclusion of community growth. Effects between network structure and participation mainly stay the same. Further, there are no effects between network structure and community growth. Additionally, in new regions community growth is also fully independent from participation, which is contrary to the established regions' sample. As a consequence, community growth in new regions does neither take place via participation nor via the network, but other factors which are to be identified in further analyses (see Chapter 4). Thus, the interplay of network structure and participation can be regarded independently from community growth.

Figure 83 Overall Effects PVAR(1)-(4), Community Growth – Network Structure – Interpersonal Participation, New Regions

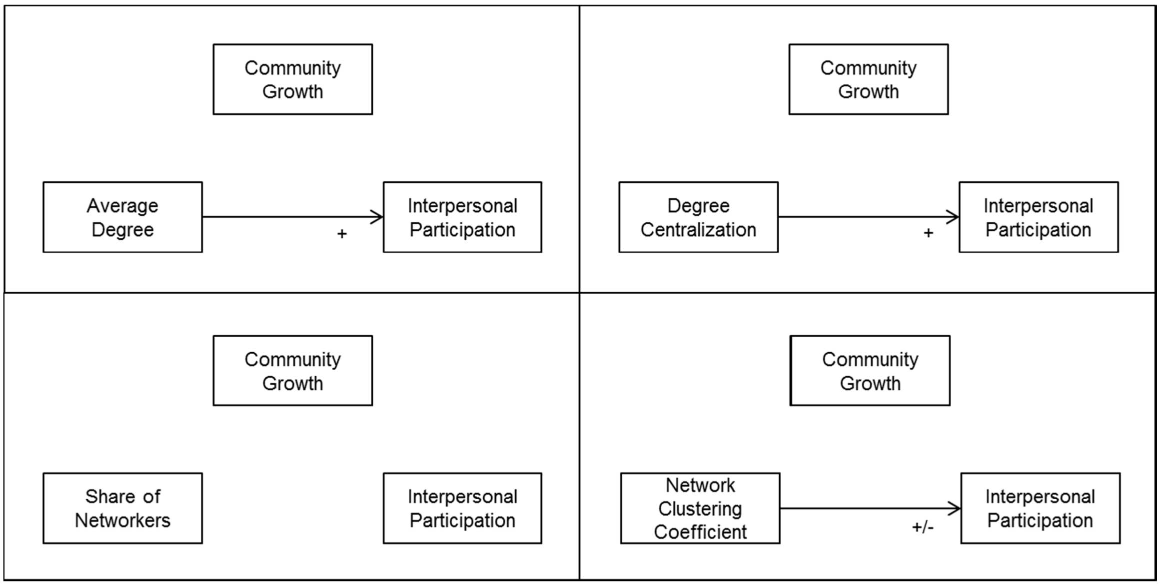


Figure 84 Overall Effects PVAR(1)-(4), Community Growth – Network Structure – Platform Participation, New Regions

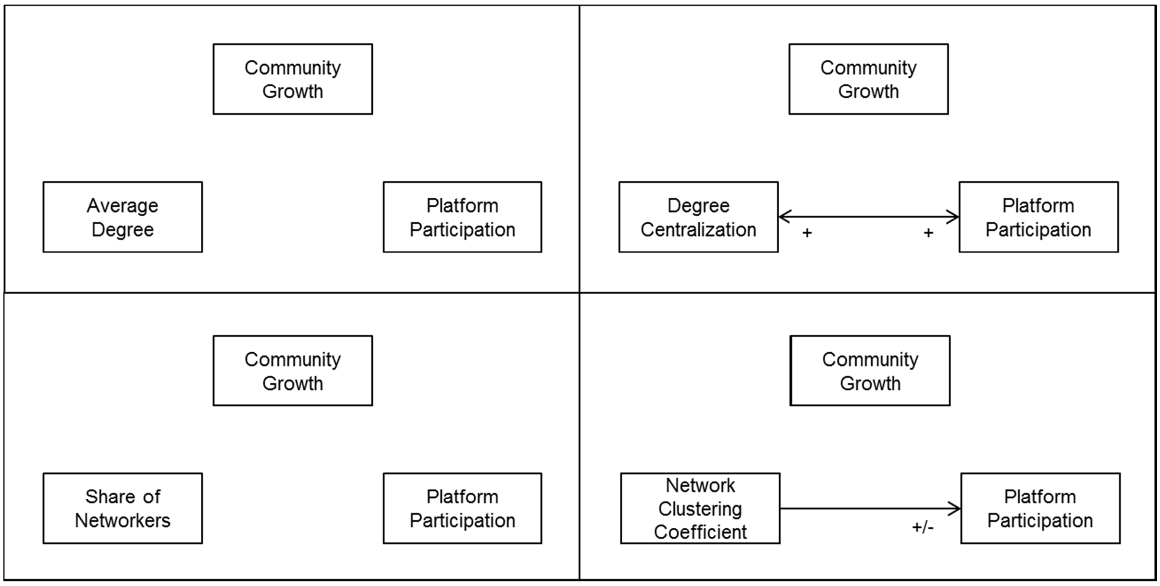
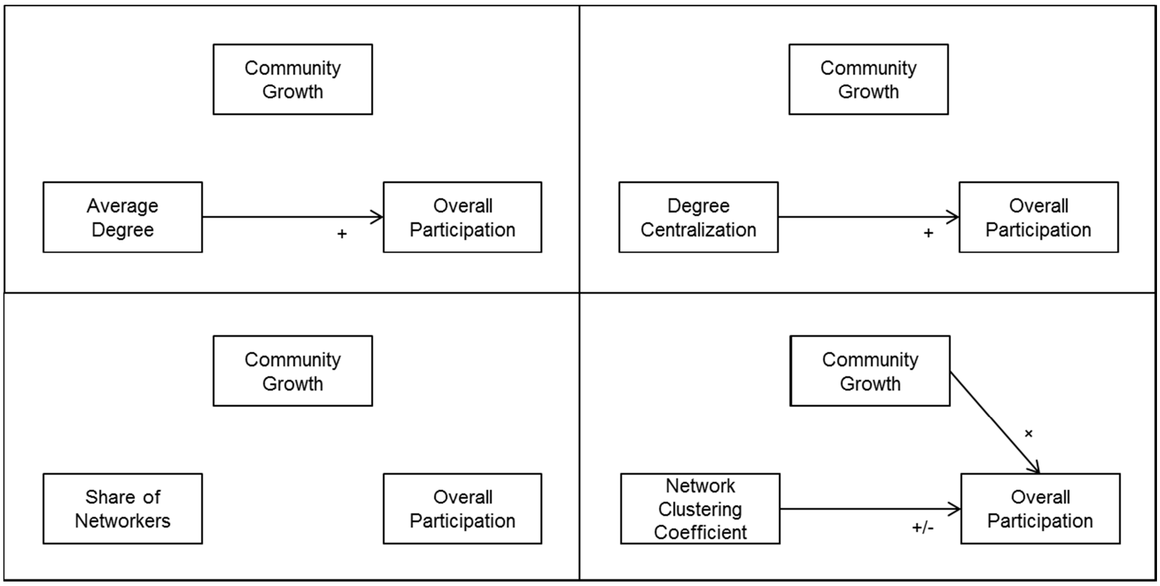


Figure 85 Overall Effects PVAR(1)-(4), Community Growth – Network Structure – Overall Participation, New Regions



All Regions

Effects arising between network structure and participation after aggregation of both established and new regions are presented in Figure 86, Figure 87, and Figure 88. Effects between community growth, network structure and participation are presented in Figure 89, Figure 90, and Figure 91. Besides the main findings holding for each community life cycle phase and already discussed at the beginning of Chapter 3.6.1, some effects prevail when both samples are jointly analyzed. First, the positive effect of degree centralization on participation discovered in new regions becomes apparent also in the all regions' sample, where this effect often lasts for a few months. Moreover, the positive impact of the share of networkers on participation, which is prominent in the established regions' sample, also spreads over the all regions' sample and often lasts for several months. Furthermore, after combining the established and the new regions' sample, there is a tendency towards a negative effect of the network clustering coefficient on participation, if effects are significant. This means that network density can have an either positive influence on participation in the case of average degree or an insignificant or even negative influence in the case of the network clustering coefficient. Thus, users should have many contacts but they should not be completely interconnected. Finally, effects of participation on community growth as uncovered in the established regions' sample are rather not prominent in the all regions' sample. Instead, reversed effects of community growth on participation are detected.

Figure 86 Overall Effects PVAR(1)-(4), Network Structure – Interpersonal Participation, All Regions

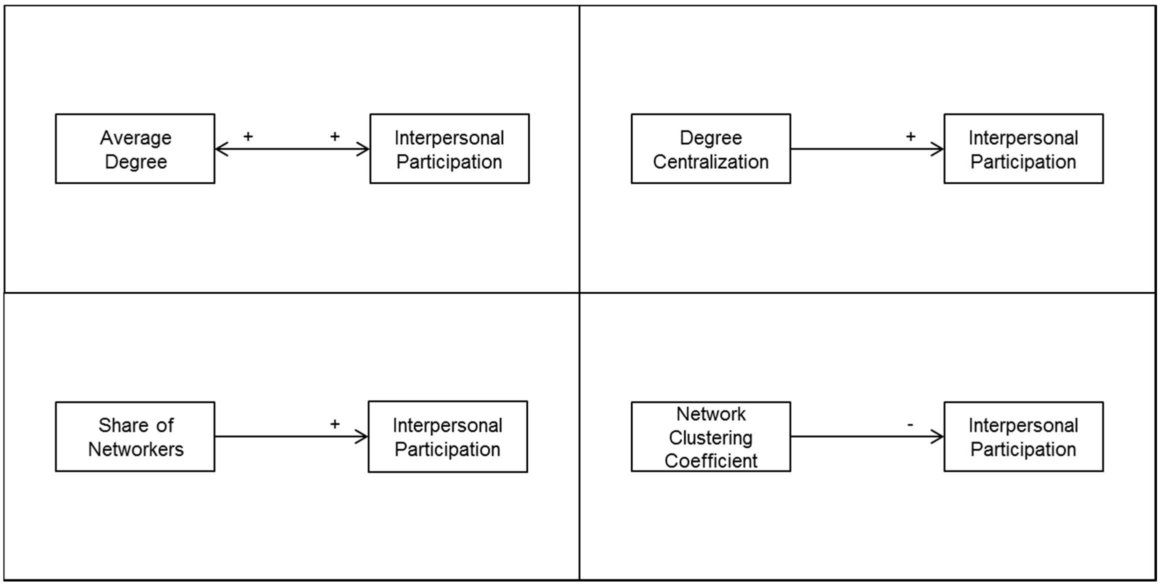


Figure 87 Overall Effects PVAR(1)-(4), Network Structure – Platform Participation, All Regions

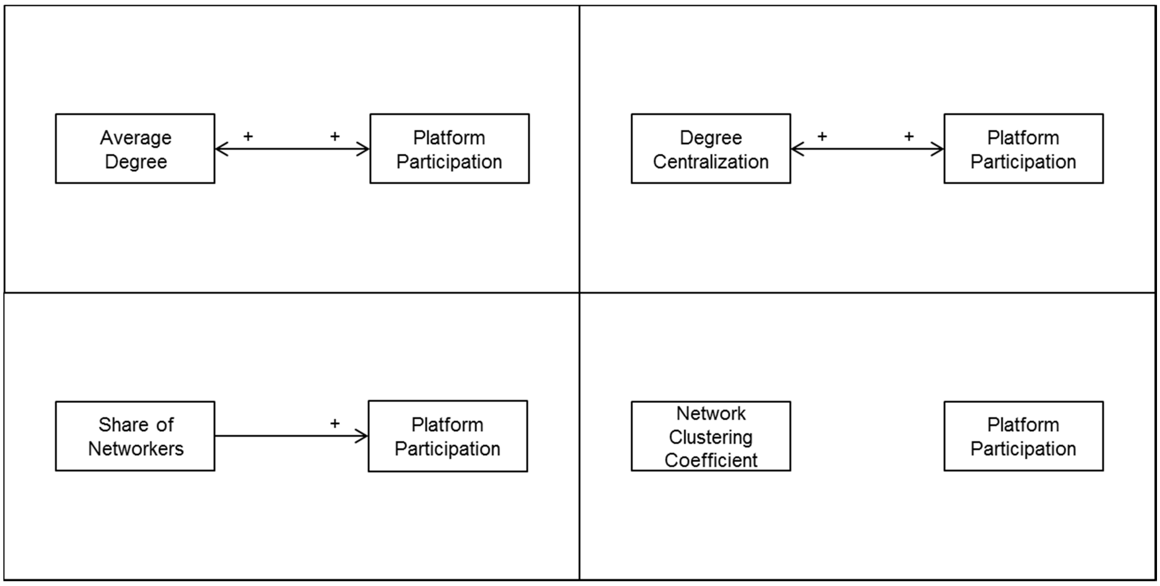


Figure 88 Overall Effects PVAR(1)-(4), Network Structure – Overall Participation, All Regions

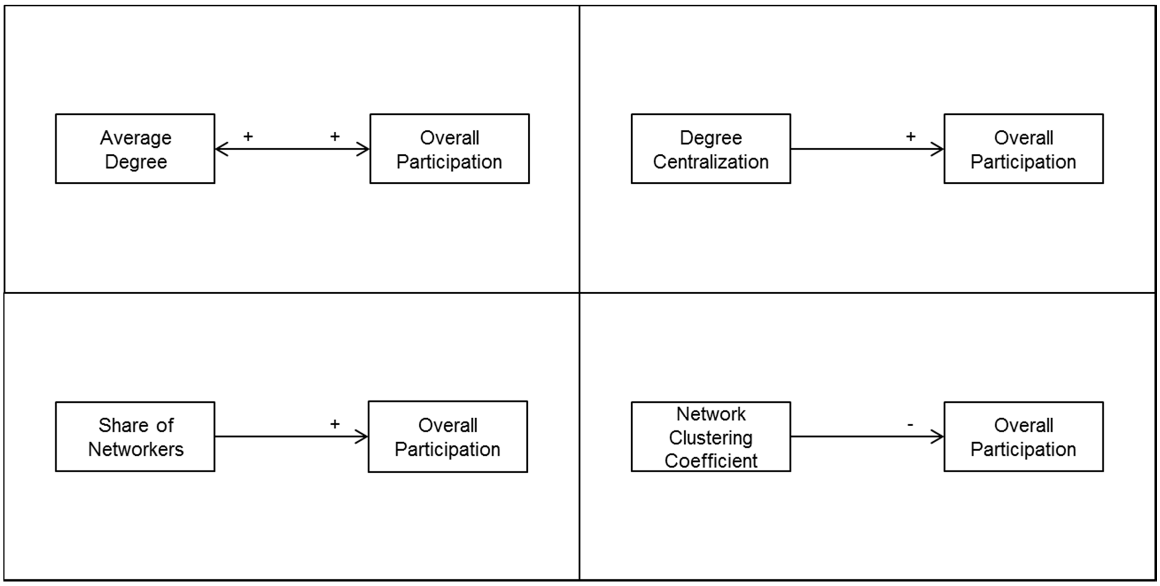


Figure 89 Overall Effects PVAR(1)-(4), Community Growth – Network Structure – Interpersonal Participation, All Regions

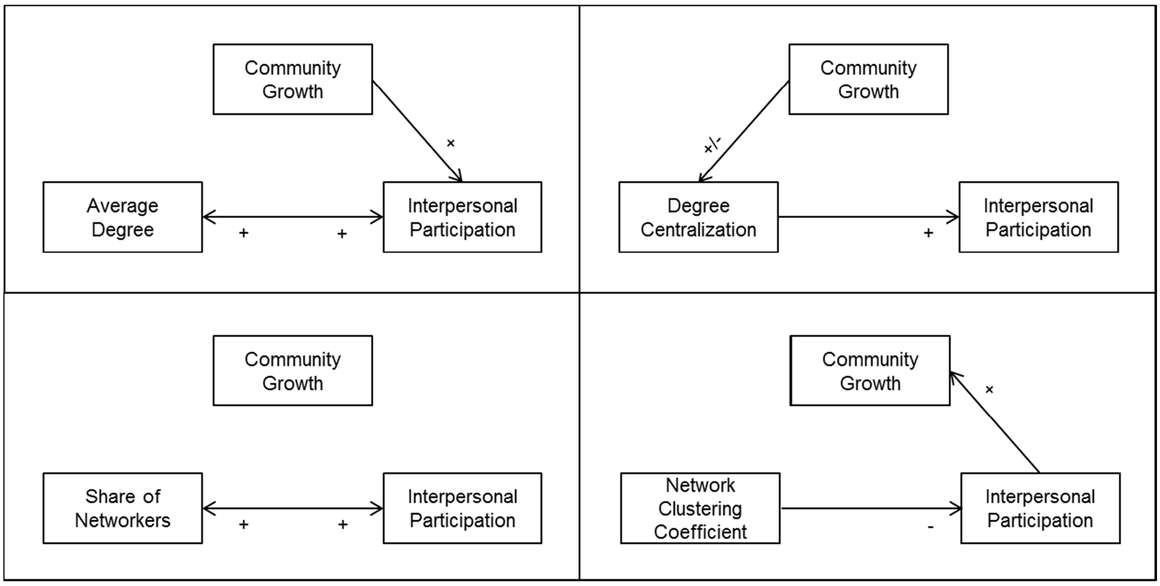


Figure 90 Overall Effects PVAR(1)-(4), Community Growth – Network Structure – Platform Participation, All Regions

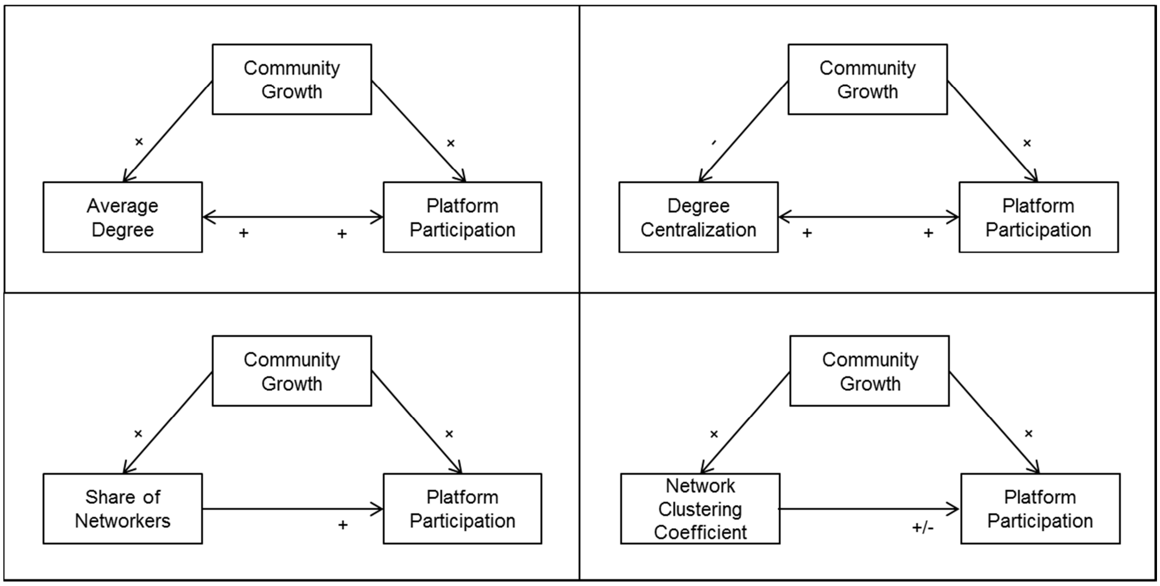
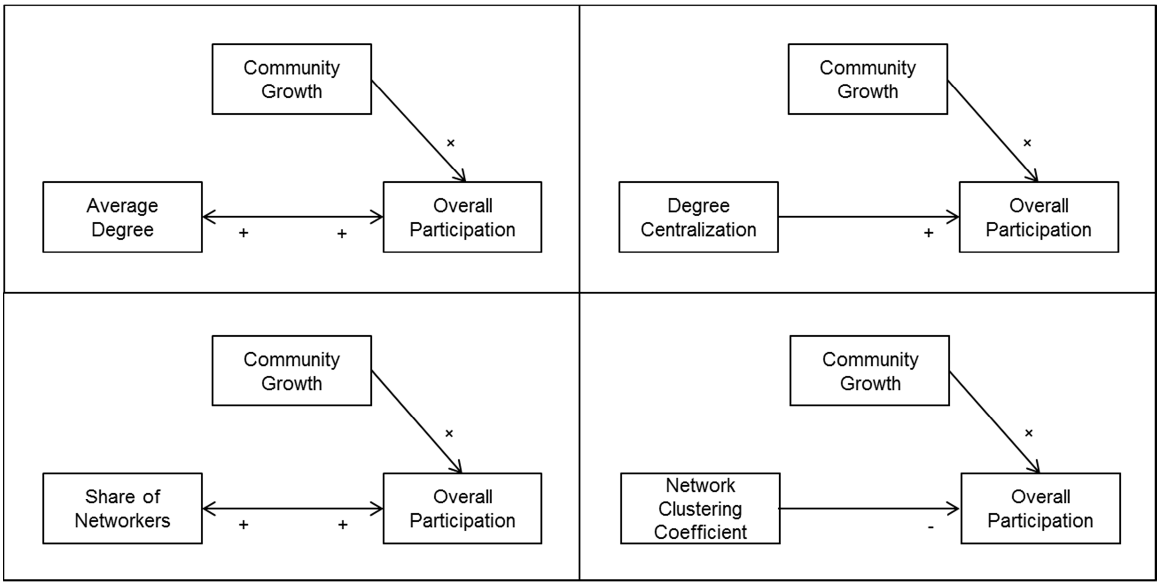


Figure 91 Overall Effects PVAR(1)-(4), Community Growth – Network Structure – Overall Participation, All Regions



3.6.2. Theoretical Implications

Coming back to the research propositions formulated at the end of Chapter 3.2, results support to a great extent RP1, which suggests an interrelationship between social structure and social action. Regardless of the community life cycle stage, reciprocal effects between network structure and participation are detected. The interrelationship between average degree, which is an indicator for network density, and interpersonal or overall participation is the most notable example since this relationship is stable throughout all examined samples. In established regions, also the share of networkers and degree centralization in conjunction with nearly all kinds of participation show reciprocal effects. This underlines the importance of considering the share of networkers as an aspect of network structure, although previous research does not concentrate on this variable. In new regions, mutual effects between degree centralization and platform participation confirm RP1. Thus, Giddens' (1984) and Bourdieu's (1977) idea of dynamic and reciprocal effects between social structure and action can be found in the context of online communities. Both network structure and participation are endogenous. (Panel) VAR models allow the representation of this dynamic process since they are able to illustrate reciprocal effects by using the information that the relevant variables provide over time. Results gained from this research project help to extend existing theory. Hence, Giddens' (1984) and Bourdieu's (1977) theory can be substantiated in two ways: First, a multifaceted perspective of both social structure and social action is necessary. Social structure and social action interrelate in different forms. Against the background of the theory of structuration this project shows that social structure can appear as degree centralization, share of networkers, and network density in the form of average degree, but not in the form of the network clustering coefficient. Further, social action can arise in the form of interpersonal participation, platform participation, as well as in the form of overall participation and therefore has to be regarded from different point of views. Second, the different forms of social structure and social action come into play in different community life cycle phases. Not all of the representations of social structure and social action evoke reciprocal effects at the same time. This research contributes to current knowledge by providing a more detailed dynamic view and demonstrates the importance of considering different community life cycle phases. Hence, it goes far beyond the work of Toral et al. (2009) who only focus on a general unidirectional relationship between network cohesion represented by average degree and a community success metric that combines the number of threads, community size, and the number of core developers in a single variable.

Results of the present project partly support RP2, which assumes that network structure forms the base for social action, i.e. network structure exhibits a positive influence on participation. This proposition is primarily based on the theory of social capital (e.g. Bourdieu 1986; Coleman 1988; Nahapiet and Ghoshal 1998; Putnam 1993). Since social capital can be obtained at a collective level, implications of social capital theory can also be employed on a macro level and thus in the present research project. According to RP2, network structure in the form of average degree and share of networkers positively influence participation. However, degree centralization exhibits both a positive and a negative impact on participation depending on the community's life cycle phase. Further, network structure in the form of the network clustering coefficient shows a tendency towards a negative effect provided that effects are significant at all. Thus, RP2 cannot be completely supported. The form of social capital has to be specified to a greater extent. While network density in the form of average degree leads to positive effects on participation, network density or network closure in the form of the network clustering coefficient can lead to negative effects. Thus, the ambiguity regarding the effects of a dense network also becomes apparent in the results of this project. On the one hand, network density can lead to trust and openness and thus facilitate information flow (Coleman 1988; Krackhardt and Hanson 1993). On the other hand, dense networks can lead to inefficiency because the access to new ideas or information is limited (Burt 1992). A similar ambiguity refers to the concept of centralization. While new communities require a more centralized network in order to stimulate participation, established communities require a more decentralized network. Also Sewell (1992) notices that centrality usually does not last endlessly. Hence, it becomes clear that general statements of social capital theory such as social capital serving as basis for social action need to be specified and regarded from different perspectives.

Results of this project also partly find evidence for RP3, which assumes that social capital augments any time it is used (Bourdieu 1986; Nahapiet and Ghoshal 1998; Putnam 1993), i.e. participation exhibits a positive influence on network structure. While in established regions average degree, degree centralization, and the share of networkers are positively affected by at least one participation variable, in new regions only average degree and degree centralization are affected. Hence, there are differences regarding the community's life cycle phase. Additionally, not all facets of network structure can be explained by participation. For example, network closure in the form of the network clustering coefficient is not influenced at all by participation. Thus, although social capital theory helps to explain the influence of participation on network structure in online communities in some instances, theory has to be refined regarding the form of network structure and the community life cycle phase.

Results of this project verify the proposition that social capital is constrained through a growing number of network members (Nahapiet and Ghoshal 1998). RP4, which can be interpreted in a way that suggests that community growth has a negative impact on network structure, is supported in the established regions' sample. In established regions, where an evolving network would lead via enhanced participation to community growth, this chain is interrupted by negative effects of community growth on network structure. Furthermore, RP4 is also valid in another way: In most other cases, e.g. in new regions, the influence of community growth on network structure is not significant. And even in the very few cases in which this effect is positive, i.e. in the all regions' sample, there is no positive influence of network structure and participation on community growth, which would encourage an endless circle of community growth and growing social capital. Thus, the building of social capital is also limited through insignificant relationships between the variables.

Finally, neither social capital theory nor the theory of structuration make concrete assumptions on the relationship between participation and community growth. Nevertheless, both theories provide a solid basis for explaining the interdependence of success factors – especially in new regions, where the interplay of network structure and participation can be regarded independently from community growth. However, in established regions (and also in the all regions' sample), social capital theory and the theory of structuration are not sufficient to form a theoretical basis for the relationship between participation and community growth. Although also previous research provides already support for the positive link between participation and member gain (Butler 2001), a further theoretical framework, which is able to explain the dynamic relationship between social action and group formation or attraction on a macro level, is required.

3.6.3. Managerial Implications

This project provides a deep understanding of successful community management in demonstrating the interdependence between online community success factors. It shows how online communities need to be directed in order to compete and sustain over time and community life cycle phases.

From a managerial perspective, results imply that community operators should determine the life cycle phase, in which their communities are inherent, and accordingly manage them. Taking the community's life cycle into account is also proposed by Iriberri and Leroy (2009).

Moreover, operators basically need to ensure connectivity among community members in all life cycle phases. It is essential that members have at least one contact in order to guarantee a high share of networkers and hence a lively and healthy community characterized by high participation (Lithium 2012a). This is especially important in established communities because these communities can also foster community growth through the positive reciprocal effects between the share of networkers and participation, which positively influences community growth. Hence, the development of contacts needs to be stimulated by showing new users the community's additional benefits, which arise when they are connected to other users. Moreover, community members should be recommended to other members after logging in. Further, it can help to gain users which are friends of community members in the offline world since they are likely to be friends in the online world as well (Ellison, Steinfield, and Lampe 2007; Subrahmanyam et al. 2008).

In addition to that, a healthy community requires an increasing network density in the form of average degree, in which trust is inherent, independently from the community life cycle phase. Through the positive reciprocal effects between average degree and participation, the liveliness of a community can be enforced. Network density can be enhanced by recommending friends of friends to the users. Further, also offline events are a good opportunity to create more relations among community members (Cothrel and Williams 1999).

Yet, community operators have to be careful in dealing with degree centralization. Whereas in new regions more centralized networks lead to higher participation rates, in established regions an increase in centralization would decrease participation. Thus, results of this project imply that community managers have to ensure that contacts between users are augmented, whereby established regions should tend towards an equally distributed number of contacts among members and new regions should ensure that each member does not have the same number of contacts. Community operators can to a certain extent interfere in this process by controlling the amount and type of "friend" suggestions.

Moreover, community managers need to realize that not each form of network structure helps to affect every kind of participation in each life cycle phase. If platform participation in an established community is lacking, mangers rather need to work on the share of networkers instead of on average degree. Further, if platform participation in a new community is lacking, they need to realize that only higher degree centralization can stimulate platform participation. Thus, a broad understanding of the different relationships between the variables of network structure and participation in general and along the community life cycle is indispensable in order to efficiently use the community's resources.

Besides, community operators should be aware that although network structure helps to ensure a healthy and successful community by encouraging participation, it has no direct impact on community growth. Only in established regions, network structure can contribute to community growth by enhancing participation, which has a direct impact on community growth. Yet, at the same time community growth is limited through the negative impact of community growth on network structure, which interrupts the positive relationship between network structure, participation, and community growth. Hence, community managers should know that success factors cannot be enhanced endlessly.

Nevertheless, in established communities, it makes sense to directly foster participation because of its positive influence on community growth. Community mangers should undertake all activities that augment participation, e.g. introduce new features, reward members for using existing features, provide content, organize contests or campaigns (e.g. Ginsburg and Weisband 2004; Iriberri and Leroy 2009; Leimeister, Sidiras, and Krcmar 2006; Lithium 2012a). However, in order to broadly ensure community growth, i.e. also in new communities, community operators have to find other ways.

3.6.4. Directions for Further Research

This research project has also some limitations that provide opportunities for further research. First, the present project is based on 13 online communities. Further research should include a higher number of communities in order to take advantage of the performance of PVAR models to a greater extent. Second, analyses are based on monthly data. In order to be able to capture also short-term effects it is recommended to additionally estimate models using weekly or daily data. Third, this project uses data of an online community which focuses on leisure activities. Hence, other types of online communities should be analyzed in order to ensure the transferability of results to other settings. Fourth, further analyses regarding community growth are required. Since a growing community is an indicator for a healthy community (Lithium 2012a), factors providing community growth need to be analyzed in detail. For example, findings of this project imply that, in new regions, community growth is neither affected by network structure nor by participation. In order to provide knowledge about community growth in new regions, it is important to identify drivers of community growth in those regions. Finally, since community growth counts among the most often cited and hence most important online community success factors (e.g. Bughin and Hagel 2000; Iriberri and Leroy 2009; Lithium 2012a; Williams and Cothrel 2000), community managers should notice early enough when growth is slowing down. Hence, providing accurate forecast models of community growth is a further step towards a forward-thinking and future-oriented community management (see Chapter 4).

4. Forecasting and Understanding Community Growth

4.1. Introduction

Members constitute the most important asset of online communities because through their presence and generated content they are indispensable for making the community attractive and keeping it alive (Iriberri and Leroy 2009; Preece 2000). The attractiveness of a community is reflected in a growing number of community members, which forms the basis for a healthy and successful community (e.g. Bughin and Hagel 2000; Iriberri and Leroy 2009; Lithium 2012a; Williams and Cothrel 2000). Hence, community growth plays a central role in the evaluation of community performance.

After having set up a community, managers need to anticipate the development of their community regarding the number of new members at an early stage in order to be able to make adequate strategic decisions. This is particularly important in light of the fact that many communities fail because of the highly competitive market for communities (comScore 2007, GlobalWebIndex 2013a, 2013b, Ma and Agarwal 2007). Thus, community managers face a similar problem such as marketing managers of consumer or industrial goods companies, who are often confronted with new product failures (Rogers 2003). In order to master the challenge of avoiding product launch failures, a few decades ago, researchers have begun to study diffusion processes and to make accurate forecasts of future sales (e.g. Bass 1969; Ching-Chin et al. 2010; Dodds 1973; Mahajan and Peterson 1979). To the present day, the diffusion model elaborated by Frank Bass (1969) counts among the most popular and often used tools for modelling diffusion processes and for predicting future diffusion (Bass 2004; Dover, Goldenberg, and Shapira 2012; Firth, Lawrence, and Clouse 2006; Kumar and Krishnan 2002; Trusov, Bucklin, and Pauwels 2009). But also econometric time series models constitute common tools for forecasting issues (Diebold 2007; Granger and Newbold 1975; Kapoor, Madhok, and Wu 1981; Kirchgässner and Wolters 2007; Stephen and Galak 2012; Trusov, Bucklin, and Pauwels 2009). Since forecasting is early seen to play a major role in marketing (Makridakis and Wheelwright 1977), it is also an indispensable task for community operators to study the diffusion of their community in the present and in the future.

However, in order to be able to set up good forecasting models, it is essential to understand the diffusion process, i.e. to identify factors influencing community growth. Although individuals having already adopted a community service seem to play a role for further diffusion (Firth, Lawrence, and Clouse 2006), a verification and broad understanding of these effects next to other possible influential factors are still missing. Further, while Trusov, Bucklin, and Pauwels (2009) find evidence for a positive influence of word of mouth (WOM) and traditional marketing on new sign-ups, they do not investigate the impact of personal selling on community growth, although it plays a role in the buying decision process (Katz and Lazarsfeld 1955). Further, they also do not consider the informational value, which is provided through online communities and constitutes one of the main reasons for individuals to join a community (e.g. Furlong 1989; Ridings and Gefen 2004). Although research concerning the role of informational value has taken place on an individual level, analyses on a macro level are still missing, especially regarding its influence on the growth of online communities.

Hence, this research project is the first to uncover the most appropriate model for forecasting community growth and at the same time to shed light on the factors influencing the diffusion process of online communities. Based on econometric modelling and various theories from social sciences on diffusion processes and group formation, different model types are built and their modelling performance as well as their forecasting accuracy are examined.

This project contributes to marketing literature in various ways. Macro effects going out from the number of individuals having already adopted a community service, effects of personal selling, and the influence of informational value on new sign-ups are analyzed. Further, I combine research from the field of marketing and econometrics by assessing the Bass diffusion model, Autoregressive Moving Average (AR/MA), Autoregressive Distributed Lag (ADL), and Vector Autoregressive (VAR) models regarding their modelling and forecasting performance of the community diffusion process. For this purpose, I apply the selected models on each of six regional communities. Thus, a verification of results becomes possible to some extent. Furthermore, as data are available since the foundation of all six communities, a comprehensive study of the whole diffusion process is possible. Further, community operators are provided with appropriate forecasting tools, which can easily be applied and do not require time-consuming regular surveys.

This research project proceeds as follows: First, theories helping to understand the diffusion process of online communities are introduced and hypotheses are derived. After the description of data and methodology, the results gained from the different models are presented for each region. Then, these results are summarized and implications for theory and management are given. Finally, the project closes by demonstrating directions for further research.

4.2. Theoretical Background

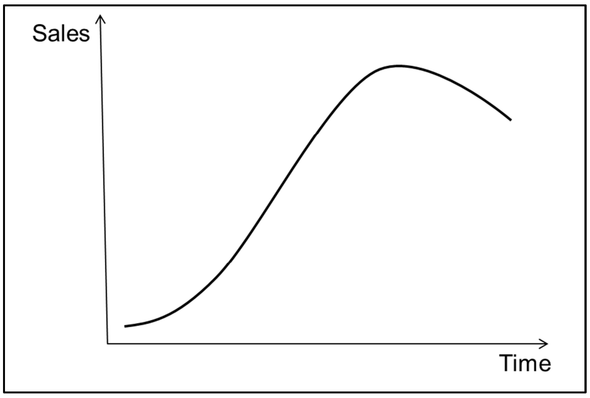
4.2.1. Diffusion Theory

In the early Sixties, Rogers (1962) provided a first comprehensive description of studies and theories about diffusion processes in general and about the diffusion of innovations in particular. According to him, innovation, communication, social system, and time are the four fundamentals in the context of the diffusion of innovations. Thus, he draws upon Katz's (1961) understanding of diffusion processes. Based on this, Rogers (2003, p. 5) defines diffusion as "the process in which an innovation is communicated through certain channels over time among the members of a social system." He interprets the essentials of diffusion as follows: An innovation is usually something new (e.g. new practice, idea, technology). Communication takes place via persons who have already adopted the innovation in the sense of word-of-mouth or via mass media. Further, time plays a role in the innovation-diffusion process, i.e. from the first time an individual learns about the innovation until the time after the decision of adoption or non-adoption.[9] Additionally, time is related to the speed with which an individual adopts an innovation compared to other individuals and to the relative speed of adoption of an innovation in general. Finally, a social system constitutes a group of interconnected individuals, who act together to achieve a collective goal.

Diffusion processes are studied from many perspectives, e.g. from a sociological, medical or educational point of view (see Rogers 2003 for an overview). In the field of marketing, a diffusion model developed by Frank Bass (1969) achieved broad recognition. He elaborates a framework for modelling and predicting first purchases of consumer durables. According to the model, initial purchases follow a certain pattern displayed in Figure 92. Thereby two groups of buyers are relevant: innovators and imitators. Innovators are those individuals who especially buy at early stages and are not influenced by the number of previous adopters. Their importance decreases after some time. In contrast, imitators are affected by the number of previous purchasers.

[9] Thus, the innovation process is similar to the typical buying decision process.

Figure 92 Initial Purchases (Bass Model)



Accordingly, potential buyers are influenced by an innovation or also called external effect and by an imitation or also called internal effect (Mahajan, Muller, and Bass 1990). Thereby, the external effect is typically associated with the influence resulting from mass media. The internal effect, which stems from the influence of previous buyers, is usually related to effects of word-of-mouth.[10] To this day, the Bass model counts among the most popular and influential diffusion models (Bass 2004). Besides its use in the field of consumer durables (e.g. Bass 1969; Gatignon, Eliashberg, and Robertson 1989; Kumar and Krishnan 2002), it has nowadays also been applied to the online world. Firth, Lawrence, and Clouse (2006) for example use the Bass model to examine the development of a university's online communities. Further, Trusov, Bucklin, and Pauwels (2009) compare the performance of the Bass model and other approaches in modelling word-of-mouth and traditional marketing effects based on data from a social networking site. Recently, Dover, Goldenberg, and Shapira (2012) analyze the link between degree-distribution of a network and adoption. In this context, they compare their model with the Bass model.

Taken together, previous research suggests that the Bass model's internal effect resulting from WOM and the Bass model's external effect resulting from promotion and advertising should influence the growth of online communities.

4.2.2. Social Learning Theory and Communication Channels

Closely related to diffusion theory is the theory of social learning. Social learning theory suggests that individuals adopt a behavior as a consequence of observing other individu-

[10] Another way of interpretation is to assume that there are not two separate groups of buyers, but each potential buyer is influenced by both an internal and external effect (Hruschka 1996; Schmalen, Binninger, and Pechtl 1993).

als' behavior or as a consequence of direct experience (Bandura 1977). Bikhchandani, Hirshleifer, and Welch (1998) describe different situations in which observational learning can be applied, e.g. in the case of crimes, politics, or new product launches. Rogers (2003) broadens the original perspective of social learning in the sense that individuals can learn from others via mass media (e.g. via TV) or via verbal and nonverbal interpersonal communication (e.g. via friends). In the context of social learning a nonverbal communication is often sufficient, which means that individuals can learn from others just by noticing their behavior (Rogers 2003). This is the case when individuals observe that people from their family or town adopt an innovation or when celebrities and other persons communicate via TV that they have already adopted the innovation. Similarly, Chen, Wang, and Xie (2011) find in their experiment on observational learning that people rely on consumer purchase statistics when they buy a certain product.

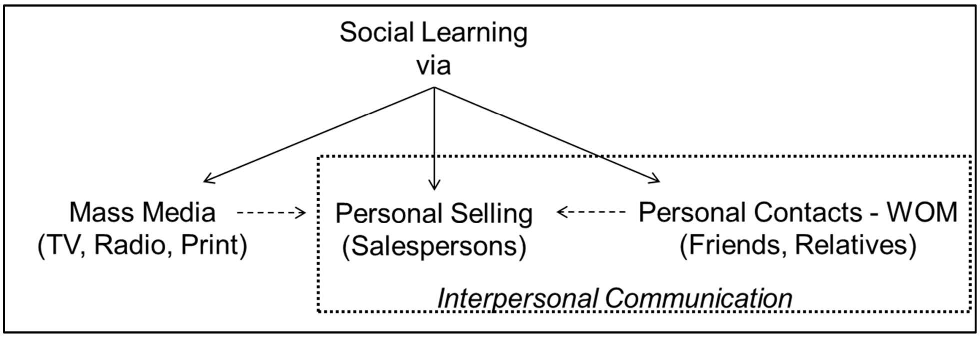
While mass media (e.g. TV, radio, and print), which address an anonymous audience, are important to make people aware of an innovation, interpersonal communication is important to persuade individuals of an innovation (Rogers 2003). One way of interpersonal communication is manifested in word of mouth (WOM) communication. Anderson (1998, p. 6) defines word of mouth as "informal communications between private parties concerning evaluations of goods and services". Engel, Kegerreis, and Blackwell (1969) show that the vast majority of innovators spread WOM, which is especially important for the diffusion of innovations. Several studies confirm the effectiveness of WOM communication: There is evidence that WOM communication has a positive impact on customer acquisition (Wangenheim and Bayón 2007). Further, Herr, Kardes, and Kim (1991) find that individuals are more easily persuaded by WOM communication than by print communication. Also in the context of online communities, effects of WOM on new member acquisition are stronger than effects resulting from traditional marketing (Trusov, Bucklin, and Pauwels 2009). Hence, individuals learn more from personal contacts than from impersonal sources.

Besides private interpersonal communication in the context of WOM, individuals can also learn from salespersons in the context of personal selling, which constitutes another way of interpersonal communication. Thereby, companies' salespersons come into direct contact with the customers in order to sell products and to build relationships (Kotler et al. 2008; Weitz and Bradford 1999). Via salespersons strong relationships between the customers and the company can be built (Reynolds and Beatty 1999). Palmatier et al.

(2006) state that relationship marketing is more successful when customers interact with an individual person instead of interacting anonymously with a company as a whole. However, Katz and Lazarsfeld (1955) show that in buying decisions people are more influenced by their personal contacts than by salespersons. Hence, personal selling lies somewhere between anonymous mass media communication and personal WOM communication (see Figure 93) because it unites both an aspect of a company's (mass media) communication and an aspect of personal WOM communication.

Applying social learning theory and research on communication channels to the context of online communities, personal selling and WOM communication may play an important role in the acquisition of potential users. People may join communities because other people from their environment already adopted. Further, especially small and regional communities can arouse the interest of potential users through personal selling. For example, regional communities can attract people at local events. Hence, personal selling and people who are already community members should influence community growth.

Figure 93 Social Learning and Communication Channels



4.2.3. Theory of Collective Behavior and Critical Mass

The theory of collective behavior describes another concept that is consistent with diffusion theory discussed in Chapter 4.2.1 and social learning theory discussed in Chapter 4.2.2. Initially, Park and Burgess (1921, p. 865) define collective behavior as "the behavior of individuals under the influence of an impulse that is common and collective, an impulse, in other words, that is the result of social interaction." This relatively general definition clearly underlines that individuals are influenced by the behavior of other individuals. This is also the key assumption of the theories discussed in the precedent sections. Further, Turner and Killian (1957) bring a more revolutionary aspect into play. They argue that in the field of collective behavior a group of individuals interacting with each other induces “emergent or spontaneous” (Turner and Killian 1957, p. 12) norms which revolutionize traditional norms. Besides, Granovetter (1978) attributes collective behavior to situations, in which individuals face two mutually exclusive alternatives and their decision which alternative to take depends on the number of individuals that have already taken a certain alternative. Thus, he limits the number of situations because only binary choices are considered. Further, by taking into account the number of individuals that have already chosen an alternative, he refers to the concept of critical mass. Critical mass represents “the idea that some threshold of participants or action has to be crossed before a social movement “explodes” into being” (Oliver, Marwell, and Teixeira 1985, p. 523). All in all, Granovetter’s (1978) view of collective behavior is very close to the imitation effect in the context of the diffusion of innovations because individuals have the binary decision to adopt or to not adopt, in which imitators are influenced by the number of previous adopters.[11] This process – also called contagion – reflects the dynamic nature of groups (Forsyth 2010). Further, Markus (1987) emphasizes the importance of a critical mass for the spread of interactive communication media because a value only arises if enough people use these media. Hence, in the case of interactive communication media, adoption does not only occur as a result of a sole kind of imitation phenomenon (e.g. in the case of the diffusion of flat-screen TVs, iPods, etc.), but also as a result of a value that individuals obtain through the fact that many other people have already adopted (e.g. in the case of the diffusion of technologies such as telephone, internet/email, social networks/online communities).

Therefore, the diffusion or growth of online communities should be dependent on the number of previous adopters and the value provided through all adopters. A possible type of such a value is discussed in the following section.

4.2.4. Theory of Social Comparison and the Value of Communities

Individuals often join groups when they search for information or for social support because they consider getting assistance by other individuals (Forsyth 2010; Watson 1966). This kind of behavior can be explained by Festinger’s (1954) theory of social comparison. Individuals need other people for getting information about their own concerns and their surroundings, e.g. what to do in certain situations of everyday life, where to go out,

[11] Other applications of Granovetter’s (1978) view of collective behavior constitute votes, strikes/protests, the leaving of social conventions (e.g. birthday parties), etc.

what to dress, etc. Thereby, people compare their opinions and abilities with those of others. Hence, they satisfy their need for information by associating and comparing themselves with others. Usually individuals have a tendency to join groups whose members are similar concerning their opinions and abilities (Festinger 1950, 1954). Further, Kulik and Mahler (1989) find that the need for getting information is even stronger than the exchange of experience with others, who are in the same situation: For instance, patients waiting for a surgery favor to a great extent roommates who already had the surgery and thus can provide more information instead of roommates who are also waiting for the surgery.

Additionally, research reveals that the informational value also plays a major role in the field of online communities (Dholakia et al. 2009; Dholakia, Bagozzi, and Klein Pearo 2004; Mathwick, Wiertz, and Ruyter 2008; Wasko and Faraj 2000; Wiertz and Ruyter 2007). The informational value provided by communities is one of the main reasons for joining a community (Ridings and Gefen 2004; Rohrmeier 2012). Many authors confirm that the access to information as well as social support attracts individuals to communities (e.g. Furlong 1989; Ridings and Gefen 2004; Ridings, Gefen, and Arinze 2006; Wellman et al. 1996). Since content in the form of information and social support is transmitted via postings or messages (Herring 1996), there should be a positive influence of the amount of postings on member acquisition, i.e. on community growth. Similarly, Forsyth (2010) states that interaction between group members makes the group or community attractive for other individuals. Further, also Preece (2000) explains that the attractiveness of an online community is ensured by members and their communication. Hagel and Armstrong (1997) even claim a reciprocal relationship between the amount of content and community growth because more content attracts more members, who in turn create more content.

Hence, the number of contributions or the number of people making contributions should positively influence community growth.

Following the discussions in Chapters 4.2.1, 4.2.2, 4.2.3, and 4.2.4, I propose that the number of people having already joined a community (Hypothesis H1), the amount of personal selling (Hypothesis H2), and the number of posters (Hypothesis H3a) or the number of contributions (Hypothesis H3b) positively affect community growth.

These propositions, built on the previous theoretical considerations, are also motivated through practical experience: Lithium (2008), a leading provider for online community platforms, manifests that promotion (H2) is especially important in the early stages in order to attract enough people to the page, at which some of these people may sign-up for the platform. Later, after having gained a critical mass (H1) the content provided by the users (H3a and H3b) will make the community self-sustaining.

4.3. Data

In order to study community growth, I use data of a European online social community with focus on leisure activities. Since the community is set up in several regions and each regional community is featured with the same platform functionalities, a fair comparison between regional communities is possible. In order to examine the communities' diffusion process from the very beginning, I only include those regional communities of which data are available since their launch. Hence, depending on the region, the dataset comprises monthly data from July or August 2009 until July 2012. Additionally, similar to Project 1 (see Chapter 3.3), I concentrate on regions with a share of internal contacts of 30% or more in order to guarantee relatively closed units. Further, only those regions are considered, which are maintained by the community operator itself since their launch. Hence, the final dataset comprises six regional communities.

Community growth or new member acquisition is described by the number of new sign-ups (Trusov, Bucklin, and Pauwels 2009). Besides past values of the number of new sign-ups, further variables, which should contribute to the explanation of new sign-ups according to theory, are participation (i.e. the number of contributions per month), the number of posters (i.e. the number of users who have contributed at least once per month), and the number of team members (e.g. photographers) per month. Descriptive statistics of all variables are displayed for each region in Table 5, Table 6, Table 7, Table 8, Table 9, Table 10.

Table 5 Descriptive Statistics; Region 1

	T	Mean	Standard Deviation	25th Percentile	50th Percentile	75th Percentile	Minimum	Maximum
New Sign-Ups	37	494.81	203.94	340.50	470.00	634.00	8	944
Participation	37	2433.16	1444.84	1285.50	2159.00	3406.50	1	7200
Posters	37	397.51	255.30	273.50	388.00	460.00	1	1681
Team	37	13.84	4.20	11.00	14.00	18.00	5	21

Table 6 Descriptive Statistics; Region 2

	T	Mean	Standard Deviation	25th Percentile	50th Percentile	75th Percentile	Minimum	Maximum
New Sign-Ups	36	272.64	117.03	209.00	243.00	368.75	9	561
Participation	36	751.94	569.42	467.50	645.50	1014.25	1	3048
Posters	36	193.97	155.19	103.50	143.50	187.00	1	635
Team	36	3.72	1.60	3.00	4.00	5.00	0	5

Table 7 Descriptive Statistics; Region 3

	T	Mean	Standard Deviation	25th Percentile	50th Percentile	75th Percentile	Minimum	Maximum
New Sign-Ups	36	112.94	91.48	63.25	81.50	146.50	2	509
Participation	36	1319.36	1214.77	375.25	800.50	2219.25	0	4236
Posters	36	91.81	139.94	23.25	33.00	57.25	0	476
Team	36	1.19	1.33	0.00	1.00	3.00	0	3

Table 8 Descriptive Statistics; Region 4

	T	Mean	Standard Deviation	25th Percentile	50th Percentile	75th Percentile	Minimum	Maximum
New Sign-Ups	36	137.50	71.06	86.00	126.00	184.25	6	305
Participation	36	310.50	391.04	83.50	190.50	363.75	0	2104
Posters	36	114.11	143.72	41.00	67.50	110.50	0	627
Team	36	1.78	1.10	1.00	1.50	3.00	0	3

Table 9 Descriptive Statistics; Region 5

	T	Mean	Standard Deviation	25th Percentile	50th Percentile	75th Percentile	Minimum	Maximum
New Sign-Ups	36	182.92	84.67	136.25	163.50	225.50	57	523
Participation	36	699.50	601.86	383.25	518.00	793.00	35	3084
Posters	36	153.08	89.78	124.25	144.50	157.75	10	531
Team	36	1.64	0.90	1.00	1.00	2.75	0	3

Table 10 Descriptive Statistics; Region 6

	T	Mean	Standard Deviation	25th Percentile	50th Percentile	75th Percentile	Minimum	Maximum
New Sign-Ups	36	193.75	110.99	104.50	217.00	257.75	14	473
Participation	36	298.17	231.79	136.00	210.00	331.75	15	1117
Posters	36	108.83	123.63	41.25	67.00	93.50	9	466
Team	36	2.75	0.91	2.00	3.00	3.00	1	5

For the following analyses, time series are logarithmized (Diebold 2007; Wooldridge 2006). Further, each of the series is tested for unit roots because the estimation procedures used in this project require stationary time series. A stochastic process containing a unit root is not stationary[12]. Inclusion of non-stationary time series would yield significant relationships, even if in fact the relationships do not exist (Wooldridge 2006). However, non-stationary processes can be transformed into stationary processes by building differences (Wooldridge 2006): For example, processes which are integrated of order one can be transformed into stationary processes by building the first differences. I use the augmented Dickey-Fuller (ADF) test in order to test for stationarity (Dickey and Fuller 1979; Said and Dickey 1984). The test statistic, where changes in the variable of interest (Δz_t) are regressed on the by one period lagged values of the variable of interest (z_{t-1}), on optional exogenous variables such as a constant term or trend (v_t), and on p lagged difference terms of the variable of interest ($\Delta z_{t-1}, \ldots, \Delta z_{t-p}$), is determined as follows (IHS Global Inc. 2013):

$$\Delta z_t = \alpha z_{t-1} + v_t'\gamma + \beta_1 \Delta z_{t-1} + \beta_2 \Delta z_{t-2} + \ldots + \beta_p \Delta z_{t-p} + e_t \qquad (29)$$

For testing the null hypothesis of $\alpha=0$ (i.e. process contains a unit root) against the alternative hypothesis $\alpha<0$ (i.e. process is stationary) the standard Student's t-distribution is not appropriate[13]. Hence, critical values proposed by MacKinnon (1996) are used. Results of the ADF tests are displayed in Table 11.

Table 11 ADF Tests

	Augmented Dickey-Fuller Test											
	Region 1		Region 2		Region 3		Region 4		Region 5		Region 6	
Variable	Statistic	p-value	Statistic	p-value	Statistic	p-value	Statistic	p-value	Statistic	p-value	Statistic	p-value
ln_new_signups	-3.9323	0.0050	-9.4891	0.0000	-4.9233	0.0004	-5.8027	0.0000	-5.0890	0.0002	-3.0417	0.0416
ln_posters	-16.5709	0.0000	-6.7841	0.0000	-2.1141	0.2407	-3.4607	0.0160	-6.0710	0.0000	-1.6592	0.4417
d_ln_posters	-8.8369	0.0000	-10.2952	0.0000	-4.7356	0.0006	-7.5510	0.0000	-8.0914	0.0000	-7.2239	0.0000
ln_participation	-2.7440	0.0779	-7.7638	0.0000	-5.9430	0.0000	-3.4815	0.0152	-3.7428	0.0080	-0.8087	0.7999
d_ln_participation	-6.3059	0.0000	-9.3423	0.0000	-7.7940	0.0000	-7.2283	0.0000	-5.3594	0.0001	-4.1129	0.0039
ln_team	-0.8672	0.7829	-2.5863	0.1062	-0.0822	0.9431	-0.4750	0.8835	-0.1444	0.9358	-2.8940	0.0572
d_ln_team	-3.1982	0.0312	-4.0186	0.0041	-2.4971	0.1262*	-5.7431	0.0000	-5.7431	0.0000	-9.5831	0.0000

**) significant at 5 % level after building second differences*

For unit root testing and model estimation I exclude the last three observations because these observations serve to measure forecast accuracy (see Chapters 4.4, 4.5, and 4.6).

[12] A process is stationary if first and second moments (i.e. mean and variance) do not depend on time (e.g. Lütkepohl 2007).

[13] Since under the null hypothesis the process is not stationary, the t-statistic does not follow an approximate standard normal distribution (e.g. Wooldridge 2006).

Further, I include a constant term as an exogenous variable.[14] The lag length *p* is automatically selected by the Schwarz Information Criterion (SC).[15]

The test results reveal that the variable describing the logarithmized number of new sign-ups (*ln_new_signups*) is stationary in all regions at a significance level of 5%. Hence, a transformation is not necessary and new sign-ups can be used in levels. The logarithmized number of posters (*ln_posters*) is stationary at a significance level of 5% in regions 1, 2, 4, and 5. In the remaining regions it is integrated of order 1. Hence, I have to calculate first differences. The logarithmized number of contributions (*ln_participation*) is stationary at a significance level of 5% in regions 2, 3, 4, and 5. In the remaining regions it is integrated of order 1. Thus, again, I have to calculate first differences. In order to preserve comparability, I include the first differences of posters and participation variables (*d_ln_posters* and *d_ln_participation*) into the analyses of each of the six regions. As *d_ln_posters* and *d_ln_participation* are always stationary, the inclusion of these variables does not pose any problem. However, since information, which is provided by the variables, gets lost after building the first differences, I additionally conduct further analyses that include posters and participation variables in levels when both types of variables are integrated of order zero (this is the case in regions 2, 4, and 5). Further, the logarithmized number of team members (*ln_team*) is always integrated of order 1 except for region 3, where it is integrated of order 2. Hence, only first differences of the team variable (*d_ln_team*) are included.[16]

Finally, I test for seasonality by regressing the logarithmized number of new sign-ups on a constant term and dummy variables for each month of a year (except for January, which serves as reference category) (Diebold 2007). Then, an F-test, which tests the null hypothesis that all parameters (except the one for the intercept) are jointly zero against the alternative hypothesis that at least one parameter is different from zero, is conducted. The tests, which are performed for each region, reveal that seasonality plays no role (see Appendix 78, Appendix 79, Appendix 80, Appendix 81, Appendix 82, and Appendix 83).

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14 I also control for both a constant and a trend (see Appendix 77). However, results barely differ.

15 For computational details of the SC see Chapter 4.4.

16 For the team variable of region 3, one should even compute second differences. However, I do not consider the second differences of the variable because of the already poor explanatory power of d_ln_team (see Chapter 4.5) and the difficult interpretation of a d2_ln_team variable.

4.4. Methodology

In order to model and predict community growth, four different approaches, which are all discussed in this chapter, are used, namely Bass Diffusion, Autoregressive Moving Average (ARMA), Autoregressive Distributed Lag (ADL), and Vector Autoregressive (VAR) models.

Individual models are evaluated using the Schwarz Criterion (SC) (Cameron and Trivedi 2005; IHS Global Inc. 2013; Schwarz 1978):

$$SC = -2 \cdot l / T + (k \cdot \ln T) / T \,, \qquad (30)$$

with the value of the log likelihood function $l = -\frac{T}{2}(1 + \ln(2\pi) + \ln(\hat{\varepsilon}'\hat{\varepsilon} / T))$, $\hat{\varepsilon}$ representing the residuals, T indicating the number of observations, and k indicating the number of coefficients. Lower values of SC indicate a "better" model. The SC penalizes the addition of further parameters and thus favors more parsimonious models (Cameron and Trivedi 2005; Schwarz 1978) compared to the Akaike Information Criterion (AIC), which is specified as follows (Akaike 1973; Cameron and Trivedi 2005; IHS Global Inc. 2013):

$$AIC = -2 \cdot l / T + 2 \cdot k / T \,,$$

where l indicates the value of the log likelihood function, T indicates the number of observations, and k indicates the number of coefficients. Again, lower values refer to a "better" model. Although the use of SC is recommended by Diebold (2007), I include the AIC as an additional model selection criterion because in practice often both criteria are reported and because a further evaluation of the estimated models independent from the SC is valuable.

The forecasting performance of the different approaches is evaluated using Root Mean Squared Error (RMSE) and Mean Absolute Error (MAE), which are common measures for out-of-sample comparisons (Wooldridge 2006). In this context, the first part of the observations serves to estimate model parameters, whereas the last part of the observations serves to measure the forecast accuracy of the estimated model by comparing the one-step-ahead forecasts with the observed values of the dependent variable. RMSE and MAE are specified as follows (Diebold 2007; IHS Global Inc. 2013; Wooldridge 2006):

$$RMSE = \sqrt{\sum_{t=T+1}^{T+h} (\hat{y}_t - y_t)^2 / h}, \tag{31}$$

$$MAE = \sum_{t=T+1}^{T+h} \left| \hat{y}_t - y_t \right| / h, \tag{32}$$

where *T+1, T+2, …, T+h* is the forecast sample, $\hat{y}_t$ represents the forecasted value, and y_t represents the actual value of the dependent variable in period *t*. The model yielding the lowest value for RMSE or MAE is to be preferred.

In the following, different models for the estimation and prediction of community growth are presented.

4.4.1. Bass Diffusion Model

The Bass model is an approach, which was originally developed by Frank Bass (1969) in order to model and predict the diffusion of new consumer durables. The model assumes that adopters of a new durable product are influenced by mass media (external effect) and WOM (internal effect). The probability of an initial purchase at time *t* for previous non-buyers is expressed as:

$$\frac{f_t}{1-F_t} = P(t) = p + q\frac{Y_t}{m}, \tag{33}$$

where *p* is the coefficient of innovation (external effect), *q* is the coefficient of imitation (internal effect), Y_t is the number of previous adopters or also called the cumulated number of adopters until *t*, *m* is the number of all adopters over the whole product life cycle, i.e. the market capacity, f_t is the probability density function, F_t is the distribution function.

For the number of additional adopters y_t at time *t* follows:

$$y_t = \frac{dY}{dt} = P(t)\cdot(m-Y_t) = \left(p + q\frac{Y_t}{m}\right)\cdot(m-Y_t) = pm + (q-p)Y_t - \frac{q}{m}Y_t^{\,2} \tag{34}$$

Solution of the differential equation (34) leads to:

$$Y_t = m\frac{1-e^{-(p+q)t}}{\left(1+\frac{q}{p}e^{-(p+q)t}\right)} \tag{35}$$

$$\Rightarrow \quad y_t = m\frac{(p+q)^2 p^{-1} e^{-(p+q)t}}{\left(1+\frac{q}{p}e^{-(p+q)t}\right)^2} \tag{36}$$

Hence, for the maximum number of adopters $y*$ at $t*$ follows:

$$t* = \frac{1}{p+q}\ln\frac{q}{p} \tag{37}$$

$$y* = \frac{m(p+q)^2}{4q} \tag{38}$$

If parameters of the Bass model are estimated from discrete time series data, the following equivalent for the basic model $y_t = pm + (q-p)Y_t - \frac{q}{m}Y_t^{\,2}$ is used:

$$y_t = a + bY_{t-1} + cY_{t-1}^2, \tag{39}$$

where a=pm, b=(q-p), c=-q/m leads to:

$$b = q - p = -cm - \frac{a}{m}; \quad \rightarrow \quad \frac{a}{m} + cm + b = 0; \quad \rightarrow \quad cm^2 + bm + a = 0; \tag{40}$$

$$m = \frac{-b \pm \sqrt{b^2 - 4ca}}{2c} \tag{41}$$

Hence, all parameters are identified.

In the present research project the following modified Bass model, which is based on equation (39) and replaces purchases by new sign-ups, is used:

$$\begin{aligned} &ln\_new\_signups_t = \\ &= \ln(a + b \cdot new\_signups\_cum_{t-1} + c \cdot new\_signups\_cum_{t-1}^2) + e_t, \end{aligned} \tag{42}$$

where $ln\_new\_signups_t$ describes the logarithmized number of new sign-ups at time t, and $new\_signups\_cum_{t-1}$ describes the cumulative number of new sign-ups at $t-1$. The transformation by logarithms is necessary in order to be able to compare this model with other models used in this project. The model is estimated by non-linear least squares (e.g. Cameron and Trivedi 2005). Since the Bass model focuses on consumer durables and excludes repeated purchases (Bass 1969), the idea of the Bass model perfectly fits to the community setting, where people within a certain community usually register once.

In order to find a good model specification, diverse residual diagnostics are employed. Residuals need to be normally distributed, autocorrelation and heteroskedasticity in the residuals have to be avoided (Diebold 2007; Wooldridge 2006).

In the present project, I make use of the Jarque-Bera normality test. The null hypothesis assumes normal distribution. The test statistic is specified as follows (Diebold 2007; IHS Global Inc. 2013):

$$Jarque-Bera = \frac{T}{6}\left(S^2 + \frac{(K-3)^2}{4}\right), \tag{43}$$

where S represents the skewness, K represents the kurtosis, and T the number of observations.

In order to test for autocorrelation in the residuals, I use a test, which is based on the work of Breusch (1978) and Godfrey (1978a). The null hypothesis assumes no serial correlation up to a specified lag order (in the present project up to lag order 4). Thereby, residuals resulting from the original model are regressed on the independent variables of the model and on lagged residuals (IHS Global Inc. 2013):

$$e_t = X_t \omega + \left(\sum_{l=1}^{4} \alpha_l e_{t-l}\right) + u_t \tag{44}$$

Then, an F-test for testing the joint significance of the lagged residuals is employed (Kirchgässner and Wolters 2007; Wooldridge 2006). If there is autocorrelation, standard errors are skewed and the forecasting quality of the model decreases (Wooldridge 2006). The problem of autocorrelation can usually be solved by adding more lags or time dummy variables (Lütkepohl 2007; Wooldridge 2006).

Finally, the White test is used for detecting heteroskedasticity in the residuals (White 1980). The null hypothesis assumes no heteroskedasticity. The alternative hypothesis assumes heteroskedasticity of unspecified, general form. The White test regresses in an auxiliary regression the squared residuals from the original model on the independent variables, their squares, and cross-products (IHS Global Inc. 2013; Wooldridge 2006).[17] When the original model contains two independent variables, the auxiliary regression is specified as follows:

$$e_t^2 = \alpha_0 + \alpha_1 x_{1,t} + \alpha_2 x_{2,t} + \alpha_3 x_{1,t}^2 + \alpha_4 x_{2,t}^2 + \alpha_5 x_{1,t} x_{2,t} + u_t \quad (45)$$

An F-test is used to test the joint significance of the regressors (except intercept) of the auxiliary regression (Wooldridge 2006). If there is heteroskedasticity in the residuals, standard errors are skewed. One way to deal with this problem is to use heteroskedasticity consistent standard errors (White 1980; Wooldridge 2006).

After having made adaptions to the Bass model according to the results of the misspecification tests, the final model is obtained.

4.4.2. Autoregressive Moving Average Model

An autoregressive moving average model (ARMA) results from the combination of an autoregressive (AR) and a moving average (MA) model (Kirchgässner and Wolters 2007). By the help of an AR model the current value of a time series is explained by past values of the variable and a stochastic shock (Diebold 2007). For an AR process of lag order *p* results:

$$y_t = a_0 + a_1 y_{t-1} + a_2 y_{t-2} + ... + a_p y_{t-p} + e_t \quad (46)$$

$$(1 - a_1 L - a_2 L^2 - ... - a_p L^p) y_t = a_0 + e_t \quad (47)$$

$$A(L) y_t = a_0 + e_t \quad (48)$$

Through an MA model the current value of a time series is explained by current and past shocks. For an MA process of lag order *q* results:

$$y_t = b_0 + e_t - b_1 e_{t-1} - b_2 e_{t-2} - ... - b_q e_{t-q} \quad (49)$$

$$y_t - b_0 = (1 - b_1 L - b_2 L^2 - ... b_q L^q) e_t \quad (50)$$

$$y_t - b_0 = B(L) e_t \quad (51)$$

[17] In the case of Bass and ARMA models equation gradients are included.

Hence, an ARMA(p,q) model is specified as follows:

$$y_t = a_0 + a_1 y_{t-1} + ... + a_p y_{t-p} + e_t - b_1 e_{t-1} - ... - b_q e_{t-q} \quad (52)$$

$$A(L) y_t = a_0 + B(L) e_t \quad (53)$$

The ARMA model is a quite flexible approach for describing a time series. Furthermore, the forecasting performance of ARMA models is rather good and often better than the performance of complex econometric models (Granger and Newbold 1975; Kirchgässner and Wolters 2007). For this reason, I select the ARMA model as one way of modelling and predicting community growth. In the present project, the ARMA model is specified as follows:

$$\begin{aligned} ln\_new\_signups_t &= a_0 + a_1 ln\_new\_signups_{t-1} + ... + a_p ln\_new\_signups_{t-p} + \\ &+ e_t - b_1 e_{t-1} - ... - b_q e_{t-q} \end{aligned} \quad (54)$$

$$A(L) ln\_new\_signups_t = a_0 + B(L) e_t \quad (55)$$

The optimal lag orders p and q are specified by SC (Diebold 2007; Kirchgässner and Wolters 2007). Additionally, autocorrelation functions (ACF) and partial autocorrelation functions (PACF) indicate a specific lag order because AR(p), MA(q), ARMA(p,q) processes are characterized by typical patterns of ACF and PACF (Diebold 2007; Kirchgässner and Wolters 2007).

Finally, also in the case of ARMA models, misspecification tests are conducted. Besides the Jarque-Bera normality test, the autocorrelation test based on Breusch (1978) and Godfrey (1978a), and the White heteroskedasticity test (see Chapter 4.4.1), a heteroskedasticity test based on Breusch and Pagan (1979) and Godfrey (1978b) is applied[18]. The null hypothesis of the test based on Breusch and Pagan (1979) and Godfrey (1978b) assumes no heteroskedasticity. In an auxiliary regression the squared residuals from the original model are regressed on the independent variables[19] (IHS Global Inc. 2013; Wooldridge 2006). When the original model contains two independent variables, the auxiliary regression is specified as follows:

$$e_t^2 = \alpha_0 + \alpha_1 x_{1,t} + \alpha_2 x_{2,t} + u_t \quad (56)$$

[18] In one case the White-test cannot be performed because the number of observations is too small for the number of parameters to be estimated.

[19] In the case of ARMA models equation gradients have to be added.

An F-test helps to test the joint significance of the regressors (except intercept) of the auxiliary regression (Wooldridge 2006).

4.4.3. Autoregressive Distributed Lag Model

With autoregressive distributed lag (ADL) models, the current value of an endogenous variable y_t is explained by lagged endogenous variables y_{t-i} ($i=1,\ldots, p$) as well as by contemporaneous and lagged exogenous variables x_{t-j} ($j=0,\ldots, q$). The general ADL model of lag order p and q is specified as follows (Diebold 2007; Wooldridge 2006):

$$y_t = a_0 + \sum_{i=1}^{p} a_i y_{t-i} + \sum_{j=0}^{q} b_j x_{t-j} + e_t \qquad (57)$$

ADL models provide a flexible way of modelling time series, which is consistent with the general-to-specific approach proposed by Hendry (1985; 1995). ADL models include a range of special cases. From an ADL(1,1) model $y_t = a_0 + a_1 y_{t-1} + b_0 x_t + b_1 x_{t-1} + e_t$ with $a_1=b_1=0$ follows for example the static model $y_t = a_0 + b_0 x_t + e_t$, with $b_1=0$ follows the partial adjustment model $y_t = a_0 + a_1 y_{t-1} + b_0 x_t + e_t$. The optimal lag orders are specified by SC. Additionally, misspecification tests play an important role because they ensure an appropriate design of the model.

In the present project, general ADL models are specified as follows, whereby different independent variables are included:

$$\begin{aligned} & ln\_new\_signups_t = \\ & = a_0 + \sum_{i=1}^{p} a_i \cdot ln\_new\_signups_{t-i} + \sum_{j=0}^{q} b_j \cdot d\_ln\_posters_{t-j} + e_t \end{aligned} \qquad (58)$$

$$\begin{aligned} & ln\_new\_signups_t = a_0 + \sum_{i=1}^{p} a_i \cdot ln\_new\_signups_{t-i} + \\ & + \sum_{j=0}^{q} b_{1,j} \cdot d\_ln\_posters_{t-j} + \sum_{j=0}^{q} b_{2,j} \cdot d\_ln\_team_{t-j} + e_t \end{aligned} \qquad (59)$$

$$\begin{aligned} & ln\_new\_signups_t = \\ & = a_0 + \sum_{i=1}^{p} a_i \cdot ln\_new\_signups_{t-i} + \sum_{j=0}^{q} b_j \cdot d\_ln\_participation_{t-j} + e_t \end{aligned} \qquad (60)$$

$$
\begin{aligned}
ln\_new\_signups_t &= a_0 + \sum_{i=1}^{p} a_i \cdot ln\_new\_signups_{t-i} + \\
&+ \sum_{j=0}^{q} b_{1,j} \cdot d\_ln\_participation_{t-j} + \sum_{j=0}^{q} b_{2,j} \cdot d\_ln\_team_{t-j} + e_t
\end{aligned} \tag{61}
$$

$$
ln\_new\_signups_t = a_0 + \sum_{i=1}^{p} a_i \cdot ln\_new\_signups_{t-i} + \sum_{j=0}^{q} b_j \cdot ln\_posters_{t-j} + e_t \tag{62}
$$

$$
\begin{aligned}
&ln\_new\_signups_t = \\
&= a_0 + \sum_{i=1}^{p} a_i \cdot ln\_new\_signups_{t-i} + \sum_{j=0}^{q} b_j \cdot ln\_participation_{t-j} + e_t
\end{aligned} \tag{63}
$$

Jarque-Bera normality test, an autocorrelation test based on Breusch (1978) and Godfrey (1978a), and heteroskedasticity tests based on White (1980) or Breusch and Pagan (1979) and Godfrey (1978b)[20] (all tests see Chapter 4.4.1 and Chapter 4.4.2) are used for mis-specification testing.

4.4.4. Vector Autoregressive Model

The vector autoregressive (VAR) approach is a flexible way to model interdependencies between variables over time (see Chapter 3.4.1). In the present project, general VAR models of lag order p are specified as follows:

$$
\begin{aligned}
&\begin{bmatrix} d\_ln\_posters_t \\ ln\_new\_signups_t \end{bmatrix} = \\
&= \begin{bmatrix} C_{d\_ln\_posters,t} \\ C_{ln\_new\_signups,t} \end{bmatrix} + \sum_{i=1}^{p} \begin{bmatrix} a_{11,i} & a_{12,i} \\ a_{21,i} & a_{22,i} \end{bmatrix} \begin{bmatrix} d\_ln\_posters_{t-i} \\ ln\_new\_signups_{t-i} \end{bmatrix} + \begin{bmatrix} e_{d\_ln\_posters,t} \\ e_{ln\_new\_signups,t} \end{bmatrix}
\end{aligned} \tag{64}
$$

$$
\begin{aligned}
&\begin{bmatrix} d\_ln\_participation_t \\ ln\_new\_signups_t \end{bmatrix} = \begin{bmatrix} C_{d\_ln\_participation,t} \\ C_{ln\_new\_signups,t} \end{bmatrix} + \\
&+ \sum_{i=1}^{p} \begin{bmatrix} a_{11,i} & a_{12,i} \\ a_{21,i} & a_{22,i} \end{bmatrix} \begin{bmatrix} d\_ln\_participation_{t-i} \\ ln\_new\_signups_{t-i} \end{bmatrix} + \begin{bmatrix} e_{d\_ln\_participation,t} \\ e_{ln\_new\_signups,t} \end{bmatrix}
\end{aligned} \tag{65}
$$

[20] In two cases the heteroskedasticity test based on Breusch and Pagan (1979) and Godfrey (1978b) (for computational details see Chapter 4.4.2) is used instead of the White test. The White test cannot be performed because the number of observations is too small for the number of parameters to be estimated.

$$\begin{bmatrix} ln\_posters_t \\ ln\_new\_signups_t \end{bmatrix} = \\ = \begin{bmatrix} C_{ln\_posters,t} \\ C_{ln\_new\_signups,t} \end{bmatrix} + \sum_{i=1}^{p} \begin{bmatrix} a_{11,i} & a_{12,i} \\ a_{21,i} & a_{22,i} \end{bmatrix} \begin{bmatrix} ln\_posters_{t-i} \\ ln\_new\_signups_{t-i} \end{bmatrix} + \begin{bmatrix} e_{ln\_posters,t} \\ e_{ln\_new\_signups,t} \end{bmatrix} \quad (66)$$

$$\begin{bmatrix} ln\_participation_t \\ ln\_new\_signups_t \end{bmatrix} = \\ = \begin{bmatrix} C_{ln\_participation,t} \\ C_{ln\_new\_signups,t} \end{bmatrix} + \sum_{i=1}^{p} \begin{bmatrix} a_{11,i} & a_{12,i} \\ a_{21,i} & a_{22,i} \end{bmatrix} \begin{bmatrix} ln\_participation_{t-i} \\ ln\_new\_signups_{t-i} \end{bmatrix} + \begin{bmatrix} e_{ln\_participation,t} \\ e_{ln\_new\_signups,t} \end{bmatrix} \quad (67)$$

Since the focus of this research project lies on the explanation of new sign-ups, both posters and participation variables occupy the first elements of the vector and thus are supposed to be more exogenous than new sign-ups and to have an instantaneous influence on them (Lütkepohl 2007). Further, this ordering of variables is also supported by theory (see Chapter 4.2.4). The lag order *p* of the VAR model is determined by SC. Additionally, misspecification tests for VAR models are conducted. They comprise the Jarque-Bera normality test with Cholesky decomposition of the residual covariance matrix for the orthogonalization of error terms (Lütkepohl 2007). Further, the White test including cross terms is used for testing heteroskedasticity. Finally, the autocorrelation LM test is employed for testing autocorrelation up to lag order 4 (Lütkepohl 2007). As these tests are extensions of the misspecification tests discussed in Chapter 4.4.1, I forego a deep discussion (for further details see IHS Global Inc. 2013; Lütkepohl 2007). Finally, impulse response functions (IRFs), which visualize how the system responds over time to exogenous impulses, are investigated (for further details see Chapter 3.4.1). Since IRFs reveal more about the interdependence between variables than Granger causality (Lütkepohl 2007), I do not perform Granger causality tests (Granger 1969), which only test whether the inclusion of lagged poster/participation variables can enhance the explanatory power of an autoregressive approach for new sign-ups and vice versa by using F-tests (IHS Global Inc. 2013). In contrast to IRFs, Granger causality tests do not show how the effects look like.

4.5. Results

In the following, I estimate Bass, ARMA, ADL, and VAR models for six regional communities using the software package EViews.

4.5.1. Region 1

Bass

The estimation of a (modified) Bass model for region 1 yields the results displayed in Table 12. A dummy variable for July 2009[21] is included since the null hypotheses assuming both normality and no heteroskedasticity are rejected in the model excluding the dummy variable. After the inclusion of a dummy variable for July 2009 misspecification tests provide satisfactory results (see Appendix 84): The results of the Jarque-Bera test reveal that the null hypothesis assuming normality cannot be rejected at a significance level of 5%. Further, the null hypothesis of the Breusch-Godfrey test assuming no autocorrelation cannot be rejected, too. Finally, also the null hypothesis of the White test assuming no heteroskedasticity cannot be rejected.

Table 12 Bass Estimation Output; Region 1

Dependent Variable: ln_new_signups				
ln_new_signups=ln(a+b*new_signups_cum_t-1+c*(new_signups_cum_t-1)²+d*DUM2009M07)				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
a	537.7810	89.74966	5.992012	0.0000
b	0.015862	0.022474	0.705776	0.4858
c	-0.000002	0.000001	-1.503230	0.1432
d	-529.7810	89.78457	-5.900579	0.0000

R-squared	0.856178	Mean dependent var	6.061784
Adjusted R-squared	0.841795	S.D. dependent var	0.786862
S.E. of regression	0.312974	Akaike info criterion	0.624738
Sum squared resid	2.938581	Schwarz criterion	0.804309
Log likelihood	-6.620539	Hannan-Quinn criter.	0.685977
Durbin-Watson stat	2.426784		

Sample: 2009M07 - 2012M04
Included observations: 34

The estimated model describes the data quite well because R² obtains a value of 0.86, indicating that 86% of the sample variation of the dependent variable can be explained by the independent variables (Wooldridge 2006). The adjusted R² reaches a value of 84%. Hence, these values lie in the range of the R² values, which Bass (1969) obtained in his work. The SC reaches a value of 0.80, the AIC equals 0.62. However, it is worth mentioning that the coefficients of the cumulative number of new sign-ups and of the squared

[21] The decision which dummy variable to include is based on the pattern of the residuals. One should choose the dummy variable for a certain month in the sense that normality is approximately established and heteroskedasticity is reduced.

cumulative number of new sign-ups do not significantly differ from zero. Figure 94 shows the adaption of the estimated model to the observed data.

Figure 94 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated Bass Model; Region 1

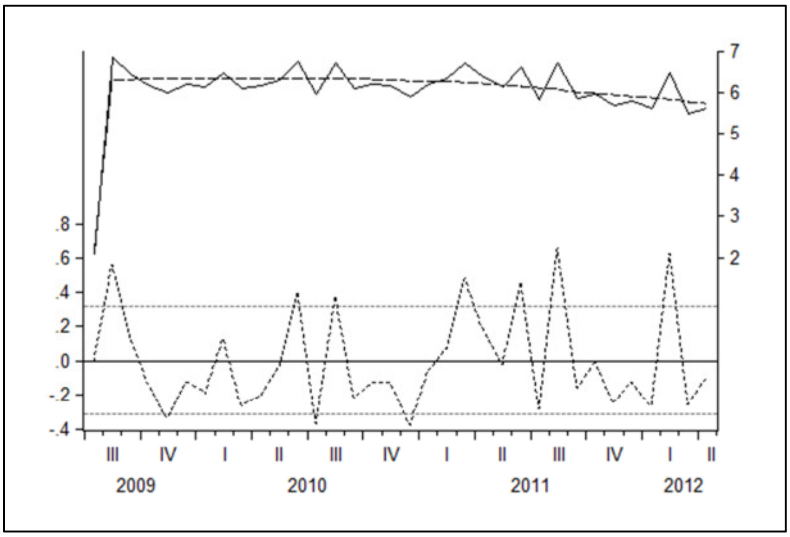
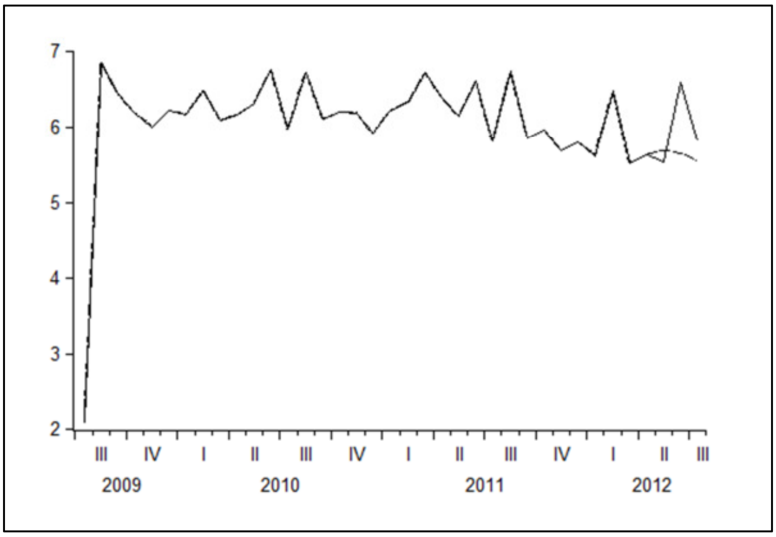


Figure 95 Actual (——) and Forecasted (– –) Values of ln_new_signups (Bass); Region 1



Based on the estimated Bass model, forecasts of new sign-ups, which refer to the time period of the holdout sample, are generated by the static one-step-ahead forecasting procedure. This forecasting procedure is a standard method for model comparisons (Trusov, Bucklin, and Pauwels 2009; Wooldridge 2006). Figure 95 displays actual and forecasted values of the logarithmized number of new sign-ups. From the forecast based on the sample ranging from May 2012 to July 2012 follows RMSE=0.569461 and MAE=0.456720.[22]

ARMA

Next, community growth is analyzed by the help of an ARMA model. To get a first idea of the right ARMA specification a correlogram of the logarithmized number of new sign-ups is generated. The correlogram, which is displayed in Figure 96, implies an ARMA(0,0) model since there are no relevant peaks in the autocorrelation function (ACF) and partial autocorrelation function (PACF). Thus, it is sufficient to concentrate on ARMA specifications of low order.[23] I estimate several ARMA specifications ranging from ARMA(0,0) to ARMA(2,2) and make a final decision of the model to choose by the help of SC (Diebold 2007). The lowest SC value among ARMA(0,0), AR(1), AR(2), MA(1), MA(2), ARMA(1,1), ARMA(1,2), ARMA(2,1), and ARMA(2,2) is attributed to the ARMA(1,2) process (see Appendix 85).

Figure 96 Correlogram of ln_new_signups; Region 1

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.122	-0.122	0.551	0.458
		2	0.008	-0.007	0.553	0.758
		3	0.009	0.009	0.557	0.906
		4	0.065	0.069	0.731	0.947
		5	0.005	0.021	0.732	0.981
		6	0.037	0.041	0.793	0.992
		7	-0.085	-0.079	1.122	0.993
		8	0.012	-0.013	1.129	0.997
		9	0.007	0.004	1.132	0.999
		10	-0.011	-0.012	1.138	1.000
		11	-0.126	-0.122	1.982	0.999
		12	0.068	0.041	2.242	0.999
		13	-0.135	-0.122	3.302	0.997
		14	0.009	-0.022	3.308	0.998
		15	-0.026	-0.015	3.352	0.999
		16	-0.021	-0.023	3.382	1.000

Sample: 2009M07 - 2012M04
Included observations: 34

[22] Measures such as SC, AIC, RMSE, and MAE are not interpreted at this point because these measures must be evaluated by comparing their values among different models (see Chapter 4.7.1).

[23] A further reason for not concentrating on ARMA processes of high order is that the sample size is not large enough for the estimation of ARMA models of high lag order.

The SC of ARMA(1,2) accounts for 0.87. Further, the null hypotheses of the Jarque-Bera assuming normality, the Breusch-Godfrey assuming no autocorrelation, and the White test assuming no heteroskedasticity cannot be rejected (see Appendix 84). Thus, there is no need to make any adaptions to the model. The estimation output of the ARMA(1,2) model is presented in Table 13. The graph of the ARMA(1,2) process together with the actual and residual values is displayed in Figure 97. Both R^2 values, whereby R^2=0.27 and adjusted R^2=0.19, refer to a poor goodness of fit. The AIC equals 0.68. Although the autoregressive component is not significant at a significance level of 5%, it should not be excluded because of stability and performance issues. Hence, in this case current values of the logarithmized number of new sign-ups are predominantly influenced by current and past shocks. Finally, the one-step-ahead forecast procedure yields RMSE=0.682572 and MAE=0.491148 based on the forecast sample ranging from May 2012 to July 2012. The actual and forecasted values of the logarithmized number of new sign-ups are presented in Figure 98.

Table 13 ARMA Estimation Output; Region 1

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	6.118055	0.122659	49.87862	0.0000
AR(1)	0.024626	0.204984	0.120134	0.9052
MA(1)	0.219313	0.069712	3.145966	0.0038
MA(2)	0.903261	0.059101	15.28338	0.0000

R-squared	0.265457	Mean dependent var	6.182461
Adjusted R-squared	0.189470	S.D. dependent var	0.357613
S.E. of regression	0.321957	Akaike info criterion	0.684415
Sum squared resid	3.006032	Schwarz criterion	0.865810
Log likelihood	-7.292844	Hannan-Quinn criter.	0.745449
F-statistic	3.493447	Durbin-Watson stat	1.987654
Prob(F-statistic)	0.028056		
Inverted AR Roots	.02		
Inverted MA Roots	-.11+.94i	-.11-.94i	

Sample (adjusted): 2009M08 - 2012M04
Included observations: 33 (after adj.)

Figure 97 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated ARMA Model; Region 1

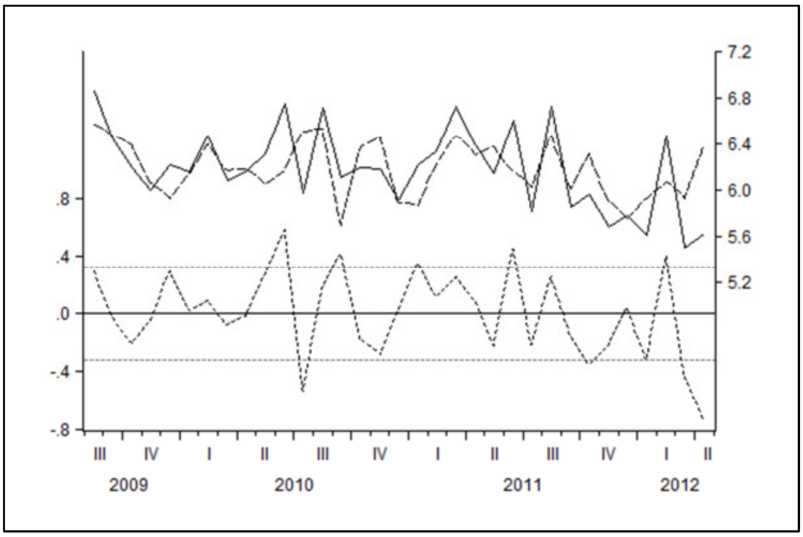
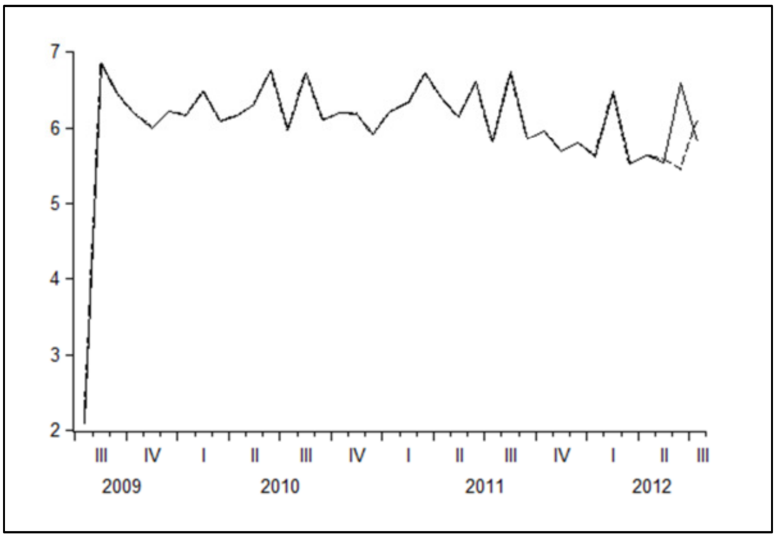


Figure 98 Actual (——) and Forecasted (– –) Values of ln_new_signups (ARMA); Region 1



ADL (d_ln_posters)

In this section, an ADL model including the first differences of the logarithmized number of posters, i.e. the growth rate of the number of posters, as an exogenous variable is used in order to examine community growth of region 1. First of all, ADL models of different lag lengths[24] are compared with each other. The best model is selected using SC. The value of SC is minimal for an ADL specification that includes the by one period lagged vari-

[24] The maximum lag length is set at lag order 2 because the number of observations does not allow considering more than two lags.

able for community growth, i.e. *ln_new_signups_t-1*, and the current poster variable, i.e. *d_ln_posters* (see Appendix 86). Since there is evidence for autocorrelation in the residuals, the model is estimated again including a dummy variable for March 2012. After that, null hypotheses of normality, autocorrelation, and heteroskedasticity tests are not rejected (see Appendix 84). Thus, a further adaption is not necessary. The estimation results of the ADL model including the dummy variable are presented in Table 14.

Table 14 ADL (d_ln_ posters) Estimation Output; Region 1

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	3.418681	0.910826	3.753386	0.0008
ln_new_signups_t-1	0.442088	0.146232	3.023198	0.0052
d_ln_posters	0.546960	0.131362	4.163766	0.0003
DUM2012M03	-0.782968	0.276055	-2.836274	0.0082

R-squared	0.486573	Mean dependent var	6.182461
Adjusted R-squared	0.433460	S.D. dependent var	0.357613
S.E. of regression	0.269171	Akaike info criterion	0.326274
Sum squared resid	2.101140	Schwarz criterion	0.507668
Log likelihood	-1.383514	Hannan-Quinn criter.	0.387307
F-statistic	9.161082	Durbin-Watson stat	2.619887
Prob(F-statistic)	0.000201		

Sample (adjusted): 2009M08 - 2012M04
Included observations: 33 (after adj.)

Both R^2 values ranging from 0.43 to 0.49 reveal a moderate goodness of fit. The SC reaches a value of 0.51, the AIC reaches a value of 0.33. Additionally, the estimation output shows that the current number of new sign-ups, i.e. *ln_new_signups*, is positively influenced by the by one period lagged number of new sign-ups, i.e. *ln_new_signups_t-1*, and by the current growth rate of the number of posters, i.e. *d_ln_posters*. In the short term, for example, a one percentage point increase in *d_ln_posters* at time *t* leads (on average and ceteris paribus) to an immediate 0.55% increase in *ln_new_signups*. Figure 99 displays the estimated model together with the actual values. The static one-step-ahead forecast procedure generates values of RMSE=0.559356 and MAE=0.489940 for the forecast sample ranging from May 2012 to July 2012. The development of actual and forecasted values is illustrated in Figure 100. In order to control for possible effects going out from the community's employees (e.g. photographers and editorial staff) on the community growth variable, I include a team variable, which takes the growth rate of the number of employees into account, i.e. *d_ln_team* (see Appendix 87 for model selection).

The community's employees might contribute to community growth because they are able to directly acquire new members. However, as can be seen from Table 15, estimation results show that the team variable has no significant impact on community growth. By contrast, the positive effect of the poster variable on community growth remains highly significant. Finally, it is not necessary to adapt the model including both posters and team variables because null hypotheses of all misspecification tests are not rejected (see Appendix 84).

Figure 99 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated ADL (d_ln_posters) Model; Region 1

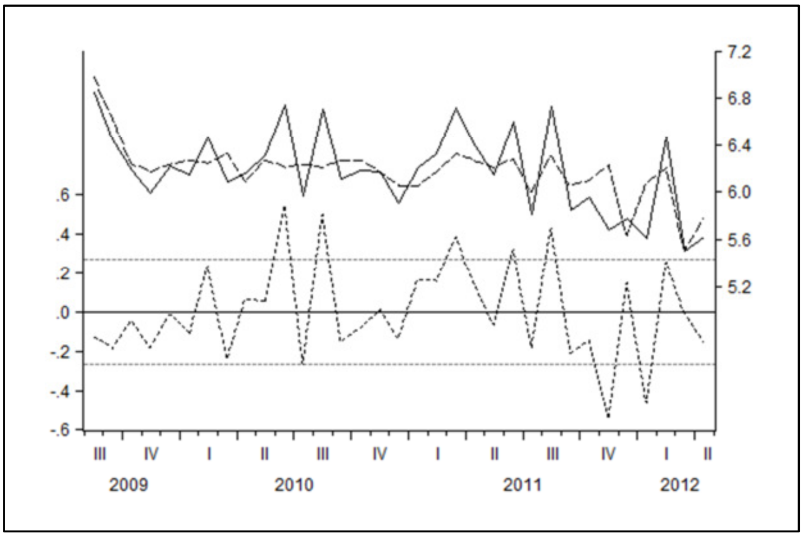


Figure 100 Actual (——) and Forecasted (– –) Values of ln_new_signups (ADL d_ln_posters); Region 1

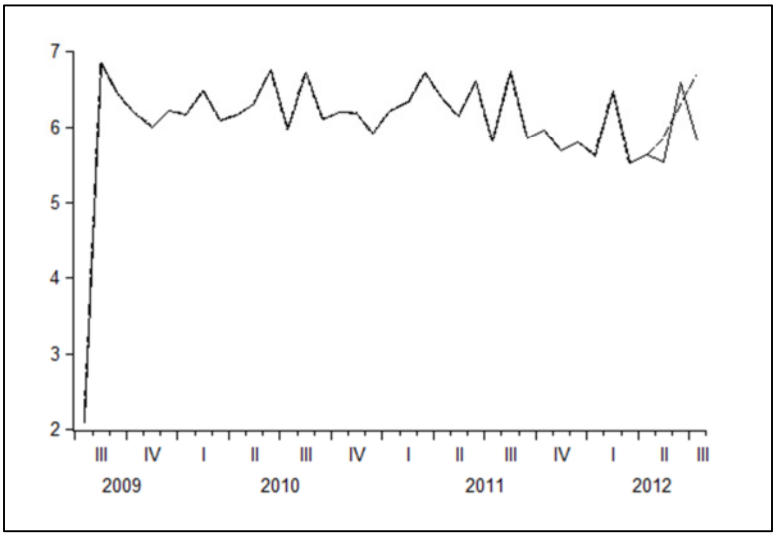


Table 15 ADL (d_ln_posters, d_ln_team) Estimation Output; Region 1

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	3.035408	1.359310	2.233050	0.0340
ln_new_signups_t-1	0.381492	0.181048	2.107139	0.0445
ln_new_signups_t-2	0.114451	0.073777	1.551320	0.1325
d_ln_posters	0.767856	0.203541	3.772490	0.0008
d_ln_team	0.934881	0.895118	1.044421	0.3056

R-squared	0.384089	Mean dependent var	6.161596
Adjusted R-squared	0.292843	S.D. dependent var	0.342320
S.E. of regression	0.287866	Akaike info criterion	0.489958
Sum squared resid	2.237405	Schwarz criterion	0.718979
Log likelihood	-2.839328	Hannan-Quinn criter.	0.565872
F-statistic	4.209380	Durbin-Watson stat	2.145029
Prob(F-statistic)	0.008909		

Sample (adjusted): 2009M09 - 2012M04
Included observations: 32 (after adj.)

ADL (d_ln_participation)

In the previous section, I examined the influence of the growth rate of the number of posters on community growth by using an ADL model. In the following section, I use participation – or more precisely the first differences of the logarithmized number of contributions made in the community, i.e. the growth rate of the number of contributions – instead of the poster variables to model community growth. The aim of this distinction is to unveil whether posters or contributions add more to the explanation and prediction of community growth. For the selection of the "best" ADL specification I use again the SC. Among all model specifications up to lag order 2, the ADL model including only a contemporaneous participation variable, i.e. *d_ln_participation*, obtains the smallest value of the SC (see Appendix 88). Since the null hypotheses of the Jarque-Bera assuming normality, the Breusch-Godfrey assuming no autocorrelation, and the White test assuming no heteroskedasticity are not rejected, changes to the model are not necessary (see Appendix 84). The estimation output displayed in Table 16 shows a value of 0.17 for R^2 and a value of 0.14 for the adjusted R^2. These values suggest a poor goodness of fit. Further, the SC amounts to 0.78. The AIC equals 0.68. Moreover, the estimation output reveals that the coefficient of the current growth rate of the number of contributions, i.e. *d_ln_participation*, is significantly different from zero at a significance level of 5%, but not at a level of 1%. The value of the coefficient indicates that a one percentage point increase in *d_ln_participation* leads to a 0.14% increase in *ln_new_signups*.

Table 16 ADL (d_ln_participation) Estimation Output; Region 1

Dependent Variable: ln_new_signups				
	Coefficient	Std. Error	t-Statistic	p-value
Constant	6.153463	0.058735	104.7666	0.0000
d_ln_participation	0.135127	0.053513	2.525143	0.0169

R-squared	0.170598	Mean dependent var	6.182461
Adjusted R-squared	0.143844	S.D. dependent var	0.357613
S.E. of regression	0.330895	Akaike info criterion	0.684659
Sum squared resid	3.394231	Schwarz criterion	0.775356
Log likelihood	-9.296870	Hannan-Quinn criter.	0.715176
F-statistic	6.376349	Durbin-Watson stat	1.751863
Prob(F-statistic)	0.016895		

Sample (adjusted): 2009M08 - 2012M04
Included observations: 33 (after adj.)

Figure 101 displays estimated and actual values of *ln_new_signups*. Finally, the static one-step-ahead forecast procedure, which is based on the forecast sample ranging from May 2012 to July 2012, generates values of RMSE=0.512529 and MAE=0.501042. The deviations of the forecasted values from the observed values are depicted in Figure 102.

Figure 101 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated ADL (d_ln_participation) Model; Region 1

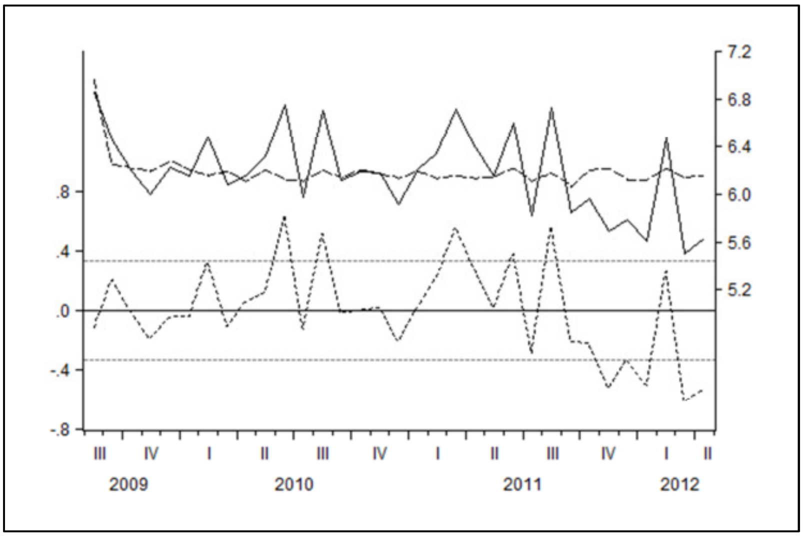
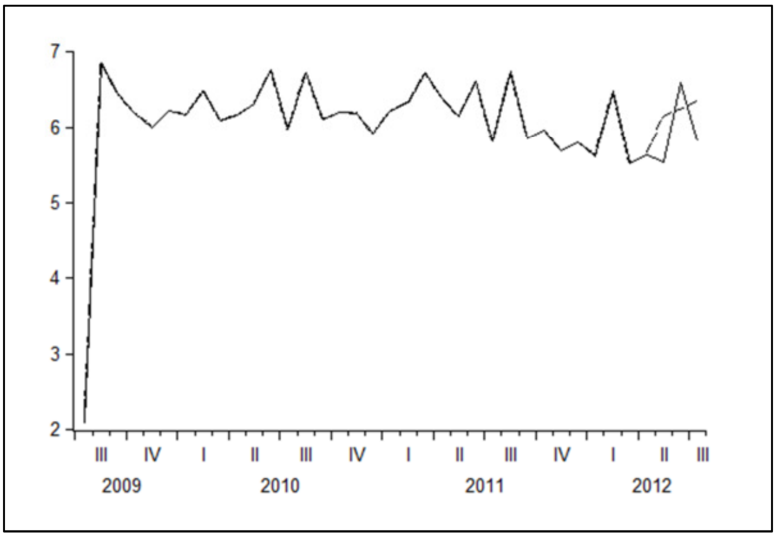


Figure 102 Actual (——) and Forecasted (– –) Values of ln_new_signups (ADL d_ln_participation); Region 1

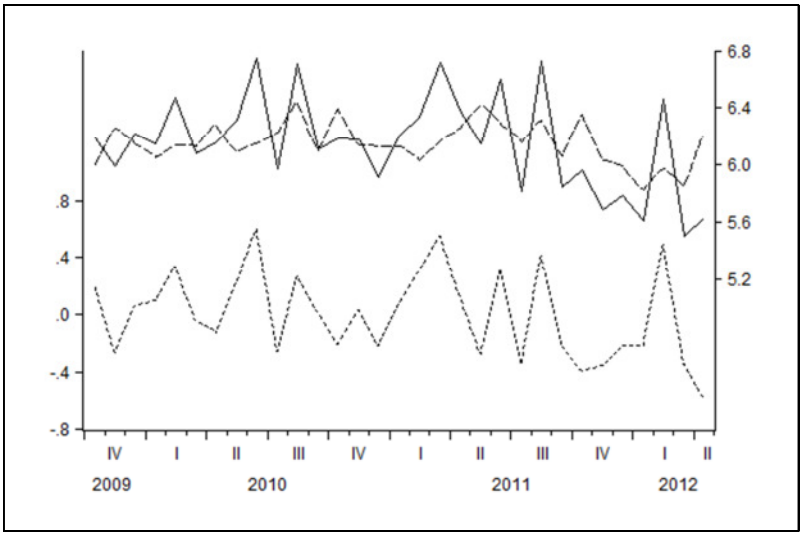


Since the results of the ADL model including posters and team variables show that the team variable does not contribute to the explanation of community growth sufficiently and also the ADL model including participation and team variables does not reveal significant effects stemming out from the team variable (see Appendix 89), I dispense with considering the team variable in the following analyses of region 1.

VAR (d_ln_posters)

In the last two sections of Chapter 4.5.1, I use VAR models in order to explain and predict community growth. In this section, I start with the integration of the growth rate of the number of posters into the VAR model. The lag order of the VAR process is selected according to the smallest SC value of VAR processes up to lag order 4. The SC is minimal for a VAR(1) process (see Appendix 90). However, because there is evidence for autocorrelated and not normally distributed residuals, the VAR process has to be adapted. Since the VAR(1) process requires several dummy variables until misspecification test results become satisfactory, I use a VAR(2) process which is an appropriate procedure in this case (Lütkepohl 2007; Wooldridge 2006). After the estimation of a VAR(2) model the null hypotheses of the VAR normality test assuming normality, of the VAR White heteroskedasticity test assuming no heteroskedasticity, and the VAR autocorrelation LM test assuming no serial correlation (up to lag order 4) are not rejected (see Appendix 91). Thus, the VAR model is correctly specified. Since the ordering of the variables in a VAR system plays an important role, i.e. the variable that comes first in the system has a potential immediate effect on the following variables (Lütkepohl 2007), I set the poster variable at the first position and the community growth variable at the second position. This proceeding is justified by theory (see Chapter 4.2.4), by the focus of this research project, which lies on the explanation of community growth, and because the ADL models already show that there are contemporaneous effects of the poster variable on the community growth variable. The estimation output reveals that the SC adds up to a value of 1.09 and the AIC reaches a value of 0.63 (see Appendix 92). Figure 103 shows actual values of the logarithmized number of new sign-ups as well as values which are generated through the VAR model. Since it is difficult to interpret the coefficients of a VAR because of the mutual dependencies between the variables, IRFs are generated (Sims 1980). They are displayed in Figure 104.

Figure 103 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated VAR (d_ln_posters) Model; Region 1



The IRF at the bottom left of Figure 104 shows the effect of a one standard deviation shock in the poster variable on current and future values of new sign-ups, i.e. there is a positive response of community growth to a shock in the poster variable, which is significant up to one month. The IRF at the top right shows that the effects of a shock in new sign-ups on the growth rate of posters are not significant. Further, there is a positive response of new sign-ups to a shock in new sign-ups. Finally, the response of the poster variable to a shock in the poster variable is significant positive up to one month, then turns significant negative after one month for a short period of time. Also for the VAR model, I use the one-step-ahead forecast procedure which generates values of

RMSE=0.448382 and MAE=0.337662 based on the forecast sample of May 2012 to July 2012. Actual and forecasted values are depicted in Figure 105.

Figure 104 Impulse Response Functions, d_ln_posters ln_new_signups, Response to Cholesky One S. D. Innovations ± 2 S. E.; Region 1

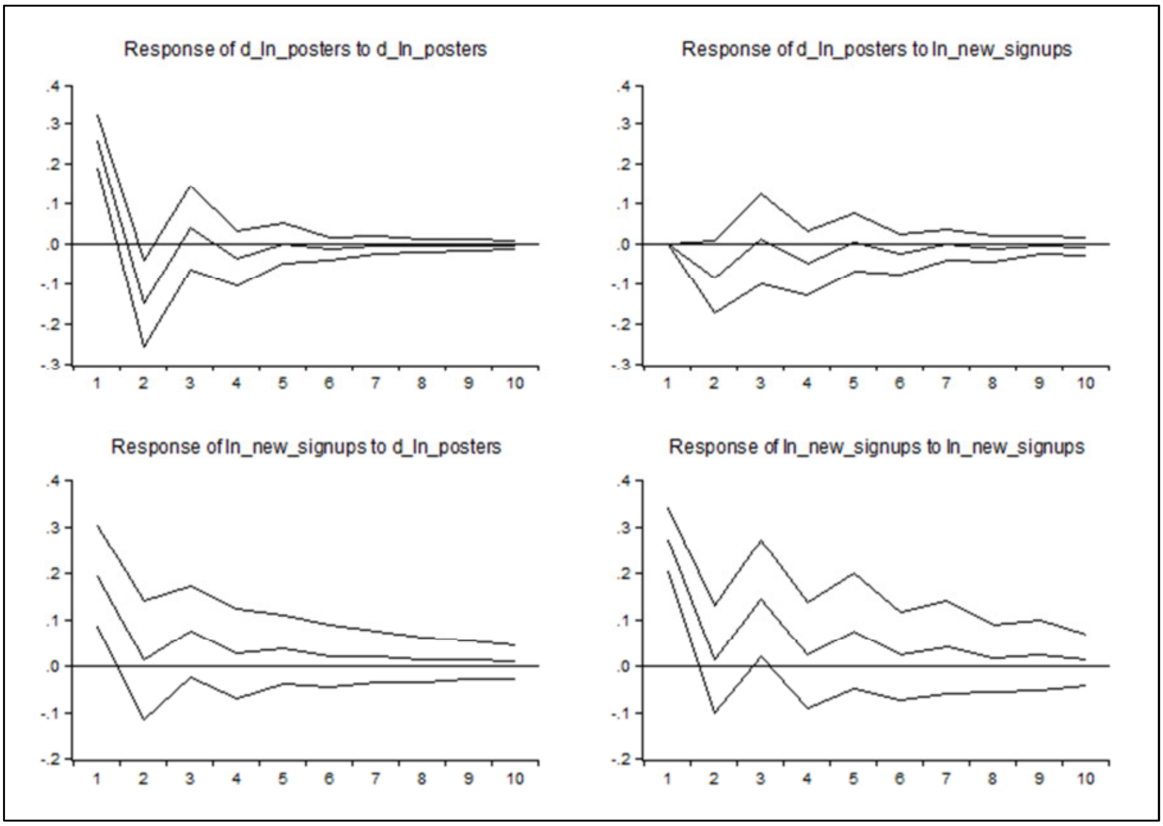
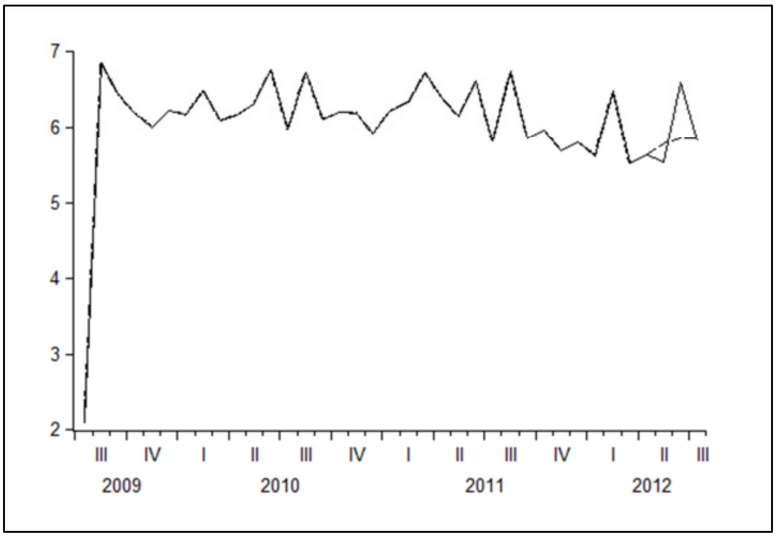


Figure 105 Actual (——) and Forecasted (– –) Values of ln_new_signups (VAR d_ln_posters); Region 1



VAR (d_ln_participation)

In the following section, I estimate a VAR model including the participation variable, i.e. the first differences of the logarithmized number of contributions made in the community, instead of the poster variable in order to analyze community growth. The lag length of the VAR model is determined by the SC. The SC value is minimal for a VAR(0) specification, i.e. a VAR model that only includes a constant term (see Appendix 93). A VAR(0) indicates that there are no dynamics in the model. Hence, the traditional VAR approach is not suitable in this case. The analysis of community growth in region 1 by a VAR model including the participation variable does not give any added value.[25]

4.5.2. Region 2

Bass

I start modeling community growth of region 2 by estimating a (modified) Bass model. Since under the standard estimation procedure residuals are not normally distributed and heteroskedasticity in the residuals arises, the model has to be estimated again including a dummy variable for August 2008. The estimation results are presented in Table 17.

Table 17 Bass Estimation Output; Region 2

Dependent Variable: ln_new_signups				
ln_new_signups=ln(a+b*new_signups_cum_t-1+c*(new_signups_cum_t-1)²+d*DUM2009M08)				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
a	214.2646	41.81715	5.123846	0.0000
b	0.023952	0.024933	0.960641	0.3447
c	-0.000002	0.000003	-0.613120	0.5446
d	-205.2691	41.96028	-4.891986	0.0000

R-squared	0.728403	Mean dependent var	5.496898
Adjusted R-squared	0.700307	S.D. dependent var	0.703551
S.E. of regression	0.385154	Akaike info criterion	1.042865
Sum squared resid	4.301962	Schwarz criterion	1.224260
Log likelihood	-13.20727	Hannan-Quinn criter.	1.103899
Durbin-Watson stat	1.902177		

Sample: 2009M08 - 2012M04
Included observations: 33

[25] I additionally estimate VAR(1) and VAR(2) models in order to double check. However, there are no significant effects of participation on community growth.

From Jarque-Bera, White, and Breusch-Godfrey test we may conclude that the null hypotheses of normality, no heteroskedasticity, and no autocorrelation cannot be rejected (see Appendix 94). Thus, a further modification is not necessary. The estimation output reveals that R^2 values range from 0.70 to 0.73, which is quite a respectable result. The SC reaches a value of 1.22, the AIC equals 1.04. However, the coefficients of the cumulative number of new sign-ups and of the squared cumulative number of new sign-ups do not significantly differ from zero. Figure 106 displays the estimated curve together with the actual data.

Figure 106 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated Bass Model; Region 2

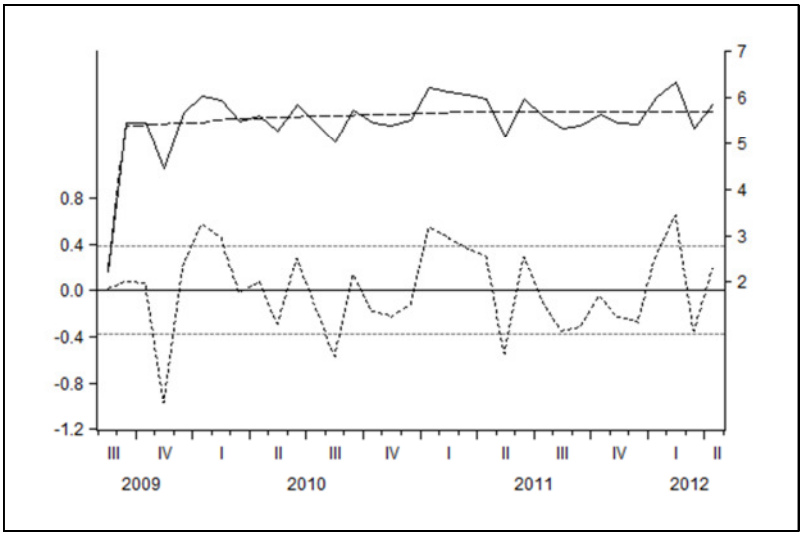
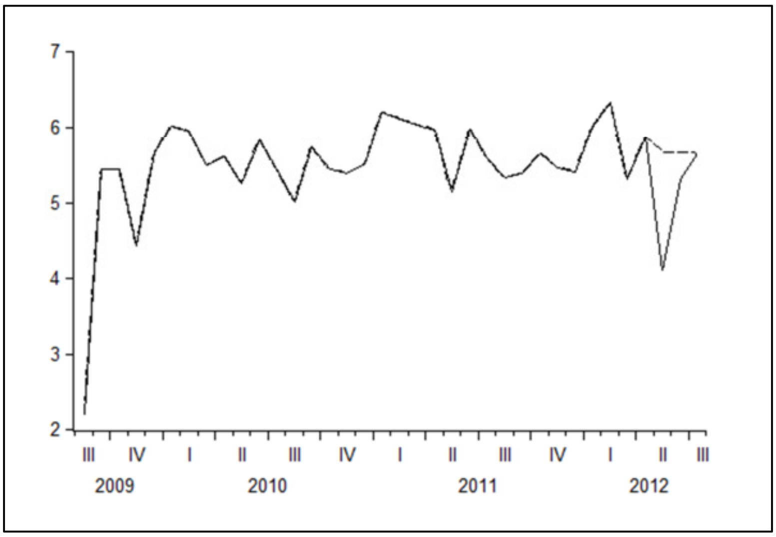


Figure 107 Actual (——) and Forecasted (– –) Values of ln_new_signups (Bass); Region 2

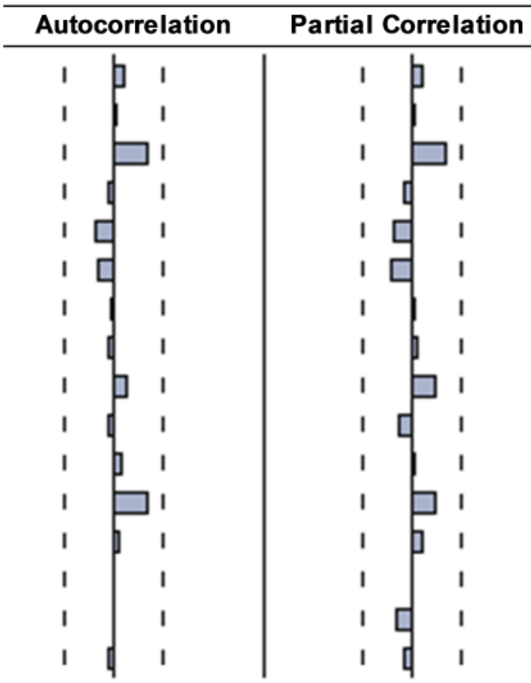


In the next step, the forecast values referring to the time period of the holdout sample are computed by the static one-step-ahead forecasting procedure. Figure 107 displays actual and forecasted values of the logarithmized number of new sign-ups. The figure shows that the forecasted values exceed the actual values. Only the last value is similar. From the forecast, which is based on the sample ranging from May 2012 to July 2012, follows RMSE=0.911829 and MAE=0.631596.

ARMA

Next, I examine community growth in region 2 with a specification of an ARMA model. For this purpose, the correlogram of the logarithmized number of new sign-ups is analyzed first. Based on the correlogram displayed in Figure 108 an ARMA(0,0) process should be selected because there are no significant peaks in the ACF and PACF. This means that neither an AR nor an MA component should be included.

Figure 108 Correlogram of ln_new_signups; Region 2



	AC	PAC	Q-Stat	Prob
1	0.066	0.066	0.157	0.692
2	0.018	0.013	0.168	0.919
3	0.234	0.233	2.270	0.518
4	-0.027	-0.060	2.299	0.681
5	-0.131	-0.138	3.011	0.698
6	-0.103	-0.150	3.464	0.749
7	-0.017	0.023	3.476	0.838
8	-0.033	0.040	3.528	0.897
9	0.093	0.163	3.947	0.915
10	-0.042	-0.091	4.034	0.946
11	0.045	0.010	4.140	0.966
12	0.224	0.159	6.889	0.865
13	0.035	0.066	6.957	0.904
14	0.002	-0.005	6.958	0.936
15	-0.002	-0.109	6.958	0.959
16	-0.025	-0.053	7.000	0.973

Sample: 2009M08 - 2012M04
Included observations: 33

However, in order to make a more precise decision concerning the order of the appropriate ARMA model, I compare SC values of all ARMA specifications up to lag order 2. The specification with the lowest value of SC=1.10 is assigned to an AR(1) process (see Appendix 95). Based on the AR(1) model, misspecification tests are performed: The null hypotheses of the Jarque-Bera, the Breusch-Godfrey, and the White test cannot be rejected (see Appendix 94). Thus, there is no need to adapt the model. Although the AR(1) model is the "best" among all other specifications, its performance is, however, quite poor. As displayed in the estimation output both R^2 values do not exceed a value of 0.02, which is extremely poor (see Table 18). The AIC equals 1.01. Further, the coefficient of the AR(1) component is not significantly different from zero. Hence, in this model, past values of the logarithmized number of new sign-ups have no significant influence on the current value of the logarithmized number of new sign-ups. However, the AR(1) component needs to be included because of stability and performance issues.

Table 18 ARMA Estimation Output; Region 2

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	5.608469	0.074955	74.82490	0.0000
AR(1)	0.068832	0.098130	0.701429	0.4884

R-squared	0.016135	Mean dependent var	5.600013
Adjusted R-squared	-0.016660	S.D. dependent var	0.385688
S.E. of regression	0.388888	Akaike info criterion	1.009409
Sum squared resid	4.537009	Schwarz criterion	1.101018
Log likelihood	-14.15055	Hannan-Quinn criter.	1.039775
F-statistic	0.492003	Durbin-Watson stat	1.906448
Prob(F-statistic)	0.488441		
Inverted AR Roots	.07		

Sample (adjusted): 2009M09 - 2012M04
Included observations: 32 (after adj.)

Figure 109 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated ARMA Model; Region 2

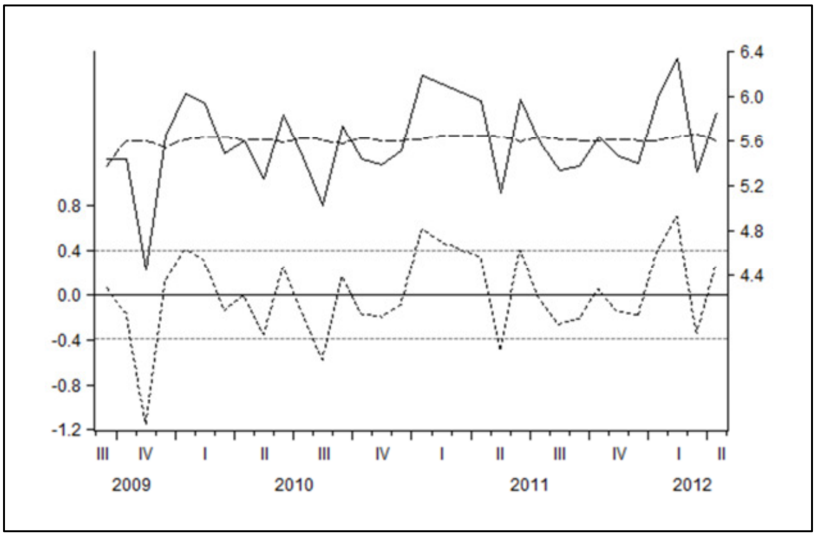


Figure 110 Actual (——) and Forecasted (– –) Values of ln_new_signups (ARMA); Region 2

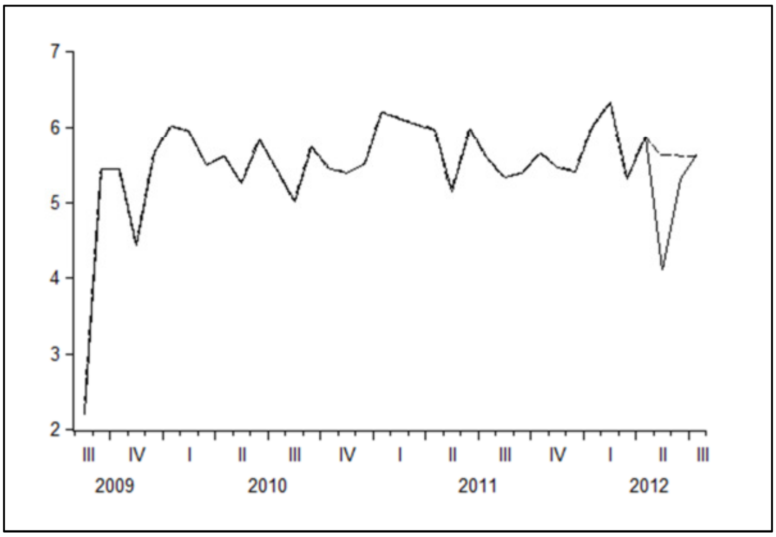


Figure 109 shows the deviations of the actual values from the estimated values. From the one-step-ahead forecast procedure values for RMSE=0.891237 and MAE=0.611291 are generated. Figure 110 reveals that the forecasted values are higher than the observed values.

ADL (d_ln_posters)

In the following, I analyze community growth with an ADL model including the growth rate of the number of posters as an exogenous variable. Among different ADL specifications the value of SC is minimal for the model of which community growth and poster variables have the maximum lag length of two (see Appendix 96). Estimation results of the selected model are presented in Table 19. Since the null hypotheses of the Jarque-Bera, the Breusch-Godfrey, and the White test are not rejected, adaptions of the model are not necessary (see Appendix 94). The estimation output reveals a value of 0.68 for R^2 and a value of 0.62 for the adjusted R^2. Thus, the model's goodness of fit is quite satisfying. The SC accounts for 0.48. The AIC reaches a value of 0.20. Further, it is apparent that *d_ln_posters* has a significant positive impact and *d_ln_posters_t-2* has a significant negative impact on *ln_new_signups* at a significance level of 5%. Coefficients of *d_ln_posters_t-1*, *ln_new_signups_t-1*, and *ln_new_signups_t-2* are not significant at a significance level of 5%. Yet, they are not excluded because of stability and performance reasons. Nevertheless, the long-run propensity, i.e. the reaction of new sign-ups to a permanent one percentage point increase in the poster variable, is still positive.

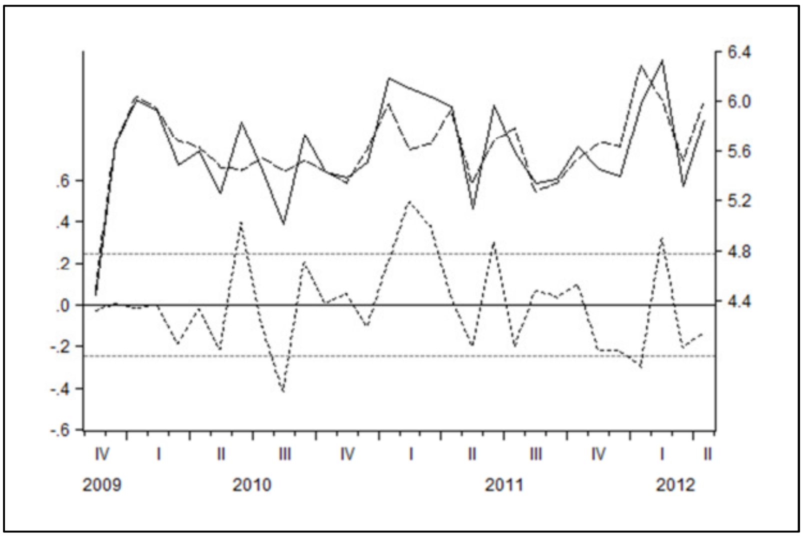
Table 19 ADL (d_ln_posters) Estimation Output; Region 2

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	2.399646	1.001372	2.396359	0.0247
ln_new_signups_t-1	0.279617	0.187309	1.492807	0.1485
ln_new_signups_t-2	0.286184	0.163321	1.752286	0.0925
d_ln_posters	0.665350	0.138255	4.812497	0.0001
d_ln_posters_t-1	0.333678	0.189367	1.762076	0.0908
d_ln_posters_t-2	-0.215893	0.063673	-3.390659	0.0024

R-squared	0.683165	Mean dependent var	5.611391
Adjusted R-squared	0.617158	S.D. dependent var	0.396070
S.E. of regression	0.245065	Akaike info criterion	0.202273
Sum squared resid	1.441369	Schwarz criterion	0.482513
Log likelihood	2.965904	Hannan-Quinn criter.	0.291924
F-statistic	10.34986	Durbin-Watson stat	2.054497
Prob(F-statistic)	0.000022		

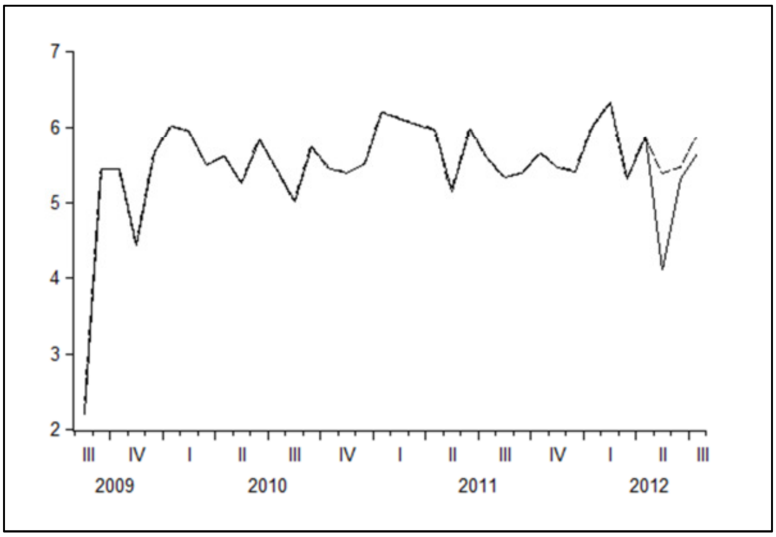
Sample (adjusted): 2009M11 - 2012M04
Included observations: 30 (after adj.)

Figure 111 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated ADL (d_ln_posters) Model; Region 2



Results displayed in the estimation output are also reflected in Figure 111. The one-step-ahead forecast procedure yields values of RMSE=0.746861 and MAE=0.543002. Figure 112 shows that the forecasted values exceed the observed values.

Figure 112 Actual (——) and Forecasted (– –) Values of ln_new_signups (ADL d_ln_posters); Region 2



Moreover, even if the team variable is added to the model, this does not change the significant positive effect of the poster variable on community growth (see Table 20; see also Appendix 97 for model selection). However, the team variable itself has no significant impact on community growth. Finally, due to the results of misspecification tests, the model including both posters and team variables does not need to be adapted (see Appendix 94).

Table 20 ADL (d_ln_posters, d_ln_team) Estimation Output; Region 2

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	1.687689	0.827280	2.040047	0.0509
ln_new_signups_t-1	0.683850	0.145736	4.692402	0.0001
d_ln_posters	0.670745	0.141319	4.746309	0.0001
d_ln_team	0.511194	0.358547	1.425738	0.1650

R-squared	0.478858	Mean dependent var	5.600013
Adjusted R-squared	0.423021	S.D. dependent var	0.385688
S.E. of regression	0.292965	Akaike info criterion	0.498943
Sum squared resid	2.403203	Schwarz criterion	0.682160
Log likelihood	-3.983096	Hannan-Quinn criter.	0.559675
F-statistic	8.576054	Durbin-Watson stat	2.448234
Prob(F-statistic)	0.000338		

Sample (adjusted): 2009M09 - 2012M04
Included observations: 32 (after adj.)

ADL (d_ln_participation)

Next, I apply an ADL model that investigates the role of the growth rate of participation in explaining and predicting community growth. Among different ADL specifications, the SC selects an ADL model including only the contemporaneous participation variable (see Appendix 98). Null hypotheses of normality, autocorrelation, and heteroskedasticity tests are not rejected (see Appendix 94). Hence, there is no need to make any changes to the model. The estimation output in Table 21 presents the SC value adding up to 1.12 and the AIC reaching a value of 1.03. Further, it displays both R^2 values ranging from -0.03 to 0.00, which refer to a very poor goodness of fit. Figure 113 contrasts estimated and actual values. The coefficient of *d_ln_participation* is highly insignificant suggesting that the growth rate of the number of contributions has no impact on the number of new sign-ups. The forecasted values, which are generated through the one-step-ahead forecast procedure, based on the forecast sample ranging from May 2012 to July 2012, are displayed in Figure 114 together with the actual values. The deviations of forecasted values from actual values are represented in the forecast errors of RMSE=0.872336 and MAE=0.600538.

Table 21 ADL (d_ln_participation) Estimation Output; Region 2

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	5.598361	0.070953	78.90260	0.0000
d_ln_participation	0.007610	0.070245	0.108338	0.9144

R-squared	0.000391	Mean dependent var	5.600013
Adjusted R-squared	-0.032929	S.D. dependent var	0.385688
S.E. of regression	0.391987	Akaike info criterion	1.025285
Sum squared resid	4.609613	Schwarz criterion	1.116894
Log likelihood	-14.40456	Hannan-Quinn criter.	1.055651
F-statistic	0.011737	Durbin-Watson stat	1.754532
Prob(F-statistic)	0.914449		

Sample (adjusted): 2009M09 - 2012M04
Included observations: 32 (after adj.)

Figure 113 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated ADL (d_ln_participation) Model; Region 2

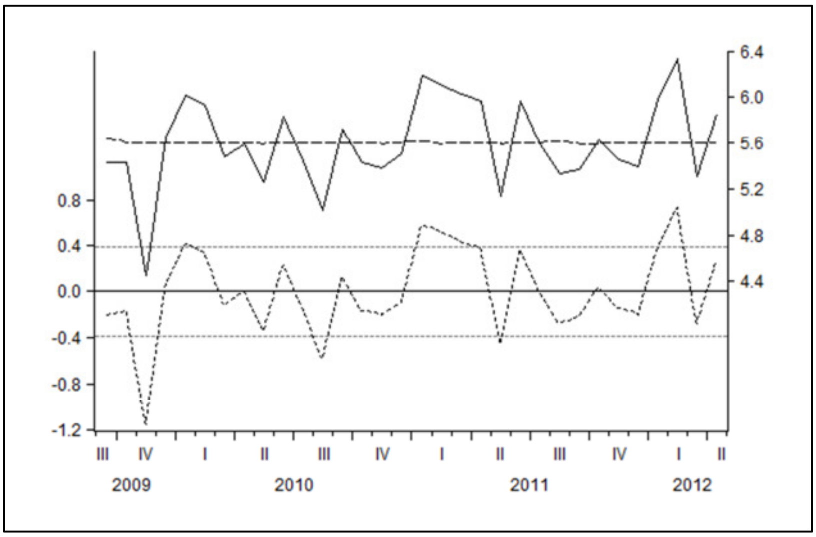
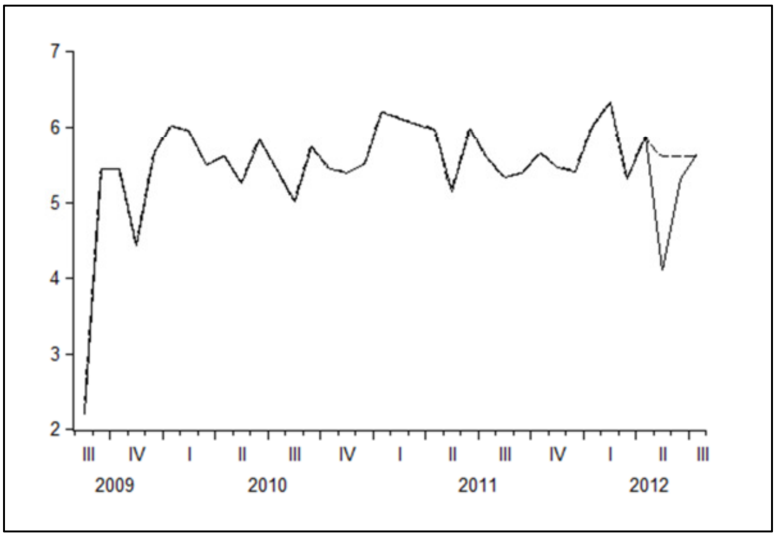


Figure 114 Actual (——) and Forecasted (– –) Values of ln_new_signups (ADL d_ln_participation); Region 2

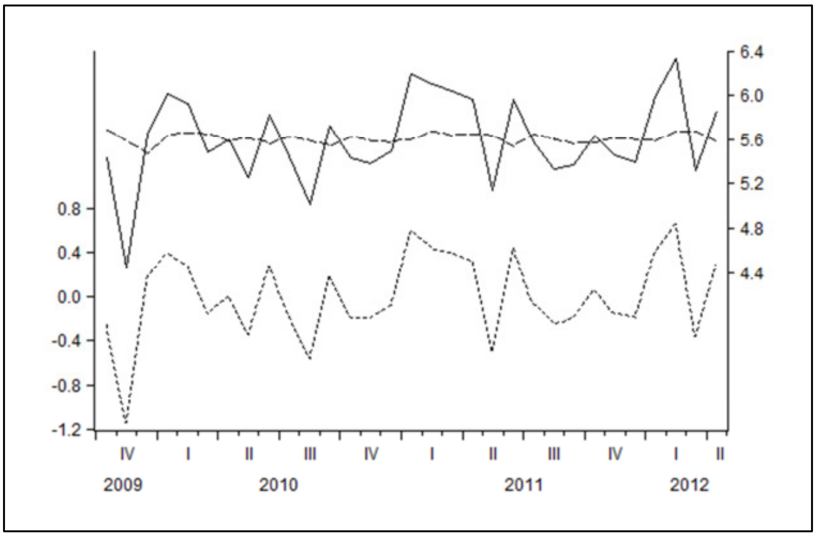


Because of the insignificant influence of the team variable on community growth in the ADL posters and in the ADL participation (see Appendix 99) model, I dispense with considering the team variable in the following analyses of region 2.

VAR (d_ln_posters)

In the following, I estimate a VAR model including the growth rate of the number of posters in order to examine and predict community growth of region 2. The lag order of the VAR model is determined by the SC, which is minimal for a VAR(1) model (Appendix 100). Then, misspecification tests are conducted. The null hypotheses of the VAR normality test assuming normality, of the VAR White heteroskedasticity test assuming no heteroskedasticity, and the VAR autocorrelation LM test assuming no serial correlation (up to lag order 4) are not rejected (see Appendix 101). Thus, the VAR model is correctly specified and no changes to the model are necessary. The estimation output displays a value of 1.54 for the SC and a value of 1.26 for the AIC (see Appendix 102). Figure 115 shows the actual values of the logarithmized number of new sign-ups together with the part of the VAR model that describes the logarithmized number of new sign-ups.

Figure 115 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated VAR (d_ln_posters) Model; Region 2



Further, effects between the variables are represented by IRFs displayed in Figure 116. They show that an impulse in the growth rate of the number of posters leads to an increase in the number of new sign-ups which is significant up to one month. An impulse in the number of new sign-ups, however, leads to a decrease in the growth rate of the number of posters that stays significant up to two months. The own-variable IRF for new sign-ups shows that an impulse in new sign-ups leads to a positive response of the variable, which lasts for up to one month. The own-variable IRF for the poster variable shows a similar pattern. Finally, forecasted values, which are generated by the one-step-ahead forecast procedure, are displayed in Figure 117 together with the observed values. Values of RMSE=0.886907 and MAE=0.568453 represent the deviations of the forecasted from the observed values.

Figure 116 Impulse Response Functions, d_ln_posters ln_new_signups, Response to Cholesky One S. D. Innovations ± 2 S. E.; Region 2

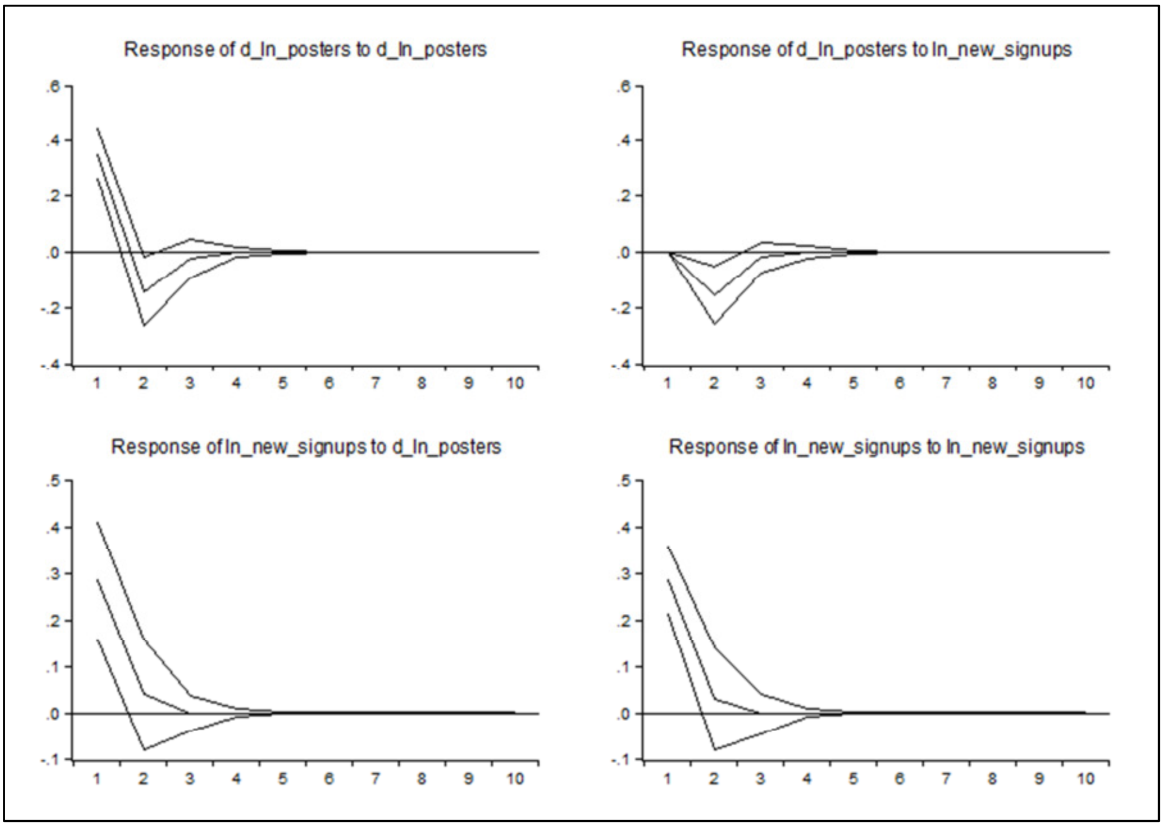
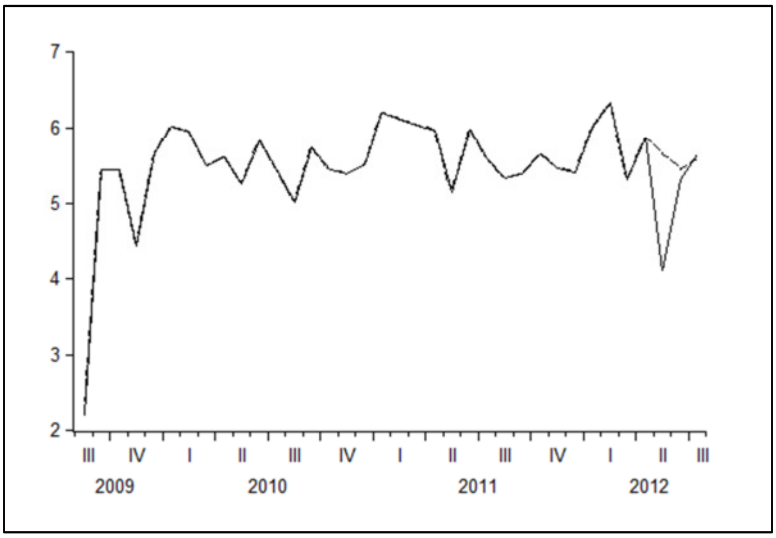


Figure 117 Actual (——) and Forecasted (– –) Values of ln_new_signups (VAR d_ln_posters); Region 2



VAR (d_ln_participation)

Next, I replace the poster variable by the participation variable, i.e. by the growth rate of participation. The SC value is minimal for a VAR(0), i.e. a VAR model that only includes a constant term (see Appendix 103). Hence, a VAR approach is not appropriate to analyze community growth of region 2.[26]

4.5.3. Region 3

Bass

The estimation of a (modified) Bass model for community growth in region 3 yields the results shown in Table 22. The null hypotheses of the Jarque-Bera test assuming normality, of the Breusch-Godfrey test assuming no autocorrelation, and of the White test assuming no heteroskedasticity cannot be rejected at a significance level of 5% (Appendix 104). Thus, it is not necessary to adapt the model.

Table 22 Bass Estimation Output; Region 3

Dependent Variable: ln_new_signups				
ln_new_signups=ln(a+b*new_signups_cum_t-1+c*(new_signups_cum_t-1)²)				
	Coefficient	Std. Error	t-Statistic	p-value
a	12.71259	4.491408	2.830424	0.0082
b	0.134789	0.026984	4.995105	0.0000
c	-0.000028	0.000009	-3.057019	0.0047

R-squared	0.597030	Mean dependent var	4.405991
Adjusted R-squared	0.570165	S.D. dependent var	0.997474
S.E. of regression	0.653962	Akaike info criterion	2.074973
Sum squared resid	12.82999	Schwarz criterion	2.211019
Log likelihood	-31.23706	Hannan-Quinn criter.	2.120749
Durbin-Watson stat	1.201404		

Sample: 2009M08 - 2012M04
Included observations: 33

The goodness of fit concerning the R^2 values is quite acceptable because the values for R^2 and adjusted R^2 are 0.60 and 0.57 respectively. The value of SC amounts for 2.21, the AIC equals 2.07. Further, the estimation results yield that all parameters are significantly different from zero even at significance level of 1%. Figure 118 shows the estimated

[26] I additionally estimate VAR(1) and VAR(2) models in order to double check. However, there are no significant effects of participation on community growth in a VAR(1). Further, a VAR(2) is misspecified because of autocorrelation.

model together with the actual data and demonstrates the typical curvilinear relationship between the variables of a Bass model. The one-step-ahead forecasting procedure yields RMSE=0.303772 and MAE=0.249843 for the sample ranging from May 2012 to July 2012. The forecasted values only slightly exceed the actual values (see Figure 119).

Figure 118 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated Bass Model; Region 3

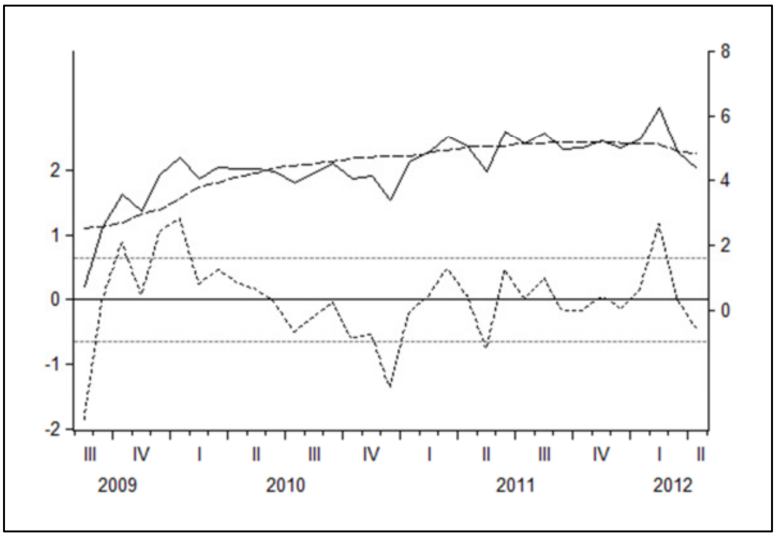
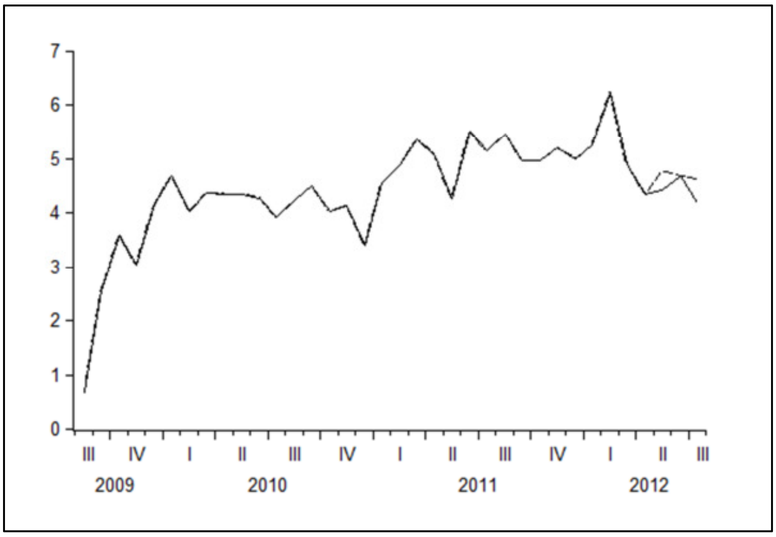


Figure 119 Actual (——) and Forecasted (– –) Values of ln_new_signups (Bass); Region 3



ARMA

In the following, I analyze community growth in region 3 by the help of an ARMA process. The correlogram of the logarithmized number of new sign-ups, which is displayed in Figure 120, indicates a AR(1) specification. ACF and PACF show the typical pattern of a AR(1) process because the autocorrelation function decays geometrically and the partial autocorrelation function peaks at displacement 1 and then abruptly gets insignificant.

Figure 120 Correlogram of ln_new_signups; Region 3

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.539	0.539	10.486	0.001
		2	0.356	0.093	15.221	0.000
		3	0.334	0.155	19.506	0.000
		4	0.177	-0.103	20.759	0.000
		5	0.171	0.088	21.958	0.001
		6	0.165	0.024	23.117	0.001
		7	0.108	-0.001	23.638	0.001
		8	0.088	-0.012	23.997	0.002
		9	0.046	-0.035	24.099	0.004
		10	0.084	0.088	24.450	0.006
		11	0.093	0.017	24.902	0.009
		12	0.029	-0.058	24.947	0.015
		13	0.000	-0.050	24.947	0.023
		14	-0.013	-0.009	24.958	0.035
		15	0.006	0.053	24.960	0.050
		16	-0.005	-0.032	24.962	0.070

Sample: 2009M08 - 2012M04
Included observations: 33

In order to verify the results derived from the correlogram, I compare all ARMA specifications up to order 2 by the help of SC (see Appendix 105). Again, AR(1) is selected as specification with the lowest value for SC=1.71. Thus, it seems that an AR(1) process helps to describe community growth in region 3. Further, there is no need to make any changes to the model because the null hypotheses of the Jarque-Bera, the Breusch-Godfrey, and the White test are not rejected (see Appendix 104). The estimation output of Table 23 shows acceptable R^2 values with R^2=0.52 and adjusted R^2=0.51. The AIC reaches a value of 1.62. Moreover, the coefficient of the AR(1) component is highly significant. Hence, the by one period lagged values of the logarithmized number of new sign-ups have a significant impact on the current logarithmized new sign-ups.

Table 23 ARMA Estimation Output; Region 3

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	4.655319	0.208730	22.30311	0.0000
AR(1)	0.538844	0.093669	5.752663	0.0000

R-squared	0.524512	Mean dependent var	4.522017
Adjusted R-squared	0.508663	S.D. dependent var	0.753969
S.E. of regression	0.528498	Akaike info criterion	1.622907
Sum squared resid	8.379311	Schwarz criterion	1.714515
Log likelihood	-23.96651	Hannan-Quinn criter.	1.653273
F-statistic	33.09313	Durbin-Watson stat	2.211388
Prob(F-statistic)	0.000003		

Inverted AR Roots	.54

Sample (adjusted): 2009M09 - 2012M04
Included observations: 32 (after adj.)

These findings are also reflected in Figure 121, which shows the adaption of the fitted values to the actual values. Finally, deviations of forecasted values from observed values are displayed in Figure 122. The one-step-ahead forecast procedure yields values of RMSE=0.259265 and MAE=0.198933 based on the sample ranging from May 2012 to July 2012.

Figure 121 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated ARMA Model; Region 3

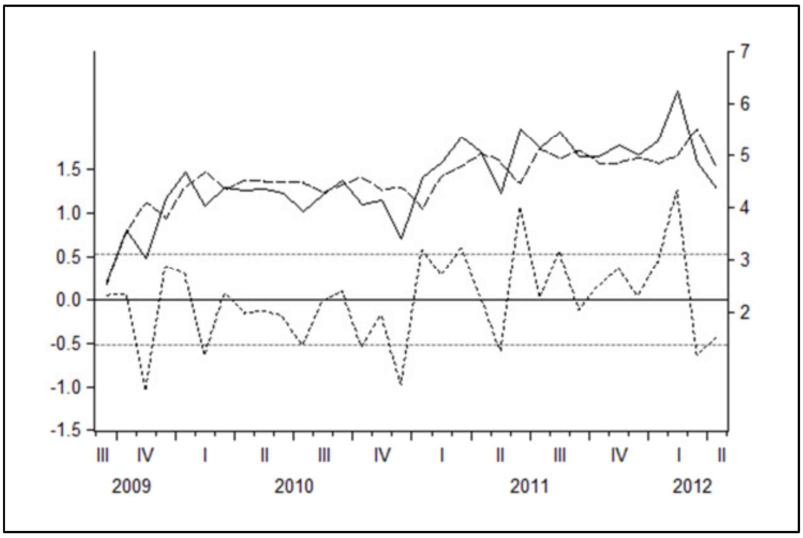
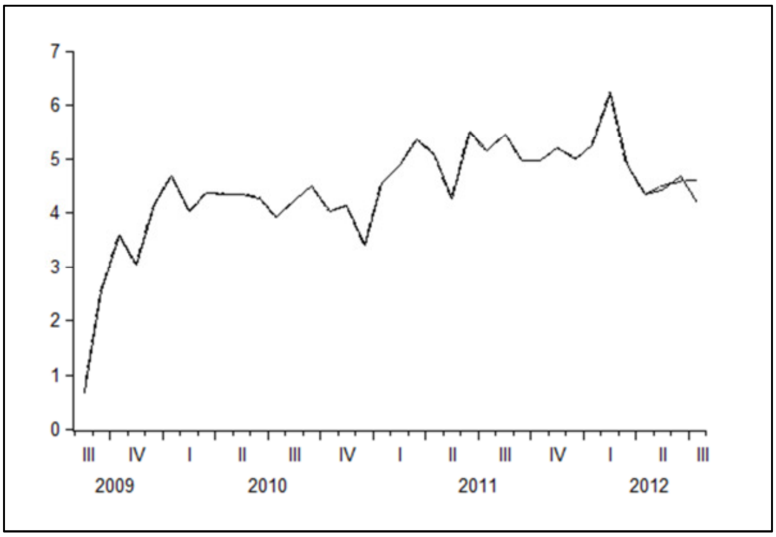


Figure 122 Actual (——) and Forecasted (– –) Values of ln_new_signups (ARMA); Region 3



ADL (d_ln_posters)

Next, an ADL specification including the growth rate of the number of posters as an exogenous variable is used in order to model community growth of region 3. The comparison of SC values of different ADL specifications yields that the model including lagged dependent and lagged independent variables up to lag order 2 shows the smallest SC value (see Appendix 106). There is no need to make any adaptions to the model since the

Table 24 ADL (d_ln_posters) Estimation Output; Region 3

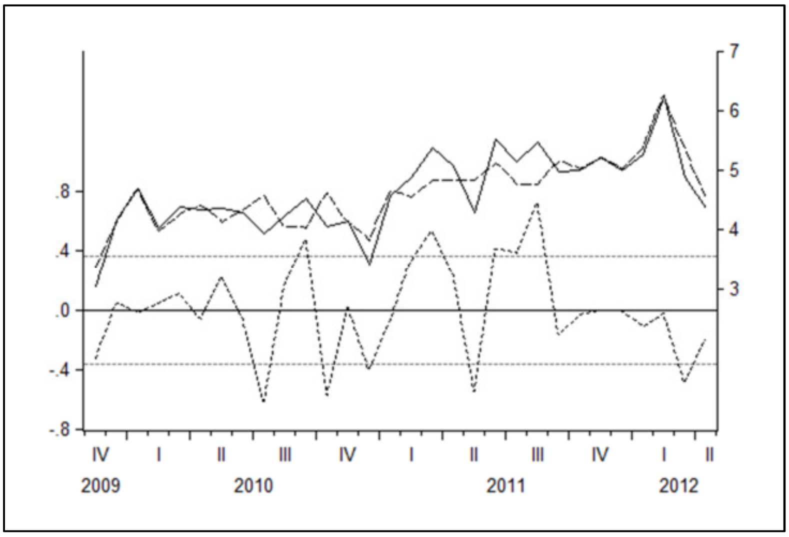
Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	1.022966	0.506370	2.020192	0.0547
ln_new_signups_t-1	0.376676	0.167765	2.245262	0.0342
ln_new_signups_t-2	0.400754	0.145657	2.751343	0.0111
d_ln_posters	0.810855	0.157005	5.164525	0.0000
d_ln_posters_t-1	0.114158	0.207215	0.550915	0.5868
d_ln_posters_t-2	-0.450108	0.158489	-2.839986	0.0090

R-squared	0.746811	Mean dependent var	4.618536
Adjusted R-squared	0.694064	S.D. dependent var	0.659995
S.E. of regression	0.365053	Akaike info criterion	0.999308
Sum squared resid	3.198328	Schwarz criterion	1.279547
Log likelihood	-8.989616	Hannan-Quinn criter.	1.088959
F-statistic	14.15820	Durbin-Watson stat	1.919528
Prob(F-statistic)	0.000002		

Sample (adjusted): 2009M11 - 2012M04
Included observations: 30 (after adj.)

null hypotheses of the Jarque-Bera, the Breusch-Godfrey, and the White test are not rejected (see Appendix 104). Thus, the model is correctly specified. The estimation output, which is presented in Table 24, shows quite respectable values for both R^2 values, whereby the value of R^2 accounts for 0.75 and the value of the adjusted R^2 accounts for 0.69. Further, the output shows a value of 1.28 for the SC and a value of about 1.00 for the AIC. All coefficients except those for the constant term and *d_ln_posters_t-1* are significantly different from zero at a significance level of 5%. Lagged values of new sign-ups, i.e. *ln_new_signups_t-1* and *ln_new_signups_t-2*, as well as *d_ln_posters* have a significant positive influence on the dependent variable. Despite the negative effect of *d_ln_posters_t-2*, the long-run propensity is still positive. Figure 123 displays the estimated model together with the actual values.

Figure 123 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated ADL (d_ln_posters) Model; Region 3



The results of the static one-step-ahead forecast procedure based on the forecast sample ranging from May 2012 to July 2012 are displayed in Figure 124. The forecasted values exceed the observed ones. Further, the deviations of forecasted values from actual values are reflected in the values of RMSE=0.329818 and MAE=0.288227. For the sake of completeness, I estimate again an ADL model that includes both posters and team variables. It is not necessary to adapt the model because of the results of misspecification tests (see Appendix 104). Estimation results of the selected ADL specification are displayed in Table 25 (see Appendix 107 for model selection). However, results show that the influence of the team variables is not significant at a significance level of 5%. Yet, the overall positive impact going out from the poster variable is verified again.

Figure 124 Actual (——) and Forecasted (– –) Values of ln_new_signups (ADL d_ln_posters); Region 3

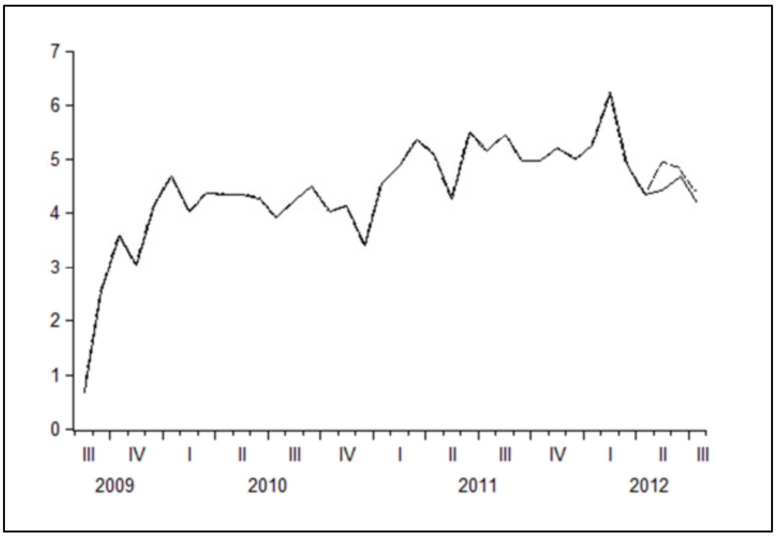


Table 25 ADL (d_ln_posters, d_ln_team) Estimation Output; Region 3

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	1.291024	0.534732	2.414337	0.0250
ln_new_signups_t-1	0.294944	0.191581	1.539524	0.1386
ln_new_signups_t-2	0.407638	0.152065	2.680677	0.0140
d_ln_posters	0.883085	0.153964	5.735677	0.0000
d_ln_team	0.659239	0.550709	1.197074	0.2446
d_ln_posters_t-1	0.177578	0.222654	0.797551	0.4341
d_ln_team_t-1	0.978390	0.495797	1.973369	0.0618
d_ln_posters_t-2	-0.435369	0.152726	-2.850656	0.0096
d_ln_team_t-2	-0.238599	0.546815	-0.436343	0.6670

R-squared	0.797212	Mean dependent var	4.618536
Adjusted R-squared	0.719959	S.D. dependent var	0.659995
S.E. of regression	0.349262	Akaike info criterion	0.977336
Sum squared resid	2.561662	Schwarz criterion	1.397695
Log likelihood	-5.660036	Hannan-Quinn criter.	1.111812
F-statistic	10.31953	Durbin-Watson stat	2.081934
Prob(F-statistic)	0.000009		

Sample (adjusted): 2009M11 - 2012M04
Included observations: 30 (after adj.)

ADL (d_ln_participation)

In the following, the contribution of the growth rate of participation to the explication and prediction of community growth in region 3 is examined by the help of an ADL model. The SC value is minimal for the ADL specification that includes *ln_new_signups_t-1* and *d_ln_participation* as exogenous variables (see Appendix 108). Results of normality, autocorrelation, and heteroskedasticity tests request no changes to the model (see Appendix 104). The estimation results presented in Table 26 display a value of 1.81 for the SC, a value of 1.67 for the AIC, a value of 0.53 for R^2, and a value of 0.50 for the adjusted R^2. Thus, the goodness of fit is acceptable. Further, *ln_new_signups_t-1* exerts a significant positive effect on *ln_new_signups*. The participation variable, however, has no significant influence on community growth. Estimation results of the ADL model are additionally visualized in Figure 125. Finally, the one-step-ahead forecast procedure leads to values of RMSE=0.260706 and MAE=0.195050. Figure 126 contrasts forecasted and observed values.

Table 26 ADL (d_ln_participation) Estimation Output; Region 3

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	2.358710	0.548722	4.298555	0.0002
ln_new_signups_t-1	0.494241	0.119134	4.148595	0.0003
d_ln_participation	-0.079914	0.129621	-0.616518	0.5424

R-squared	0.530664	Mean dependent var	4.522017
Adjusted R-squared	0.498296	S.D. dependent var	0.753969
S.E. of regression	0.534045	Akaike info criterion	1.672385
Sum squared resid	8.270907	Schwarz criterion	1.809798
Log likelihood	-23.75817	Hannan-Quinn criter.	1.717934
F-statistic	16.39470	Durbin-Watson stat	2.062445
Prob(F-statistic)	0.000017		

Sample (adjusted): 2009M09 - 2012M04
Included observations: 32 (after adj.)

Figure 125 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated ADL (d_ln_participation) Model; Region 3

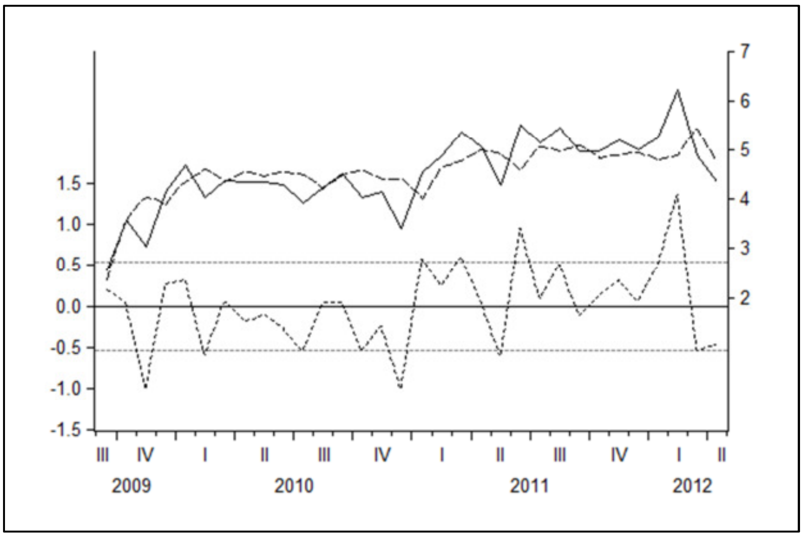
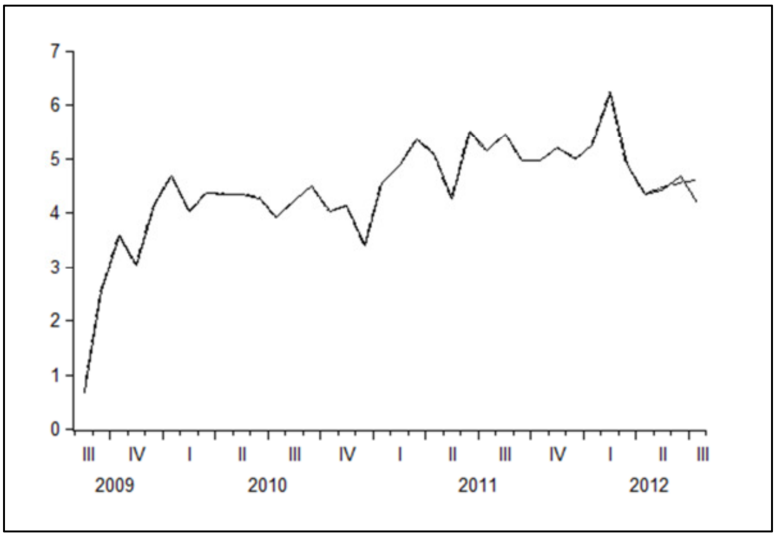


Figure 126 Actual (——) and Forecasted (– –) Values of ln_new_signups (ADL d_ln_participation); Region 3

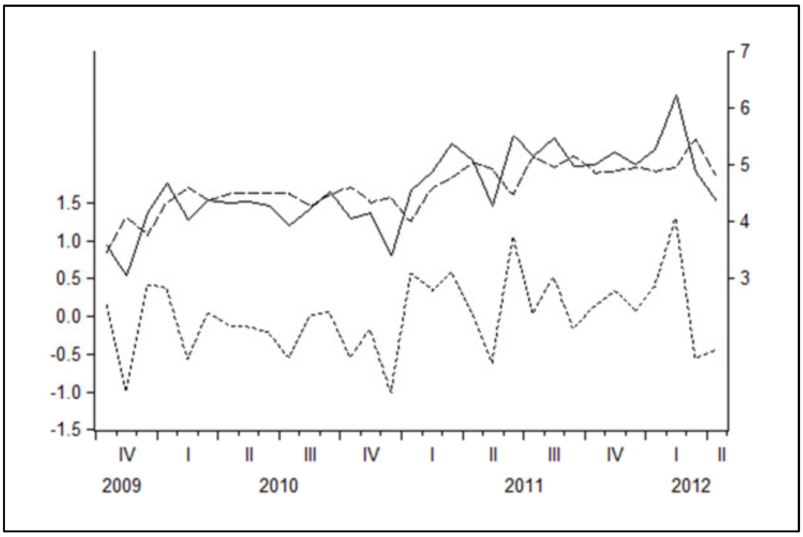


Because of the insignificant influence of the team variable on community growth in the ADL posters and in the ADL participation (see Appendix 109) model, I dispense with considering the team variable in the following analyses of region 3.

VAR (d_ln_posters)

The next step is to find an appropriate VAR specification for modeling and predicting community growth of region 3. First of all, I examine the role of the growth rate of the number of posters in analyzing community growth by a VAR model. The SC selects a VAR(1) model as the specification obtaining the lowest SC value (see Appendix 110). Further, null hypotheses of normality, autocorrelation, and heteroskedasticity tests are not rejected (see Appendix 111). Thus, there is no need to make any adaptions to the model. The SC of the estimated VAR(1) process adds up to 2.75, the AIC equals 2.47 (see Appendix 112). Figure 127 shows actual values of the logarithmized number of new sign-ups as well as values which are generated through the VAR model.

Figure 127 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated VAR (d_ln_posters) Model; Region 3



The IRFs are shown in Figure 128. The IRF at the bottom left implies that a shock in the growth rate of the number of posters generates a positive response of the number of new sign-ups, which is significant up to one month. The IRF at the top right shows that a shock in new sign-ups does not lead to a significant response of the poster variable. Further, both own-variable IRFs show a positive response to a shock in the respective variable, whereby the response of new sign-ups stays significant up to three months and the response of the poster variable stays significant up to one month. Finally, the results of the one-step-ahead forecast procedure are illustrated together with the observed values in Figure 129 and are also reflected in the values of RMSE=0.310970 and MAE=0.252235.

Figure 128 Impulse Response Functions, d_ln_posters ln_new_signups, Response to Cholesky One S. D. Innovations ± 2 S. E.; Region 3

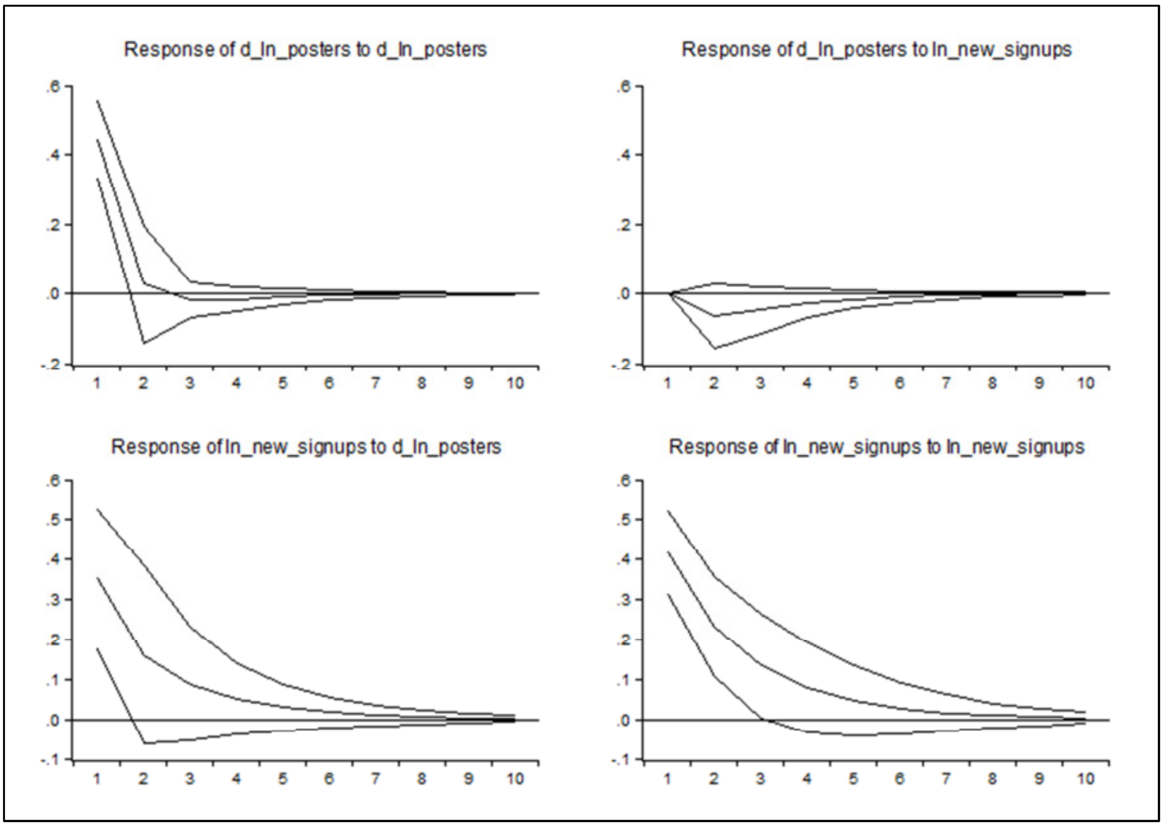
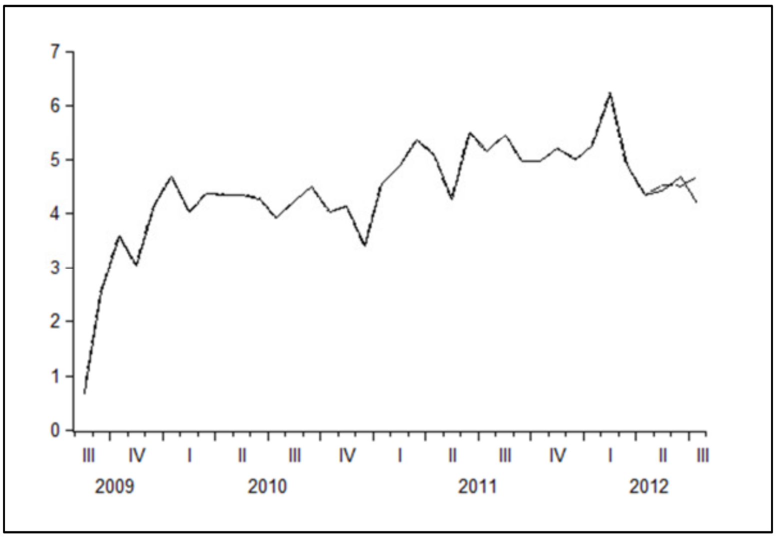


Figure 129 Actual (——) and Forecasted (– –) Values of ln_new_signups (VAR d_ln_posters); Region 3



VAR (d_ln_participation)

Finally, I examine the role of the participation variable, i.e. the growth rate of the number of contributions, by a VAR approach. The SC selects a VAR(0) process because the value of SC is minimal for a VAR(0) model among all other VAR specifications up to lag order 4 (see Appendix 113). A VAR(0) implies that there are no dynamics in the model. Hence, the VAR approach including the participation variable is not suitable in this context.[27]

4.5.4. Region 4

Bass

At first, community growth of region 4 is analyzed by the help of the (modified) Bass diffusion model. Since under the standard estimation procedure heteroskedasticity in the residuals arises (see Appendix 114), the model has to be estimated again using the heteroskedasticity consistent covariance matrix estimator (White 1980). Table 27 contains the estimation results. Jarque-Bera and Breusch-Godfrey test indicate that the null hypotheses of normally distributed and not autocorrelated residuals cannot be rejected at a significance level of 5% (see Appendix 114). Thus, a modification of the model is not necessary.

Table 27 Bass Estimation Output; Region 4

Dependent Variable: ln_new_signups				
ln_new_signups=ln(a+b*new_signups_cum_t-1+c*(new_signups_cum_t-1)²)				
	Coefficient	Std. Error	t-Statistic	p-value
a	35.74112	25.49797	1.401725	0.1713
b	0.086741	0.033729	2.571734	0.0153
c	-0.000015	0.000008	-2.007132	0.0538

R-squared	0.284014	Mean dependent var	4.710523
Adjusted R-squared	0.236281	S.D. dependent var	0.774622
S.E. of regression	0.676950	Akaike info criterion	2.144070
Sum squared resid	13.74785	Schwarz criterion	2.280116
Log likelihood	-32.37716	Hannan-Quinn criter.	2.189846
Durbin-Watson stat	1.463174		

Sample: 2009M08 - 2012M04
Included observations: 33
White heteroskedasticity-consistent std. errors & covariance

[27] I additionally estimate VAR(1) and VAR(2) models in order to double check. However, there are no significant effects of participation on community growth.

Values of R^2 range from 0.24 to 0.28 and denote a poor model fit. The SC amounts for 2.28, the AIC reaches a value of 2.14. Moreover, the Bass estimation output shows that only the parameter of the cumulative number of new sign-ups differs significantly from zero at a significance level of 5%. The p-value of the parameter of the squared cumulative number of new sign-ups only slightly exceeds 5%. Thus, the parameter is significant different from zero at a significance level of 6%.

Figure 130 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated Bass Model; Region 4

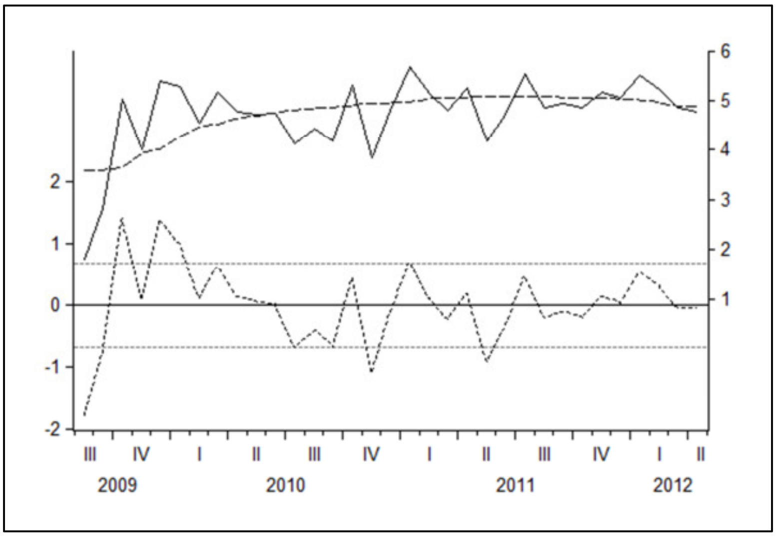


Figure 131 Actual (——) and Forecasted (– –) Values of ln_new_signups (Bass); Region 4

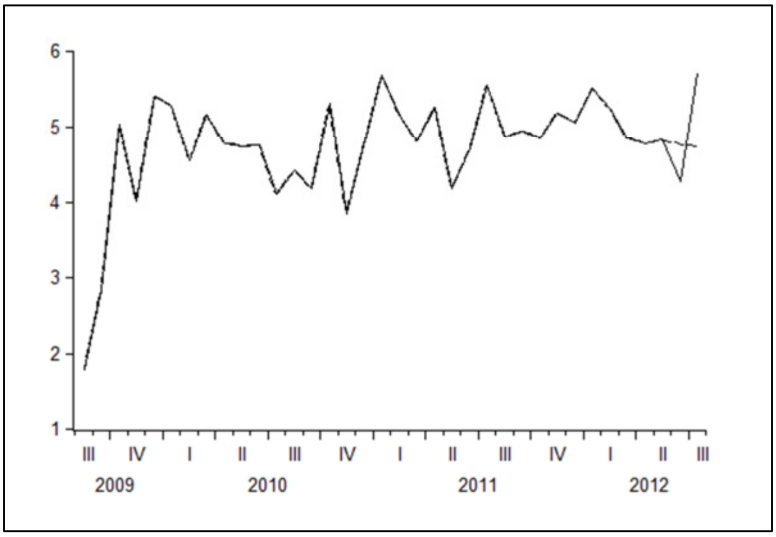


Figure 130 illustrates the estimated values, which follow the typical curvilinear course of new sign-ups in a Bass model, together with the actual values. The poor model fit seemingly results from the deviations between actual and estimated values, which are observable especially in the beginning and in the middle of the observation sample. From the one-step-ahead forecast procedure, values for RMSE=0.645011 and MAE=0.506322 are obtained. The deviations of the forecasted values from the actual values are displayed in Figure 131.

ARMA

Next, I make use of an ARMA process in order to model community growth. From the ACF and PACF displayed in Figure 132 one may conclude that an ARMA(0,0) should be appropriate because neither ACF nor PACF show significant peaks. Additionally, ARMA specifications up to order 2 are compared using SC. The value of SC is minimal for an AR(2) process with SC=1.57 (see Appendix 115). After estimation of an AR(2) model the null hypotheses of Jarque-Bera and Breusch-Godfrey test cannot be rejected (see Appendix 114). However, the null hypothesis of the White test is rejected, which implies heteroskedasticity in the residuals (see Appendix 114). For this reason, the model is estimated again using the White heteroskedasticity consistent covariance matrix estimator.

Figure 132 Correlogram of ln_new_signups; Region 4

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.277	0.277	2.760	0.097
		2	0.057	-0.021	2.880	0.237
		3	0.144	0.145	3.680	0.298
		4	-0.164	-0.268	4.756	0.313
		5	-0.069	0.068	4.952	0.422
		6	0.034	0.008	5.000	0.544
		7	-0.087	-0.038	5.336	0.619
		8	-0.058	-0.068	5.493	0.704
		9	0.046	0.072	5.593	0.780
		10	0.121	0.149	6.331	0.787
		11	0.089	0.001	6.747	0.819
		12	0.174	0.129	8.419	0.752
		13	0.085	-0.035	8.834	0.785
		14	-0.074	-0.052	9.166	0.820
		15	0.133	0.170	10.293	0.801
		16	-0.115	-0.226	11.186	0.798

Sample: 2009M08 - 2012M04
Included observations: 33

Table 28 ARMA Estimation Output; Region 4

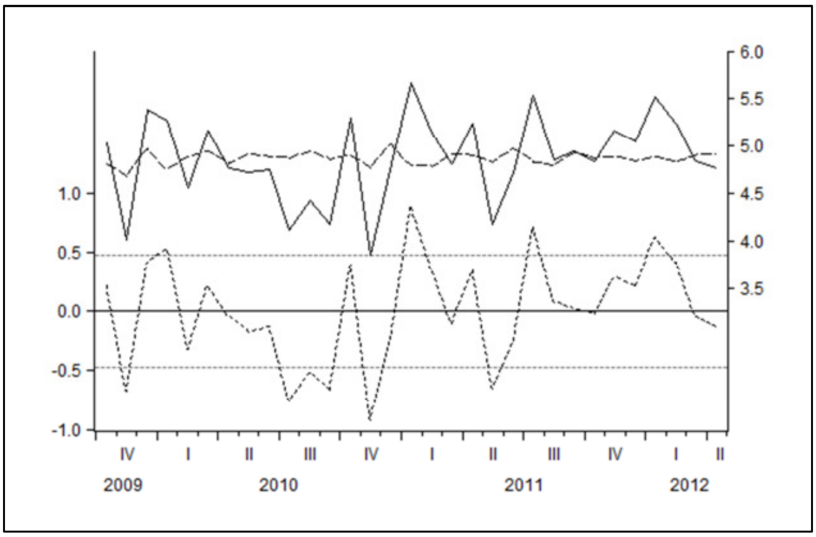
Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	4.872676	0.077891	62.55758	0.0000
AR(1)	-0.103224	0.147199	-0.701252	0.4889
AR(2)	0.087057	0.126263	0.689494	0.4962

R-squared	0.025050	Mean dependent var	4.865235
Adjusted R-squared	-0.044589	S.D. dependent var	0.462450
S.E. of regression	0.472648	Akaike info criterion	1.430832
Sum squared resid	6.255079	Schwarz criterion	1.569605
Log likelihood	-19.17790	Hannan-Quinn criter.	1.476069
F-statistic	0.359717	Durbin-Watson stat	1.898836
Prob(F-statistic)	0.701052		
Inverted AR Roots	.25	-.35	

Sample (adjusted): 2009M10 - 2012M04
Included observations: 31 (after adj.)
White heteroskedasticity-consistent std. errors & covariance

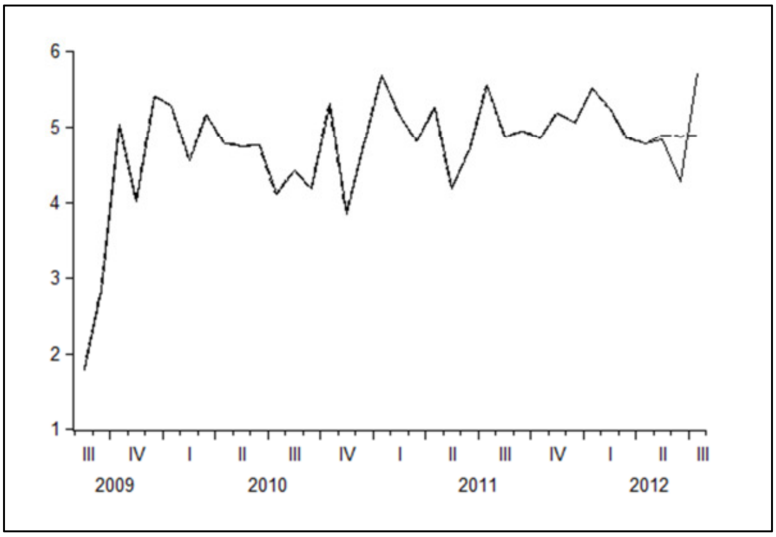
Estimation results are presented in Table 28. The goodness of fit is extremely poor because R² values do not exceed a value of 0.03. The AIC equals 1.43. Further, the coefficients of the AR components do not significantly differ from zero at a significance level of 5%. Hence, in this model, past values of the logarithmized number of new sign-ups have no significant influence on the current value of the logarithmized number of new

Figure 133 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated ARMA Model; Region 4



sign-ups. However, the AR components need to be included because of stability and performance issues. Figure 133 displays the deviations of the estimated values from the actual values. Lastly, the one-step-ahead forecast procedure generates values of RMSE=0.599637 and MAE=0.499543 based on the forecast sample ranging from May 2012 to July 2012. The deviations of the forecasted values from the observed values are presented in Figure 134.

Figure 134 Actual (——) and Forecasted (– –) Values of ln_new_signups (ARMA); Region 4



ADL (d_ln_posters)

In the following, community growth of region 4 is analyzed by the help of an ADL model that includes the growth rate of the number of posters. I use the SC in order to compare different ADL specifications up to lag order 2. The SC selects a model containing *ln_new_signups_t-1* and *d_ln_posters* as exogenous variables (see Appendix 116). Since this specification yields heteroskedasticity in the residuals, but null hypotheses of normality and autocorrelation tests are not rejected (see Appendix 114), the model is estimated again using a heteroskedasticity consistent covariance matrix estimator. As can be seen from the estimation output in Table 29, both R^2 values of R^2=0.58 and adjusted R^2=0.55 indicate an acceptable goodness of fit. Moreover, the SC accounts for 1.18, the AIC equals 1.05. The output further reveals that all variables exert a significant positive influence on *ln_new_signups*. In the short term, for example, a one percentage point increase in the growth rate of the number of posters at *t* leads to an immediate 0.61% increase in the number of new sign-ups.

Table 29 ADL (d_ln_posters) Estimation Output; Region 4

Dependent Variable: ln_new_signups				
	Coefficient	Std. Error	t-Statistic	p-value
Constant	2.110938	0.479505	4.402330	0.0001
ln_new_signups_t-1	0.548282	0.100828	5.437776	0.0000
d_ln_posters	0.614068	0.154132	3.984046	0.0004

R-squared	0.575191	Mean dependent var	4.801734
Adjusted R-squared	0.545894	S.D. dependent var	0.579652
S.E. of regression	0.390612	Akaike info criterion	1.046857
Sum squared resid	4.424759	Schwarz criterion	1.184270
Log likelihood	-13.74971	Hannan-Quinn criter.	1.092405
F-statistic	19.63297	Durbin-Watson stat	2.471874
Prob(F-statistic)	0.000004	Wald F-statistic	15.05387
Prob(Wald F-statistic)	0.000033		

Sample (adjusted): 2009M09 - 2012M04
Included observations: 32 (after adj.)
White heteroskedasticity-consistent std. errors & covariance

Figure 135 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated ADL (d_ln_posters) Model; Region 4

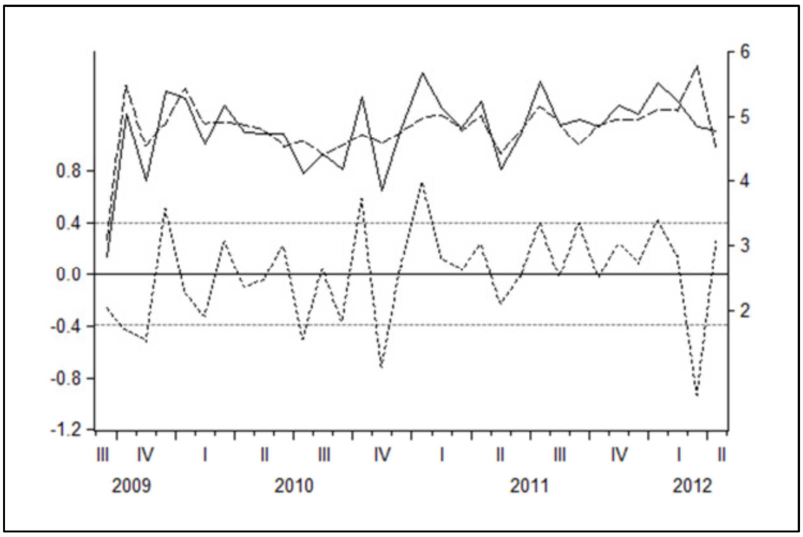


Figure 135 displays the estimated model together with the actual values. The one-step-ahead forecast procedure generates values of RMSE=0.364028 and MAE=0.299059. Figure 136 contrasts the graphs of actual and forecasted values. Finally, the model is estimated again adding a team variable. Since also in this case heteroskedasticity in the residuals plays a role (see Appendix 114), the ADL model is estimated using a heteroskedasticity consistent covariance matrix estimator. The estimation results of the ADL model including both posters and team variables are displayed in Table 30 (see Appendix 117 for model selection). Again, the team variable does not contribute to the explication community growth. Yet, all other variables exert a highly significant positive influence on *ln_new_signups*.

Figure 136 Actual (——) and Forecasted (– –) Values of ln_new_signups (ADL d_ln_posters); Region 4

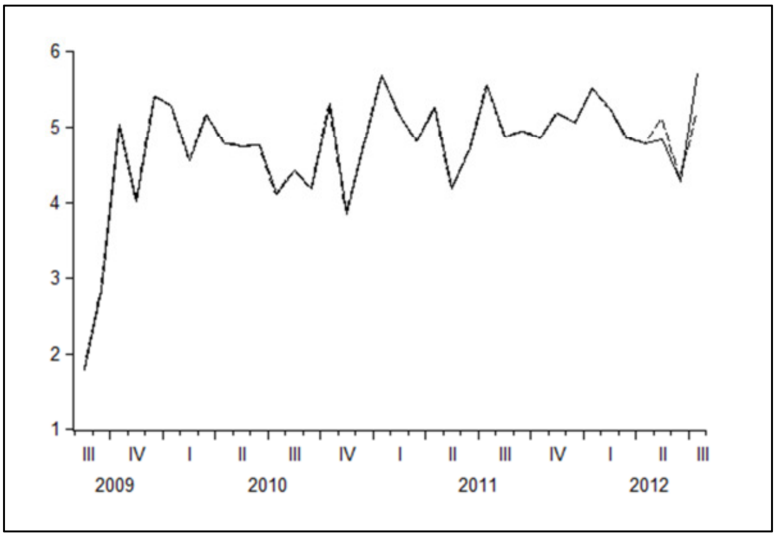


Table 30 ADL (d_ln_posters, d_ln_team) Estimation Output; Region 4

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	2.119295	0.493554	4.293944	0.0002
ln_new_signups_t-1	0.545728	0.104560	5.219305	0.0000
d_ln_posters	0.614001	0.156536	3.922422	0.0005
d_ln_team	0.107203	0.161620	0.663306	0.5126

R-squared	0.575849	Mean dependent var	4.801734
Adjusted R-squared	0.530404	S.D. dependent var	0.579652
S.E. of regression	0.397218	Akaike info criterion	1.107807
Sum squared resid	4.417904	Schwarz criterion	1.291024
Log likelihood	-13.72490	Hannan-Quinn criter.	1.168538
F-statistic	12.67141	Durbin-Watson stat	2.492385
Prob(F-statistic)	0.000021	Wald F-statistic	13.96776
Prob(Wald F-statistic)	0.000009		

Sample (adjusted): 2009M09 - 2012M04
Included observations: 32 (after adj.)
White heteroskedasticity-consistent std. errors & covariance

ADL (d_ln_participation)

Next, the growth rate of participation is included into the ADL model. Different ADL specifications up to lag order 2 are compared by the help of the SC. The SC is minimal for the model that includes lagged dependent variables up to lag order 2 and the contemporaneous participation variable (see Appendix 118). Since the null hypotheses of the Jarque-Bera, the Breusch-Godfrey, and the White test are not rejected, there is no need to adjust the model (see Appendix 114). The results of the model estimation are displayed in Table 31. Both R^2 values ranging from 0.26 to 0.33 imply a relatively poor goodness of fit. The SC amounts to 1.30, the AIC equals 1.12. Further, the estimation output reveals that the coefficients of *ln_new_signups_t-1* and *ln_new_signups_t-2* are not significant at a significance level of 5%. However, *d_ln_participation* exerts a significant positive influence on *ln_new_signups*.

Table 31 ADL (d_ln_participation) Estimation Output; Region 4

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	2.917749	0.859192	3.395921	0.0021
ln_new_signups_t-1	0.235342	0.164236	1.432955	0.1633
ln_new_signups_t-2	0.154473	0.100019	1.544440	0.1341
d_ln_participation	0.414070	0.117469	3.524948	0.0015

R-squared	0.332315	Mean dependent var	4.865235
Adjusted R-squared	0.258128	S.D. dependent var	0.462450
S.E. of regression	0.398317	Akaike info criterion	1.116778
Sum squared resid	4.283729	Schwarz criterion	1.301809
Log likelihood	-13.31006	Hannan-Quinn criter.	1.177094
F-statistic	4.479418	Durbin-Watson stat	2.330319
Prob(F-statistic)	0.011205		

Sample (adjusted): 2009M10 - 2012M04
Included observations: 31 (after adj.)

Figure 137 presents estimated values together with the actual values. Finally, the static one-step-ahead forecast procedure yields values of RMSE=0.222048 and MAE=0.180803 based on the forecast sample ranging from May 2012 to July 2012. Figure 138 displays forecasted and actual values.

Figure 137 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated ADL (d_ln_participation) Model; Region 4

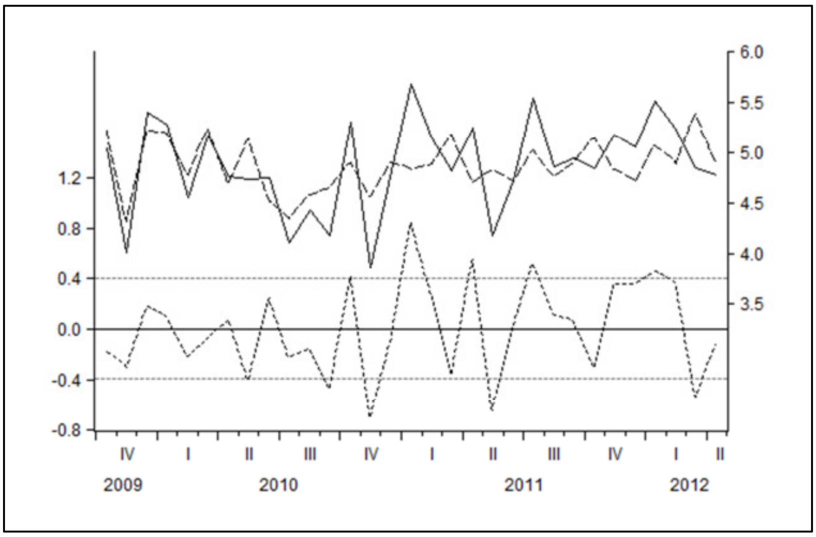
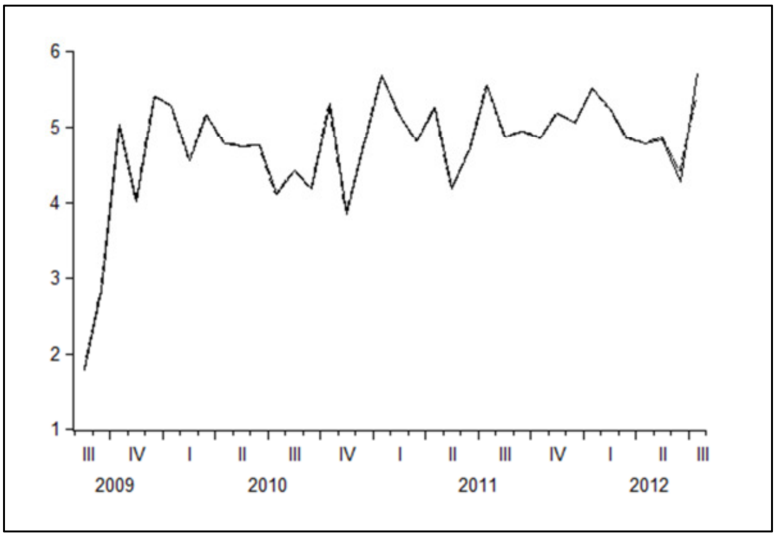


Figure 138 Actual (——) and Forecasted (– –) Values of ln_new_signups (ADL d_ln_participation); Region 4



Because of the insignificant influence of the team variable on community growth in the ADL posters and in the ADL participation (see Appendix 119) model, I dispense with considering the team variable in the following analyses of region 4.

VAR (d_ln_posters)

In the remaining sections of Chapter 4.5.4, I try to find a VAR specification that describes community growth of region 4 best. First, I concentrate on the influence of the poster variable, i.e. the growth rate of the number of posters. The SC value is minimal for a VAR(0) process, i.e. a VAR model without any dynamics, which only includes a constant term (see Appendix 120). Thus, a VAR model containing the poster variable is not a good choice for the explanation of community growth in region 4.[28]

VAR (d_ln_participation)

Finally, I consider the role of the participation variable, i.e. the growth rate of the number of contributions, in explaining community growth of region 4 by a VAR approach. The SC selects again a VAR(0) model as the model that obtains the smallest SC value among VAR specifications up to lag order 4 (see Appendix 121). Thus, a VAR model including the participation variable is also unsuitable for modeling community growth in region 4.[29]

4.5.5. Region 5

Bass

I start the analysis of community growth in region 5 by estimating a (modified) Bass diffusion model. The estimation results are displayed in Table 32. Since the null hypotheses of the Jarque-Bera, Breusch-Godfrey, and White test cannot be rejected at a significance level of 5% (Appendix 122), it is not necessary to make any adaptions to the model.

Table 32 Bass Estimation Output; Region 5

Dependent Variable: ln_new_signups

ln_new_signups=ln(a+b*new_signups_cum_t-1+c*(new_signups_cum_t-1)²)

	Coefficient	Std. Error	t-Statistic	p-value
a	121.5248	24.04103	5.054891	0.0000
b	0.051516	0.021976	2.344205	0.0259
c	-0.000008	0.000004	-2.308875	0.0280

R-squared	0.131725	Mean dependent var	5.130377
Adjusted R-squared	0.073840	S.D. dependent var	0.410142
S.E. of regression	0.394710	Akaike info criterion	1.065176
Sum squared resid	4.673872	Schwarz criterion	1.201222
Log likelihood	-14.57540	Hannan-Quinn criter.	1.110951
Durbin-Watson stat	1.532486		

Sample: 2009M08 - 2012M04
Included observations: 33

[28] I additionally estimate VAR(1) and VAR(2) models in order to double check. VAR(1) is misspecified because of autocorrelation. Further, IRFs of VAR(2) show a positive response of new sign-ups to a shock in the poster variable.

[29] I additionally estimate VAR(1) and VAR(2) models in order to double check. VAR(1) is misspecified because of autocorrelation. Further, IRFs of VAR(2) show a positive response of new sign-ups to a shock in the participation variable.

Both R² values with $R^2=0.13$ and adjusted $R^2=0.07$ refer to a quite poor model fit. The SC reaches a value of 1.20, the AIC reaches a value of 1.07. Further, the estimation output shows that all parameters are significantly different from zero at a significance level of 5%. Although the estimated model fits into the observed values, some deviations are visible, which imply the poor R² values (see Figure 139). Finally, from the one-step-ahead forecast procedure, which is based on the sample ranging from May 2012 to July 2012, follow RMSE=0.588346 and MAE=0.535764. Figure 140 contrasts actual values with forecasted values.

Figure 139 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated Bass Model; Region 5

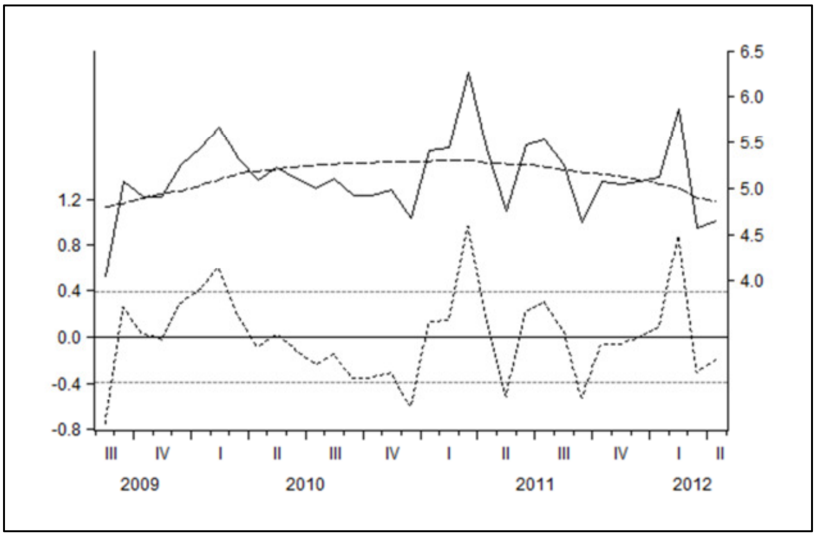
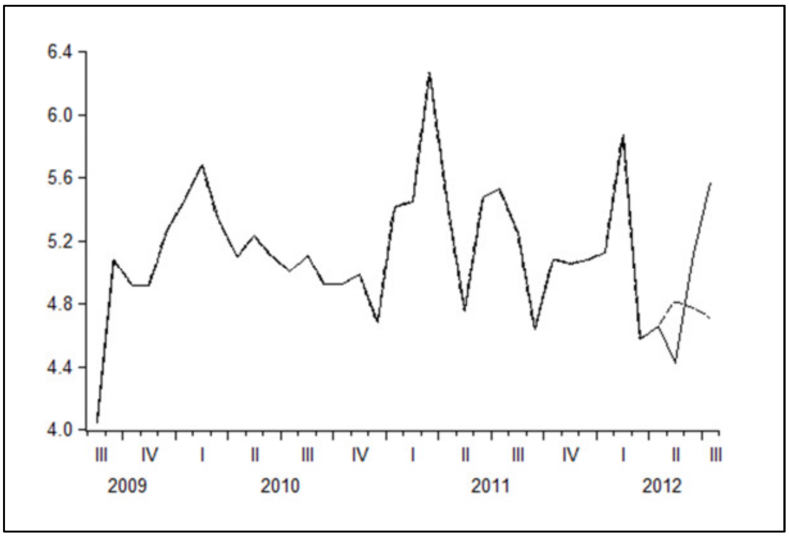


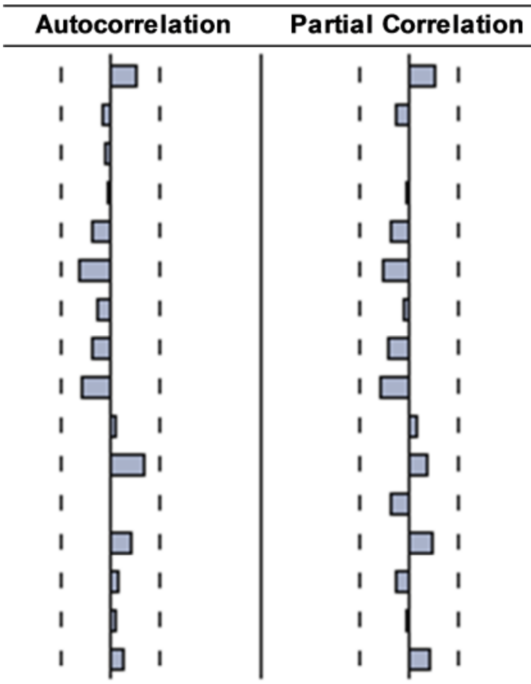
Figure 140 Actual (——) and Forecasted (– –) Values of ln_new_signups (Bass); Region 5



ARMA

In this section, community growth of region 5 is analyzed by the help of an ARMA process. The correlogram displayed in Figure 141 implies an ARMA(0,0) process because neither the ACF nor the PACF show any significant peaks. In order to check this suggestion, I compare SC values of all ARMA specifications up to order 2. Thereby, the ARMA(2,2) model obtains the lowest SC value among all models (see Appendix 123). However, because of autocorrelation and heteroskedasticity in the residuals, dummy variables for March 2011 and February 2012 need to be included. After the integration of two more variables the model is estimated again. The null hypotheses of the Jarque-Bera, the Breusch-Godfrey, and the Breusch-Pagan-Godfrey test are not rejected because the probability values of the statistics exceed the significance level of 5% (see Appendix 122). The estimation output of the ARMA(2,2) process including both dummy variables is presented in Table 33. The goodness of fit is moderate whereby R^2 equals 0.50 and the adjusted R^2 does not exceed a value of 0.38. The SC reaches a value of 0.91, the AIC a value of 0.59.

Figure 141 Correlogram of ln_new_signups; Region 5



	AC	PAC	Q-Stat	Prob
1	0.177	0.177	1.129	0.288
2	-0.060	-0.094	1.263	0.532
3	-0.029	-0.001	1.295	0.730
4	-0.017	-0.017	1.307	0.860
5	-0.134	-0.136	2.053	0.842
6	-0.218	-0.181	4.095	0.664
7	-0.084	-0.039	4.411	0.731
8	-0.121	-0.151	5.087	0.748
9	-0.201	-0.204	7.027	0.634
10	0.030	0.043	7.074	0.718
11	0.223	0.131	9.679	0.559
12	0.006	-0.132	9.681	0.644
13	0.138	0.159	10.777	0.629
14	0.043	-0.098	10.890	0.695
15	0.035	-0.025	10.971	0.755
16	0.082	0.136	11.429	0.782

Sample: 2009M08 - 2012M04
Included observations: 33

Table 33 ARMA Estimation Output; Region 5

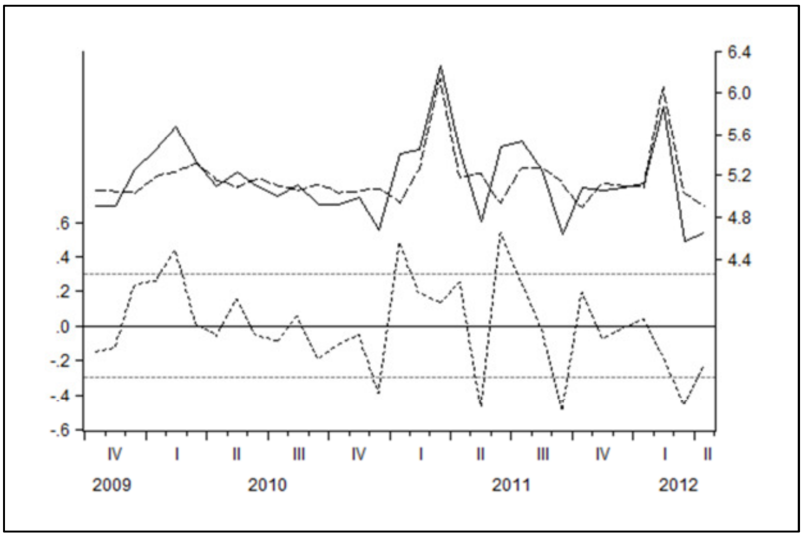
Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	5.102097	0.082984	61.48283	0.0000
DUM2011M03	0.897087	0.312426	2.871359	0.0084
DUM2012M02	0.933429	0.276407	3.377014	0.0025
AR(1)	-0.053967	1.856067	-0.029076	0.9770
AR(2)	0.015054	0.294356	0.051143	0.9596
MA(1)	0.477591	1.841864	0.259298	0.7976
MA(2)	0.121094	0.756841	0.159999	0.8742

R-squared	0.500000	Mean dependent var	5.167032
Adjusted R-squared	0.375000	S.D. dependent var	0.372228
S.E. of regression	0.294272	Akaike info criterion	0.587056
Sum squared resid	2.078307	Schwarz criterion	0.910860
Log likelihood	-2.099372	Hannan-Quinn criter.	0.692608
F-statistic	3.999998	Durbin-Watson stat	1.974166
Prob(F-statistic)	0.006470		

Inverted AR Roots	.10	-.15
Inverted MA Roots	-.24+.25i	-.24-.25i

Sample (adjusted): 2009M10 - 2012M04
Included observations: 31 (after adj.)

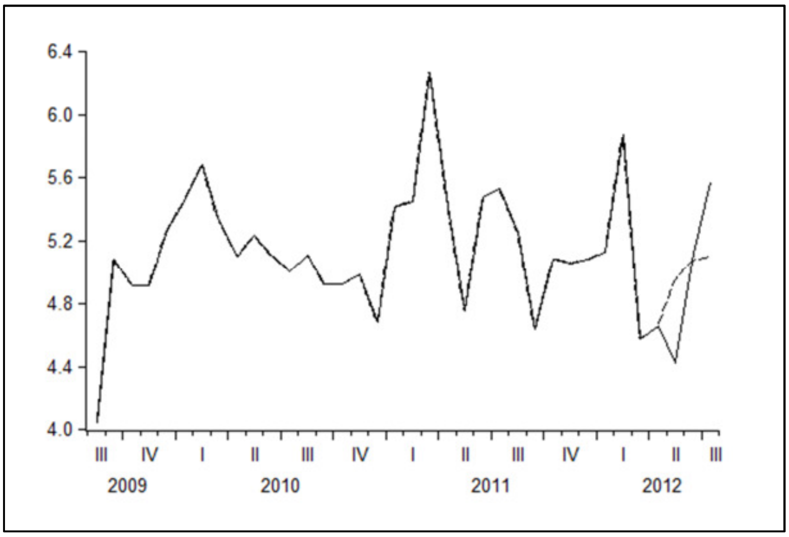
Figure 142 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated ARMA Model; Region 5



Besides, the estimation results show that all ARMA components are not significant at a significance level of 5%. Only the coefficients of the constant term and the dummy variables are significantly different from zero because their probability values do not exceed

5%. Hence, in this model, past values of the logarithmized number of new sign-ups (and also past shocks) have no significant influence on the current value of the logarithmized number of new sign-ups. However, the ARMA components should be included because of stability and performance issues. The above results are also visualized by Figure 142, which displays the estimated model together with the actual data. The static one-step-ahead forecast procedure yields values of RMSE=0.410786 and MAE=0.346638. The divergence of forecasted values from observed values is presented in Figure 143.

Figure 143 Actual (——) and Forecasted (– –) Values of ln_new_signups (ARMA); Region 5



ADL (d_ln_posters)

Next, I use an ADL model including the growth rate of the number of posters in order to examine community growth of region 5. Among different ADL specifications the model containing *ln_new_signups_t-1*, *ln_new_signups_t-2*, and *d_ln_posters* as exogenous variables is the one which obtains the lowest SC value (see Appendix 124). Since the null hypotheses of the Jarque-Bera, of the Breusch-Godfrey, and of the White test cannot be rejected, no changes to the model have to be made (see Appendix 122). The estimation output reveals that the values of SC and AIC equal 0.62 and 0.43 respectively (see Table 34). Further, both R^2 values ranging from 0.42 to 0.48 imply a moderate goodness of fit. Moreover, the estimation results show that both *ln_new_signups_t-1* and *d_ln_posters* have a significant positive impact on *ln_new_signups* at a significance level of 5% because the probability values are smaller than 5%, whereas *ln_new_signups_t-2* has no

Table 34 ADL (d_ln_posters) Estimation Output; Region 5

Dependent Variable: ln_new_signups				
	Coefficient	Std. Error	t-Statistic	p-value
Constant	2.045054	1.069231	1.912639	0.0665
ln_new_signups_t-1	0.642959	0.168989	3.804745	0.0007
ln_new_signups_t-2	-0.052382	0.130736	-0.400671	0.6918
d_ln_posters	1.140439	0.242595	4.701006	0.0001

R-squared	0.481103	Mean dependent var	5.167032
Adjusted R-squared	0.423448	S.D. dependent var	0.372228
S.E. of regression	0.282637	Akaike info criterion	0.430604
Sum squared resid	2.156853	Schwarz criterion	0.615635
Log likelihood	-2.674368	Hannan-Quinn criter.	0.490920
F-statistic	8.344492	Durbin-Watson stat	1.788853
Prob(F-statistic)	0.000436		

Sample (adjusted): 2009M10 - 2012M04
Included observations: 31 (after adj.)

Figure 144 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated ADL (d_ln_posters) Model; Region 5

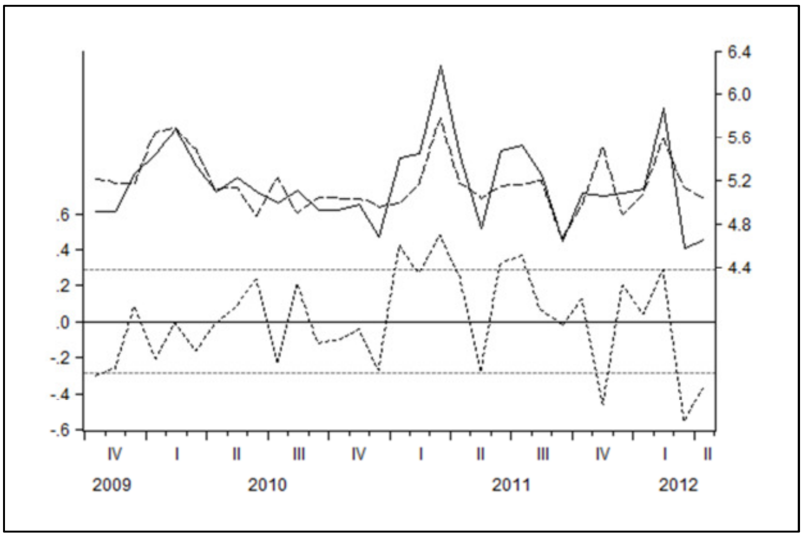
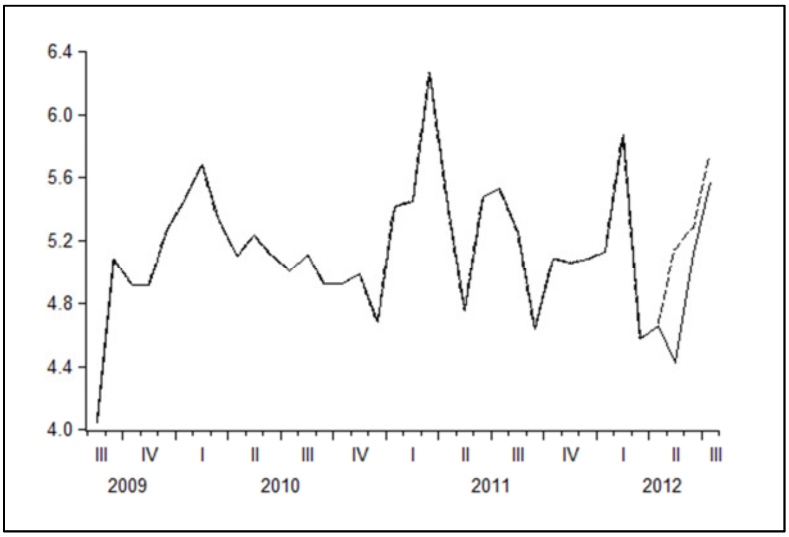


Figure 145 Actual (——) and Forecasted (– –) Values of ln_new_signups (ADL d_ln_posters); Region 5



significant impact. In the short term, a one percentage point increase in the poster variable at time *t* leads to a considerable immediate increase of 1.14% in the number of new sign-ups. Thus, again there is evidence for the role of the poster variable in explaining community growth. Figure 144 displays the estimated model together with the actual values. Based on the forecast sample ranging from May 2012 to July 2012, the static one-step-ahead forecast procedure generates values, which exceed the actual values as displayed in Figure 145. This leads to values of RMSE=0.435657 and MAE=0.347253. Finally, an ADL model including both posters and team variables is estimated. The results of the selected ADL specification are presented in Table 35 (see Appendix 125 for model selection). Due to the results of misspecification tests there is no need to make any adaptions to the model (see Appendix 122). The results of the ADL model prove again the contribution of the poster variable and of lagged values of new sign-ups to the explication of current new sign-ups. Further, also the contemporaneous team variable, i.e. *d_ln_team*, differs significantly from zero at a significance level of 5%. The coefficient indicates that, in the short term, a one percentage point increase in *d_ln_team* leads to an immediate decrease of 0.79% in *ln_new_signups*. Yet, a one percentage point increase in *d_ln_posters* leads to a considerable immediate increase of 1.20% in *ln_new_signups*.

Table 35 ADL (d_ln_posters, d_ln_team) Estimation Output; Region 5

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	1.071250	0.885418	1.209881	0.2376
ln_new_signups_t-1	0.782946	0.170326	4.596746	0.0001
d_ln_posters	1.202745	0.222576	5.403742	0.0000
d_ln_team	-0.785024	0.352931	-2.224298	0.0354
d_ln_posters_t-1	-0.171709	0.155799	-1.102121	0.2809
d_ln_team_t-1	0.499045	0.342509	1.457028	0.1576

R-squared	0.596866	Mean dependent var	5.167032
Adjusted R-squared	0.516240	S.D. dependent var	0.372228
S.E. of regression	0.258895	Akaike info criterion	0.307200
Sum squared resid	1.675670	Schwarz criterion	0.584746
Log likelihood	1.238405	Hannan-Quinn criter.	0.397673
F-statistic	7.402838	Durbin-Watson stat	1.825673
Prob(F-statistic)	0.000223		

Sample (adjusted): 2009M10 - 2012M04
Included observations: 31 (after adj.)

ADL (d_ln_participation)

In the following, an ADL model including the growth rate of participation is specified in order to model community growth of region 5. Among different ADL specifications up to lag order 2, the SC value of the model including the contemporaneous participation variable is minimal (see Appendix 126). Null hypotheses of normality, autocorrelation, and heteroskedasticity tests are not rejected. Thus, there is no need to make changes to the model (see Appendix 122). Results of the estimated ADL model are displayed in Table 36. The SC value adds up to 1.01, the AIC equals 0.92. Both R^2 values ranging from -0.03 to 0.00 imply a very poor goodness of fit. Further, Table 36 shows that the coefficient of *d_ln_participation* is highly insignificant. Thus, the included participation variable does not help to explain community growth. Figure 146 contrasts the estimated model and actual values. The estimated values differ considerably from the actual values. Finally, the one-step-ahead forecast procedure yields forecast errors of RMSE=0.495176 and MAE=0.407219. The deviations of the forecasted values from the observed values are presented in Figure 147.

Table 36 ADL (d_ln_participation) Estimation Output; Region 5

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	5.165317	0.066539	77.62895	0.0000
d_ln_participation	-0.011952	0.119117	-0.100334	0.9207

R-squared	0.000335	Mean dependent var	5.164356
Adjusted R-squared	-0.032987	S.D. dependent var	0.366488
S.E. of regression	0.372483	Akaike info criterion	0.923213
Sum squared resid	4.162319	Schwarz criterion	1.014822
Log likelihood	-12.77142	Hannan-Quinn criter.	0.953579
F-statistic	0.010067	Durbin-Watson stat	1.527128
Prob(F-statistic)	0.920747		

Sample (adjusted): 2009M09 - 2012M04
Included observations: 32 (after adj.)

Figure 146 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated ADL (d_ln_participation) Model; Region 5

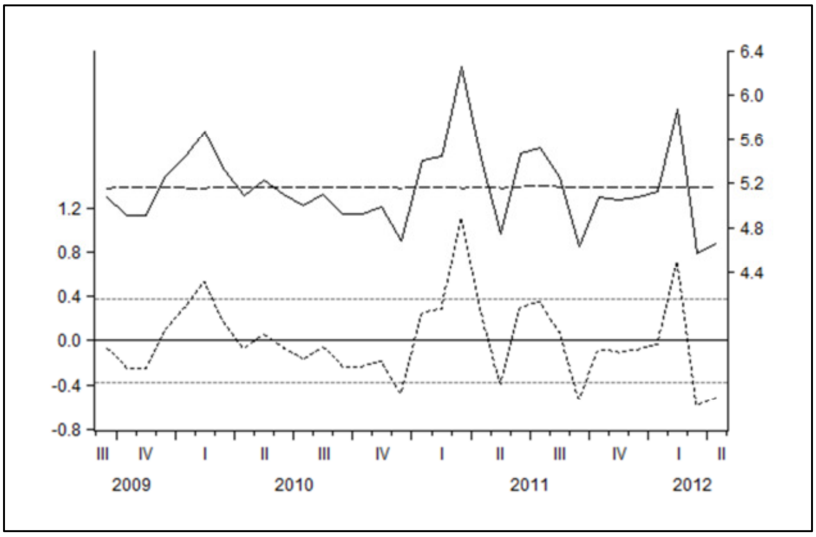
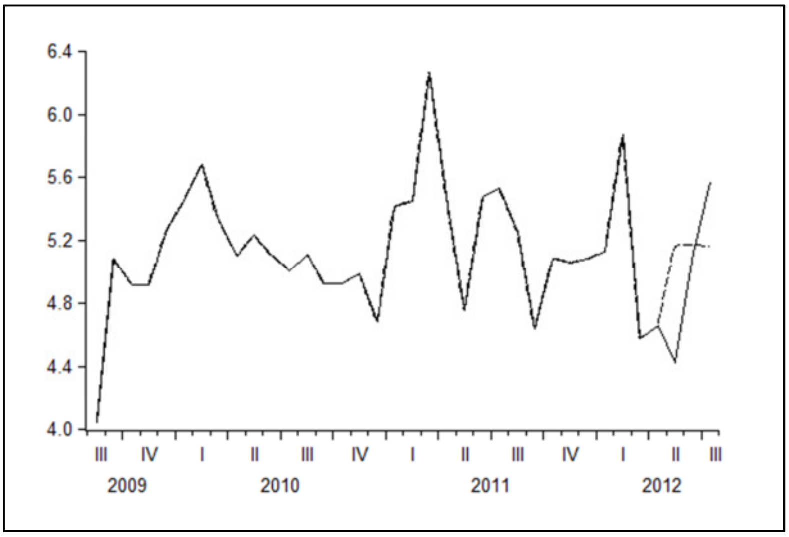


Figure 147 Actual (——) and Forecasted (– –) Values of ln_new_signups (ADL d_ln_participation); Region 5



Due to results of most ADL models including a team variable and the consequential low importance of the team variable in explaining community growth (see also Appendix 127), I do not consider a team variable in the following analyses of region 5.

VAR (d_ln_posters)

Next, I investigate community growth of region 5 by the help of a VAR process including the poster variable. The SC is minimal for a VAR(1) process (see Appendix 128). The null hypotheses of the VAR normality test assuming normality, of the VAR White heteroskedasticity test assuming no heteroskedasticity, and the VAR autocorrelation LM test assuming no serial correlation (up to lag order 4) are not rejected (see Appendix 129). Hence, the VAR model is correctly specified. The VAR(1) process yields values of SC=0.55 and AIC=0.28 (see Appendix 130). Figure 148 shows actual values of the logarithmized number of new sign-ups as well as values which are generated through the VAR model. IRFs are illustrated in Figure 149. The IRF at the bottom left shows that an impulse in the poster variable is followed by a positive response of community growth, which is significant up to one month. The IRF at the top right implies that there is a negative response of the poster variable to a shock in new sign-ups, which stays significant for about two months. Further, both own-variable IRFs show that a shock in the variable is followed by a positive response of the respective variable, which is significant up to one month.

Figure 148 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated VAR (d_ln_posters) Model; Region 5

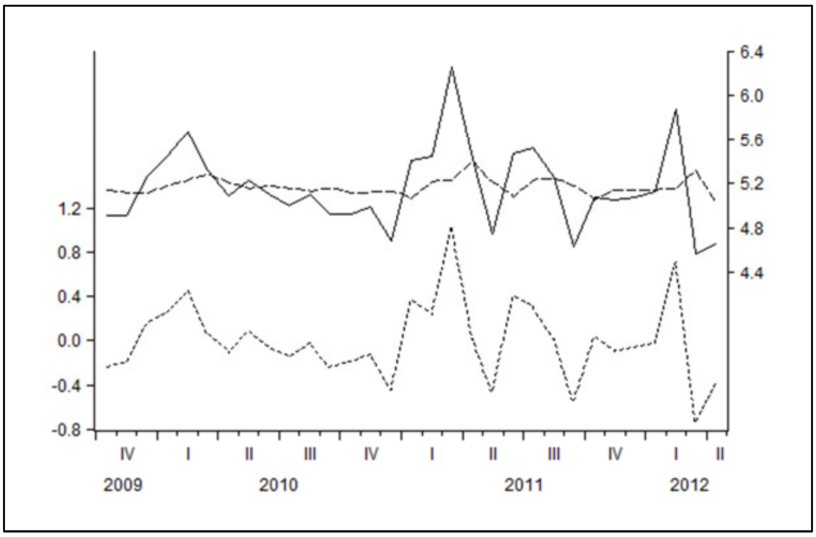
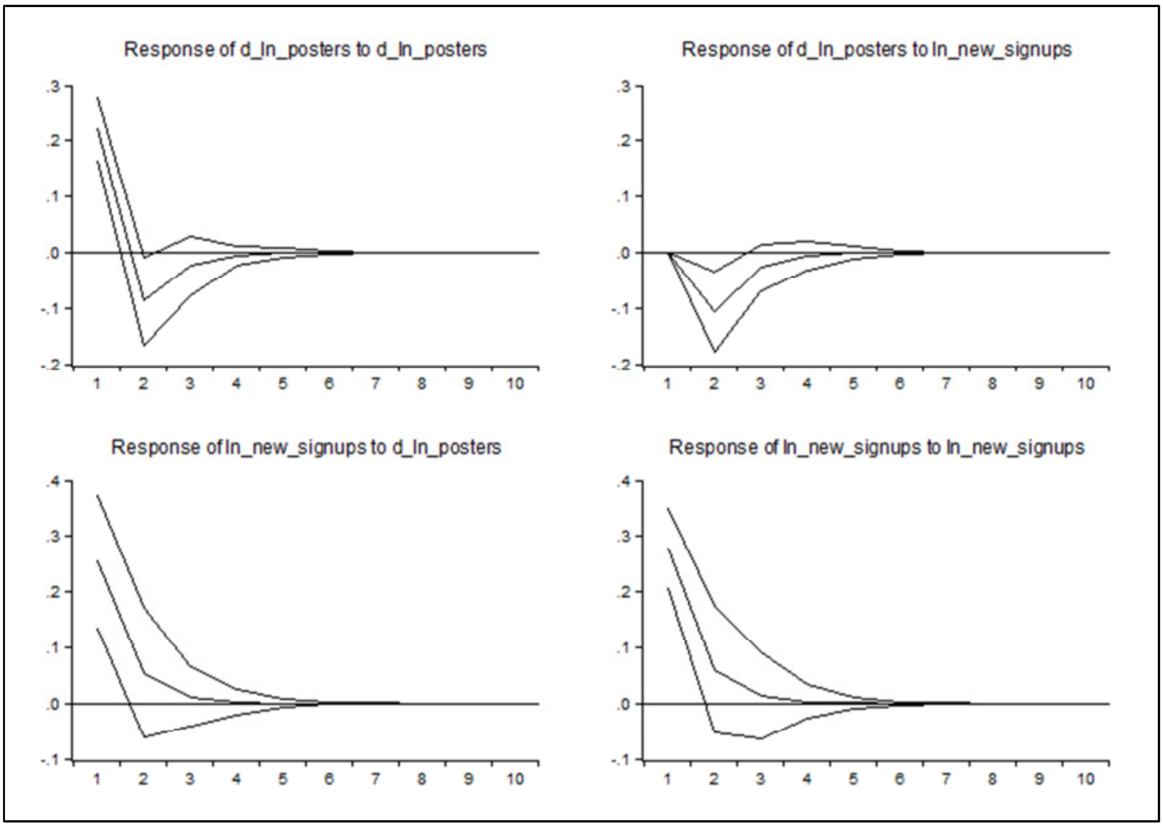
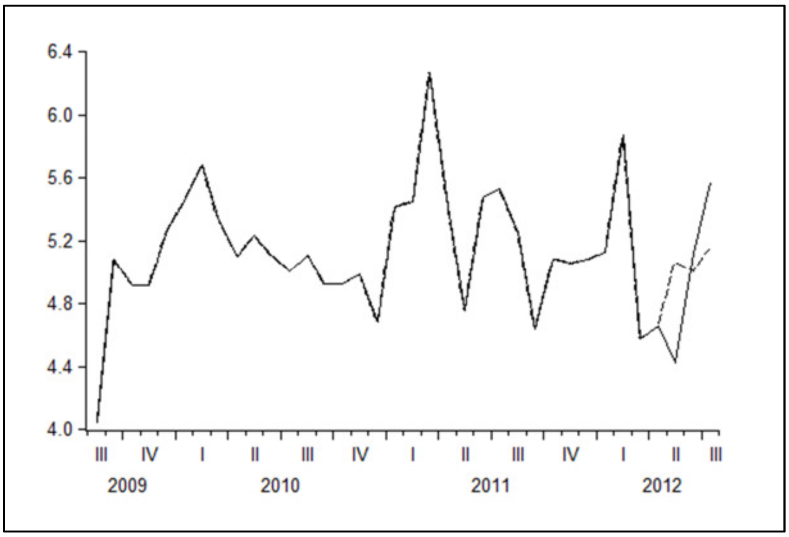


Figure 149 Impulse Response Functions, d_ln_posters ln_new_signups, Response to Cholesky One S. D. Innovations ± 2 S. E.; Region 5



Finally, based on the forecast sample ranging from May 2012 to July 2012, the one-step-ahead forecast procedure generates values, which are depicted in Figure 150 together with the observed values. The deviations of the forecasted values from the observed values are reflected in the forecast errors of RMSE=0.443818 and MAE=0.387960.

Figure 150 Actual (——) and Forecasted (– –) Values of ln_new_signups (VAR d_ln_posters); Region 5



VAR (d_ln_participation)

In the final section of Chapter 4.5.5, I investigate the role of the participation variable, i.e. the growth rate of the number of contributions, in explaining community growth by a VAR approach. The SC is minimal for a VAR(0) process (see Appendix 131). This indicates that a dynamic VAR approach is not consistent with the data. The analysis of community growth in region 5 by a VAR model including the growth rate of the number of contributions does not give any added value.[30]

4.5.6. Region 6

Bass

Finally, community growth of region 6 is analyzed. For this purpose, I start again with the (modified) Bass diffusion model. Null hypotheses of Jarque-Bera, Breusch-Godfrey, and White test cannot be rejected (Appendix 132). Thus, a modification of the model is not necessary. The estimation results of the Bass model are shown in Table 37. Both values of R^2 amounting to 0.72 and 0.70 are quite respectable. The value of SC accounts for

30 I additionally estimate VAR(1) and VAR(2) models in order to double check. However, there are no significant effects of participation on community growth.

1.73, the AIC equals 1.60. Further, all model parameters are significantly different from zero. Figure 151 shows the adaption of the estimated Bass model to the observed data and reflects the typical curvilinear relationship between the variables of a Bass model. Further, the one-step-ahead forecast procedure leads to values of RMSE=0.651676 and MAE=0.634025 based on the forecast sample ranging from May 2012 to July 2012. The deviations of the forecasted values from the observed values are illustrated in Figure 152. It is observable that the forecasted values take on lower values than the actual ones.

Table 37 Bass Estimation Output; Region 6

Dependent Variable: ln_new_signups				
ln_new_signups=ln(a+b*new_signups_cum_t-1+c*(new_signups_cum_t-1)²)				
	Coefficient	Std. Error	t-Statistic	p-value
a	23.30942	6.635989	3.512576	0.0014
b	0.145121	0.025782	5.628840	0.0000
c	-0.000020	0.000005	-3.660407	0.0010

R-squared	0.717675	Mean dependent var	4.937071
Adjusted R-squared	0.698853	S.D. dependent var	0.937795
S.E. of regression	0.514633	Akaike info criterion	1.595781
Sum squared resid	7.945399	Schwarz criterion	1.731827
Log likelihood	-23.33038	Hannan-Quinn criter.	1.641556
Durbin-Watson stat	2.085568		

Sample: 2009M08 - 2012M04
Included observations: 33

Figure 151 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated Bass Model; Region 6

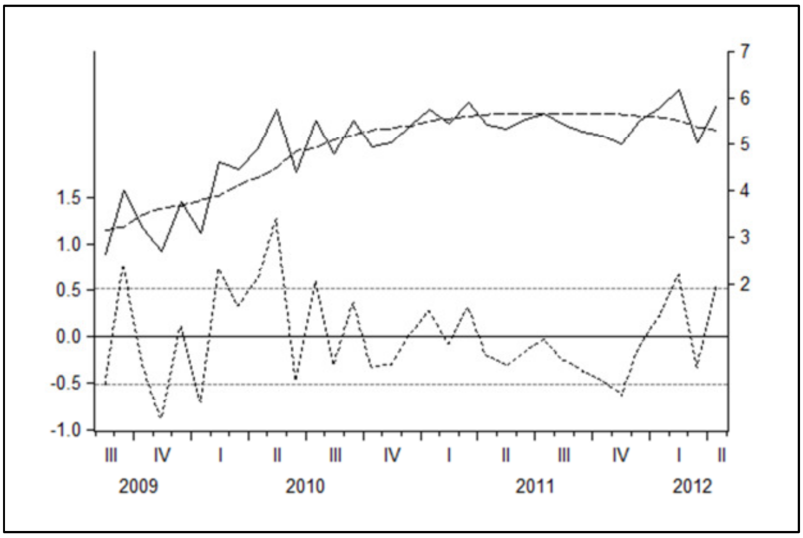
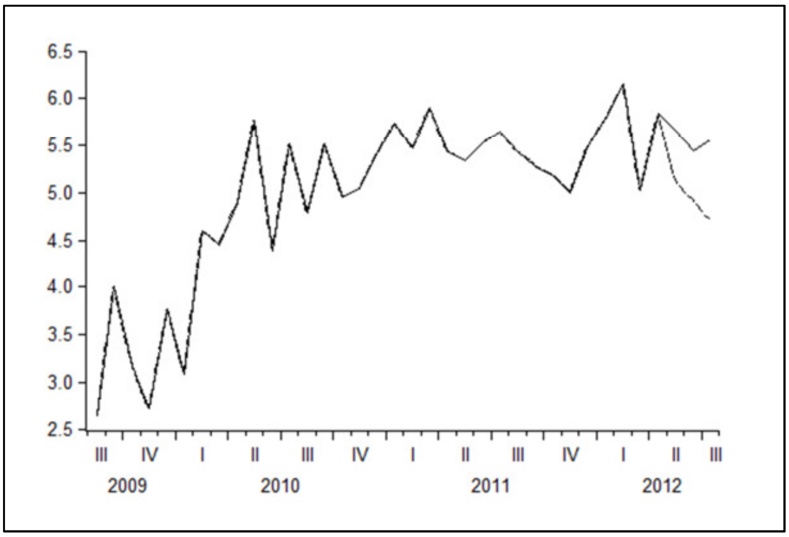


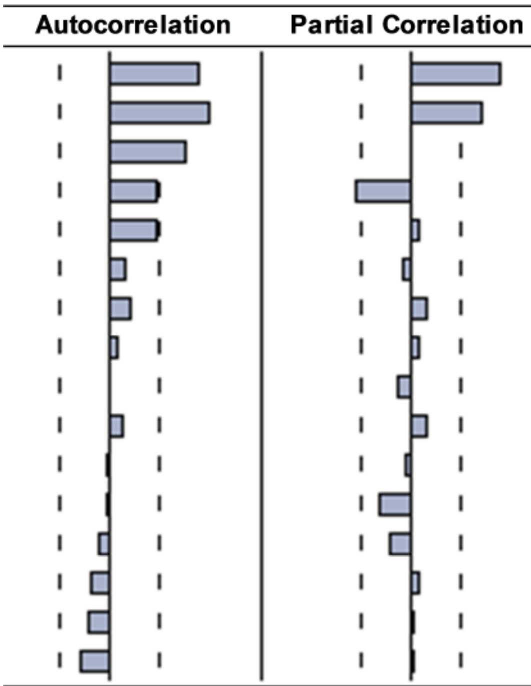
Figure 152 Actual (——) and Forecasted (– –) Values of ln_new_signups (Bass); Region 6



ARMA

In the following, an ARMA process is used in order to investigate community growth of region 6. From ACF and PACF displayed in Figure 153 one may conclude that an AR(2) process is suitable because ACF is geometrically decaying and PACF shows peaks at displacement one and two and afterwards gets insignificant.

Figure 153 Correlogram of ln_new_signups; Region 6



	AC	PAC	Q-Stat	Prob
1	0.618	0.618	13.773	0.000
2	0.683	0.488	31.167	0.000
3	0.519	0.003	41.535	0.000
4	0.322	-0.373	45.668	0.000
5	0.320	0.049	49.905	0.000
6	0.106	-0.062	50.385	0.000
7	0.139	0.099	51.247	0.000
8	0.062	0.054	51.422	0.000
9	-0.001	-0.093	51.422	0.000
10	0.088	0.108	51.808	0.000
11	-0.021	-0.026	51.830	0.000
12	-0.018	-0.212	51.849	0.000
13	-0.082	-0.145	52.235	0.000
14	-0.135	0.043	53.347	0.000
15	-0.149	0.020	54.776	0.000
16	-0.205	0.011	57.626	0.000

Sample: 2009M08 - 2012M04
Included observations: 33

However, to get a more detailed idea of the best ARMA specification, I compare SC values of all ARMA specifications up to order 2. The SC selects an ARMA(1,1) process because the SC of this specification, reaching a value of 1.08, is minimal among all models (see Appendix 133). Since the results of autocorrelation and heteroskedasticity tests show evidence for autocorrelation and heteroskedasticity in the residuals, a dummy variable for September 2009 is added to the model. The ARMA(1,1) model is estimated again together with the dummy variable. Null hypotheses of the Jarque-Bera, the Breusch-Godfrey, and the White test are rejected because the probability values of the corresponding statistics exceed the significance level of 5% (see Appendix 132). The estimation results of the ARMA(1,1) process including the dummy variable are presented in Table 38. Although the SC value increases to 1.32 due to the inclusion of the dummy variable, both R^2 values ranging from 0.78 to 0.80 imply a good fit of the estimated model. The AIC equals 1.14. Further, the coefficients of all ARMA components are significantly different from zero even at a significance level of 1%. Thus, current values of the logarithmized number of new sign-ups are influenced by their past values, more precisely by the by one period lagged values, as well as by current and by one period lagged shocks.

Table 38 ARMA Estimation Output; Region 6

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	5.553274	0.072253	76.85918	0.0000
DUM2009M09	1.898583	0.653126	2.906919	0.0071
AR(1)	0.818617	0.033129	24.71011	0.0000
MA(1)	-0.960559	0.098889	-9.713540	0.0000

R-squared	0.798649	Mean dependent var	5.008884
Adjusted R-squared	0.777076	S.D. dependent var	0.855661
S.E. of regression	0.403999	Akaike info criterion	1.141661
Sum squared resid	4.570028	Schwarz criterion	1.324878
Log likelihood	-14.26657	Hannan-Quinn criter.	1.202392
F-statistic	37.02020	Durbin-Watson stat	2.436044
Prob(F-statistic)	0.000000		

Inverted AR Roots	.82
Inverted MA Roots	.96

Sample (adjusted): 2009M09 - 2012M04
Included observations: 32 (after adj.)

Figure 154 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated ARMA Model; Region 6

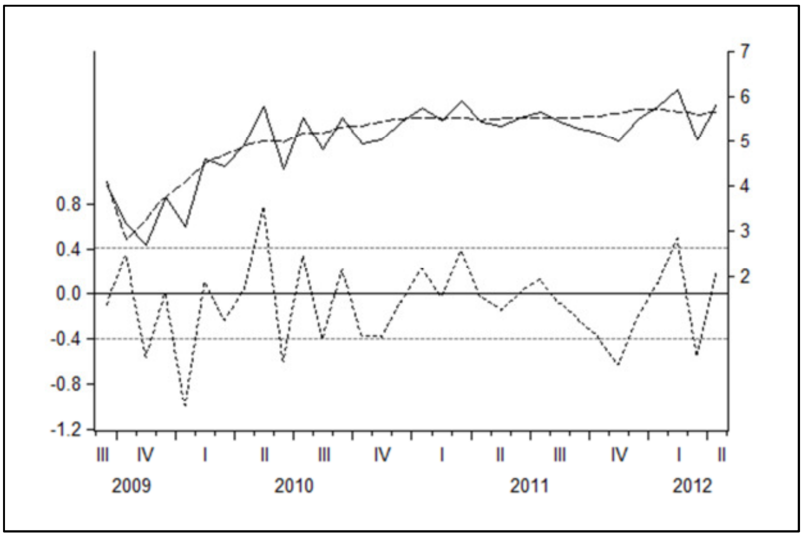
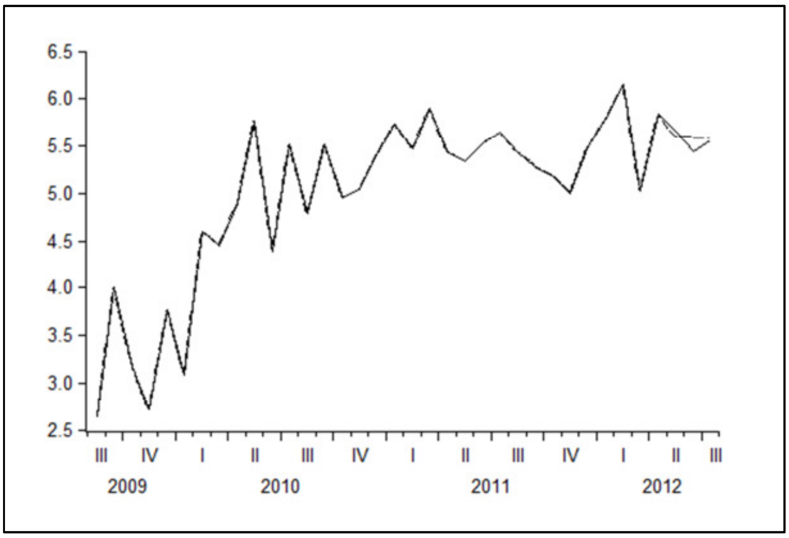


Figure 155 Actual (——) and Forecasted (– –) Values of ln_new_signups (ARMA); Region 6



The results of the estimation output are also reflected in the graphical illustration of the estimated values of new sign-ups together with the actual values (see Figure 154). Finally, the one-step-ahead forecast procedure generates values of RMSE=0.095207 and MAE=0.079101 for the forecast sample ranging from May 2012 to July 2012. These values reflect the relatively small deviations of the forecasted values from the observed values, which are displayed in Figure 155.

ADL (d_ln_posters)

Next, I analyze community growth of region 6 by the help of an ADL model including the growth rate of the number of posters. The SC selects an ADL specification that contains *ln_new_signups_t-1*, *d_ln_posters*, and *d_ln_posters_t-1* as exogenous variables (see Appendix 134). The null hypotheses of normality and autocorrelation tests are not rejected (see Appendix 132). However, results of the White test show evidence for heteroskedasticity in the residuals (see Appendix 132). Thus, the ADL model is estimated again using a heteroskedasticity consistent covariance matrix estimator. The ADL estimation output, which is presented in Table 39, displays both R^2 values, whereby R^2 amounts to a value of 0.83 and adjusted R^2 amounts to a value of 0.81. Thus, the estimated model describes the data quite well. Further, the estimation output displays values of SC=1.18 and AIC=0.99. Moreover, coefficients of lagged new sign-ups and both poster variables are significantly different from zero. More precisely, both *ln_new_signups_t-1* and *d_ln_posters* exert a significant positive influence on *ln_new_signups*. Although *d_ln_posters_t-1* has a negative influence on *ln_new_signups*, the long-run propensity is still positive.

Table 39 ADL (d_ln_posters) Estimation Output; Region 6

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	0.728575	0.727797	1.001068	0.3257
ln_new_signups_t-1	0.861084	0.137417	6.266191	0.0000
d_ln_posters	0.888504	0.118878	7.474049	0.0000
d_ln_posters_t-1	-0.534876	0.133154	-4.016975	0.0004

R-squared	0.825326	Mean dependent var	5.041192
Adjusted R-squared	0.805918	S.D. dependent var	0.849732
S.E. of regression	0.374347	Akaike info criterion	0.992649
Sum squared resid	3.783670	Schwarz criterion	1.177679
Log likelihood	-11.38606	Hannan-Quinn criter.	1.052964
F-statistic	42.52463	Durbin-Watson stat	2.605351
Prob(F-statistic)	0.000000	Wald F-statistic	26.23724
Prob(Wald F-statistic)	0.000000		

Sample (adjusted): 2009M10 - 2012M04
Included observations: 31 (after adj.)
White heteroskedasticity-consistent std. errors & covariance

Figure 156 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated ADL (d_ln_posters) Model; Region 6

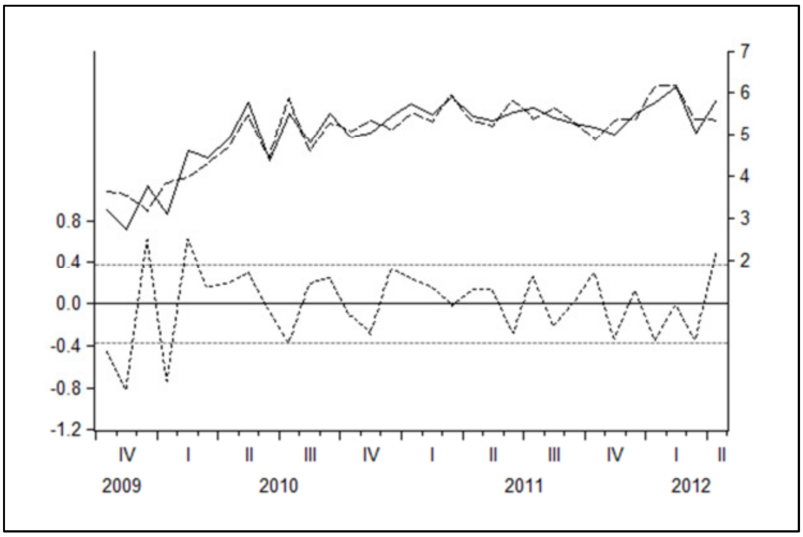


Figure 157 Actual (——) and Forecasted (– –) Values of ln_new_signups (ADL d_ln_posters); Region 6

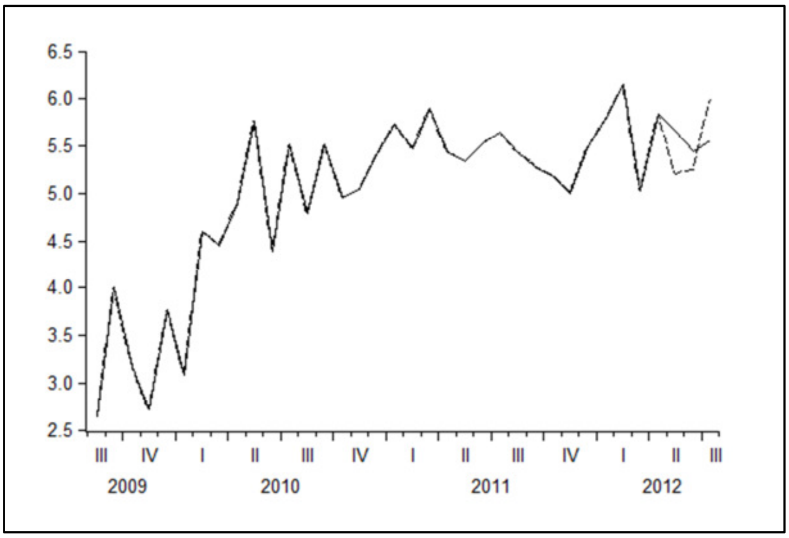


Figure 156 displays the estimated values together with the actual values. The one-step-ahead forecast procedure yields values of RMSE=0.381549 and MAE=0.361416. The deviations of the forecasted values from the actual values are shown in Figure 157. Finally, again team variables are added to the model. The estimation results of the selected ADL specification are displayed in Table 40 (see Appendix 135 for model selection). Results of misspecification tests request no changes to the model (see Appendix 132). The estimation results prove again the positive influence of lagged new sign-ups and the positive influence of *d_ln_posters* on *ln_new_signups*. The coefficient of *ln_new_signups_t-2* is significant at a significance level of 5%. Further, the positive effect of *d_ln_posters* is highly significant at a significance level of 5% and at a significance level of 1%. However, the coefficient of *d_ln_team_t-2* indicates a negative influence on *ln_new_signups*, which is significant at a significance level of 5%, but not at a level of 1%.

Table 40 ADL (d_ln_posters, d_ln_team) Estimation Output; Region 6

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	1.172644	0.395897	2.961994	0.0074
ln_new_signups_t-1	0.343846	0.183181	1.877085	0.0745
ln_new_signups_t-2	0.440884	0.168407	2.617967	0.0161
d_ln_posters	0.843708	0.143713	5.870781	0.0000
d_ln_team	0.493748	0.676425	0.729938	0.4735
d_ln_posters_t-1	-0.016940	0.205677	-0.082363	0.9351
d_ln_team_t-1	-0.034189	0.688334	-0.049669	0.9609
d_ln_posters_t-2	-0.240988	0.159637	-1.509602	0.1460
d_ln_team_t-2	-1.165802	0.429340	-2.715338	0.0130

R-squared	0.883999	Mean dependent var	5.103297
Adjusted R-squared	0.839809	S.D. dependent var	0.789464
S.E. of regression	0.315975	Akaike info criterion	0.777015
Sum squared resid	2.096639	Schwarz criterion	1.197374
Log likelihood	-2.655229	Hannan-Quinn criter.	0.911492
F-statistic	20.00417	Durbin-Watson stat	1.971438
Prob(F-statistic)	0.000000		

Sample (adjusted): 2009M11 - 2012M04
Included observations: 30 (after adj.)

ADL (d_ln_participation)

In this section, I apply an ADL model that considers the growth rate of participation instead of the growth rate of posters in order to analyze community growth. Among all ADL specifications up to lag order 2, the model including both the dependent variable and the participation variable up to lag order 2 obtains the lowest SC value of 1.56 (see Appendix 136). Since the null hypotheses of the Jarque-Bera, Breusch-Godfrey, and the White test cannot be rejected at a significance level of 5%, no changes to the model are made (see Appendix 132). The values of R^2=0.77 and adjusted R^2=0.72, which are displayed in Table 41, indicate a quite respectable goodness of fit. The AIC reaches a value of 1.28. However, the estimation output shows that besides the constant term only the coefficients of *ln_new_signups_t-2* and *d_ln_participation* are significant at a significance level of 5%. Both variables exert a positive influence on *ln_new_signups*. Further, the coefficient of *d_ln_participation* indicates that, in the short term, a one percentage point increase in *d_ln_participation* leads to an immediate 0.41% increase in *ln_new_signups*. However, at a significance level of 1% none of the variables except the constant term has a significant impact on community growth. Figure 158 displays estimated and actual values. Finally, the static one-step-ahead forecast procedure based on the forecast sample ranging from May 2012 to July 2012 generates values which are displayed in Figure 159 together with the observed values. The deviations of the forecasted values from the actual values are reflected in the forecast errors of RMSE=0.261179 and MAE=0.225563.

Due to results of most ADL models including a team variable and the consequential low importance of the team variable in explaining community growth (see also Appendix 137), I do not consider a team variable in the following analyses of region 6.

Table 41 ADL (d_ln_participation) Estimation Output; Region 6

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	1.423998	0.507160	2.807785	0.0098
ln_new_signups_t-1	0.333442	0.184078	1.811422	0.0826
ln_new_signups_t-2	0.407081	0.171824	2.369181	0.0262
d_ln_participation	0.408564	0.163695	2.495886	0.0198
d_ln_participation_t-1	-0.129753	0.171882	-0.754897	0.4577
d_ln_participation_t-2	-0.258132	0.145541	-1.773596	0.0888

R-squared	0.766703	Mean dependent var	5.103297
Adjusted R-squared	0.718099	S.D. dependent var	0.789464
S.E. of regression	0.419161	Akaike info criterion	1.275732
Sum squared resid	4.216700	Schwarz criterion	1.555972
Log likelihood	-13.13599	Hannan-Quinn criter.	1.365383
F-statistic	15.77461	Durbin-Watson stat	2.198716
Prob(F-statistic)	0.000001		

Sample (adjusted): 2009M11 - 2012M04
Included observations: 30 (after adj.)

Figure 158 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated ADL (d_ln_participation) Model; Region 6

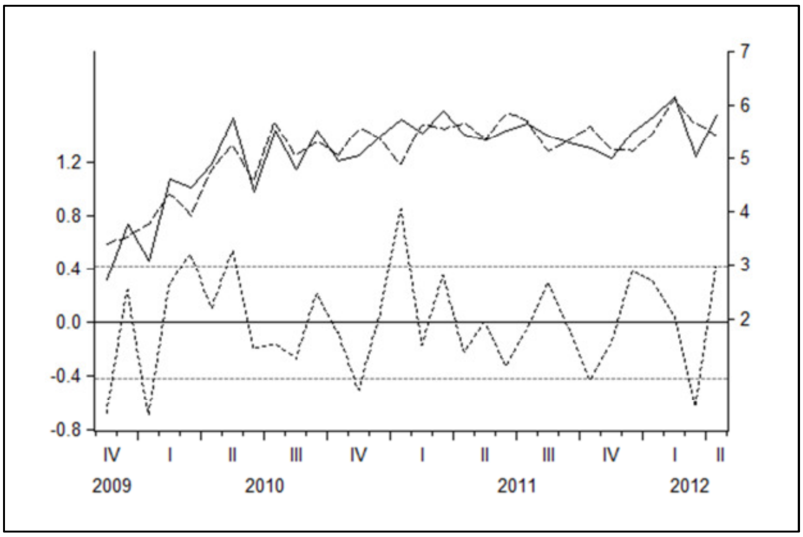
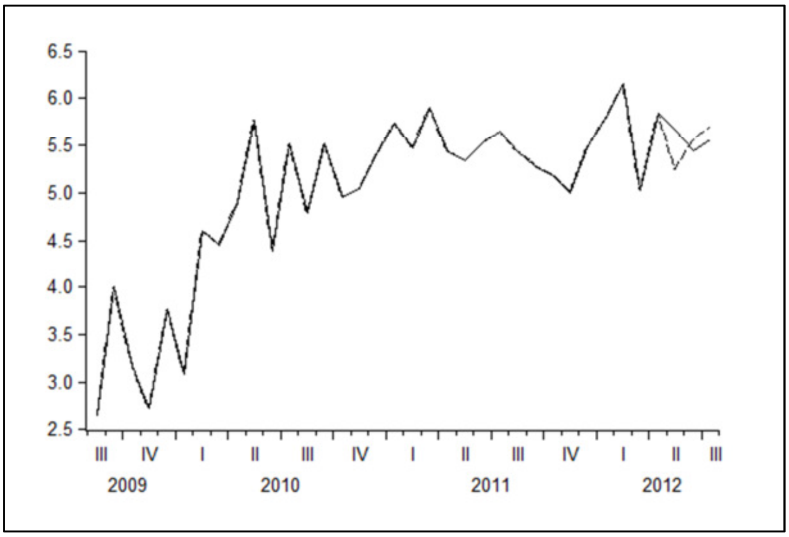


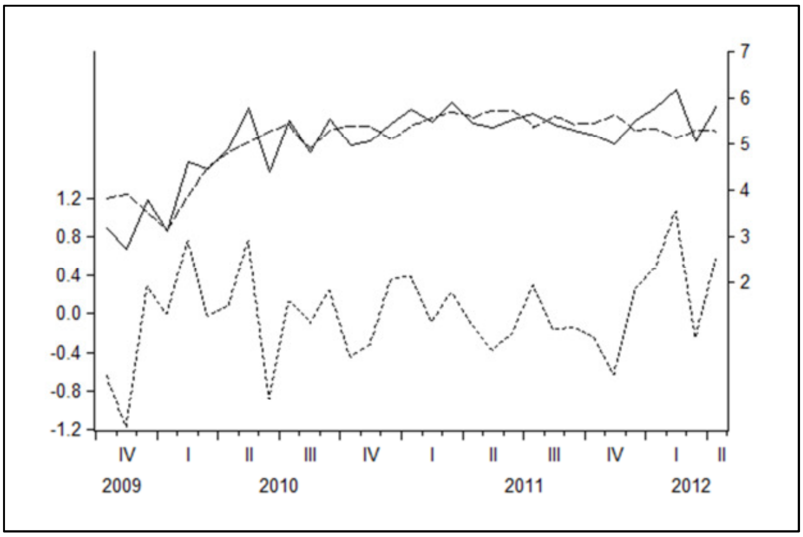
Figure 159 Actual (——) and Forecasted (– –) Values of ln_new_signups (ADL d_ln_participation); Region 6



VAR (d_ln_posters)

Next, I apply a VAR approach including the growth rate of the number of posters in order to model and predict community growth of region 6. The value of SC is minimal for a VAR(1) process (see Appendix 138). However, since there is evidence for heteroskedasticity in the residuals, I include a dummy variable for January 2010 as an exogenous variable into the model. Then, the VAR(1) specification containing the dummy variable is

Figure 160 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated VAR (d_ln_posters) Model; Region 6



estimated again. Null hypotheses of normality, autocorrelation, and heteroskedasticity tests are not rejected at a significance level of 5% (see Appendix 139). Thus, no more changes to the model are necessary. The SC of the estimated model adds up to 2.54, the AIC reaches a value of 2.17 (see Appendix 140). Figure 160 shows the actual values of the logarithmized number of new sign-ups together with the part of the VAR model that describes the logarithmized number of new sign-ups. Further, IRFs are generated in order to identify effects between the variables (see Figure 161). An impulse in the growth rate of the number of posters leads to a positive response of new sign-ups that is significant up to one month. In contrast, an impulse in new sign-ups does not lead to any significant response of the poster variable. Regarding the own-variable IRFs, there is a positive response, which is significant up to one month in the case of the poster variable and up to five months in the case of new sign-ups. Finally, the one-step-ahead forecast procedure is applied based on the forecast sample ranging from May 2012 to July 2012. The forecast procedure yields forecast errors of RMSE=0.304962 and MAE=0.222500. The deviations of the forecasted values from the observed values are depicted in Figure 162.

Figure 161 Impulse Response Functions, d_ln_posters ln_new_signups, Response to Cholesky One S. D. Innovations ± 2 S. E.; Region 6

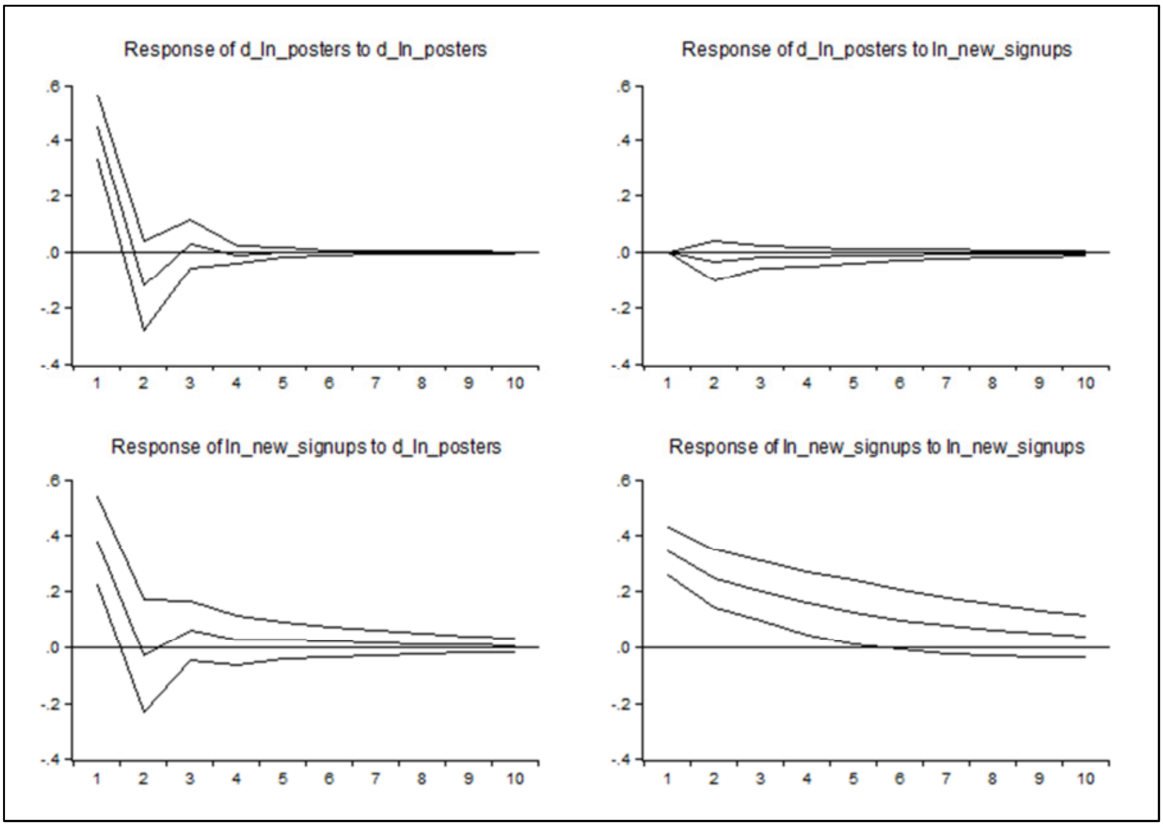
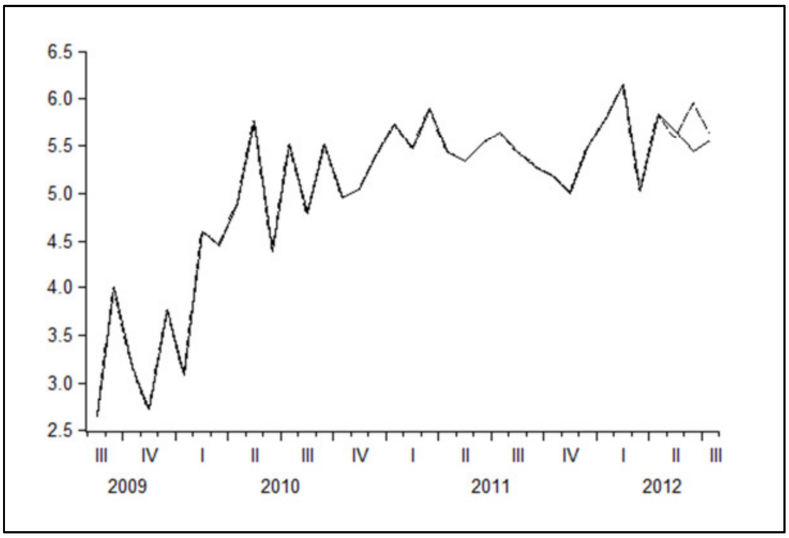


Figure 162 Actual (——) and Forecasted (– –) Values of ln_new_signups (VAR d_ln_posters); Region 6



VAR (d_ln_participation)

In this final section of Chapter 4.5, I specify a VAR model including the participation variable, i.e. the growth rate of the number of contributions, in order to model and predict community growth of region 6. The SC selects a VAR(1) model because the VAR(1) model obtains the smallest value of SC among VAR specifications up to lag order 4 (see Appendix 141). Since there is evidence for autocorrelation in the residuals, I adjust the model by adding a dummy variable for January 2010. The VAR(1) process including the dummy variable is estimated again. The null hypotheses of the VAR normality test, of the VAR White heteroskedasticity test, and of the VAR autocorrelation LM test are not rejected (see Appendix 142). Therefore, further changes to the model are not necessary. The estimated model generates values of 3.50 for the SC and 3.13 for the AIC (see Appendix 143). Figure 163 shows actual values of the logarithmized number of new sign-ups as well as values which are generated through the VAR model. IRFs are presented in Figure 164. The IRF at the bottom left shows that a shock in the growth rate of the number of contributions leads to a positive response of community growth, which is significant for only a very short period time, i.e. for less than one month. The IRF at the top right shows no significant response of the participation variable to a shock in new sign-ups. The own-variable IRFs show a positive response to a shock in the respective variable, whereby the effect is significant up to four months in the case of new sign-ups and up to one month in the case of the participation variable.

Figure 163 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated VAR (d_ln_participation) Model; Region 6

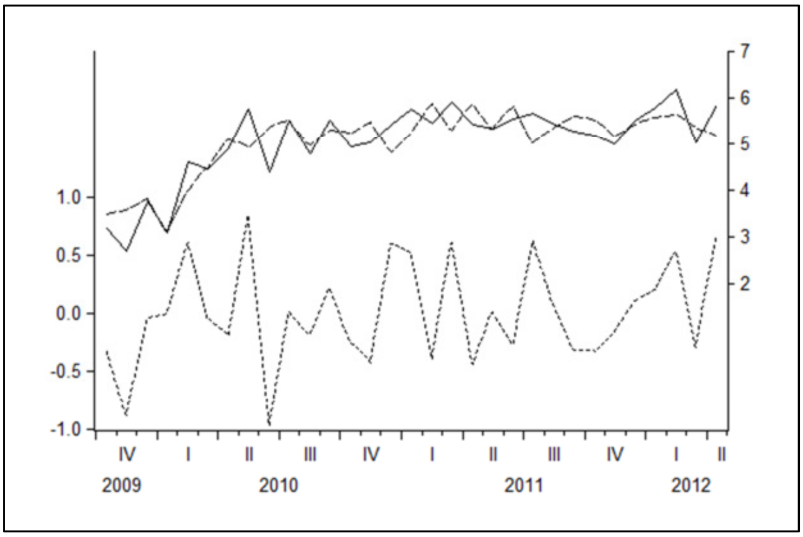
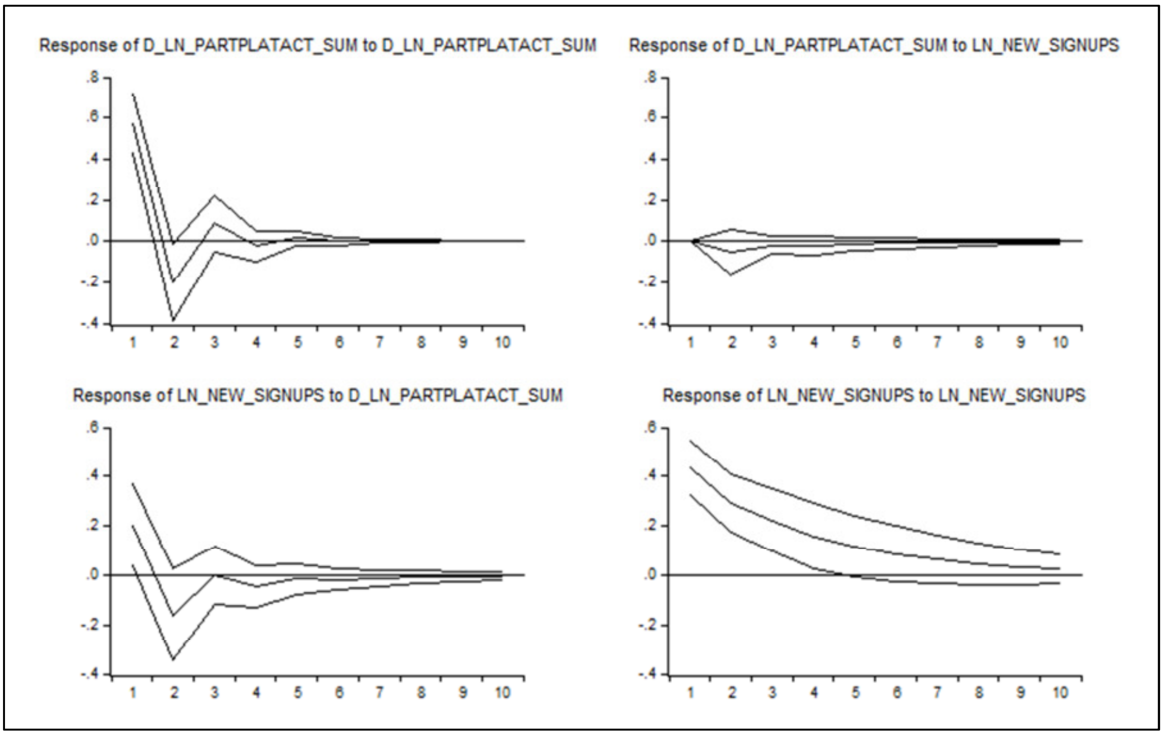
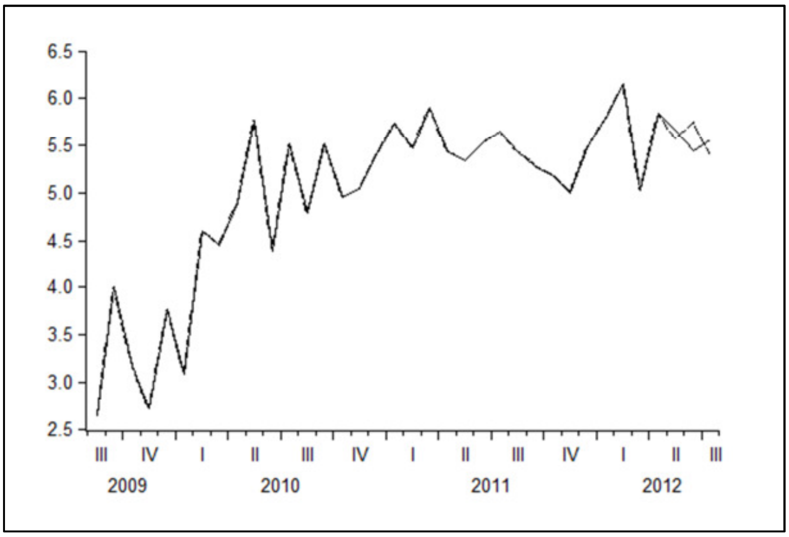


Figure 164 Impulse Response Functions, d_ln_participation ln_new_signups, Response to Cholesky One S. D. Innovations ± 2 S. E.; Region 6



Finally, the one-step-ahead forecast procedure yields forecast errors of RMSE=0.210604 and MAE=0.186739 based on the forecast sample ranging from May 2012 to July 2012. Forecasted and observed values are contrasted in Figure 165.

Figure 165 Actual (——) and Forecasted (– –) Values of ln_new_signups (VAR d_ln_participation); Region 6



4.6. Results of Further Analyses

In Chapter 4.6, I estimate again VAR and ADL models including posters or participation variables in order to explain community growth. However, this time, posters and participation variables are considered in levels, not in first differences because information, which is provided by the variables, gets lost after building the first differences. Variables can be included in levels when they are integrated of order zero. As both posters and participation variables contain no unit roots only in region 2, 4, and 5, only those regions can be analyzed by using posters and participation variables in levels.

4.6.1. Region 2

ADL (ln_posters)

First of all, an ADL approach containing the logarithmized number of posters as an exogenous variable is applied to examine community growth in region 2. In order to determine the best ADL specification, ADL models up to lag order 2 are compared by the help of SC. The SC is minimal for an ADL model including *ln_posters*, *ln_posters_t-1*, and *ln_posters_t-2* (see Appendix 145). Since the null hypotheses of the Jarque-Bera test assuming normality, the Breusch-Godfrey test assuming no autocorrelation, and the White test assuming no heteroskedasticity are not rejected, adaptions to the model are not necessary (see Appendix 144). The estimation results are presented in Table 42.

Table 42 ADL (ln_posters) Estimation Output; Region 2

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	3.812355	0.419858	9.080116	0.0000
ln_posters	0.700495	0.128818	5.437867	0.0000
ln_posters_t-1	-0.236283	0.148508	-1.591048	0.1232
ln_posters_t-2	-0.115382	0.067591	-1.707059	0.0993

R-squared	0.577146	Mean dependent var	5.605519
Adjusted R-squared	0.530162	S.D. dependent var	0.390783
S.E. of regression	0.267861	Akaike info criterion	0.323220
Sum squared resid	1.937243	Schwarz criterion	0.508251
Log likelihood	-1.009912	Hannan-Quinn criter.	0.383536
F-statistic	12.28393	Durbin-Watson stat	1.435604
Prob(F-statistic)	0.000030		

Sample (adjusted): 2009M10 - 2012M04
Included observations: 31 (after adj.)

Both R² values, whereby R²=0.58 and adjusted R²=0.53, show an acceptable goodness of fit. The SC adds up to 0.51. The AIC equals 0.32. Further, the estimation output reveals that a 1% increase in the number of posters at time *t*, i.e. *ln_posters*, leads to a 0.70% increase in *ln_new_signups*. The coefficients of the lagged poster variables are not significantly different from zero at a significance level of 5%. Figure 166 displays actual and estimated values.

Figure 166 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated ADL (ln_posters) Model; Region 2

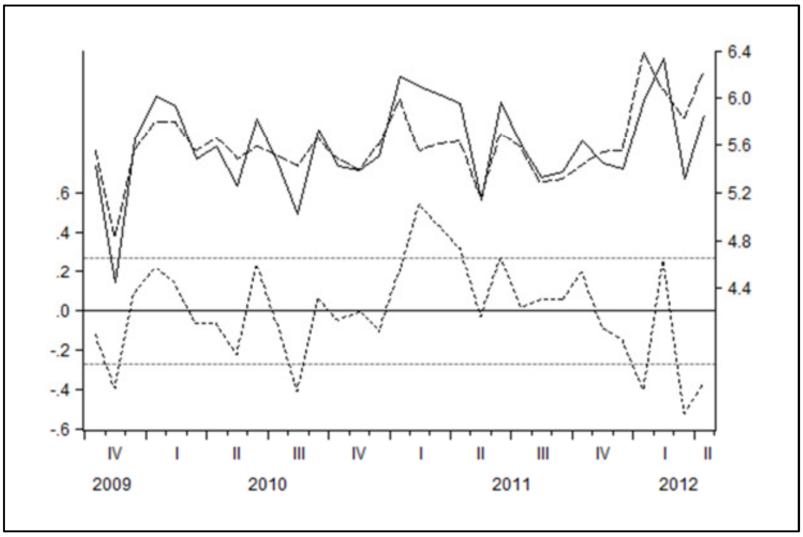
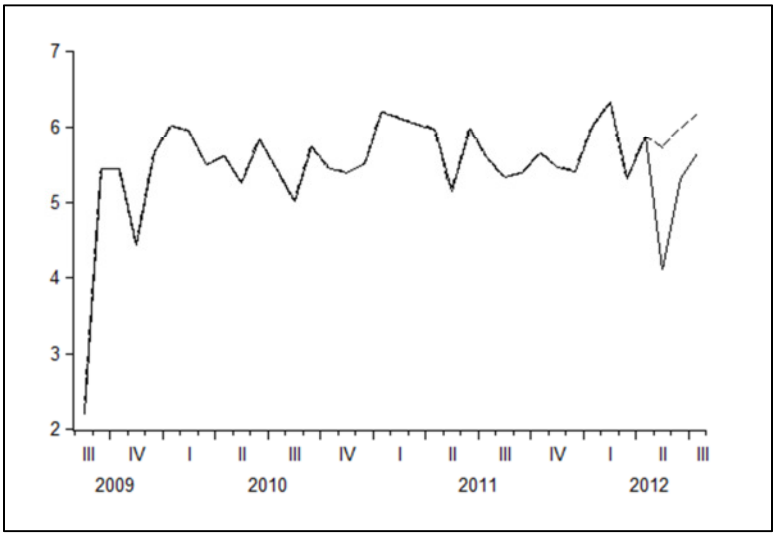


Figure 167 Actual (——) and Forecasted (– –) Values of ln_new_signups (ADL ln_posters); Region 2



Finally, the one-step-ahead forecast procedure yields forecast errors of RMSE=1.054225 and MAE=0.940555 based on the forecast sample ranging from May 2012 to July 2012. From Figure 167 it becomes apparent that the forecasted values exceed the observed values.

ADL (ln_participation)

Next, I use an ADL model including participation in levels, i.e. the logarithmized number of contributions, instead of the poster variable in levels in order to analyze community growth of region 2. The SC selects an ADL model including *ln_new_signups_t-1* and *ln_participation* as exogenous variables because this specification obtains the lowest SC value among ADL specifications up to lag order 2 (see Appendix 146). Null hypotheses of normality, autocorrelation, and heteroskedasticity tests are not rejected (see Appendix 144). Thus, there is no need to make any changes to the model. The estimation output of Table 43 presents values of adjusted R^2 and R^2 ranging from 0.12 to 0.17. These values indicate a poor goodness of fit. The SC amounts to a value of 1.03, the AIC to a value of 0.90. Further, the output reveals that a 1% increase in *ln_participation* leads to a 0.22% increase in *ln_new_signups*. However, the coefficient is only significant at a significance level of 5% and not on a level of 1%. Further, the influence of *ln_new_signups_t-1* is not significant at a significance level of 5%.

Table 43 ADL (ln_participation) Estimation Output; Region 2

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	4.492076	0.593503	7.568745	0.0000
ln_new_signups_t-1	-0.052611	0.105029	-0.500919	0.6202
ln_participation	0.219549	0.093336	2.352250	0.0257

R-squared	0.173776	Mean dependent var	5.600013
Adjusted R-squared	0.116795	S.D. dependent var	0.385688
S.E. of regression	0.362466	Akaike info criterion	0.897287
Sum squared resid	3.810065	Schwarz criterion	1.034700
Log likelihood	-11.35660	Hannan-Quinn criter.	0.942836
F-statistic	3.049713	Durbin-Watson stat	1.929735
Prob(F-statistic)	0.062794		

Sample (adjusted): 2009M09 - 2012M04
Included observations: 32 (after adj.)

Figure 168 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated ADL (ln_participation) Model; Region 2

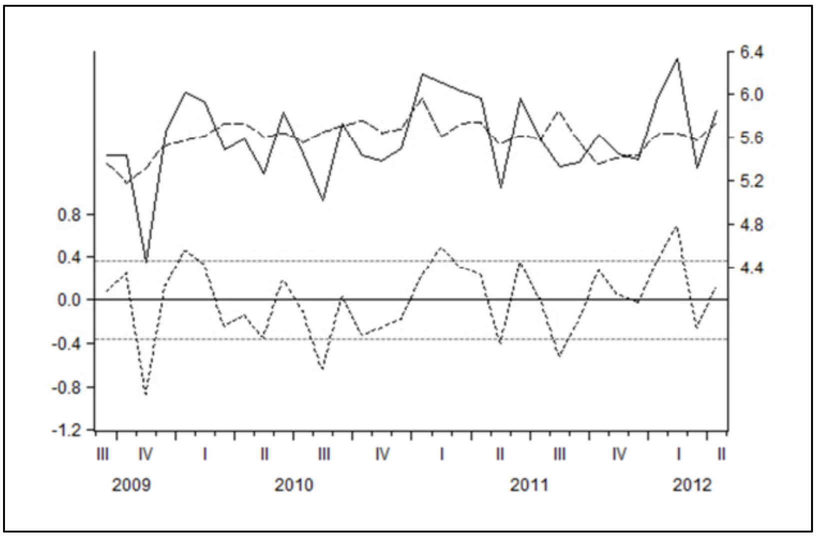


Figure 169 Actual (——) and Forecasted (– –) Values of ln_new_signups (ADL ln_participation); Region 2

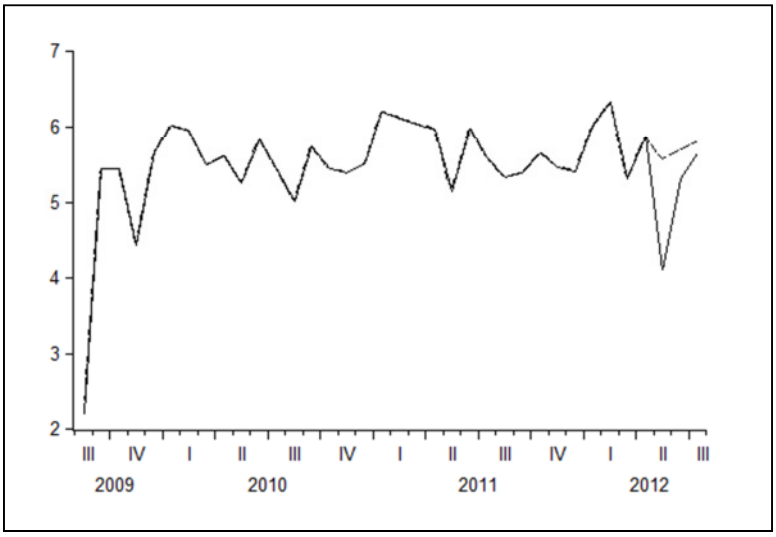
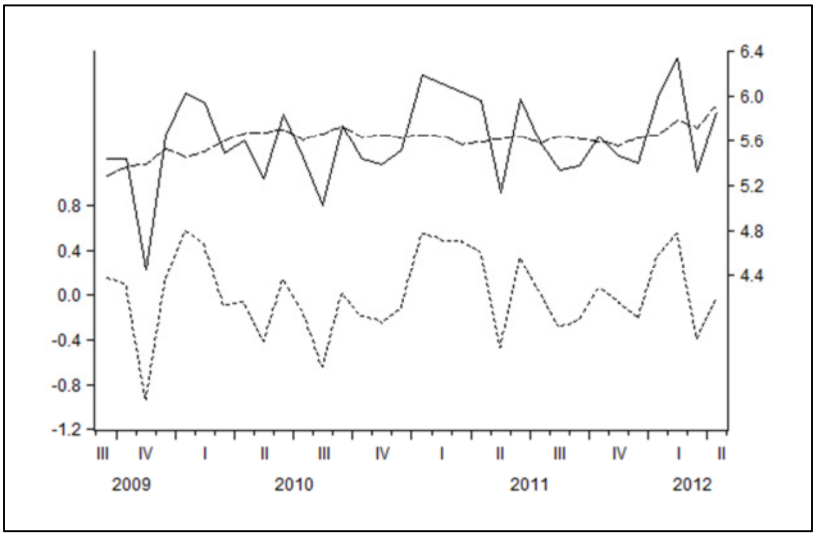


Figure 168 displays the estimated values together with the actual values. Finally, the one-step-ahead forecast procedure generates values that exceed the observed values as apparent from Figure 169. Deviations of forecasted values from observed values are reflected in the forecast errors of RMSE=0.876823 and MAE=0.666234.

VAR (ln_posters)

In the following two sections, I use a VAR approach in order to explain and predict community growth of region 2. I start again with the inclusion of the poster variable, i.e. the logarithmized number of posters. The lag length of the VAR model is determined by the SC. Among VAR models up to lag order 4, the value of SC is minimal for a VAR process of lag order 1 (see Appendix 147). The null hypotheses of the VAR normality test assuming normality, of the VAR White heteroskedasticity test assuming no heteroskedasticity, and the VAR autocorrelation LM test assuming no serial correlation (up to lag order 4) are not rejected (see Appendix 148). Thus, no changes to the model are necessary. The estimated model yields a value of SC=1.58. The AIC reaches a value of 1.31 (see Appendix 149). Figure 170 shows actual values of the logarithmized number of new sign-ups as well as values which are generated through the VAR model.

Figure 170 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated VAR (ln_posters) Model; Region 2



IRFs are presented in Figure 171. The IRF at the bottom left shows the effect of a one standard deviation shock in the poster variable on current and future values of new sign-ups, i.e. there is a positive response of community growth to a shock in the number of posters, which is significant up to one month. The IRF at the top right shows a negative response of the number of posters to a shock in new sign-ups, which stays significant for up to four months. The own-variable IRFs express a positive response, which is significant up to one month in the case of new sign-ups and up to five months in the case of the poster variable. Finally, I perform a one-step-ahead forecast procedure based on the forecast sample ranging from May 2012 to July 2012. From Figure 172 it becomes apparent that the forecasted values exceed the observed values, which is reflected in the forecast errors of RMSE=1.155746 and MAE=0.983532.

Figure 171 Impulse Response Functions, ln_posters ln_new_signups, Response to Cholesky One S. D. Innovations ± 2 S. E.; Region 2

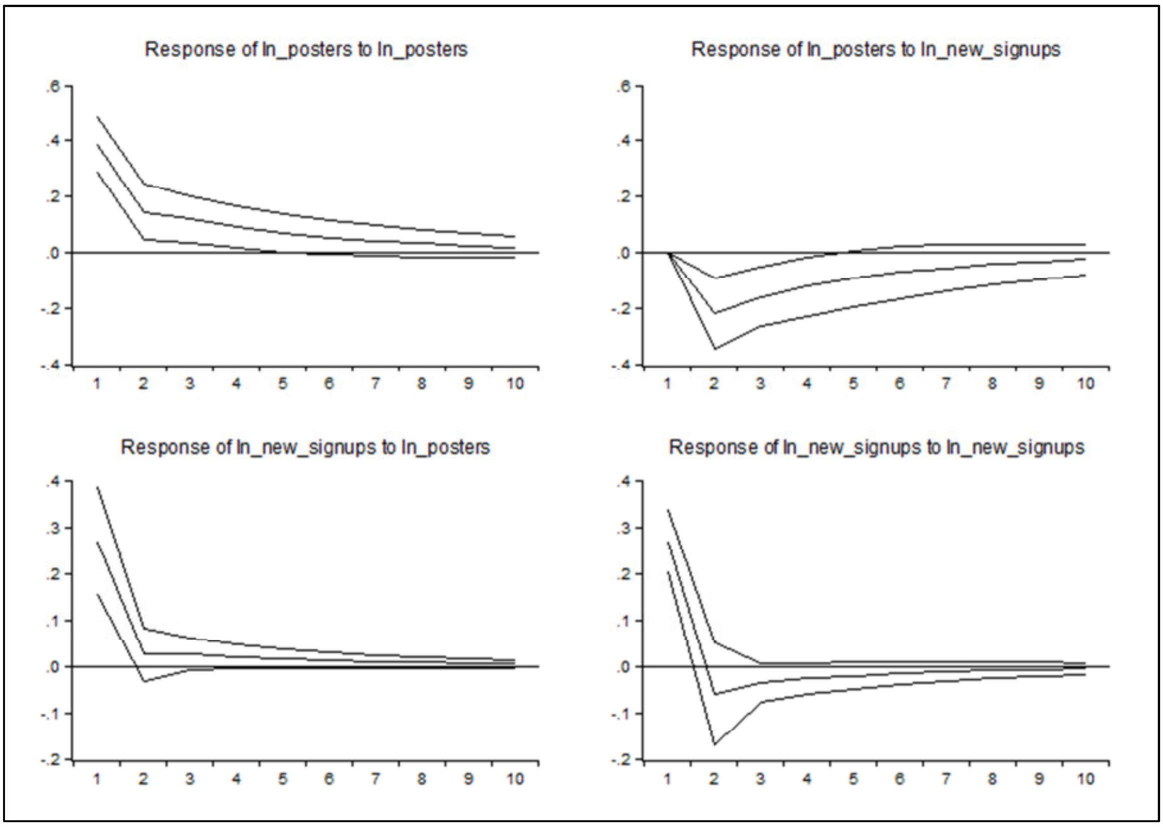
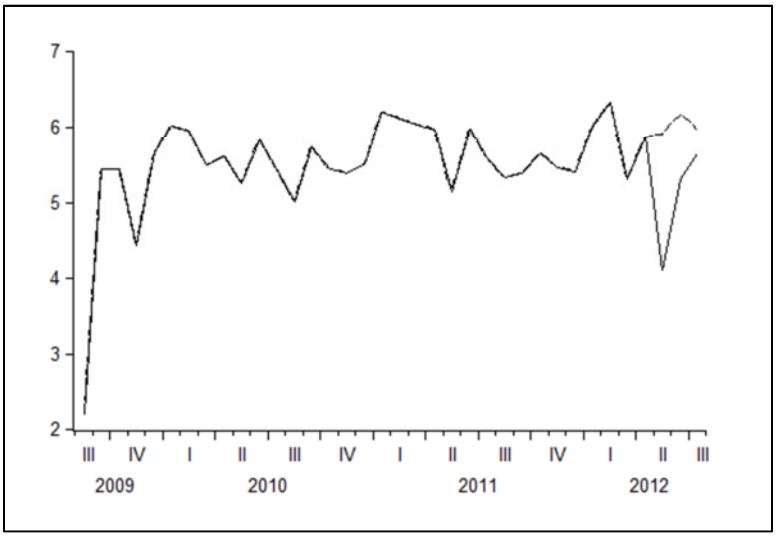


Figure 172 Actual (——) and Forecasted (– –) Values of ln_new_signups (VAR ln_posters); Region 2



VAR (ln_participation)

Next, I chose the participation variable in levels, i.e. the logarithmized number of contributions, instead of the logarithmized number of posters in order to formulate a VAR process. The SC selects a VAR(0) process because this specification obtains the smallest SC value among VAR models up to lag order 4 (see Appendix 150). Since a VAR(0) model only includes a constant term, it indicates that there are no dynamics in the model. As a consequence, the traditional VAR approach including participation in levels is not suitable for modeling community growth in region 2.[31]

4.6.2. Region 4

ADL (ln_posters)

In the following, community growth of region 4 is analyzed. For this purpose, I start with an ADL model including the poster variable in levels. Among different ADL specifications, the SC selects a model that contains *ln_posters* and *ln_posters_t-1* as exogenous variables (see Appendix 152). Since there is evidence for heteroskedasticity in the residuals, but null hypotheses of normality and autocorrelation tests are not rejected (see Appendix 151), the model is estimated again using a heteroskedasticity consistent

Table 44 ADL (ln_posters) Estimation Output; Region 4

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	3.182187	0.352696	9.022458	0.0000
ln_posters	0.669656	0.160044	4.184208	0.0002
ln_posters_t-1	-0.284081	0.097844	-2.903398	0.0070

R-squared	0.620038	Mean dependent var	4.801734
Adjusted R-squared	0.593834	S.D. dependent var	0.579652
S.E. of regression	0.369419	Akaike info criterion	0.935288
Sum squared resid	3.957636	Schwarz criterion	1.072701
Log likelihood	-11.96461	Hannan-Quinn criter.	0.980836
F-statistic	23.66172	Durbin-Watson stat	1.535065
Prob(F-statistic)	0.000001	Wald F-statistic	9.860056
Prob(Wald F-statistic)	0.000541		

Sample (adjusted): 2009M09 - 2012M04
Included observations: 32 (after adj.)
White heteroskedasticity-consistent std. errors & covariance

[31] I additionally estimate VAR(1) and VAR(2) models in order to double check. IRFs of VAR(1) do not show any significant response of new sign-ups to a shock in participation. IRFs of VAR(2) show only a very slight significant positive response of new sign-ups to a shock in participation.

covariance matrix estimator. The estimation output, which is presented in Table 44, shows acceptable values for both R^2 values. R^2 adds up to a value of 0.62, the adjusted R^2 adds up to a value of 0.59. Moreover, the estimated model generates an SC value of 1.07. The AIC reaches a value of 0.94. The output reveals a significant positive influence of *ln_posters* on *ln_new_signups* and a significant negative impact of *ln_posters_t-1* on *ln_new_signups*. Nevertheless, the long-run propensity, i.e. the reaction of new sign-ups to a permanent 1% increase in the poster variable, is still positive. In detail, in the long run, a permanent 1% increase in the number of posters leads to a 0.39(=0.67-0.28)% increase in the number of new sign-ups, while in the short term a 1% increase in *ln_posters* leads to an immediate 0.67% increase in *ln_new_signups*.

Figure 173 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated ADL (ln_posters) Model; Region 4

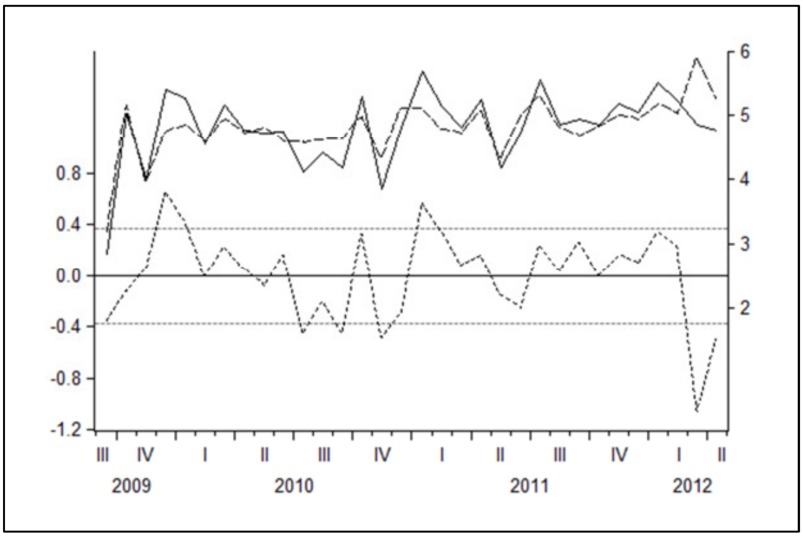
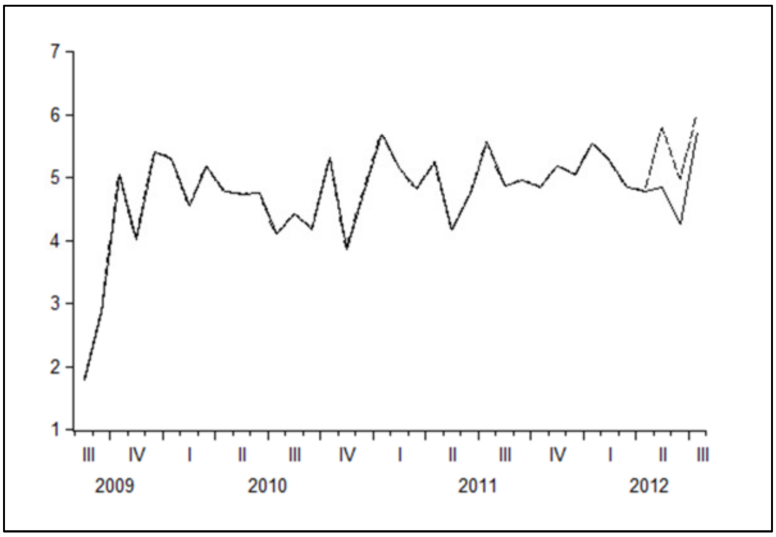


Figure 173 displays the estimated model together with the actual values. Finally, the static one-step-ahead forecast procedure yields values, which are illustrated together with the observed values in Figure 174. The graphs show that the forecasted values exceed the observed values. Results of the forecast procedure, which is based on the sample ranging from May 2012 to July 2012, are also reflected in the forecast errors of RMSE=0.702416 and MAE=0.640264.

Figure 174 Actual (——) and Forecasted (– –) Values of ln_new_signups (ADL ln_posters); Region 4



ADL (ln_participation)

Next, I add the number of contributions instead of the number of posters to model and predict community growth of region 4. At first, I use the SC in order to compare different ADL specifications up to lag order 2. The SC selects a model including the contemporaneous and the by one period lagged participation variable as the specification obtaining the lowest SC value among all ADL models up to lag order 2 (see Appendix 153). The null hypotheses of the Jarque-Bera, the Breusch-Godfrey, and the White test are not rejected (see Appendix 151). Hence, the model is correctly specified. Results of the estimated model are displayed in Table 45. Both R^2 values of $R^2= 0.62$ and adjusted $R^2=0.60$ indicate an acceptable goodness of fit. Further, the estimation output shows that the SC amounts to a value of 1.06. The AIC equals 0.93. Moreover, estimation results imply that the current number of contributions exerts a highly significant positive effect on community growth. More precisely, a 1% increase in *ln_participation* leads to an immediate 0.58% increase in *ln_new_signups*. Yet, in the long run, the positive influence is diminished because of the significant negative coefficient of *ln_participation_t-1*. Figure 175 displays estimated and actual values together with the residuals. Finally, the static one-step-ahead forecast procedure yields forecast errors of RMSE=0.495923 and MAE=0.477706. Figure 176 shows that the forecasted values are higher than the observed values.

Table 45 ADL (ln_participation) Estimation Output; Region 4

Dependent Variable: ln_new_signups				
	Coefficient	Std. Error	t-Statistic	p-value
Constant	3.170873	0.267197	11.86717	0.0000
ln_participation	0.584348	0.096400	6.061710	0.0000
ln_participation_t-1	-0.269820	0.081356	-3.316536	0.0025

R-squared	0.623482	Mean dependent var	4.801734
Adjusted R-squared	0.597516	S.D. dependent var	0.579652
S.E. of regression	0.367741	Akaike info criterion	0.926182
Sum squared resid	3.921761	Schwarz criterion	1.063595
Log likelihood	-11.81891	Hannan-Quinn criter.	0.971730
F-statistic	24.01081	Durbin-Watson stat	1.916366
Prob(F-statistic)	0.000001		

Sample (adjusted): 2009M09 - 2012M04
Included observations: 32 (after adj.)

Figure 175 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated ADL (ln_participation) Model; Region 4

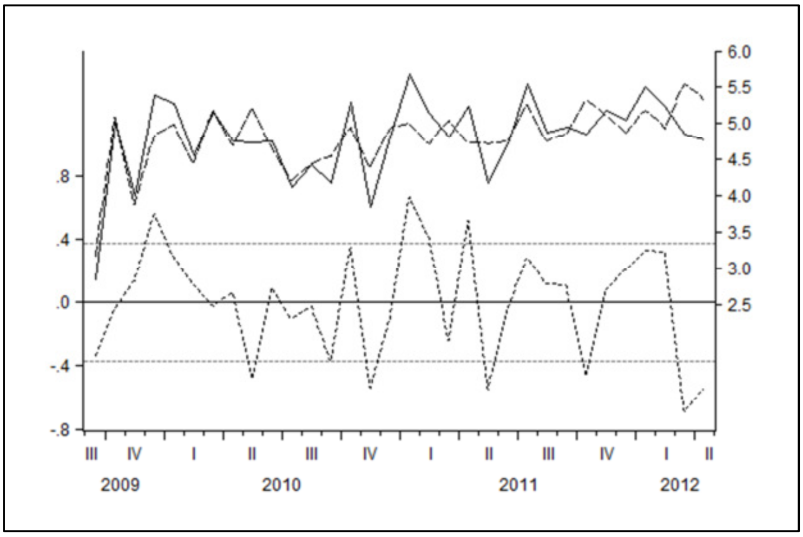
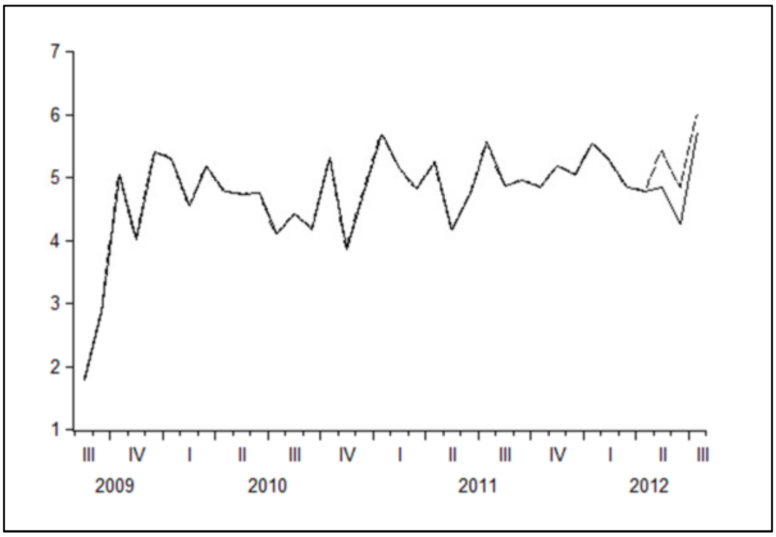


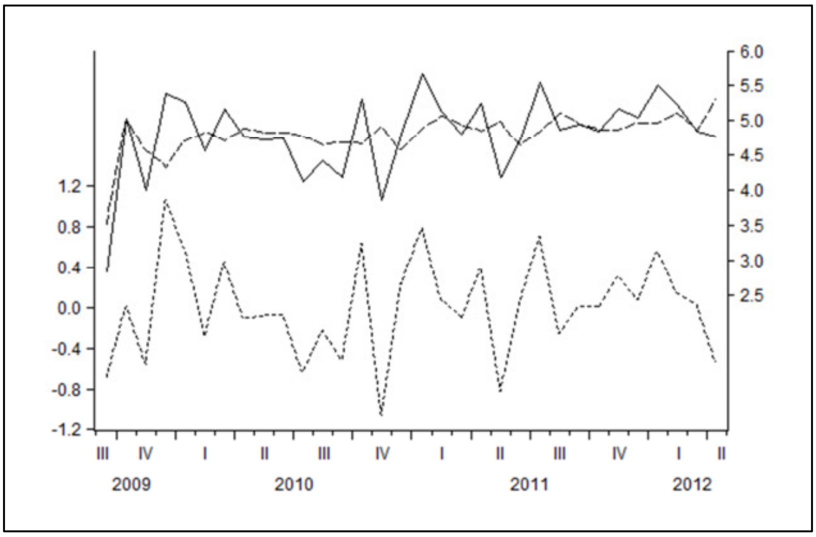
Figure 176 Actual (——) and Forecasted (– –) Values of ln_new_signups (ADL ln_participation); Region 4



VAR (ln_posters)

In the following, I estimate a VAR model including posters in levels in order to explain and predict community growth of region 4. The SC is minimal for a VAR(1) process (see Appendix 154). As there is evidence for autocorrelation, heteroskedasticity, and no normality in the residuals of the VAR(1) model, I include a dummy variable for October 2009 and a dummy variable for March 2012 in order to correct misspecification.

Figure 177 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated VAR (ln_posters) Model; Region 4



After the estimation of the VAR(1) process including both dummy variables, the null hypotheses of the VAR normality test, of the VAR White heteroskedasticity test, and the VAR autocorrelation LM test are not rejected at a significance level of 5% (see Appendix 155). Thus, the model is correctly specified. The estimated model generates a value of SC=1.97. The AIC equals 1.51 (see Appendix 156). Figure 177 shows the actual values of the logarithmized number of new sign-ups together with the part of the VAR model that describes the logarithmized number of new sign-ups. IRFs, which are displayed in Figure 178, indicate that an impulse in the number of posters generates a positive response of new sign-ups that is significant up to three months. In contrast, an impulse in new sign-ups generates no significant response of the number of posters. Regarding the own-variable IRFs, there is a positive response of new sign-ups to a shock in new sign-ups, which stays significant up to one month. Further, there is a positive response of the poster variable to a shock in the poster variable that lasts up to seven months. Finally, the one-step-ahead forecast procedure generates forecast errors of RMSE=0.766993 and MAE=0.707702. The deviations of the forecasted values from the observed values are illustrated in Figure 179.

Figure 178 Impulse Response Functions, ln_posters ln_new_signups, Response to Cholesky One S. D. Innovations ± 2 S. E.; Region 4

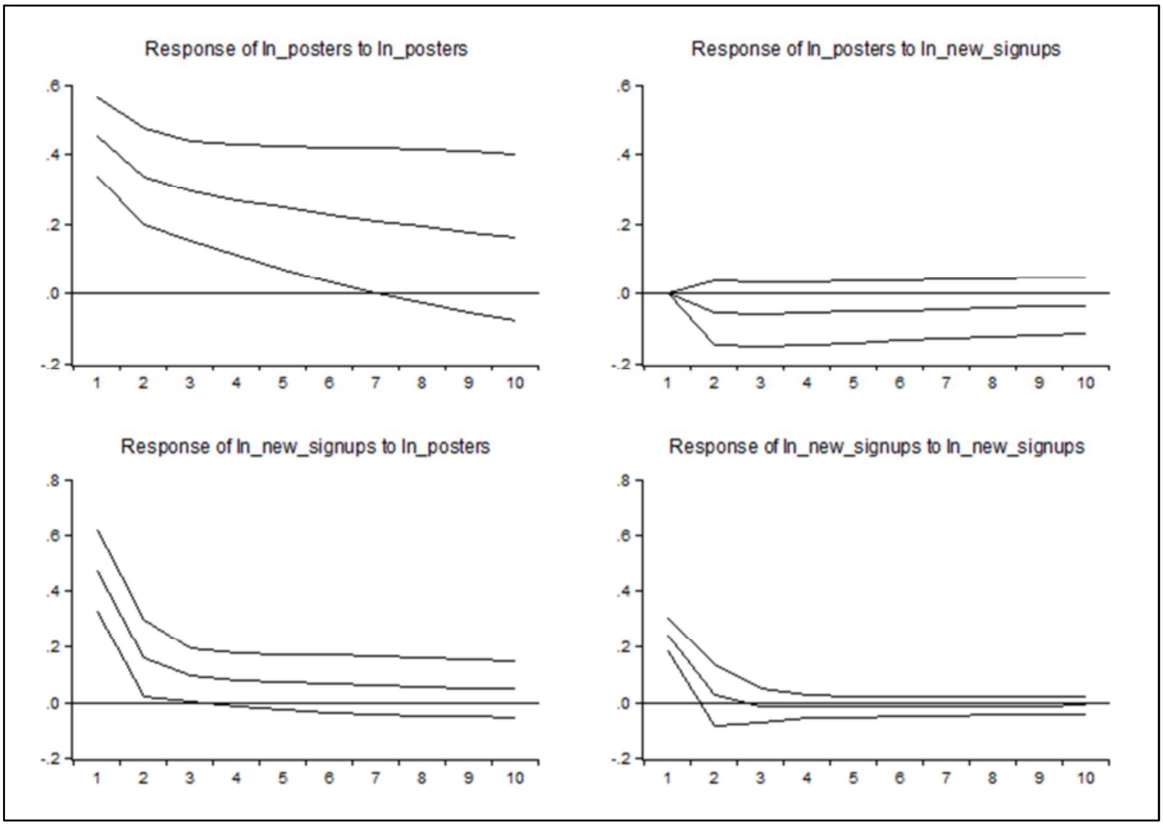
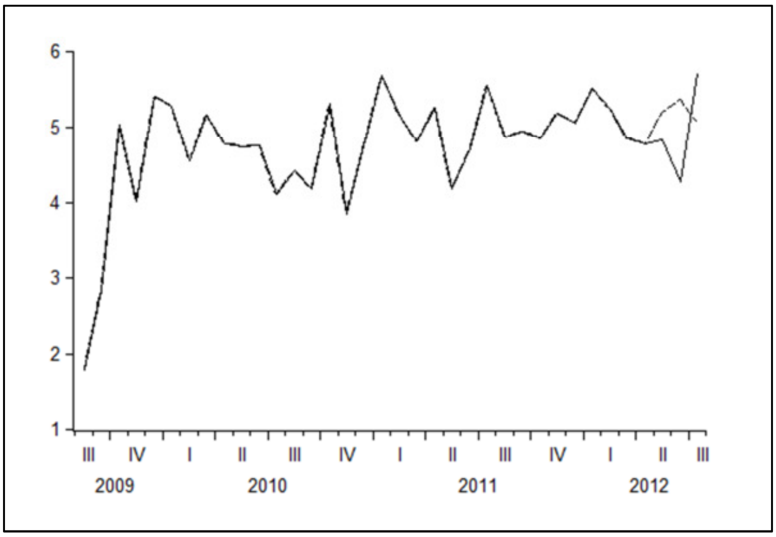


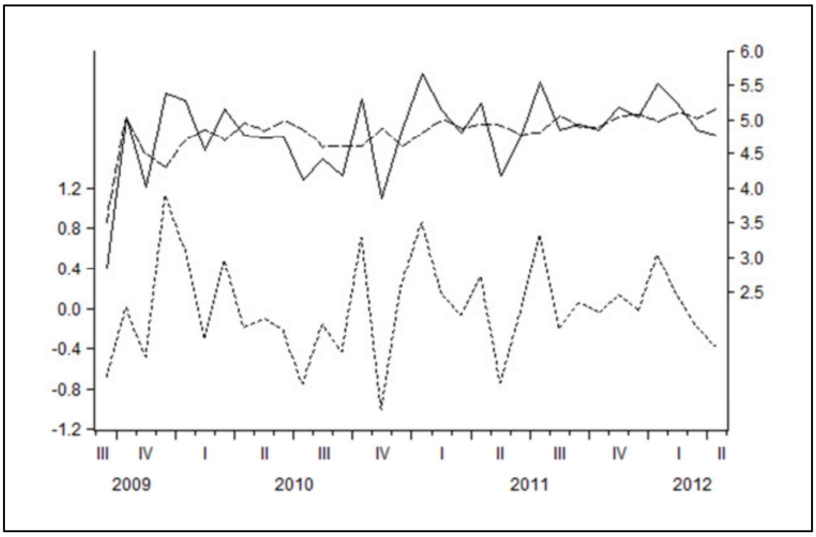
Figure 179 Actual (——) and Forecasted (– –) Values of ln_new_signups (VAR ln_posters); Region 4



VAR (ln_participation)

In the final section of Chapter 4.6.2, I use a VAR approach containing the participation variable in levels in order to analyze and predict community growth of region 4. The SC recommends a VAR(1) approach because this specification obtains the smallest SC value among VAR models up to lag order 4 (see Appendix 157). However, as this specification causes both autocorrelation and heteroskedasticity in the residuals, I include a dummy variable for October 2009. After the integration of the dummy variable into the VAR

Figure 180 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated VAR (ln_participation) Model; Region 4



process, the null hypotheses of autocorrelation, heteroskedasticity, and normality tests are not rejected at a significance level of 5% (see Appendix 158). Hence, no further adaption is necessary. The SC of the estimated model adds up to 3.27, the AIC reaches a value of 2.90 (see Appendix 159). Figure 180 shows the actual values of the logarithmized number of new sign-ups together with the part of the VAR model that describes the logarithmized number of new sign-ups. IRFs, which are illustrated in Figure 181, imply that an impulse in the number of contributions leads to positive response of new sign-ups that stays significant up to three months. By contrast, an impulse in new sign-ups induces no significant response of the participation variable. The own-variable IRFs show a positive response, which is significant up to one month in the case of new sign-ups and up to six months in the case of the participation variable. Values, which are generated by the one-step-ahead forecast procedure based on the forecast sample of May 2012 to July 2012, are presented together with the observed values in Figure 182. The deviations between these values are reflected in the forecast errors of RMSE=0.721041 and MAE=0.674794.

Figure 181 Impulse Response Functions, ln_participation ln_new_signups, Response to Cholesky One S. D. Innovations ± 2 S. E.; Region 4

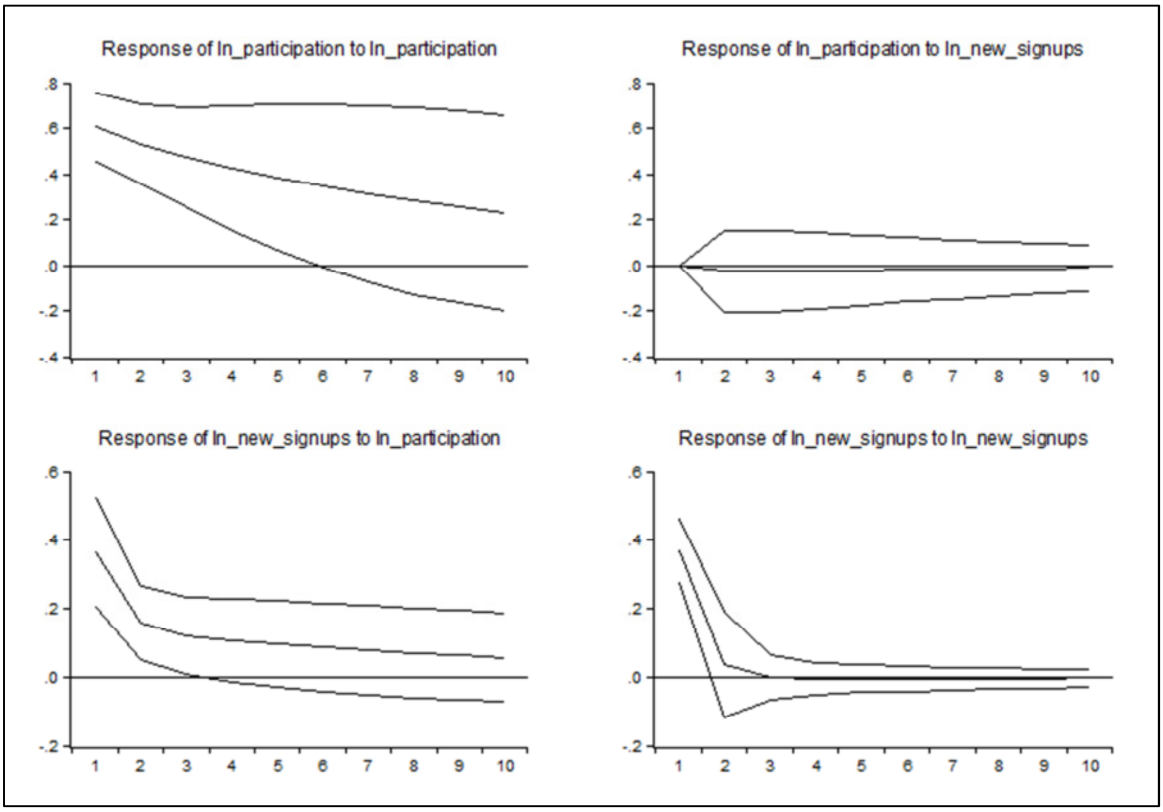
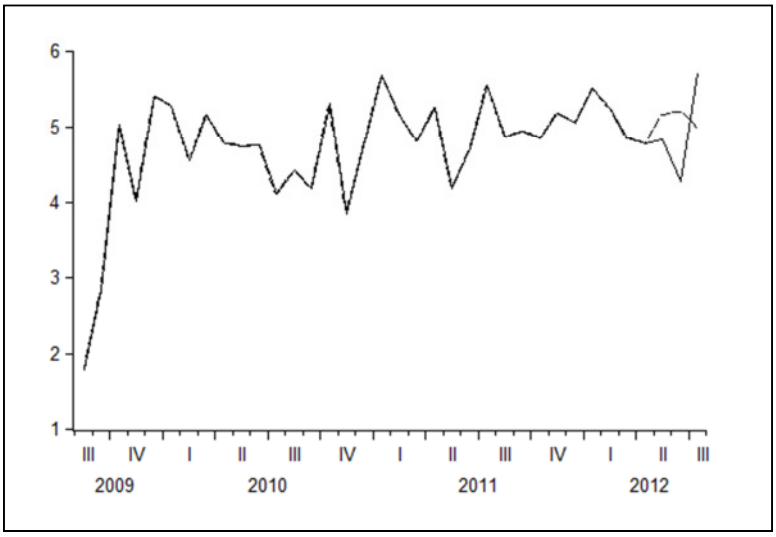


Figure 182 Actual (——) and Forecasted (– –) Values of ln_new_signups (VAR ln_participation); Region 4



4.6.3. Region 5

ADL (ln_posters)

In the following section, community growth of region 5 is examined by an ADL model that contains the poster variable in levels. Among different ADL specifications up to lag order 2, the SC value is minimal for a specification that includes *ln_new_signups_t-1*, *ln_posters*, and *ln_posters_t-1* as exogenous variables (see Appendix 161). Since null hypotheses of normality, autocorrelation, and heteroskedasticity tests are not rejected, there is no need to make any changes to the model (see Appendix 160). The estimation output (see Table 46) shows that both R^2 values ranging from 0.44 to 0.49 imply a moderate goodness of fit. Besides, the estimated model yields an SC value of 0.55. The AIC reaches a value of 0.37. Further, the estimation output proves that all coefficients – with the exception of the constant term's coefficient – are significant different from zero even at a significance level of 1%. Both *ln_new_signups_t-1* and *ln_posters* exert a positive influence on *ln_new_signups*. In contrast, *ln_posters_t-1* exerts a negative impact on *ln_new_signups*. In the short term, a 1% increase in *ln_posters* leads to an immediate 1.19% increase in *ln_new_signups*. Despite the negative effect of the lagged poster variable, the long-run propensity is still positive. Figure 183 shows the pattern of the estimated and actual values. Moreover, the one-step-ahead forecast procedure generates values that exceed the observed values, which is apparent from Figure 184. These results are also reflected in the forecast errors of RMSE=0.682844 and MAE=0.661482.

Table 46 ADL (ln_posters) Estimation Output; Region 5

Dependent Variable: ln_new_signups				
	Coefficient	Std. Error	t-Statistic	p-value
Constant	0.691891	0.945775	0.731559	0.4705
ln_new_signups_t-1	0.569302	0.167519	3.398424	0.0021
ln_posters	1.188510	0.238576	4.981688	0.0000
ln_posters_t-1	-0.887258	0.196920	-4.505682	0.0001

R-squared	0.493705	Mean dependent var	5.164356
Adjusted R-squared	0.439459	S.D. dependent var	0.366488
S.E. of regression	0.274387	Akaike info criterion	0.367914
Sum squared resid	2.108070	Schwarz criterion	0.551131
Log likelihood	-1.886622	Hannan-Quinn criter.	0.428645
F-statistic	9.101229	Durbin-Watson stat	1.771441
Prob(F-statistic)	0.000229		

Sample (adjusted): 2009M09 - 2012M04
Included observations: 32 (after adj.)

Figure 183 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated ADL (ln_posters) Model; Region 5

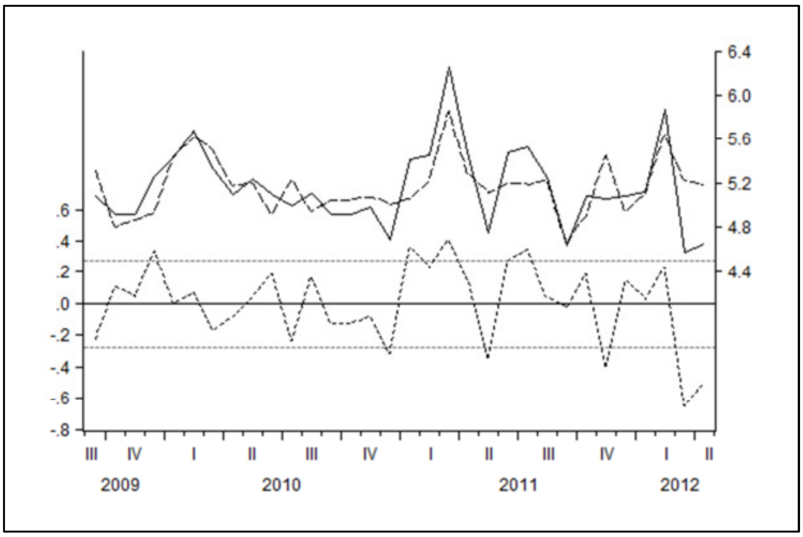
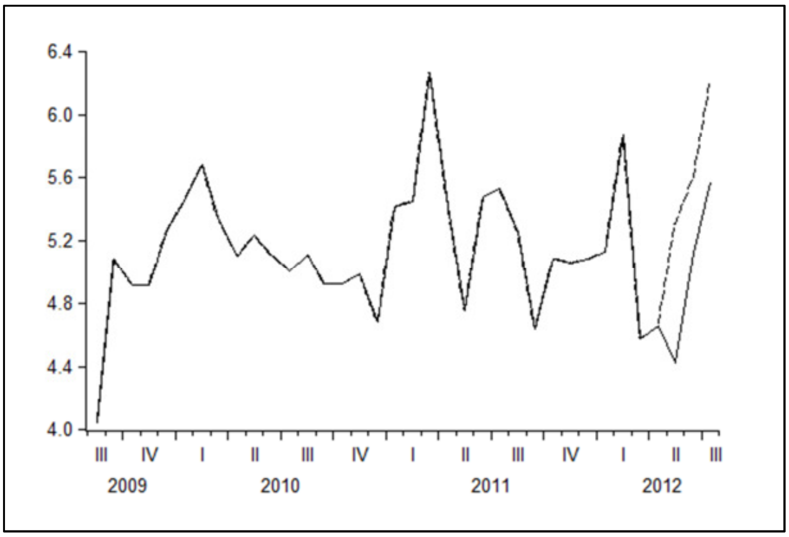


Figure 184 Actual (——) and Forecasted (– –) Values of ln_new_signups (ADL ln_posters); Region 5



ADL (ln_participation)

Next, I make use of an ADL model containing the participation variable in levels in order to explain and predict community growth of region 5. The SC selects an ADL model that only includes the contemporaneous participation variable, i.e. *ln_participation*, besides the constant term (see Appendix 162). The null hypotheses of the Jarque-Bera, the Breusch-Godfrey, and the White test are not rejected (see Appendix 160). Hence, the model is correctly specified. The estimation output is presented in Table 47. Both R^2 values, whereby R^2 adds up to 0.18 and adjusted R^2 adds up to 0.15, indicate a poor goodness of fit. The SC obtains a value of 1.04, the AIC reaches a value of 0.95. Moreover, estimation results show that the coefficient of *ln_participation* is significantly different from zero at a significance level of 5%, but not at a level of 1% because $0.01 < 0.0148 < 0.05$. The estimated coefficient implies that a 1% increase in the number of contributions leads to a 0.20% increase in the number of new sign-ups. Figure 185 illustrates the estimated model and actual values. Finally, the one-step-ahead forecast procedure yields forecast errors of RMSE=0.435531 and MAE=0.307779 based on the forecast sample ranging from May 2012 to July 2012. The deviations of the forecasted values from the observed values are depicted in Figure 186.

Table 47 ADL (ln_participation) Estimation Output; Region 5

Dependent Variable: ln_new_signups				
	Coefficient	Std. Error	t-Statistic	p-value
Constant	3.874444	0.491025	7.890521	0.0000
ln_participation	0.202450	0.078437	2.581067	0.0148

R-squared	0.176887	Mean dependent var	5.130377
Adjusted R-squared	0.150335	S.D. dependent var	0.410142
S.E. of regression	0.378058	Akaike info criterion	0.951154
Sum squared resid	4.430767	Schwarz criterion	1.041852
Log likelihood	-13.69405	Hannan-Quinn criter.	0.981671
F-statistic	6.661908	Durbin-Watson stat	1.684810
Prob(F-statistic)	0.014805		

Sample (adjusted): 2009M08 - 2012M04
Included observations: 33 (after adj.)

Figure 185 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated ADL (ln_participation) Model; Region 5

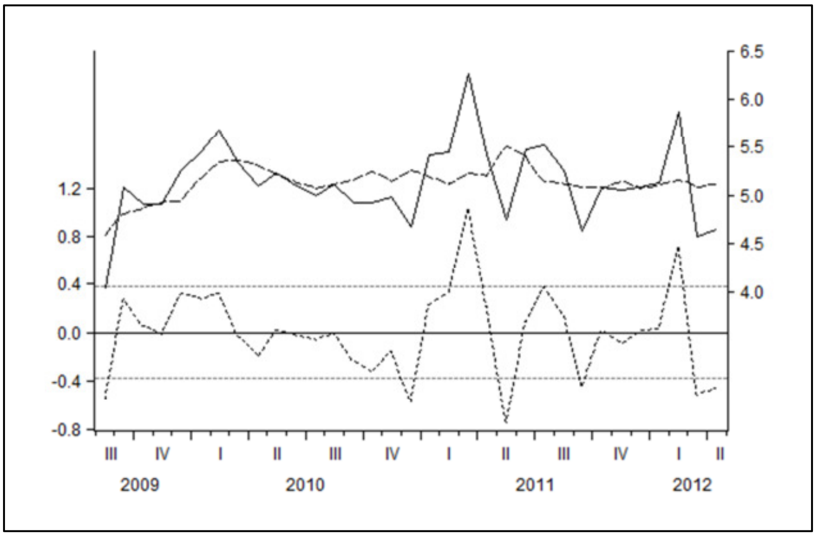
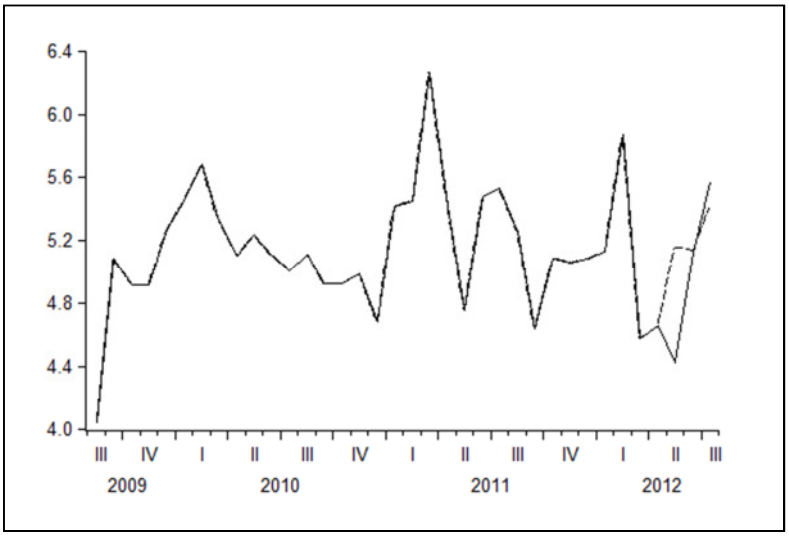


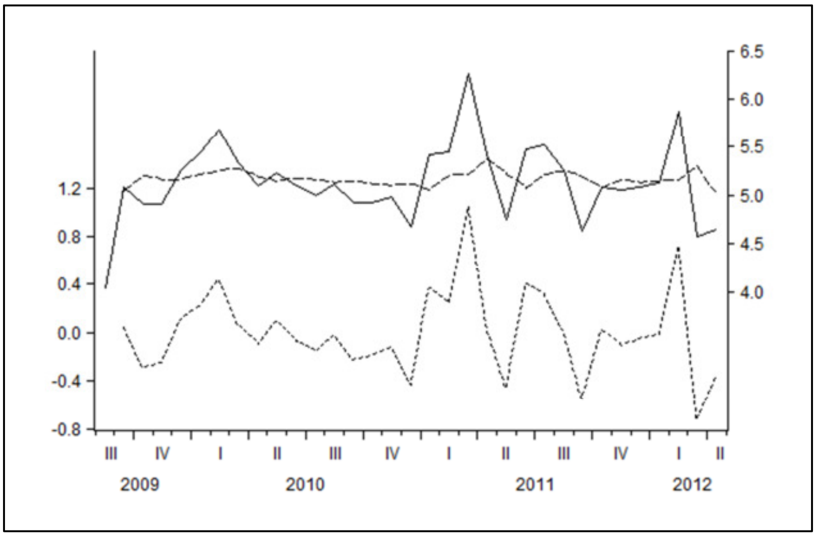
Figure 186 Actual (——) and Forecasted (– –) Values of ln_new_signups (ADL ln_participation); Region 5



VAR (ln_posters)

In this section, I estimate a VAR process including the poster variable in levels in order to analyze and predict community growth of region 5. The lag length of the VAR model is determined by the SC. The SC selects a VAR(1) process as the specification with the lowest SC value among VAR models up to lag order 4 (see Appendix 163). Since null hypotheses of the VAR normality test, of the VAR White heteroskedasticity test, and of the VAR autocorrelation LM test are not rejected at a significance level of 5%, no changes to the model are necessary (see Appendix 164). Thus, the VAR(1) model is correctly

Figure 187 Actual (——) and Fitted (– –) Values of ln_new_signups and Residual (----) Values from the Estimated VAR (ln_posters) Model; Region 5



specified and generates values of SC=0.42 and AIC=0.14 (see Appendix 165). Figure 187 shows actual values of the logarithmized number of new sign-ups as well as values which are generated through the VAR model. IRFs are displayed in Figure 188. The IRF at the bottom left shows a positive response of the community growth variable to a shock in the number of posters, which stays significant for about one month. In contrast, the IRF at the top right indicates that an impulse in new sign-ups leads to a negative response of the poster variable that is significant up to five months. The own-variable IRFs show both a positive response, whereby the response of new sign-ups stays significant for about one month and the response of the poster variable stays significant up to three months. The one-step-ahead forecast procedure yields forecast errors of RMSE=0.450178 and MAE=0.408871 based on the forecast sample ranging from May 2012 to July 2012. Forecasted and observed values are depicted in Figure 189.

Figure 188 Impulse Response Functions, ln_posters ln_new_signups, Response to Cholesky One S. D. Innovations ± 2 S. E.; Region 5

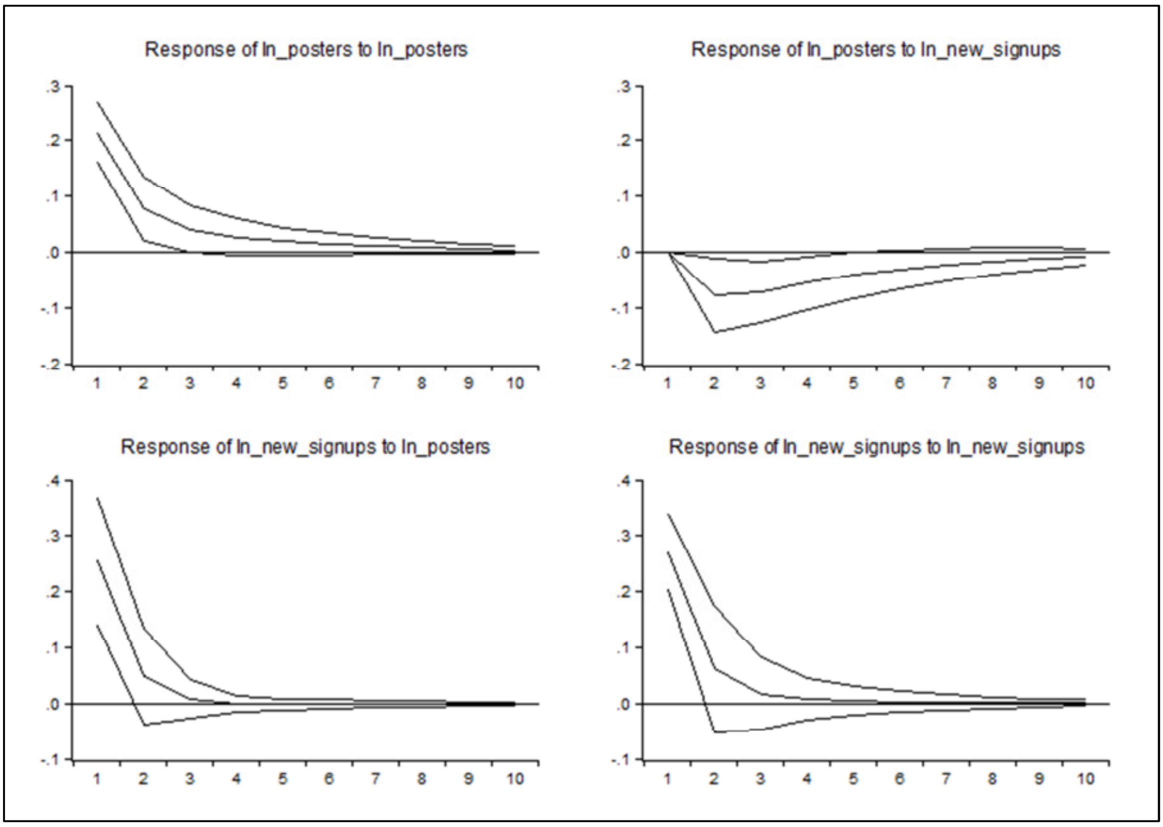
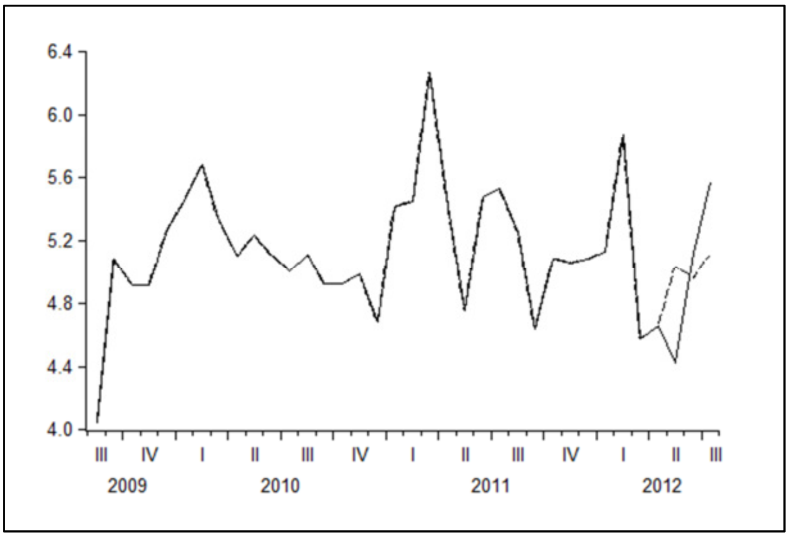


Figure 189 Actual (——) and Forecasted (– –) Values of ln_new_signups (VAR ln_posters); Region 5



VAR (ln_participation)

Finally, I consider the participation variable in levels instead of the poster variable in order to formulate a VAR process. Among VAR models up to lag order 4, the SC is minimal for a VAR(0) process (see Appendix 166). Since a VAR(0) model only includes a constant term, it indicates that there are no dynamics in the model. Thus, a VAR model including the participation variable in levels is not suitable for modeling community growth in region 5.[32]

4.7. Discussion

4.7.1. Summary of Results

This is the first research project to compare different econometric models on the basis of their performance in modelling and forecasting community growth. Thereby, the most appropriate models to explain and predict community growth are identified. Furthermore, based on the included independent variables, the project also contributes to the understanding of community growth.

[32] I additionally estimate VAR(1) and VAR(2) models in order to double check. VAR(1) is misspecified because of no normality and autocorrelation in the residuals. Further, VAR(2) is misspecified because of not normally distributed residuals.

Factors Influencing Community Growth

The overall effects of past new sign-ups, posters, participation, and team variables on community growth are displayed in Table 48. Summing up, the findings of this project support to a great extent hypothesis H1, which assumes that the number of people having already joined a community positively affects community growth. Accordingly, the respective parameter estimates of the Bass model are significant positive in four regional communities. Thus, the model demonstrates a positive influence of the cumulative number of already registered individuals on community growth. Often, also a negative influence of the squared cumulative number is identified, which means that community growth is still positive, but diminishing. Further, in the case of ARMA models, a positive influence of past new sign-ups on current new sign-ups, i.e. on community growth, is detected twice (regions 3 and 6). Effects are insignificant in the four remaining regional communities. Additionally, the ADL models identify significant positive effects of past new sign-ups on community growth in all regional communities. Finally, also the VAR model specifications imply that, in all regions, an impulse in new sign-ups leads to a positive response of community growth. Hence, as the influence of past new sign-ups on current new sign-ups is mostly significant and positive, hypothesis H1 is confirmed.

Also hypotheses H3a and H3b, which indicate that the number of posters (H3a) and the number of contributions (H3b) positively affect community growth, are supported because of the significant positive parameter estimates of those variables in almost all models. Additionally, the transfer of these hypotheses to the growth rates of the respective variables yields similar results. However, results imply that posters play a more important role in explaining community growth than contributions do. In particular, ADL models reveal overall significant positive effects of the growth rate of the number of posters on community growth in all regions. In contrast, the influence of the growth rate of the number of contributions is only significant in three out of six cases. This is an initial indication that poster variables are superior to participation variables in explaining community growth. Regarding the influence of the level variables, i.e. the number of posters and the number of contributions, on community growth, results are balanced: Positive effects of both the number of posters and the number of contributions on community growth are detected in three out of three cases. Although in the long run in some cases (see Chapter 4.5 and Chapter 4.6) the positive effects are diminished by the negative sign of lagged posters/participation variables, overall effects are still positive as indicated in Table 48. Regarding the VAR model specifications, the findings imply that in five out of six

Table 48 Overall Effects on Community Growth

	Bass	ARMA	ADL						VAR				
	Past New Sign-Ups	Past New Sign-Ups	Past New Sign-Ups	Posters	Growth Rate Posters	Participation	Growth Rate Participation	Growth Rate Team	Past New Sign-Ups	Posters	Growth Rate Posters	Participation	Growth Rate Participation
Region 1	n.s.	n.s.	+		+		+	n.s.	+		+		*VAR(0)*
Region 2	n.s.	n.s.	+	+	+	+	n.s.	n.s.	+	+	+	*VAR(0)*	*VAR(0)*
Region 3	+	+	+		+		n.s.	n.s.	+		+		*VAR(0)*
Region 4	+	n.s.	+	+	+	+	+	n.s.	+	+	*VAR(0)*	+	*VAR(0)*
Region 5	+	n.s.	+	+	+	+	n.s.	-	+	+	+	*VAR(0)*	*VAR(0)*
Region 6	+	+	+		+		+	-	+		+		+

regions an impulse in the growth rate of the number of posters is followed by a significant positive response of the number of new sign-ups, which diminishes over time. Only in region 4 the VAR model fails to explain the relationship between the posters' growth rate and community growth. Additionally, in three out of three regions there is a significant positive impact of the number of posters on community growth, which diminishes over time. In region 2 and region 5 the models even reveal a reciprocal relationship between the growth rate or the number of posters and community growth, whereby the effect of community growth on both poster variables is significant negative. In contrast to the VAR models including the different poster variables, the VAR model fails to explain the relationship between the growth rate of contributions and community growth as well as between the number of contributions and community growth in most cases. Only in region 4 and region 6 a significant positive response of community growth, which diminishes over time, can be identified. Hence, this is a further indication that the participation variables play a minor role in the explication of community growth. Further, significant effects of community growth on the growth rate and on the number of contributions are not detected. Thus, there are no reciprocal relationships between these variables.

By hypothesis H2, I propose a positive impact of the amount of personal selling on community growth. However, this hypothesis is not confirmed for various reasons: Firstly, the variable representing the number of the regional communities' employees or team members cannot be included into the models because of its non-stationarity. Secondly, the team growth rate does not exert any significant impact on community growth in four regional communities. This suggests that the team growth rate plays a minor role in explaining community growth. Thirdly, in the remaining two regions, a significant negative impact is detected.

In summary, the results of this project reflect the practical findings pointed out by Lithium (2008). Lithium (2008) claims that after having gained a critical mass (H1) the content (H3a and H3b) provided by the users will make the community self-sustaining. Although H2 cannot be supported, this does not necessarily conflict with the practical experience of Lithium (2008) because promotion might still attract people to the page, but for various reasons people do not register.

Modelling and Forecasting Performance

In order to assess the performance of the applied econometric models, values of SC and AIC are summarized in Table 49 and models are ranked according their performance.[33] Thereby, a value of 1 is attributed to the best model, i.e. the model with the lowest value of SC/AIC, a value of 2 is attributed to the second best model, etc. Then, for each model, these values are summed up over all regions. The best model is the model with the lowest total sum of attributed ranks. For the assessment of the models' forecasting quality, which is based on RMSE and MAE (see Table 49), the same approach of ranking the models and summing up over regions is used.

When Bass, ARMA, ADL and VAR models including the growth rate of the number of posters, as well as ADL and VAR models including the growth rate of the number of contributions are compared regarding SC and AIC, the ADL model including the growth rate of the number of posters is by far the best model over all regions, i.e. over regions 1 to 6 (see Table 49 and Appendix 167). The second best model over all regions is the ARMA model. The models with the lowest performance are both VAR models, whereby the VAR model including the growth rate of the number of contributions performs worst. Comparing these models with regard to their forecasting performance, the ARMA model produces the best forecasts. The worst forecasting performance is provided by the VAR model containing the growth rate of the number of contributions.

The comparison based on SC and AIC of Bass, ARMA, ADL and VAR models including the number of posters, as well as ADL and VAR models including the number of contributions yields that over the comparable regions, i.e. region 2, 4, 5, the ADL model including the number of posters performs best, followed by the ADL model comprising the number of contributions (see Table 49 and Appendix 168). The worst model is represented by the VAR model including the number of contributions. Regarding the models' forecasting performance the ADL model including the number of contributions constitutes the best model, but is closely followed by the ARMA model. The poorest forecasting performance is provided by both VAR models, whereby the VAR model containing the participation variable performs worst.

The evaluation regarding SC and AIC of all the ten estimated models, i.e. Bass, ARMA, ADL and VAR models including the growth rate or number of posters respectively, as

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[33] I do not compare values of (adjusted) R^2 because results can be misleading (Wooldridge 2006): The focus of this project is not to completely explain community growth, but to find out more about the (ceteris paribus) relationships between the discussed variables and community growth.

Table 49 Model Selection and Forecasting Performance

	Bass		ARMA		ADL								VAR							
					ln_posters		d_ln_posters		ln_participation		d_ln_participation		ln_posters		d_ln_posters		ln_participation		d_ln_participation	
	SC	RMSE	SC	RMSE	SC	RMSE	SC	RMSE	SC	RMSE	SC	RMSE	SC	RMSE	SC	RMSE	SC	RMSE	SC	RMSE
	AIC	MAE	AIC	MAE	AIC	MAE	AIC	MAE	AIC	MAE	AIC	MAE	AIC	MAE	AIC	MAE	AIC	MAE	AIC	MAE
Region 1	0.804309	0.569461	0.865810	0.682572			0.507668	0.559356			0.775356	0.512529			1.092977	0.448382			*VAR(0)*	
	0.624738	0.456720	0.684415	0.491148			0.326274	0.489940			0.684659	0.501042			0.630401	0.337662				
Region 2	1.224260	0.911829	1.101018	0.891237	0.508251	1.054225	0.482513	0.746861	1.034700	0.876823	1.116894	0.872336	1.583560	1.155746	1.540703	0.886907	*VAR(0)*		*VAR(0)*	
	1.042865	0.631596	1.009409	0.611291	0.323220	0.940555	0.202273	0.543002	0.897287	0.666234	1.025285	0.600538	1.308734	0.983532	1.263157	0.568453				
Region 3	2.211019	0.303772	1.714515	0.259265			1.279547	0.329818			1.809798	0.260706			2.750804	0.31097			*VAR(0)*	
	2.074973	0.249843	1.622907	0.198933			0.999308	0.288227			1.672385	0.19505			2.473258	0.252235				
Region 4	2.280116	0.645011	1.569605	0.599637	1.072701	0.702416	1.184270	0.364028	1.063595	0.495923	1.301809	0.222048	1.971732	0.766993	*VAR(0)*		3.266785	0.721041	*VAR(0)*	
	2.144070	0.506322	1.430832	0.499543	0.935288	0.640264	1.046857	0.299059	0.926182	0.477706	1.116778	0.180803	1.513690	0.707702			2.900351	0.674794		
Region 5	1.201222	0.588346	0.910860	0.410786	0.551131	0.682844	0.615635	0.435657	1.041852	0.435531	1.014822	0.495176	0.419585	0.450178	0.552748	0.443818	*VAR(0)*		*VAR(0)*	
	1.065176	0.535764	0.587056	0.346638	0.367914	0.661482	0.430604	0.347253	0.951154	0.307779	0.923213	0.407219	0.144759	0.408871	0.275202	0.387960				
Region 6	1.731827	0.651676	1.324878	0.095207			1.177679	0.381549			1.555972	0.261179			2.541438	0.304962			3.500587	0.210604
	1.595781	0.634025	1.141661	0.079101			0.992649	0.361416			1.275732	0.225563			2.171377	0.222500			3.130526	0.186739

well as ADL and VAR models including the growth rate or number of contributions respectively reveals that over the comparable regions, i.e. region 2, 4, 5, the ADL models including the number of posters or the growth rate of the number of posters respectively perform by far best (see Table 49 and Appendix 169). The lowest performance is obtained by the VAR models including the number of contributions or the growth rate of the number of contributions respectively. Comparing the models concerning their forecasting quality, the ADL model containing the growth rate of the number of posters outperforms all other models. The poorest forecasting performance is provided by the VAR models including the number of contributions or the growth rate of the number of contributions respectively.

Taken together, these findings suggest that ADL models perform best while VAR models perform worst based on model selection criteria such as SC and AIC. Specifically, ADL models that include the poster variables always constitute the best models. Hence, poster variables are superior in modelling community growth than participation variables. This is further supported by a direct comparison of the ADL (or VAR) models including the growth rate or the number of posters respectively versus the ADL (or VAR) models including the growth rate or the number of contributions respectively. Thereby, the models including the poster variables almost always outperform the models containing the participation variables regarding SC and AIC. Thus, in order to ensure community growth, a higher participation is not enough. It is rather important to have more people who contribute at all in order to guarantee community growth. Besides, ARMA and Bass models occupy medium rankings, whereby ARMA models perform better than Bass models regarding SC and AIC.

Concerning the forecasting performance based on RMSE and MAE, the findings imply that the ADL model including the growth rate of the number of posters, the ARMA model, and the ADL model including the number of contributions perform best. Hence, these findings support Granger’s and Newbold’s (1975) as well as Kirchgässner’s and Wolters’ (2007) notion that usually relatively “simple” univariate models like ARMA models beat complex models regarding their forecasting performance. Besides, the Bass model holds again a medium ranking. Furthermore, in a direct comparison of the three above mentioned best forecasting models, the ADL model including the growth rate of the number of posters provides by far the best forecasts.

Combining the results of model selection based on SC and AIC and of forecasting performance based on RMSE and MAE, the ADL model containing the growth rate of the number of posters seems to be the most suitable model for modelling and predicting community growth.

4.7.2. Theoretical Implications

From a theoretical perspective, this project contributes to the understanding of community growth in various ways:

Firstly, the theories discussed in Chapter 4.2 provide a solid basis for the understanding of community growth. Hypotheses H1, H3a, and H3b, which assume that the number of people having already joined a community, the number of posters, and the number of contributions positively affect community growth, are confirmed. Hence, the discussed aspects of diffusion theory, of the theory of social learning, of the theories of collective behavior and critical mass, as well as those of the theory of social comparison can be transferred to the setting of online communities. Moreover, these findings suggest that it is not enough to rely on only one theory. The variety of theories contributes to the understanding of community growth in explaining how people having already joined a community, how posters or how participation foster community growth. Especially, the detected impact of people having already registered for a community on community growth can be deducted from almost all discussed theories.

Additionally, the findings of this project also surpass the implications of the discussed theories, especially those of the theory of social comparison and the value of online communities. Results reveal that not only an increase in the number of posters and contributions enhances community growth, but also an increase in the growth rates of these variables. This adds a more dynamic aspect to the investigated relationships. Especially the growth rate of the number of posters is identified to play a central role, which suggests that a steady increase in the growth rate can enhance community growth. However, sometimes endless growth is restricted by the counterbalancing negative effect of community growth on the number of posters as well as on the growth rate of the number of posters. Hence, Hagel's and Armstrong's (1997) idea of an endless circle created by the positive reciprocal relationship between the amount of content and community growth cannot be confirmed by the present research because there is either only a unidirectional positive effect on community growth or the discussed counterbalancing effect occurs.

Moreover, this research is the first to demonstrate that posters play a more important role in explaining community growth than just contributions. Hence, community growth can be ensured by the number of members, who contribute to the community, and by the growth rate of this number. It is not enough to provide a mere high number of contributions. The contributions have to come from different sources, i.e. from many different members. This is also comparable to Burt's (1992) and Granovetter's (1973) view of the attractiveness of having access to diverse sources of information, which they underline in their work on structural holes and weak ties respectively. Furthermore, Butler's (2001) finding of communication volume positively affecting community growth can be expanded. Although the present project reveals – similar to Butler (2001) – positive effects of the number of contributions on community growth, the number of people who contribute plays a more important role than the pure volume of contributions.

Taking all these aspects together, the discussed theories provide a helpful basis for the understanding of community growth, but not sufficiently. Especially theories about social comparison and the value of online communities need to be specified based on the findings of this research project.

Furthermore, theoretical considerations about the influence of personal selling on community growth need to be revised. Deducted from the theory of social learning and from research on communication channels, hypothesis H2 assumes a positive impact of the amount of personal selling on community growth. However, the present research does not find support for this hypothesis. In most cases, there is no significant relationship between the team variable and community growth at all. One reason might be that personal selling does not directly influence community growth. Hence, personal selling might have the same effects as the by Rogers (2003) postulated effects of mass media, which only make people aware of an innovation rather than persuading them to adopt. In the context of online communities this would mean that personal selling brings potential members to the community page (Lithium 2008), but for the definite registration other factors such as the informational value of the community play a role. Only in two regional communities a significant impact of personal selling on community growth is revealed. This impact is, however, negative. This suggests that either theory implies a wrong assumption concerning the direct influence of personal selling on community growth or the amount of personal selling requires another measuring – such as the number of photos taken by team members or the general amount of editorial content provided by team members – in order to detect a significant positive relationship. However, these variables are not available for this project's observation period. Concentrating on the available variable, i.e. the growth rate of the number of team members[34], the negative impact on community growth can result from the disturbance of a sense of community. McMillan and Chavis (1986, p. 9) define sense of community as "a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together". This kind of feeling can be disrupted if someone tries to interfere in the natural evolution of the community. Hence, an external intervention in the community process through personal acquisition of new members by the community provider can damage the sense of community and thus reduce community growth.

Moreover, the present project contributes to marketing literature in the sense that appropriate models for the accurate forecast of community growth are identified. Although the traditional Bass model still enjoys a great popularity (Bass 2004), it is not the best model for predicting the growth of online communities. For this purpose, econometric models such as ADL and ARMA models perform best. Further, the findings of this project imply that relatively complex VAR models are inferior to ADL and ARMA models and even to the Bass model. Hence, this empirical project also contributes to econometric literature in confirming the findings of Granger and Newbold (1975) and the statement of Kirchgässner and Wolters (2007) in the sense that the forecasting performance of simple models is often better than the performance of complex models.

Finally, the used dataset is unique in community research. Since models are applied to each of six regional communities, it is possible to compare the results. Hence, to some extent, a first verification of the findings is possible. Furthermore, the dataset comprises information about the communities since their foundation. Therefore, the whole diffusion can be analyzed.

[34] A variable representing the number of team members cannot be included into the analyses due to estimation issues (see Chapter 4.3).

4.7.3. Managerial Implications

Also from a managerial perspective, the present project provides valuable insights. First and foremost, results of this project support community managers in selecting an appropriate model for forecasting community growth. This is particularly important in light of a timely anticipation of an imminent decline of community growth. In this way, community operators have the opportunity to gain time to take countermeasures. Apart from that, it is generally indispensable that community managers are kept informed about the development of their community. Thus, by anticipating a likely future incline, decline, or stagnation of community growth, they are able to take the appropriate strategic decisions according to the expectations proposed by the forecasting models. The results of this project show that ADL and ARMA models have the best forecasting performance of all investigated models. Especially the ADL model including the growth rate of the number of posters outperforms all other models regarding their forecasting quality. Although univariate ARMA models are suitable for predicting future new sign-ups, an additional inclusion of the growth rate of the number of posters makes the forecasts more precise. Hence, it is recommended to choose an ADL model including the posters' growth rate. Nevertheless, it is beneficial to additionally estimate ARMA models or even ADL models including the participation variable in order to verify results. However, in the case of opposed results one should rely on the ADL model including the posters' growth rate. If community management's resources are limited in order to calculate variables such as the growth rate of the number of posters, ARMA models which require only time series data on the number of new sign-ups should be considered. Further, ARMA models should be preferred to the Bass model, which can also be estimated by only knowing the number of new sign-ups. Moreover, community operators should dispense with the estimation of complex VAR models since their forecasting performance is inferior to other models.

Besides, the findings of this project confirm the importance of individuals having already joined the community for ensuring further community growth. Hence, people who have already joined the community are a valuable asset. Community management should integrate members into measures that attract new members in order to reach a critical mass as soon as possible. Thereby, community operators should motivate existing members to recommend the community to others (Rohrmeier 2012; Williams and Cothrel 2000). This can be achieved by continuous improvements of the service and by satisfying the needs of members so that actual members recommend the community to others. Further, referral programs, which provide incentives for members to recommend the community, constitute another valuable way of attracting new members (Schmitt, Skiera, and van den Bulte 2011).

In addition to that, the findings of this project imply that also the number of posters as well as the growth rate of the number of posters positively affect community growth. Moreover, a positive influence of the number of contributions and in some cases a positive influence of the growth rate of the number of contributions on community growth is detected. However, models including the poster variables always exert a positive impact on community growth and even perform better. This means that community operators should concentrate on getting community members contributing and posting. Ensuring a high number of contributions produced by a small number of members is not enough. It is rather important to achieve a higher number of members, who contribute at all. This can be attained by rewarding the engagement of posters and by recognizing their contributions, by enhancing the usability and security of the page, or by providing members the possibility to create an online identity besides their real-life identity (e.g. Iriberri and Leroy 2009; Koh et al. 2007; Preece, Nonnecke, and Andrews 2004).

Finally, results of this project imply that personal selling in the form of the team growth rate does not directly contribute to a rise in community growth. However, this does not imply that personal selling is worthless. Personal selling might work similar as mass media, which make people aware of an innovation (Rogers 2003). However, this statement has to be analyzed by further research. In any case, according to the findings of this project, personal selling has to be applied with caution because of possible negative effects on community growth.

4.7.4. Directions for Further Research

Although this project provides valuable insights into the understanding and forecasting of online community growth, there is still room for further research. First, this project should encourage researchers to keep on investigating factors influencing community growth. Especially other variables for the representation of personal selling should be identified and their influence on community growth should be analyzed. Further, a model is needed, which describes the different stages that a potential new member passes through until registration based on Rogers' (2003) innovation-decision process. By analyzing factors that are important for each stage, the role played by personal selling might become clearer. Further, the inclusion of information about the monthly number of offline and online recommendations sent out by community members could also shed additional light on the understanding of community growth. Moreover, the discussed models should be applied to more communities and also to other sorts of communities in order to verify the results provided by the present research project to a greater extent and to generalize the findings. Furthermore, the analyses should also be conducted based on weekly or daily data. In this way, possible short-term effects, which are probably not apparent on a monthly basis, could be detected and results could be compared. Finally, further research should include more observations in order to be able to enlarge the estimation and forecasting period. Thus, results concerning the model and forecasting performance would become more precise.

5. General Discussion and Conclusion

The overarching objective of this thesis is to provide an understanding of the dynamics in the evolution of online communities by focusing on their success factors. Although community success is widely discussed in theory and practice (e.g. Cothrel 2000; Leimeister, Sidiras, and Krcmar 2006; Lin 2008; Lithium 2011b; Preece 2001; Williams and Cothrel 2000), a comprehensive dynamic investigation has been neglected by prior research. From a theoretical perspective, it is important to learn more about the dynamic aspects of communities in order to specify and extend existing socio-scientific theories for community research. From a managerial perspective, the understanding of community dynamics helps managers to decide about the timing and selection of measures leading to an optimal community evolution process and successful community management. Using time series data from a number of online communities, the thesis provides a comprehensive macro level investigation of the community evolution process and the interdependence of success factors. As such, it offers valuable insights for theory and management.

5.1. Summary of Key Findings

In the following, the main results of the two empirical projects, which both investigate dynamics in the community evolution process by concentrating on community success factors, are summarized.

Project 1 investigates the interdependence of community success factors – such as network structure, community participation, and community growth – over time and community life cycle phases. In detail, this project addresses the questions whether and which success factors interdepend at all, how they interdepend, and when they interdepend. Drawing from social capital theory (e.g. Bourdieu 1986; Coleman 1988) and the theory of structuration (Giddens 1984), a theoretical framework is set up and tested by a panel vector autoregressive approach, which treats all variables as endogenous and allows a simultaneous analysis of effects appearing in different regional communities. The results of *Project 1* reveal that, regardless of the communities' life cycle phase, some general statements are valid: Network structure influences participation and vice versa. Especially, positive reciprocal effects between network structure in the form of average degree and different participation variables, such as active interpersonal participation and overall participation, are detected. Results further reveal that all these effects mainly last for several months. Hence, average degree and participation contribute to the guarantee of a lively and successful community. However, network structure in the form of average degree, degree centralization, share of networkers, and network clustering coefficient does not directly influence community growth. Concerning the remaining relationships, a distinction between established and new regional communities is necessary because the results of *Project 1* show that interdependencies between success factors differ over time and community life cycle phase: In the case of established regions, positive reciprocal effects between the share of networkers and all of the three participation variables, i.e. active interpersonal participation, active platform participation, and overall participation, are detected in addition to the general effects discussed above. Moreover, degree centralization exerts a negative impact on all participation variables. However, this effect is counterbalanced by a positive effect of platform participation and overall participation on degree centralization. In contrast, only the network clustering coefficient exerts no significant effects on participation. Taken together, in established regions, community members should be interconnected and the network should not become too central. Regarding the interdependence between participation and community growth, results of *Project 1* show that, in established regions, all participation variables exert a positive impact on community growth. These effects often last for several months. Reversed effects are rather unusual. Hence, community growth can be directly stimulated by participation, which is directly stimulated by average degree and the share of networkers. Finally, community growth has a significant negative influence on average degree and the share of networkers. Thus, positive effects between average degree or the share of networkers, participation, and community growth are counterbalanced. This means that communities do not grow endlessly. In the case of new regions, results reveal – in addition to the already discussed positive reciprocal effects between average degree and participation – a positive influence of degree centralization on all participation variables, which lasts for several months. Moreover, there are even positive reciprocal effects between degree centralization and active platform participation. Other variables representing network structure such as the share of networkers and the network clustering coefficient play a minor role. As a consequence, new regional communities require a central network as opposed to established regions. Further, the network should be dense in the form of average degree. Finally, in new regions, community growth is not affected by participation and there are also no effects between community growth and network structure. Thus, community growth in new regions is neither stimulated by participation nor by network structure.

Hence, other factors contributing to community growth in new regions need to be identified.

Project 2 sheds light on the diffusion process of online communities. In particular, this project investigates which factors contribute to the growth of online communities, how these factors influence community growth, and which modelling approaches perform best in explaining and predicting community growth. Using theories from social sciences on diffusion processes and group formation, a theoretical basis is formed and tested by methods from diffusion research and econometrics such as Bass, ARMA, ADL, and VAR models. At the same time, these models are evaluated regarding their capability in modelling and predicting community growth in order to identify the most suitable approach. Thereby, all analyses are based on data reflecting the diffusion process of six regional communities since their foundation. The results of *Project 2* show that people having already joined a community play a central role in the diffusion process of online communities because of their positive influence on community growth. This finding is confirmed for all regional communities by all models. Moreover, also people making contributions to the community, so-called posters, as well as contributions per se, i.e. participation in general, play a role in the diffusion process: In particular, overall positive effects of the number and the growth rate of posters as well as of the number and the growth rate of contributions, i.e. participation, are detected, although they diminish over time in some instances. However, in most cases effects of participation variables are not significant in contrast to the poster variables, which are significant in all but one instance. Hence, posters play a superior role in explaining community growth than participation in general. Moreover, in some cases significant reciprocal effects between the poster variables and community growth are detected, whereby negative effects of community growth on the number and growth rate of posters serve as counterbalancing effects to the positive effects going out from the poster variables. Furthermore, results of *Project 2* reveal that personal selling in the form of a team growth rate does not contribute to the diffusion of online communities because of its mostly insignificant and in two cases negative effects on community growth. Taking these findings together, people having already joined a community as well as posters play a major role in understanding the communities' diffusion process. This is also verified by the results gained from the comparison of Bass, ARMA, ADL, and VAR models regarding their modelling and forecasting performance: ADL models, which examine the influence of people having already joined a community in the form of past new sign-ups and the number or growth rate of posters on community growth, perform by far best. However, for forecasting issues, the model including the growth rate of posters should be preferred. Additionally, also the ARMA model, which considers only the influence of people having already joined a community out of the variables of interest, produces good forecasts. Finally, the lowest performance is provided by VAR models, especially those including the participation variables.

5.2. General Implications for Theory and Management

This thesis contributes to existing literature and research as well as to management practice in various ways.

From a theoretical perspective, a number of general implications are derived:

Following the claim of prior research to shed light on community dynamics and the interplay of success factors (Iriberri and Leroy 2009; Toder-Alon, Berger, and Weinberg 2010), this thesis contributes to a better understanding of the communities' evolution process and the relationship between success factors of online communities. According to the theories of Giddens (1984) and Bourdieu (1977), who both attribute a dynamical aspect to the interrelation of structure and social activities, reciprocal effects between network structure and community participation are revealed. Especially the positive interrelationship between network density in the form of average degree and different participation variables is prominent and long lasting. Interdependencies between other variables of network structure and participation differ regarding the community's life cycle phase. While in established regional communities, several reciprocal effects between network structure in the form of the share of networkers or degree centralization and diverse participation variables are uncovered, in new regional communities, the only reciprocal effects are detected between degree centralization and platform participation. Such differences also occur in the way in which effects appear: Although theory suggests a positive impact of network structure on participation and vice versa (e.g. Bourdieu 1986; Coleman 1988; Nahapiet and Ghoshal 1998; Putnam 1993), this general statement has to be treated with caution. Even though there are positive effects, especially between average degree and some participation variables, the nature of effects depends on the one hand on the respective variables to be considered and on the other hand again on the community's life cycle phase. While, for example, in new regional communities, degree centralization influences participation positively, there is a negative effect of degree centralization on participation in established regional communities. In contrast, in some cases there are even no significant effects at all, as for the relationship between the network clustering coefficient and participation in established regional communities, for instance. By showing the nature of effects between different aspects of network structure and different aspects of participation, this thesis provides a more detailed understanding of the interdependencies than existing theory and research does. Hence, the thesis advances theoretical knowledge by taking into account different aspects of network structure and community participation and by revealing the various significant and also nonsignificant effects between these variables. Moreover, it adds a further dynamical aspect by demonstrating that interdependencies vary across community life cycle phases. Therefore, this research adds to current knowledge by demonstrating the importance of considering different community life cycle phases.

Besides, this thesis contributes to a better understanding of the relationship between community growth and network structure. According to Nahapiet's and Ghoshal's (1998) view, social capital is constrained through a growing number of network members. Results provide empirical evidence for this notion because of negative effects of community growth on network structure variables in established regional communities. However, theory makes no assumption concerning the influence of network structure on community growth. Similarly, this thesis is not able to show significant effects of network structure on community growth.

Additionally, this thesis advances theoretical knowledge on the relationship between community participation and growth. It provides empirical evidence for Preece's (2000) and Forsyth's (2010) view that interaction and participation make a community attractive for new members because, in established regional communities, positive effects of participation on community growth are detected. This is in line with previous research of Butler (2001), who has already demonstrated a positive influence of communication activity on member gain in the context of mailing lists. Further, in one case even positive reciprocal effects between platform participation and community growth are detected. This would support Hagel's and Armstrong's (1997) notion of a positive reciprocal relationship between the amount of content and community growth because more content attracts more members, who in turn create more content. In contrast, in new regions, participation plays a minor role in influencing community growth. Instead, the number of posters or the growth rate of the number of posters, which brings even a more dynamic aspect into play, have a positive impact on community growth. Thus, in new communities, it is important that contributions come from different sources, which is in line with Burt's (1992) and Granovetter's (1973) view of the attractiveness of having access to diverse sources of information. Additionally, the role of posters in ensuring community growth is also consistent with Preece's (2000) and Forsyth's (2010) view. Hence, also on a macro level there is empirical evidence for the theory of social comparison and for the role of informational value in attracting new members. Yet, this thesis shows that a more detailed view is necessary. In this way, especially in the beginning of a community's evolution process, a high number of people contributing to the community are important in order to ensure the community's evolution and growth. Later, community growth can be enforced by a higher participation in general regardless of whether the amount of participation comes from only a few or from several community members. Furthermore, in contrast to the case of established regional communities, in new regional communities, there is no empirical evidence for a positive reciprocal relationship between the amount of content and community growth as claimed by Hagel and Armstrong (1997). This is in line with the experience of Andrews (2002) and Lithium (2008), who argue that self-sustaining effects between content and growth occur not at the beginning of a community's life, but at later stages.

Moreover, this thesis adds to marketing theory by demonstrating the positive influence of people, who have already joined the community, on the diffusion process of online communities. This suggests that diffusion theory, the theory of social learning, theories of collective behavior and critical mass are also valid in the context of online communities. However, the theory of social learning fails to explain community growth in one aspect: There is no empirical evidence for a positive influence of personal selling on community growth. In two regional communities, even a negative effect is detected, which may indicate that the sense of community (McMillan and Chavis 1986) is disturbed when community employees interfere in member acquisition.

Finally, this thesis extends marketing literature and contributes to econometric literature in identifying ADL and ARMA models as the most appropriate approach for forecasting community growth.

Besides, this thesis also offers important insights for management practice:

The results of this thesis suggest that a closer understanding of community dynamics is indispensable for an optimal community evolution process and successful community management. Knowing more about the community evolution process and the interplay of community success factors over time and life cycle phases, managers are able to take the optimal measures at the right time for achieving the community's goals. Accordingly, results imply that community operators should consider the community's life cycle phase when managing their community because effects among community success factors mostly differ between established and new communities. Taking into account a life cycle perspective is also proposed by Iriberri and Leroy (2009). In this sense, only some general propositions are applicable to all communities regardless of their development status.

It is essential for community operators to ensure a basic connectivity among community members because of its positive influence on community participation, which is an elementary requirement for successful community management (e.g. Cothrel and Williams 1999; Leimeister, Sidiras, and Krcmar 2006; Lithium 2012a). Although connectivity is essential for all communities, it is especially important for established communities because of the positive reciprocal effects between the share of networkers and all kinds of participation, which have a positive impact on community growth. Moreover, healthy communities require an increasing network density in the form of average degree in order to stimulate participation. This relation is especially powerful because of the positive reciprocal effects between average degree and interpersonal or overall participation, which even exert an additional positive effect on community growth in the case of established regions. Furthermore, community managers must pay attention to the network's centralization. Whereas in new communities degree centralization has a positive impact on all participation variables, one observes a negative influence in established regions. Hence, in established communities, community managers need to prevent an increasing centralization, i.e. they need to maintain an equally distributed number of contacts among community members, in order to avoid a decrease in participation. In contrast, in new communities, they need to force the formation of a central network in order to enhance the amount of user generated content. Taking these aspects together, it is important for community management to regularly analyze the community's social network. Although the investigated aspects of network structure influence the amount of user generated content in various ways, network variables have no direct effect on community growth.

Yet, as already indicated, in established regions the amount of user generated content in the form of interpersonal, platform, and overall participation has a positive influence on community growth. However, because of nonsignificant or negative effects of community growth on network structure, which in turn directly influences participation and indirectly community growth, a permanent supervision of success metrics is indispensable for ensuring community success. Community management needs to consider all factors and activities that enhance participation in order to maintain an attractive and lively community. In contrast, in order to stimulate community growth in new regions, an increase in participation in general is not sufficient, while an increase in the number of posters is. Hence, community managers need to motivate as many community members as possible to generate content.

Additionally, results of this thesis confirm the importance of people having already joined a community for the further evolution of the community. Hence, managers should bring a critical mass to the community in order to ensure the community's attractiveness (Lithium 2008; Preece 2000).

Moreover, despite the frequent use of personal selling for acquiring new customers, this instrument cannot be used to directly foster the growth of online communities. Further, although this thesis shows that personal selling has mostly no significant influence on community growth, in a few cases there is a significant negative effect on community growth suggesting that growth decreases if the amount of personal selling increases. Hence community managers should be cautious by sending out employees for user acquisition until their influence is closer investigated in further research.

Finally, results of this thesis support community management by providing tools that timely inform community operators about the future development of their community. Among these tools, ADL models including the growth rate of the number of posters as an exogenous variable as well as ARMA models are identified to be the most appropriate ones to predict community growth. Hence, by the help of these models, community managers can observe how the community's future evolution will proceed and can accordingly adapt their strategies.

5.3. Conclusion and Outlook

In summary, this thesis provides an extensive investigation of dynamics in the online communities' evolution process. Thereby, it offers a detailed analysis of the interrelationship between success factors of online communities in general and also across community life cycle phases. Results suggest that a life cycle perspective is indispensable for analyzing the interplay of community success factors because of the different effects between the variables at different times. Moreover, this thesis identifies factors and methods, which contribute to an accurate forecast of community growth. However, there is also room for further research.

First, this thesis treats community success from a rather social point of view. Accordingly, the used success metrics are comparable to Preece's (2000; 2001) sociability measures. However, community success can also be regarded from a more technical point of view by concentrating on usability metrics such as the number of errors in using the service or breakdowns of the application and privacy or security issues (Leimeister, Sidiras, and Krcmar 2006; Preece 2000, 2001). Further research should focus on the interplay of sociability and usability measures. Research can address the following questions: 1) Do the number of errors or breakdowns and the number of messages in the newspapers concerning privacy violation or security breaches affect community growth or participation? If yes, which effects occur and how do these effects develop over time? 2) Does community growth or participation influence usability measures? If yes, which effects occur and how do these effects develop over time?

Second, this thesis investigates the relationship between community success factors such as network structure, participation, and community growth. Yet, as many communities are created for business and therefore need to generate revenues, one goal of communities is to maximize their profits (Bughin and Hagel 2000; Cothrel 2000). Since most community firms are financed by advertising revenues (Trusov, Bodapati, and Bucklin 2010), it would be fruitful to include the amount of revenues earned through advertising into the investigation of community success. In this way, the impact of community success factors on revenues can be analyzed.

Third, more and more companies spend money on the setup of their own community platform (Forrester 2010). As a result, companies can revert to a huge amount of data, which they own themselves and which they can use for the evaluation of their business goals. Regardless of whether the community is created for social support, social marketing, social commerce, or ideation, it offers many ways to influence business value (Lithium 2012b). Hence, further research should 1) apply the research framework of this thesis to data of company owned social communities or brand communities in order to verify and generalize the results of this thesis, 2) investigate the impact of community success factors on business value. Thereby, the influence on customer satisfaction, loyalty, brand awareness, or sales is of special interest from a marketing perspective.

Finally, further research should pave the way for a new type of customer lifetime or customer equity measurement, which can be applied in the community context. Since some users contribute more to the community's success than other users, it is important to identify them and determine their influence or value (Lithium 2011a). As online communities are by definition a social phenomenon, customer equity measurement must include network effects as claimed by Algesheimer and Wangenheim (2006). Thus, social network analysis should be applied in order to determine the value that is derived from the users' position in the network. Additionally, a customer equity measurement for online communities should also consider the users' participation behavior. Thereby, one can distinguish between the various forms of participation used in this thesis such as interpersonal or platform participation. Different forms of participation should be weighted differently. Hence, based on data from social network analysis and participation behavior, customer lifetime value for community users or customer equity for the whole community can be determined.

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Appendix

Appendix 1 Panel Unit Root Tests; Established Regions

	Fisher-type[1]								Im-Pesaran-Shin (AIC4)[2]		Im-Pesaran-Shin (BIC4)[3]		Levin-Lin-Chu (AIC4)[4]			Levin-Lin-Chu (BIC4)[5]		
	Inverse chi-squared		Inverse normal		Inverse logit		Modified inv. chi-squared		W-t-bar		W-t-bar		Unadjusted t	Adjusted t*		Unadjusted t	Adjusted t*	
Variable	Statistic	p-value	Statistic	p-value	Statistic	p-value	Statistic	p-value	Statistic	p-value	Statistic	p-value	Statistic	Statistic	p-value	Statistic	Statistic	p-value
ln_new_signups	18.4979	0.0471	-1.5624	0.0591	-1.5449	0.0666	1.9002	0.0287	-1.6043	0.0543	-2.6879	0.0036	-3.7602	-1.3997	0.0808	-4.6296	-2.6773	0.0037
ln_average_degree	15.8204	0.1049	-0.2348	0.4072	-0.3384	0.3688	1.3015	0.0965	-0.1162	0.4537	0.4871	0.6869	-3.4303	-0.4966	0.3097	-2.9525	0.0288	0.5115
ln_degree_centralization	10.9630	0.3604	1.3874	0.9173	1.5876	0.9384	0.2153	0.4148	-1.5430	0.0614	-1.1889	0.1172	-4.6474	-3.0153	0.0013	-4.3860	-2.7331	0.0031
ln_networker_share	5.7790	0.8335	1.6052	0.9458	1.7082	0.9509	-0.9439	0.8274	1.7023	0.9556	1.8585	0.9685	-1.8668	0.9853	0.8378	-1.7393	1.1162	0.8678
ln_network_cc	13.6023	0.1919	-0.6718	0.2508	-0.7115	0.2412	0.8055	0.2103	-1.0731	0.1416	-1.0731	0.1416	-4.1486	-3.7183	0.0001	-4.1486	-3.7183	0.0001
ln_partintact	5.4069	0.8624	0.5943	0.7238	0.5497	0.7066	-1.0271	0.8478	-0.5060	0.3064	-0.7361	0.2308	-2.7478	-1.7434	0.0406	-2.8086	-1.8266	0.0339
ln_partplatact	47.0636	0.0000	-1.9899	0.0233	-4.7136	0.0000	8.2877	0.0000	-0.4712	0.3187	-0.5419	0.2940	-3.5804	-1.9990	0.0228	-3.6189	-2.1013	0.0178
ln_partintactplat	5.4355	0.8603	0.5813	0.7195	0.5382	0.7027	-1.0207	0.8463	0.0921	0.5367	-0.1537	0.4389	-2.4196	-1.2712	0.1018	-2.3344	-1.2481	0.1060

1) 4 lags included
2) lag length specified by minimization of AIC (maximum 4 lags)
3) lag length specified by minimization of BIC (maximum 4 lags)
4) lag length specified by minimization of AIC (maximum 4 lags)
5) lag length specified by minimization of BIC (maximum 4 lags)

Appendix 2 Panel Unit Root Tests; New Regions

	Fisher-type[1)]								Im-Pesaran-Shin (AIC4)[2)]		Im-Pesaran-Shin (BIC4)[3)]	
	Inverse chi-squared		Inverse normal		Inverse logit		Modified inv. chi-squared		W-t-bar		W-t-bar	
Variable	Statistic	p-value	Statistic	p-value	Statistic	p-value	Statistic	p-value	Statistic	p-value	Statistic	p-value
ln_new_signups	39.6853	0.0009	-3.1867	0.0007	-3.4100	0.0007	4.1870	0.0000	-9.9027	0.0000	-9.9027	0.0000
ln_average_degree	53.0918	0.0000	-4.0278	0.0000	-4.7508	0.0000	6.5570	0.0000	-2.8709	0.0020	-2.5861	0.0049
ln_degree_centralization	94.0815	0.0000	-3.8996	0.0000	-8.1755	0.0000	13.8030	0.0000	-10.0022	0.0000	-11.0618	0.0000
ln_networker_share	90.1579	0.0000	-6.7089	0.0000	-8.7735	0.0000	13.1094	0.0000	-5.1042	0.0000	-5.5080	0.0000
ln_network_cc	21.4423	0.1621	0.2452	0.5969	0.1350	0.5534	0.9621	0.1680	-15.4566	0.0000	-12.2748	0.0000
ln_partintact	37.1133	0.0020	-2.5458	0.0055	-2.9100	0.0028	3.7323	0.0001	-2.6871	0.0036	-3.5011	0.0002
ln_partplatact	42.3913	0.0003	-2.1032	0.0177	-3.0700	0.0018	4.6654	0.0000	-3.1102	0.0009	-4.0960	0.0000
ln_partintactplat	21.3698	0.1647	-1.3268	0.0923	-1.3090	0.0987	0.9493	0.1712	-2.3969	0.0083	-3.2612	0.0006

1) 4 lags included
2) lag length specified by minimization of AIC (maximum 4 lags)
3) lag length specified by minimization of BIC (maximum 4 lags)

Appendix 3 Panel Unit Root Tests; All Regions

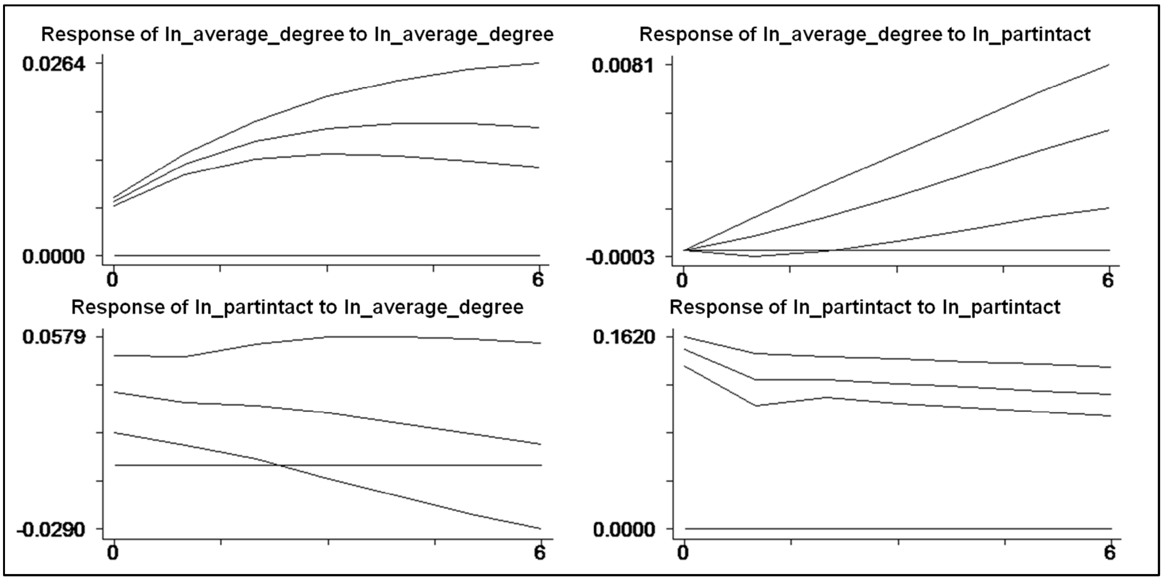
	Fisher-type[1)]								Im-Pesaran-Shin (AIC4)[2)]		Im-Pesaran-Shin (BIC4)[3)]	
	Inverse chi-squared		Inverse normal		Inverse logit		Modified inv. chi-squared		W-t-bar		W-t-bar	
Variable	Statistic	p-value	Statistic	p-value	Statistic	p-value	Statistic	p-value	Statistic	p-value	Statistic	p-value
ln_new_signups	58.3790	0.0003	-3.5119	0.0002	-3.6499	0.0003	4.4902	0.0000	-9.1522	0.0000	-9.8840	0.0000
ln_average_degree	67.6214	0.0000	-3.1373	0.0009	-3.7656	0.0002	5.7719	0.0000	-2.2014	0.0139	-1.6067	0.0541
ln_degree_centralization	102.3893	0.0000	-1.9862	0.0235	-5.1821	0.0000	10.5933	0.0000	-8.6437	0.0000	-9.3160	0.0000
ln_networker_share	95.9295	0.0000	-4.2667	0.0000	-5.8039	0.0000	9.6975	0.0000	-3.2948	0.0005	-3.2819	0.0005
ln_network_cc	54.6976	0.0008	-0.8584	0.1953	-1.8451	0.0347	3.9796	0.0000	-12.1508	0.0000	-10.2669	0.0000
ln_partintact	41.8452	0.0255	-1.5526	0.0603	-1.8647	0.0332	2.1973	0.0140	-2.4660	0.0068	-3.2544	0.0006
ln_partplatact	89.4942	0.0000	-2.8890	0.0019	-5.2944	0.0000	8.8051	0.0000	-2.8576	0.0021	-3.6879	0.0001
ln_partintactplat	26.4039	0.4411	-0.6379	0.2618	-0.6519	0.2583	0.0560	0.4777	-2.3885	0.0085	-2.7223	0.0032

1) 4 lags included
2) lag length specified by minimization of AIC (maximum 4 lags)
3) lag length specified by minimization of BIC (maximum 4 lags)

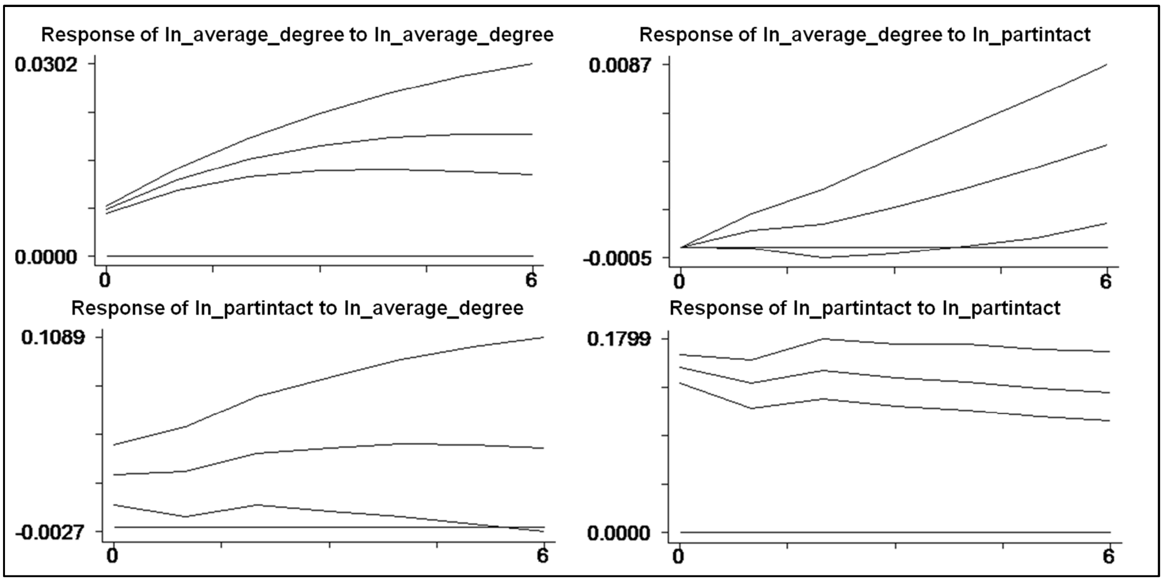
Appendix 4 Estimation Results PVAR(1)-(4) ln_average_degree ln_partintact; Established Regions

```
. pvar ln_average_degree ln_partintact, lag(1) gmm monte 1000
GMM started : 10:16:53
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 215
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                           b_GMM     se_GMM      t_GMM
L.h_ln_average_degree  .91851714  .01047436  87.691926
    L.h_ln_partintact  .00794965  .00175799  4.5220128
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                            b_GMM      se_GMM       t_GMM
L.h_ln_average_degree  -.19678358   .14414995  -1.3651311
    L.h_ln_partintact   .96893256   .01358235   71.337635
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree      ln_partintact
ln_average_degree           .0001884
    ln_partintact          .00035004          .02575688

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1591   1.0000
             |   0.0196
             |

GMM finished : 10:16:55

Starting Monte-Carlo loop : 10:16:56 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 10:17:01
```

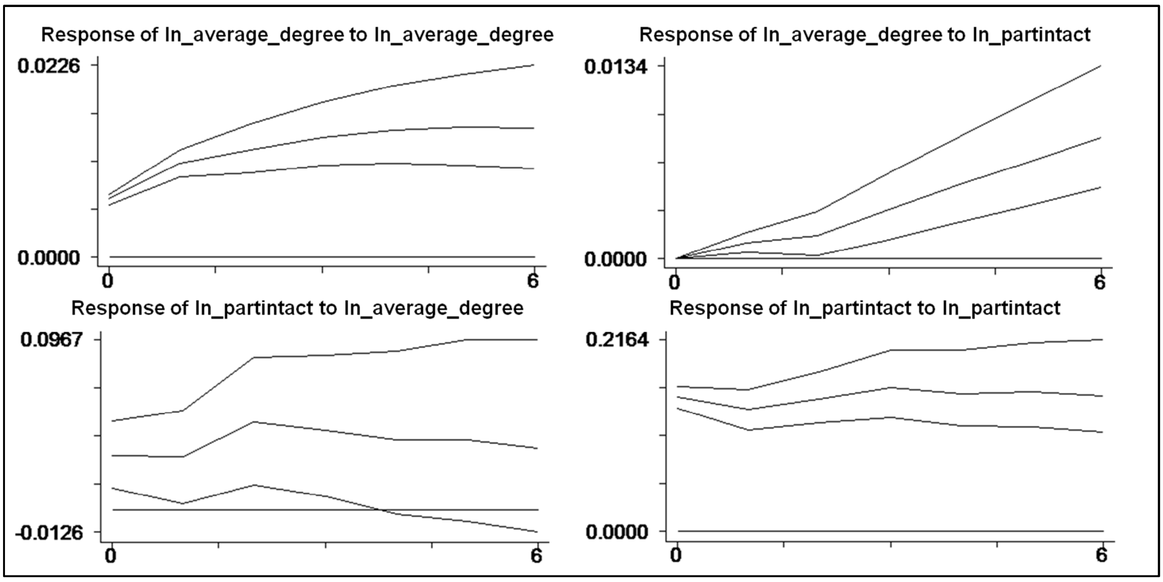
```
. pvar ln_average_degree ln_partintact, lag(2) gmm monte 1000
GMM started : 11:26:49
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 210
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                            b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.6535205   .07885755   20.968449
     L.h_ln_partintact   .00413019   .00334491   1.2347672
L2.h_ln_average_degree  -.68506526   .07147924  -9.5841154
    L2.h_ln_partintact   -.0007313   .00330434  -.22131321
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                            b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   .17064984    1.105784   .15432476
     L.h_ln_partintact     .828677   .07456035   11.114178
L2.h_ln_average_degree  -.46066052   1.0036023  -.45900705
    L2.h_ln_partintact   .14553178   .07347526    1.980691
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree      ln_partintact
ln_average_degree          .00005691
    ln_partintact          .00024575           .0239301

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.2107   1.0000
             |   0.0021
             |

GMM finished : 11:26:51

Starting Monte-Carlo loop : 11:26:51 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 11:26:57
```



```
. pvar ln_average_degree ln_partintact, lag(3) gmm monte 1000
GMM started : 11:31:49
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 205
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree     1.60943   .11754788   13.691697
     L.h_ln_partintact   .00502943   .00321889   1.5624727
L2.h_ln_average_degree  -.55405622   .17330663  -3.1969706
    L2.h_ln_partintact  -.00564532   .00388127  -1.4545013
L3.h_ln_average_degree  -.08704107   .07537761  -1.1547338
    L3.h_ln_partintact   .00390774   .00323998   1.2061027
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   .63545906   1.6386799   .38778717
     L.h_ln_partintact   .90801544   .07391416   12.284729
L2.h_ln_average_degree   .13198747   2.4420467   .05404789
    L2.h_ln_partintact   .15786808   .09211215   1.7138681
L3.h_ln_average_degree  -.84105928   1.0809125  -.77810117
    L3.h_ln_partintact  -.10753011   .06657648  -1.6151367
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree      ln_partintact
ln_average_degree           .00005434
    ln_partintact           .00022224          .02429595

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 |  0.1939   1.0000
             |  0.0053
             |

GMM finished : 11:31:50

Starting Monte-Carlo loop : 11:31:51 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 11:31:57
```



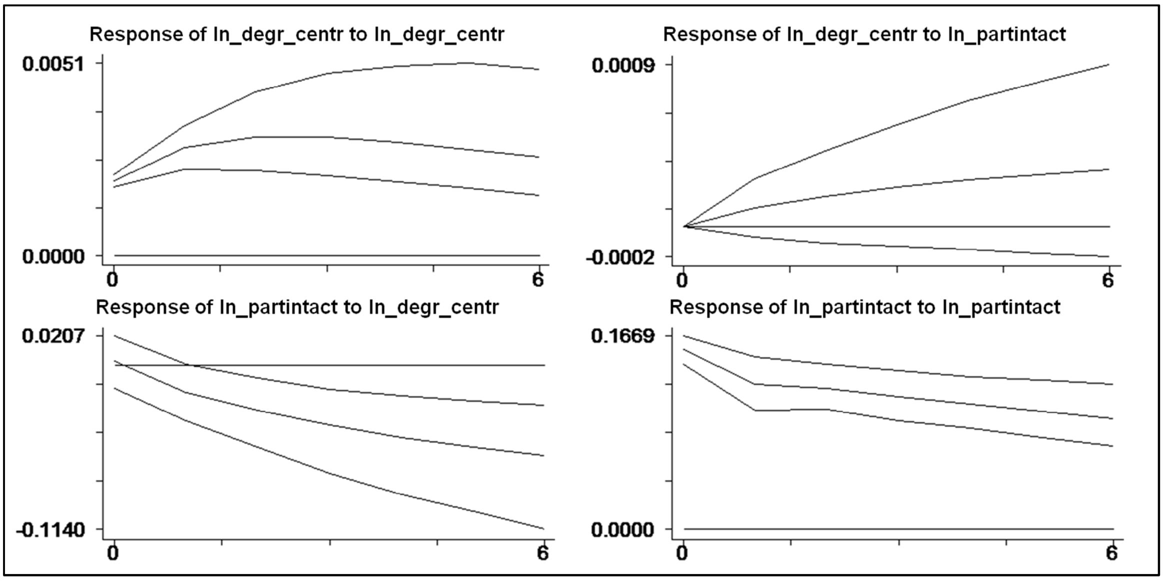
```
. pvar ln_average_degree ln_partintact, lag(4) gmm monte 1000
GMM started : 11:36:00
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 200
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                             b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.5844089   .11537412   13.732792
     L.h_ln_partintact   .00720875    .0029407   2.4513725
L2.h_ln_average_degree  -.71348028   .16503047  -4.3233245
    L2.h_ln_partintact  -.00720376   .00341013  -2.1124608
L3.h_ln_average_degree   .21903995   .11779601   1.8594853
    L3.h_ln_partintact   .01007474    .0037213   2.7073165
L4.h_ln_average_degree  -.12853961   .05465096  -2.3520102
    L4.h_ln_partintact  -.00512758   .00346279  -1.4807672
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                             b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   .30734024   1.7039022   .18037434
     L.h_ln_partintact    .9067344   .07556413   11.999535
L2.h_ln_average_degree   2.0463906   2.4919654   .82119541
    L2.h_ln_partintact   .16012149   .09731154   1.6454522
L3.h_ln_average_degree  -4.6544214   2.2201542  -2.0964406
    L3.h_ln_partintact   .01311667   .09101741   .14411168
L4.h_ln_average_degree   2.2191932   1.1565558   1.9187948
    L4.h_ln_partintact  -.11120773   .06543245  -1.6995807
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree      ln_partintact
ln_average_degree          .00004682
    ln_partintact          .00021281          .02406551

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.2014   1.0000
             |   0.0042
             |

GMM finished : 11:36:02

Starting Monte-Carlo loop : 11:36:03 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 11:36:09
```



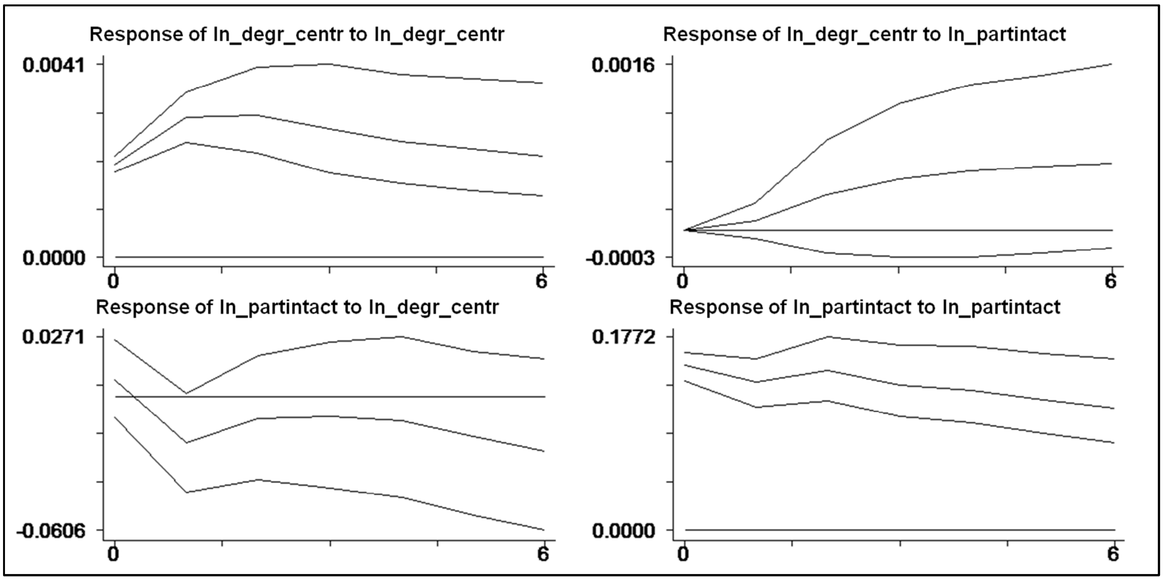
Appendix 5 Estimation Results PVAR(1)-(4) ln_degree_centralization ln_partintact; Established Regions

```
. pvar ln_degr_centr ln_partintact, lag(1) gmm monte 1000
GMM started : 12:13:48
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 215
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                      b_GMM     se_GMM      t_GMM
L.h_ln_degr_centr  .96332602  .02388169  40.337439
L.h_ln_partintact    .000522  .00029713  1.7567868
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                       b_GMM      se_GMM       t_GMM
L.h_ln_degr_centr  -2.5416637   1.3370381  -1.9009658
L.h_ln_partintact   .94309634   .01837206   51.333176
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
               ln_degr_centr  ln_partintact
ln_degr_centr      5.254e-06
ln_partintact      2.038e-06      .02547139

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0055   1.0000
             |   0.9356
             |

GMM finished : 12:13:50

Starting Monte-Carlo loop : 12:13:51 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:13:57
```

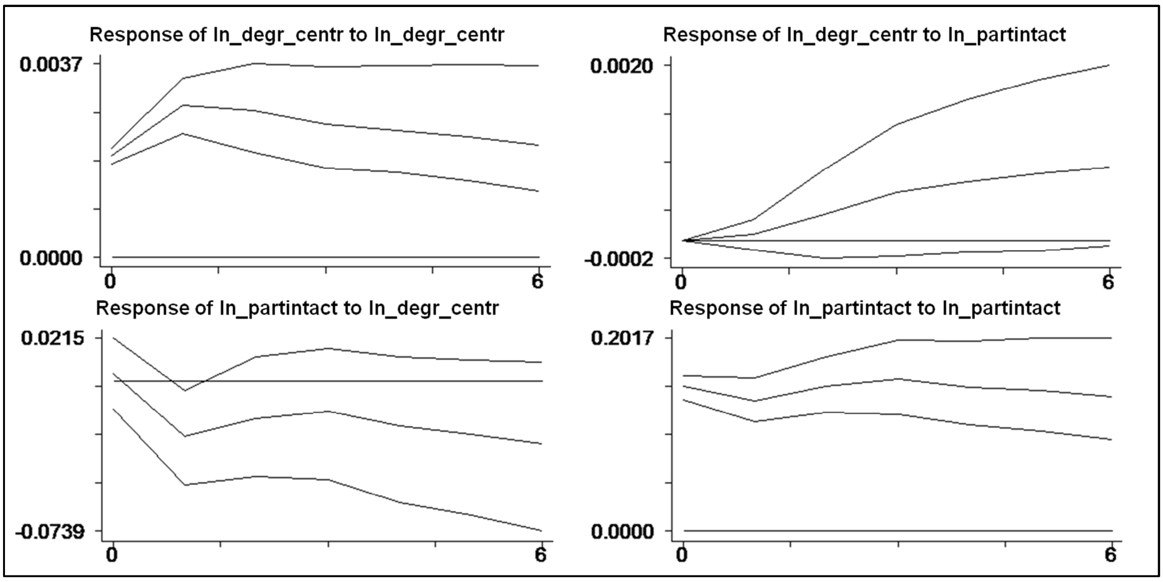
```
. pvar ln_degr_centr ln_partintact, lag(2) gmm monte 1000
GMM started : 12:30:40
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 210
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                         b_GMM      se_GMM       t_GMM
 L.h_ln_degr_centr   1.4288112   .15533694   9.1981419
 L.h_ln_partintact   .00068284   .00063574   1.0740866
L2.h_ln_degr_centr  -.46603857   .15437447  -3.0188838
L2.h_ln_partintact  -.00043639   .00050522   -.8637542
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                         b_GMM      se_GMM       t_GMM
 L.h_ln_degr_centr  -10.326738   4.0544879  -2.5469895
 L.h_ln_partintact   .80797512    .0785344   10.288168
L2.h_ln_degr_centr   6.4930233   3.7478077   1.7324857
L2.h_ln_partintact   .13645091   .06964749   1.9591649
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
               ln_degr_centr  ln_partintact
ln_degr_centr      4.046e-06
ln_partintact      5.266e-06       .0240438

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0169   1.0000
             |   0.8078
             |

GMM finished : 12:30:42

Starting Monte-Carlo loop : 12:30:43 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:30:49
```



```
. pvar ln_degr_centr ln_partintact, lag(3) gmm monte 1000
GMM started : 12:35:12
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 205
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                         b_GMM      se_GMM       t_GMM
 L.h_ln_degr_centr   1.4956987   .15513723    9.641133
 L.h_ln_partintact   .00058205   .00069828   .83354897
L2.h_ln_degr_centr  -.71461751   .22916507  -3.1183527
L2.h_ln_partintact   .00082891   .00119452   .69392329
L3.h_ln_degr_centr   .18347107   .10716222   1.7120872
L3.h_ln_partintact   -.0009845   .00123372  -.79799779
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                         b_GMM      se_GMM       t_GMM
 L.h_ln_degr_centr  -14.118665   4.4727951  -3.1565642
 L.h_ln_partintact   .89945416   .07450895   12.071759
L2.h_ln_degr_centr   24.978653   8.8644822   2.8178355
L2.h_ln_partintact   .16614474   .08649161   1.9209348
L3.h_ln_degr_centr   -13.67034   6.1040887  -2.2395383
L3.h_ln_partintact   -.1203054   .06769671  -1.7771232
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
               ln_degr_centr  ln_partintact
ln_degr_centr      3.880e-06
ln_partintact      .00001491      .02282586

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 |  0.0503   1.0000
             |  0.4739
             |

GMM finished : 12:35:14

Starting Monte-Carlo loop : 12:35:15 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:35:21
```



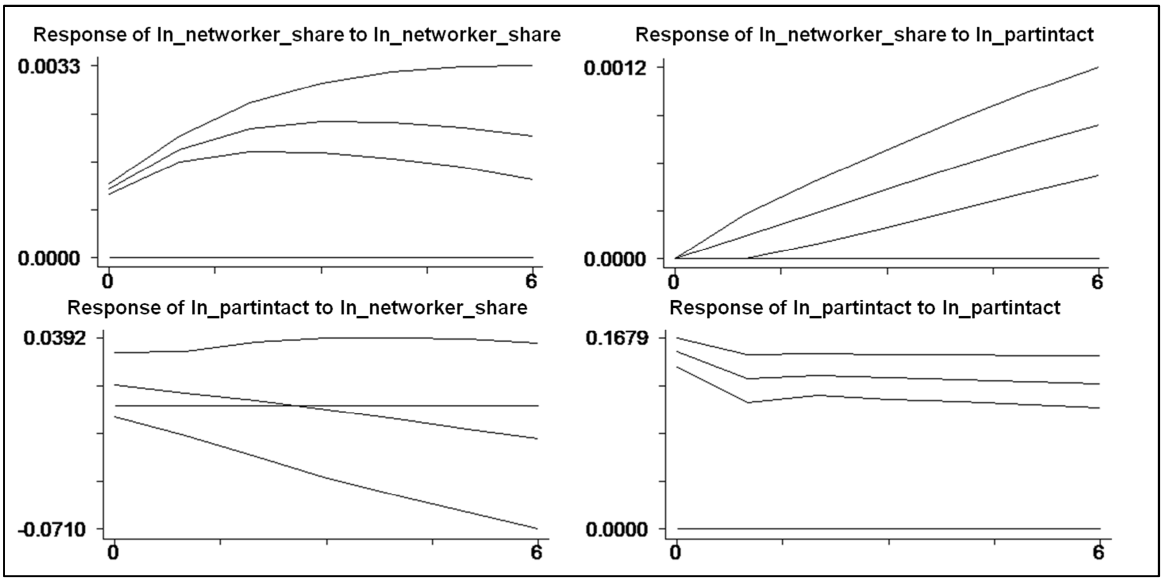
```
. pvar ln_degr_centr ln_partintact, lag(4) gmm monte 1000 '
GMM started : 12:38:19
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 200
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                         b_GMM      se_GMM       t_GMM
 L.h_ln_degr_centr   1.4930182   .14820792   10.073808
 L.h_ln_partintact     .000498   .00074339    .6699039
L2.h_ln_degr_centr  -.79035029   .22612033  -3.4952642
L2.h_ln_partintact   .00089947   .00129931    .6922642
L3.h_ln_degr_centr   .36255895   .15417906   2.3515447
L3.h_ln_partintact  -.00032525   .00146126  -.22258366
L4.h_ln_degr_centr  -.10631722   .07073053  -1.5031306
L4.h_ln_partintact  -.00060955   .00087918  -.69332185
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                         b_GMM      se_GMM       t_GMM
 L.h_ln_degr_centr  -15.854016   4.6481402    -3.41083
 L.h_ln_partintact   .90298693   .08022147   11.256175
L2.h_ln_degr_centr   26.562981   10.523568   2.5241421
L2.h_ln_partintact   .19290091   .09768452   1.9747336
L3.h_ln_degr_centr  -13.374259   11.211477  -1.1929079
L3.h_ln_partintact  -.00492142   .08815288  -.05582821
L4.h_ln_degr_centr   .27010829   4.9946491   .05407953
L4.h_ln_partintact  -.13265362   .05854812  -2.2657194
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
               ln_degr_centr  ln_partintact
ln_degr_centr      3.794e-06
ln_partintact      7.597e-06      .02277969

Residuals correlation matrix

              |      u1       u2
--------------+-----------------
           u1 |  1.0000
              |
              |
           u2 |  0.0259   1.0000
              |  0.7156
              |

GMM finished : 12:38:21

Starting Monte-Carlo loop : 12:38:21 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:38:28
```



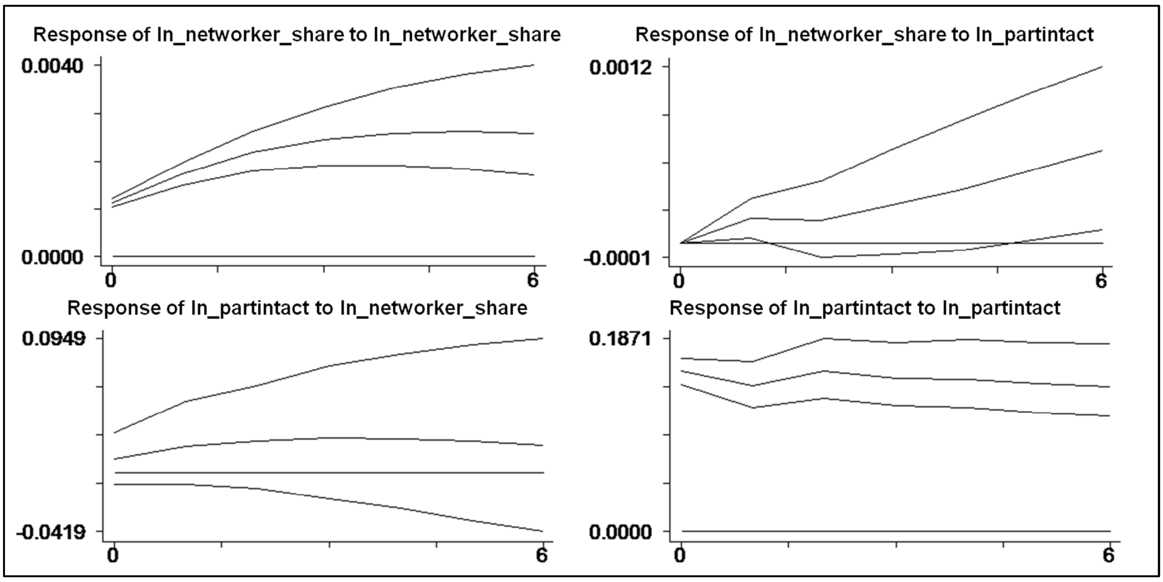
Appendix 6 Estimation Results PVAR(1)-(4) ln_networker_share ln_partintact; Established Regions

```
. pvar ln_networker_share ln_partintact, lag(1) gmm monte 1000
GMM started : 14:06:52
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 215
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                            b_GMM     se_GMM      t_GMM
L.h_ln_networker_share  .91138481  .01175056  77.560956
     L.h_ln_partintact  .00100867  .00021033  4.7955931
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                             b_GMM      se_GMM       t_GMM
L.h_ln_networker_share   -1.829009   1.2992131  -1.4077821
     L.h_ln_partintact   .98149181   .01730114   56.729892
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share       ln_partintact
ln_networker_share           4.071e-06
     ln_partintact           .00003574           .02605348

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1098   1.0000
             |   0.1085
             |

GMM finished : 14:06:54

Starting Monte-Carlo loop : 14:06:54 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 14:07:00
```

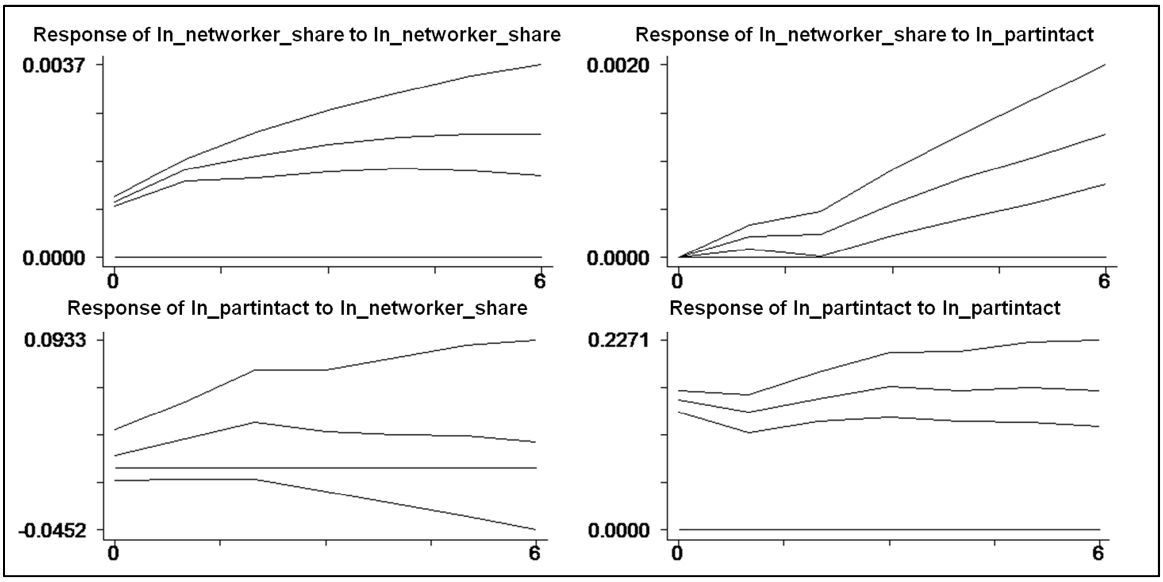
```
. pvar ln_networker_share ln_partintact, lag(2) gmm monte 1000
GMM started : 14:28:04
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 210
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM        t_GMM
 L.h_ln_networker_share   1.5649166   .08296734   18.861839
      L.h_ln_partintact   .00095684   .00056582   1.6910619
L2.h_ln_networker_share   -.6007318   .07455011   -8.058094
     L2.h_ln_partintact  -.00040262   .00059616  -.67534876
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                              b_GMM      se_GMM        t_GMM
 L.h_ln_networker_share  -2.3194742   8.6712832  -.26748915
      L.h_ln_partintact   .84703358   .07147818   11.850241
L2.h_ln_networker_share  -.45008287    7.463141  -.06030743
     L2.h_ln_partintact   .14858399   .07417035     2.00328
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share       ln_partintact
ln_networker_share           1.403e-06
     ln_partintact           .00001427           .02447761

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 |  0.0766   1.0000
             |  0.2694
             |

GMM finished : 14:28:06

Starting Monte-Carlo loop : 14:28:06 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 14:28:12
```



```
. pvar ln_networker_share ln_partintact, lag(3) gmm monte 1000
GMM started : 14:31:09
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 205
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                             b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   1.5318729   .10481042   14.615654
      L.h_ln_partintact   .00108215   .00053389   2.0269263
L2.h_ln_networker_share  -.43050117   .13614402  -3.1621012
     L2.h_ln_partintact    -.001635   .00072379  -2.2589505
L3.h_ln_networker_share  -.13406024   .05498241  -2.4382386
     L3.h_ln_partintact   .00102513    .0005745   1.7843814
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                             b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   8.7160822   12.751926   .68351106
      L.h_ln_partintact   .90691724   .07423401   12.217004
L2.h_ln_networker_share  -10.059847   18.187669  -.55311363
     L2.h_ln_partintact   .16547911   .09440483    1.752867
L3.h_ln_networker_share   .30009293   7.7630182   .03865673
     L3.h_ln_partintact  -.09920748   .06797609  -1.4594467
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share       ln_partintact
ln_networker_share           1.304e-06
     ln_partintact           .00001087           .02425521

Residuals correlation matrix

             |     u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0612   1.0000
             |   0.3832
             |

GMM finished : 14:31:11

Starting Monte-Carlo loop : 14:31:11 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 14:31:17
```



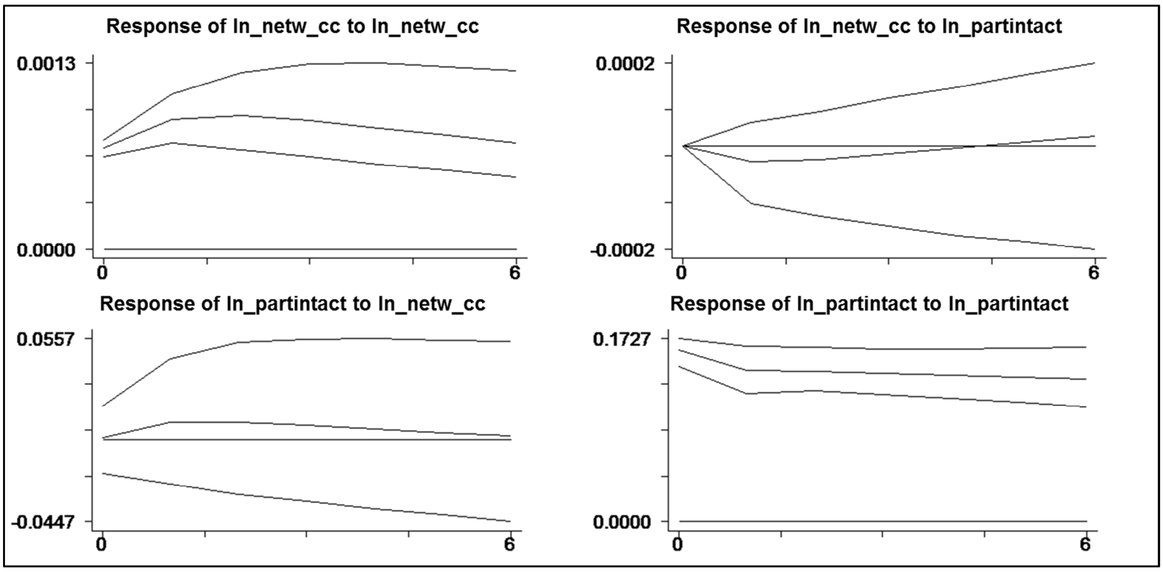
```
. pvar ln_networker_share ln_partintact, lag(4) gmm monte 1000
GMM started : 14:33:14
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 200
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   1.5502362   .09593477   16.159273
      L.h_ln_partintact   .00140226   .00051063   2.7461506
L2.h_ln_networker_share  -.62953513   .12333468  -5.1042831
     L2.h_ln_partintact  -.00185634   .00069947  -2.6539066
L3.h_ln_networker_share   .17290742   .15376727   1.1244748
     L3.h_ln_partintact   .00230725   .00067957   3.3951334
L4.h_ln_networker_share  -.12466615   .08088666  -1.5412449
     L4.h_ln_partintact  -.00125696   .00060446  -2.0794583
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   11.713984   12.813625   .91418195
      L.h_ln_partintact   .90361421   .07623561   11.852914
L2.h_ln_networker_share  -6.5804469   19.147375  -.34367358
     L2.h_ln_partintact   .17750936   .09968132   1.7807685
L3.h_ln_networker_share  -17.924258   17.718985  -1.0115849
     L3.h_ln_partintact   .01623092   .09082044   .17871437
L4.h_ln_networker_share   12.171811   8.0827898   1.5058924
     L4.h_ln_partintact   -.1234096   .06931377  -1.7804486
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share       ln_partintact
ln_networker_share           1.160e-06
     ln_partintact           .00001002           .02421646

Residuals correlation matrix

             |      u1       u2
-------------+-----------------
          u1 |  1.0000
             |
             |
          u2 |  0.0603   1.0000
             |  0.3963
             |

GMM finished : 14:33:15

Starting Monte-Carlo loop : 14:33:15 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 14:33:22
```



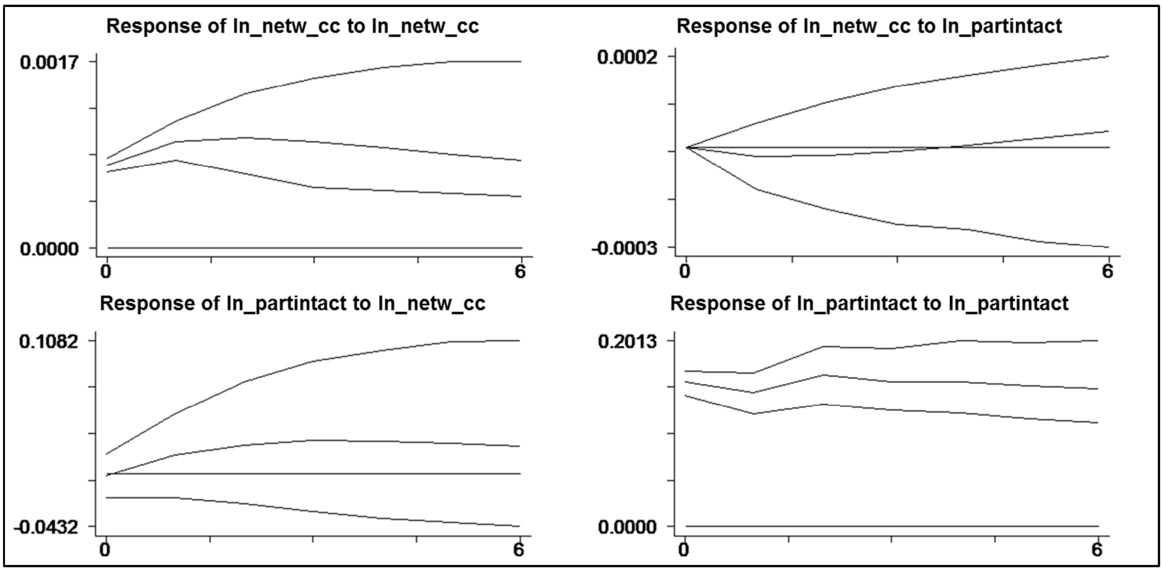
Appendix 7 Estimation Results PVAR(1)-(4) ln_network_cc ln_partintact; Established Regions

```
. pvar ln_netw_cc ln_partintact, lag(1) gmm monte 1000
GMM started : 10:38:52
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 215
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                      b_GMM     se_GMM      t_GMM
   L.h_ln_netw_cc  .76038352  .29752781  2.5556721
L.h_ln_partintact  .00107395   .0015688  .68456525
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                       b_GMM      se_GMM       t_GMM
   L.h_ln_netw_cc  -1.7983928   1.5790464  -1.1389106
L.h_ln_partintact   .97546487   .01605255   60.766956
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                  ln_netw_cc  ln_partintact
   ln_netw_cc      .00025741
ln_partintact     -.00003301       .0272553

Residuals correlation matrix

             |        u1       u2
-------------+-------------------
          u1 |    1.0000
             |
             |
          u2 |   -0.0118   1.0000
             |    0.8636
             |

GMM finished : 10:38:53

Starting Monte-Carlo loop : 10:38:54 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 10:39:00
```

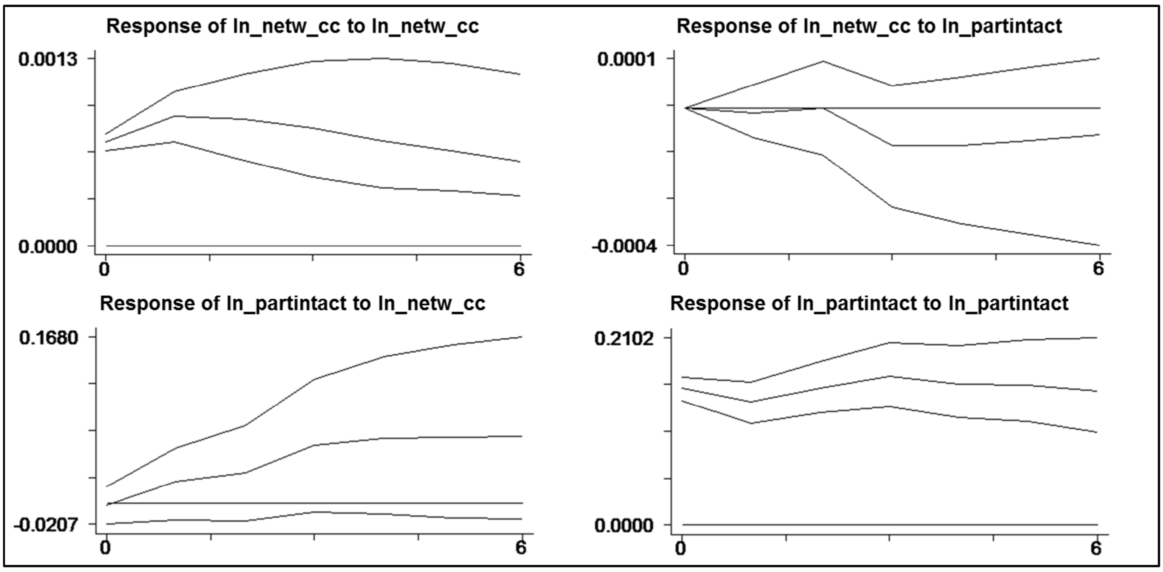
```
. pvar ln_netw_cc ln_partintact, lag(2) gmm monte 1000
GMM started : 10:53:13
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 210
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                         b_GMM      se_GMM       t_GMM
    L.h_ln_netw_cc   .41870742   .31026228   1.3495273
 L.h_ln_partintact   .00107535   .00104586   1.0281947
   L2.h_ln_netw_cc   .40170985   .29156572   1.3777678
L2.h_ln_partintact  -.00043988   .00090355  -.48683626
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                         b_GMM      se_GMM       t_GMM
    L.h_ln_netw_cc  -1.3141523   .94909669  -1.3846348
 L.h_ln_partintact   .88423734   .07174265   12.325128
   L2.h_ln_netw_cc  -.76177967   .92133082  -.82682534
L2.h_ln_partintact   .09893152   .07012778   1.4107322
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                  ln_netw_cc  ln_partintact
   ln_netw_cc      .00022224
ln_partintact      .00001828       .0264184

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0080   1.0000
             |   0.9080
             |

GMM finished : 10:53:14

Starting Monte-Carlo loop : 10:53:15 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 10:53:21
```



```
. pvar ln_netw_cc ln_partintact, lag(3) gmm monte 1000
GMM started : 10:57:01
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 205
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                         b_GMM      se_GMM       t_GMM
    L.h_ln_netw_cc   .28131243   .22592592   1.2451534
 L.h_ln_partintact   .00093352   .00153288   .60899475
   L2.h_ln_netw_cc   .26807977   .21451346   1.2497107
L2.h_ln_partintact  -.00390131   .00324361  -1.2027703
   L3.h_ln_netw_cc   .25917671   .21051008   1.2311843
L3.h_ln_partintact   .00351055    .0034265   1.0245308
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                         b_GMM      se_GMM       t_GMM
    L.h_ln_netw_cc  -.97515346   .62779913   -1.553289
 L.h_ln_partintact   .94237931   .06840384   13.776701
   L2.h_ln_netw_cc  -.44937645   .62111304  -.72350187
L2.h_ln_partintact    .1716717   .09161173   1.8739052
   L3.h_ln_netw_cc  -.19670183   .60031071   -.3276667
L3.h_ln_partintact  -.13668494   .07075422  -1.9318273
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                  ln_netw_cc  ln_partintact
   ln_netw_cc      .00020709
ln_partintact      .00007037      .02526618

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0309   1.0000
             |   0.6601
             |

GMM finished : 10:57:03

Starting Monte-Carlo loop : 10:57:03 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 10:57:10
```



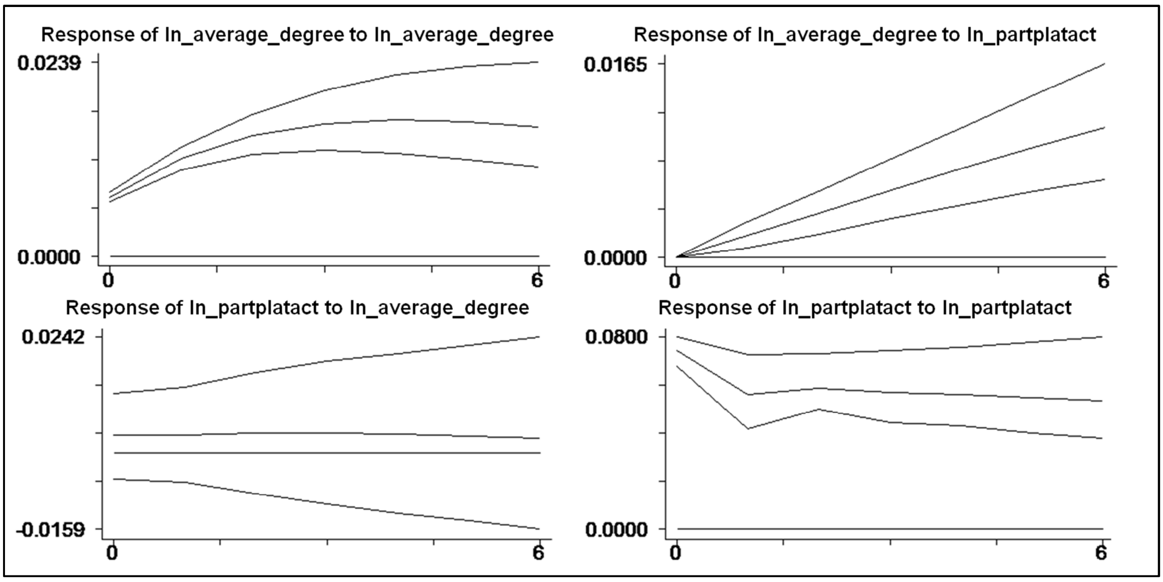
```
. pvar ln_netw_cc ln_partintact, lag(4) gmm monte 1000
GMM started : 11:02:47
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 200
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                         b_GMM      se_GMM       t_GMM
    L.h_ln_netw_cc   .20473903   .16945783   1.2082005
 L.h_ln_partintact   .00117632    .0009522   1.2353787
   L2.h_ln_netw_cc   .19727685   .16020902   1.2313717
L2.h_ln_partintact  -.00432688   .00485877  -.89052922
   L3.h_ln_netw_cc   .18994515   .15959219   1.1901908
L3.h_ln_partintact   .00040392   .00212291   .19026788
   L4.h_ln_netw_cc   .18930825   .16243477   1.1654417
L4.h_ln_partintact   .00331931    .0027165   1.2219067
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                         b_GMM      se_GMM       t_GMM
    L.h_ln_netw_cc  -.63067667   .51450148  -1.2258015
 L.h_ln_partintact   .93225371   .07162763    13.01528
   L2.h_ln_netw_cc  -.23832627   .47921637  -.49732497
L2.h_ln_partintact   .19662458   .10016535   1.9629999
   L3.h_ln_netw_cc  -.04422883   .44714464  -.09891392
L3.h_ln_partintact  -.01651972   .09184182  -.17987142
   L4.h_ln_netw_cc    -.097008   .46876217  -.20694502
L4.h_ln_partintact  -.13289781   .06555449  -2.0272877
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                  ln_netw_cc  ln_partintact
   ln_netw_cc      .00020044
ln_partintact      .00011473      .02514851

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0511   1.0000
             |   0.4722
             |

GMM finished : 11:02:49

Starting Monte-Carlo loop : 11:02:49 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 11:02:56
```



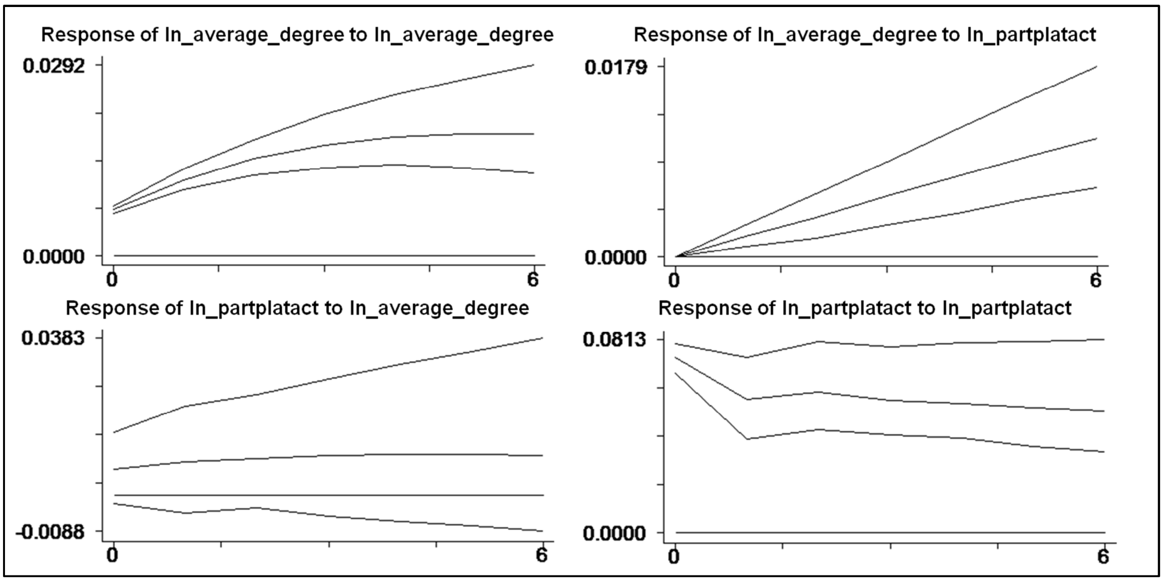
Appendix 8 Estimation Results PVAR(1)-(4) ln_average_degree ln_partplatact; Established Regions

```
. pvar ln_average_degree ln_partplatact, lag(1) gmm monte 1000
GMM started : 11:13:03
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 215
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                           b_GMM     se_GMM      t_GMM
L.h_ln_average_degree  .90639358  .00947788  95.632531
   L.h_ln_partplatact  .03512872  .00573323  6.1272091
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                           b_GMM     se_GMM      t_GMM
L.h_ln_average_degree  .02792488  .09355447  .29848793
   L.h_ln_partplatact  .96371856  .03682579  26.169667
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree     ln_partplatact
ln_average_degree          .00018317
   ln_partplatact         -.00004523          .00581417

Residuals correlation matrix

             |        u1       u2
-------------+--------------------
          u1 |    1.0000
             |
             |
          u2 |   -0.0434   1.0000
             |    0.5266
             |

GMM finished : 11:13:05

Starting Monte-Carlo loop : 11:13:05 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 11:13:11
```

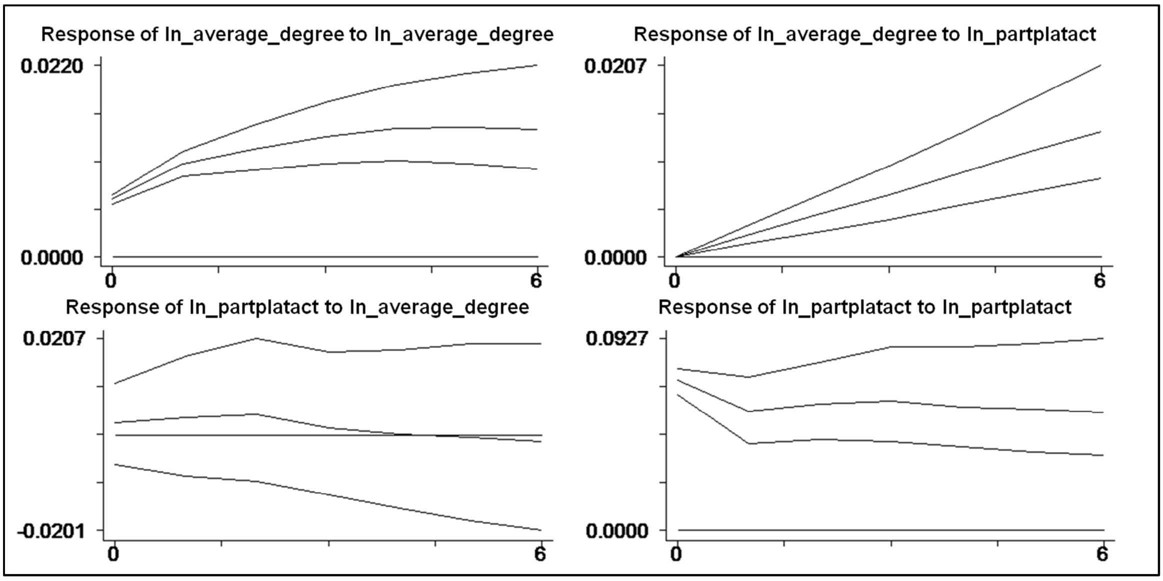
```
. pvar ln_average_degree ln_partplatact, lag(2) gmm monte 1000
GMM started : 11:56:40
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 210
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                            b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.6359351   .07409958   22.077521
    L.h_ln_partplatact   .02630296   .00865731   3.0382359
L2.h_ln_average_degree  -.66942334   .06772524  -9.8844001
   L2.h_ln_partplatact  -.01208782   .00894577  -1.3512341
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                            b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   .13587755   .51900909   .26180187
    L.h_ln_partplatact   .75827503   .12755661   5.9446157
L2.h_ln_average_degree  -.15599704   .46930771   -.3323982
   L2.h_ln_partplatact   .21421111   .13038026    1.642972
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree     ln_partplatact
ln_average_degree          .00005327
   ln_partplatact           .0000263          .00551397

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0492   1.0000
             |   0.4782
             |

GMM finished : 11:56:41

Starting Monte-Carlo loop : 11:56:41 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 11:56:47
```



```
. pvar ln_average_degree ln_partplatact, lag(3) gmm monte 1000
GMM started : 11:59:20
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 205
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.6047379   .10673293   15.035078
    L.h_ln_partplatact   .02720868   .00857535   3.1728949
L2.h_ln_average_degree   -.5526349   .15627537  -3.5362892
   L2.h_ln_partplatact   -.0134314   .01032852  -1.3004195
L3.h_ln_average_degree  -.08177989   .06811195  -1.2006688
   L3.h_ln_partplatact  -.00079094    .0080681  -.09803299
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   .45042511   .95151628   .47337615
    L.h_ln_partplatact   .76444386   .13284426   5.7544364
L2.h_ln_average_degree  -.51799929   1.4594829  -.35491975
   L2.h_ln_partplatact   .20529213   .14398928   1.4257459
L3.h_ln_average_degree   .07613531   .64360427   .11829523
   L3.h_ln_partplatact  -.01958879   .09920047  -.19746667
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree     ln_partplatact
ln_average_degree           .00005129
   ln_partplatact           .00004464          .00545004

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 |  0.0852   1.0000
             |  0.2243
             |

GMM finished : 11:59:22

Starting Monte-Carlo loop : 11:59:22 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 11:59:29
```



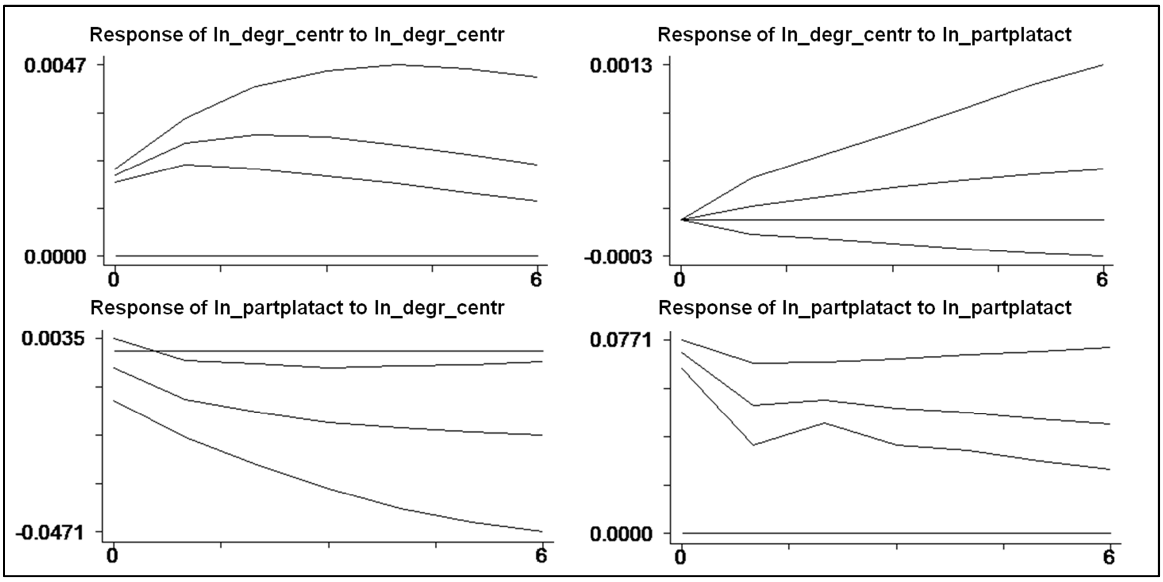
```
. pvar ln_average_degree ln_partplatact, lag(4) gmm monte 1000
GMM started : 12:01:40
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 200
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                             b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.5946678   .10310274   15.466784
    L.h_ln_partplatact   .03379739   .00762327    4.433451
L2.h_ln_average_degree  -.71553319    .1518352  -4.7125647
   L2.h_ln_partplatact  -.01692328   .01035127  -1.6348989
L3.h_ln_average_degree   .24054286   .11745907   2.0478866
   L3.h_ln_partplatact   .00121962   .00927725    .13146393
L4.h_ln_average_degree  -.15285973   .05541256  -2.7585754
   L4.h_ln_partplatact  -.00142597   .00698481  -.20415377
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                             b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree    .2468784   .92883906    .26579244
    L.h_ln_partplatact   .79409659   .13562893   5.8549202
L2.h_ln_average_degree  -.26005967   1.4958696  -.17385184
   L2.h_ln_partplatact   .19885113   .14425873    1.378434
L3.h_ln_average_degree  -.46743703   1.2630257  -.37009305
   L3.h_ln_partplatact   .03336071   .12362781    .26984792
L4.h_ln_average_degree   .45441564   .65589844    .69281403
   L4.h_ln_partplatact   -.0461768   .09203413  -.50173558
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree     ln_partplatact
ln_average_degree          .00004479
   ln_partplatact          .00001869          .00525327

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 |  0.0387   1.0000
             |  0.5861
             |

GMM finished : 12:01:41

Starting Monte-Carlo loop : 12:01:42 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:01:49
```



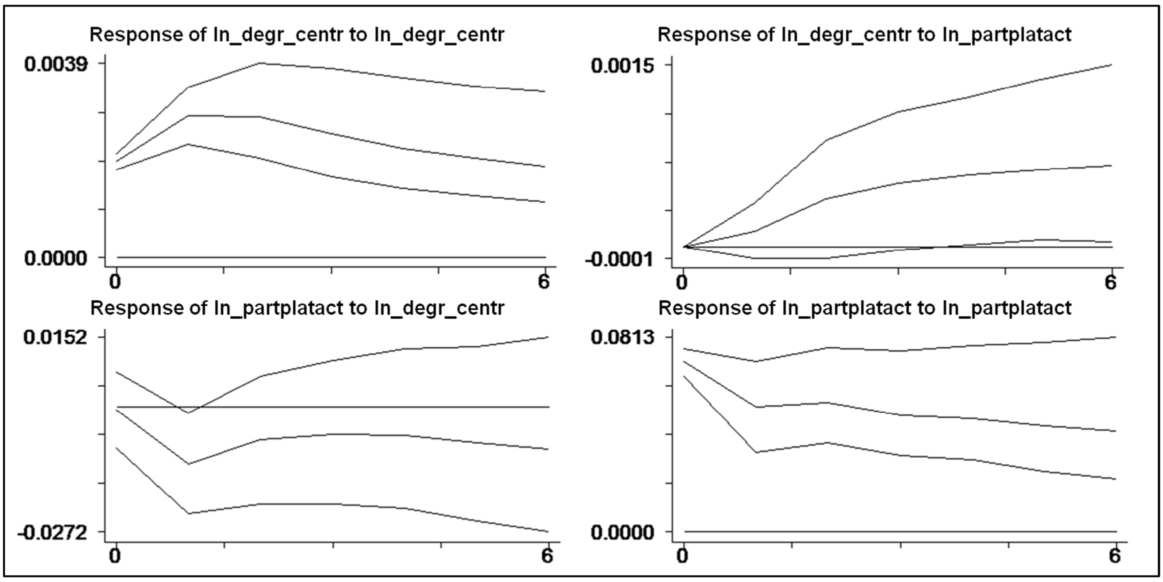
Appendix 9 Estimation Results PVAR(1)-(4) ln_degree_centralization ln_partplatact; Established Regions

```
. pvar ln_degr_centr ln_partplatact, lag(1) gmm monte 1000
GMM started : 12:32:40
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 215
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                        b_GMM     se_GMM      t_GMM
 L.h_ln_degr_centr  .94316035   .0247322  38.134916
L.h_ln_partplatact   .0019035  .00109564  1.7373479
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                         b_GMM      se_GMM       t_GMM
 L.h_ln_degr_centr   -.2653077   1.0652106  -.24906596
L.h_ln_partplatact   .95724856    .0501473   19.088734
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                 ln_degr_centr  ln_partplatact
 ln_degr_centr       5.156e-06
ln_partplatact      -.00001571       .00563982

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0917   1.0000
             |   0.1805
             |

GMM finished : 12:32:41

Starting Monte-Carlo loop : 12:32:42 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:32:48
```

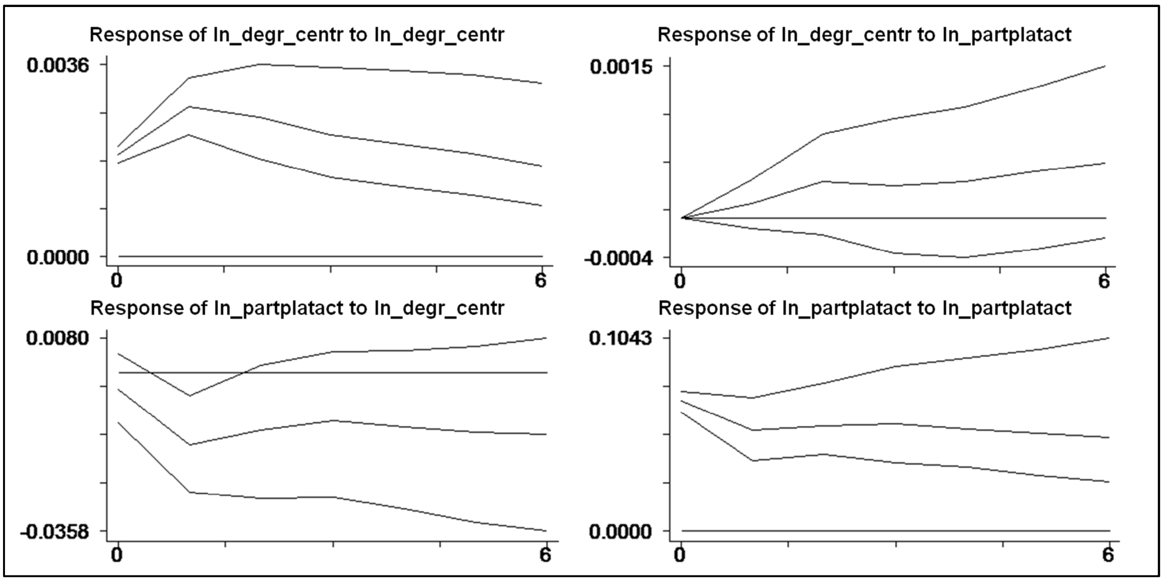
```
. pvar ln_degr_centr ln_partplatact, lag(2) gmm monte 1000
GMM started : 12:43:58
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 210
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                          b_GMM      se_GMM       t_GMM
  L.h_ln_degr_centr   1.4033622   .16091593   8.7210893
 L.h_ln_partplatact   .00162903   .00204869   .79515631
 L2.h_ln_degr_centr  -.45288884   .15604294  -2.9023347
L2.h_ln_partplatact  -.00075941   .00184807  -.41091949
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                          b_GMM      se_GMM       t_GMM
  L.h_ln_degr_centr  -4.7185345   2.5895708  -1.8221299
 L.h_ln_partplatact   .71283669   .13882115   5.1349287
 L2.h_ln_degr_centr   3.6117739   2.3678905   1.5253129
L2.h_ln_partplatact   .24240869   .11630856   2.0841862
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                 ln_degr_centr  ln_partplatact
 ln_degr_centr       4.003e-06
ln_partplatact      -8.360e-06       .00516227

Residuals correlation matrix

             |         u1       u2
-------------+--------------------
          u1 |     1.0000
             |
             |
          u2 |    -0.0581   1.0000
             |     0.4018
             |

GMM finished : 12:44:00

Starting Monte-Carlo loop : 12:44:00 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:44:06
```



```
. pvar ln_degr_centr ln_partplatact, lag(3) gmm monte 1000
GMM started : 12:46:43
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 205
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                         b_GMM      se_GMM       t_GMM
  L.h_ln_degr_centr   1.4702364   .16160045    9.097972
 L.h_ln_partplatact   .00190166   .00210197   .90470199
 L2.h_ln_degr_centr  -.69274073   .23260765  -2.9781511
L2.h_ln_partplatact   .00157401   .00271227   .58032945
 L3.h_ln_degr_centr   .17553052   .10731759   1.6356174
L3.h_ln_partplatact  -.00202217   .00252466  -.80096969
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                         b_GMM      se_GMM       t_GMM
  L.h_ln_degr_centr  -6.0324825   2.7701589  -2.1776666
 L.h_ln_partplatact    .7344464   .14823593   4.9545776
 L2.h_ln_degr_centr   9.9934728    3.751747   2.6636852
L2.h_ln_partplatact   .23049428   .12668546   1.8194217
 L3.h_ln_degr_centr  -4.8381727   2.1482612  -2.2521343
L3.h_ln_partplatact  -.02318836   .09015261  -.25721231
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                 ln_degr_centr  ln_partplatact
 ln_degr_centr       3.822e-06
ln_partplatact      -1.608e-06       .00504568

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0115   1.0000
             |   0.8705
             |

GMM finished : 12:46:45

Starting Monte-Carlo loop : 12:46:46 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:46:52
```



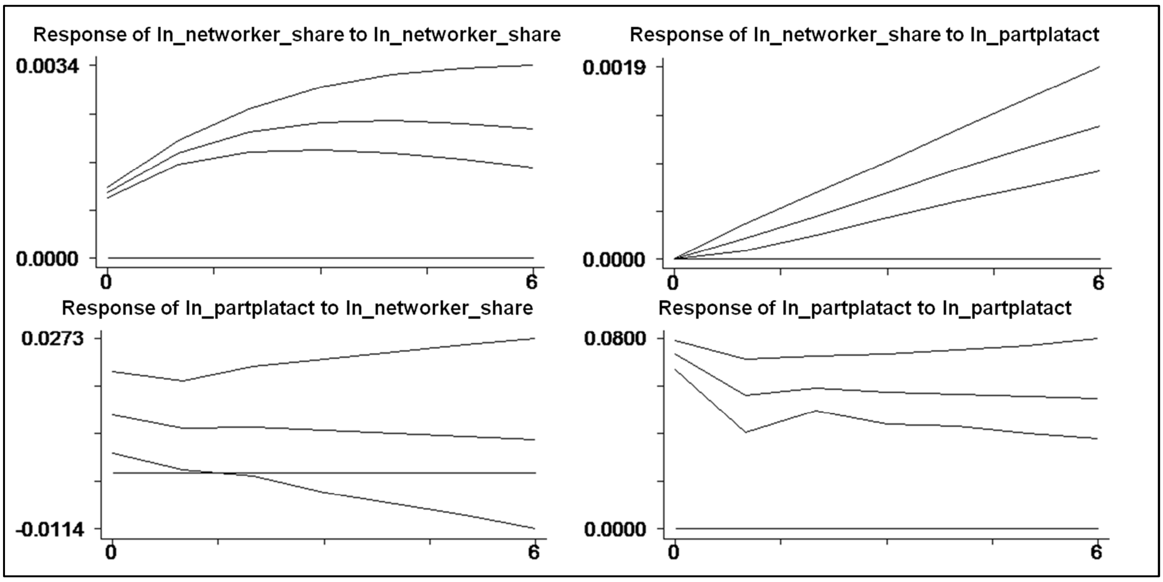
```
. pvar ln_degr_centr ln_partplatact, lag(4) gmm monte 1000
GMM started : 12:55:52
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 200
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                        b_GMM      se_GMM       t_GMM
  L.h_ln_degr_centr   1.4707502   .16150626   9.1064598
 L.h_ln_partplatact   .00203191   .00213394    .9521844
 L2.h_ln_degr_centr  -.77072394   .23689798  -3.2534002
L2.h_ln_partplatact   .00048872   .00258943   .18873582
 L3.h_ln_degr_centr   .32645304   .16129893   2.0239008
L3.h_ln_partplatact  -.00333749   .00328433  -1.0161865
 L4.h_ln_degr_centr  -.08725051   .07604036  -1.1474237
L4.h_ln_partplatact   .00220197   .00244117   .90201501
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                        b_GMM      se_GMM       t_GMM
  L.h_ln_degr_centr  -6.9643632   2.7632505  -2.5203517
 L.h_ln_partplatact    .7765267   .14971713   5.1866257
 L2.h_ln_degr_centr   10.524136   3.9934396   2.6353562
L2.h_ln_partplatact   .22238271   .12816178   1.7351718
 L3.h_ln_degr_centr  -4.3344866   3.8627679  -1.1221194
L3.h_ln_partplatact   .03689735   .12190719   .30266752
 L4.h_ln_degr_centr  -.08555775   2.2409609  -.03817905
L4.h_ln_partplatact  -.07677662   .09257349  -.82935863
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                ln_degr_centr  ln_partplatact
 ln_degr_centr       3.726e-06
ln_partplatact      -7.245e-06       .00491801

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0534   1.0000
             |   0.4524
             |

GMM finished : 12:55:53

Starting Monte-Carlo loop : 12:55:53 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:56:00
```



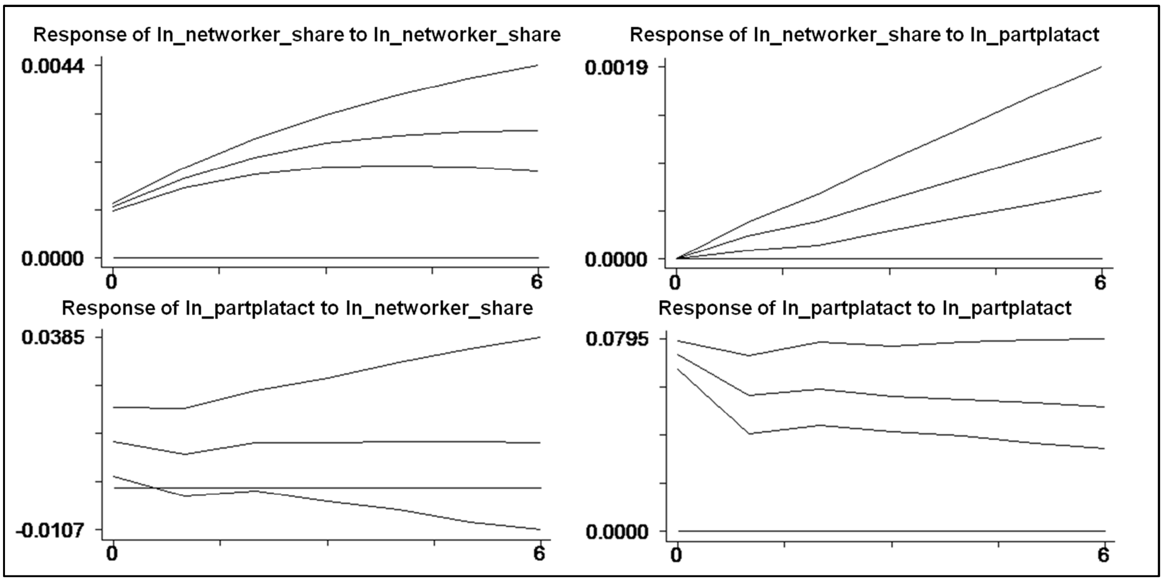
Appendix 10 Estimation Results PVAR(1)-(4) ln_networker_share ln_partplatact; Established Regions

```
. pvar ln_networker_share ln_partplatact, lag(1) gmm monte 1000
GMM started : 13:07:21
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 215
----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                            b_GMM     se_GMM      t_GMM
L.h_ln_networker_share  .90351329  .01180113  76.561571
    L.h_ln_partplatact  .00454113  .00053742  8.4498819
----------------------------------------------------------------------------
----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                            b_GMM     se_GMM      t_GMM
L.h_ln_networker_share   .2095209  .69133584  .30306674
    L.h_ln_partplatact  .95888636  .04333048  22.129604
----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share      ln_partplatact
ln_networker_share           3.923e-06
    ln_partplatact           8.953e-06           .00577035

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0600   1.0000
             |   0.3816
             |

GMM finished : 13:07:23

Starting Monte-Carlo loop : 13:07:23 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 13:07:29
```

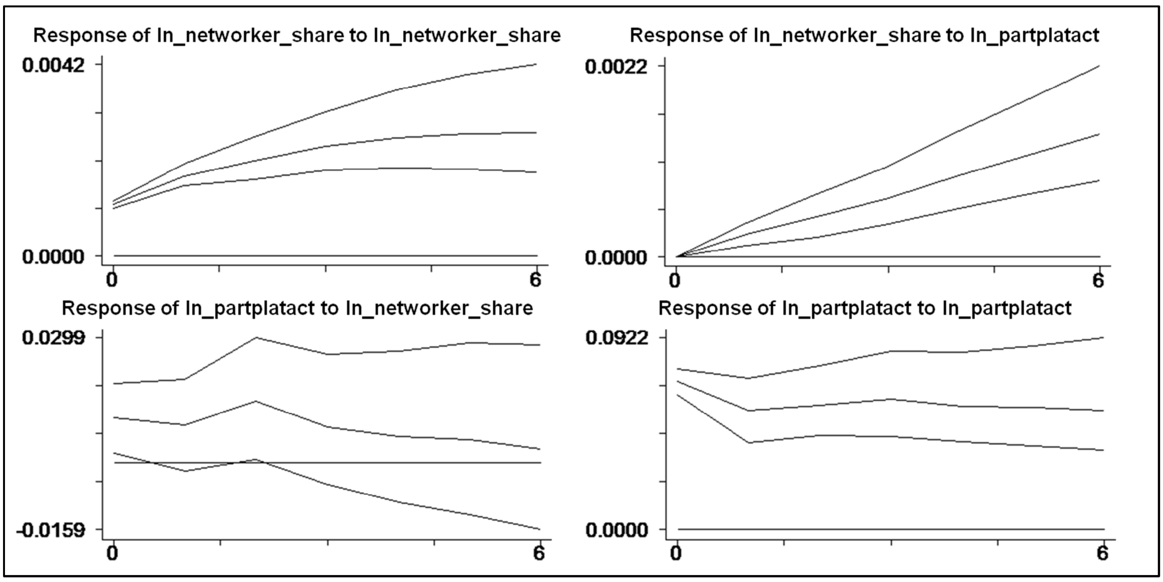
```
. pvar ln_networker_share ln_partplatact, lag(2) gmm monte 1000
GMM started : 13:11:31
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 210
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   1.5652169   .08086823   19.355152
     L.h_ln_partplatact   .00294731    .0011505   2.5617781
L2.h_ln_networker_share   -.5989888    .0731843  -8.1846623
    L2.h_ln_partplatact  -.00093417   .00128426   -.7274015
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   .02912355   2.9166366   .00998532
     L.h_ln_partplatact   .76180369   .12268054   6.2096539
L2.h_ln_networker_share  -.29232928   2.4444832  -.11958736
    L2.h_ln_partplatact   .22177815   .12584178   1.7623571
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share      ln_partplatact
ln_networker_share           1.402e-06
    ln_partplatact            .0000139           .00552873

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1583   1.0000
             |   0.0217
             |

GMM finished : 13:11:32

Starting Monte-Carlo loop : 13:11:33 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 13:11:39
```



```
. pvar ln_networker_share ln_partplatact, lag(3) gmm monte 1000
GMM started : 13:15:00
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 205
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   1.5310651   .10332168    14.81843
     L.h_ln_partplatact    .0030427   .00115023   2.6452927
L2.h_ln_networker_share  -.42576076     .136337  -3.1228556
    L2.h_ln_partplatact  -.00193851   .00134576  -1.4404579
L3.h_ln_networker_share  -.13187722   .05496064  -2.3994848
    L3.h_ln_partplatact   .00047546   .00100752   .47191476
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share  -.39784605   4.3764186  -.09090676
     L.h_ln_partplatact    .7690713    .1277511   6.0200756
L2.h_ln_networker_share   2.4931946   6.0261617   .41372847
    L2.h_ln_partplatact   .21415694   .13350147   1.6041542
L3.h_ln_networker_share  -2.1539558   2.7087272  -.79519112
    L3.h_ln_partplatact  -.02115576   .09695426  -.21820349
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share      ln_partplatact
ln_networker_share           1.341e-06
    ln_partplatact           .00001379           .00542124

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 |  0.1622   1.0000
             |  0.0202
             |

GMM finished : 13:15:01

Starting Monte-Carlo loop : 13:15:02 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 13:15:08
```



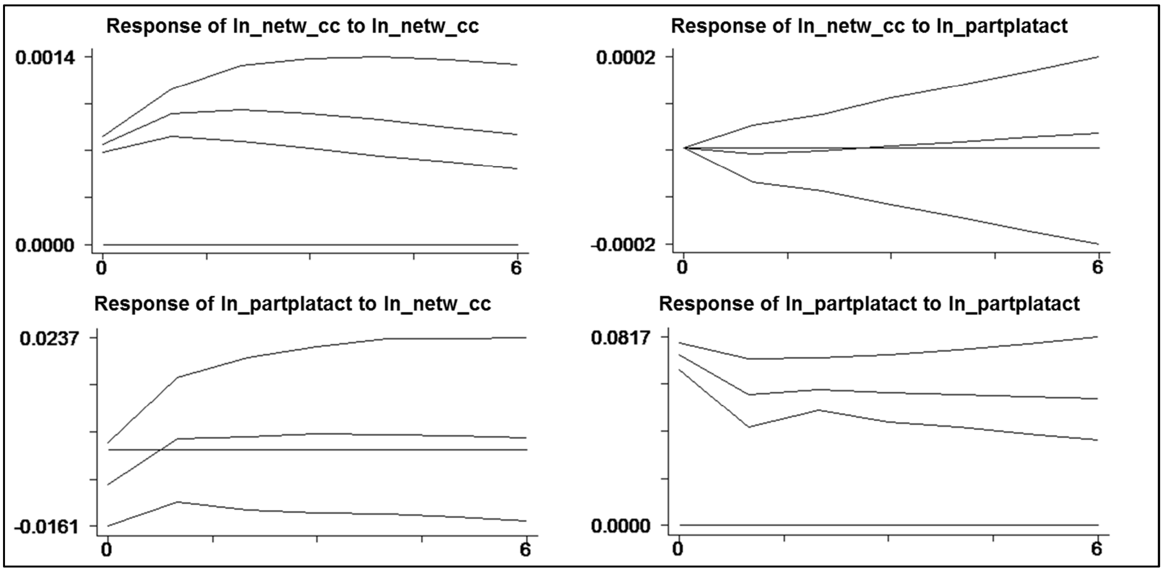
```
. pvar ln_networker_share ln_partplatact, lag(4) gmm monte 1000
GMM started : 13:16:54
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 200
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   1.5146801   .10383647   14.587169
     L.h_ln_partplatact   .00379074    .0011538     3.28544
L2.h_ln_networker_share   -.5167903   .14797598  -3.4923931
    L2.h_ln_partplatact  -.00208477   .00136971  -1.5220504
L3.h_ln_networker_share   .09449779   .16729104   .56487059
    L3.h_ln_partplatact   .00013048   .00124369   .10491238
L4.h_ln_networker_share   -.1186568   .08607918  -1.3784611
    L4.h_ln_partplatact  -1.188e-06   .00101741  -.00116766
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   .28439306   4.4619063   .06373802
     L.h_ln_partplatact   .80398117   .13226891   6.0783835
L2.h_ln_networker_share   4.2782436    6.288978   .68027644
    L2.h_ln_partplatact   .18827634   .13952229   1.3494355
L3.h_ln_networker_share  -11.776286   5.6916051  -2.0690624
    L3.h_ln_partplatact   .03523092   .12116841   .29075993
L4.h_ln_networker_share   6.9749693   3.0641133   2.2763419
    L4.h_ln_partplatact  -.04568378   .09241878  -.49431267
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share      ln_partplatact
ln_networker_share           1.272e-06
    ln_partplatact           .00001215           .00519279

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1501   1.0000
             |   0.0339
             |

GMM finished : 13:16:56

Starting Monte-Carlo loop : 13:16:56 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 13:17:03
```



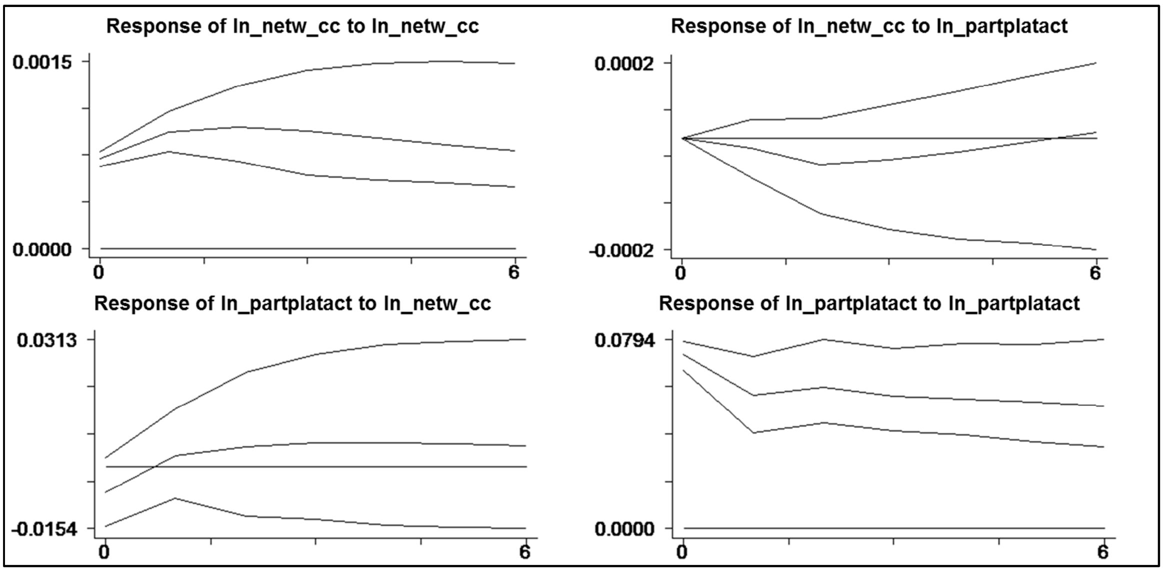
Appendix 11 Estimation Results PVAR(1)-(4) ln_network_cc ln_partplatact; Established Regions

```
. pvar ln_netw_cc ln_partplatact, lag(1) gmm monte 1000
GMM started : 09:09:47
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 215
-------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                        b_GMM     se_GMM      t_GMM
    L.h_ln_netw_cc  .78752022  .27086474  2.9074298
L.h_ln_partplatact  .00290258  .00471366  .61577999
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                        b_GMM     se_GMM      t_GMM
    L.h_ln_netw_cc  .10173413   .5105595  .19926008
L.h_ln_partplatact   .9639369  .03879621   24.84616
-------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_netw_cc  ln_partplatact
    ln_netw_cc       .00026353
ln_partplatact       .00003248       .00573556

Residuals correlation matrix

             |        u1       u2
-------------+--------------------
          u1 |    1.0000
             |
             |
          u2 |    0.0266   1.0000
             |    0.6978
             |

GMM finished : 09:09:49

Starting Monte-Carlo loop : 09:09:49 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 09:09:55
```

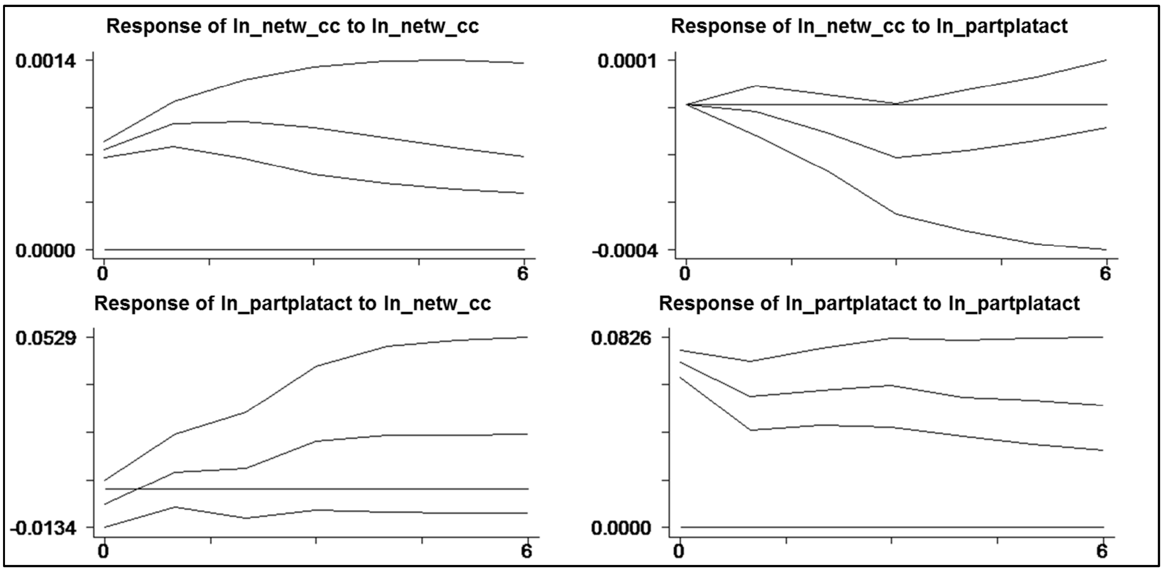
```
. pvar ln_netw_cc ln_partplatact, lag(2) gmm monte 1000
GMM started : 09:17:12
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 210
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                          b_GMM      se_GMM       t_GMM
     L.h_ln_netw_cc   .42678567   .31009172   1.3763208
 L.h_ln_partplatact  -.00048785   .00290581  -.16788598
    L2.h_ln_netw_cc   .40815807   .29225105   1.3966009
L2.h_ln_partplatact   .00213244   .00151791   1.4048528
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                          b_GMM      se_GMM       t_GMM
     L.h_ln_netw_cc  -.13127127   .30785084  -.42641193
 L.h_ln_partplatact   .76738813   .12244744   6.2670819
    L2.h_ln_netw_cc  -.14721327   .28930539  -.50885076
L2.h_ln_partplatact   .21270454    .1163943   1.8274481
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_netw_cc  ln_partplatact
    ln_netw_cc       .00022405
ln_partplatact       4.713e-07       .00560341

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0007   1.0000
             |   0.9924
             |

GMM finished : 09:17:14

Starting Monte-Carlo loop : 09:17:14 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 09:17:20
```



```
. pvar ln_netw_cc ln_partplatact, lag(3) gmm monte 1000
GMM started : 09:19:27
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 205
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                        b_GMM      se_GMM       t_GMM
     L.h_ln_netw_cc   .29105444    .2315747    1.256849
 L.h_ln_partplatact  -.00075369   .00289142  -.26066438
    L2.h_ln_netw_cc   .27487723   .22016311   1.2485163
L2.h_ln_partplatact  -.00058673   .00159335  -.36823791
    L3.h_ln_netw_cc   .26911896   .21640168   1.2436085
L3.h_ln_partplatact   .00264771    .0012767   2.0738718
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                        b_GMM      se_GMM       t_GMM
     L.h_ln_netw_cc  -.07601192   .21792695  -.34879539
 L.h_ln_partplatact   .77032107   .12613478   6.1071267
    L2.h_ln_netw_cc  -.09394223   .20222421  -.46454493
L2.h_ln_partplatact   .21887306   .13284853   1.6475384
    L3.h_ln_netw_cc  -.05075156   .18970853  -.26752384
L3.h_ln_partplatact  -.02277235    .0912729  -.24949741
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                  ln_netw_cc  ln_partplatact
    ln_netw_cc      .0002096
ln_partplatact     7.368e-06        .0054579

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0070   1.0000
             |   0.9202
             |

GMM finished : 09:19:28

Starting Monte-Carlo loop : 09:19:29 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 09:19:35
```



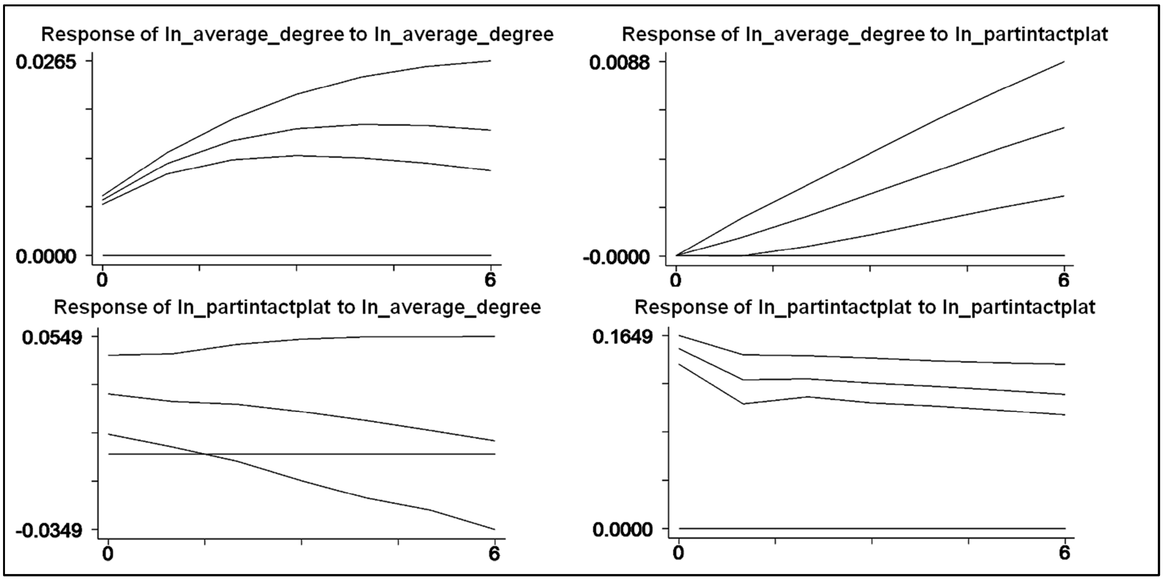
```
. pvar ln_netw_cc ln_partplatact, lag(4) gmm monte 1000
GMM started : 09:22:13
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 200
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                        b_GMM      se_GMM       t_GMM
     L.h_ln_netw_cc   .22019166   .18067962   1.2186856
 L.h_ln_partplatact  -.00074895   .00285952   -.2619152
    L2.h_ln_netw_cc   .20642247   .16942978   1.2183364
L2.h_ln_partplatact  -.00005275    .0017205  -.03066021
    L3.h_ln_netw_cc   .20065999     .168475   1.1910372
L3.h_ln_partplatact   .00335356   .00425526   .78809725
    L4.h_ln_netw_cc   .20044271   .17072641    1.174058
L4.h_ln_partplatact  -.00155112   .00475685  -.32608046
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                        b_GMM      se_GMM       t_GMM
     L.h_ln_netw_cc   .04164317   .19601246   .21245166
 L.h_ln_partplatact   .80560232   .12916142   6.2371744
    L2.h_ln_netw_cc   .01562674   .16524475   .09456725
L2.h_ln_partplatact   .20849455   .13719611   1.5196826
    L3.h_ln_netw_cc   .04599721   .14385072   .31975656
L3.h_ln_partplatact   .02600169    .1247614   .20841131
    L4.h_ln_netw_cc  -.03896514   .13241446  -.29426652
L4.h_ln_partplatact  -.06858612   .08900987  -.77054511
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                  ln_netw_cc  ln_partplatact
    ln_netw_cc     .00020377
ln_partplatact     .00002368       .00534133

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 |  0.0228   1.0000
             |  0.7487
             |

GMM finished : 09:22:15

Starting Monte-Carlo loop : 09:22:16 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 09:22:22
```



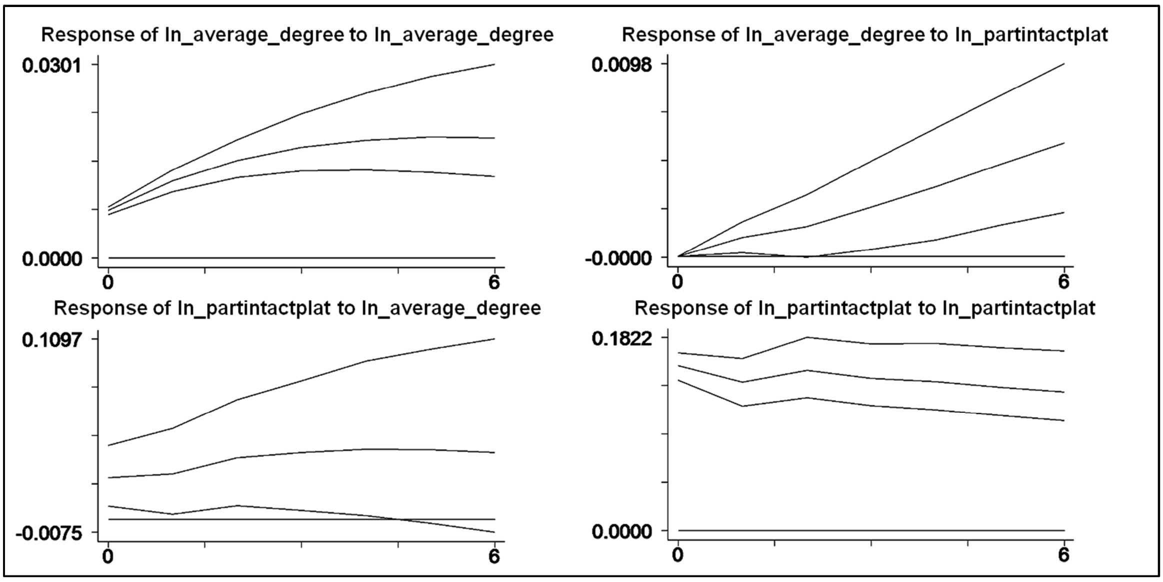
Appendix 12 Estimation Results PVAR(1)-(4) ln_average_degree ln_partintactplat; Established Regions

```
. pvar ln_average_degree ln_partintactplat, lag(1) gmm monte 1000
GMM started : 10:31:32
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 215
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                           b_GMM     se_GMM      t_GMM
L.h_ln_average_degree  .91599191  .01060828  86.346876
L.h_ln_partintactplat  .00809072   .0017813  4.5420292
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                            b_GMM      se_GMM       t_GMM
L.h_ln_average_degree  -.19049658   .16185511  -1.1769574
L.h_ln_partintactplat   .96946926    .0136734   70.901857
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree  ln_partintactplat
ln_average_degree          .00019004
ln_partintactplat          .00030594           .0260314

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1377   1.0000
             |   0.0438
             |

GMM finished : 10:31:34

Starting Monte-Carlo loop : 10:31:35 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 10:31:40
```

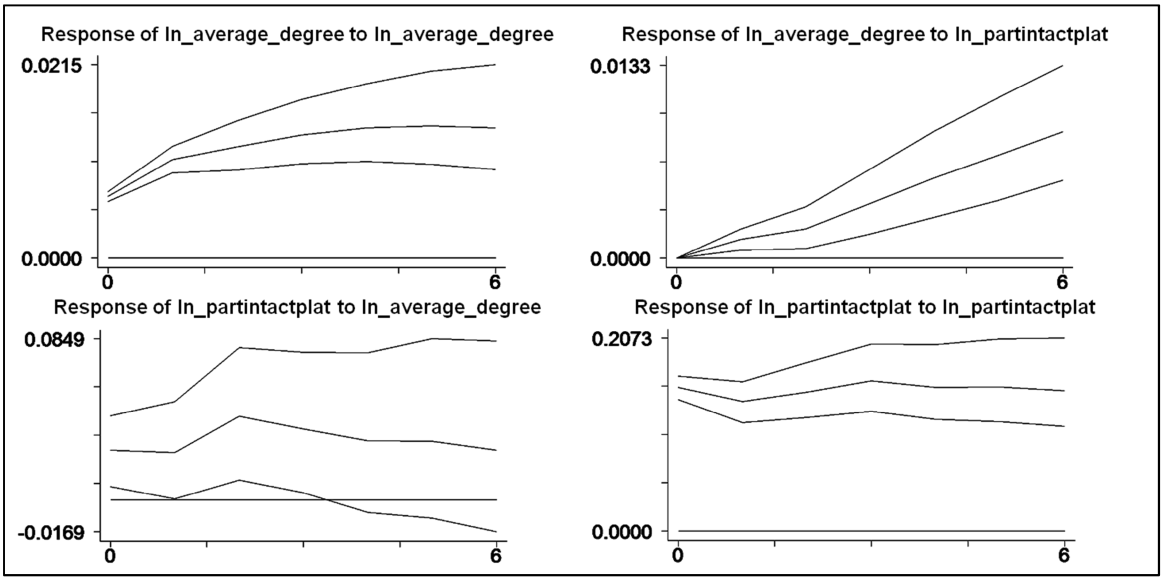
```
. pvar ln_average_degree ln_partintactplat, lag(2) gmm monte 1000
GMM started : 10:33:22
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 210
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                             b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.6454855   .07899584   20.830029
 L.h_ln_partintactplat   .00528709   .00324234   1.6306438
L2.h_ln_average_degree  -.67862791   .07131988  -9.5152695
L2.h_ln_partintactplat  -.00172456   .00325133  -.53041804
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                             b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   .17778938   1.0749283   .16539651
 L.h_ln_partintactplat   .82683828   .07370713   11.217887
L2.h_ln_average_degree  -.46483662   .96827588   -.4800663
L2.h_ln_partintactplat   .14782601   .07313711   2.0212176
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree  ln_partintactplat
ln_average_degree          .00005656
ln_partintactplat          .00021214          .02437761

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1809   1.0000
             |   0.0086
             |

GMM finished : 10:33:23

Starting Monte-Carlo loop : 10:33:24 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 10:33:30
```



```
. pvar ln_average_degree ln_partintactplat, lag(3) gmm monte 1000
GMM started : 10:22:51
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 205
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                            b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.5981156   .11810859     13.5309
 L.h_ln_partintactplat   .00619421   .00307818   2.0122961
L2.h_ln_average_degree  -.54134205   .17247287  -3.1387084
L2.h_ln_partintactplat   -.0057629    .0038448  -1.4988806
L3.h_ln_average_degree  -.08955017   .07458873  -1.2005859
L3.h_ln_partintactplat   .00303747   .00316006   .96120724
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                            b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   .63467808   1.6677858   .38055131
 L.h_ln_partintactplat   .89950732   .07399743   12.155926
L2.h_ln_average_degree   .14202189   2.4622758   .05767912
L2.h_ln_partintactplat   .15843108   .09087384   1.7434179
L3.h_ln_average_degree  -.84761042   1.0794168   -.7852485
L3.h_ln_partintactplat  -.09975419   .06593497  -1.5129179
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree  ln_partintactplat
ln_average_degree          .00005403
ln_partintactplat          .00018851          .02488241

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1630   1.0000
             |   0.0195
             |

GMM finished : 10:22:52

Starting Monte-Carlo loop : 10:22:53 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 10:23:00
```



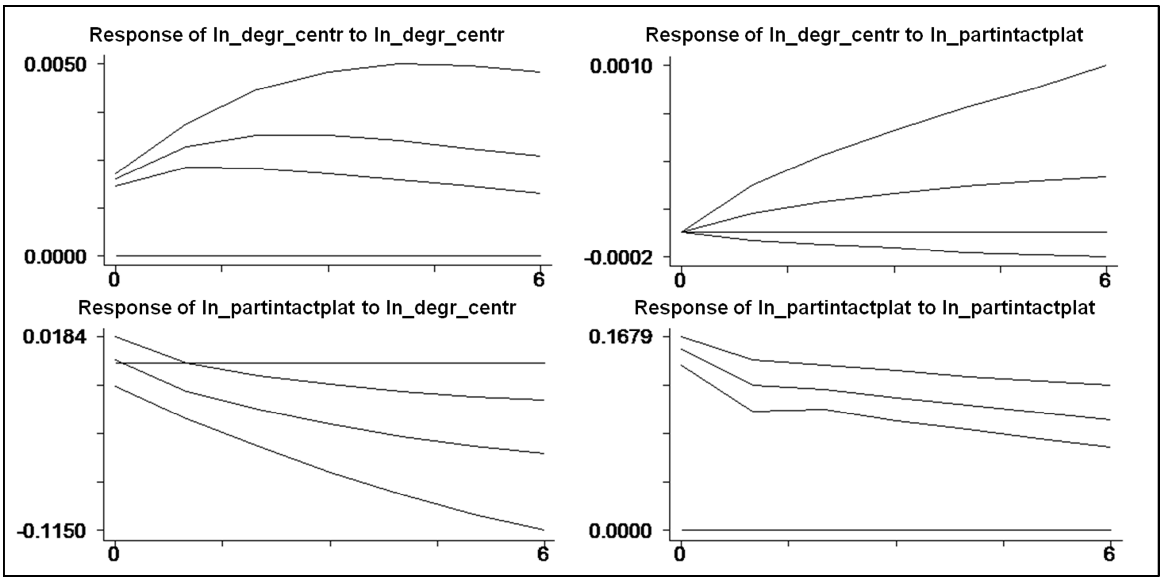
```
. pvar ln_average_degree ln_partintactplat, lag(4) gmm monte 1000
GMM started : 10:35:07
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 200
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.5677525   .11622906   13.488473
 L.h_ln_partintactplat    .0082618   .00286273   2.8859846
L2.h_ln_average_degree  -.70412292   .16445469  -4.2815619
L2.h_ln_partintactplat  -.00747343   .00342432  -2.1824551
L3.h_ln_average_degree     .237338   .11815477   2.0087044
L3.h_ln_partintactplat     .008583   .00382819   2.2420498
L4.h_ln_average_degree   -.1420381    .0551278  -2.5765242
L4.h_ln_partintactplat  -.00420274   .00356445  -1.1790705
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   .20305368   1.7167209   .11827996
 L.h_ln_partintactplat   .90086036   .07421523   12.138484
L2.h_ln_average_degree   2.2495987   2.5013768   .89934419
L2.h_ln_partintactplat   .15404612     .095411   1.6145531
L3.h_ln_average_degree  -4.9084986   2.3485669  -2.0899974
L3.h_ln_partintactplat   .01393178   .08622033   .16158341
L4.h_ln_average_degree   2.3534527   1.2459988   1.8888081
L4.h_ln_partintactplat  -.09852622   .06396619  -1.5402858
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree  ln_partintactplat
ln_average_degree           .00004664
ln_partintactplat           .00017707          .02448192

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1665   1.0000
             |   0.0184
             |

GMM finished : 10:35:10

Starting Monte-Carlo loop : 10:35:10 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 10:35:17
```



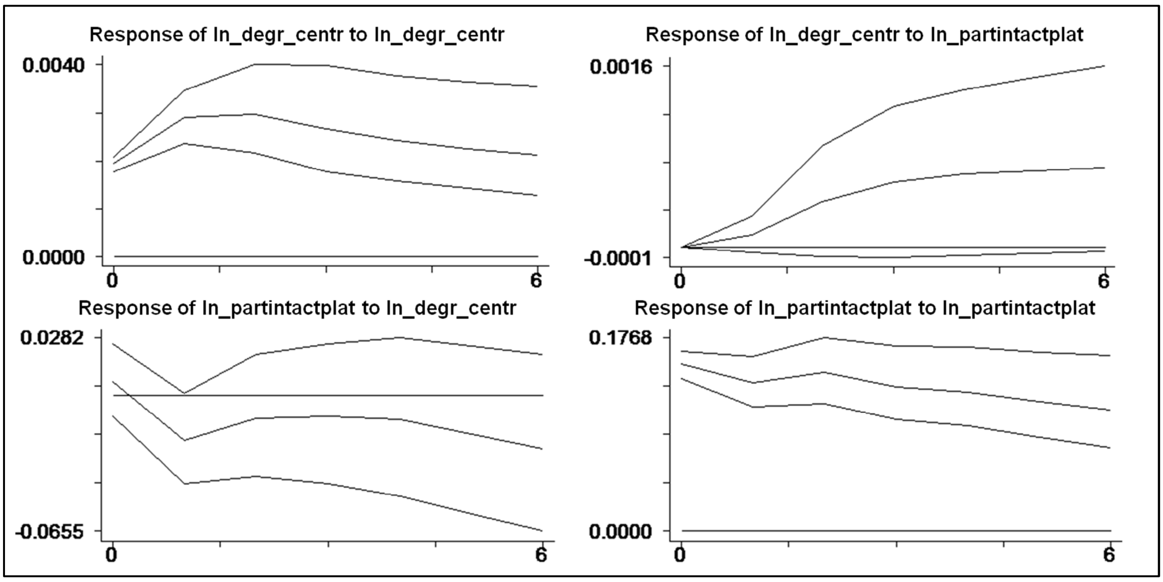
Appendix 13 Estimation Results PVAR(1)-(4) ln_degree_centralization ln_partintactplat; Established Regions

```
. pvar ln_degr_centr ln_partintactplat, lag(1) gmm monte 1000
GMM started : 10:43:37
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 215
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                           b_GMM     se_GMM      t_GMM
    L.h_ln_degr_centr  .96259168  .02414177  39.872457
L.h_ln_partintactplat  .00051698  .00029442  1.7559158
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                            b_GMM      se_GMM       t_GMM
    L.h_ln_degr_centr   -2.461484   1.5255249  -1.6135326
L.h_ln_partintactplat   .94451011   .01940062   48.684527
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                       ln_degr_centr  ln_partintactplat
    ln_degr_centr          5.255e-06
ln_partintactplat         -1.661e-07          .02573861

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0005   1.0000
             |   0.9940
             |

GMM finished : 10:43:39

Starting Monte-Carlo loop : 10:43:40 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 10:43:46
```

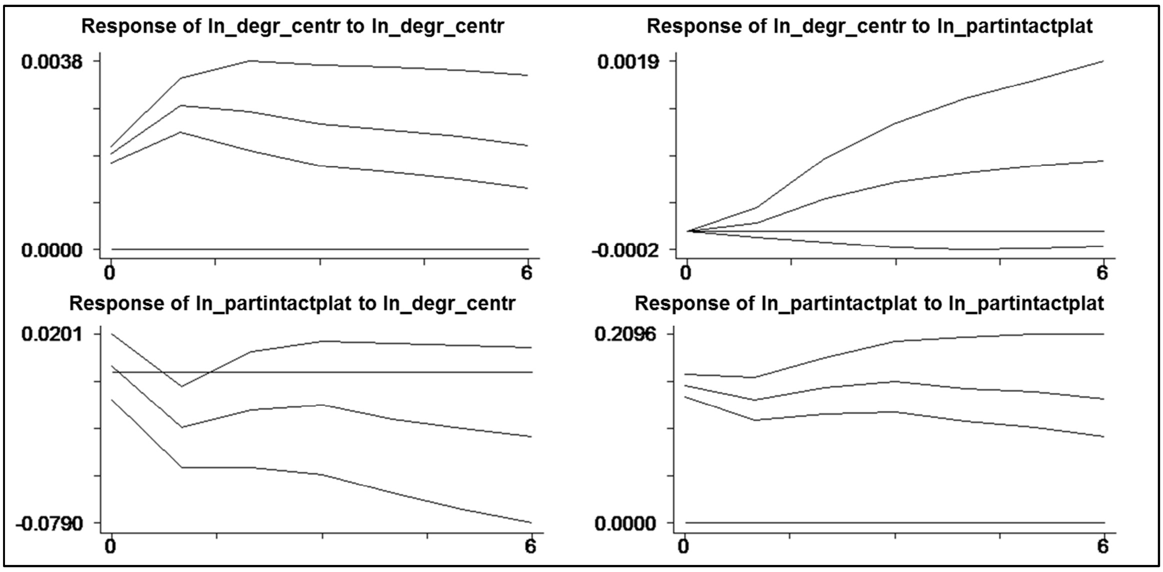
```
. pvar ln_degr_centr ln_partintactplat, lag(2) gmm monte 1000
GMM started : 11:20:55
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 210
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                           b_GMM      se_GMM       t_GMM
     L.h_ln_degr_centr   1.4282584   .15514361   9.2060408
 L.h_ln_partintactplat   .00072254    .0006225   1.1607123
    L2.h_ln_degr_centr  -.46613198   .15410371  -3.0247941
L2.h_ln_partintactplat  -.00047682   .00049314  -.96688827
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                           b_GMM      se_GMM       t_GMM
     L.h_ln_degr_centr  -10.318992    4.062397  -2.5401239
 L.h_ln_partintactplat   .80526817   .07844556   10.265313
    L2.h_ln_degr_centr   6.5345122   3.6709403    1.780065
L2.h_ln_partintactplat   .14013128   .06858874   2.0430655
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                       ln_degr_centr  ln_partintactplat
    ln_degr_centr          4.042e-06
ln_partintactplat          4.047e-06          .02443723

Residuals correlation matrix

             |      u1       u2
-------------+-----------------
          u1 |   1.0000
             |
             |
          u2 |   0.0129   1.0000
             |   0.8529
             |

GMM finished : 11:20:57

Starting Monte-Carlo loop : 11:20:57 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 11:21:03
```



```
. pvar ln_degr_centr ln_partintactplat, lag(3) gmm monte 1000
GMM started : 11:22:54
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 205
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                           b_GMM      se_GMM       t_GMM
     L.h_ln_degr_centr   1.4951662   .15510422    9.639752
 L.h_ln_partintactplat   .00070894   .00066054   1.0732718
    L2.h_ln_degr_centr  -.71072435   .22971222  -3.0939771
L2.h_ln_partintactplat   .00096572   .00117018    .82526749
    L3.h_ln_degr_centr   .18109639   .10713488   1.6903589
L3.h_ln_partintactplat  -.00123399   .00119234  -1.0349259
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                           b_GMM      se_GMM       t_GMM
     L.h_ln_degr_centr   -14.26105   4.5156706  -3.1581245
 L.h_ln_partintactplat   .88861774   .07599866   11.692545
    L2.h_ln_degr_centr   25.141922   8.5672598   2.9346515
L2.h_ln_partintactplat   .16853856   .08470507   1.9897103
    L3.h_ln_degr_centr  -13.700574   5.8996726  -2.3222601
L3.h_ln_partintactplat   -.1117335   .06548956  -1.7061269
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                       ln_degr_centr  ln_partintactplat
    ln_degr_centr          3.863e-06
ln_partintactplat          .00001351          .02338912

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 |  0.0451   1.0000
             |  0.5206
             |

GMM finished : 11:22:55

Starting Monte-Carlo loop : 11:22:56 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 11:23:02
```



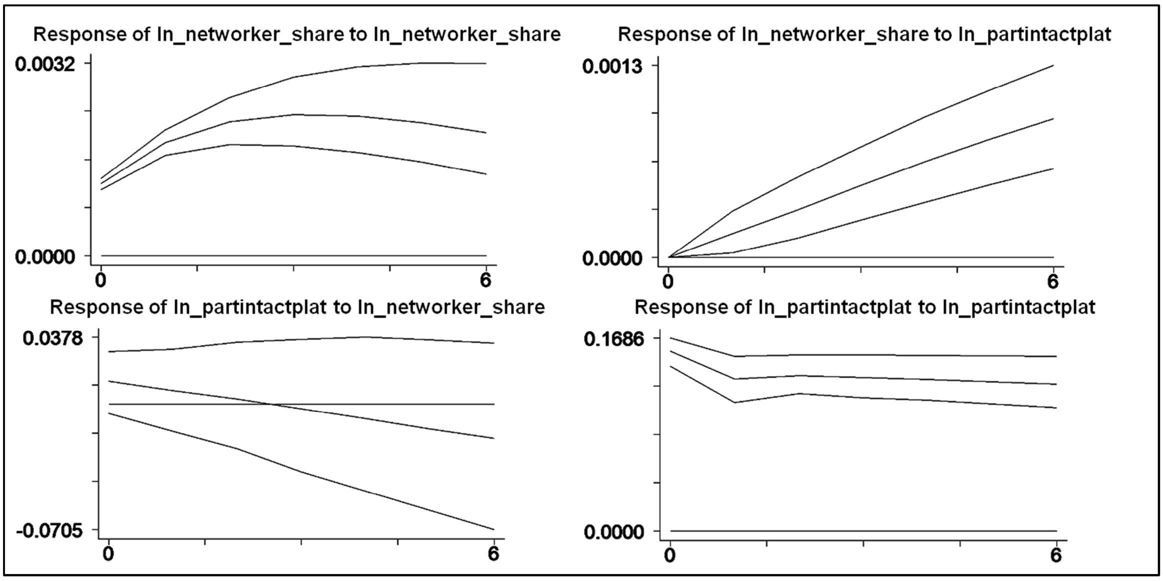
```
. pvar ln_degr_centr ln_partintactplat, lag(4) gmm monte 1000
GMM started : 11:25:36
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 200
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                           b_GMM      se_GMM       t_GMM
     L.h_ln_degr_centr    1.493182   .14978015   9.9691586
 L.h_ln_partintactplat   .00059794   .00070128    .8526367
    L2.h_ln_degr_centr  -.78879995   .22897063  -3.4449831
L2.h_ln_partintactplat   .00094574   .00125205   .75535173
    L3.h_ln_degr_centr   .35970741    .1559497   2.3065606
L3.h_ln_partintactplat  -.00091054     .001495  -.60905605
    L4.h_ln_degr_centr  -.10716459   .07152036  -1.4983789
L4.h_ln_partintactplat    -.000192   .00095898  -.20021686
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                           b_GMM      se_GMM       t_GMM
     L.h_ln_degr_centr  -16.485814   4.5937086   -3.588781
 L.h_ln_partintactplat   .89726892   .08032408   11.170609
    L2.h_ln_degr_centr   27.511172   9.9812898   2.7562743
L2.h_ln_partintactplat   .18579996   .09479192   1.9600822
    L3.h_ln_degr_centr  -14.417775   10.859424  -1.3276739
L3.h_ln_partintactplat   .00588154    .0844138   .06967505
    L4.h_ln_degr_centr   .90833553   5.0118341   .18123815
L4.h_ln_partintactplat  -.13001034   .05833193  -2.2288021
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                     ln_degr_centr  ln_partintactplat
    ln_degr_centr          3.784e-06
ln_partintactplat          6.733e-06          .02329788

Residuals correlation matrix

             |        u1       u2
-------------+-------------------
          u1 |    1.0000
             |
             |
          u2 |    0.0228   1.0000
             |    0.7489
             |

GMM finished : 11:25:38

Starting Monte-Carlo loop : 11:25:38 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 11:25:45
```



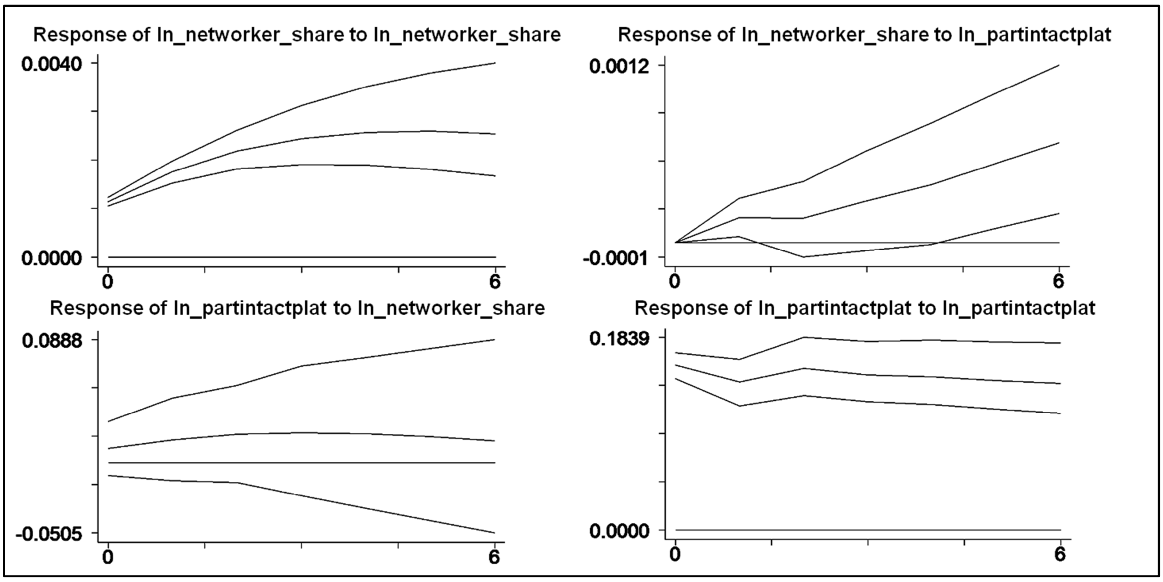
Appendix 14 Estimation Results PVAR(1)-(4) ln_networker_share ln_partintactplat; Established Regions

```
. pvar ln_networker_share ln_partintactplat, lag(1) gmm monte 1000
GMM started : 11:30:22
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 215
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                            b_GMM     se_GMM      t_GMM
L.h_ln_networker_share  .90827394  .01186357  76.559923
 L.h_ln_partintactplat  .00104683  .00021583  4.8502801
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                             b_GMM      se_GMM       t_GMM
L.h_ln_networker_share  -1.8134943   1.4368945  -1.2620928
 L.h_ln_partintactplat    .9820892   .01822827   53.877265
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share   ln_partintactplat
ln_networker_share           4.074e-06
 ln_partintactplat           .00003399           .02630504

Residuals correlation matrix

             |        u1       u2
_____________|__________________
          u1 |    1.0000
             |
             |
          u2 |    0.1039   1.0000
             |    0.1289
             |

GMM finished : 11:30:24

Starting Monte-Carlo loop : 11:30:24 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 11:30:30
```

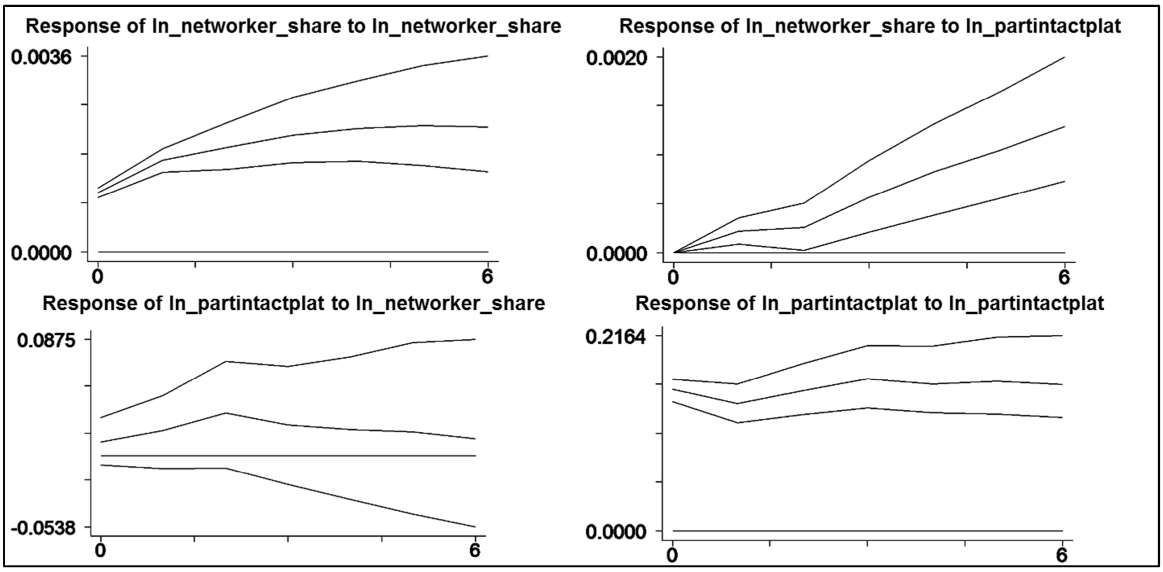
```
. pvar ln_networker_share ln_partintactplat, lag(2) gmm monte 1000
GMM started : 11:39:43
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 210
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                            b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   1.5589685   .08295477   18.792994
  L.h_ln_partintactplat   .00098335   .00055454   1.7732557
L2.h_ln_networker_share  -.59713154   .07412258  -8.0560001
 L2.h_ln_partintactplat  -.00039981   .00058764  -.68037477
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                            b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share  -2.8583671   8.3792246  -.34112549
  L.h_ln_partintactplat   .84376319   .07063327    11.94569
L2.h_ln_networker_share  -.01817657   7.0869809  -.00256478
 L2.h_ln_partintactplat   .15352689    .0743121   2.0659743
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share   ln_partintactplat
ln_networker_share           1.394e-06
 ln_partintactplat           .00001529           .02488266

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0818   1.0000
             |   0.2380
             |

GMM finished : 11:39:44

Starting Monte-Carlo loop : 11:39:45 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 11:39:51
```



```
. pvar ln_networker_share ln_partintactplat, lag(3) gmm monte 1000
GMM started : 11:46:25
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 205
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   1.5215674   .10653129   14.282822
  L.h_ln_partintactplat     .001098   .00052521   2.0905798
L2.h_ln_networker_share  -.41980784   .13707277  -3.0626639
 L2.h_ln_partintactplat  -.00156005   .00070442  -2.2146652
L3.h_ln_networker_share  -.13652348   .05475344  -2.4934229
 L3.h_ln_partintactplat   .00096456   .00056025   1.7216542
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   6.2070943   12.839869   .48342349
  L.h_ln_partintactplat    .8982266   .07340123   12.237214
L2.h_ln_networker_share  -6.0838397   18.070979  -.33666354
 L2.h_ln_partintactplat   .16686103   .09244941   1.8048902
L3.h_ln_networker_share  -1.2856109   7.6676697  -.16766644
 L3.h_ln_partintactplat  -.09027632   .06720709  -1.3432559
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share   ln_partintactplat
ln_networker_share           1.298e-06
 ln_partintactplat           .00001186           .02484156

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0662   1.0000
             |   0.3457
             |

GMM finished : 11:46:26

Starting Monte-Carlo loop : 11:46:27 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 11:46:33
```



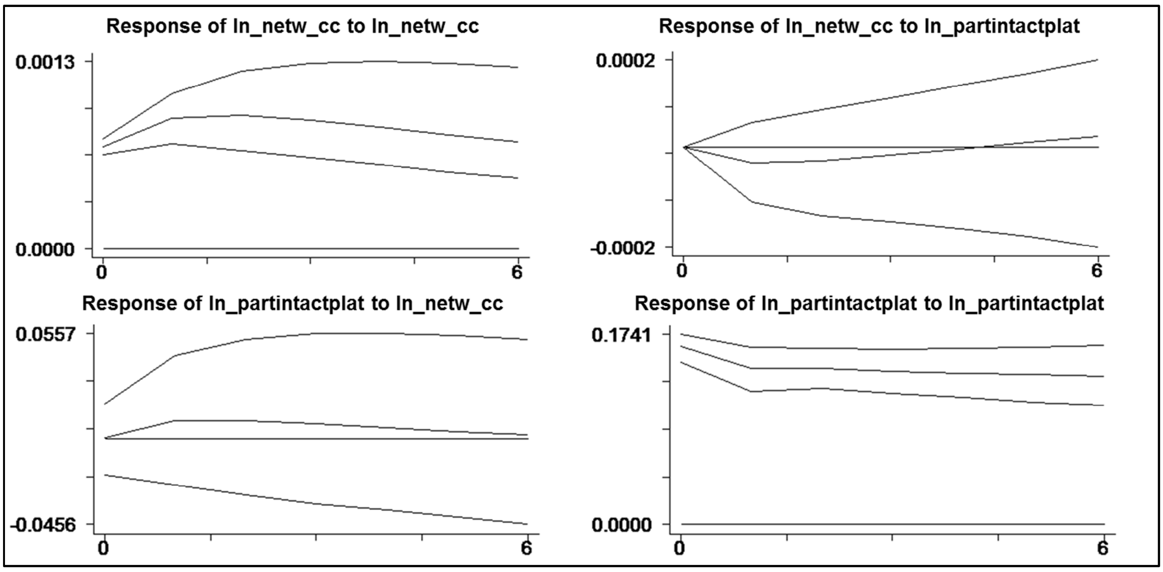
```
. pvar ln_networker_share ln_partintactplat, lag(4) gmm monte 1000
GMM started : 11:56:38
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 200
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   1.5320426    .0992972    15.42886
  L.h_ln_partintactplat    .0014012   .00050278   2.7869149
L2.h_ln_networker_share  -.60874837   .12586634  -4.8364666
 L2.h_ln_partintactplat  -.00175169    .0006675  -2.6242402
L3.h_ln_networker_share   .17226565    .1539765   1.1187788
 L3.h_ln_partintactplat   .00210462   .00067827   3.1029213
L4.h_ln_networker_share  -.12981335    .0813298  -1.5961351
 L4.h_ln_partintactplat  -.00111975   .00059374  -1.8859249
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   8.9594964   12.935183   .69264548
  L.h_ln_partintactplat   .89921572   .07391835   12.164986
L2.h_ln_networker_share  -1.4566619   18.998603  -.07667205
 L2.h_ln_partintactplat   .16790729   .09658814   1.7383841
L3.h_ln_networker_share   -22.05582   17.806383  -1.2386468
 L3.h_ln_partintactplat   .01942349   .08605524   .22570952
L4.h_ln_networker_share   13.670288   8.2316713   1.6606941
 L4.h_ln_partintactplat  -.10952393   .06790706  -1.6128503
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share   ln_partintactplat
ln_networker_share           1.158e-06
 ln_partintactplat           .00001102           .02466629

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0657   1.0000
             |   0.3550
             |

GMM finished : 11:56:39

Starting Monte-Carlo loop : 11:56:40 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 11:56:47
```



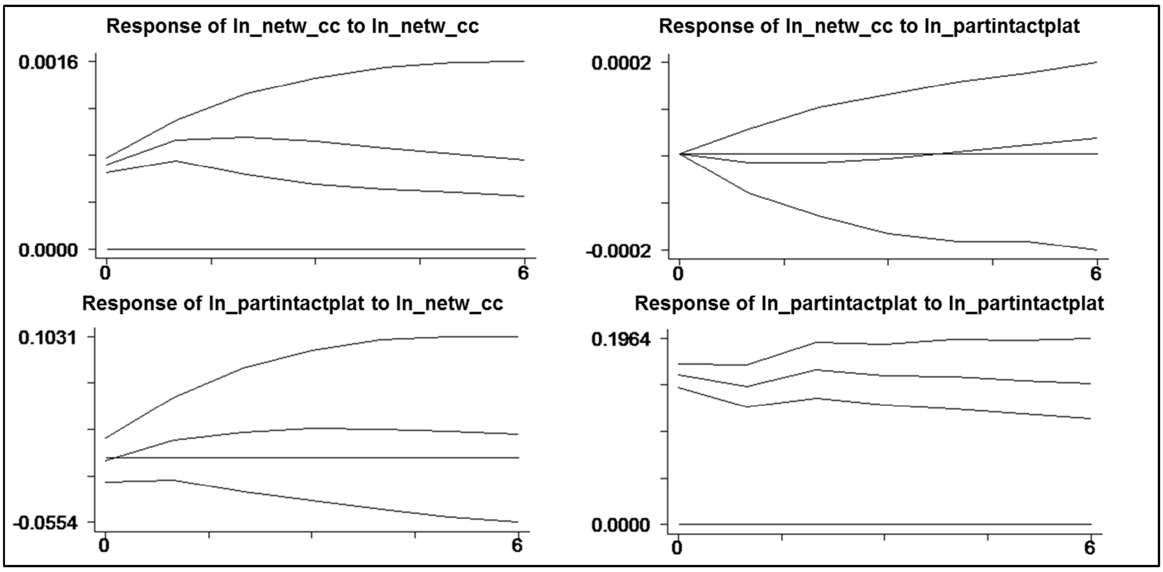
Appendix 15 Estimation Results PVAR(1)-(4) ln_network_cc ln_partintactplat; Established Regions

```
. pvar ln_netw_cc ln_partintactplat, lag(1) gmm monte 1000
GMM started : 12:03:58
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 215
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                           b_GMM      se_GMM       t_GMM
       L.h_ln_netw_cc  .75373717   .3052497  2.4692478
L.h_ln_partintactplat  .00114573  .00166328  .68883786
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                            b_GMM       se_GMM        t_GMM
       L.h_ln_netw_cc  -1.7795553   1.6012237  -1.1113721
L.h_ln_partintactplat   .97590298   .01627729   59.954885
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                          ln_netw_cc  ln_partintactplat
       ln_netw_cc          .00025597
ln_partintactplat         -.00001676          .02746726

Residuals correlation matrix

             |        u1       u2
-------------+--------------------
          u1 |    1.0000
             |
             |
          u2 |   -0.0056   1.0000
             |    0.9348
             |

GMM finished : 12:03:59

Starting Monte-Carlo loop : 12:04:00 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:04:05
```

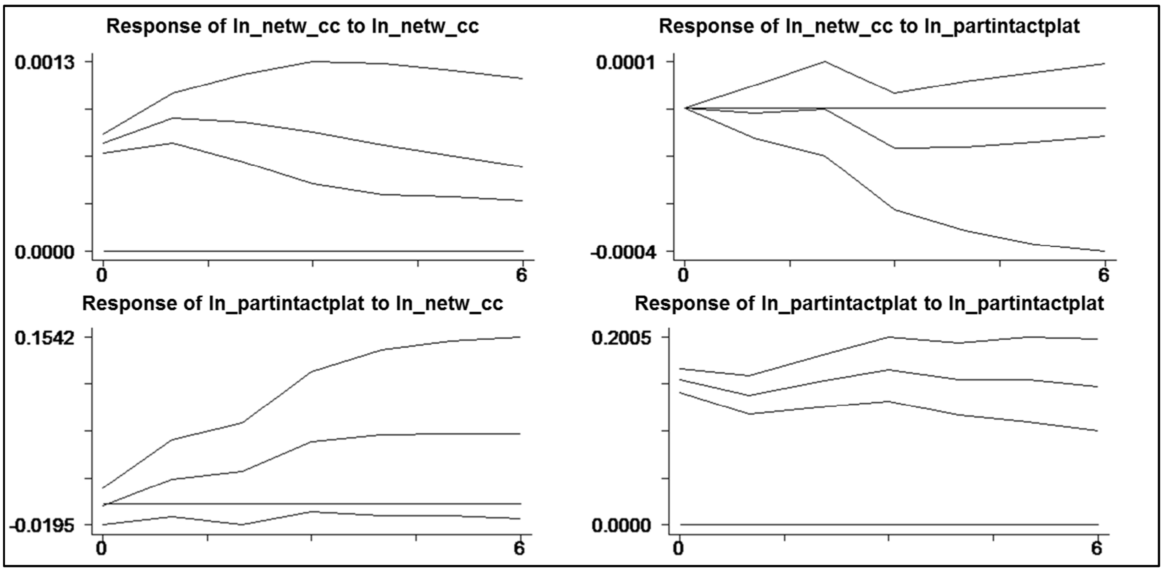
```
. pvar ln_netw_cc ln_partintactplat, lag(2) gmm monte 1000
GMM started : 12:29:21
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 210
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                            b_GMM      se_GMM       t_GMM
        L.h_ln_netw_cc   .41630759   .31006928   1.3426277
 L.h_ln_partintactplat   .00095112   .00117357   .81045387
       L2.h_ln_netw_cc   .39936445   .29127237   1.3711031
L2.h_ln_partintactplat  -.00027363   .00074835  -.36564829
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                            b_GMM      se_GMM       t_GMM
        L.h_ln_netw_cc  -1.3545502   .97478538  -1.3895882
 L.h_ln_partintactplat   .88079723   .07011678    12.56186
       L2.h_ln_netw_cc  -.79394402   .94382093  -.84120197
L2.h_ln_partintactplat   .10295749    .0688452   1.4954927
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                         ln_netw_cc  ln_partintactplat
       ln_netw_cc          .00022168
ln_partintactplat           .0000252           .0268432

Residuals correlation matrix

             |     u1       u2
-------------+-----------------
          u1 |   1.0000
             |
             |
          u2 |   0.0108   1.0000
             |   0.8761
             |

GMM finished : 12:29:22

Starting Monte-Carlo loop : 12:29:23 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:29:29
```



```
. pvar ln_netw_cc ln_partintactplat, lag(3) gmm monte 1000
GMM started : 12:31:39
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 205
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                           b_GMM      se_GMM       t_GMM
        L.h_ln_netw_cc   .27981075   .22552692   1.2406978
 L.h_ln_partintactplat    .0007789   .00175493    .44383511
       L2.h_ln_netw_cc   .26680515   .21402541     1.246605
L2.h_ln_partintactplat  -.00375552   .00314705   -1.1933483
       L3.h_ln_netw_cc   .25783055   .21002573   1.2276142
L3.h_ln_partintactplat   .00355433   .00355338   1.0002666
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                           b_GMM      se_GMM       t_GMM
        L.h_ln_netw_cc  -1.0113985   .65470976  -1.5448043
 L.h_ln_partintactplat    .9325343   .06732612   13.851003
       L2.h_ln_netw_cc  -.48384129   .64193145  -.75372735
L2.h_ln_partintactplat   .17206937    .0899526   1.9128893
       L3.h_ln_netw_cc  -.17080601   .61239497  -.27891479
L3.h_ln_partintactplat  -.12718844   .06827759  -1.8628139
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                        ln_netw_cc  ln_partintactplat
       ln_netw_cc        .00020676
ln_partintactplat        .00007677          .02587715

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 |  0.0333   1.0000
             |  0.6350
             |

GMM finished : 12:31:41

Starting Monte-Carlo loop : 12:31:42 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:31:48
```



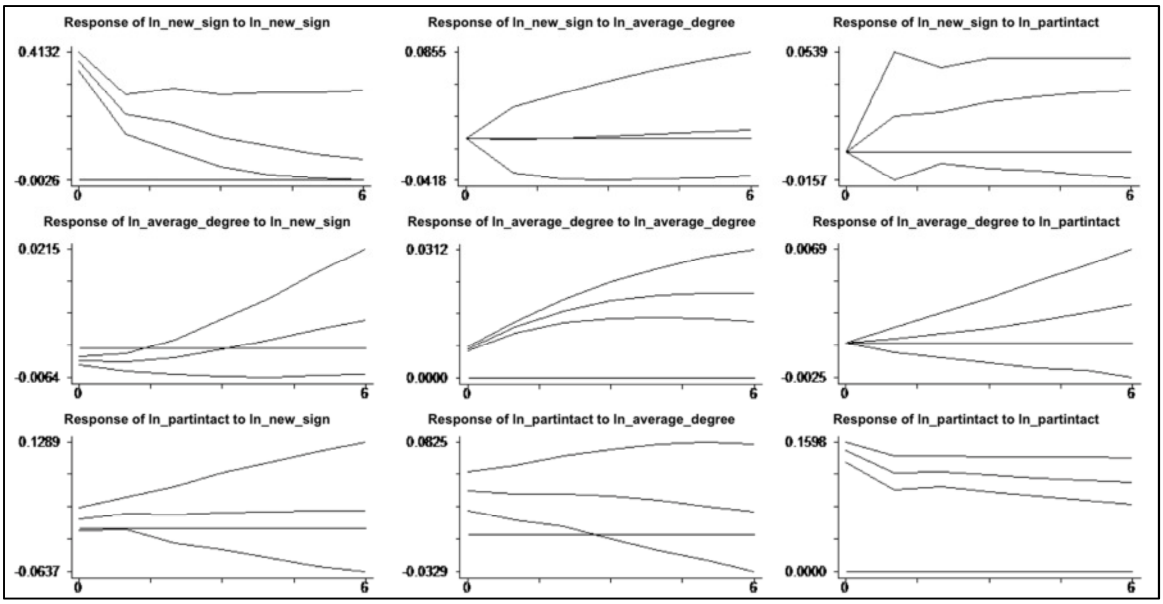
```
. pvar ln_netw_cc ln_partintactplat, lag(4) gmm monte 1000
GMM started : 12:33:38
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 200
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                            b_GMM      se_GMM       t_GMM
        L.h_ln_netw_cc     .204991   .17016764   1.2046415
 L.h_ln_partintactplat   .00086625   .00111181    .77913092
       L2.h_ln_netw_cc   .19691799   .16057289   1.2263464
L2.h_ln_partintactplat  -.00393791   .00446299  -.88234787
       L3.h_ln_netw_cc   .18948639   .15980473   1.1857371
L3.h_ln_partintactplat   .00103803   .00262876    .39487407
       L4.h_ln_netw_cc   .18944244   .16278555   1.1637547
L4.h_ln_partintactplat   .00262583   .00209729   1.2520074
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                            b_GMM      se_GMM       t_GMM
        L.h_ln_netw_cc  -.66434631   .53623271  -1.2389142
 L.h_ln_partintactplat   .92786258   .07003911   13.247777
       L2.h_ln_netw_cc  -.25770289   .49536343  -.52022995
L2.h_ln_partintactplat   .18847288   .09778369   1.9274469
       L3.h_ln_netw_cc  -.01498481   .45490707  -.03294037
L3.h_ln_partintactplat  -.01027289   .08806485  -.11665143
       L4.h_ln_netw_cc  -.11086948   .47044915   -.2356673
L4.h_ln_partintactplat  -.12621538   .06490669  -1.9445666
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                         ln_netw_cc  ln_partintactplat
       ln_netw_cc          .00020051
ln_partintactplat          .00011976          .02574082

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0528   1.0000
             |   0.4581
             |

GMM finished : 12:33:39

Starting Monte-Carlo loop : 12:33:40 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:33:47
```



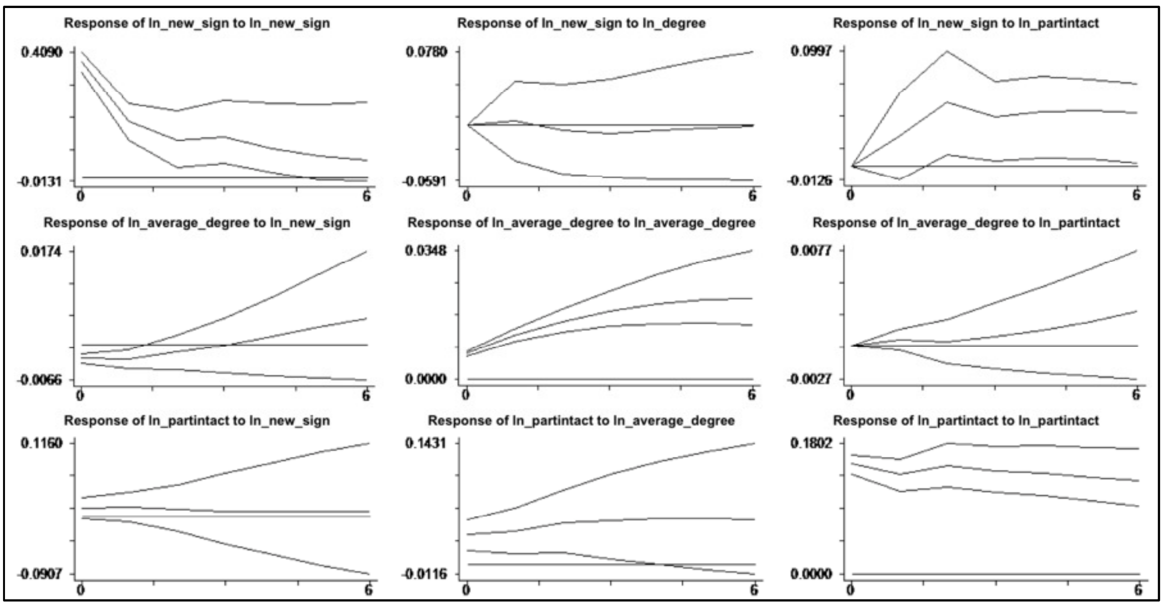
Appendix 16 Estimation Results PVAR(1)-(4) ln_new_signups ln_average_degree ln_partintact; Established Regions

```
. pvar ln_new_sign ln_average_degree ln_partintact, lag(1) gmm monte 1000
GMM started : 10:38:10
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 215
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                          b_GMM     se_GMM      t_GMM
      L.h_ln_new_sign  .73860948  .13879383  5.3216304
L.h_ln_average_degree   .1454686  .40716487  .35727198
    L.h_ln_partintact  .08819849  .05635499  1.5650519
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                           b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign  -.00323491   .00437757  -.73897294
L.h_ln_average_degree   .92137001   .01171057   78.678504
    L.h_ln_partintact   .00925085   .00246825   3.7479383
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                           b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign  -.01423252   .05064363  -.28103274
L.h_ln_average_degree   -.1842319   .14717036  -1.2518275
    L.h_ln_partintact   .97465742   .02376158   41.018201
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                     ln_new_sign  ln_average_degree      ln_partintact
      ln_new_sign         .15695324
ln_average_degree        -.00145876          .00017439
    ln_partintact         .00255216          .00033431          .02588947

Residuals correlation matrix

             |        u1       u2       u3
-------------+-----------------------------
          u1 |    1.0000
             |
             |
          u2 |   -0.2798   1.0000
             |    0.0000
             |
          u3 |    0.0402   0.1575   1.0000
             |    0.5575   0.0208
             |

GMM finished : 10:38:12

Starting Monte-Carlo loop : 10:38:14 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 10:38:21
```

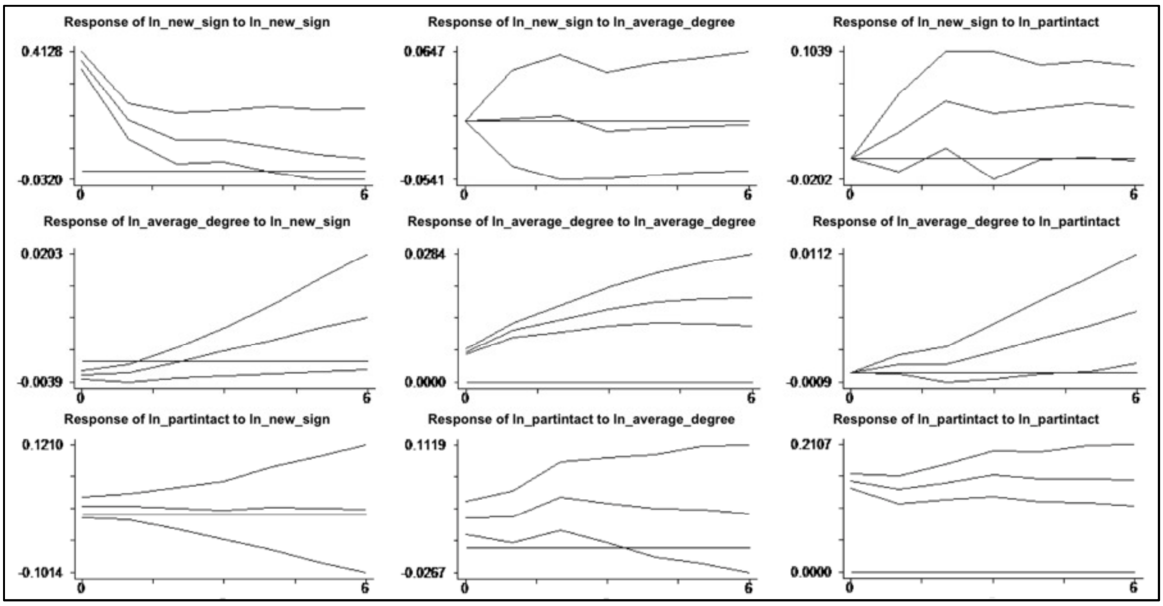
```
. pvar ln_new_sign ln_average_degree ln_partintact, lag(2) gmm monte 1000
GMM started : 10:51:14
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 210
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                              b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign    .53573993   .11617671   4.6114229
 L.h_ln_average_degree   -.79178234    3.171662  -.24964272
     L.h_ln_partintact    .12643399   .14461365    .8742881
      L2.h_ln_new_sign    .18261454   .09599846   1.9022652
L2.h_ln_average_degree    .90030783   2.9717381   .30295665
    L2.h_ln_partintact   -.02743414   .12326388  -.22256435
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                              b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign    .00441826   .00214488   2.0599091
 L.h_ln_average_degree      1.73957   .08897271   19.551725
     L.h_ln_partintact    .00206215   .00372423   .55371137
      L2.h_ln_new_sign    .00056374   .00148669   .37918941
L2.h_ln_average_degree   -.76869369    .0829446  -9.2675553
    L2.h_ln_partintact   -.00133931   .00351762  -.38074245
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                              b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign    .03296369   .03874338   .85082128
 L.h_ln_average_degree    .55650155   1.5937658   .34917398
     L.h_ln_partintact    .82034796   .07726669   10.617097
      L2.h_ln_new_sign   -.01887588   .03178638   -.5938355
L2.h_ln_average_degree   -.82893987   1.4862166  -.55775174
    L2.h_ln_partintact    .14546381   .07479864   1.9447387
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                     ln_new_sign  ln_average_degree      ln_partintact
      ln_new_sign      .14772373
ln_average_degree     -.00105994          .00005877
    ln_partintact      .00530033          .00024455          .02388634

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.3600   1.0000
             |   0.0000
             |
          u3 |   0.0893   0.2064   1.0000
             |   0.1976   0.0026
             |

GMM finished : 10:51:16

Starting Monte-Carlo loop : 10:51:17 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 10:51:24
```



```
. pvar ln_new_sign ln_average_degree ln_partintact, lag(3) gmm monte 1000
GMM started : 10:54:01
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 205
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                              b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .47836114   .10871081   4.4003088
 L.h_ln_average_degree  -.11376703   3.7925629   -.0299974
     L.h_ln_partintact   .17054752   .15138756   1.1265623
      L2.h_ln_new_sign   .06078615   .11158454   .54475426
L2.h_ln_average_degree  -2.5676369    5.618195  -.45702168
    L2.h_ln_partintact   .13001041   .17137259   .75864181
      L3.h_ln_new_sign   .15956929   .07912875   2.0165779
L3.h_ln_average_degree   2.7661271   3.0464159   .90799393
    L3.h_ln_partintact  -.18201784   .14748209  -1.2341691
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                              b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00405542   .00184474   2.1983722
 L.h_ln_average_degree   1.6792022   .13114926   12.803749
     L.h_ln_partintact   .00324729   .00351661   .92341444
      L2.h_ln_new_sign   .00273937   .00154873   1.7687806
L2.h_ln_average_degree  -.58958095   .19749589  -2.9852822
    L2.h_ln_partintact  -.00674611   .00405992  -1.6616361
      L3.h_ln_new_sign  -.00186935   .00128092  -1.4593781
L3.h_ln_average_degree  -.11742261   .08802784  -1.3339259
    L3.h_ln_partintact   .00400848   .00331382   1.2096245
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                              b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign    .0161594   .03235035   .49951244
 L.h_ln_average_degree    1.072169   1.8847542    .5688641
     L.h_ln_partintact   .90154184    .0746243   12.081076
      L2.h_ln_new_sign  -.01546173   .03488164  -.44326277
L2.h_ln_average_degree  -.78225732   2.6081124  -.29993237
    L2.h_ln_partintact   .16444656   .09475499   1.7354924
      L3.h_ln_new_sign  -.01057639   .03185088  -.33205969
L3.h_ln_average_degree  -.35815986   1.2806538  -.27966955
    L3.h_ln_partintact  -.10338159   .06902887  -1.4976572
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                        ln_new_sign  ln_average_degree      ln_partintact
      ln_new_sign          .14411904
ln_average_degree         -.00098593           .00005528
    ln_partintact          .00486873             .000208          .02433266

Residuals correlation matrix

             |       u1       u2       u3
-------------+----------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.3494   1.0000
             |   0.0000
             |
          u3 |   0.0823   0.1794   1.0000
             |   0.2409   0.0101
             |

GMM finished : 10:54:03

Starting Monte-Carlo loop : 10:54:04 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 10:54:12
```



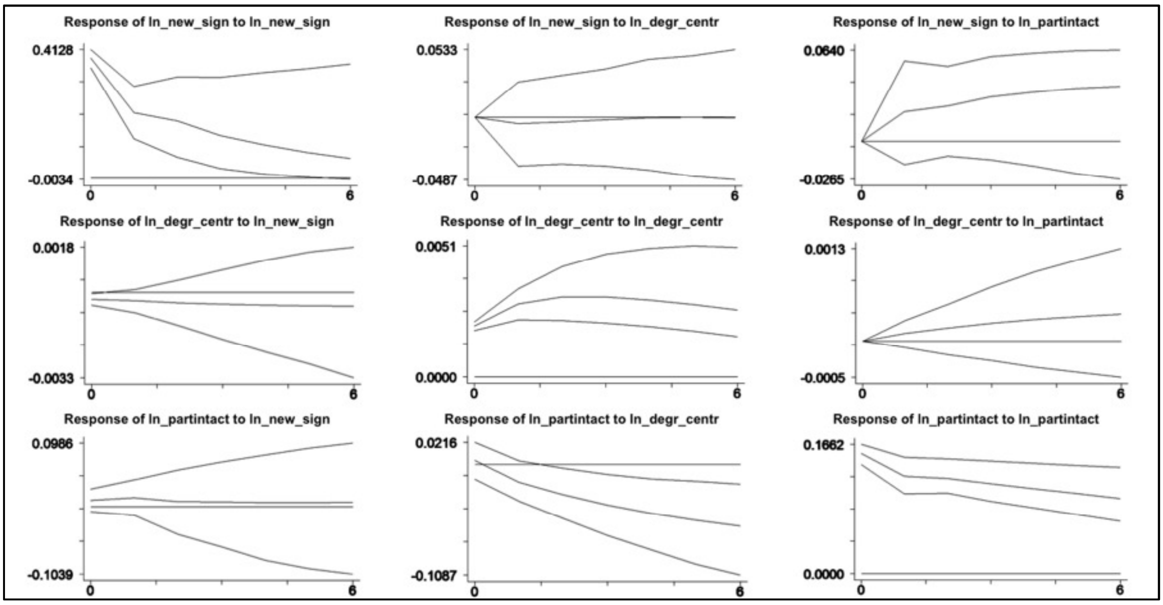
```
. pvar ln_new_sign ln_average_degree ln_partintact, lag(4) gmm monte 1000
GMM started : 10:58:21
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 200
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                              b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign    .44774125   .10844662   4.1286788
 L.h_ln_average_degree   -.47712675   4.0397176  -.11810894
     L.h_ln_partintact    .16743709    .1539525   1.0875893
      L2.h_ln_new_sign    .05974681   .10901954   .54803762
L2.h_ln_average_degree   -.11045675   6.1796907  -.01787415
    L2.h_ln_partintact    .14720929   .19452849   .75674926
      L3.h_ln_new_sign    .11345365   .09236824   1.2282755
L3.h_ln_average_degree   -1.7780137   6.4904048  -.27394497
    L3.h_ln_partintact   -.17721727   .18739313   -.9456978
      L4.h_ln_new_sign    .03005306   .07282431     .412679
L4.h_ln_average_degree     2.452516     3.60375   .68054554
    L4.h_ln_partintact    .00094731   .16748775   .00565597
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                              b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign    .00513424   .00189769   2.7055222
 L.h_ln_average_degree    1.6777267   .12776415   13.131436
     L.h_ln_partintact    .00482288   .00343944   1.4022284
      L2.h_ln_new_sign    .00193717   .00151752   1.2765382
L2.h_ln_average_degree   -.78456776   .19735871   -3.975339
    L2.h_ln_partintact   -.00843173   .00370794  -2.2739659
      L3.h_ln_new_sign    .00009776   .00146239   .06685066
L3.h_ln_average_degree    .22926642   .14531237   1.5777488
    L3.h_ln_partintact    .00919346   .00399342   2.3021523
      L4.h_ln_new_sign    .00014869   .00116591    .1275305
L4.h_ln_average_degree   -.15636277   .06468972  -2.4171194
    L4.h_ln_partintact   -.00477305   .00359913  -1.3261695
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                              b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign    .00824668   .03108382   .26530462
 L.h_ln_average_degree    .62387118   1.9796529    .3151417
     L.h_ln_partintact    .90031741   .07641388   11.782119
      L2.h_ln_new_sign    .00010294   .03319023   .00310164
L2.h_ln_average_degree     1.752813   2.8858501   .60738186
    L2.h_ln_partintact    .16120515   .09571931   1.6841444
      L3.h_ln_new_sign   -.03754376   .03288844  -1.1415485
L3.h_ln_average_degree   -5.2426635   2.4301157   -2.157372
    L3.h_ln_partintact    .02369587   .09332026   .25391994
      L4.h_ln_new_sign    .01434914   .02807556   .51109013
L4.h_ln_average_degree    2.7768431   1.2500076   2.2214609
    L4.h_ln_partintact   -.10925439   .06689845  -1.6331378
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                         ln_new_sign  ln_average_degree      ln_partintact
      ln_new_sign          .14549395
ln_average_degree         -.00095757          .00005236
    ln_partintact          .00496369          .00018902           .0239501

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.3471   1.0000
             |   0.0000
             |
          u3 |   0.0841   0.1688   1.0000
             |   0.2362   0.0169
             |

GMM finished : 10:58:23

Starting Monte-Carlo loop : 10:58:25 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 10:58:35
```



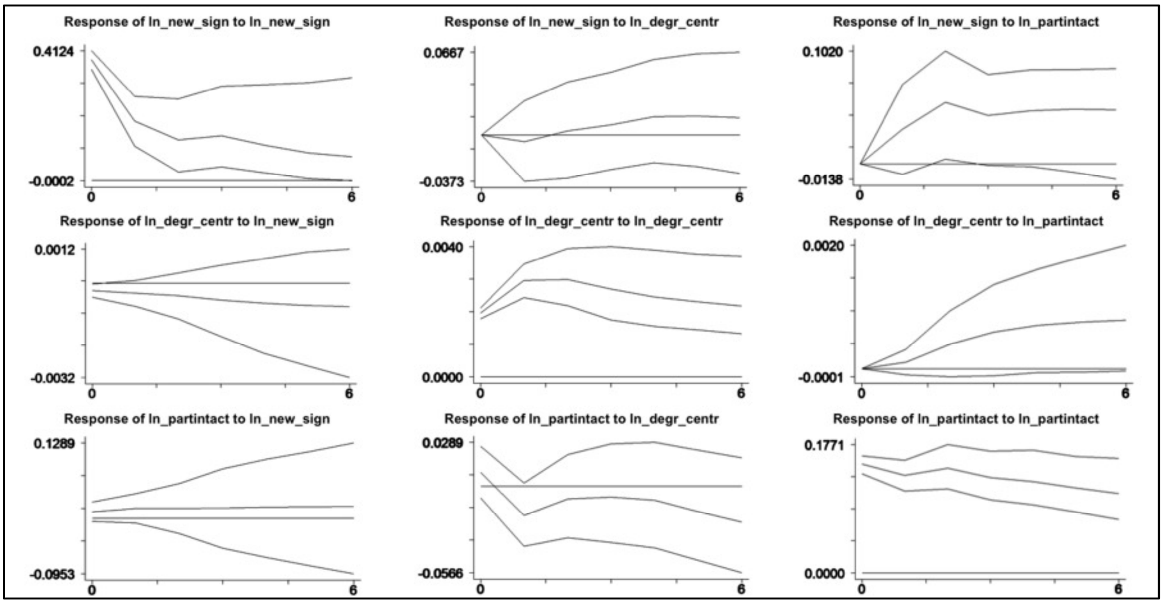
Appendix 17 Estimation Results PVAR(1)-(4) ln_new_signups ln_degree_centralization ln_partintact; Established Regions

```
. pvar ln_new_sign ln_degr_centr ln_partintact, lag(1) gmm monte 1000
GMM started : 11:16:30
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 215
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                       b_GMM     se_GMM      t_GMM
  L.h_ln_new_sign  .73036366  .16363933  4.4632527
L.h_ln_degr_centr  2.0313015  3.4661111  .58604628
L.h_ln_partintact  .11207585   .0792549   1.414119
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                        b_GMM      se_GMM       t_GMM
  L.h_ln_new_sign  -.00136771   .00073931  -1.8499811
L.h_ln_degr_centr   .97613453   .02773845   35.190671
L.h_ln_partintact    .0012065   .00055771   2.1633058
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                        b_GMM      se_GMM       t_GMM
  L.h_ln_new_sign  -.00591999   .05648251  -.10481097
L.h_ln_degr_centr  -2.4862234   1.3567131  -1.8325344
L.h_ln_partintact   .94605913   .03205853   29.510375
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                ln_new_sign  ln_degr_centr  ln_partintact
  ln_new_sign      .15685537
ln_degr_centr     -.00016184      5.441e-06
ln_partintact      .00272562      7.392e-06      .02551423

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1748   1.0000
             |   0.0102
             |
          u3 |   0.0431   0.0199   1.0000
             |   0.5300   0.7721
             |

GMM finished : 11:16:32

Starting Monte-Carlo loop : 11:16:33 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 11:16:40
```

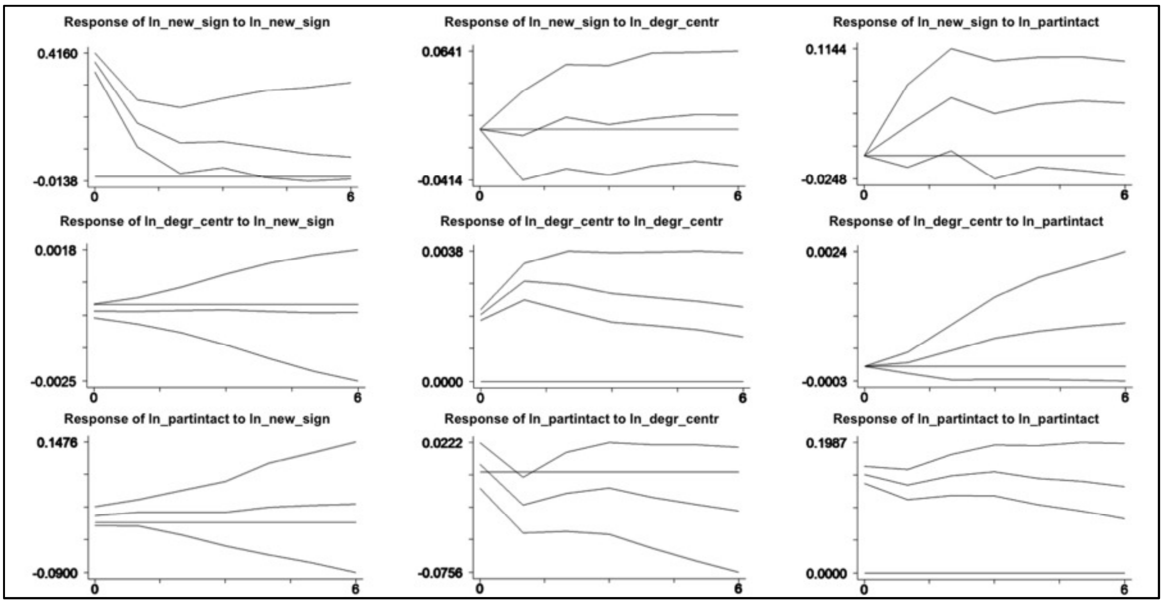
```
. pvar ln_new_sign ln_degr_centr ln_partintact, lag(2) gmm monte 1000
GMM started : 11:31:20
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 210
----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .53833094   .12918449   4.1671485
 L.h_ln_degr_centr  -2.7815932   9.6951234  -.28690642
 L.h_ln_partintact   .13365359   .14474458   .92337546
  L2.h_ln_new_sign   .17983601   .10663892   1.6864013
L2.h_ln_degr_centr   4.6826934   10.247846   .45694415
L2.h_ln_partintact  -.01842562   .11259648  -.16364297
----------------------------------------------------------------------------
----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .00013784   .00051491    .2676932
 L.h_ln_degr_centr   1.4296156   .16222637   8.8124733
 L.h_ln_partintact   .00071229   .00075806   .93961777
  L2.h_ln_new_sign  -.00027451   .00039943  -.68725339
L2.h_ln_degr_centr  -.46553524   .16666271  -2.7932778
L2.h_ln_partintact  -.00039434   .00051306  -.76861447
----------------------------------------------------------------------------
----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .00871076   .03831158   .22736624
 L.h_ln_degr_centr  -10.321609   4.0359676  -2.5574063
 L.h_ln_partintact    .8109671   .08187251   9.9052435
  L2.h_ln_new_sign   -.0211907   .03590157  -.59024437
L2.h_ln_degr_centr    6.605757    3.747483   1.7627183
L2.h_ln_partintact   .13997041   .06958732   2.0114356
----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                ln_new_sign  ln_degr_centr  ln_partintact
  ln_new_sign      .14843101
ln_degr_centr     -.00010198       4.038e-06
ln_partintact      .00388517       4.805e-06       .02402281

Residuals correlation matrix

             |       u1        u2        u3
-------------+------------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1317   1.0000
             |   0.0566
             |
          u3 |   0.0650   0.0154   1.0000
             |   0.3488   0.8241
             |

GMM finished : 11:31:23

Starting Monte-Carlo loop : 11:31:24 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 11:31:31
```



```
. pvar ln_new_sign ln_degr_centr ln_partintact, lag(3) gmm monte 1000
GMM started : 11:43:45
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
________ Results of the Estimation by system GMM__________
number of observations used : 205
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                        b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .48463825   .12557158    3.859458
 L.h_ln_degr_centr  -3.7050538   10.279135  -.36044411
 L.h_ln_partintact   .20774388   .16352964   1.2703745
  L2.h_ln_new_sign   .09068443   .10897166   .83218362
L2.h_ln_degr_centr   10.180928   16.555737   .61494864
L2.h_ln_partintact   .08609364   .17581139   .48969319
  L3.h_ln_new_sign   .15895764   .08746288   1.8174297
L3.h_ln_degr_centr    -3.50507   10.262395  -.34154502
L3.h_ln_partintact  -.18143179   .14399928  -1.2599493
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                        b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .00007788   .00045873   .16978005
 L.h_ln_degr_centr   1.5020596   .15270566   9.8363058
 L.h_ln_partintact   .00069967   .00083573   .83719682
  L2.h_ln_new_sign  -.00034121   .00033114  -1.0304001
L2.h_ln_degr_centr  -.73402965   .22611327  -3.2462917
L2.h_ln_partintact   .00090055   .00117772     .764656
  L3.h_ln_new_sign  -.00025914   .00032288  -.80258106
L3.h_ln_degr_centr   .20183253    .1100937   1.8332796
L3.h_ln_partintact  -.00089762   .00123722  -.72551554
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                        b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .00952877   .03336439   .28559686
 L.h_ln_degr_centr  -13.962315    4.444771  -3.1412901
 L.h_ln_partintact   .89630999   .07703289   11.635419
  L2.h_ln_new_sign  -.00025297   .03077639  -.00821952
L2.h_ln_degr_centr   24.868476   9.0558256   2.7461302
L2.h_ln_partintact   .16614185   .08731738   1.9027351
  L3.h_ln_new_sign  -.00390849   .03606646  -.10836906
L3.h_ln_degr_centr  -13.762737   6.5779045  -2.0922677
L3.h_ln_partintact  -.11983458   .06855635  -1.7479721
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                 ln_new_sign  ln_degr_centr  ln_partintact
  ln_new_sign      .14687575
ln_degr_centr     -.00009773      3.880e-06
ln_partintact      .00403337      .00001488       .0228133

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1294   1.0000
             |   0.0643
             |
          u3 |   0.0696   0.0500   1.0000
             |   0.3215   0.4762
             |

GMM finished : 11:43:48

Starting Monte-Carlo loop : 11:43:49 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 11:43:57
```



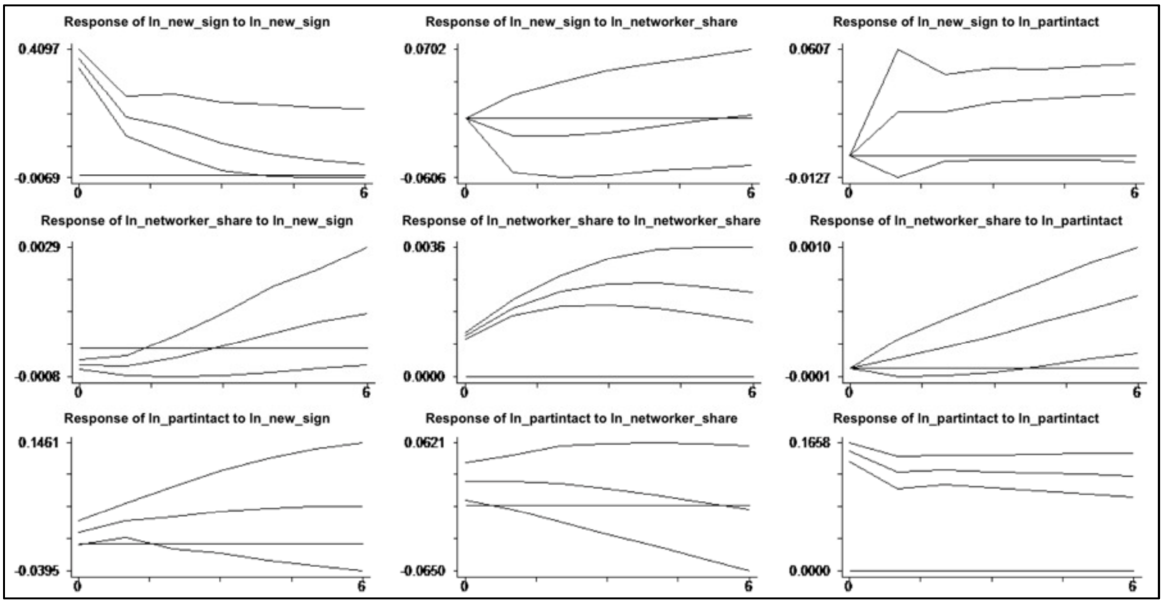
```
. pvar ln_new_sign ln_degr_centr ln_partintact, lag(4) gmm monte 1000
GMM started : 11:54:00
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 200
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .45828901   .12542365   3.6539282
 L.h_ln_degr_centr  -3.2799211   10.874252  -.30162268
 L.h_ln_partintact   .21230043   .18118148   1.1717557
  L2.h_ln_new_sign   .07161186   .11060583   .64745109
L2.h_ln_degr_centr   13.542578   19.363598   .69938335
L2.h_ln_partintact   .12740969   .20025747   .63622939
  L3.h_ln_new_sign   .12925188   .08988584   1.4379559
L3.h_ln_degr_centr  -11.564633   20.991389  -.55092271
L3.h_ln_partintact  -.22926356   .18345506  -1.2496988
  L4.h_ln_new_sign    .0284887   .07785363   .36592645
L4.h_ln_degr_centr   5.0536696   12.968415   .38969063
L4.h_ln_partintact   .02152732   .14715147   .14629361
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign    .0002617   .00048464   .53998261
 L.h_ln_degr_centr   1.5000827   .14802157   10.134217
 L.h_ln_partintact    .0005033   .00089922   .55970434
  L2.h_ln_new_sign  -.00026757   .00031317  -.85439328
L2.h_ln_degr_centr   -.8020208   .22865265  -3.5075946
L2.h_ln_partintact   .00091302   .00128152   .71244681
  L3.h_ln_new_sign   .00003235   .00034719   .09316373
L3.h_ln_degr_centr   .36567747   .16110474    2.269812
L3.h_ln_partintact  -.00033761   .00146862  -.22988126
  L4.h_ln_new_sign  -.00019914   .00026384   -.7547485
L4.h_ln_degr_centr  -.10290545   .08493527   -1.211575
L4.h_ln_partintact  -.00052145    .0008602  -.60620125
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .01020627   .03205269    .3184215
 L.h_ln_degr_centr  -15.652091   4.4751275  -3.4975744
 L.h_ln_partintact   .89337085   .08139493   10.975756
  L2.h_ln_new_sign  -.00010014   .02995436  -.00334303
L2.h_ln_degr_centr    26.19214   10.086378   2.5967835
L2.h_ln_partintact   .19310976   .09702962   1.9902147
  L3.h_ln_new_sign  -.00662555   .03327307  -.19912648
L3.h_ln_degr_centr  -13.013522   10.694368  -1.2168575
L3.h_ln_partintact  -.00718059   .08744564  -.08211491
  L4.h_ln_new_sign   .02246522   .02964653   .75776879
L4.h_ln_degr_centr  -.24273715   4.8908078   -.0496313
L4.h_ln_partintact  -.13535208   .06059067  -2.2338766
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                 ln_new_sign  ln_degr_centr  ln_partintact
  ln_new_sign      .14885962
ln_degr_centr     -.00008829      3.773e-06
ln_partintact      .00482942      8.172e-06      .02263719

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1178   1.0000
             |   0.0966
             |
          u3 |   0.0831   0.0279   1.0000
             |   0.2418   0.6944
             |

GMM finished : 11:54:02

Starting Monte-Carlo loop : 11:54:03 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 11:54:12
```



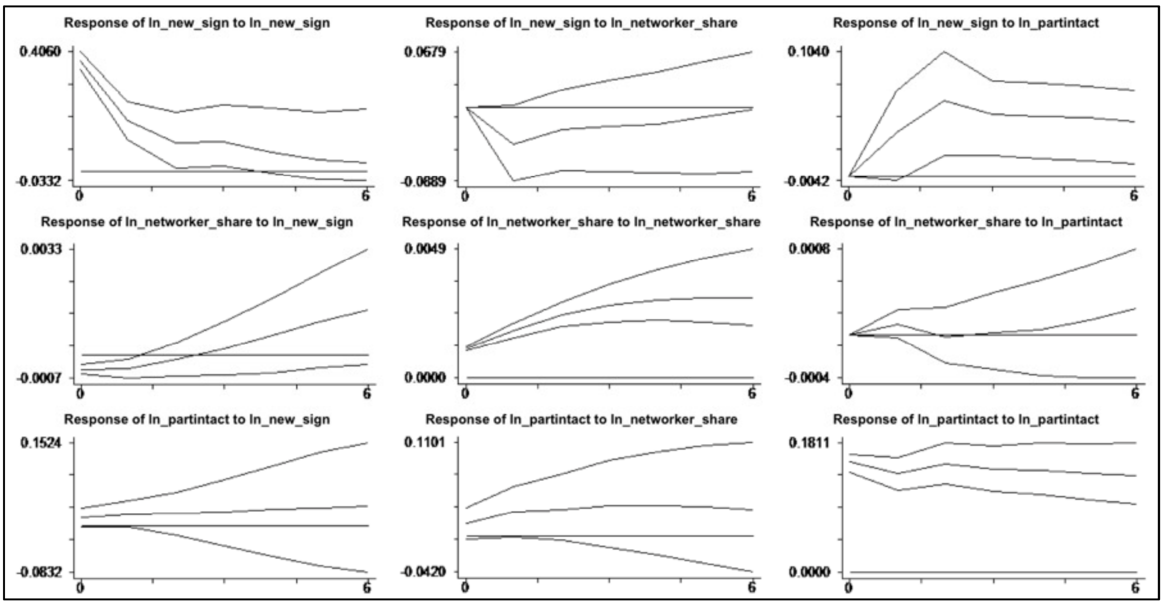
Appendix 18 Estimation Results PVAR(1)-(4) ln_new_signups ln_networker_share ln_partintact; Established Regions

```
. pvar ln_new_sign ln_networker_share ln_partintact, lag(1) gmm monte 1000
GMM started : 12:03:33
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 215
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                           b_GMM      se_GMM      t_GMM
       L.h_ln_new_sign  .67157945  .12777507  5.2559505
L.h_ln_networker_share  2.8558779  4.0746751  .70088482
     L.h_ln_partintact  .09356022  .05193164  1.8016034
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.00092621   .00066041  -1.4024731
L.h_ln_networker_share   .92259342   .01370049   67.340167
     L.h_ln_partintact   .00129672   .00023069   5.6210345
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00461621     .046493   .09928824
L.h_ln_networker_share  -1.8848722   1.3332706  -1.4137206
     L.h_ln_partintact   .98005617   .02299856     42.6138
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                        ln_new_sign  ln_networker_share       ln_partintact
       ln_new_sign          .1527831
ln_networker_share         -.00027488           3.548e-06
     ln_partintact          .00363747           .00003917           .02603235

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.3745   1.0000
             |   0.0000
             |
          u3 |   0.0577   0.1290   1.0000
             |   0.3995   0.0589
             |

GMM finished : 12:03:35

Starting Monte-Carlo loop : 12:03:36 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 12:03:42
```

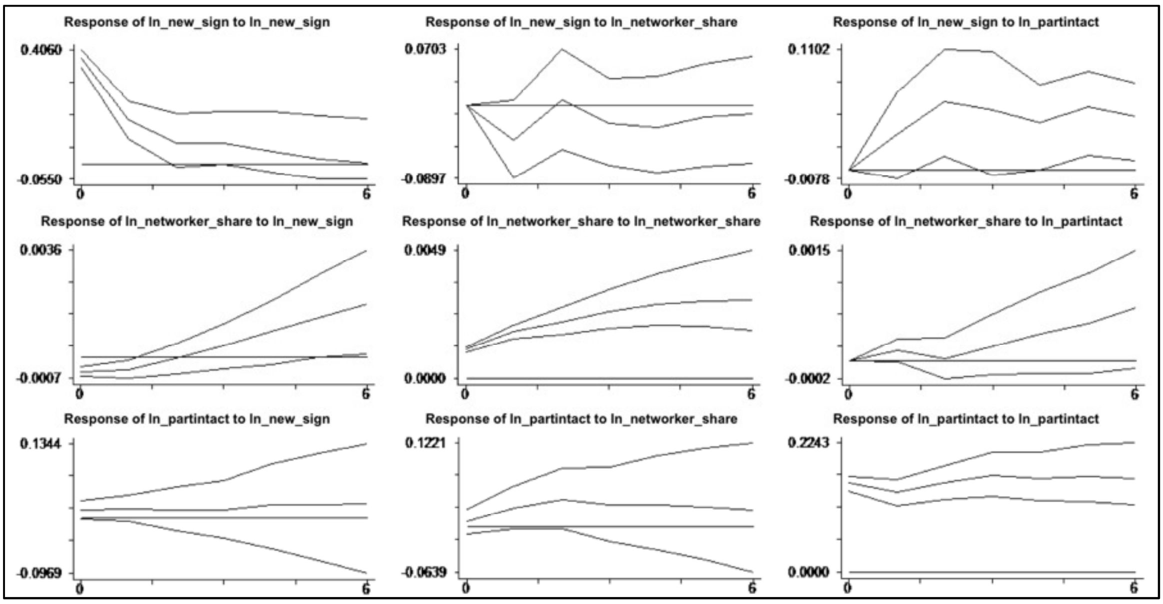
```
. pvar ln_new_sign ln_networker_share ln_partintact, lag(2) gmm monte 1000
GMM started : 12:11:56
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 210
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .47460908   .12095238   3.9239334
 L.h_ln_networker_share  -18.691456    21.57335  -.86641417
      L.h_ln_partintact   .16393483   .14192983   1.1550414
       L2.h_ln_new_sign   .15828979    .0959257   1.6501291
L2.h_ln_networker_share   20.113372   20.219269    .99476258
     L2.h_ln_partintact  -.04053881   .12579268  -.32226688
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .00070858   .00035642   1.9880479
 L.h_ln_networker_share   1.6548363   .09224259   17.940045
      L.h_ln_partintact   .00057807   .00061519    .9396614
       L2.h_ln_new_sign   .00023977   .00025337   .94633343
L2.h_ln_networker_share  -.69411901   .08489801  -8.1759164
     L2.h_ln_partintact  -.00041011   .00062642  -.65468949
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .05555767    .0429498    1.293549
 L.h_ln_networker_share   3.2318348   11.925659   .27099843
      L.h_ln_partintact   .82532195   .07577244   10.892113
       L2.h_ln_new_sign  -.00664514   .03229661  -.20575344
L2.h_ln_networker_share  -6.1002774   10.977573  -.55570367
     L2.h_ln_partintact   .14973152   .07587966   1.9732761
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                         ln_new_sign  ln_networker_share       ln_partintact
       ln_new_sign         .14438922
ln_networker_share        -.00018169           1.548e-06
     ln_partintact         .00594275           .00002011           .02466182

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.3847   1.0000
             |   0.0000
             |
          u3 |   0.0996   0.1029   1.0000
             |   0.1505   0.1374
             |

GMM finished : 12:11:58

Starting Monte-Carlo loop : 12:11:59 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 12:12:06
```



```
. pvar ln_new_sign ln_networker_share ln_partintact, lag(3) gmm monte 1000
GMM started : 12:13:53
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 205
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .39018917   .11516313   3.3881432
 L.h_ln_networker_share  -42.169132   25.100089  -1.6800391
      L.h_ln_partintact   .23904594   .15044828   1.5888912
       L2.h_ln_new_sign    .0785309   .11779101   .66669685
L2.h_ln_networker_share   51.421182   32.985365    1.558909
     L2.h_ln_partintact   .12675137   .16592553   .76390513
       L3.h_ln_new_sign   .15369073   .07895994   1.9464392
L3.h_ln_networker_share  -7.9217671   18.930986  -.41845508
     L3.h_ln_partintact  -.23070497   .14761258  -1.5629086
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .00072387   .00030513   2.3723097
 L.h_ln_networker_share   1.5868745   .11907353   13.326845
      L.h_ln_partintact   .00064984    .0005667   1.1467098
       L2.h_ln_new_sign   .00070697   .00032293   2.1892547
L2.h_ln_networker_share  -.38871963   .17693543  -2.1969576
     L2.h_ln_partintact  -.00190875   .00074562  -2.5599321
       L3.h_ln_new_sign  -.00006048   .00023222  -.26043523
L3.h_ln_networker_share  -.23424107   .08588298  -2.7274447
     L3.h_ln_partintact   .00115215   .00058225   1.9788042
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .03766483   .03602005    1.045663
 L.h_ln_networker_share    13.81114   14.545991   .94948087
      L.h_ln_partintact   .89539043   .07508343   11.925273
       L2.h_ln_new_sign  -.01674882   .03746847  -.44701113
L2.h_ln_networker_share  -17.367817   20.644715  -.84127182
     L2.h_ln_partintact   .16396768   .09741572   1.6831749
       L3.h_ln_new_sign  -.00774161   .03147561  -.24595581
L3.h_ln_networker_share   2.5961758   10.384902   .24999521
     L3.h_ln_partintact  -.09329226   .06962424  -1.3399393
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                      ln_new_sign  ln_networker_share       ln_partintact
       ln_new_sign          .14083432
ln_networker_share         -.00017094           1.469e-06
     ln_partintact           .0060007           8.355e-06           .02409966

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.3759   1.0000
             |   0.0000
             |
          u3 |   0.1031   0.0444   1.0000
             |   0.1414   0.5271
             |

GMM finished : 12:13:55

Starting Monte-Carlo loop : 12:13:56 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 12:14:04
```



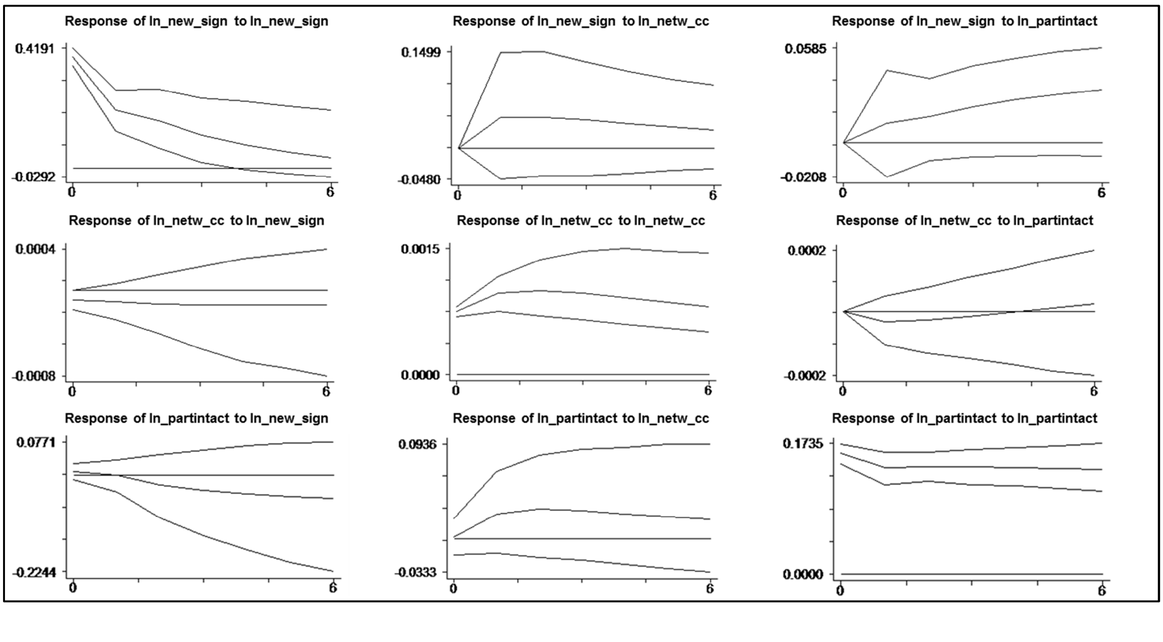
```
. pvar ln_new_sign ln_networker_share ln_partintact, lag(4) gmm monte 1000
GMM started : 12:15:42
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 200
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                            b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .36008795   .11708354   3.0754789
 L.h_ln_networker_share  -39.683266   25.722677  -1.5427347
      L.h_ln_partintact   .21465528   .15459665   1.3884859
       L2.h_ln_new_sign   .07997168   .11770454   .67942733
L2.h_ln_networker_share    76.46587   33.977569   2.2504809
     L2.h_ln_partintact   .17014766   .17556008   .96917056
       L3.h_ln_new_sign   .07072944   .09463576   .74738596
L3.h_ln_networker_share  -73.199925   34.814567   -2.102566
     L3.h_ln_partintact  -.23372965   .18408665  -1.2696719
       L4.h_ln_new_sign   .01150346   .06861269   .16765795
L4.h_ln_networker_share   38.194777    24.22911   1.5764003
     L4.h_ln_partintact   .01383499   .18587286   .07443253
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                            b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign    .0008345   .00031092    2.683998
 L.h_ln_networker_share   1.5798723   .12038784   13.123189
      L.h_ln_partintact   .00087403   .00059113   1.4785688
       L2.h_ln_new_sign   .00061106   .00032405   1.8857252
L2.h_ln_networker_share  -.55676663   .16989854  -3.2770537
     L2.h_ln_partintact  -.00213315   .00076008  -2.8064932
       L3.h_ln_new_sign   .00036359   .00026425   1.3759282
L3.h_ln_networker_share   .14073916   .17651783   .79730848
     L3.h_ln_partintact   .00203065   .00073767   2.7528007
       L4.h_ln_new_sign   .00004783   .00021778   .21963874
L4.h_ln_networker_share  -.20115275   .09244327  -2.1759588
     L4.h_ln_partintact  -.00095636   .00065828  -1.4528027
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                            b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .03141583    .0345969   .90805324
 L.h_ln_networker_share   17.887057   14.102003   1.2684054
      L.h_ln_partintact   .89499942   .07663408   11.678869
       L2.h_ln_new_sign  -.01779892   .03618552  -.49187975
L2.h_ln_networker_share  -14.621861   21.391051   -.6835504
     L2.h_ln_partintact   .17755003    .0995456   1.7836049
       L3.h_ln_new_sign  -.04136899   .03368937  -1.2279538
L3.h_ln_networker_share  -20.461975   18.540843  -1.1036163
     L3.h_ln_partintact   .03015309   .09451898   .31901628
       L4.h_ln_new_sign     .013968   .02644195   .52825168
L4.h_ln_networker_share   16.692871   8.6422155   1.9315499
     L4.h_ln_partintact  -.12463987   .07088314  -1.7583854
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                           ln_new_sign  ln_networker_share       ln_partintact
       ln_new_sign           .14070212
ln_networker_share          -.00017199           1.481e-06
     ln_partintact           .00565887           2.403e-06           .02401312

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.3770   1.0000
             |   0.0000
             |
          u3 |   0.0974   0.0128   1.0000
             |   0.1699   0.8575
             |

GMM finished : 12:15:44

Starting Monte-Carlo loop : 12:15:46 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 12:15:55
```



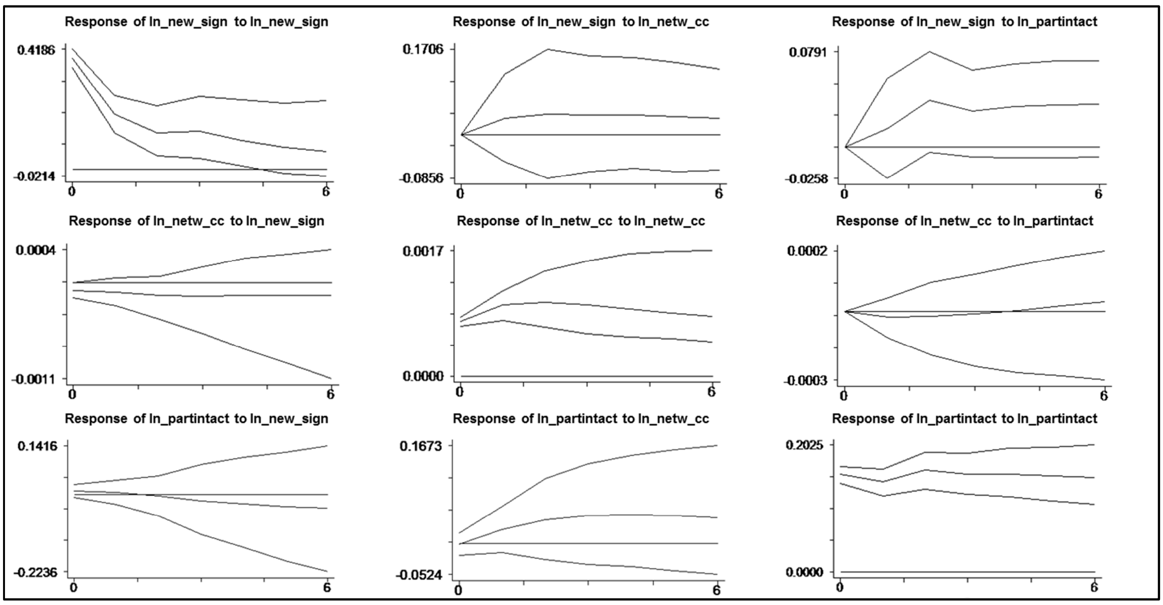
Appendix 19 Estimation Results PVAR(1)-(4) ln_new_signups ln_network_cc ln_partintact; Established Regions

```
. pvar ln_new_sign ln_netw_cc ln_partintact, lag(1) gmm monte 1000
GMM started : 12:18:04
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 215
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                      b_GMM     se_GMM      t_GMM
  L.h_ln_new_sign  .70881398    .124659  5.6860233
   L.h_ln_netw_cc  2.7565424  4.6073055  .59829815
L.h_ln_partintact  .08765385  .05525453  1.5863649
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                       b_GMM      se_GMM       t_GMM
  L.h_ln_new_sign   .01004064   .00562942   1.7835998
   L.h_ln_netw_cc   .57118527   .29676842   1.9246834
L.h_ln_partintact  -.00204796   .00189703  -1.0795604
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                       b_GMM      se_GMM       t_GMM
  L.h_ln_new_sign  -.04019023   .06158115  -.65263847
   L.h_ln_netw_cc  -1.0410785   1.5363888  -.67761397
L.h_ln_partintact   .98796112   .02673325   36.956266
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                 ln_new_sign     ln_netw_cc  ln_partintact
  ln_new_sign      .15940691
   ln_netw_cc      .00063287      .00024702
ln_partintact       .0006692     -.00003648      .02744953

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |  1.0000
             |
             |
          u2 |  0.1002   1.0000
             |  0.1429
             |
          u3 |  0.0104  -0.0137   1.0000
             |  0.8797   0.8412
             |

GMM finished : 12:18:06

Starting Monte-Carlo loop : 12:18:07 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 12:18:14
```

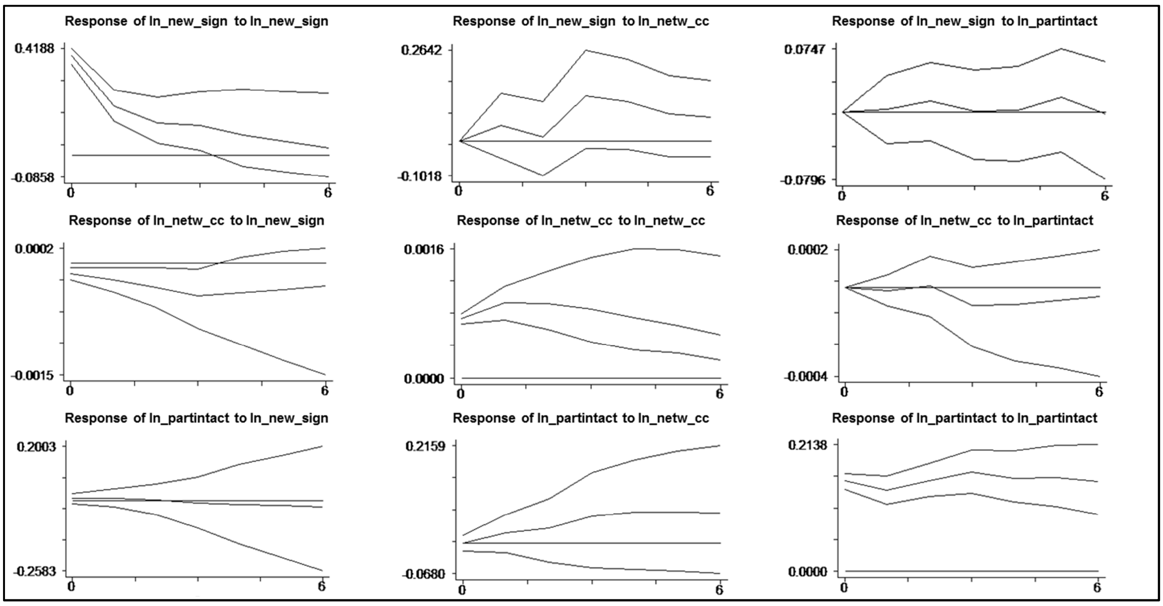
```
. pvar ln_new_sign ln_netw_cc ln_partintact, lag(2) gmm monte 1000
GMM started : 12:35:17
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 210
---------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .55551191   .10319209   5.3832798
    L.h_ln_netw_cc   .33179068   3.3615618   .09870135
 L.h_ln_partintact   .09001363    .1148893   .78348136
  L2.h_ln_new_sign   .18594009   .08642019   2.1515815
   L2.h_ln_netw_cc   .83462478   3.0802741   .27095795
L2.h_ln_partintact  -.01117343   .10927483  -.10225071
---------------------------------------------------------------------------------
---------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .00474944   .00263349   1.8034802
    L.h_ln_netw_cc    .3291407   .25110156   1.3107872
 L.h_ln_partintact   .00006854    .0018711   .03662964
  L2.h_ln_new_sign   .00316569   .00208623    1.517425
   L2.h_ln_netw_cc   .33466439   .23979361   1.3956352
L2.h_ln_partintact  -.00182449   .00216206  -.84386728
---------------------------------------------------------------------------------
---------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign  -.02001334   .04821089  -.41512063
    L.h_ln_netw_cc  -.53928741   1.0474646  -.51485025
 L.h_ln_partintact   .89151541   .07253103   12.291504
  L2.h_ln_new_sign  -.04883964   .04222741  -1.1565861
   L2.h_ln_netw_cc  -.13889739   .90965242  -.15269282
L2.h_ln_partintact   .11259061   .07246584    1.553706
---------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                 ln_new_sign     ln_netw_cc  ln_partintact
  ln_new_sign      .15021821
   ln_netw_cc      .00034677      .00021608
ln_partintact      .00255612      .00001622      .02686384

Residuals correlation matrix

                 |      u1       u2       u3
-----------------+---------------------------
              u1 |  1.0000
                 |
                 |
              u2 |  0.0606   1.0000
                 |  0.3825
                 |
              u3 |  0.0405   0.0069   1.0000
                 |  0.5596   0.9207
                 |

GMM finished : 12:35:20

Starting Monte-Carlo loop : 12:35:20 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 12:35:28
```



```
. pvar ln_new_sign ln_netw_cc ln_partintact, lag(3) gmm monte 1000
GMM started : 12:45:43
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 205
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .50049373   .09499592   5.2685813
    L.h_ln_netw_cc  -2.0235746   2.0666348  -.97916414
 L.h_ln_partintact   .13261133   .12953248   1.0237689
  L2.h_ln_new_sign   .09829227    .0927964    1.059225
   L2.h_ln_netw_cc  -1.5808631   1.7814225  -.88741618
L2.h_ln_partintact   .10799573   .17631949   .61250025
  L3.h_ln_new_sign    .1527323   .08535521    1.789373
   L3.h_ln_netw_cc   5.2381455   1.6067157   3.2601571
L3.h_ln_partintact  -.17306772   .13914353  -1.2438072
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .00306703   .00174125   1.7613993
    L.h_ln_netw_cc   .22420675   .18260036   1.2278549
 L.h_ln_partintact   .00030444   .00200113   .15213595
  L2.h_ln_new_sign   .00138341   .00100091   1.3821509
   L2.h_ln_netw_cc   .22706038   .17685239   1.2838977
L2.h_ln_partintact  -.00426223   .00382784  -1.1134821
  L3.h_ln_new_sign   .00206713   .00171541    1.205036
   L3.h_ln_netw_cc   .23140166   .17770332   1.3021797
L3.h_ln_partintact   .00253579   .00315453    .8038588
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign  -.01046244   .04313724  -.24253841
    L.h_ln_netw_cc  -.51995004   .93233688  -.55768473
 L.h_ln_partintact   .94594464    .0699557   13.522052
  L2.h_ln_new_sign  -.02572202   .03090313  -.83234339
   L2.h_ln_netw_cc  -.09365841   .75022614  -.12484024
L2.h_ln_partintact   .17538406   .09467984   1.8523908
  L3.h_ln_new_sign  -.01585453   .04663657  -.33995909
   L3.h_ln_netw_cc   .02757773   .63301293   .04356583
L3.h_ln_partintact  -.12826179   .07000848  -1.8320893
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                ln_new_sign     ln_netw_cc  ln_partintact
  ln_new_sign      .14169898
   ln_netw_cc      .00001253      .00020283
ln_partintact      .00287005      .00007299      .02547241

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0022   1.0000
             |   0.9746
             |
          u3 |   0.0478   0.0321   1.0000
             |   0.4960   0.6474
             |

GMM finished : 12:45:45

Starting Monte-Carlo loop : 12:45:45 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 12:45:54
```



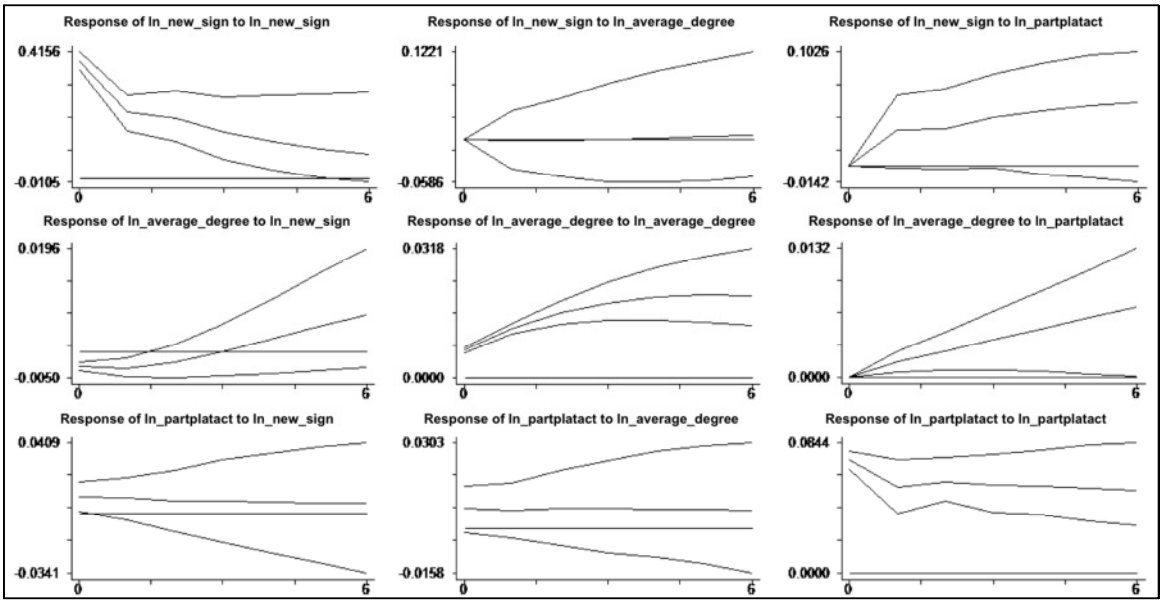
```
. pvar ln_new_sign ln_netw_cc ln_partintact, lag(4) gmm monte 1000
GMM started : 12:55:34
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 200
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .49504277   .09657395   5.1260488
    L.h_ln_netw_cc  -1.9542464   1.9382864  -1.0082341
 L.h_ln_partintact   .11860296   .13232349   .89631074
  L2.h_ln_new_sign   .08066384   .09574417   .84249348
   L2.h_ln_netw_cc  -1.4910345   1.6461685  -.90576058
L2.h_ln_partintact   .14492815   .19712131   .73522312
  L3.h_ln_new_sign   .13171559   .08864184   1.4859302
   L3.h_ln_netw_cc   5.3632285   1.4436853   3.7149568
L3.h_ln_partintact  -.26551138   .17926139  -1.4811409
  L4.h_ln_new_sign   .03298047   .07278194    .4531408
   L4.h_ln_netw_cc  -.98499905   1.2119053    -.812769
L4.h_ln_partintact   .07200806   .14099893   .51069935
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .00180129    .0016366   1.1006315
    L.h_ln_netw_cc   .18293725   .15073874   1.2136048
 L.h_ln_partintact   .00086407   .00150746   .57319551
  L2.h_ln_new_sign   .00220224   .00153334   1.4362443
   L2.h_ln_netw_cc   .18284775   .14389334   1.2707173
L2.h_ln_partintact  -.00534568   .00575152  -.92943708
  L3.h_ln_new_sign   .00391536   .00350263   1.1178337
   L3.h_ln_netw_cc   .18396748   .14536591   1.2655476
L3.h_ln_partintact   .00035182   .00251924   .13965353
  L4.h_ln_new_sign  -.00430966   .00457485  -.94203156
   L4.h_ln_netw_cc   .18493936   .15016968    1.231536
L4.h_ln_partintact   .00359812   .00321903   1.1177638
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .00116943   .04488806   .02605207
    L.h_ln_netw_cc  -.55651431   .89326652  -.62301038
 L.h_ln_partintact   .93292112   .07194806   12.966591
  L2.h_ln_new_sign  -.02113264   .02932268  -.72069271
   L2.h_ln_netw_cc  -.17030991   .66476655  -.25619506
L2.h_ln_partintact   .20145186   .10219957   1.9711616
  L3.h_ln_new_sign  -.01144476   .03803543  -.30089725
   L3.h_ln_netw_cc  -.02798303   .52912094  -.05288589
L3.h_ln_partintact  -.01799205   .09046451  -.19888515
  L4.h_ln_new_sign    .0196683   .03779109   .52044798
   L4.h_ln_netw_cc  -.13551501   .61004633  -.22213888
L4.h_ln_partintact  -.13321806   .06650464  -2.0031395
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
               ln_new_sign     ln_netw_cc  ln_partintact
  ln_new_sign      .14304154
   ln_netw_cc      .00003044      .00019538
ln_partintact      .00374614      .00012708       .0251009

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0056   1.0000
             |   0.9368
             |
          u3 |   0.0626   0.0574   1.0000
             |   0.3789   0.4194
             |

GMM finished : 12:55:36

Starting Monte-Carlo loop : 12:55:38 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 12:55:48
```



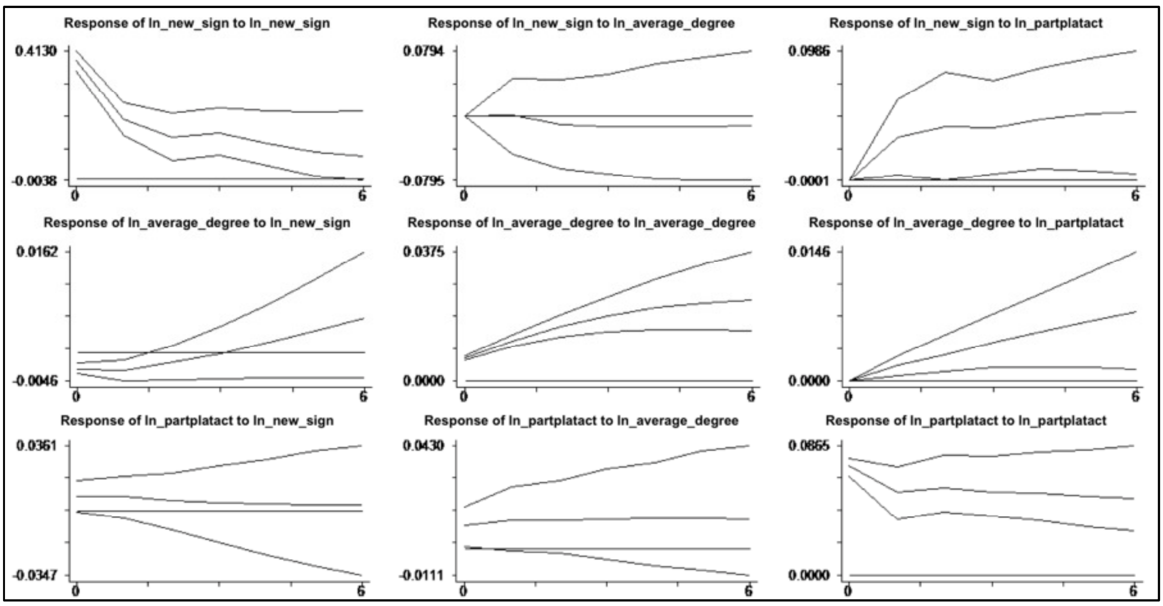
Appendix 20 Estimation Results PVAR(1)-(4) ln_new_signups ln_average_degree ln_partplatact; Established Regions

```
. pvar ln_new_sign ln_average_degree ln_partplatact, lag(1) gmm monte 1000
GMM started : 13:06:21
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 215
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                          b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign  .76030778  .12537842   6.064104
L.h_ln_average_degree  .14084742  .39308473  .35831312
   L.h_ln_partplatact  .31123956  .20254815  1.5366201
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                           b_GMM       se_GMM        t_GMM
      L.h_ln_new_sign  -.00045859   .00395616  -.11591691
L.h_ln_average_degree   .90684029   .01024673   88.500459
   L.h_ln_partplatact   .03584862   .00852598   4.2046333
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                           b_GMM       se_GMM        t_GMM
      L.h_ln_new_sign  -.00398214   .02156276  -.18467657
L.h_ln_average_degree   .03180393   .10644581   .29878047
   L.h_ln_partplatact   .96996977   .05584131   17.370111
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                        ln_new_sign  ln_average_degree     ln_partplatact
      ln_new_sign          .15912481
ln_average_degree         -.00137129          .00018038
   ln_partplatact          .00332234         -.00005499          .00585486

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.2574   1.0000
             |   0.0001
             |
          u3 |   0.1092  -0.0532   1.0000
             |   0.1104   0.4376
             |

GMM finished : 13:06:22

Starting Monte-Carlo loop : 13:06:23 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 13:06:30
```

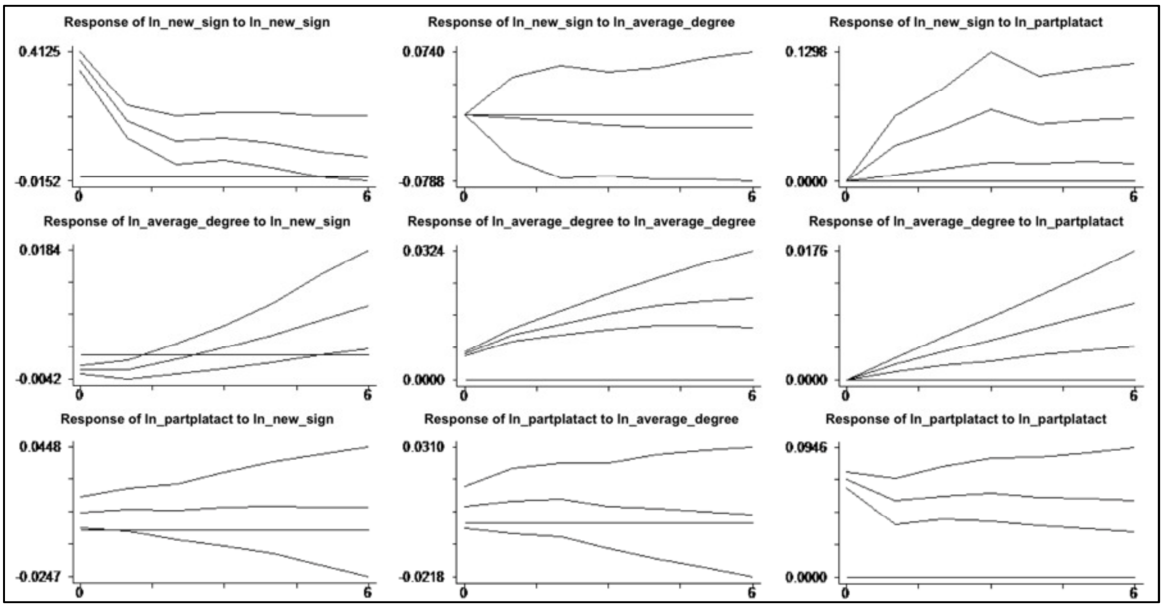
```
. pvar ln_new_sign ln_average_degree ln_partplatact, lag(2) gmm monte 1000
GMM started : 13:13:19
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 210
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .54788188   .10467885   5.2339309
 L.h_ln_average_degree  -.57965785   3.5329344  -.16407263
    L.h_ln_partplatact   .44066241   .26779399   1.6455276
      L2.h_ln_new_sign   .19664284   .08861144   2.2191587
L2.h_ln_average_degree   .67659873   3.2078966   .21091663
   L2.h_ln_partplatact  -.1035805    .3401234  -.30453801
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .00420031   .00185473   2.2646514
 L.h_ln_average_degree   1.7413642   .08757253   19.884823
    L.h_ln_partplatact   .02139299   .00906115   2.3609572
      L2.h_ln_new_sign   .00088167   .00126446   .69727117
L2.h_ln_average_degree  -.76957693   .08111564  -9.4874056
   L2.h_ln_partplatact  -.0187538    .00962351  -1.9487494
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .00513199   .01916757   .26774349
 L.h_ln_average_degree   .14439426   .68657233    .2103118
    L.h_ln_partplatact   .75790414   .13442007   5.6383258
      L2.h_ln_new_sign  -.00741474   .01196553  -.61967509
L2.h_ln_average_degree  -.16166363   .67036059  -.24115921
   L2.h_ln_partplatact   .21822264   .12884807   1.6936431
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                         ln_new_sign  ln_average_degree     ln_partplatact
      ln_new_sign          .14894424
ln_average_degree         -.00108364          .00005615
   ln_partplatact          .00371743          .00002014          .00552559

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |  1.0000
             |
             |
          u2 | -0.3750   1.0000
             |  0.0000
             |
          u3 |  0.1298   0.0362   1.0000
             |  0.0605   0.6018
             |

GMM finished : 13:13:21

Starting Monte-Carlo loop : 13:13:22 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 13:13:29
```



```
. pvar ln_new_sign ln_average_degree ln_partplatact, lag(3) gmm monte 1000
GMM started : 13:16:11
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 205
----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .49316269    .0959324   5.1407311
 L.h_ln_average_degree  -.53630155   4.3742923  -.12260304
    L.h_ln_partplatact   .45553787   .24470639   1.8615692
      L2.h_ln_new_sign   .07679266   .10618658   .72318611
L2.h_ln_average_degree  -1.5200656   6.0817919  -.24993713
   L2.h_ln_partplatact   .01006933   .39546604   .02546193
      L3.h_ln_new_sign   .16910893   .07712562   2.1926427
L3.h_ln_average_degree   1.9824754   3.0787129   .64392995
   L3.h_ln_partplatact  -.07693127   .39041843  -.19704826
----------------------------------------------------------------------------
----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00359807   .00153087   2.3503389
 L.h_ln_average_degree   1.6905278   .12123959   13.943694
    L.h_ln_partplatact   .02399857   .00872171   2.7515906
      L2.h_ln_new_sign   .00292094   .00143916   2.0296159
L2.h_ln_average_degree  -.59519001   .17785834  -3.3464274
   L2.h_ln_partplatact  -.01928314   .01099214  -1.7542656
      L3.h_ln_new_sign  -.00161209   .00118935  -1.3554383
L3.h_ln_average_degree  -.11731455   .07943387  -1.4768833
   L3.h_ln_partplatact  -.00367873   .00901793  -.40793489
----------------------------------------------------------------------------
----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00933379   .01716898   .54364267
 L.h_ln_average_degree   .68886702    1.022704   .67357417
    L.h_ln_partplatact   .75801464   .13656645   5.5505188
      L2.h_ln_new_sign  -.01186488   .01475682  -.80402719
L2.h_ln_average_degree  -1.0738641   1.6693526   -.6432818
   L2.h_ln_partplatact   .20763993   .13919356   1.4917352
      L3.h_ln_new_sign  -.00346523   .01062025  -.32628537
L3.h_ln_average_degree   .39138952   .83513151   .46865615
   L3.h_ln_partplatact  -.00315776   .10809696  -.02921229
----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                      ln_new_sign  ln_average_degree     ln_partplatact
      ln_new_sign        .14653503
ln_average_degree       -.00102802           .0000528
   ln_partplatact        .00326213           .0000415          .00544991

Residuals correlation matrix

             |     u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.3697   1.0000
             |   0.0000
             |
          u3 |   0.1155   0.0774   1.0000
             |   0.0990   0.2701
             |

GMM finished : 13:16:12

Starting Monte-Carlo loop : 13:16:13 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 13:16:21
```



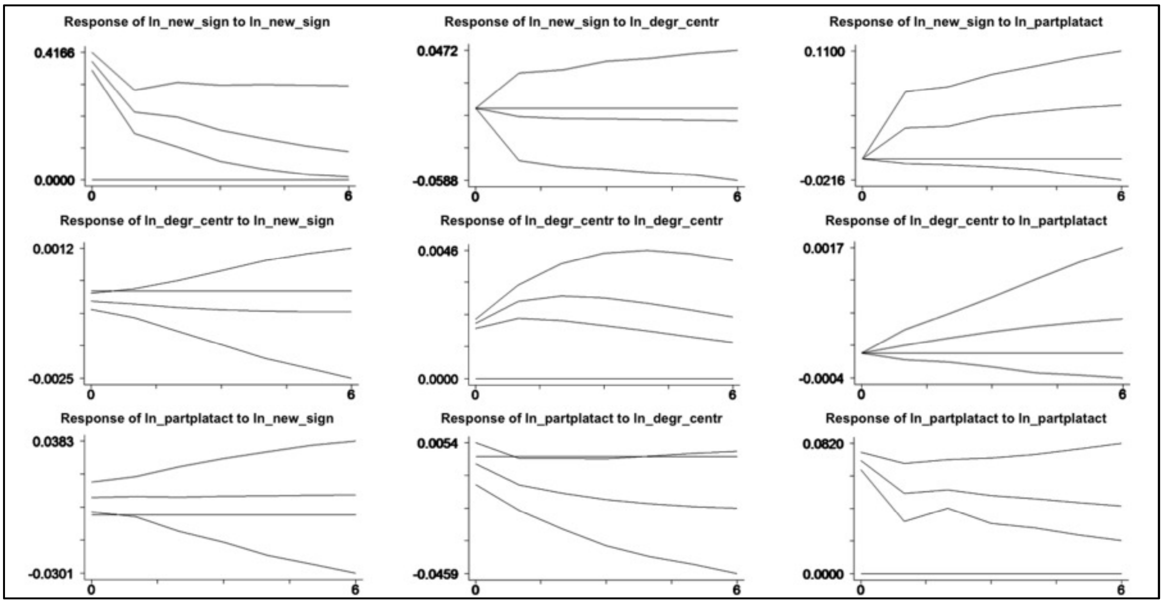
```
. pvar ln_new_sign ln_average_degree ln_partplatact, lag(4) gmm monte 1000
GMM started : 13:17:48
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 200
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .45994167   .09181275   5.0095622
 L.h_ln_average_degree  -1.0819209   4.3633311  -.24795756
    L.h_ln_partplatact   .50901853   .25308597   2.0112475
      L2.h_ln_new_sign   .06622661   .10618793   .62367362
L2.h_ln_average_degree   .17519061   6.3419246    .0276242
   L2.h_ln_partplatact   .12239865   .38593112   .31715154
      L3.h_ln_new_sign   .13206543   .09159319   1.4418695
L3.h_ln_average_degree  -.43535385   6.3317837   -.0687569
   L3.h_ln_partplatact   .17834423   .49106222    .3631805
      L4.h_ln_new_sign   .04469971   .07052061    .6338531
L4.h_ln_average_degree      1.3276   3.3293997   .39875057
   L4.h_ln_partplatact  -.36652123   .38708271  -.94688091
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00432985   .00152487   2.8394945
 L.h_ln_average_degree   1.6994742   .11726988   14.491993
    L.h_ln_partplatact   .02961564   .00791832   3.7401411
      L2.h_ln_new_sign   .00177322   .00147633   1.2011033
L2.h_ln_average_degree  -.79045479   .18253948  -4.3303224
   L2.h_ln_partplatact  -.02234757   .01082106  -2.0651933
      L3.h_ln_new_sign   .00030777   .00133559   .23043825
L3.h_ln_average_degree   .24485484   .14438537   1.6958424
   L3.h_ln_partplatact  -.00194647   .00973727  -.19989942
      L4.h_ln_new_sign   .00029867   .00104404   .28606632
L4.h_ln_average_degree  -.17775492   .06239156  -2.8490217
   L4.h_ln_partplatact  -.00470766   .00729908  -.64496647
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .01314989   .01742503   .75465515
 L.h_ln_average_degree   .58218035   1.0319077   .56417871
    L.h_ln_partplatact   .78258767   .13976879    5.599159
      L2.h_ln_new_sign  -.00751092   .01361051  -.55184661
L2.h_ln_average_degree  -.81663224    1.761066  -.46371474
   L2.h_ln_partplatact   .19298648   .13904982   1.3878945
      L3.h_ln_new_sign  -.00280376   .01185787  -.23644678
L3.h_ln_average_degree   -.2389163   1.4462258  -.16519986
   L3.h_ln_partplatact   .04177667   .12964826   .32223086
      L4.h_ln_new_sign   .00024557   .00813781   .03017672
L4.h_ln_average_degree   .45460988     .783168   .58047556
   L4.h_ln_partplatact  -.04570552   .09029447  -.50618292
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                         ln_new_sign  ln_average_degree     ln_partplatact
      ln_new_sign          .14698919
ln_average_degree         -.00101287           .00004911
   ln_partplatact          .00371266           .00001883          .00524222

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.3771   1.0000
             |   0.0000
             |
          u3 |   0.1338   0.0371   1.0000
             |   0.0589   0.6017
             |

GMM finished : 13:17:49

Starting Monte-Carlo loop : 13:17:51 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 13:18:00
```



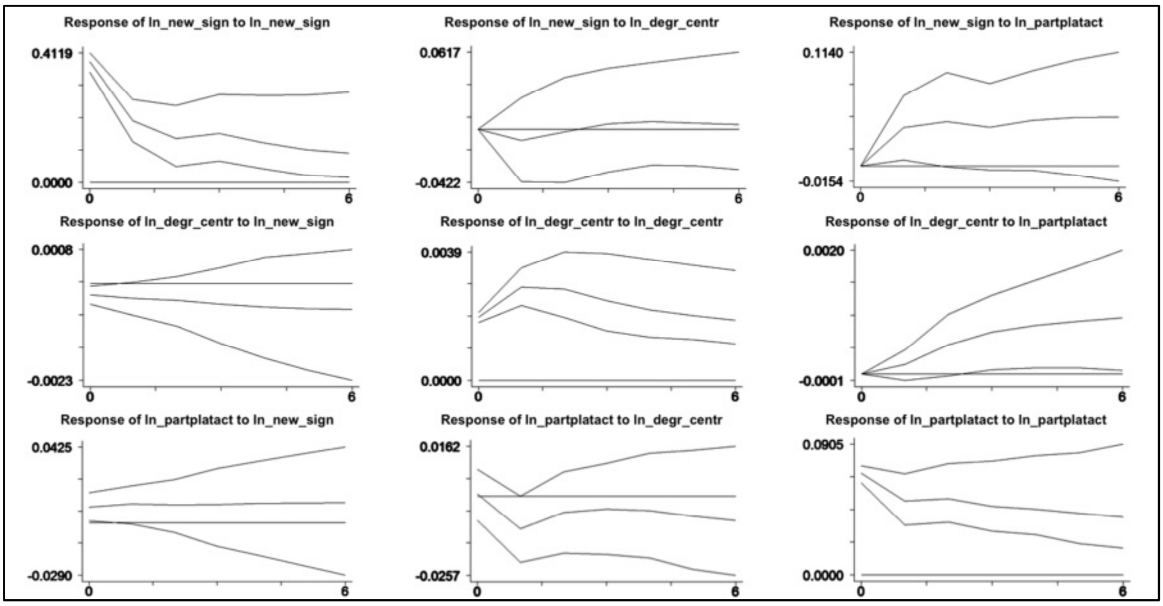
Appendix 21 Estimation Results PVAR(1)-(4) ln_new_signups ln_degree_centralization ln_partplatact; Established Regions

```
. pvar ln_new_sign ln_degr_centr ln_partplatact, lag(1) gmm monte 1000
GMM started : 13:20:50
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 215
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                        b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .7726092   .14145807   5.4617542
 L.h_ln_degr_centr  1.3762677   3.2922624     .418031
L.h_ln_partplatact   .3458386   .25060553   1.3800118
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                         b_GMM       se_GMM        t_GMM
   L.h_ln_new_sign  -.00117065    .00058557   -1.9991492
 L.h_ln_degr_centr   .95268414    .02625023    36.292407
L.h_ln_partplatact   .00413274    .00169514    2.4379865
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                         b_GMM       se_GMM        t_GMM
   L.h_ln_new_sign   .01084568    .02163654    .50126696
 L.h_ln_degr_centr  -.35354258    1.1272511   -.31363251
L.h_ln_partplatact   .93659538    .07759227    12.070731
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                 ln_new_sign   ln_degr_centr  ln_partplatact
   ln_new_sign      .16054516
 ln_degr_centr     -.00017538       5.061e-06
ln_partplatact      .00388343       -.0000119       .00557743

Residuals correlation matrix

             |      u1       u2       u3
-------------+----------------------------
          u1 |  1.0000
             |
             |
          u2 | -0.1944   1.0000
             |  0.0042
             |
          u3 |  0.1298  -0.0709   1.0000
             |  0.0573   0.3010
             |

GMM finished : 13:20:52

Starting Monte-Carlo loop : 13:20:53 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 13:21:00
```

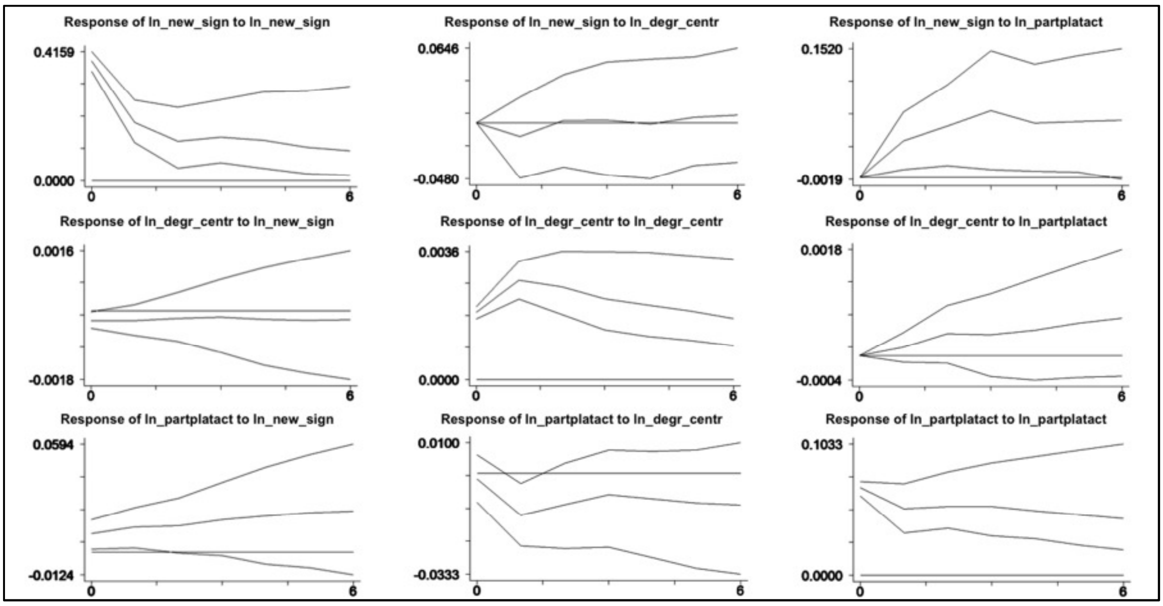
```
. pvar ln_new_sign ln_degr_centr ln_partplatact, lag(2) gmm monte 1000
GMM started : 13:33:21
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 210
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                         b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign    .5581821    .1187825   4.6991947
  L.h_ln_degr_centr  -2.8400742   10.703833  -.26533244
 L.h_ln_partplatact   .44401563   .30285313   1.4661088
   L2.h_ln_new_sign   .20143025   .09601753   2.0978486
 L2.h_ln_degr_centr   4.0072369   10.473823   .38259545
L2.h_ln_partplatact  -.09179113   .27626085  -.33226253
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                         b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .00006183   .00044656    .1384628
  L.h_ln_degr_centr   1.3993106   .17141968   8.1630685
 L.h_ln_partplatact   .00180131   .00213434   .84396594
   L2.h_ln_new_sign  -.00029488   .00035646  -.82724176
 L2.h_ln_degr_centr  -.44725853   .17027757  -2.6266438
L2.h_ln_partplatact  -.00047315   .00206804  -.22878904
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                         b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .00454709   .01622645   .28022677
  L.h_ln_degr_centr  -4.6249866   2.5417581  -1.8196014
 L.h_ln_partplatact   .71055182   .14771954    4.810141
   L2.h_ln_new_sign   -.0039565   .01397244  -.28316444
 L2.h_ln_degr_centr   3.5180931    2.494764   1.4101908
L2.h_ln_partplatact   .24361214   .11600661   2.0999849
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                   ln_new_sign   ln_degr_centr  ln_partplatact
   ln_new_sign       .15008427
 ln_degr_centr      -.00011542       3.975e-06
ln_partplatact       .00350607      -8.214e-06       .00515849

Residuals correlation matrix

             |     u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1495   1.0000
             |   0.0303
             |
          u3 |   0.1260  -0.0574   1.0000
             |   0.0684   0.4082
             |

GMM finished : 13:33:23

Starting Monte-Carlo loop : 13:33:24 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 13:33:31
```



```
. pvar ln_new_sign ln_degr_centr ln_partplatact, lag(3) gmm monte 1000
GMM started : 14:01:18
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 205
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .49311181   .11516771   4.2816847
  L.h_ln_degr_centr  -4.7379801   10.666371  -.44419795
 L.h_ln_partplatact   .54057018   .28564924   1.8924265
   L2.h_ln_new_sign   .10009295   .10382876   .96401956
 L2.h_ln_degr_centr   11.274206   16.384066   .68812016
L2.h_ln_partplatact    -.023118   .36191463  -.06387695
   L3.h_ln_new_sign   .16875944   .08119576   2.0784268
 L3.h_ln_degr_centr  -5.0315889   10.270497  -.48990706
L3.h_ln_partplatact  -.19795085   .33773276  -.58611682
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .00006992   .00038153   .18327472
  L.h_ln_degr_centr   1.4715389   .16120167   9.1285587
 L.h_ln_partplatact   .00212456   .00208453   1.0192021
   L2.h_ln_new_sign  -.00032311   .00030619  -1.0552598
 L2.h_ln_degr_centr  -.70891122   .23004486  -3.0816216
L2.h_ln_partplatact   .00189136   .00270747    .6985713
   L3.h_ln_new_sign  -.00020833   .00029516  -.70584241
 L3.h_ln_degr_centr   .19343531   .10962922   1.7644503
L3.h_ln_partplatact  -.00164792   .00272946  -.60375195
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .00679137   .01495627   .45408185
  L.h_ln_degr_centr   -5.866655   2.7020766  -2.1711654
 L.h_ln_partplatact   .72759363   .15543944   4.6808818
   L2.h_ln_new_sign  -.00109668    .0127562  -.08597229
 L2.h_ln_degr_centr   9.8764549   3.8153512   2.5886096
L2.h_ln_partplatact   .22789854   .12401966   1.8376002
   L3.h_ln_new_sign  -.00037841   .01189877  -.03180241
 L3.h_ln_degr_centr  -4.9168359   2.3101373  -2.1283739
L3.h_ln_partplatact  -.02379017   .09397998  -.25314082
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                  ln_new_sign   ln_degr_centr  ln_partplatact
   ln_new_sign       .14740309
 ln_degr_centr      -.00010541       3.776e-06
ln_partplatact       .00344819      -1.109e-06       .00503172

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1413   1.0000
             |   0.0433
             |
          u3 |   0.1266  -0.0081   1.0000
             |   0.0705   0.9088
             |

GMM finished : 14:01:20

Starting Monte-Carlo loop : 14:01:20 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 14:01:29
```



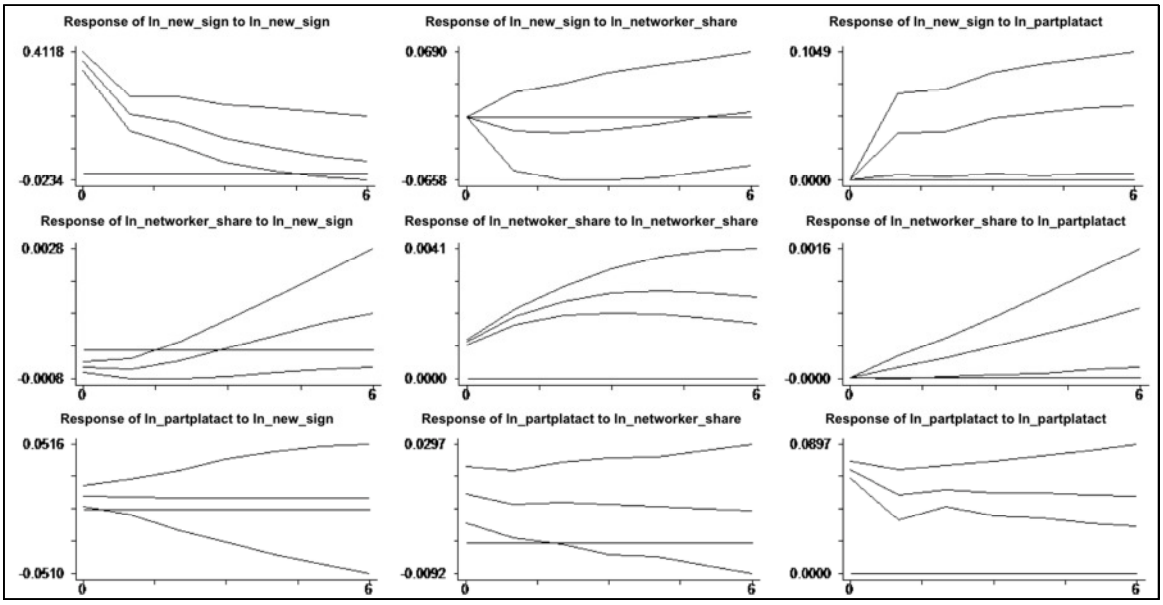
```
. pvar ln_new_sign ln_degr_centr ln_partplatact, lag(4) gmm monte 1000
GMM started : 14:09:10
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 200
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                         b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .46644388   .11351709   4.1090189
  L.h_ln_degr_centr  -5.5876948   11.550408  -.48376601
 L.h_ln_partplatact    .6287118   .30374809   2.0698461
   L2.h_ln_new_sign   .08104334   .10561881   .76731916
 L2.h_ln_degr_centr     16.8728   19.504441   .86507478
L2.h_ln_partplatact   .12077782   .36463918   .33122558
   L3.h_ln_new_sign   .14016969   .08623624   1.6254151
 L3.h_ln_degr_centr  -11.592076   20.775948  -.55795654
L3.h_ln_partplatact   .08833727   .45313163   .19494836
   L4.h_ln_new_sign   .04705168   .07353705   .63983631
 L4.h_ln_degr_centr   3.4441502   12.454506   .27653848
L4.h_ln_partplatact  -.45269405   .36731753  -1.2324325
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                         b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .00024719   .00039978   .61832667
  L.h_ln_degr_centr   1.4760665   .16396802   9.0021609
 L.h_ln_partplatact    .0020439    .0021433   .95362192
   L2.h_ln_new_sign  -.00025787   .00029062   -.8873119
 L2.h_ln_degr_centr  -.78168031   .23991734  -3.2581234
L2.h_ln_partplatact   .00056876   .00255833   .22231568
   L3.h_ln_new_sign   .00005127   .00032481   .15783583
 L3.h_ln_degr_centr   .32894739   .16512764   1.9920796
L3.h_ln_partplatact  -.00322047   .00334288  -.96338191
   L4.h_ln_new_sign  -.00026098   .00023912   -1.091414
 L4.h_ln_degr_centr  -.08212322   .08465879  -.97004955
L4.h_ln_partplatact   .00246163   .00242318   1.0158695
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                         b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .01156191   .01533019   .75419221
  L.h_ln_degr_centr  -6.5736956   2.6963523  -2.4379958
 L.h_ln_partplatact   .75801852   .15778617   4.8040873
   L2.h_ln_new_sign    .0015949   .01256044   .12697813
 L2.h_ln_degr_centr   10.071951   4.0468376   2.4888448
L2.h_ln_partplatact   .21464731   .12463599   1.7221937
   L3.h_ln_new_sign   .00520557   .01154873   .45074862
 L3.h_ln_degr_centr   -3.779913   3.8840723  -.97318297
L3.h_ln_partplatact   .02987093   .12133342   .24618881
   L4.h_ln_new_sign   .00196231   .00919008   .21352492
 L4.h_ln_degr_centr  -.70705087   2.4969887  -.28316142
L4.h_ln_partplatact  -.08313731   .08915084  -.93254651
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                 ln_new_sign   ln_degr_centr  ln_partplatact
   ln_new_sign       .14892998
 ln_degr_centr      -.00009551       3.680e-06
ln_partplatact       .00395664      -6.122e-06       .00487368

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1291   1.0000
             |   0.0685
             |
          u3 |   0.1468  -0.0457   1.0000
             |   0.0380   0.5201
             |

GMM finished : 14:09:13

Starting Monte-Carlo loop : 14:09:15 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 14:09:24
```



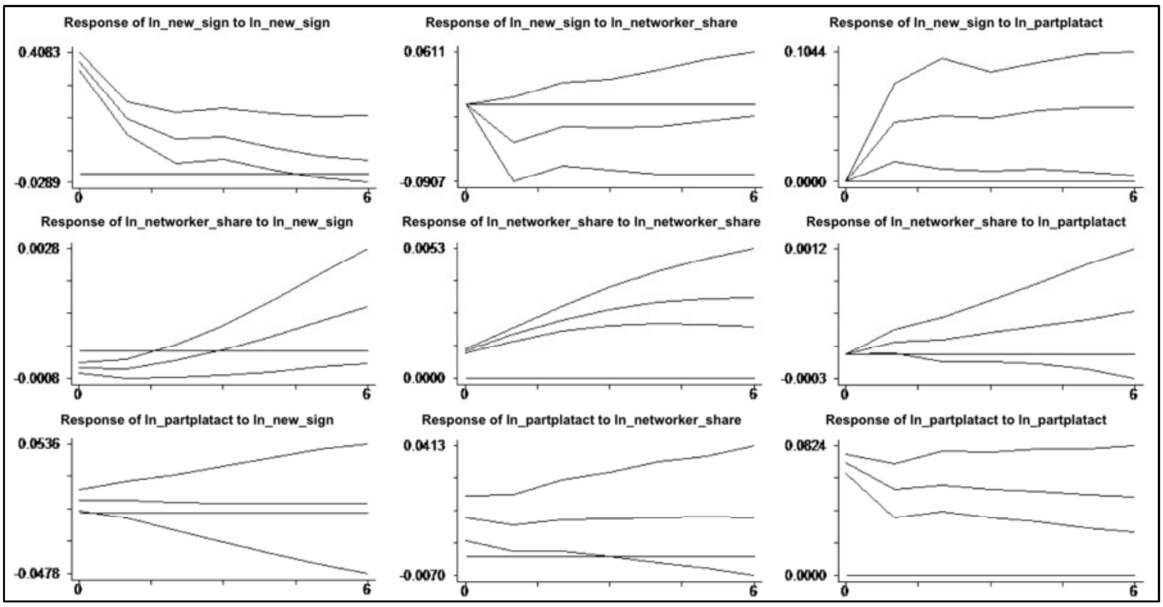
Appendix 22 Estimation Results PVAR(1)-(4) ln_new_signups ln_networker_share ln_partplatact; Established Regions

```
. pvar ln_new_sign ln_networker_share ln_partplatact, lag(1) gmm monte 1000
GMM started : 10:45:38
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 215
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                           b_GMM     se_GMM      t_GMM
       L.h_ln_new_sign  .69263844  .11588796  5.9767941
L.h_ln_networker_share  2.7148854  3.6054333  .75299835
    L.h_ln_partplatact  .34332676  .18575567  1.8482707
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   -.0004855   .00056921  -.85294823
L.h_ln_networker_share   .90953993   .01119393   81.252982
    L.h_ln_partplatact   .00513973   .00081857   6.2789192
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   -.0070466   .02809018  -.25085621
L.h_ln_networker_share   .29699147   .94971939   .31271497
    L.h_ln_partplatact   .96757451   .05325853   18.167503
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                          ln_new_sign  ln_networker_share      ln_partplatact
       ln_new_sign          .15418496
ln_networker_share         -.00026482           3.559e-06
    ln_partplatact           .0034967           8.755e-06           .00584121

Residuals correlation matrix

             |       u1       u2       u3
-------------+----------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.3591   1.0000
             |   0.0000
             |
          u3 |   0.1168   0.0612   1.0000
             |   0.0875   0.3718
             |

GMM finished : 10:45:39

Starting Monte-Carlo loop : 10:45:40 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 10:45:47
```

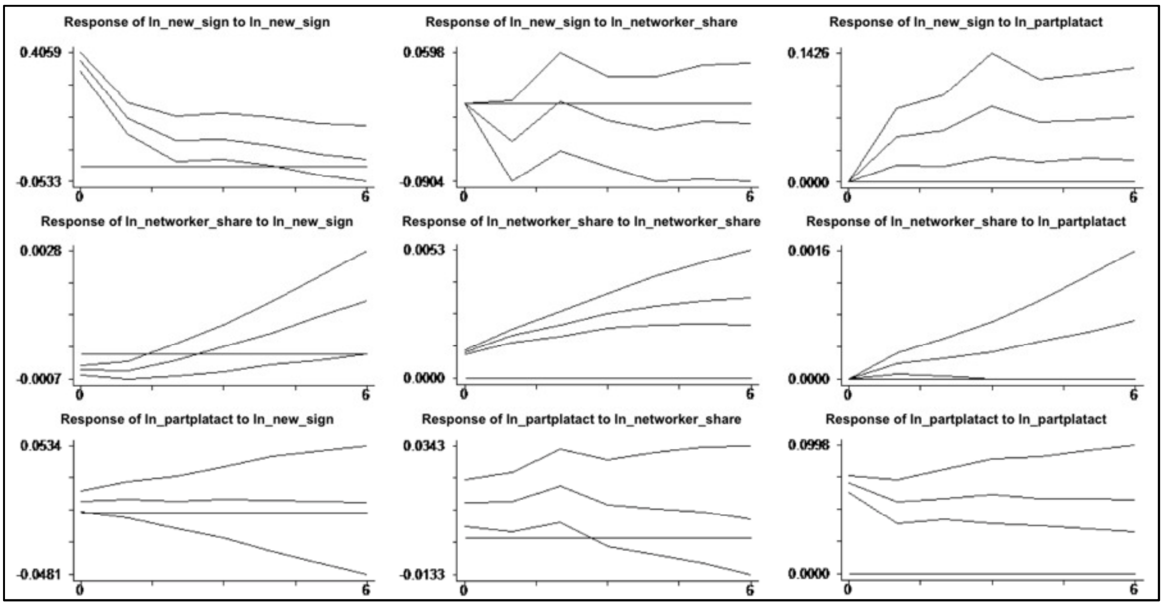
```
. pvar ln_new_sign ln_networker_share ln_partplatact, lag(2) gmm monte 1000
GMM started : 10:56:12
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 210
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .49173397    .1075779   4.5709573
 L.h_ln_networker_share  -19.385475   22.261817  -.87079481
     L.h_ln_partplatact   .53375015     .2869238   1.8602505
       L2.h_ln_new_sign   .17709299   .08834344   2.0045971
L2.h_ln_networker_share    20.10215   20.348383    .98789912
    L2.h_ln_partplatact    -.079565   .28939658  -.27493414
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .00067389   .00030794   2.1883544
 L.h_ln_networker_share   1.6673558   .09516289   17.521072
     L.h_ln_partplatact   .00185812   .00117571   1.5804265
       L2.h_ln_new_sign   .00024692   .00022328   1.1058703
L2.h_ln_networker_share  -.70181431   .08677537  -8.0877129
    L2.h_ln_partplatact  -.00146225   .00132761  -1.1014112
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .00662155   .02597325   .25493712
 L.h_ln_networker_share   .40743768   4.3113157   .09450426
     L.h_ln_partplatact   .75813972   .13661507    5.549459
       L2.h_ln_new_sign  -.00624772   .01380238  -.45265522
L2.h_ln_networker_share  -.63624719   4.4595995  -.14266913
    L2.h_ln_partplatact   .22351847   .12245625   1.8252925
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                        ln_new_sign  ln_networker_share      ln_partplatact
       ln_new_sign          .14531163
ln_networker_share         -.00017741           1.533e-06
    ln_partplatact          .00386919           .00001223            .0055277

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.3763   1.0000
             |   0.0000
             |
          u3 |   0.1367   0.1330   1.0000
             |   0.0479   0.0544
             |

GMM finished : 10:56:15

Starting Monte-Carlo loop : 10:56:16 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 10:56:24
```



```
. pvar ln_new_sign ln_networker_share ln_partplatact, lag(3) gmm monte 1000
GMM started : 10:58:48
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 205
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .41326599   .09738614   4.2435809
 L.h_ln_networker_share  -48.659253   27.664363  -1.7589146
     L.h_ln_partplatact   .66825013   .26651449   2.5073689
       L2.h_ln_new_sign   .10588651   .11014834   .96130831
L2.h_ln_networker_share   64.448546   36.256806   1.7775572
    L2.h_ln_partplatact   .05432784   .37374572   .14536044
       L3.h_ln_new_sign   .17303272   .07681545    2.252577
L3.h_ln_networker_share  -16.334276   18.270017   -.8940482
    L3.h_ln_partplatact  -.26016877   .35528347  -.73228503
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                             b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .00057667   .00026043    2.214291
 L.h_ln_networker_share   1.5963106   .12128879   13.161238
     L.h_ln_partplatact   .00208347   .00112957   1.8444866
       L2.h_ln_new_sign   .00067726   .00029796    2.272973
L2.h_ln_networker_share  -.39594931   .17951405  -2.2056731
    L2.h_ln_partplatact  -.00298005    .0015156  -1.9662469
       L3.h_ln_new_sign   -.0000915   .00021041   -.4348363
L3.h_ln_networker_share  -.22481344   .08461102  -2.6570231
    L3.h_ln_partplatact   .00031342   .00113065   .27720105
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                             b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .00713567   .02349011   .30377324
 L.h_ln_networker_share   .73344108   4.5767444   .16025389
     L.h_ln_partplatact   .76238496   .14086034   5.4123466
       L2.h_ln_new_sign    -.005724   .01530647  -.37395944
L2.h_ln_networker_share   .52450027   6.2535534   .08387236
    L2.h_ln_partplatact   .21559062   .12922872   1.6682872
       L3.h_ln_new_sign  -.00201556   .01126993  -.17884381
L3.h_ln_networker_share  -1.2877918   3.9114848  -.32923349
    L3.h_ln_partplatact  -.01616566    .0994408  -.16256562
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                        ln_new_sign  ln_networker_share      ln_partplatact
       ln_new_sign        .14314004
ln_networker_share       -.00017204           1.434e-06
    ln_partplatact        .00354365           .00001185            .0054225

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.3799   1.0000
             |   0.0000
             |
          u3 |   0.1273   0.1344   1.0000
             |   0.0689   0.0547
             |

GMM finished : 10:58:49

Starting Monte-Carlo loop : 10:58:50 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 10:58:58
```



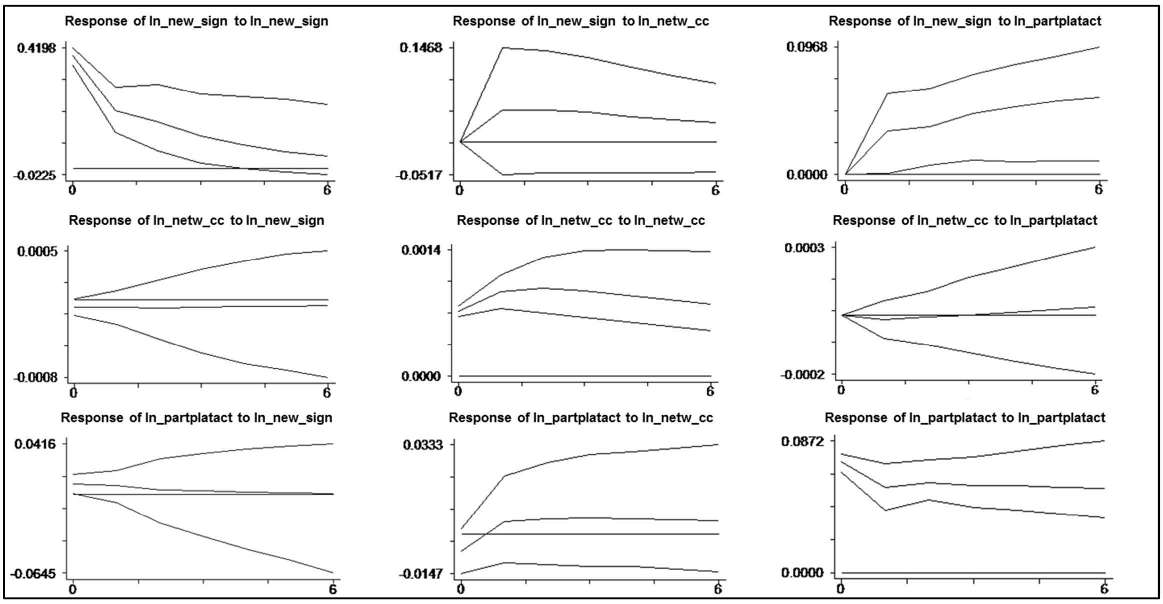
```
. pvar ln_new_sign ln_networker_share ln_partplatact, lag(4) gmm monte 1000
GMM started : 11:05:25
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 200
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .37953869   .09404231   4.0358289
 L.h_ln_networker_share  -48.186545   27.369902   -1.760567
     L.h_ln_partplatact   .72145632   .26741084   2.6979322
       L2.h_ln_new_sign   .09889953   .10872326   .90964462
L2.h_ln_networker_share   84.625968    36.94959   2.2903087
    L2.h_ln_partplatact    .0972828   .37470004   .25962847
       L3.h_ln_new_sign   .09793459   .09129821    1.072689
L3.h_ln_networker_share  -67.589341   34.163955  -1.9783816
    L3.h_ln_partplatact   .08978027    .4990686   .17989565
       L4.h_ln_new_sign   .03182815   .06680577   .47642814
L4.h_ln_networker_share   31.124732   20.726086   1.5017178
    L4.h_ln_partplatact  -.34468895   .39471021  -.87327093
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign    .0006038   .00025487   2.3690849
 L.h_ln_networker_share   1.5603569   .12806312    12.18428
     L.h_ln_partplatact   .00279619   .00115501   2.4209294
       L2.h_ln_new_sign   .00061302   .00031372   1.9540153
L2.h_ln_networker_share  -.45479277   .19500185  -2.3322485
    L2.h_ln_partplatact  -.00313548   .00153017  -2.0491113
       L3.h_ln_new_sign   .00029315   .00023797   1.2318558
L3.h_ln_networker_share   .04666233    .1926662   .24219264
    L3.h_ln_partplatact  -.00063649   .00131404  -.48438033
       L4.h_ln_new_sign  -2.835e-06   .00020244  -.01400303
L4.h_ln_networker_share  -.17582832   .09453371  -1.8599536
    L4.h_ln_partplatact   3.966e-06   .00099343   .00399191
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .01248361   .02248649   .55516044
 L.h_ln_networker_share   2.7142738   4.6386071   .58514846
     L.h_ln_partplatact   .79161218   .14419259   5.4899645
       L2.h_ln_new_sign  -.00244375   .01504352   -.1624455
L2.h_ln_networker_share   1.7686694   6.8539445   .25805131
    L2.h_ln_partplatact   .18263059   .13296812   1.3734916
       L3.h_ln_new_sign  -.01267017   .01355099  -.93499974
L3.h_ln_networker_share  -13.629841   5.8228965  -2.3407322
    L3.h_ln_partplatact   .05134542   .12640928   .40618396
       L4.h_ln_new_sign  -.00246596   .00831702  -.29649594
L4.h_ln_networker_share   8.9882875   4.2124962     2.13372
    L4.h_ln_partplatact  -.03847797   .09035825  -.42583799
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                          ln_new_sign  ln_networker_share      ln_partplatact
       ln_new_sign          .14113127
ln_networker_share         -.00017023            1.416e-06
    ln_partplatact           .0034401            .00001048           .00518141

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.3809   1.0000
             |   0.0000
             |
          u3 |   0.1273   0.1223   1.0000
             |   0.0725   0.0844
             |

GMM finished : 11:05:27

Starting Monte-Carlo loop : 11:05:28 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 11:05:37
```



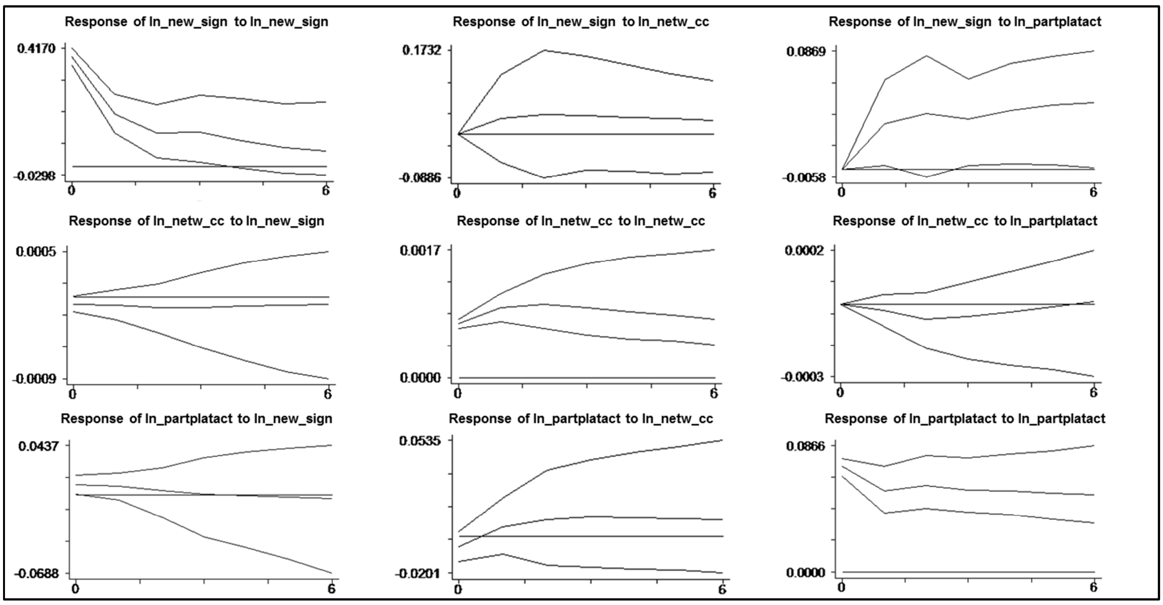
Appendix 23 Estimation Results PVAR(1)-(4) ln_new_signups ln_network_cc ln_partplatact; Established Regions

```
. pvar ln_new_sign ln_netw_cc ln_partplatact, lag(1) gmm monte 1000
GMM started : 11:08:05
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 215
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                        b_GMM     se_GMM      t_GMM
   L.h_ln_new_sign  .70438943  .12653831  5.5666101
    L.h_ln_netw_cc   3.176164  4.4634654  .71159148
L.h_ln_partplatact   .3555497  .19237029  1.8482569
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign    .0112815   .00626861   1.7996815
    L.h_ln_netw_cc   .57114201   .28945061   1.9731933
L.h_ln_partplatact  -.01167356   .00761421   -1.533127
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                        b_GMM     se_GMM      t_GMM
   L.h_ln_new_sign  .00331116  .02287975  .14472001
    L.h_ln_netw_cc   .0382264  .50794737  .07525661
L.h_ln_partplatact  .95965876  .05529397  17.355577
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                   ln_new_sign      ln_netw_cc  ln_partplatact
   ln_new_sign       .16034405
    ln_netw_cc       .00069842       .00025177
ln_partplatact       .00346403       5.723e-06       .00572087

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1093   1.0000
             |   0.1100
             |
          u3 |   0.1146   0.0049   1.0000
             |   0.0939   0.9428
             |

GMM finished : 11:08:06

Starting Monte-Carlo loop : 11:08:07 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 11:08:14
```

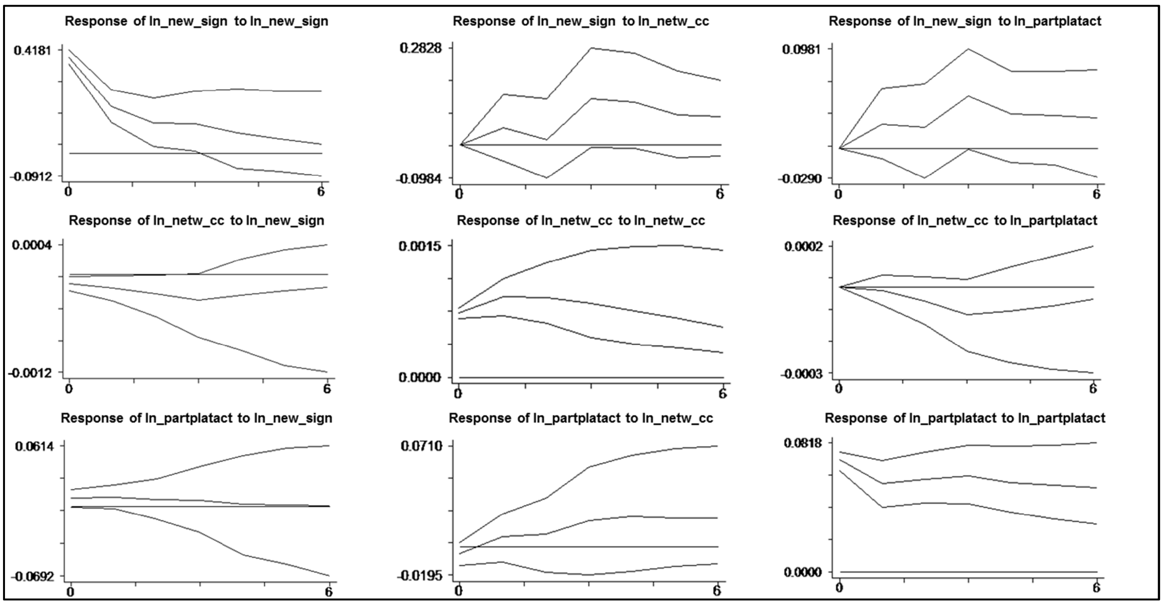
```
. pvar ln_new_sign ln_netw_cc ln_partplatact, lag(2) gmm monte 1000
GMM started : 11:25:36
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 210
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                         b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .55022203   .10685935   5.1490304
     L.h_ln_netw_cc   .60804243   3.4045315   .17859798
 L.h_ln_partplatact   .39884642   .24914935   1.6008327
   L2.h_ln_new_sign   .18693909   .08968595   2.0843742
    L2.h_ln_netw_cc   1.0368036    3.087812   .33577291
L2.h_ln_partplatact  -.08953832   .25352263  -.35317683
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                         b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .00537504   .00286501   1.8760997
     L.h_ln_netw_cc   .32589405   .24799947   1.3140917
 L.h_ln_partplatact  -.00653863   .00547315  -1.1946739
   L2.h_ln_new_sign   .00358324   .00215566   1.6622484
    L2.h_ln_netw_cc   .33261829   .23685241   1.4043273
L2.h_ln_partplatact  -.00321973   .00397215  -.81057662
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                         b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign    .0006388   .01607661   .03973458
     L.h_ln_netw_cc   -.0377662   .36891381  -.10237135
 L.h_ln_partplatact   .77046898   .12426648    6.200135
   L2.h_ln_new_sign  -.00903088   .01910446  -.47271078
    L2.h_ln_netw_cc  -.06555957   .31085628  -.21089993
L2.h_ln_partplatact   .22043459   .12079353   1.8248875
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                   ln_new_sign      ln_netw_cc  ln_partplatact
   ln_new_sign       .15081962
    ln_netw_cc       .00038476       .00021782
ln_partplatact       .00333226      -9.517e-06       .00562211

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0668   1.0000
             |   0.3352
             |
          u3 |   0.1146  -0.0085   1.0000
             |   0.0976   0.9028
             |

GMM finished : 11:25:37

Starting Monte-Carlo loop : 11:25:38 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 11:25:45
```



```
. pvar ln_new_sign ln_netw_cc ln_partplatact, lag(3) gmm monte 1000
GMM started : 11:42:47
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 205
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                        b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .48104301   .10057647   4.7828582
     L.h_ln_netw_cc   -1.810745   2.0735116  -.87327462
 L.h_ln_partplatact   .47234404   .25219356   1.8729425
   L2.h_ln_new_sign   .09139672   .09427202    .96950005
    L2.h_ln_netw_cc  -1.4777399   1.7434568  -.84759195
L2.h_ln_partplatact    -.033287   .35715034  -.09320164
   L3.h_ln_new_sign   .14336908   .08905699   1.6098577
    L3.h_ln_netw_cc   5.1552988    1.506753   3.4214625
L3.h_ln_partplatact  -.13136251   .32767366  -.40089432
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                        b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign    .0037476   .00202429   1.8513162
     L.h_ln_netw_cc   .22167881   .18121747   1.2232751
 L.h_ln_partplatact  -.00463613   .00490043  -.94606506
   L2.h_ln_new_sign    .0017453   .00117578    1.484376
    L2.h_ln_netw_cc   .22502131   .17574018   1.2804204
L2.h_ln_partplatact  -.00368074   .00379005  -.97115879
   L3.h_ln_new_sign   .00245447   .00190701   1.2870774
    L3.h_ln_netw_cc   .23504823   .17708454   1.3273222
L3.h_ln_partplatact  -.00042189   .00308038  -.13696115
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                        b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign    .0013743   .01445652   .09506465
     L.h_ln_netw_cc   .03477557   .33718985    .1031335
 L.h_ln_partplatact   .77272819   .12774439   6.0490185
   L2.h_ln_new_sign  -.01000018   .01543287  -.64797951
    L2.h_ln_netw_cc   .00116284   .26310146   .00441974
L2.h_ln_partplatact   .22611687   .13432058    1.683412
   L3.h_ln_new_sign  -.00421135   .01675564  -.25133907
    L3.h_ln_netw_cc   .00631002   .20029234   .03150403
L3.h_ln_partplatact  -.01602656   .09559264  -.16765473
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                   ln_new_sign      ln_netw_cc  ln_partplatact
   ln_new_sign       .14165153
    ln_netw_cc       2.504e-06       .00020489
ln_partplatact       .00334615      -1.538e-06       .00548947

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0004   1.0000
             |   0.9958
             |
          u3 |   0.1201  -0.0014   1.0000
             |   0.0864   0.9841
             |

GMM finished : 11:42:50

Starting Monte-Carlo loop : 11:42:50 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 11:42:59
```



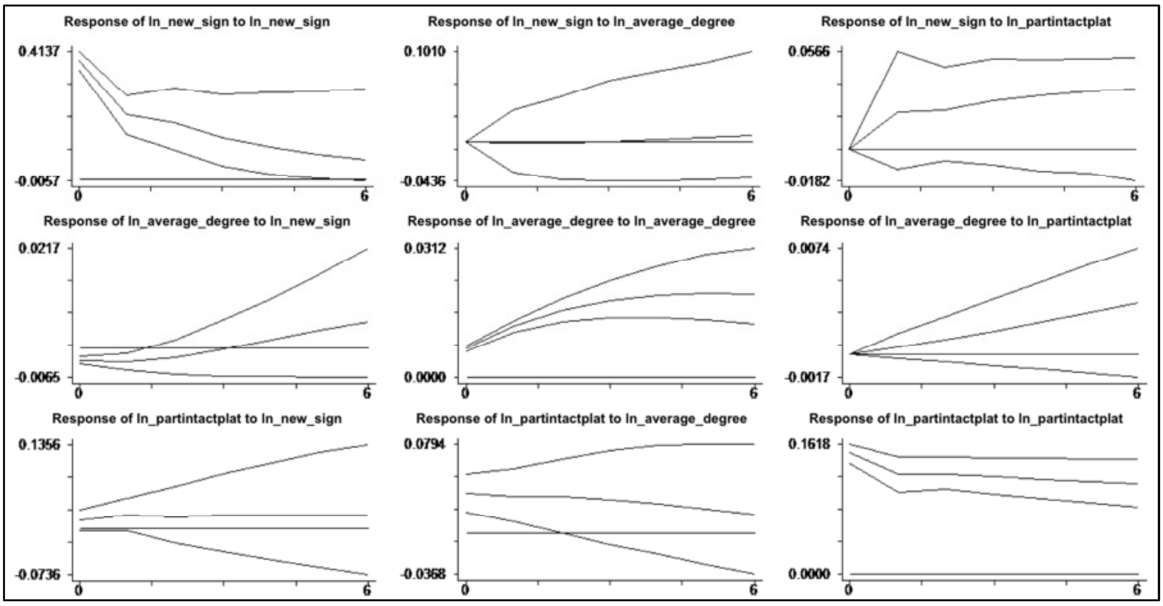
```
. pvar ln_new_sign ln_netw_cc ln_partplatact, lag(4) gmm monte 1000
GMM started : 11:54:35
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 200
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                         b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .48295399   .10362554   4.6605689
     L.h_ln_netw_cc  -1.6484099   2.0214342  -.81546551
 L.h_ln_partplatact   .45424902   .26224404   1.7321615
   L2.h_ln_new_sign   .07957769   .09560292   .83237725
    L2.h_ln_netw_cc   -1.315255   1.6541786  -.79511061
L2.h_ln_partplatact   .05583706    .3620775     .154213
   L3.h_ln_new_sign   .13139687   .08966233   1.4654634
    L3.h_ln_netw_cc   5.2902644   1.4127986   3.7445283
L3.h_ln_partplatact   .11414449   .44969483   .25382656
   L4.h_ln_new_sign   .03777371   .07505172   .50330241
    L4.h_ln_netw_cc   -.7727487   1.2129177  -.63709904
L4.h_ln_partplatact  -.35741414   .34632771  -1.0320114
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                         b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .00258599   .00203898   1.2682747
     L.h_ln_netw_cc   .18260722   .15030153   1.2149392
 L.h_ln_partplatact  -.00327729   .00480437  -.68214863
   L2.h_ln_new_sign   .00269806   .00178149   1.5144915
    L2.h_ln_netw_cc   .18072376   .14320609   1.2619838
L2.h_ln_partplatact  -.00364547   .00375997  -.96954531
   L3.h_ln_new_sign   .00426983    .0037167   1.1488235
    L3.h_ln_netw_cc   .18818458   .14584804   1.2902785
L3.h_ln_partplatact   .00085803   .00404909   .21190676
   L4.h_ln_new_sign  -.00376121   .00417944  -.89993149
    L4.h_ln_netw_cc   .18799138   .15107533   1.2443553
L4.h_ln_partplatact  -.00017297   .00371175  -.04660096
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                         b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .00636404   .01535744   .41439446
     L.h_ln_netw_cc   .06414933    .3377173   .18994978
 L.h_ln_partplatact   .80289478   .13042605   6.1559387
   L2.h_ln_new_sign  -.00773968   .01472057  -.52577352
    L2.h_ln_netw_cc   .04870953   .24868366   .19586944
L2.h_ln_partplatact   .21099283    .1384996   1.5234183
   L3.h_ln_new_sign   .00108177   .01398656   .07734342
    L3.h_ln_netw_cc   .06262539    .1753756   .35709294
L3.h_ln_partplatact   .02742522   .12594541   .21775486
   L4.h_ln_new_sign   -.0013008   .01283675  -.10133444
    L4.h_ln_netw_cc  -.06677634   .16928828  -.39445342
L4.h_ln_partplatact  -.06757745   .08715728  -.77535057
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                   ln_new_sign      ln_netw_cc  ln_partplatact
   ln_new_sign       .14340963
    ln_netw_cc        .0000679       .00019837
ln_partplatact       .00359686       .00001444       .00533747

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0126   1.0000
             |   0.8592
             |
          u3 |   0.1301   0.0141   1.0000
             |   0.0664   0.8429
             |

GMM finished : 11:54:38

Starting Monte-Carlo loop : 11:54:39 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 11:54:49
```



Appendix 24 Estimation Results PVAR(1)-(4) ln_new_signups ln_average_degree ln_partintactplat; Established Regions

```
. pvar ln_new_sign ln_average_degree ln_partintactplat, lag(1) gmm monte 1000
GMM started : 12:03:29
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 215
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                          b_GMM     se_GMM      t_GMM
      L.h_ln_new_sign  .73282782  .14200502  5.1605768
L.h_ln_average_degree   .1331378    .411184  .32379129
L.h_ln_partintactplat  .09129588  .05859304  1.5581353
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                           b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign  -.00382337   .00451189  -.84740014
L.h_ln_average_degree   .91891125   .01166075   78.803794
L.h_ln_partintactplat   .00965327   .00256573   3.7623856
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                           b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign  -.01556777   .05338883   -.2915923
L.h_ln_average_degree  -.17860981   .17068847  -1.0464082
L.h_ln_partintactplat   .97583153   .02489336   39.200468
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                       ln_new_sign  ln_average_degree  ln_partintactplat
      ln_new_sign          .15658041
ln_average_degree         -.00148536          .00017395
ln_partintactplat          .00301933          .00029118          .02617795

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.2855   1.0000
             |   0.0000
             |
          u3 |   0.0474   0.1367   1.0000
             |   0.4894   0.0453
             |

GMM finished : 12:03:30

Starting Monte-Carlo loop : 12:03:32 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 12:03:38
```

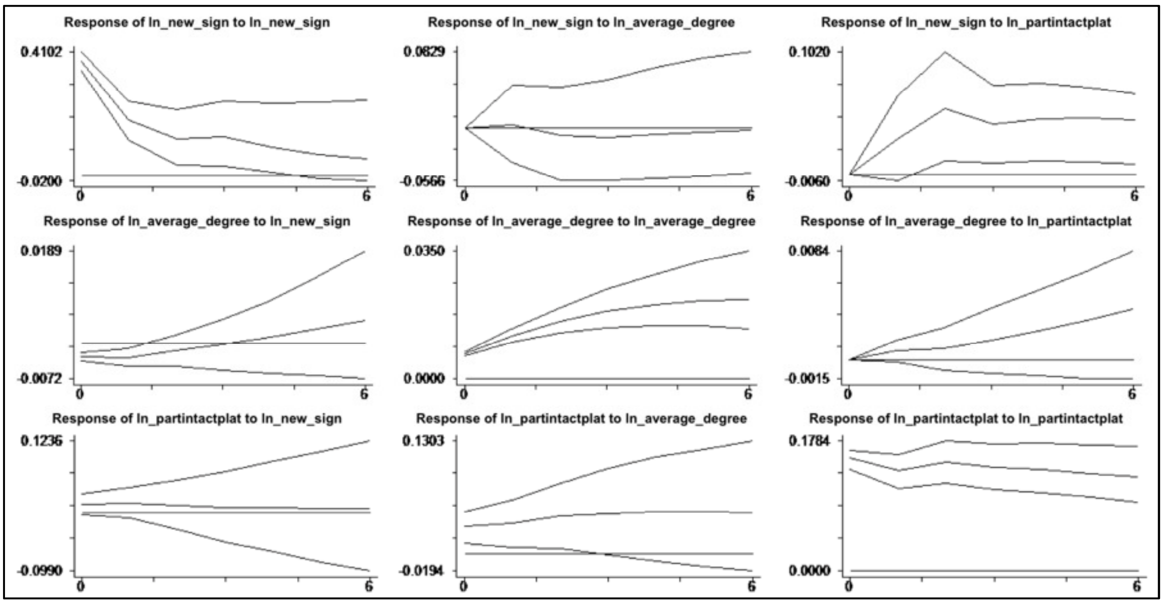
```
. pvar ln_new_sign ln_average_degree ln_partintactplat, lag(2) gmm monte 1000
GMM started : 12:12:29
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 210
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                           b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .53090171    .1194581   4.4442504
 L.h_ln_average_degree  -.87269011   3.3234664   -.2625843
 L.h_ln_partintactplat   .14101562   .14272442   .98802729
      L2.h_ln_new_sign   .17974975   .09799668   1.8342432
L2.h_ln_average_degree   .97414307   3.0864632   .31561791
L2.h_ln_partintactplat  -.03787616   .12520208  -.30252025
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                           b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00433248   .00220238    1.967184
 L.h_ln_average_degree   1.7319753    .0912467   18.981239
 L.h_ln_partintactplat   .00340381   .00362098   .94002467
      L2.h_ln_new_sign   .00057904   .00153239   .37787052
L2.h_ln_average_degree   -.7618191   .08476625  -8.9872928
L2.h_ln_partintactplat  -.00252656   .00347208  -.72767886
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                           b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .03233892   .04170531   .77541503
 L.h_ln_average_degree   .50825799   1.6338756   .31107508
 L.h_ln_partintactplat   .82013394   .07674966   10.685832
      L2.h_ln_new_sign  -.02305958    .0335876  -.68655039
L2.h_ln_average_degree  -.77653059   1.5291833  -.50780741
L2.h_ln_partintactplat   .14848617   .07418481   2.0015711
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                        ln_new_sign  ln_average_degree  ln_partintactplat
      ln_new_sign          .14753588
ln_average_degree         -.00107188          .00005851
ln_partintactplat          .00572958          .00020979          .02431509

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.3651   1.0000
             |   0.0000
             |
          u3 |   0.0957   0.1759   1.0000
             |   0.1669   0.0106
             |

GMM finished : 12:12:31

Starting Monte-Carlo loop : 12:12:31 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 12:12:39
```



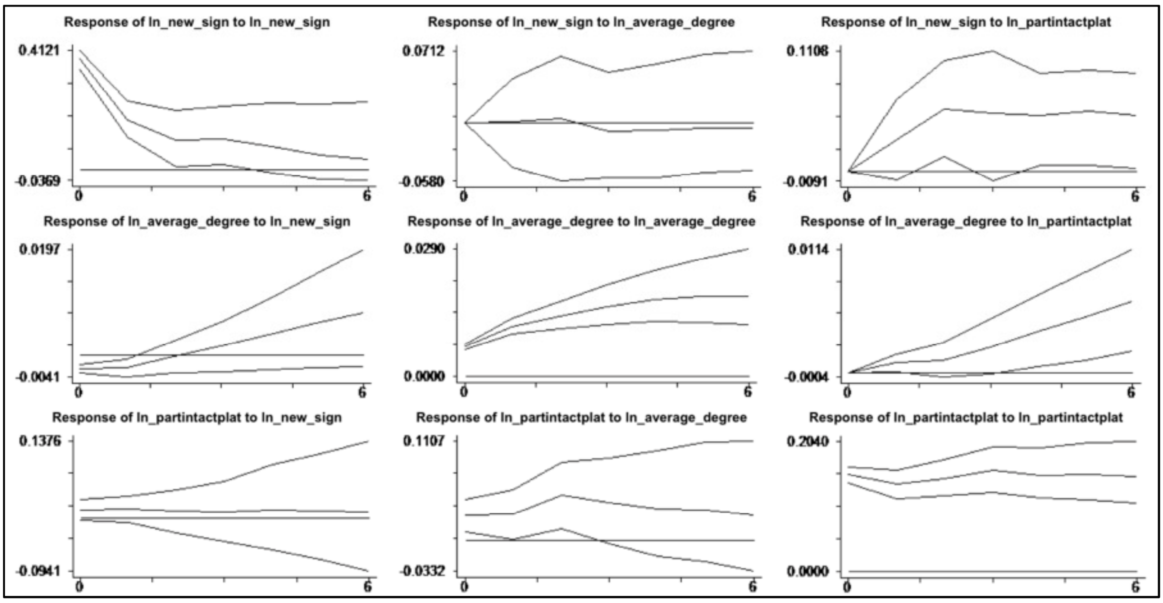
```
. pvar ln_new_sign ln_average_degree ln_partintactplat, lag(3) gmm monte 1000
GMM started : 12:15:56
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 205
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                              b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .47267334   .11104231   4.2566958
 L.h_ln_average_degree  -.26542979   3.9555217  -.06710361
 L.h_ln_partintactplat   .18804318   .14509212   1.2960261
      L2.h_ln_new_sign   .05962418   .11273503   .52888782
L2.h_ln_average_degree  -2.2735097   5.6858182   -.3998562
L2.h_ln_partintactplat   .10079906   .17293861   .58286035
      L3.h_ln_new_sign   .15808142   .08030015   1.9686318
L3.h_ln_average_degree    2.614323   3.0429631   .85913727
L3.h_ln_partintactplat  -.16686358   .14850551  -1.1236188
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                              b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00394315   .00188299   2.0940877
 L.h_ln_average_degree   1.6706226   .13230705    12.62686
 L.h_ln_partintactplat   .00457939   .00334246   1.3700665
      L2.h_ln_new_sign   .00274428   .00156203   1.7568679
L2.h_ln_average_degree  -.58034205   .19604447  -2.9602571
L2.h_ln_partintactplat  -.00701417   .00396339  -1.7697397
      L3.h_ln_new_sign  -.00181109   .00132414  -1.3677432
L3.h_ln_average_degree  -.11823344    .0866893  -1.3638758
L3.h_ln_partintactplat   .00309121   .00328634   .94062237
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                              b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .01840213   .03591621   .51236267
 L.h_ln_average_degree    1.122406   1.9282391   .58208859
 L.h_ln_partintactplat   .89201798   .07587284    11.75675
      L2.h_ln_new_sign  -.02020073   .03670627   -.5503347
L2.h_ln_average_degree  -.90944339   2.6364837  -.34494558
L2.h_ln_partintactplat   .16510297   .09307472   1.7738756
      L3.h_ln_new_sign  -.00981748   .03262239  -.30094308
L3.h_ln_average_degree  -.28206084    1.305207   -.2161043
L3.h_ln_partintactplat  -.09367413   .06893238  -1.3589279
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                         ln_new_sign  ln_average_degree  ln_partintactplat
      ln_new_sign           .1442086
ln_average_degree         -.00100474           .00005507
ln_partintactplat           .0054347           .00017654          .02489189

Residuals correlation matrix
```

	u1	u2	u3
u1	1.0000		
u2	-0.3567 0.0000	1.0000	
u3	0.0908 0.1955	0.1508 0.0309	1.0000

```
GMM finished : 12:15:58

Starting Monte-Carlo loop : 12:15:58 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 12:16:07
```



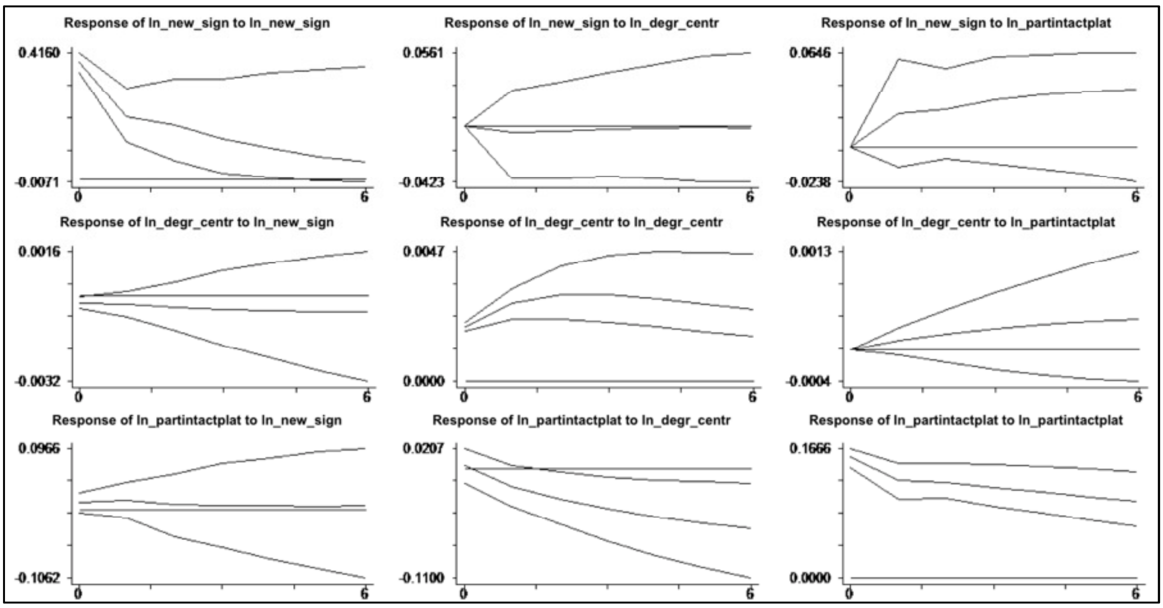
```
. pvar ln_new_sign ln_average_degree ln_partintactplat, lag(4) gmm monte 1000
GMM started : 12:18:20
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 200
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .43987757   .11038432   3.9849644
 L.h_ln_average_degree  -.58598974   4.2092517  -.13921471
 L.h_ln_partintactplat   .18897282    .1485602   1.2720286
      L2.h_ln_new_sign   .05827342   .10998762   .52981803
L2.h_ln_average_degree   .10489142   6.1792272   .01697484
L2.h_ln_partintactplat   .13013679   .19300658   .67426092
      L3.h_ln_new_sign   .11145903   .09318217   1.1961412
L3.h_ln_average_degree  -2.0362942   6.3979895  -.31827095
L3.h_ln_partintactplat  -.11821991    .1950063  -.60623635
      L4.h_ln_new_sign   .03050682   .07394971   .41253472
L4.h_ln_average_degree   2.6244989   3.5743908   .73425069
L4.h_ln_partintactplat  -.05622422   .17208891  -.32671609
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign    .0050749   .00193989   2.6160817
 L.h_ln_average_degree   1.6669163   .12877102   12.944809
 L.h_ln_partintactplat   .00609568   .00334524   1.8221947
      L2.h_ln_new_sign   .00186942   .00154085   1.2132382
L2.h_ln_average_degree  -.78048379   .19620294  -3.9779414
L2.h_ln_partintactplat  -.00886627   .00367379   -2.413385
      L3.h_ln_new_sign   .00024009   .00149101   .16102196
L3.h_ln_average_degree   .24641419    .1454703   1.6939141
L3.h_ln_partintactplat   .00765376   .00409365   1.8696665
      L4.h_ln_new_sign   .00014013    .0011999   .11678728
L4.h_ln_average_degree  -.16771573   .06457475  -2.5972338
L4.h_ln_partintactplat  -.00394731   .00366347  -1.0774795
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .01316062   .03471412    .3791142
 L.h_ln_average_degree   .60378911   2.0242346   .29828021
 L.h_ln_partintactplat   .89242281   .07666561   11.640458
      L2.h_ln_new_sign  -.00245863   .03404827  -.07221018
L2.h_ln_average_degree   1.8005354   2.9400464   .61241733
L2.h_ln_partintactplat   .15516077   .09470868   1.6382951
      L3.h_ln_new_sign  -.03510638   .03348424  -1.0484448
L3.h_ln_average_degree   -5.400698     2.62114  -2.0604386
L3.h_ln_partintactplat   .02453987    .0899985   .27266978
      L4.h_ln_new_sign   .00981634   .02907039   .33767485
L4.h_ln_average_degree   2.8867113   1.4175252   2.0364444
L4.h_ln_partintactplat  -.09486321   .06605287  -1.4361708
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                       ln_new_sign  ln_average_degree  ln_partintactplat
      ln_new_sign         .14552651
ln_average_degree        -.00098758           .00005237
ln_partintactplat         .00558897            .0001574          .02435955

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.3579   1.0000
             |   0.0000
             |
          u3 |   0.0939   0.1394   1.0000
             |   0.1859   0.0490
             |

GMM finished : 12:18:21

Starting Monte-Carlo loop : 12:18:23 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 12:18:32
```



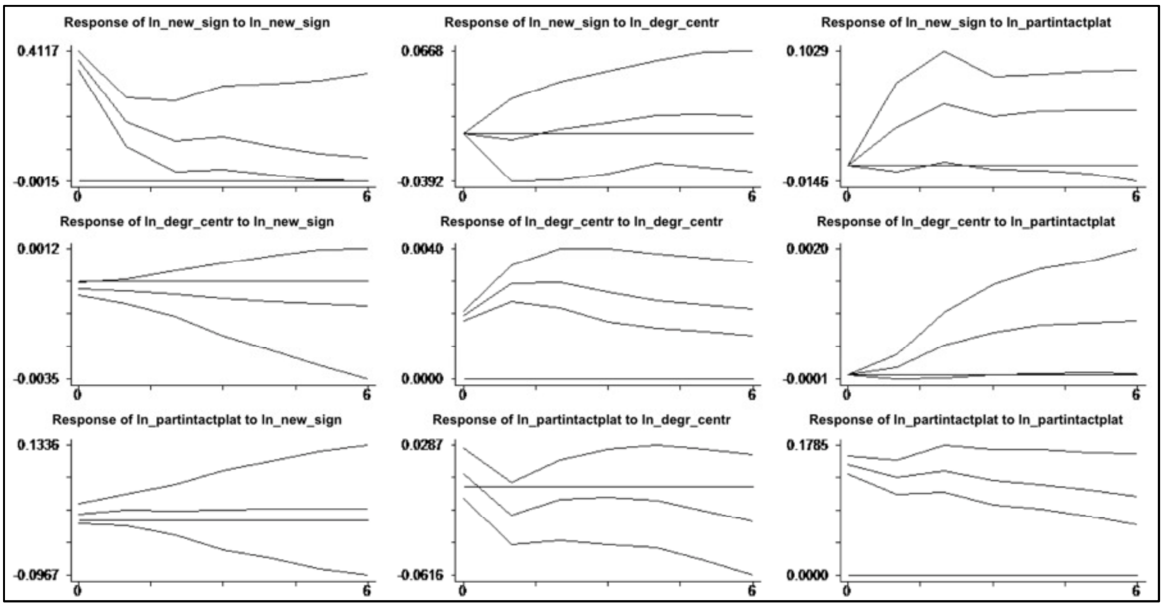
Appendix 25 Estimation Results PVAR(1)-(4) ln_new_signups ln_degree_centralization ln_partintactplat; Established Regions

```
. pvar ln_new_sign ln_degr_centr ln_partintactplat, lag(1) gmm monte 1000
GMM started : 12:30:08
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 215
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                           b_GMM     se_GMM      t_GMM
      L.h_ln_new_sign  .72165019  .16926809  4.2633564
    L.h_ln_degr_centr  1.9340415   3.436061  .56286587
L.h_ln_partintactplat  .11530043  .08141425  1.4162191
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                            b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign  -.00146865   .00077855  -1.8863788
    L.h_ln_degr_centr   .97473455   .02771962   35.164071
L.h_ln_partintactplat   .00124428   .00057368    2.168947
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                            b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign  -.00511963   .05922302  -.08644654
    L.h_ln_degr_centr  -2.4191546   1.6119182  -1.5007924
L.h_ln_partintactplat   .94704543   .03541399   26.742131
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                        ln_new_sign      ln_degr_centr  ln_partintactplat
      ln_new_sign         .15633086
    ln_degr_centr        -.00016319          5.482e-06
ln_partintactplat         .00326253          5.352e-06          .02577432

Residuals correlation matrix

             |      u1       u2       u3
_____________|___________________________
          u1 |   1.0000
             |
             |
          u2 |  -0.1758   1.0000
             |   0.0098
             |
          u3 |   0.0514   0.0143   1.0000
             |   0.4534   0.8354
             |

GMM finished : 12:30:11

Starting Monte-Carlo loop : 12:30:12 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 12:30:19
```

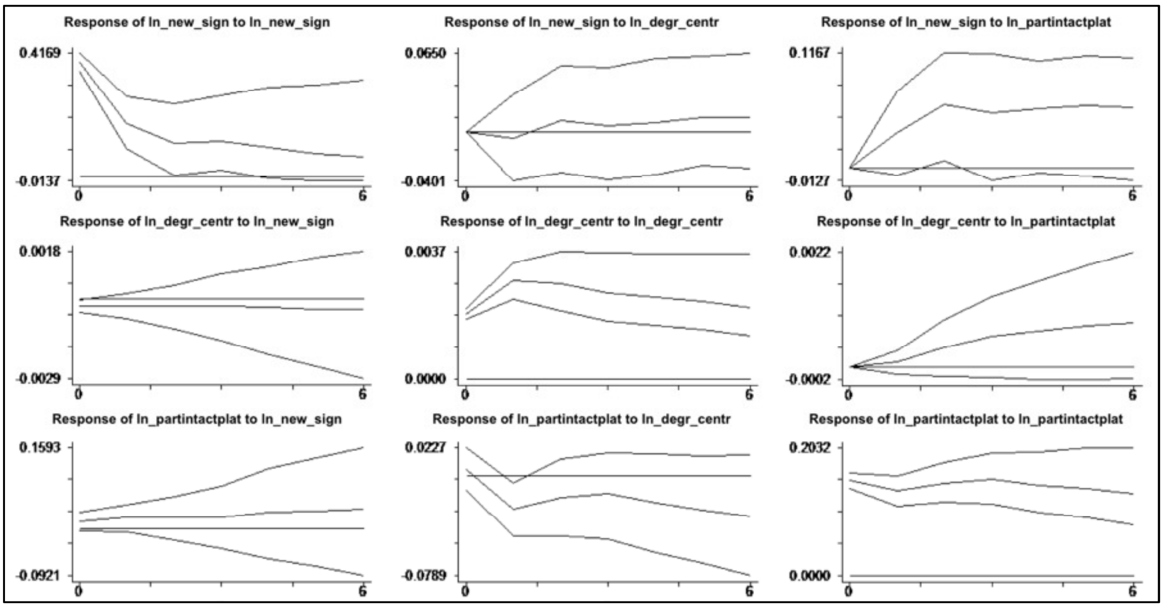
```
. pvar ln_new_sign ln_degr_centr ln_partintactplat, lag(2) gmm monte 1000
GMM started : 12:35:59
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 210
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .53332122   .13304738   4.0085061
     L.h_ln_degr_centr  -2.6877263   9.8718508  -.27226165
 L.h_ln_partintactplat   .14926807   .14476472    1.031108
      L2.h_ln_new_sign    .1762583    .1098094   1.6051295
    L2.h_ln_degr_centr   4.5961344   10.337226    .4446197
L2.h_ln_partintactplat  -.03024121    .1140267  -.26521165
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00011381   .00053627   .21222457
     L.h_ln_degr_centr   1.4280636    .1624447   8.7910755
 L.h_ln_partintactplat   .00075885    .0007496   1.0123432
      L2.h_ln_new_sign   -.0002897    .0004183  -.69254866
    L2.h_ln_degr_centr  -.46451236   .16661744  -2.7878976
L2.h_ln_partintactplat  -.00042273   .00050765  -.83272244
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00919791   .04028539    .2283188
     L.h_ln_degr_centr  -10.353443   3.9933071   -2.592699
 L.h_ln_partintactplat   .80861181   .08296464   9.7464631
      L2.h_ln_new_sign  -.02492877   .03750525  -.66467425
    L2.h_ln_degr_centr   6.6961721   3.7091698   1.8053021
L2.h_ln_partintactplat   .14486873   .06794418   2.1321726
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                         ln_new_sign      ln_degr_centr  ln_partintactplat
      ln_new_sign          .14829558
    ln_degr_centr         -.00010298           4.035e-06
ln_partintactplat          .00436457           3.546e-06          .02440747

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1331   1.0000
             |   0.0540
             |
          u3 |   0.0725   0.0113   1.0000
             |   0.2958   0.8707
             |

GMM finished : 12:36:01

Starting Monte-Carlo loop : 12:36:02 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 12:36:09
```



```
. pvar ln_new_sign ln_degr_centr ln_partintactplat, lag(3) gmm monte 1000
GMM started : 12:38:24
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 205
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .48020067   .12948706    3.708484
     L.h_ln_degr_centr  -3.5708234   10.380694  -.34398696
 L.h_ln_partintactplat   .22456758   .15950445   1.4079079
      L2.h_ln_new_sign   .08858112    .1108215    .7993135
    L2.h_ln_degr_centr   10.300113   16.685236   .61731897
L2.h_ln_partintactplat   .06169196   .17604774   .35042742
      L3.h_ln_new_sign   .15783612    .0894935   1.7636602
    L3.h_ln_degr_centr  -3.7583188   10.383533   -.3619499
L3.h_ln_partintactplat  -.17148203    .1449004  -1.1834476
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00004416   .00047972   .09206141
     L.h_ln_degr_centr   1.5006724   .15288538   9.8156697
 L.h_ln_partintactplat   .00082332   .00079538   1.0351259
      L2.h_ln_new_sign  -.00035753   .00034318  -1.0418126
    L2.h_ln_degr_centr  -.73038071   .22669286  -3.2218955
L2.h_ln_partintactplat    .0010525   .00115212   .91353558
      L3.h_ln_new_sign  -.00026412   .00034253  -.77109046
    L3.h_ln_degr_centr   .20031434   .11018284   1.8180175
L3.h_ln_partintactplat  -.00113552   .00120515  -.94222338
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .01171817   .03622822   .32345421
     L.h_ln_degr_centr  -14.026956   4.4659146  -3.1408921
 L.h_ln_partintactplat   .88521988   .08062718   10.979175
      L2.h_ln_new_sign  -.00411417    .0321966  -.12778274
    L2.h_ln_degr_centr   24.858029   8.7789862   2.8315376
L2.h_ln_partintactplat   .16872382   .08541331   1.9753808
      L3.h_ln_new_sign  -.00278587   .03702042  -.07525236
    L3.h_ln_degr_centr  -13.689608   6.4010952  -2.1386353
L3.h_ln_partintactplat  -.11089354   .06676536  -1.6609443
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                       ln_new_sign      ln_degr_centr  ln_partintactplat
     ln_new_sign           .1469215
   ln_degr_centr         -.00009804          3.870e-06
ln_partintactplat          .00456623          .00001322          .02337532

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1300   1.0000
             |   0.0632
             |
          u3 |   0.0778   0.0440   1.0000
             |   0.2673   0.5313
             |

GMM finished : 12:38:25

Starting Monte-Carlo loop : 12:38:26 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 12:38:35
```



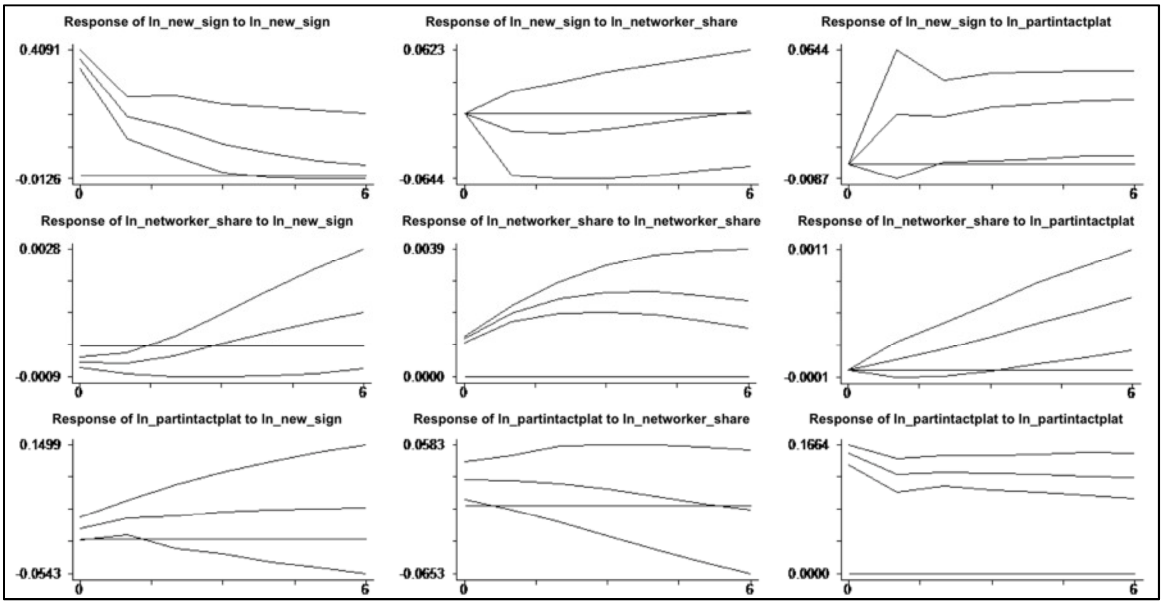
```
. pvar ln_new_sign ln_degr_centr ln_partintactplat, lag(4) gmm monte 1000
GMM started : 12:40:51
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 200
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                              b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .45365999   .12977886   3.4956386
     L.h_ln_degr_centr  -3.3801538   11.213611  -.30143313
 L.h_ln_partintactplat   .23476076    .1771358   1.3253151
      L2.h_ln_new_sign   .07099498   .11264508   .63025367
    L2.h_ln_degr_centr   14.304152   19.799334   .72245624
L2.h_ln_partintactplat   .11126557   .19945687   .55784277
      L3.h_ln_new_sign   .12953595   .09107634   1.4222789
    L3.h_ln_degr_centr   -11.99946   21.153588  -.56725413
L3.h_ln_partintactplat  -.16943552   .18869724   -.8979226
      L4.h_ln_new_sign   .03001797   .07966202   .37681657
    L4.h_ln_degr_centr   5.1885943   12.970185   .40004012
L4.h_ln_partintactplat   -.0395971   .15258401  -.25951017
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                              b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00022991   .00050435   .45586062
     L.h_ln_degr_centr   1.4998093    .1497731   10.013876
 L.h_ln_partintactplat   .00062017   .00086153   .71985038
      L2.h_ln_new_sign   -.0002939   .00032698  -.89884638
    L2.h_ln_degr_centr  -.80031507    .2314829    -3.45734
L2.h_ln_partintactplat    .0009645   .00122971   .78432628
      L3.h_ln_new_sign   .00001908    .0003542   .05387742
    L3.h_ln_degr_centr   .36173392   .16253437   2.2255842
L3.h_ln_partintactplat  -.00090524   .00150483  -.60155655
      L4.h_ln_new_sign  -.00021513   .00027169  -.79183158
    L4.h_ln_degr_centr  -.10184215    .0856222  -1.1894363
L4.h_ln_partintactplat  -.00010008    .0009437  -.10605326
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                              b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .01422663   .03509128   .40541777
     L.h_ln_degr_centr  -16.174643   4.4165824  -3.6622531
 L.h_ln_partintactplat   .88737462   .08443181   10.509956
      L2.h_ln_new_sign  -.00288353   .03129225  -.09214843
    L2.h_ln_degr_centr   26.961652   9.6230966   2.8017646
L2.h_ln_partintactplat   .18611184   .09470457   1.9651834
      L3.h_ln_new_sign  -.00346993   .03405612   -.1018887
    L3.h_ln_degr_centr  -13.909909   10.427056  -1.3340208
L3.h_ln_partintactplat   .00316536   .08422086   .03758406
      L4.h_ln_new_sign   .01890633   .03073966   .61504665
    L4.h_ln_degr_centr   .34709047   5.0450438   .06879831
L4.h_ln_partintactplat  -.13219106   .05981338  -2.2100584
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                         ln_new_sign      ln_degr_centr  ln_partintactplat
      ln_new_sign           .1494776
    ln_degr_centr         -.00009038          3.764e-06
ln_partintactplat          .00529758          6.969e-06          .02319939

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1205   1.0000
             |   0.0892
             |
          u3 |   0.0899   0.0236   1.0000
             |   0.2054   0.7404
             |

GMM finished : 12:40:53

Starting Monte-Carlo loop : 12:40:54 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 12:41:03
```



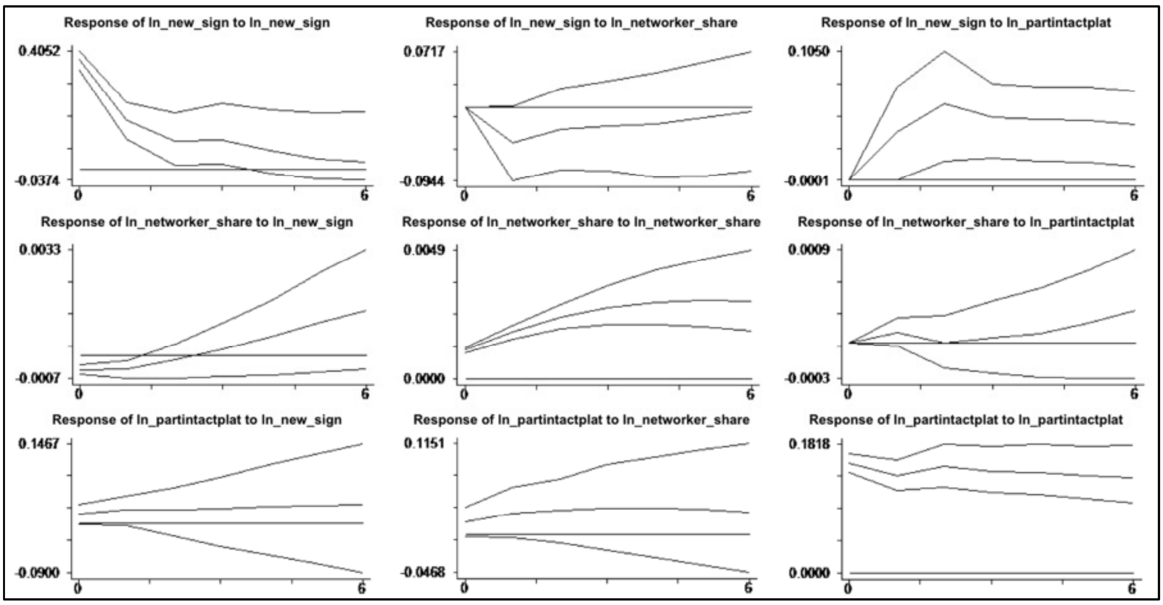
Appendix 26 Estimation Results PVAR(1)-(4) ln_new_signups ln_networker_share ln_partintactplat; Established Regions

```
. pvar ln_new_sign ln_networker_share ln_partintactplat, lag(1) gmm monte 1000
GMM started : 13:09:28
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 215
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                            b_GMM     se_GMM      t_GMM
       L.h_ln_new_sign  .66769916  .12874722  5.1861249
L.h_ln_networker_share  2.7138077  4.1545464  .65321395
 L.h_ln_partintactplat  .09679979  .05448259  1.7767105
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.00096323   .00066886  -1.4401024
L.h_ln_networker_share    .9190884   .01375701   66.808721
 L.h_ln_partintactplat    .0013565   .00023934   5.6677167
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00303843   .05159281   .05889241
L.h_ln_networker_share  -1.8476075   1.5803142  -1.1691393
 L.h_ln_partintactplat   .98111238   .02373972   41.327884
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                      ln_new_sign  ln_networker_share   ln_partintactplat
       ln_new_sign      .15266389
ln_networker_share     -.00027662           3.524e-06
 ln_partintactplat       .0041017            .0000372           .02629028

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.3782   1.0000
             |   0.0000
             |
          u3 |   0.0649   0.1224   1.0000
             |   0.3440   0.0733
             |

GMM finished : 13:09:30

Starting Monte-Carlo loop : 13:09:31 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 13:09:37
```

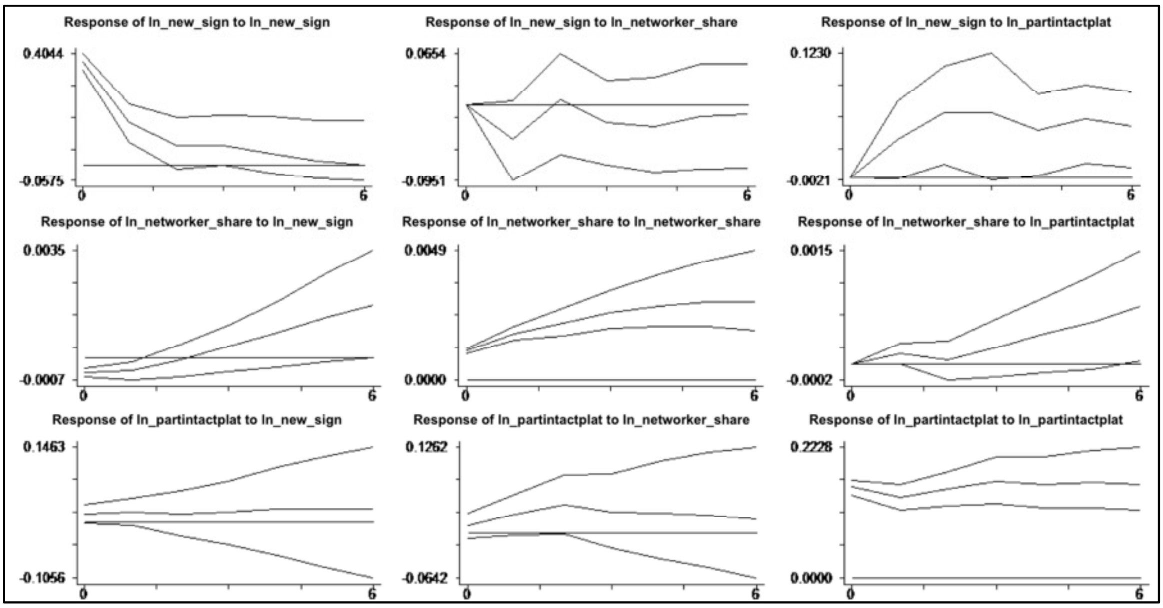
```
. pvar ln_new_sign ln_networker_share ln_partintactplat, lag(2) gmm monte 1000
GMM started : 13:36:54
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 210
-------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .46883031   .12264475   3.8226693
 L.h_ln_networker_share  -19.887231   22.540329  -.88229549
  L.h_ln_partintactplat   .17941497   .14216707   1.2620009
       L2.h_ln_new_sign   .15531861   .09686772   1.6034094
L2.h_ln_networker_share    21.14656   20.886235    1.012464
 L2.h_ln_partintactplat  -.05027424   .12779585  -.39339495
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .00070381   .00036171   1.9457745
 L.h_ln_networker_share   1.6512266   .09406502   17.554099
  L.h_ln_partintactplat    .0006128   .00060134   1.0190508
       L2.h_ln_new_sign   .00023964    .0002565   .93429918
L2.h_ln_networker_share  -.69154113   .08621409  -8.0212082
 L2.h_ln_partintactplat  -.00042835   .00061831  -.69277325
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .05365232   .04771129   1.1245205
 L.h_ln_networker_share   2.3521694    12.09354     .194498
  L.h_ln_partintactplat   .82420731   .07643444   10.783193
       L2.h_ln_new_sign  -.01116398    .0345072  -.32352615
L2.h_ln_networker_share  -5.2337923    11.22792  -.46614087
 L2.h_ln_partintactplat   .15436838   .07531863   2.0495379
-------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                          ln_new_sign  ln_networker_share   ln_partintactplat
       ln_new_sign          .14433374
ln_networker_share         -.00018356           1.546e-06
 ln_partintactplat          .00632788           .00002079           .02502069

Residuals correlation matrix

             |       u1       u2       u3
-------------+----------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.3891   1.0000
             |   0.0000
             |
          u3 |   0.1053   0.1057   1.0000
             |   0.1283   0.1267
             |

GMM finished : 13:36:56

Starting Monte-Carlo loop : 13:36:56 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 13:37:04
```



```
. pvar ln_new_sign ln_networker_share ln_partintactplat, lag(3) gmm monte 1000
GMM started : 13:39:56
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 205
---------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                            b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .38477427   .11559375   3.3286771
 L.h_ln_networker_share  -43.912392   26.343881  -1.6668915
  L.h_ln_partintactplat   .25550715   .14585507   1.7517878
       L2.h_ln_new_sign   .07725233   .11802523   .65454079
L2.h_ln_networker_share   53.572449   33.623743   1.5932922
 L2.h_ln_partintactplat   .10583969   .16781423   .63069559
       L3.h_ln_new_sign   .15340679   .07962633   1.9265838
L3.h_ln_networker_share   -8.563177   18.802367   -.4554308
 L3.h_ln_partintactplat  -.22091272   .14799602  -1.4926937
---------------------------------------------------------------------------
---------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                            b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .00072257   .00030845   2.3425702
 L.h_ln_networker_share   1.5844882   .12115882   13.077779
  L.h_ln_partintactplat   .00068993   .00055548   1.2420387
       L2.h_ln_new_sign    .0007111   .00032668   2.1767234
L2.h_ln_networker_share  -.38601456   .17759403  -2.1735784
 L2.h_ln_partintactplat  -.00187145   .00073443    -2.54818
       L3.h_ln_new_sign  -.00005693   .00023568  -.24154926
L3.h_ln_networker_share  -.23453532   .08577194  -2.7344063
 L3.h_ln_partintactplat   .00107792     .000572   1.8844693
---------------------------------------------------------------------------
---------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                            b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .03763072   .04202022   .89553842
 L.h_ln_networker_share   11.412332    14.59377   .78200025
  L.h_ln_partintactplat    .8861889   .07708436   11.496351
       L2.h_ln_new_sign  -.01857011   .04017635  -.46221492
L2.h_ln_networker_share  -13.645089   20.435225   -.6677239
 L2.h_ln_partintactplat   .16536123   .09472762   1.7456496
       L3.h_ln_new_sign   -.0062341   .03251066  -.19175559
L3.h_ln_networker_share   1.1651016   10.626605   .10964005
 L3.h_ln_partintactplat  -.08390016   .06917274  -1.2129078
---------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                        ln_new_sign  ln_networker_share   ln_partintactplat
       ln_new_sign           .14099604
ln_networker_share          -.00017376           1.474e-06
 ln_partintactplat           .00646813           .00001014           .02469379

Residuals correlation matrix

             |     u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.3812   1.0000
             |   0.0000
             |
          u3 |   0.1097   0.0532   1.0000
             |   0.1174   0.4490
             |

GMM finished : 13:39:58

Starting Monte-Carlo loop : 13:39:59 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 13:40:07
```



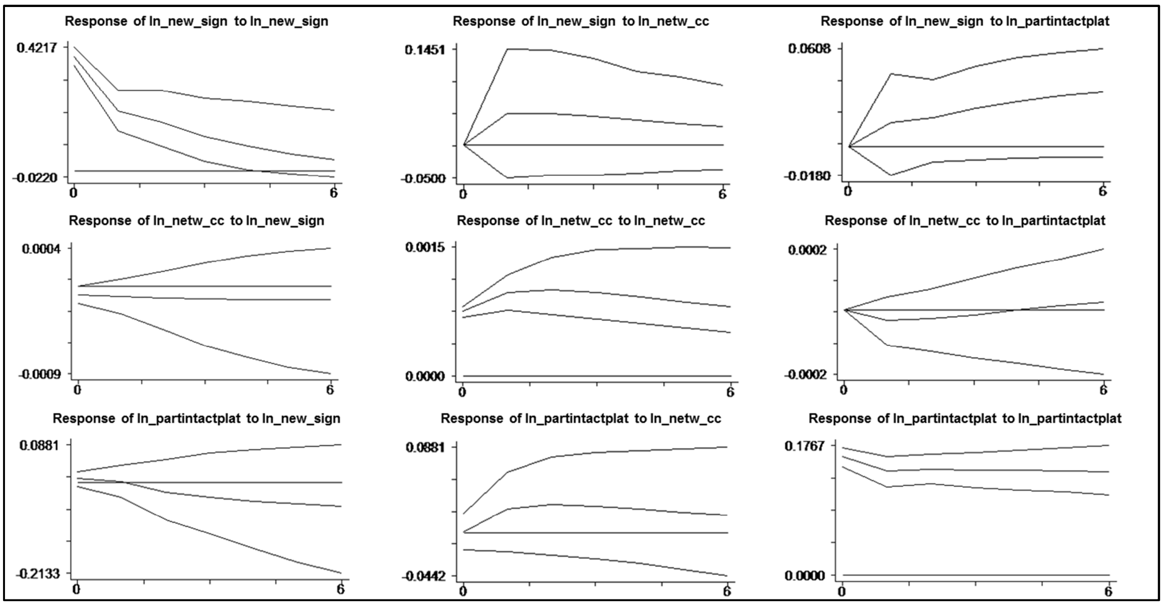
```
. pvar ln_new_sign ln_networker_share ln_partintactplat, lag(4) gmm monte 1000
GMM started : 13:41:54
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 200
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .34984202   .11735581   2.9810371
 L.h_ln_networker_share  -40.137944   26.800925  -1.4976328
  L.h_ln_partintactplat   .24114587    .1504895   1.6024099
       L2.h_ln_new_sign   .07408959   .11819407   .62684694
L2.h_ln_networker_share   74.897906   34.529003   2.1691303
 L2.h_ln_partintactplat   .15045929   .17672453   .85137751
       L3.h_ln_new_sign   .06930688   .09535515   .72682886
L3.h_ln_networker_share  -71.248726   34.764971  -2.0494401
 L3.h_ln_partintactplat  -.16923286   .19289426  -.87733489
       L4.h_ln_new_sign   .01222659    .0689963   .17720652
L4.h_ln_networker_share   38.377469   23.860988   1.6083772
 L4.h_ln_partintactplat  -.04927364   .19386036  -.25417079
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                             b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .00083767   .00031713   2.6413789
 L.h_ln_networker_share   1.5726636   .12360266   12.723542
  L.h_ln_partintactplat   .00090028   .00058207   1.5466755
       L2.h_ln_new_sign    .0006201   .00033156   1.8702205
L2.h_ln_networker_share  -.54278304   .17254019  -3.1458354
 L2.h_ln_partintactplat  -.00205702   .00074206  -2.7720332
       L3.h_ln_new_sign   .00037183   .00026774    1.388739
L3.h_ln_networker_share   .13525058   .17843623   .75797711
 L3.h_ln_partintactplat   .00181341   .00073827   2.4562921
       L4.h_ln_new_sign   .00004859   .00022215   .21871412
L4.h_ln_networker_share   -.2026886   .09343011  -2.1694142
 L4.h_ln_partintactplat  -.00084603   .00065247  -1.2966602
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                             b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .03541643   .04021721   .88062884
 L.h_ln_networker_share   15.628009    14.23477   1.0978757
  L.h_ln_partintactplat    .8879307   .07727997    11.48979
       L2.h_ln_new_sign  -.01713003   .03892656   -.4400601
L2.h_ln_networker_share  -9.7927476   21.351032  -.45865453
 L2.h_ln_partintactplat   .16706606   .09652615   1.7307855
       L3.h_ln_new_sign   -.0397358   .03492729  -1.1376719
L3.h_ln_networker_share  -24.939695    18.45953  -1.3510472
 L3.h_ln_partintactplat    .0350977   .09175229   .38252663
       L4.h_ln_new_sign   .00913952   .02760899   .33103403
L4.h_ln_networker_share   18.355785   9.2768477   1.9786662
 L4.h_ln_partintactplat  -.10986755   .07140568  -1.5386389
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                      ln_new_sign  ln_networker_share   ln_partintactplat
       ln_new_sign       .1411053
ln_networker_share     -.00017959           1.501e-06
 ln_partintactplat      .00605727           5.064e-06           .02442942

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |  1.0000
             |
             |
          u2 | -0.3904   1.0000
             |  0.0000
             |
          u3 |  0.1032   0.0265   1.0000
             |  0.1457   0.7097
             |

GMM finished : 13:41:56

Starting Monte-Carlo loop : 13:41:58 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 13:42:08
```



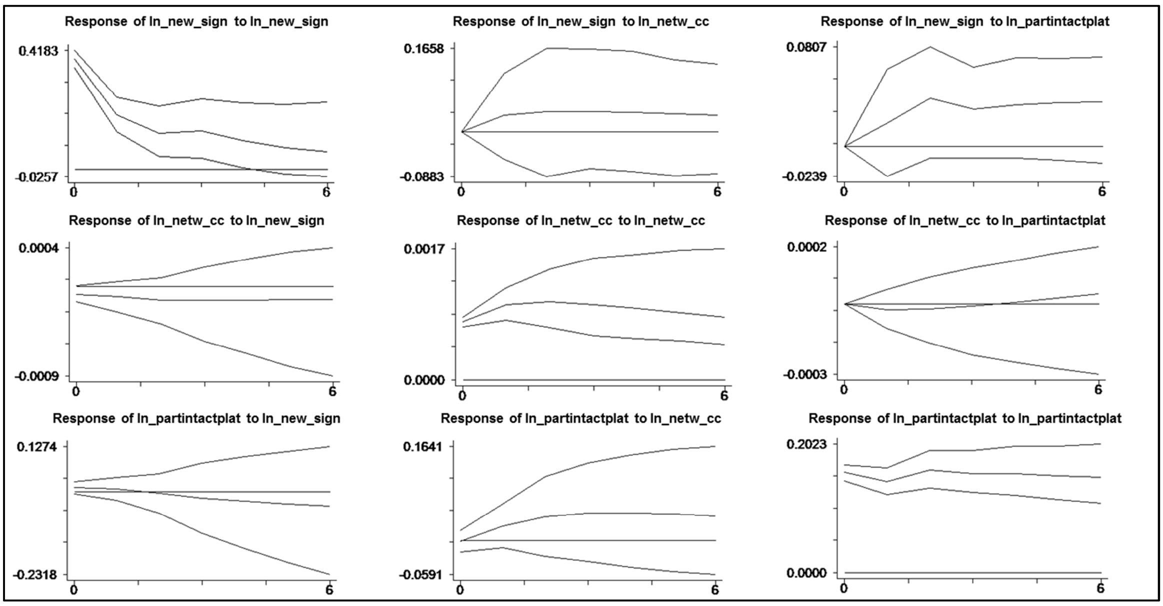
Appendix 27 Estimation Results PVAR(1)-(4) ln_new_signups ln_network_cc ln_partintactplat; Established Regions

```
. pvar ln_new_sign ln_netw_cc ln_partintactplat, lag(1) gmm monte 1000
GMM started : 13:50:08
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 215
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                           b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign  .70410878   .1267356    5.55573
       L.h_ln_netw_cc  2.5816032  4.6202782  .55875493
L.h_ln_partintactplat  .09105554  .05810366  1.5671221
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                            b_GMM       se_GMM        t_GMM
      L.h_ln_new_sign   .01008065    .0056942    1.770336
       L.h_ln_netw_cc   .57432863   .30016925   1.9133494
L.h_ln_partintactplat  -.00207456   .00201626  -1.0289191
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                            b_GMM       se_GMM        t_GMM
      L.h_ln_new_sign  -.03968938   .06126874  -.64779167
       L.h_ln_netw_cc  -1.0731904   1.5327261  -.70018409
L.h_ln_partintactplat   .98858187   .02731888   36.186768
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                       ln_new_sign         ln_netw_cc  ln_partintactplat
      ln_new_sign          .1588285
       ln_netw_cc         .00061327          .00024768
ln_partintactplat         .00124538         -.00002683          .02767511

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0972   1.0000
             |   0.1557
             |
          u3 |   0.0191  -0.0100   1.0000
             |   0.7809   0.8847
             |

GMM finished : 13:50:12

Starting Monte-Carlo loop : 13:50:13 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 13:50:19
```

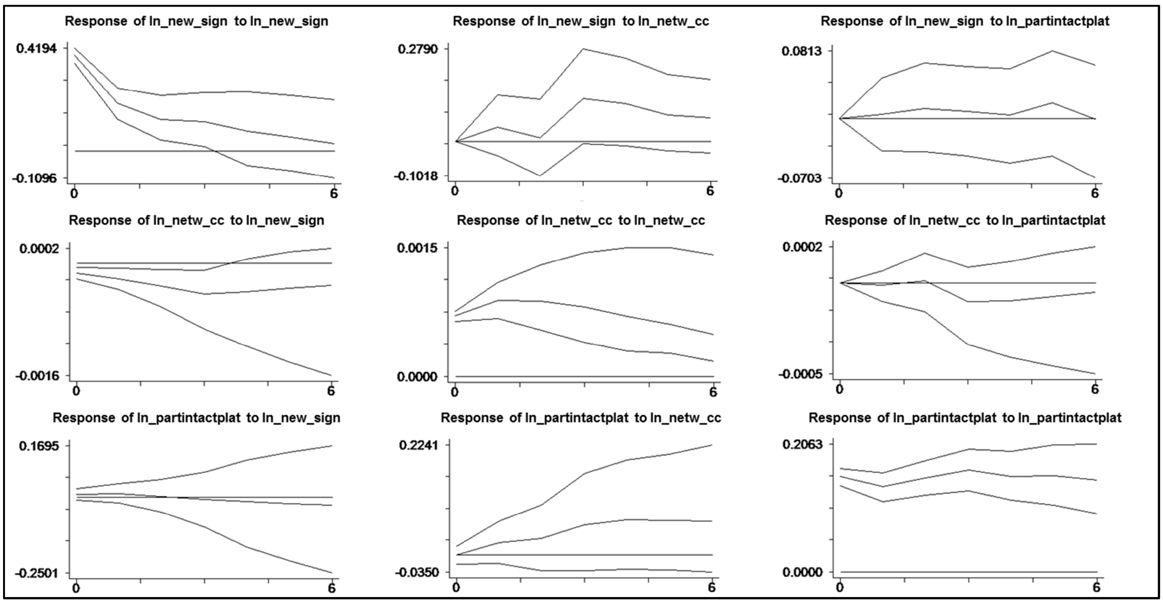
```
. pvar ln_new_sign ln_netw_cc ln_partintactplat, lag(2) gmm monte 1000
GMM started : 13:59:11
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 210
--------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .55441012   .10413416   5.3239985
        L.h_ln_netw_cc   .24986518   3.3463072   .07466893
 L.h_ln_partintactplat   .10477613   .11655992   .89890363
      L2.h_ln_new_sign   .18576864   .08701619   2.1348744
       L2.h_ln_netw_cc   .77299691    3.069888   .25179972
L2.h_ln_partintactplat  -.02427511   .11084596  -.21899859
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00476477   .00267829   1.7790311
        L.h_ln_netw_cc   .33090723   .25297542   1.3080608
 L.h_ln_partintactplat  -.00012555   .00199009  -.06308799
      L2.h_ln_new_sign   .00317433   .00213049   1.4899526
       L2.h_ln_netw_cc   .33625629   .24152017   1.3922493
L2.h_ln_partintactplat  -.00166108   .00206128  -.80585033
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.01868962   .04810565  -.38851192
        L.h_ln_netw_cc  -.60410078   1.0375305  -.58224872
 L.h_ln_partintactplat   .88827235   .07127371   12.462832
      L2.h_ln_new_sign  -.05161047   .04228556  -1.2205223
       L2.h_ln_netw_cc  -.19296277   .90912554  -.21225097
L2.h_ln_partintactplat   .11746114   .07037447   1.6690873
--------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                      ln_new_sign         ln_netw_cc  ln_partintactplat
      ln_new_sign          .15001933
       ln_netw_cc          .00034069          .00021644
ln_partintactplat          .00302743          .00002101          .02725511

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0595   1.0000
             |   0.3910
             |
          u3 |   0.0476   0.0088   1.0000
             |   0.4926   0.8986
             |

GMM finished : 13:59:14

Starting Monte-Carlo loop : 13:59:15 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 13:59:22
```



```
. pvar ln_new_sign ln_netw_cc ln_partintactplat, lag(3) gmm monte 1000
GMM started : 14:20:25
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 205
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                              b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .49890834   .09599368   5.1973042
        L.h_ln_netw_cc  -2.0737107   2.0697012  -1.0019373
 L.h_ln_partintactplat   .14994073   .13145161   1.1406534
      L2.h_ln_new_sign    .0978071   .09322238   1.0491804
       L2.h_ln_netw_cc  -1.6129028   1.7868897  -.90263143
L2.h_ln_partintactplat   .08235046   .17593222   .46808062
      L3.h_ln_new_sign   .15389175   .08538443   1.8023397
       L3.h_ln_netw_cc   5.1965237    1.615689   3.2162897
L3.h_ln_partintactplat   -.1639315   .14230806  -1.1519481
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                              b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00308221   .00178247   1.7291768
        L.h_ln_netw_cc   .22514462   .18367291   1.2257911
 L.h_ln_partintactplat    .0001513   .00218004   .06940182
      L2.h_ln_new_sign   .00139331   .00102012   1.3658229
       L2.h_ln_netw_cc   .22809766    .1778823   1.2822954
L2.h_ln_partintactplat  -.00421836   .00379496  -1.1115686
      L3.h_ln_new_sign   .00205238   .00172522   1.1896333
       L3.h_ln_netw_cc   .23217186   .17869901   1.2992342
L3.h_ln_partintactplat   .00262579   .00326289   .80474484
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                              b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.00944905   .04345737  -.21743274
        L.h_ln_netw_cc  -.55235543   .91560041  -.60327128
 L.h_ln_partintactplat   .93600312   .06932867   13.500954
      L2.h_ln_new_sign  -.03018437   .03148825  -.95859174
       L2.h_ln_netw_cc  -.12508165   .74117585  -.16876109
L2.h_ln_partintactplat    .1770385   .09316556    1.900257
      L3.h_ln_new_sign  -.01536493   .04645124  -.33077535
       L3.h_ln_netw_cc   .04534718   .62328527    .0727551
L3.h_ln_partintactplat  -.11859132    .0690995  -1.7162398
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                      ln_new_sign         ln_netw_cc  ln_partintactplat
      ln_new_sign          .14170137
       ln_netw_cc          7.592e-06            .000203
ln_partintactplat          .00338272          .00007793           .0260849

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |  1.0000
             |
             |
          u2 |  0.0013   1.0000
             |  0.9851
             |
          u3 |  0.0557   0.0339   1.0000
             |  0.4276   0.6294
             |

GMM finished : 14:20:27

Starting Monte-Carlo loop : 14:20:28 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 14:20:36
```



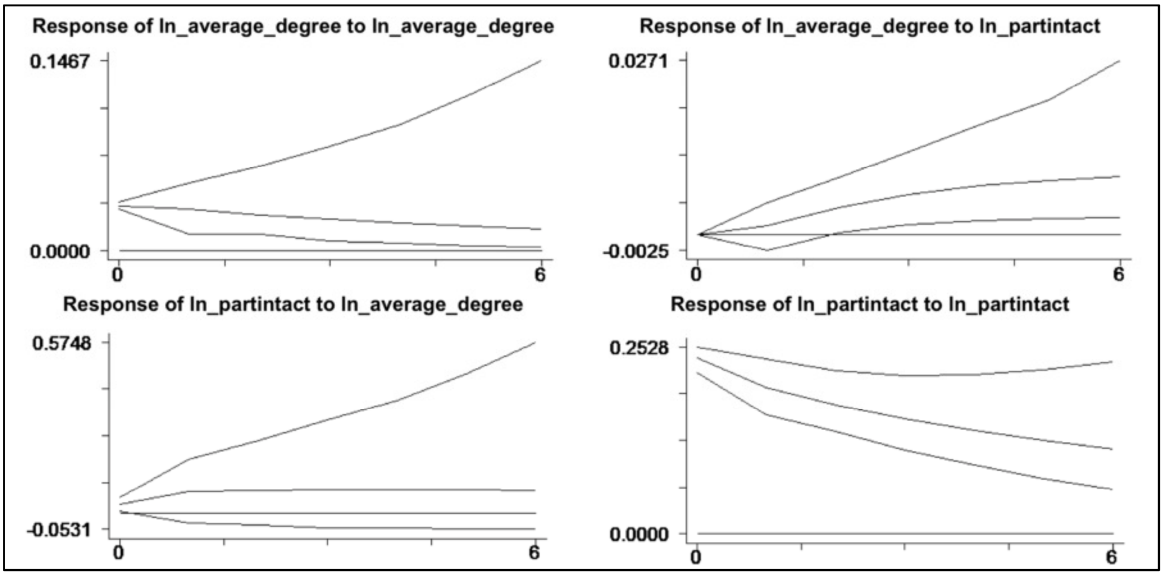
```
. pvar ln_new_sign ln_netw_cc ln_partintactplat, lag(4) gmm monte 1000
GMM started : 14:35:16
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 200
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                          b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .49605048   .09810954   5.0560882
        L.h_ln_netw_cc  -1.9607324   1.9450459  -1.0080648
 L.h_ln_partintactplat   .13316677   .13407684   .99321232
      L2.h_ln_new_sign   .08313406   .09649101   .86157317
       L2.h_ln_netw_cc  -1.5115137   1.6494743  -.91636087
L2.h_ln_partintactplat   .12440825   .19631788   .63370823
      L3.h_ln_new_sign   .13464996   .08896892   1.5134494
       L3.h_ln_netw_cc   5.3343598   1.4497926   3.6793953
L3.h_ln_partintactplat  -.20672057   .18489305  -1.1180548
      L4.h_ln_new_sign   .03681708   .07336796    .5018142
       L4.h_ln_netw_cc  -.95321078   1.2222955  -.77985295
L4.h_ln_partintactplat   .01599308   .14591408   .10960614
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                          b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00182806   .00171371   1.0667255
        L.h_ln_netw_cc   .18334263   .15124492   1.2122233
 L.h_ln_partintactplat   .00057007    .0016589   .34364371
      L2.h_ln_new_sign   .00224432   .00158893   1.4124735
       L2.h_ln_netw_cc   .18298226   .14433504   1.2677605
L2.h_ln_partintactplat  -.00513287   .00552527  -.92897991
      L3.h_ln_new_sign   .00393151   .00353191   1.1131391
       L3.h_ln_netw_cc   .18401851   .14576308   1.2624494
L3.h_ln_partintactplat   .00094015   .00293762   .32003633
      L4.h_ln_new_sign  -.00431622   .00456725  -.94503675
       L4.h_ln_netw_cc   .18537197   .15057345   1.2311066
L4.h_ln_partintactplat   .00306198   .00275047   1.1132557
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                          b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00334758   .04499267   .07440282
        L.h_ln_netw_cc  -.54980285   .87939948  -.62520261
 L.h_ln_partintactplat   .92832314   .07114369   13.048566
      L2.h_ln_new_sign  -.02548402   .02982638  -.85441222
       L2.h_ln_netw_cc  -.15392516   .65858627  -.23372058
L2.h_ln_partintactplat   .19394551   .10048457   1.9301024
      L3.h_ln_new_sign  -.00899816   .03820576   -.2355183
       L3.h_ln_netw_cc   .02180208   .51593446   .04225745
L3.h_ln_partintactplat  -.01099341   .08842362   -.1243266
      L4.h_ln_new_sign   .01455817   .03793475   .38376858
       L4.h_ln_netw_cc   -.1454659   .59056527  -.24631637
L4.h_ln_partintactplat   -.1261572   .06541952  -1.9284337
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                    ln_new_sign         ln_netw_cc  ln_partintactplat
      ln_new_sign          .14360106
       ln_netw_cc          .00003985          .00019558
ln_partintactplat          .00416372          .00012982           .0257186

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0074   1.0000
             |   0.9171
             |
          u3 |   0.0686   0.0579   1.0000
             |   0.3347   0.4153
             |

GMM finished : 14:35:18

Starting Monte-Carlo loop : 14:35:19 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 14:35:28
```



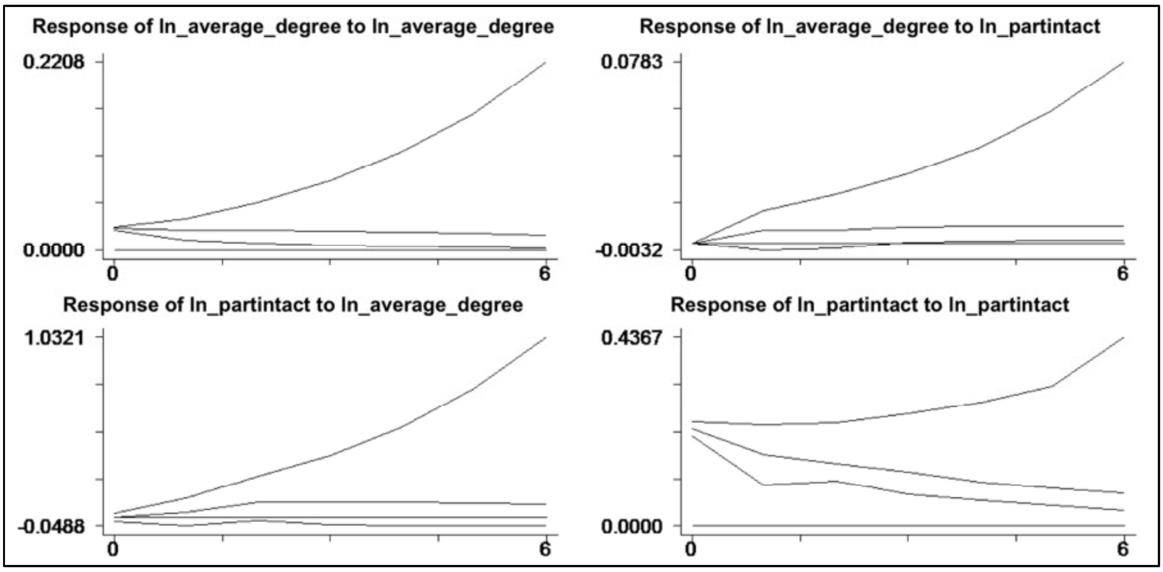
Appendix 28 Estimation Results PVAR(1)-(4) ln_average_degree ln_partintact; New Regions

```
. pvar ln_average_degree ln_partintact, lag(1) gmm monte 1000
GMM started : 15:00:26
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 272
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                           b_GMM      se_GMM       t_GMM
L.h_ln_average_degree  .92542288  .12997255  7.1201409
    L.h_ln_partintact   .0181369  .00633922  2.8610592
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                           b_GMM      se_GMM       t_GMM
L.h_ln_average_degree  1.2861758  .93846964  1.3705033
    L.h_ln_partintact  .91015128   .0662416  13.739875
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree      ln_partintact
ln_average_degree          .0016681
    ln_partintact         .00454766          .17579259

Residuals correlation matrix

             |        u1        u2
_____________|__________________
          u1 |    1.0000
             |
             |
          u2 |    0.2647    1.0000
             |    0.0000
             |

GMM finished : 15:00:27

Starting Monte-Carlo loop : 15:00:28 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 15:00:34
```

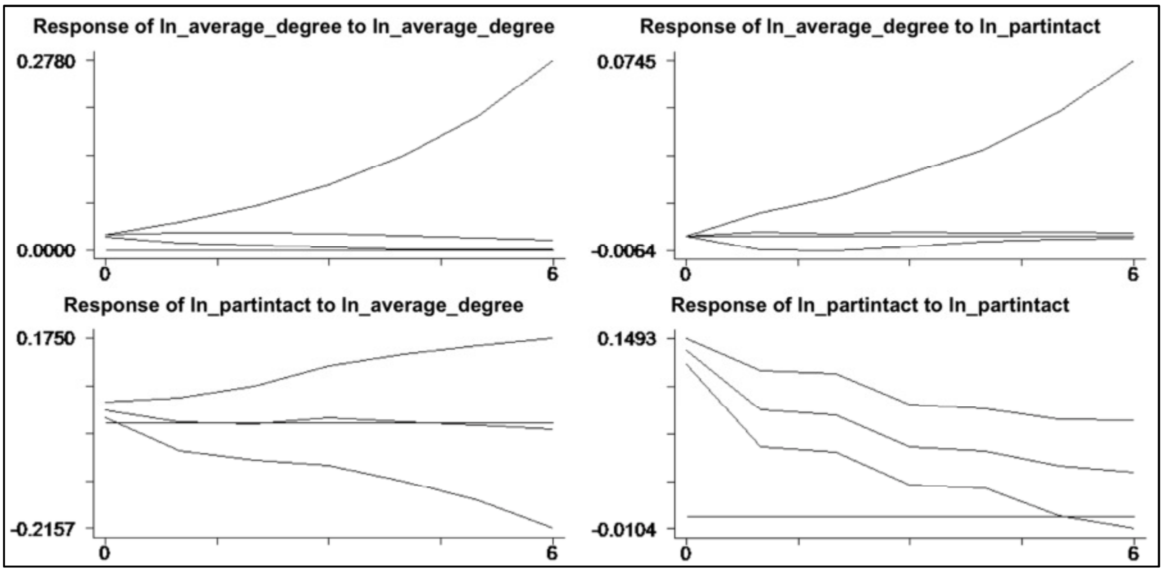
```
. pvar ln_average_degree ln_partintact, lag(2) gmm monte 1000
GMM started : 15:26:02
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 264
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                            b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   .92356526   .32325489   2.8570806
     L.h_ln_partintact   .00584354   .00955415   .61162377
L2.h_ln_average_degree  -.07399879   .17382027  -.42572014
    L2.h_ln_partintact   .00713864    .0101417   .70389022
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                            b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.3646947   1.7814611   .76605362
     L.h_ln_partintact   .83093162   .08731545   9.5164332
L2.h_ln_average_degree   -.7898035    1.028947  -.76758421
    L2.h_ln_partintact   .03186068   .06419268    .4963289
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree      ln_partintact
ln_average_degree          .00121186
    ln_partintact          .00106311          .05748803

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1376   1.0000
             |   0.0254
             |

GMM finished : 15:26:03

Starting Monte-Carlo loop : 15:26:04 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 15:26:10
```



```
. pvar ln_average_degree ln_partintact, lag(3) gmm monte 1000
GMM started : 15:24:41
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 256
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   .94260777   .29045091   3.2453256
     L.h_ln_partintact   .02478031   .02202156    1.125275
L2.h_ln_average_degree   .02779427   .11972748    .23214612
    L2.h_ln_partintact  -.01738499   .01770356  -.98200547
L3.h_ln_average_degree   -.0816503   .12046073  -.67781676
    L3.h_ln_partintact   .00335029   .01117603    .29977481
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.2620231   1.8141341   .69566142
     L.h_ln_partintact   .73237892   .17821144   4.1096067
L2.h_ln_average_degree   1.4386406   1.0569485   1.3611265
    L2.h_ln_partintact   .07146268   .13384732   .53391196
L3.h_ln_average_degree  -1.8582492   .82401686  -2.2551107
    L3.h_ln_partintact  -.03094046   .06316851  -.48980833
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree      ln_partintact
ln_average_degree          .00064139
    ln_partintact         -.00004848          .05097255

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0045   1.0000
             |   0.9435
             |

GMM finished : 15:24:44

Starting Monte-Carlo loop : 15:24:44 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 15:24:51
```



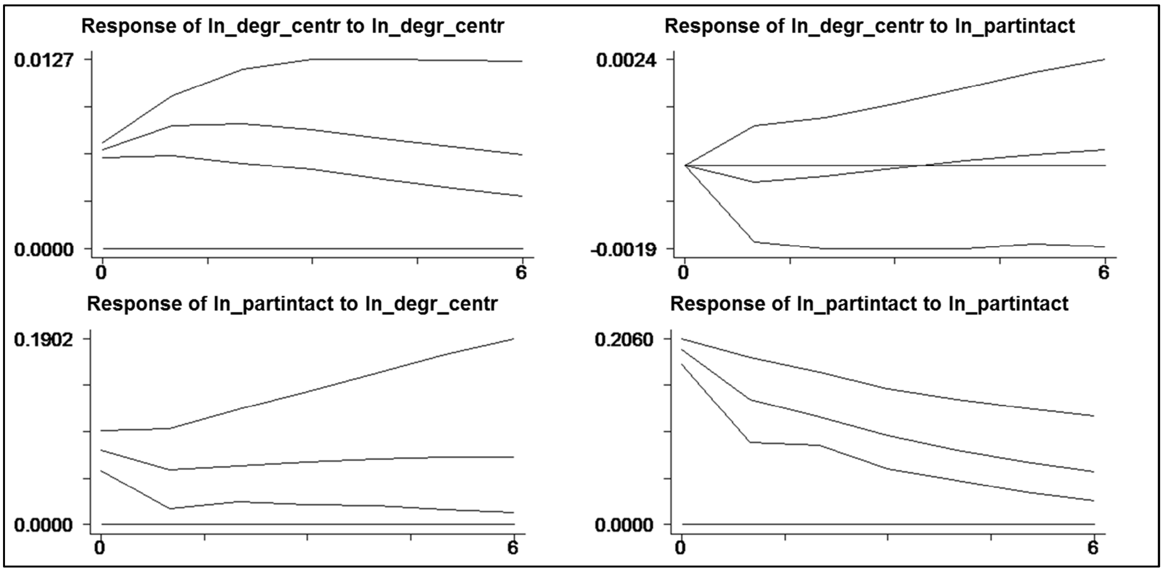
```
. pvar ln_average_degree ln_partintact, lag(4) gmm monte 1000
GMM started : 15:30:17
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 248
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.1413935    .3947153    2.891688
     L.h_ln_partintact     .012432   .03384001   .36737576
L2.h_ln_average_degree  -.14383443   .14568756   -.9872801
    L2.h_ln_partintact  -.01742403   .02181131  -.79885297
L3.h_ln_average_degree  -.07563573    .1139359  -.66384456
    L3.h_ln_partintact   .01108281   .01490436    .7435954
L4.h_ln_average_degree  -.03070089   .05184449  -.59217265
    L4.h_ln_partintact  -.00336101   .01242122  -.27058575
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree  -.70790743    1.395934  -.50712098
     L.h_ln_partintact   .64179863   .12832068   5.0015213
L2.h_ln_average_degree   .41420205   .92931298   .44570781
    L2.h_ln_partintact   .20649682   .11857189   1.7415327
L3.h_ln_average_degree   1.0354026   1.2436269   .83256688
    L3.h_ln_partintact  -.10431625   .08643581  -1.2068637
L4.h_ln_average_degree  -1.1589688    .8559025  -1.3540897
    L4.h_ln_partintact   .05784379   .04516565   1.2807032
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree      ln_partintact
ln_average_degree          .00048608
    ln_partintact          .00060462          .02021934

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1905   1.0000
             |   0.0026
             |

GMM finished : 15:30:19

Starting Monte-Carlo loop : 15:30:19 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 15:30:26
```



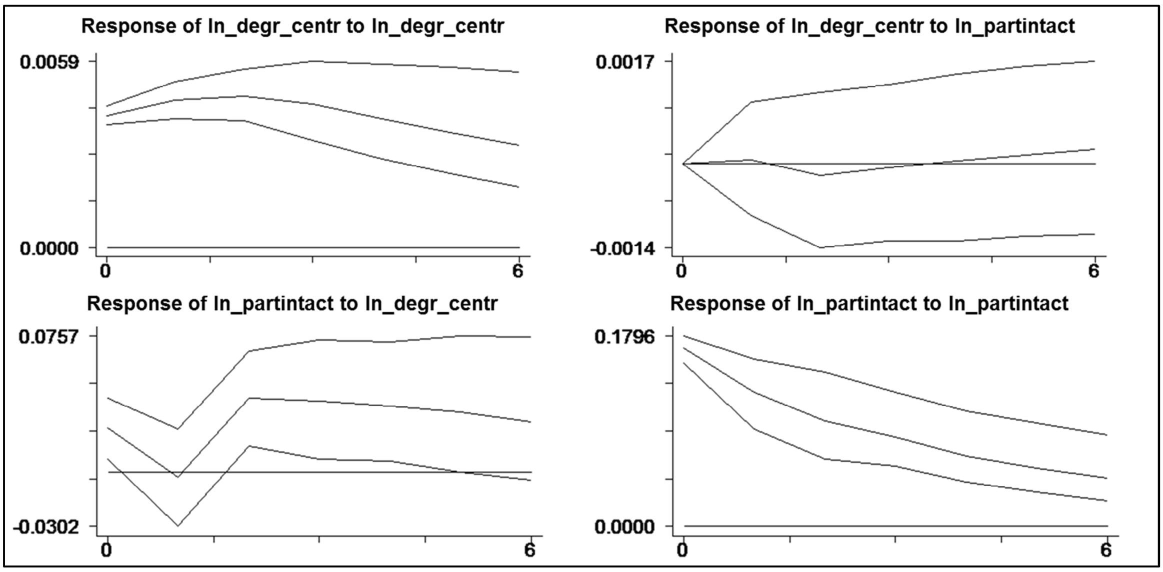
Appendix 29 Estimation Results PVAR(1)-(4) ln_degree_centralization ln_partintact; New Regions

```
. pvar ln_degr_centr ln_partintact, lag(1) gmm monte 1000
GMM started : 15:53:02
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 271
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                      b_GMM     se_GMM      t_GMM
L.h_ln_degr_centr  .89167172  .05851602   15.23808
L.h_ln_partintact  .00121972  .00135328  .90130041
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                      b_GMM     se_GMM      t_GMM
L.h_ln_degr_centr  1.9811135  1.3236519  1.4967027
L.h_ln_partintact   .8184515  .05451865  15.012321
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
               ln_degr_centr  ln_partintact
ln_degr_centr      .00010975
ln_partintact      .00049223      .05238434

Residuals correlation matrix

             |        u1       u2
-------------+------------------
          u1 |    1.0000
             |
             |
          u2 |    0.2038   1.0000
             |    0.0007
             |

GMM finished : 15:53:03

Starting Monte-Carlo loop : 15:53:03 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 15:53:09
```

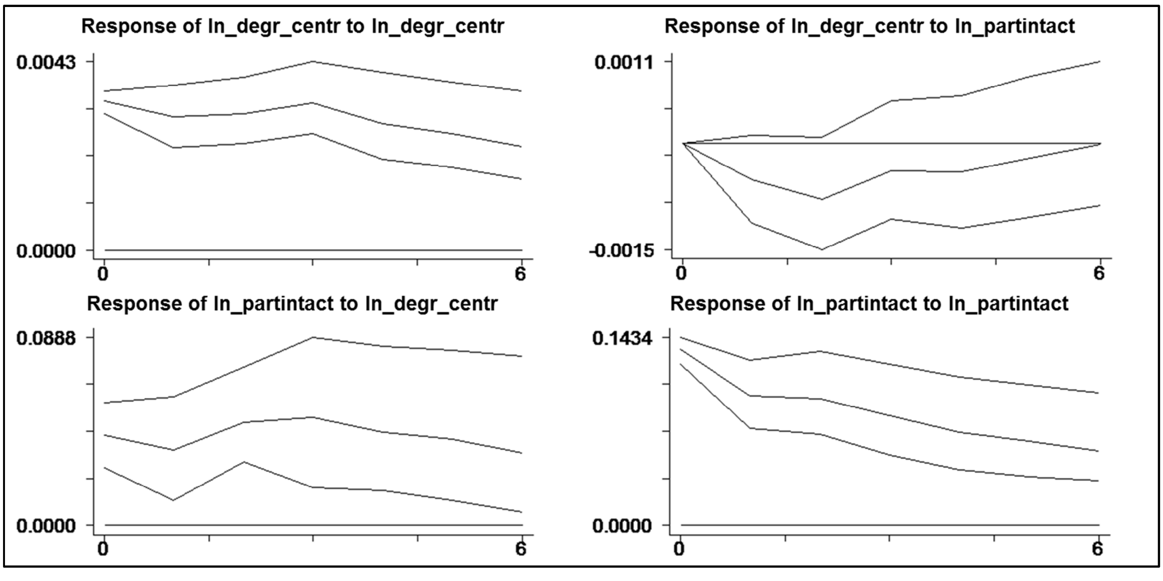
```
. pvar ln_degr_centr ln_partintact, lag(2) gmm monte 1000
GMM started : 16:02:07
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 263
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                         b_GMM      se_GMM       t_GMM
 L.h_ln_degr_centr   .97078912   .23660442   4.1030051
 L.h_ln_partintact   .00060819   .00370904   .16397577
L2.h_ln_degr_centr  -.05328086   .20718682  -.25716338
L2.h_ln_partintact    .0006043   .00371054   .16286105
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                        b_GMM     se_GMM      t_GMM
 L.h_ln_degr_centr  .57580814  2.6190106  .21985712
 L.h_ln_partintact   .7141414  .13621429   5.242779
L2.h_ln_degr_centr   1.234187  2.2095775  .55856241
L2.h_ln_partintact  .10538786  .09443033  1.1160382
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
               ln_degr_centr  ln_partintact
ln_degr_centr      .00009327
ln_partintact      .00049601      .04342854

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.2458   1.0000
             |   0.0001
             |

GMM finished : 16:02:09

Starting Monte-Carlo loop : 16:02:09 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 16:02:15
```



```
. pvar ln_degr_centr ln_partintact, lag(3) gmm monte 1000
GMM started : 16:06:53
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 255
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                         b_GMM      se_GMM       t_GMM
 L.h_ln_degr_centr   .83200536   .21795546   3.8173182
 L.h_ln_partintact   .00358509   .00381113   .94068882
L2.h_ln_degr_centr   .18499657    .2110597   .87651297
L2.h_ln_partintact  -.00441789   .00390011  -1.1327609
L3.h_ln_degr_centr  -.12501814    .0713266  -1.7527562
L3.h_ln_partintact   .00222138    .0022841   .97253899
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                         b_GMM      se_GMM       t_GMM
 L.h_ln_degr_centr   .68691135    2.759935   .24888678
 L.h_ln_partintact    .6797771   .12545395   5.4185388
L2.h_ln_degr_centr   5.4975203   3.8189336   1.4395433
L2.h_ln_partintact   .11004197   .12994465   .84683719
L3.h_ln_degr_centr  -5.0344238   2.6599006  -1.8927112
L3.h_ln_partintact   .00114981    .0841525   .01366346
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
               ln_degr_centr  ln_partintact
ln_degr_centr      .00006094
ln_partintact      .00010927      .03271732

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 |  0.0771   1.0000
             |  0.2199
             |

GMM finished : 16:06:55

Starting Monte-Carlo loop : 16:06:56 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 16:07:02
```



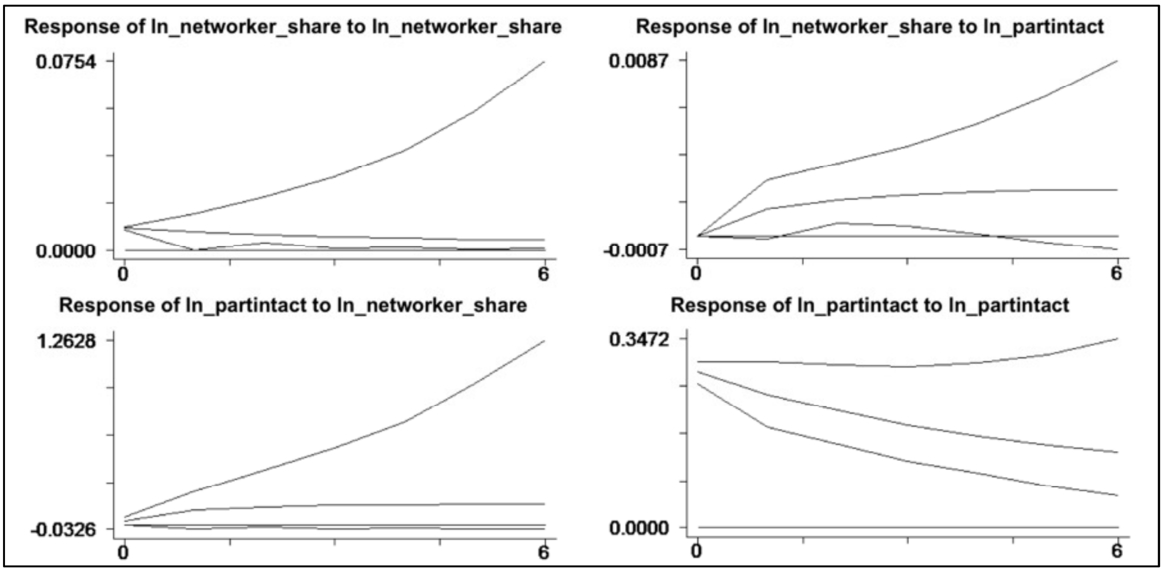
```
. pvar ln_degr_centr ln_partintact, lag(4) gmm monte 1000
GMM started : 16:08:17
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 247
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                        b_GMM      se_GMM       t_GMM
 L.h_ln_degr_centr   .65908222   .23661196   2.7854984
 L.h_ln_partintact  -.00193626   .00244416  -.79219892
L2.h_ln_degr_centr   .32489223   .23864509   1.3614034
L2.h_ln_partintact  -.00009492   .00300059  -.03163536
L3.h_ln_degr_centr   .03272702   .09089392   .36005725
L3.h_ln_partintact   .00457369   .00289903   1.5776635
L4.h_ln_degr_centr  -.16377697   .05970077  -2.7432975
L4.h_ln_partintact   -.0013381   .00193552  -.69134019
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                        b_GMM      se_GMM       t_GMM
 L.h_ln_degr_centr   2.1350257   1.7707079    1.205747
 L.h_ln_partintact   .74220557   .10348005    7.172451
L2.h_ln_degr_centr   1.2843577   1.6719369    .7681855
L2.h_ln_partintact   .18310436   .10544217   1.7365384
L3.h_ln_degr_centr  -.56823035   1.8258681  -.31121106
L3.h_ln_partintact  -.01919726   .10270502  -.18691643
L4.h_ln_degr_centr  -2.7748603   2.2368343  -1.2405301
L4.h_ln_partintact  -.03370831   .06345871  -.53118503
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
               ln_degr_centr  ln_partintact
ln_degr_centr      .00004996
ln_partintact      .00020254      .02011852

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.2015   1.0000
             |   0.0015
             |

GMM finished : 16:08:18

Starting Monte-Carlo loop : 16:08:19 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 16:08:25
```



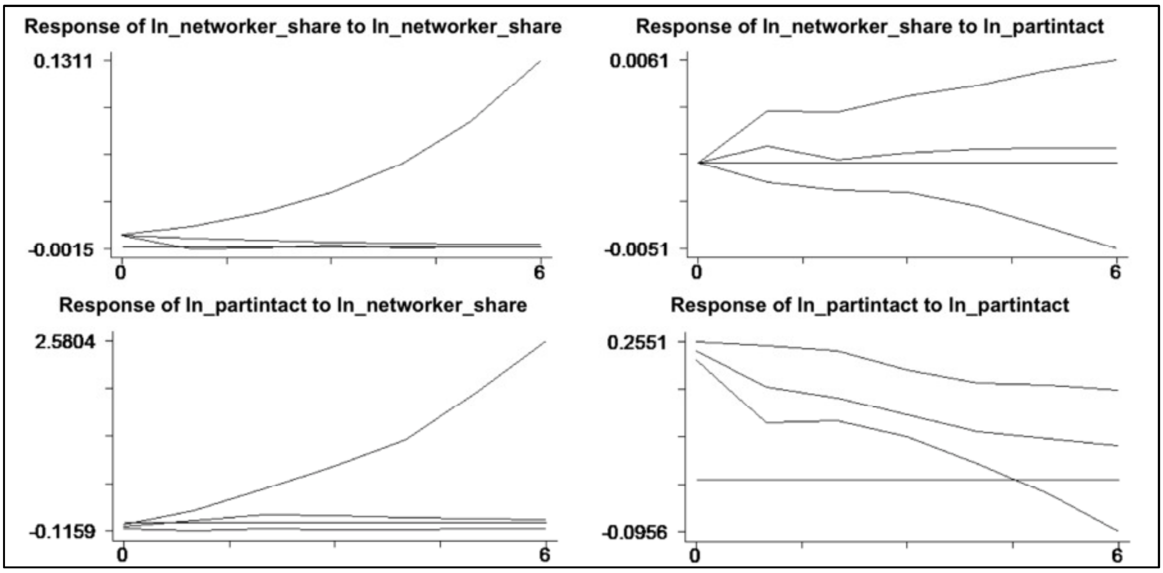
Appendix 30 Estimation Results PVAR(1)-(4) ln_networker_share ln_partintact; New Regions

```
. pvar ln_networker_share ln_partintact, lag(1) gmm monte 1000
GMM started : 17:06:41
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 272
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                            b_GMM     se_GMM      t_GMM
L.h_ln_networker_share  .68637699  .13829585   4.963106
     L.h_ln_partintact  .00260759  .00279798  .93195542
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                            b_GMM     se_GMM      t_GMM
L.h_ln_networker_share  4.9875433  2.8239545  1.7661557
     L.h_ln_partintact  .82370805  .06845059  12.033616
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share       ln_partintact
ln_networker_share            .0001515
     ln_partintact          -.00060949           .16653221

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1090   1.0000
             |   0.0727
             |

GMM finished : 17:06:42

Starting Monte-Carlo loop : 17:06:43 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 17:06:48
```

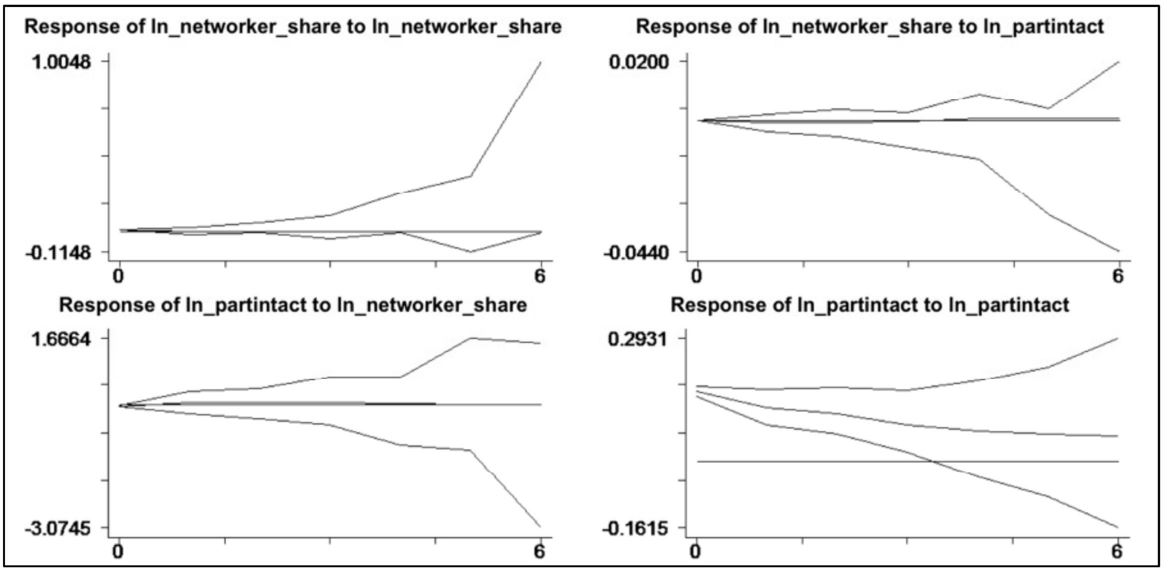
```
. pvar ln_networker_share ln_partintact, lag(2) gmm monte 1000
GMM started : 17:08:51
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 264
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   .81039454   .47071092   1.7216396
      L.h_ln_partintact   .00474626   .00308991     1.53605
L2.h_ln_networker_share   .00173579   .22198027   .00781958
     L2.h_ln_partintact  -.00168146   .00539568  -.31163022
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   8.6590806   8.7529295   .98927801
      L.h_ln_partintact   .85489503   .12570667   6.8007133
L2.h_ln_networker_share  -3.3457129   4.3044975  -.77725981
     L2.h_ln_partintact  -.02209102   .10549063  -.20941216
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share       ln_partintact
ln_networker_share           .00008108
     ln_partintact           .00023633           .08275449

Residuals correlation matrix

             |        u1       u2
-------------+-------------------
          u1 |    1.0000
             |
             |
          u2 |    0.0998   1.0000
             |    0.1056
             |

GMM finished : 17:08:52

Starting Monte-Carlo loop : 17:08:53 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 17:08:59
```



```
. pvar ln_networker_share ln_partintact, lag(3) gmm monte 1000
GMM started : 17:10:20
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 256
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                             b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   .78253938    .5759166   1.3587721
      L.h_ln_partintact   .00414132   .00534304   .77508588
L2.h_ln_networker_share  -.10648648   .15187875  -.70112825
     L2.h_ln_partintact  -.00561874   .00600384  -.93585866
L3.h_ln_networker_share   .06734549   .19166665   .35136779
     L3.h_ln_partintact   .00379879   .00436582   .87012088
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                             b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   8.5280784   11.155116    .7644993
      L.h_ln_partintact   .72359474   .17817682   4.0611048
L2.h_ln_networker_share   5.1097322   3.4476239   1.4821026
     L2.h_ln_partintact   .07742228   .15771761   .49089178
L3.h_ln_networker_share  -7.9950149   4.4771122  -1.7857526
     L3.h_ln_partintact  -.04139268   .08338156  -.49642484
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share       ln_partintact
ln_networker_share           .00007168
     ln_partintact          -.00042004           .05934415

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1920   1.0000
             |   0.0020
             |

GMM finished : 17:10:22

Starting Monte-Carlo loop : 17:10:22 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 17:10:28
```



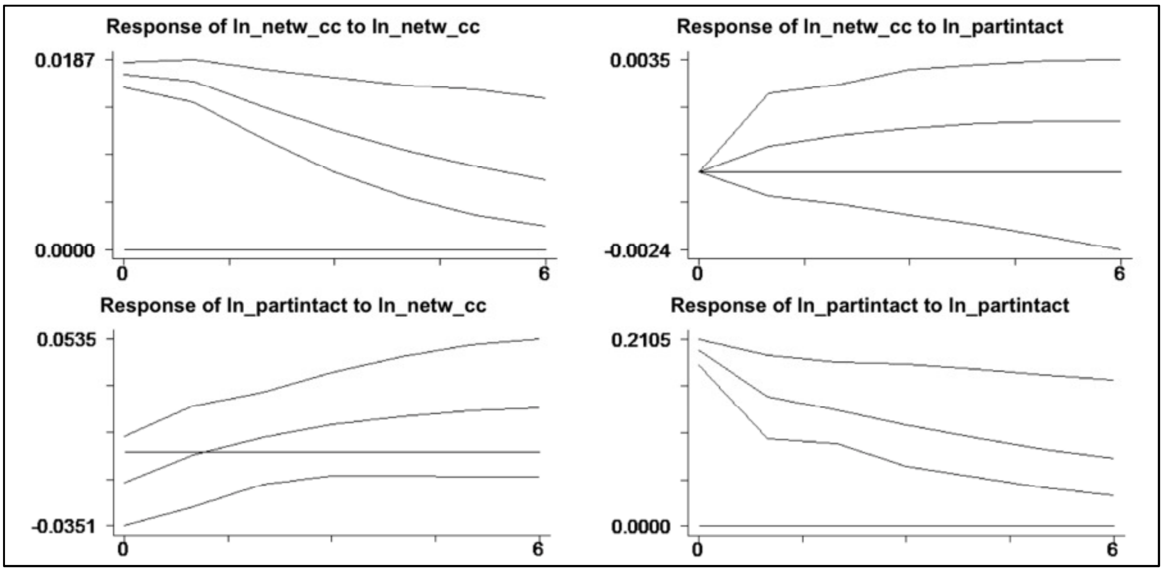
```
. pvar ln_networker_share ln_partintact, lag(4) gmm monte 1000
GMM started : 17:12:13
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 248
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   .25951996   1.0190075   .25467913
      L.h_ln_partintact  -.00545229   .01062912  -.51295836
L2.h_ln_networker_share   .07075779   .40376756   .17524387
     L2.h_ln_partintact   .00127612   .01265076   .10087268
L3.h_ln_networker_share   .09132241   .20810557   .43882734
     L3.h_ln_partintact   .00188773   .01018806   .18528822
L4.h_ln_networker_share  -.00366932   .27377481  -.01340269
     L4.h_ln_partintact   .00530701   .00818667   .64825017
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   6.5685763   12.854868   .51097969
      L.h_ln_partintact   .76724491    .1568815   4.8906017
L2.h_ln_networker_share  -1.8868038   4.3874017   -.4300504
     L2.h_ln_partintact   .13048501   .14939237   .87343822
L3.h_ln_networker_share  -.10789045   2.6368342  -.04091666
     L3.h_ln_partintact  -.08960682   .13016724  -.68839758
L4.h_ln_networker_share  -1.7835537   3.3446575   -.5332545
     L4.h_ln_partintact   .02207013   .09729803    .2268302
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share       ln_partintact
ln_networker_share           .00017327
     ln_partintact          -.00062176            .0291335

Residuals correlation matrix

             |        u1       u2
-------------+-------------------
          u1 |    1.0000
             |
             |
          u2 |   -0.2670   1.0000
             |    0.0000
             |

GMM finished : 17:12:14

Starting Monte-Carlo loop : 17:12:14 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 17:12:21
```



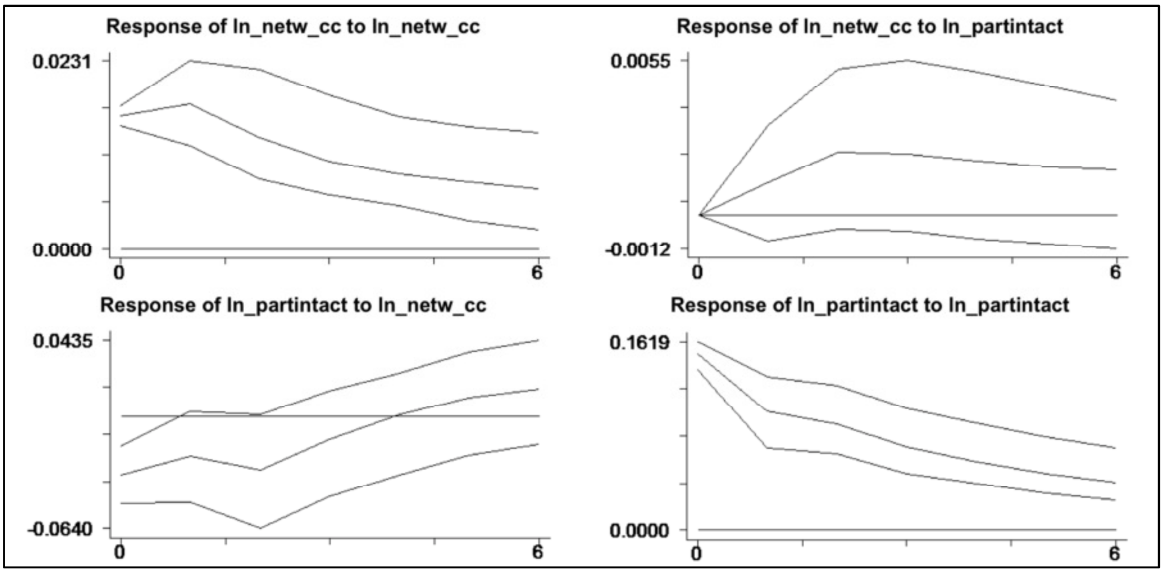
Appendix 31 Estimation Results PVAR(1)-(4) ln_network_cc ln_partintact; New Regions

```
. pvar ln_netw_cc ln_partintact, lag(1) gmm monte 1000
GMM started : 17:13:44
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 259
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                      b_GMM     se_GMM      t_GMM
   L.h_ln_netw_cc  .73113803  .07871482  9.2884417
L.h_ln_partintact  .01162813   .0086981  1.3368586
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                      b_GMM     se_GMM      t_GMM
   L.h_ln_netw_cc  .11920648  .39540337  .30148069
L.h_ln_partintact  .86261424  .07651951  11.273127
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                  ln_netw_cc  ln_partintact
   ln_netw_cc       .0011782
ln_partintact      .00116576      .04859215

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1510   1.0000
             |   0.0150
             |

GMM finished : 17:13:45

Starting Monte-Carlo loop : 17:13:46 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 17:13:51
```

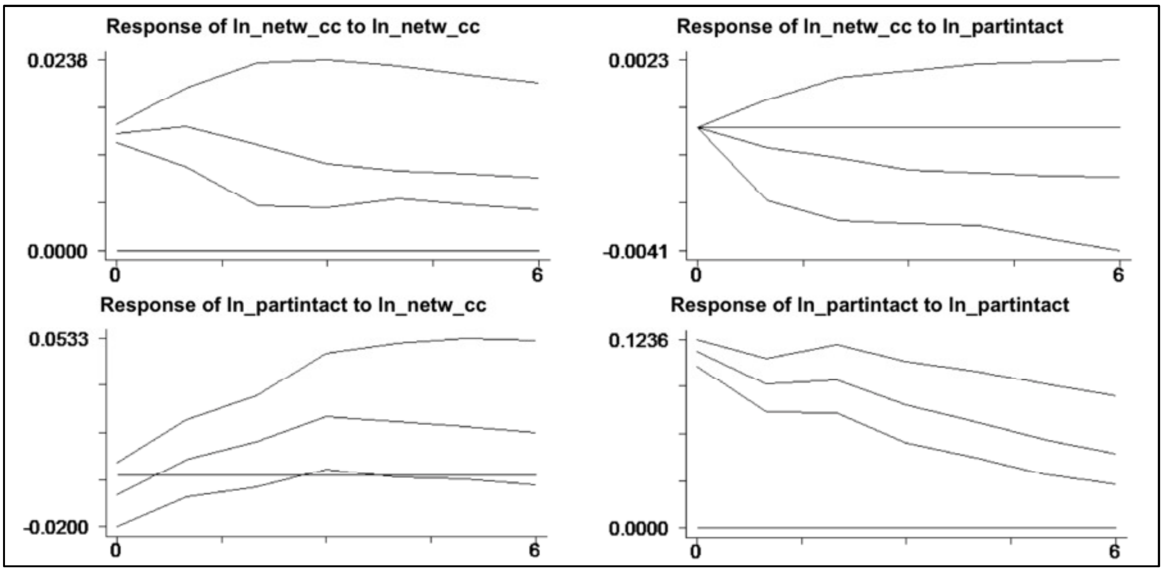
```
. pvar ln_netw_cc ln_partintact, lag(2) gmm monte 1000
GMM started : 17:17:46
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 251
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                        b_GMM      se_GMM       t_GMM
    L.h_ln_netw_cc   .96236205   .06072411   15.848105
 L.h_ln_partintact   .00405157   .00482205   .84021814
   L2.h_ln_netw_cc  -.10922364   .05186109  -2.1060808
L2.h_ln_partintact  -.00116844   .00475599  -.24567672
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                       b_GMM     se_GMM      t_GMM
    L.h_ln_netw_cc   .5418984  .58113688   .9324798
 L.h_ln_partintact  .73910734  .14682758  5.0338454
   L2.h_ln_netw_cc  .02052581  .75075786  .02734013
L2.h_ln_partintact  .11216593  .09627941  1.1650044
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                  ln_netw_cc  ln_partintact
   ln_netw_cc      .00029576
ln_partintact     -.00024554      .03938995

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0724   1.0000
             |   0.2531
             |

GMM finished : 17:17:48

Starting Monte-Carlo loop : 17:17:48 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 17:17:54
```



```
. pvar ln_netw_cc ln_partintact, lag(3) gmm monte 1000
GMM started : 17:18:53
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 243
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                        b_GMM      se_GMM       t_GMM
    L.h_ln_netw_cc   1.1008773   .19314853    5.699641
 L.h_ln_partintact   .00756724   .00851949   .88822685
   L2.h_ln_netw_cc  -.34830778   .21214707  -1.6418222
L2.h_ln_partintact   .00133808   .00676134   .19790219
   L3.h_ln_netw_cc   .12300638   .08342148   1.4745169
L3.h_ln_partintact   -.0048607   .00453896  -1.0708838
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                        b_GMM      se_GMM       t_GMM
    L.h_ln_netw_cc  -.01019711   .73013676  -.01396602
 L.h_ln_partintact   .67658994   .11995486   5.6403713
   L2.h_ln_netw_cc  -.61884968   .98522645  -.62812939
L2.h_ln_partintact   .14525023   .11613967   1.2506513
   L3.h_ln_netw_cc   1.2720122   .80720627   1.5758206
L3.h_ln_partintact  -.02864119    .0691697  -.41407136
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                 ln_netw_cc  ln_partintact
   ln_netw_cc      .00026657
ln_partintact      -.0005414      .02407614

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.2136   1.0000
             |   0.0008
             |

GMM finished : 17:18:54

Starting Monte-Carlo loop : 17:18:55 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 17:19:01
```



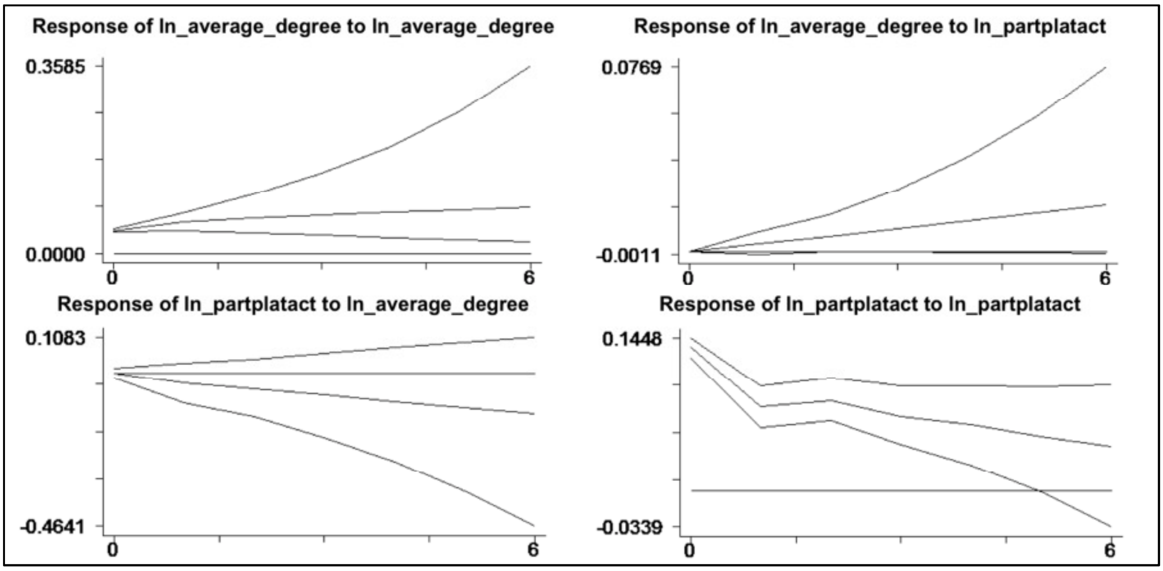
```
. pvar ln_netw_cc ln_partintact, lag(4) gmm monte 1000
GMM started : 17:21:08
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 235
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                         b_GMM      se_GMM       t_GMM
    L.h_ln_netw_cc   1.0492573   .20047521   5.2338508
 L.h_ln_partintact  -.00586305   .00951215  -.61637511
   L2.h_ln_netw_cc   -.1991391   .17657647  -1.1277782
L2.h_ln_partintact   .00205626    .0070303   .29248555
   L3.h_ln_netw_cc   .00744729   .20562214   .03621831
L3.h_ln_partintact  -.00095928   .00524655  -.18284049
   L4.h_ln_netw_cc   .08184837   .05522594   1.4820639
L4.h_ln_partintact   .00114149   .00401253   .28448088
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                         b_GMM      se_GMM       t_GMM
    L.h_ln_netw_cc   .85481649   .42442957   2.0140361
 L.h_ln_partintact    .8122616   .08239475    9.858172
   L2.h_ln_netw_cc  -.25471898   .61925337   -.4113324
L2.h_ln_partintact   .18114678    .0838071   2.1614729
   L3.h_ln_netw_cc   .18272718   .43063227   .42432301
L3.h_ln_partintact  -.12364109   .08978059  -1.3771473
   L4.h_ln_netw_cc  -.55289531   .25072672   -2.205171
L4.h_ln_partintact  -.00545221   .05549572   -.0982456
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                  ln_netw_cc  ln_partintact
   ln_netw_cc      .00021318
ln_partintact       -.000109      .01346239

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0642   1.0000
             |   0.3271
             |

GMM finished : 17:21:10

Starting Monte-Carlo loop : 17:21:10 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 17:21:17
```



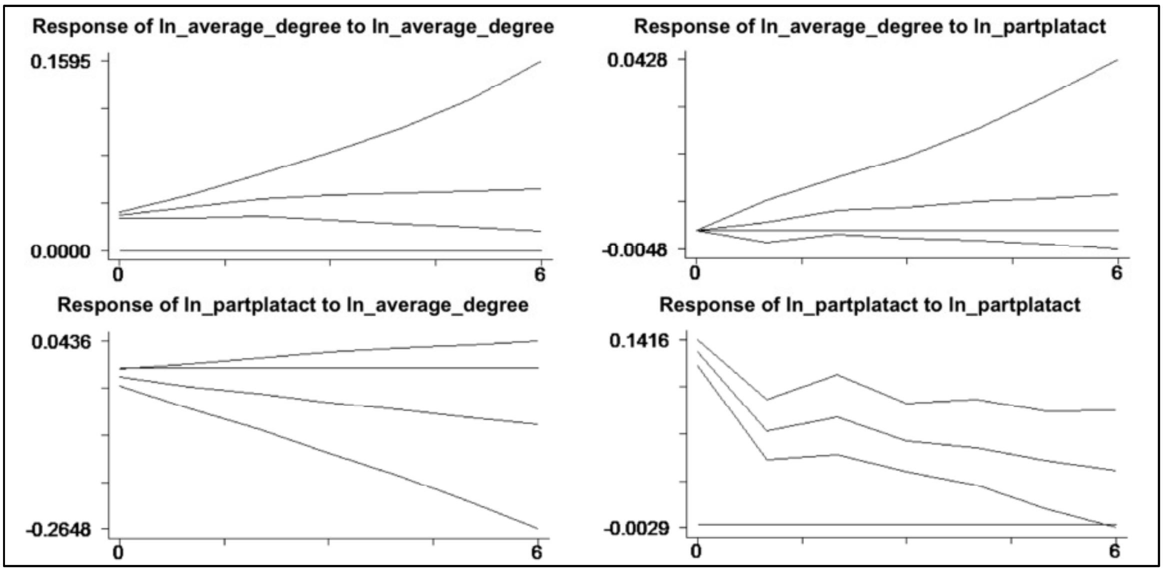
Appendix 32 Estimation Results PVAR(1)-(4) ln_average_degree ln_partplatact; New Regions

```
. pvar ln_average_degree ln_partplatact, lag(1) gmm monte 1000
GMM started : 17:23:12
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 272
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                           b_GMM     se_GMM      t_GMM
L.h_ln_average_degree  1.2859831  .29507395  4.3581722
   L.h_ln_partplatact   .0736064  .05097356  1.4440114
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                           b_GMM     se_GMM      t_GMM
L.h_ln_average_degree  .25095797  .80230356  .31279678
   L.h_ln_partplatact  .92343273  .10798559  8.5514439
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree     ln_partplatact
ln_average_degree          .00635893
   ln_partplatact          .00584214          .03349808

Residuals correlation matrix

             |        u1       u2
-------------+------------------
          u1 |    1.0000
             |
             |
          u2 |    0.3883   1.0000
             |    0.0000
             |

GMM finished : 17:23:13

Starting Monte-Carlo loop : 17:23:14 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 17:23:20
```

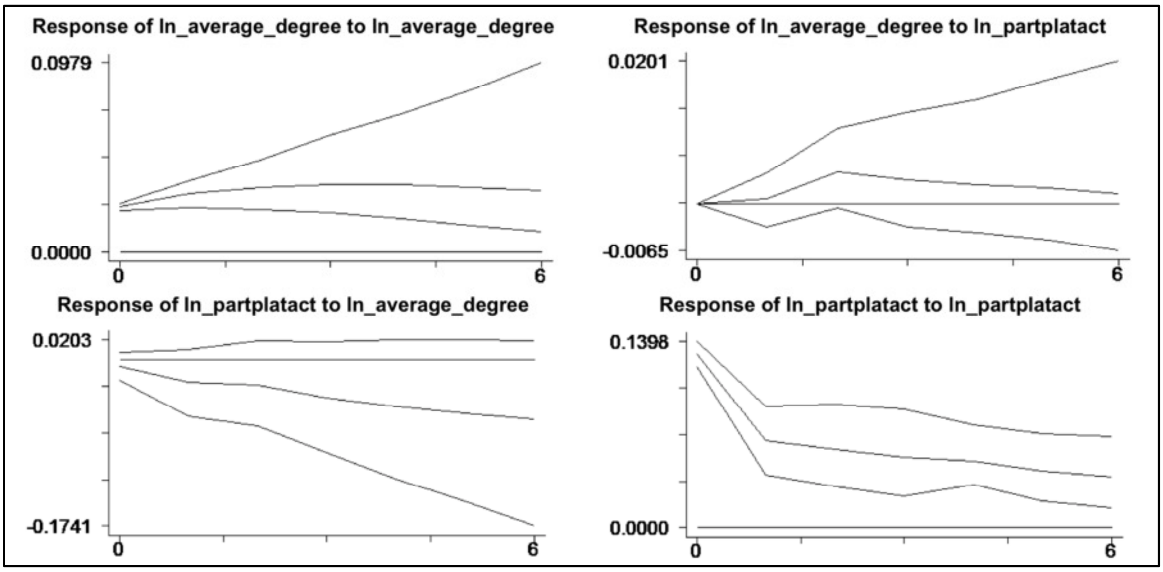
```
. pvar ln_average_degree ln_partplatact, lag(2) gmm monte 1000
GMM started : 17:27:46
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 264
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.3706047   .23054202   5.9451406
    L.h_ln_partplatact   .02455395   .02064105   1.1895688
L2.h_ln_average_degree  -.30711844   .16572221  -1.8532123
   L2.h_ln_partplatact  -.00163365   .02167183  -.07538146
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree  -.67596267   .87765772   -.7701894
    L.h_ln_partplatact   .58705002   .08059099   7.2843133
L2.h_ln_average_degree   .25378396   .43933875   .57764985
   L2.h_ln_partplatact   .30261754   .06806368   4.4460944
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree     ln_partplatact
ln_average_degree          .00192277
   ln_partplatact         -.00002809          .01843039

Residuals correlation matrix

             |       u1        u2
-------------+--------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0045    1.0000
             |   0.9422
             |

GMM finished : 17:27:48

Starting Monte-Carlo loop : 17:27:48 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 17:27:54
```



```
. pvar ln_average_degree ln_partplatact, lag(3) gmm monte 1000
GMM started : 17:28:51
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 256
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.2245025   .18943394    6.464008
    L.h_ln_partplatact   .01482512   .02246287   .65998312
L2.h_ln_average_degree  -.03170397   .16910665  -.18747914
   L2.h_ln_partplatact   .01141321   .02709786   .42118502
L3.h_ln_average_degree  -.16165878   .07071855  -2.2859458
   L3.h_ln_partplatact  -.01777939   .01292102   -1.376005
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree  -.74421928   .76319003  -.97514282
    L.h_ln_partplatact   .54429151   .09983804    5.451745
L2.h_ln_average_degree   .21724288    .5547597   .39159816
   L2.h_ln_partplatact   .33978147   .11886733   2.8584933
L3.h_ln_average_degree   .02997494   .40250064   .07447177
   L3.h_ln_partplatact  -.01388489   .13383362  -.10374742
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree     ln_partplatact
ln_average_degree          .00091066
   ln_partplatact         -.00047318          .01770386

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1116   1.0000
             |   0.0748
             |

GMM finished : 17:28:53

Starting Monte-Carlo loop : 17:28:53 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 17:28:59
```



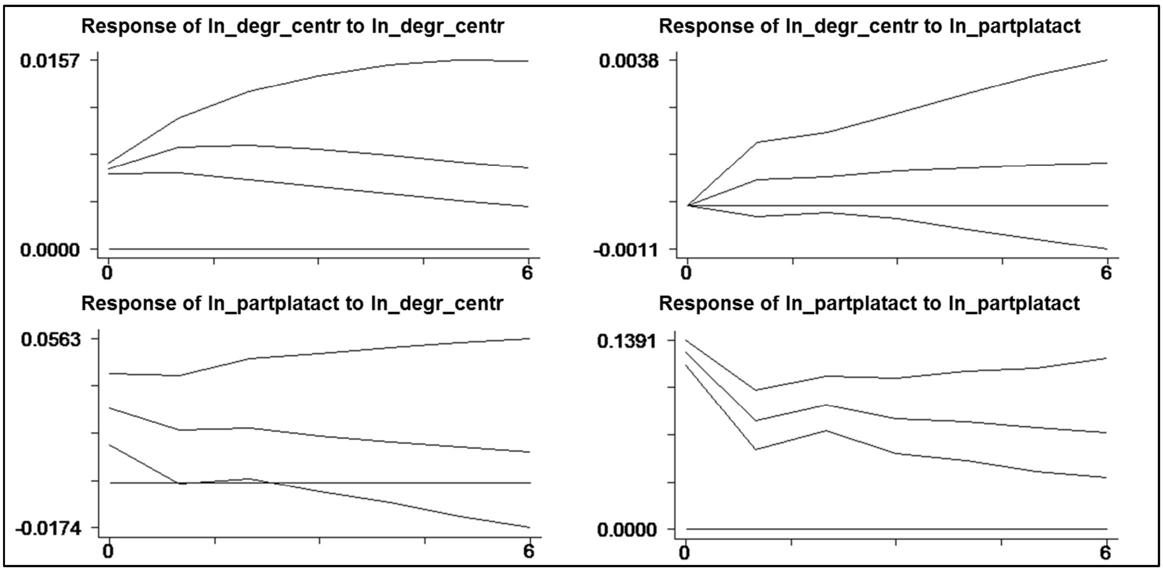
```
. pvar ln_average_degree ln_partplatact, lag(4) gmm monte 1000
GMM started : 17:30:10
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 248
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.2876487   .17151897   7.5073255
    L.h_ln_partplatact   .00510849   .01798676    .2840141
L2.h_ln_average_degree  -.22582379   .12366231  -1.8261327
   L2.h_ln_partplatact    .0251294   .02735975   .91848061
L3.h_ln_average_degree  -.02037019   .09157761  -.22243635
   L3.h_ln_partplatact  -.03238719     .014444  -2.2422586
L4.h_ln_average_degree  -.08029304   .04908226   -1.635887
   L4.h_ln_partplatact  -.00139162   .01062374  -.13099176
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree  -.84107552   .91354642  -.92067081
    L.h_ln_partplatact   .50441848   .11742202   4.2957743
L2.h_ln_average_degree   .49918381   .83334589   .59901154
   L2.h_ln_partplatact   .20133145   .10066137   2.0000865
L3.h_ln_average_degree  -.37331262   .47967378  -.77826354
   L3.h_ln_partplatact   .10620695   .14909455    .7123463
L4.h_ln_average_degree   .15114392   .19460827   .77665723
   L4.h_ln_partplatact   .03899813   .10563136   .36919079
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree     ln_partplatact
ln_average_degree           .0005457
   ln_partplatact         -.00017167          .01704737

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0520   1.0000
             |   0.4146
             |

GMM finished : 17:30:11

Starting Monte-Carlo loop : 17:30:11 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 17:30:18
```



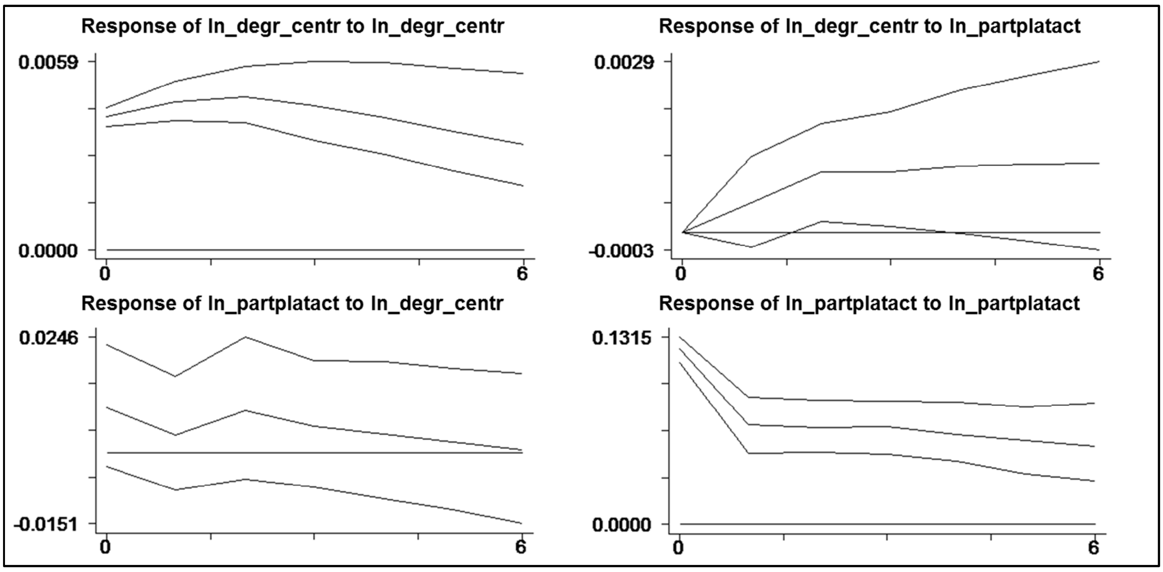
Appendix 33 Estimation Results PVAR(1)-(4) ln_degree_centralization ln_partplatact; New Regions

```
. pvar ln_degr_centr ln_partplatact, lag(1) gmm monte 1000
GMM started : 17:32:05
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 271
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                        b_GMM     se_GMM      t_GMM
 L.h_ln_degr_centr  .88741048  .05653605  15.696366
L.h_ln_partplatact    .004294  .00221192  1.9412991
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                        b_GMM     se_GMM      t_GMM
 L.h_ln_degr_centr  .53161629   .6677499  .79613084
L.h_ln_partplatact  .87096618  .08104737  10.746384
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                 ln_degr_centr  ln_partplatact
 ln_degr_centr       .00010907
ln_partplatact       .00017721       .02045631

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1177   1.0000
             |   0.0530
             |

GMM finished : 17:32:06

Starting Monte-Carlo loop : 17:32:07 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 17:32:12
```

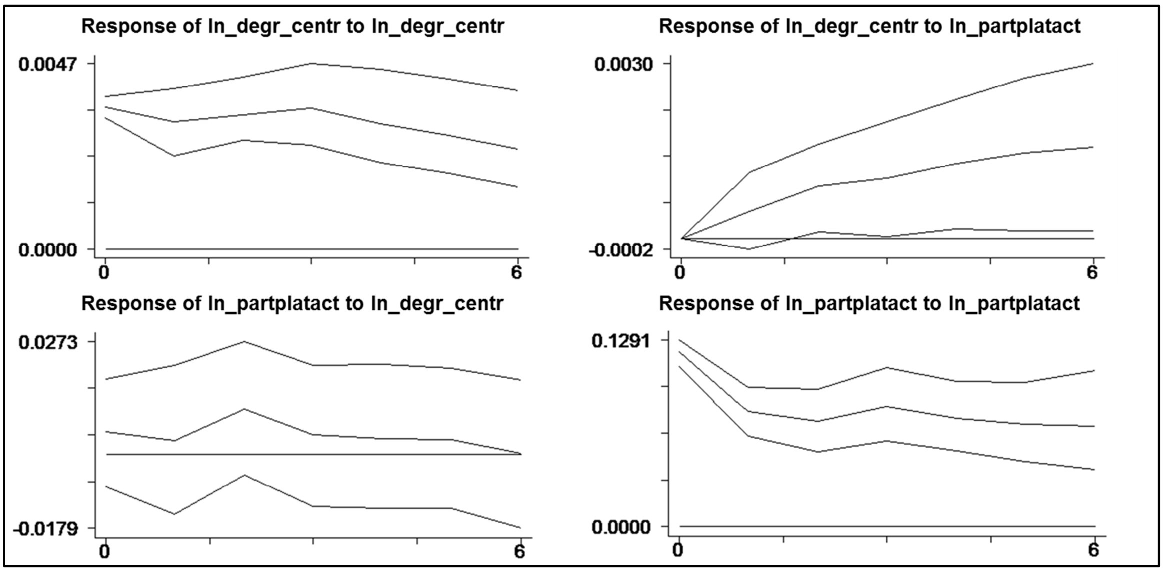
```
. pvar ln_degr_centr ln_partplatact, lag(2) gmm monte 1000
GMM started : 17:36:37
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 263
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                        b_GMM      se_GMM       t_GMM
  L.h_ln_degr_centr   .96917044   .23134169   4.1893463
 L.h_ln_partplatact   .00800594   .00496011   1.6140625
 L2.h_ln_degr_centr  -.04259945   .19798121  -.21516916
L2.h_ln_partplatact  -.00540255   .00552212   -.9783464
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                        b_GMM      se_GMM       t_GMM
  L.h_ln_degr_centr   .39484352   1.1939573   .33070154
 L.h_ln_partplatact   .61069858   .09893312   6.1728425
 L2.h_ln_degr_centr   -.6007448   1.1295883  -.53182632
L2.h_ln_partplatact   .32505302   .09500497   3.4214318
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                 ln_degr_centr  ln_partplatact
 ln_degr_centr       .00009285
ln_partplatact       .00018913       .01783751

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1472   1.0000
             |   0.0169
             |

GMM finished : 17:36:38

Starting Monte-Carlo loop : 17:36:39 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 17:36:45
```



```
. pvar ln_degr_centr ln_partplatact, lag(3) gmm monte 1000
GMM started : 17:39:23
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 255
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                           b_GMM      se_GMM       t_GMM
  L.h_ln_degr_centr    .8321954   .21296734   3.9076198
 L.h_ln_partplatact   .00780203   .00487444   1.6005983
 L2.h_ln_degr_centr   .17379949   .20153153   .86239356
L2.h_ln_partplatact   .00165838   .00599268   .27673372
 L3.h_ln_degr_centr  -.10050263    .0610987  -1.6449226
L3.h_ln_partplatact  -.00677398   .00333669  -2.0301522
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                           b_GMM      se_GMM       t_GMM
  L.h_ln_degr_centr   .31225169   .93754491   .33305251
 L.h_ln_partplatact   .55991767   .09252146   6.0517599
 L2.h_ln_degr_centr   .17398383   1.1757852   .14797246
L2.h_ln_partplatact   .23767091   .10140223   2.3438432
 L3.h_ln_degr_centr  -.92142417   1.0730804  -.85867209
L3.h_ln_partplatact   .11222697   .12757205   .87971439
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                 ln_degr_centr  ln_partplatact
 ln_degr_centr       .00006069
ln_partplatact       .00003523       .01526944

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 |  0.0369   1.0000
             |  0.5580
             |

GMM finished : 17:39:24

Starting Monte-Carlo loop : 17:39:25 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 17:39:31
```



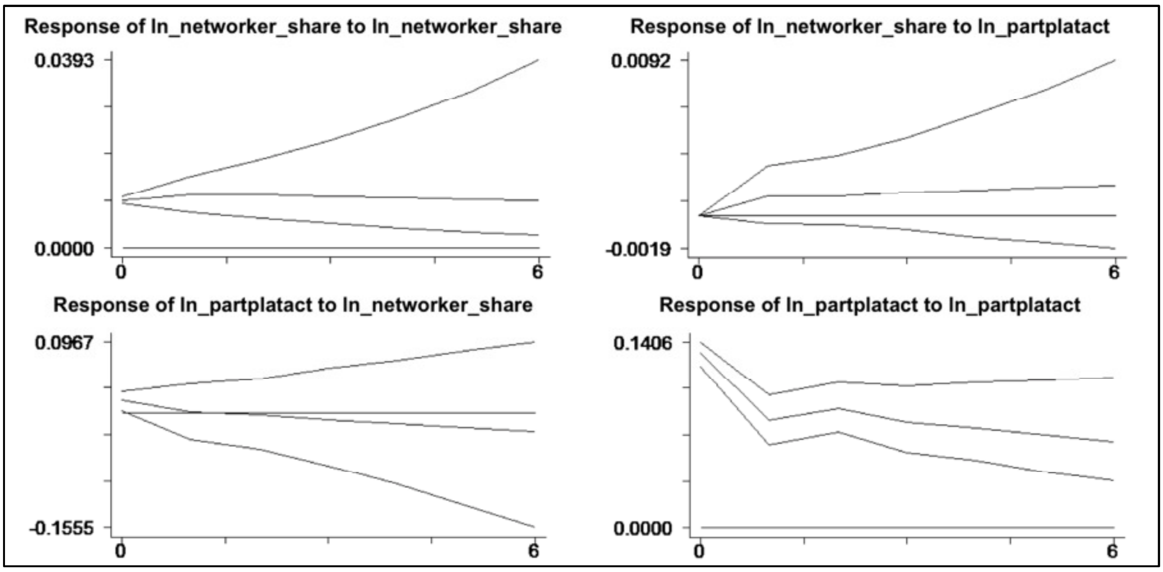
```
. pvar ln_degr_centr ln_partplatact, lag(4) gmm monte 1000
GMM started : 17:40:34
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 247
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                        b_GMM      se_GMM       t_GMM
  L.h_ln_degr_centr    .6353403   .22763446    2.791055
 L.h_ln_partplatact   .00556076     .003578   1.5541543
 L2.h_ln_degr_centr   .32820682   .23111711   1.4200888
L2.h_ln_partplatact   .00315056   .00451545   .69772928
 L3.h_ln_degr_centr   .05204828   .09155193   .56851106
L3.h_ln_partplatact  -.00222141   .00318055  -.69843567
 L4.h_ln_degr_centr  -.15188527   .06069907  -2.5022668
L4.h_ln_partplatact  -.00261022   .00271254  -.96227974
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                        b_GMM      se_GMM       t_GMM
  L.h_ln_degr_centr   .77296036   1.0605903   .72880204
 L.h_ln_partplatact   .65386938   .08293655   7.8839714
 L2.h_ln_degr_centr   .07833732   1.1091692   .07062703
L2.h_ln_partplatact   .17912142   .09498135   1.8858588
 L3.h_ln_degr_centr  -1.2239853   1.1770547  -1.0398712
L3.h_ln_partplatact   .16888355   .13510066   1.2500572
 L4.h_ln_degr_centr  -.13742408   .93654462  -.14673522
L4.h_ln_partplatact   -.0600655   .07151747  -.83987165
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                 ln_degr_centr  ln_partplatact
 ln_degr_centr       .00005051
ln_partplatact       .00002675       .01477066

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0311   1.0000
             |   0.6262
             |

GMM finished : 17:40:35

Starting Monte-Carlo loop : 17:40:36 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 17:40:43
```



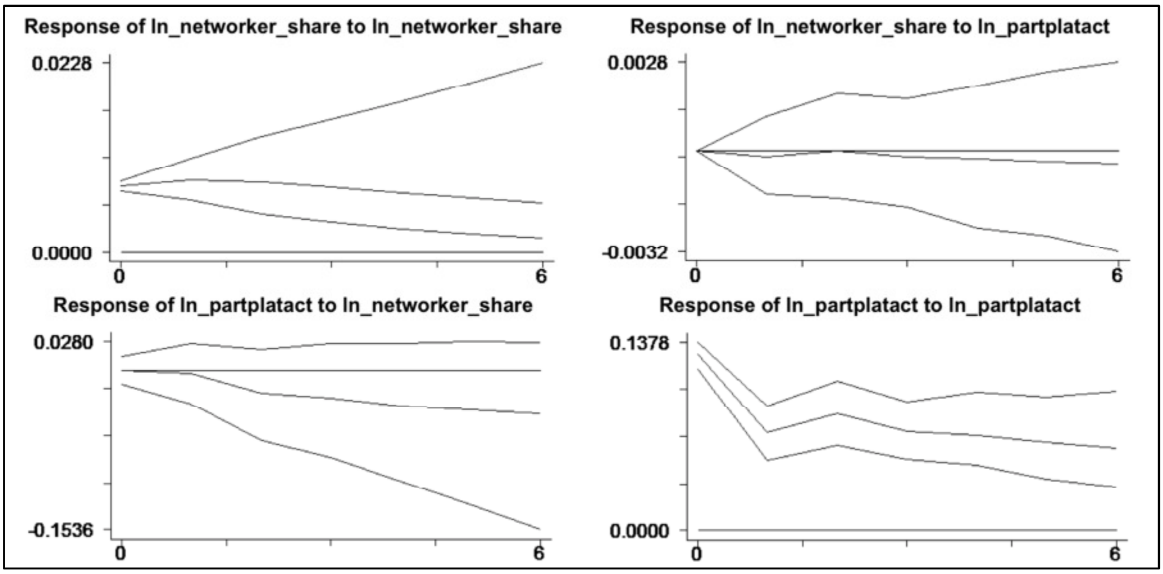
Appendix 34 Estimation Results PVAR(1)-(4) ln_networker_share ln_partplatact; New Regions

```
. pvar ln_networker_share ln_partplatact, lag(1) gmm monte 1000
GMM started : 14:49:39
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 272
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                            b_GMM     se_GMM      t_GMM
L.h_ln_networker_share   .8168415  .12252552  6.6667049
    L.h_ln_partplatact  .00097256  .00472152  .20598468
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                            b_GMM     se_GMM      t_GMM
L.h_ln_networker_share  .85759163  .99599688  .86103848
    L.h_ln_partplatact  .89666779  .06973883  12.857511
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share      ln_partplatact
ln_networker_share           .00015677
    ln_partplatact           .00013838           .03199901

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0583   1.0000
             |   0.3379
             |

GMM finished : 14:49:41

Starting Monte-Carlo loop : 14:49:41 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 14:49:47
```

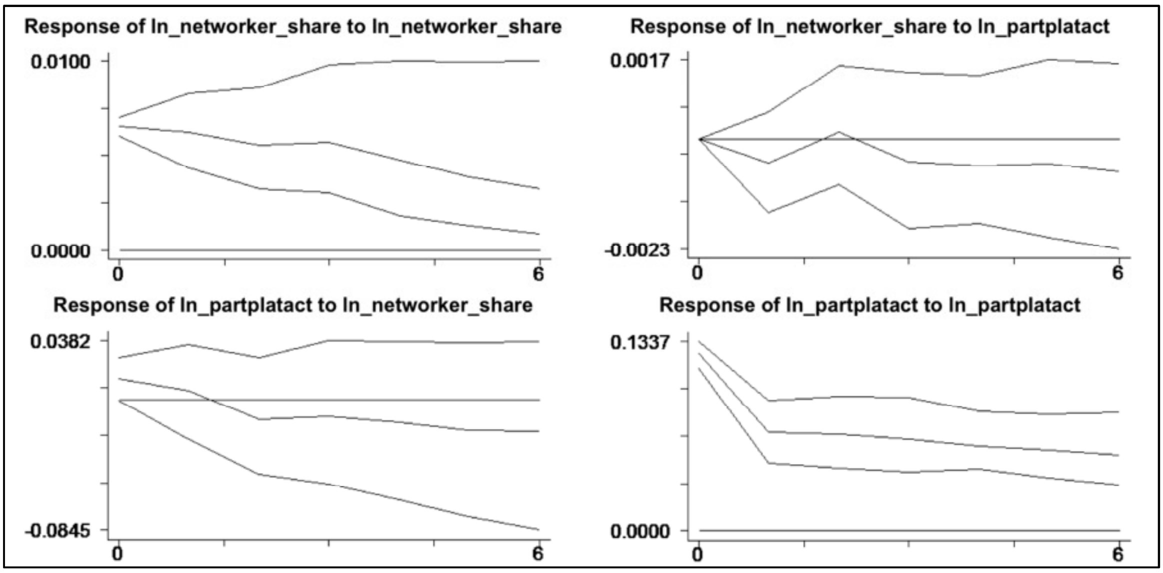
```
. pvar ln_networker_share ln_partplatact, lag(2) gmm monte 1000
GMM started : 15:32:49
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 264
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   1.1067217   .22327234   4.9568243
     L.h_ln_partplatact   .00878964   .00768704   1.1434367
L2.h_ln_networker_share  -.12580578   .13454962  -.93501404
    L2.h_ln_partplatact  -.00641103   .00876403  -.73151626
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share  -.93654181   2.2255731  -.42080927
     L.h_ln_partplatact   .61605949   .07947241   7.7518662
L2.h_ln_networker_share   .17711535   1.2317261   .14379442
    L2.h_ln_partplatact   .30897565   .07588717   4.0715136
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share      ln_partplatact
ln_networker_share            .0000989
    ln_partplatact           .00016307           .01773779

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1260   1.0000
             |   0.0408
             |

GMM finished : 15:32:51

Starting Monte-Carlo loop : 15:32:51 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 15:32:57
```



```
. pvar ln_networker_share ln_partplatact, lag(3) gmm monte 1000
GMM started : 15:34:47
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 256
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                             b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   1.0934625   .18160549   6.0210871
     L.h_ln_partplatact   -.0012829    .0056788   -.2259103
L2.h_ln_networker_share  -.14126326   .11960723  -1.1810595
    L2.h_ln_partplatact   .00220954   .01001514    .2206197
L3.h_ln_networker_share  -.02498588   .07428756  -.33633999
    L3.h_ln_partplatact  -.00200539   .00557099   -.3599704
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                             b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share  -.37267529   2.2255962  -.16744964
     L.h_ln_partplatact   .55655522   .09070346   6.1359864
L2.h_ln_networker_share   -2.178812    1.494337   -1.458046
    L2.h_ln_partplatact   .35517757   .11138364   3.1887769
L3.h_ln_networker_share   1.1490611   .96061816   1.1961684
    L3.h_ln_partplatact  -.00928084   .12275403   -.0756052
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share      ln_partplatact
ln_networker_share           .00006426
    ln_partplatact           1.891e-06           .01662151

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 |  0.0033   1.0000
             |  0.9583
             |

GMM finished : 15:34:49

Starting Monte-Carlo loop : 15:34:49 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 15:34:55
```



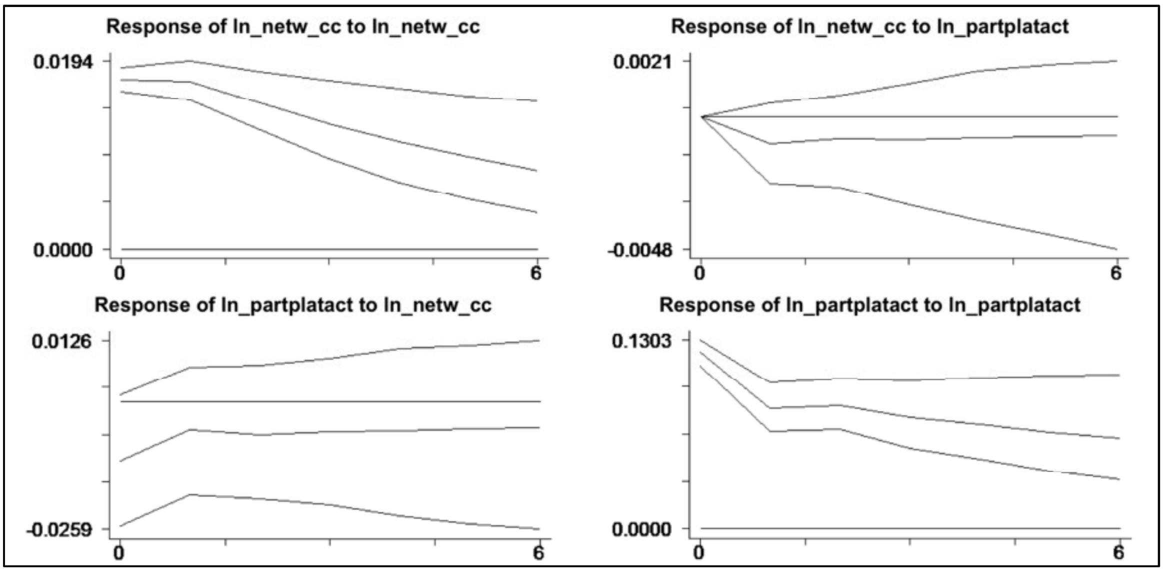
```
. pvar ln_networker_share ln_partplatact, lag(4) gmm monte 1000
GMM started : 15:36:51
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 248
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share      .959583   .17535091   5.4723582
     L.h_ln_partplatact  -.00391937   .00528166  -.74207045
L2.h_ln_networker_share  -.08015694   .17734285  -.45198856
    L2.h_ln_partplatact   .00708229   .00731775   .96782405
L3.h_ln_networker_share    .1385274   .12662719   1.0939783
    L3.h_ln_partplatact  -.00702679   .00491727  -1.4290037
L4.h_ln_networker_share   -.1676704   .07363588  -2.2770204
    L4.h_ln_partplatact   .00189089   .00381407   .49576835
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share  -.19384363   2.6707817  -.07257936
     L.h_ln_partplatact   .55715554   .10110243   5.5108029
L2.h_ln_networker_share  -2.7921741   2.1045901  -1.3267068
    L2.h_ln_partplatact   .23392997   .10279002   2.2758044
L3.h_ln_networker_share   1.8830451   1.2796974   1.4714769
    L3.h_ln_partplatact   .07475593   .13627777   .54855562
L4.h_ln_networker_share  -.28380142   .94356973  -.30077419
    L4.h_ln_partplatact   .02914477   .09129266   .31924543
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share      ln_partplatact
ln_networker_share           .00004299
    ln_partplatact           .00008739           .01579373

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 |  0.1052   1.0000
             |  0.0983
             |

GMM finished : 15:36:53

Starting Monte-Carlo loop : 15:36:53 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 15:37:00
```



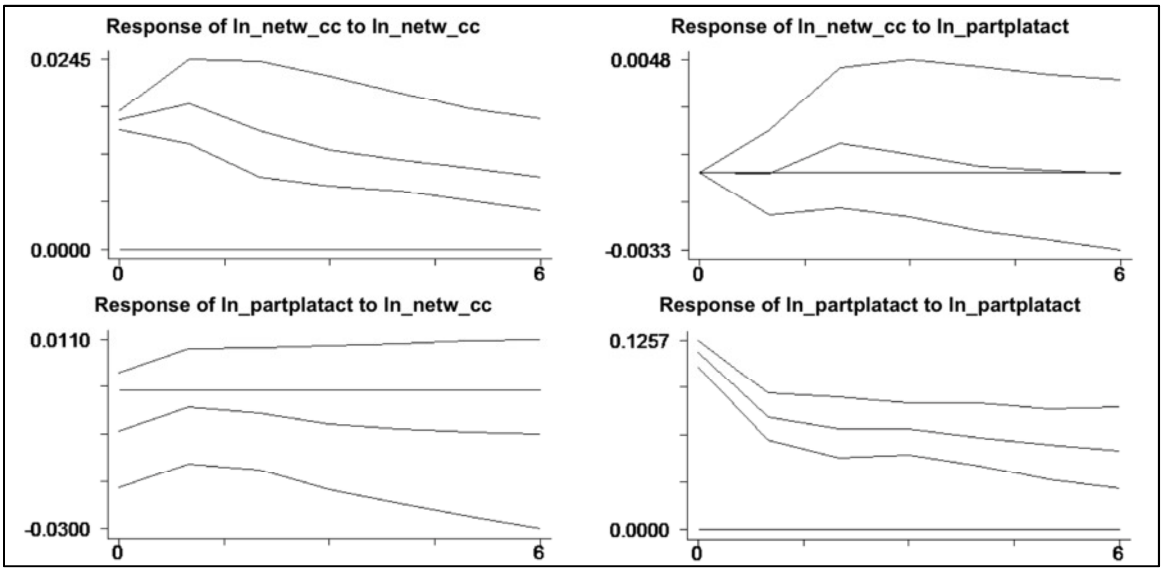
Appendix 35 Estimation Results PVAR(1)-(4) ln_network_cc ln_partplatact; New Regions

```
. pvar ln_netw_cc ln_partplatact, lag(1) gmm monte 1000
GMM started : 15:39:20
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 259
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                        b_GMM     se_GMM      t_GMM
    L.h_ln_netw_cc  .80222616  .05694562  14.087584
L.h_ln_partplatact  .00332148  .00824356  .40291845
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                        b_GMM     se_GMM      t_GMM
    L.h_ln_netw_cc  .01722156  .15289125  .11263927
L.h_ln_partplatact  .90980778  .06748483  13.481664
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_netw_cc  ln_partplatact
    ln_netw_cc       .00133113
ln_partplatact       .00022593       .01685586

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0480   1.0000
             |   0.4421
             |

GMM finished : 15:39:21

Starting Monte-Carlo loop : 15:39:22 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 15:39:27
```

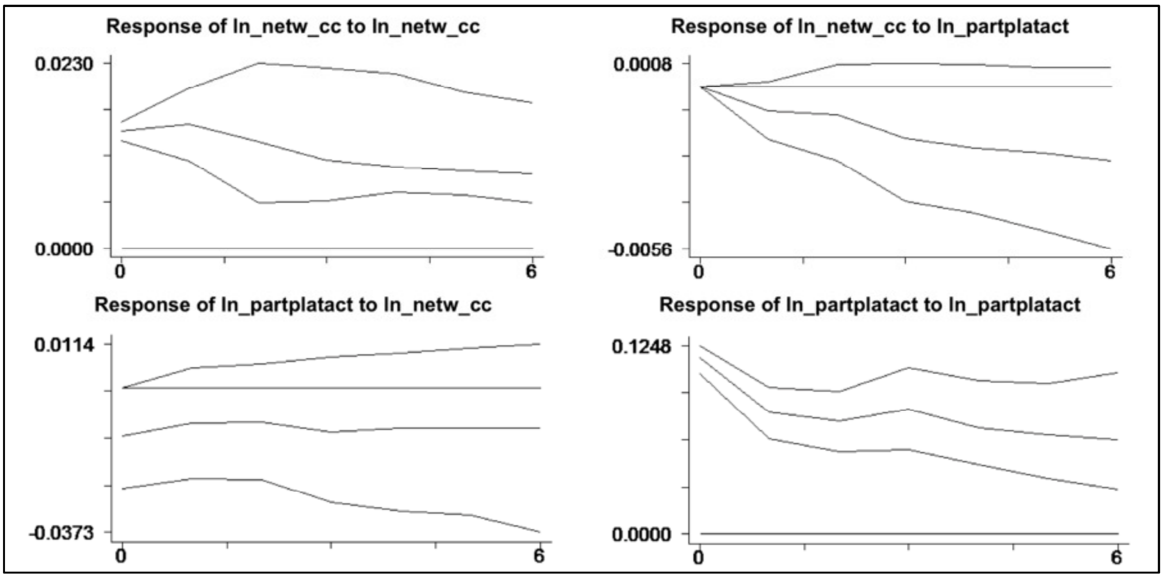
```
. pvar ln_netw_cc ln_partplatact, lag(2) gmm monte 1000
GMM started : 15:43:27
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 251
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                          b_GMM      se_GMM       t_GMM
     L.h_ln_netw_cc   .98496415   .05370241   18.341152
 L.h_ln_partplatact  -.00781157    .0071639  -1.0904072
    L2.h_ln_netw_cc    -.110427   .05286079  -2.0890154
L2.h_ln_partplatact   .00646987    .0067565   .95757752
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                          b_GMM      se_GMM       t_GMM
     L.h_ln_netw_cc   .13496049   .30449929   .44322105
 L.h_ln_partplatact   .67899274   .08315782   8.1651103
    L2.h_ln_netw_cc   -.1274869   .29290806  -.43524545
L2.h_ln_partplatact   .23392916   .08236942   2.8400002
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_netw_cc  ln_partplatact
    ln_netw_cc       .00030401
ln_partplatact      -.00020722       .01502346

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0959   1.0000
             |   0.1297
             |

GMM finished : 15:43:29

Starting Monte-Carlo loop : 15:43:30 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 15:43:36
```



```
. pvar ln_netw_cc ln_partplatact, lag(3) gmm monte 1000
GMM started : 15:44:52
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 243
---------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                         b_GMM      se_GMM       t_GMM
     L.h_ln_netw_cc   1.1241228   .20320536   5.5319543
 L.h_ln_partplatact   -.0002811   .00959971  -.02928199
    L2.h_ln_netw_cc  -.34362041   .22136852   -1.552255
L2.h_ln_partplatact   .01096809     .008955      1.2248
    L3.h_ln_netw_cc   .12512093   .08923455   1.4021578
L3.h_ln_partplatact  -.01207552   .00719315  -1.6787517
---------------------------------------------------------------------------
---------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                         b_GMM      se_GMM       t_GMM
     L.h_ln_netw_cc   .12393619   .38024166   .32594059
 L.h_ln_partplatact   .63714147   .07608146   8.3744645
    L2.h_ln_netw_cc  -.21204075   .34568757  -.61338842
L2.h_ln_partplatact   .16196837   .10616981   1.5255595
    L3.h_ln_netw_cc  -.04258811    .1419014  -.30012468
L3.h_ln_partplatact   .10163981    .1315584   .77258322
---------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                  ln_netw_cc  ln_partplatact
    ln_netw_cc     .00027952
ln_partplatact    -.00014834       .01383509

Residuals correlation matrix

             |     u1       u2
-------------+-----------------
          u1 |  1.0000
             |
             |
          u2 | -0.0744   1.0000
             |  0.2480
             |

GMM finished : 15:44:53

Starting Monte-Carlo loop : 15:44:53 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 15:45:00
```



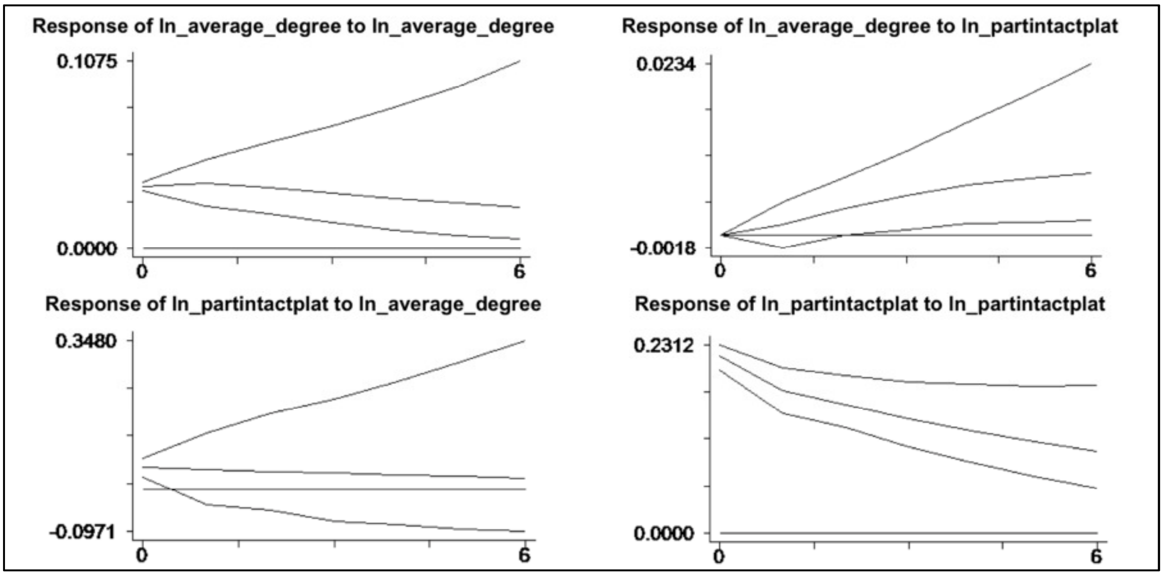
```
. pvar ln_netw_cc ln_partplatact, lag(4) gmm monte 1000
GMM started : 15:46:18
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 235
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                         b_GMM      se_GMM       t_GMM
     L.h_ln_netw_cc   1.0521101   .19164752   5.4898185
 L.h_ln_partplatact  -.00701087   .00497036  -1.4105354
    L2.h_ln_netw_cc  -.20761058   .17565493  -1.1819229
L2.h_ln_partplatact   .00418958    .0090691   .46196149
    L3.h_ln_netw_cc   .01004133    .2104405   .04771576
L3.h_ln_partplatact  -.00650762    .0063104  -1.0312536
    L4.h_ln_netw_cc   .07495443   .05049571   1.4843721
L4.h_ln_partplatact   .00320916   .00541544   .59259521
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                         b_GMM      se_GMM       t_GMM
     L.h_ln_netw_cc  -.04120167   .42915398  -.09600673
 L.h_ln_partplatact   .69089703   .08190441   8.4354072
    L2.h_ln_netw_cc   .01922116   .54447218   .03530238
L2.h_ln_partplatact   .16382996    .1053683   1.5548317
    L3.h_ln_netw_cc  -.11021905   .35641716  -.30924171
L3.h_ln_partplatact   .15042157     .152901   .98378411
    L4.h_ln_netw_cc   .05822895   .15157379   .38416241
L4.h_ln_partplatact  -.09682909   .07715765  -1.2549514
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                  ln_netw_cc  ln_partplatact
    ln_netw_cc     .00021134
ln_partplatact    -.00018101       .01376681

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1055   1.0000
             |   0.1066
             |

GMM finished : 15:46:19

Starting Monte-Carlo loop : 15:46:20 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 15:46:27
```



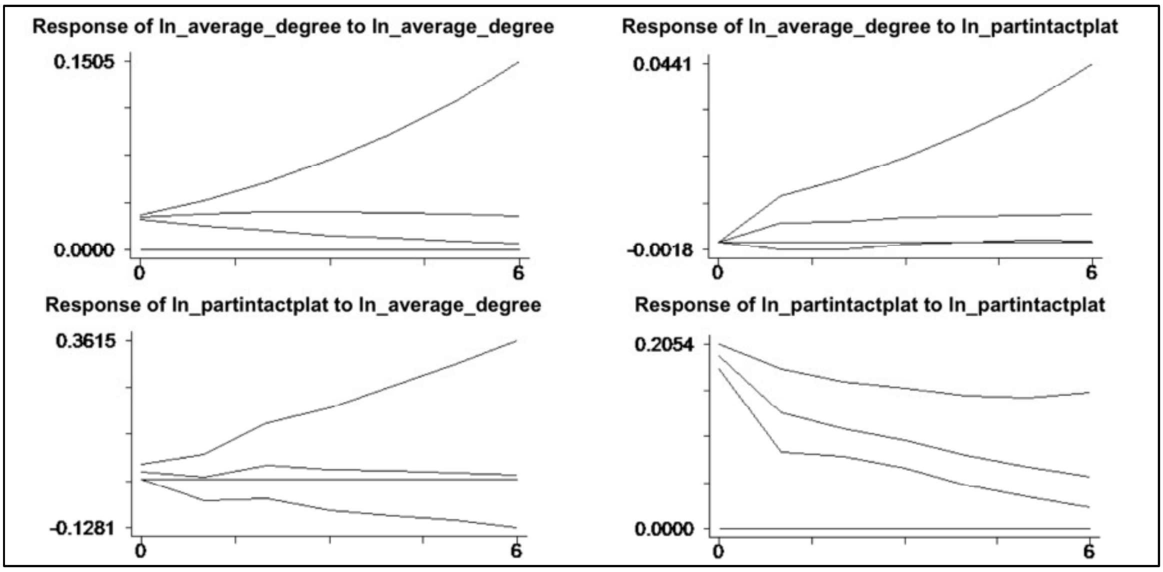
Appendix 36 Estimation Results PVAR(1)-(4) ln_average_degree ln_partintactplat; New Regions

```
. pvar ln_average_degree ln_partintactplat, lag(1) gmm monte 1000
GMM started : 15:49:28
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 272
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                           b_GMM     se_GMM      t_GMM
L.h_ln_average_degree  .95144812  .09288101  10.243731
L.h_ln_partintactplat  .01777846  .00622317  2.8568164
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                           b_GMM     se_GMM      t_GMM
L.h_ln_average_degree   .6752309  .67339047  1.0027331
L.h_ln_partintactplat  .90708734  .05595598   16.21073
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree  ln_partintactplat
ln_average_degree          .00180453
ln_partintactplat          .00444719          .14632314

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.2694   1.0000
             |   0.0000
             |

GMM finished : 15:49:30

Starting Monte-Carlo loop : 15:49:30 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 15:49:36
```

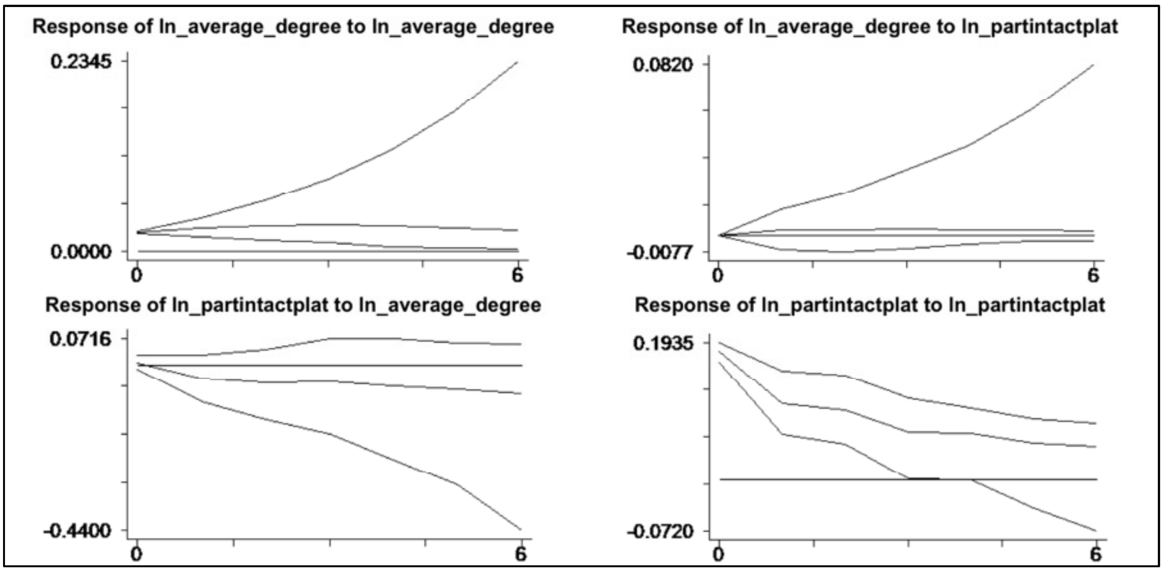
```
. pvar ln_average_degree ln_partintactplat, lag(2) gmm monte 1000
GMM started : 15:56:11
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 264
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.0476412    .2136439   4.9036792
 L.h_ln_partintactplat   .00670967   .00903977   .74223917
L2.h_ln_average_degree  -.13967561   .13308264  -1.0495405
L2.h_ln_partintactplat   .00420568   .00900871   .46684633
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   .14143615   1.3877038   .10192099
 L.h_ln_partintactplat   .80608548   .07229539   11.149888
L2.h_ln_average_degree  -.12647237   .76458674  -.16541272
L2.h_ln_partintactplat   .07563338   .05358451   1.4114784
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree  ln_partintactplat
ln_average_degree          .00125125
ln_partintactplat          .00183142          .04968231

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.2329   1.0000
             |   0.0001
             |

GMM finished : 15:56:12

Starting Monte-Carlo loop : 15:56:13 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 15:56:19
```



```
. pvar ln_average_degree ln_partintactplat, lag(3) gmm monte 1000
GMM started : 16:03:10
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 256
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.0659038   .21886471   4.8701493
 L.h_ln_partintactplat   .02476886   .02107144   1.1754709
L2.h_ln_average_degree   .02158774   .14140422   .15266685
L2.h_ln_partintactplat   -.0165015   .01690042  -.97639582
L3.h_ln_average_degree  -.12913989   .09350755  -1.3810637
L3.h_ln_partintactplat  -.00055866    .0088788  -.06292109
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree  -.35231577   1.3089458  -.26915993
 L.h_ln_partintactplat   .67299888    .1436681   4.6844002
L2.h_ln_average_degree   1.5654937   .72071902   2.1721276
L2.h_ln_partintactplat   .13381814   .10882057   1.2297137
L3.h_ln_average_degree  -1.2870299   .63045236  -2.0414388
L3.h_ln_partintactplat   .00489624   .04750037   .10307801
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree  ln_partintactplat
ln_average_degree          .00069218
ln_partintactplat          .00049638          .03724827

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0978   1.0000
             |   0.1185
             |

GMM finished : 16:03:11

Starting Monte-Carlo loop : 16:03:12 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 16:03:18
```



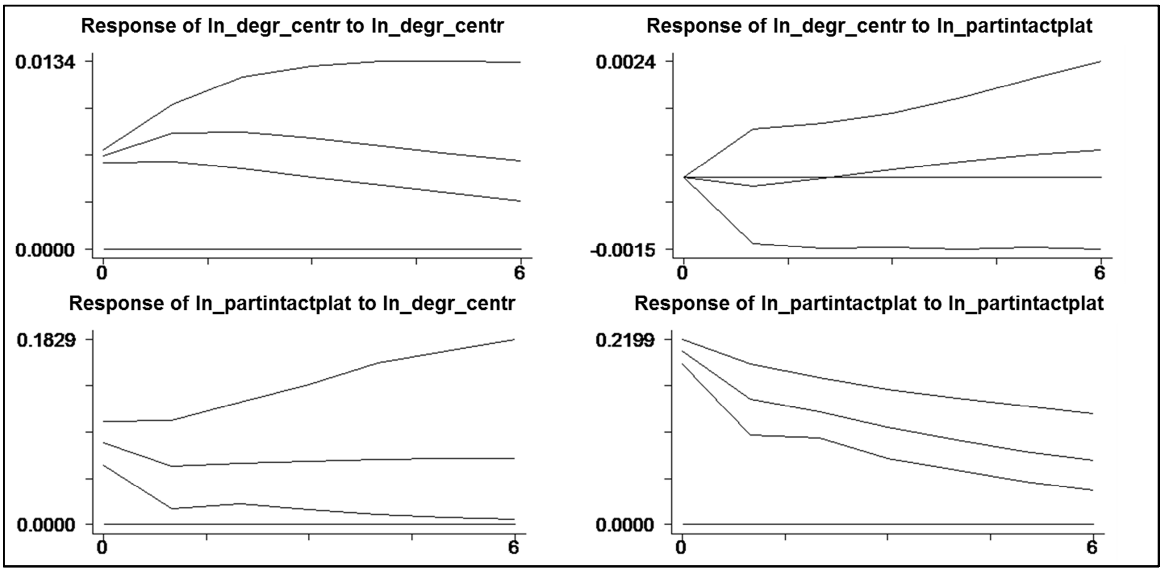
```
. pvar ln_average_degree ln_partintactplat, lag(4) gmm monte 1000
GMM started : 16:07:47
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 248
-------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                            b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.2454989   .30200574   4.1240902
 L.h_ln_partintactplat   .01469199   .03142608   .46750941
L2.h_ln_average_degree  -.17556998   .12359044   -1.420579
L2.h_ln_partintactplat  -.01369038   .02033145  -.67335957
L3.h_ln_average_degree   -.0782884   .11051198  -.70841555
L3.h_ln_partintactplat   .00466181   .01308576   .35625027
L4.h_ln_average_degree  -.04676104   .04693158  -.99636629
L4.h_ln_partintactplat  -.00440565   .01023279  -.43054215
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                            b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   -1.698972   1.5607115  -1.0885882
 L.h_ln_partintactplat   .59564059   .15041363   3.9600175
L2.h_ln_average_degree   .88197298   1.1361428   .77628706
L2.h_ln_partintactplat   .21777491    .1254607   1.7358018
L3.h_ln_average_degree   .90137036   1.2311083   .73216173
L3.h_ln_partintactplat  -.07448526   .09568894  -.77841036
L4.h_ln_average_degree  -.98830096   .80028252  -1.2349401
L4.h_ln_partintactplat   .07793172   .06247652   1.2473762
-------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree  ln_partintactplat
ln_average_degree           .00052935
ln_partintactplat           .00016071           .0324274

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0404   1.0000
             |   0.5265
             |

GMM finished : 16:07:48

Starting Monte-Carlo loop : 16:07:49 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 16:07:56
```



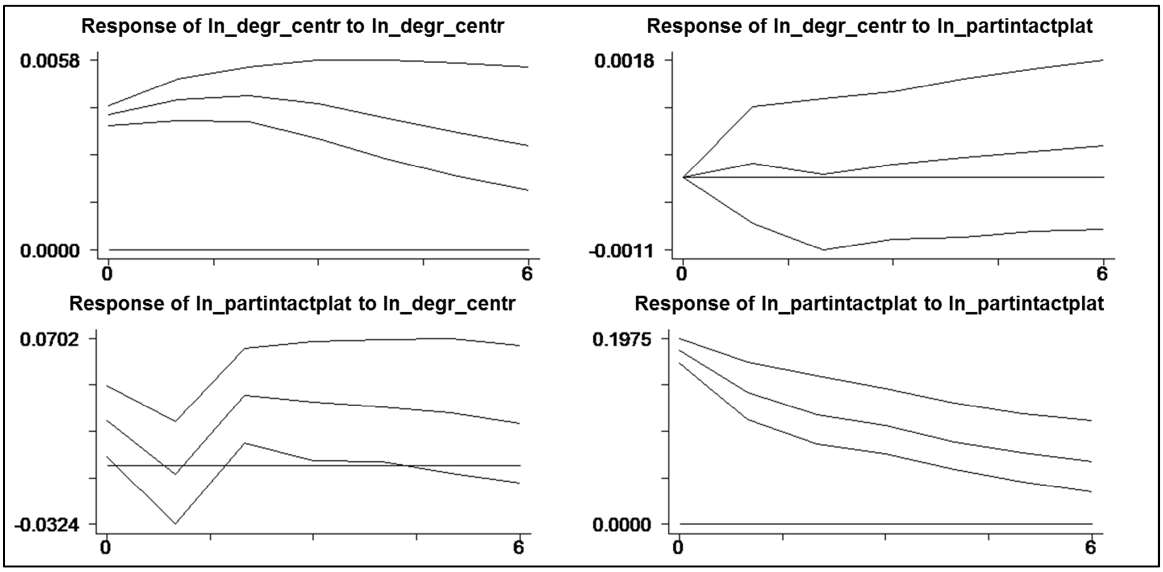
Appendix 37 Estimation Results PVAR(1)-(4) ln_degree_centralization ln_partintactplat; New Regions

```
. pvar ln_degr_centr ln_partintactplat, lag(1) gmm monte 1000
GMM started : 16:13:21
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 271
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                           b_GMM     se_GMM      t_GMM
    L.h_ln_degr_centr  .88284517  .05996827  14.721872
L.h_ln_partintactplat  .00156004  .00125552  1.2425466
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                           b_GMM     se_GMM      t_GMM
    L.h_ln_degr_centr  1.7786831  1.3098043  1.3579763
L.h_ln_partintactplat  .84044881  .04755928  17.671605
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                       ln_degr_centr  ln_partintactplat
    ln_degr_centr          .00010898
ln_partintactplat          .00053136          .05766883

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.2111   1.0000
             |   0.0005
             |

GMM finished : 16:13:23

Starting Monte-Carlo loop : 16:13:23 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 16:13:29
```

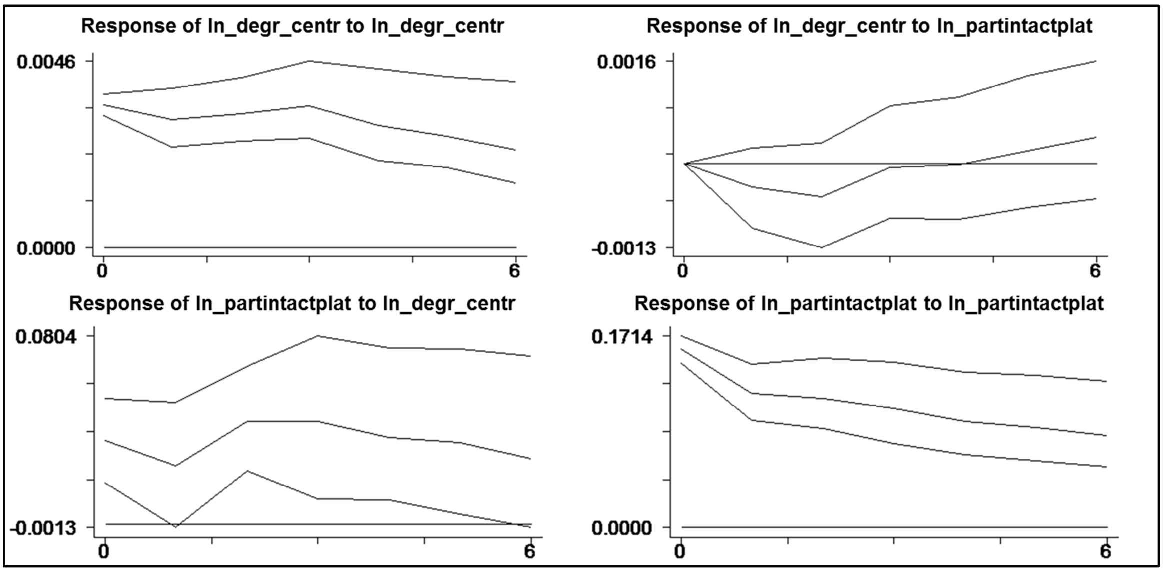
```
. pvar ln_degr_centr ln_partintactplat, lag(2) gmm monte 1000
GMM started : 16:16:57
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 263
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                           b_GMM      se_GMM       t_GMM
     L.h_ln_degr_centr   .96273162   .23635685   4.0732123
 L.h_ln_partintactplat   .00188989   .00328811   .57476597
    L2.h_ln_degr_centr  -.04994305   .20593768  -.24251537
L2.h_ln_partintactplat  -.00045869   .00334975  -.13693188
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                          b_GMM     se_GMM      t_GMM
     L.h_ln_degr_centr   .4896889  2.6518976  .18465603
 L.h_ln_partintactplat  .71777659  .11407481  6.2921568
    L2.h_ln_degr_centr  .87468881  2.2778458  .38399826
L2.h_ln_partintactplat  .13228955  .08420966  1.5709545
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                       ln_degr_centr  ln_partintactplat
    ln_degr_centr          .00009296
ln_partintactplat          .00051086          .04917151

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.2387   1.0000
             |   0.0001
             |

GMM finished : 16:16:58

Starting Monte-Carlo loop : 16:16:58 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 16:17:04
```



```
. pvar ln_degr_centr ln_partintactplat, lag(3) gmm monte 1000
GMM started : 16:19:06
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 255
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                            b_GMM      se_GMM       t_GMM
     L.h_ln_degr_centr   .82767824   .21679754   3.8177474
 L.h_ln_partintactplat     .004228   .00343674   1.2302364
    L2.h_ln_degr_centr   .18398793   .20904609    .88013094
L2.h_ln_partintactplat  -.00378818   .00354403  -1.0688904
    L3.h_ln_degr_centr  -.12249331   .07057771  -1.7355808
L3.h_ln_partintactplat   .00112142   .00208695    .53734875
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                            b_GMM      se_GMM       t_GMM
     L.h_ln_degr_centr   .45428818   2.8184689    .16118261
 L.h_ln_partintactplat   .68815844   .10326433   6.6640476
    L2.h_ln_degr_centr   5.1612535   3.8424172   1.3432309
L2.h_ln_partintactplat   .14461148   .11097088   1.3031481
    L3.h_ln_degr_centr   -5.052213   2.6578401  -1.9008717
L3.h_ln_partintactplat  -.00019896   .07903368  -.00251741
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                       ln_degr_centr  ln_partintactplat
    ln_degr_centr          .00006085
ln_partintactplat           .0000975          .03876598

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 |  0.0633   1.0000
             |  0.3141
             |

GMM finished : 16:19:07

Starting Monte-Carlo loop : 16:19:08 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 16:19:14
```



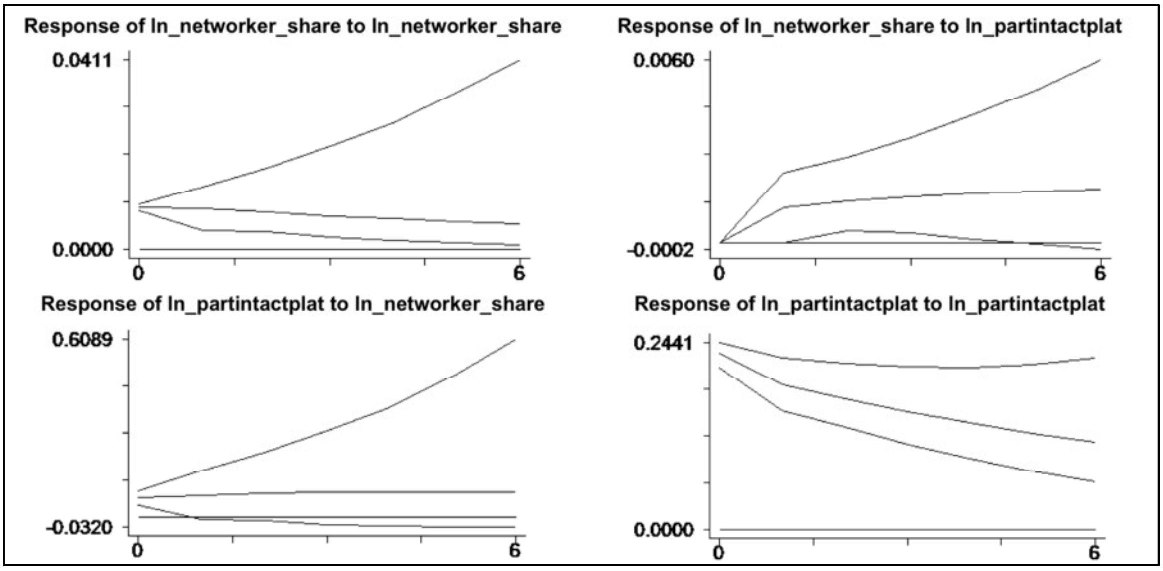
```
. pvar ln_degr_centr ln_partintactplat, lag(4) gmm monte 1000
GMM started : 16:20:18
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 247
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                            b_GMM      se_GMM       t_GMM
     L.h_ln_degr_centr   .64673651   .23296913   2.7760609
 L.h_ln_partintactplat  -.00051603   .00232307  -.22213493
    L2.h_ln_degr_centr   .32354599   .23525671   1.3752891
L2.h_ln_partintactplat   .00036646   .00263377   .13914081
    L3.h_ln_degr_centr   .03482307   .09056691    .3845011
L3.h_ln_partintactplat   .00316221   .00252604    1.251846
    L4.h_ln_degr_centr  -.16053095   .06113521  -2.6258348
L4.h_ln_partintactplat  -.00127908   .00187659  -.68159562
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                            b_GMM      se_GMM       t_GMM
     L.h_ln_degr_centr   2.0952895   1.7796351   1.1773703
 L.h_ln_partintactplat   .74389867   .08425429   8.8292079
    L2.h_ln_degr_centr   1.3222608   1.8857208   .70119648
L2.h_ln_partintactplat   .17751459   .08683952   2.0441683
    L3.h_ln_degr_centr  -1.0633939    1.713411  -.62062979
L3.h_ln_partintactplat   .01167878   .08871759    .1316399
    L4.h_ln_degr_centr  -2.7463156   1.8424246  -1.4905986
L4.h_ln_partintactplat  -.03282456   .05512342   -.5954739
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                      ln_degr_centr  ln_partintactplat
    ln_degr_centr          .00005021
ln_partintactplat          .00017139          .02724234

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1465   1.0000
             |   0.0213
             |

GMM finished : 16:20:19

Starting Monte-Carlo loop : 16:20:20 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 16:20:26
```



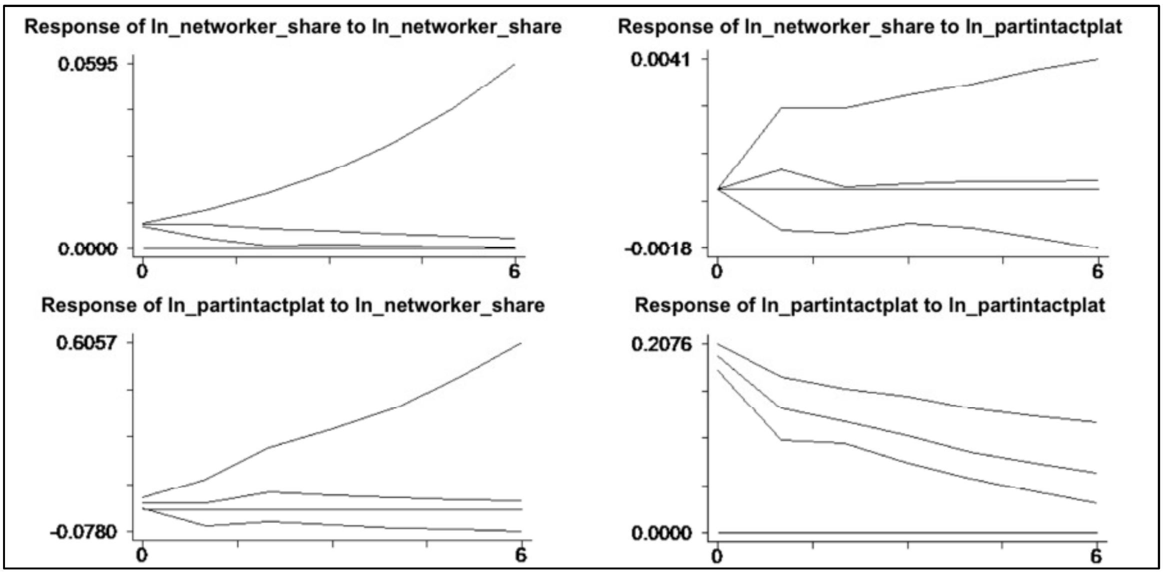
Appendix 38 Estimation Results PVAR(1)-(4) ln_networker_share ln_partintactplat; New Regions

```
. pvar ln_networker_share ln_partintactplat, lag(1) gmm monte 1000
GMM started : 16:23:10
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 272
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                            b_GMM     se_GMM      t_GMM
L.h_ln_networker_share  .73518989  .10578913  6.9495789
 L.h_ln_partintactplat  .00168229  .00228409  .73652457
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                            b_GMM     se_GMM      t_GMM
L.h_ln_networker_share  3.1766556  1.7724059  1.7922845
 L.h_ln_partintactplat  .86251262  .05017466  17.190204
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share   ln_partintactplat
ln_networker_share            .0001472
 ln_partintactplat          -.00009373           .14712539

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0155   1.0000
             |   0.7991
             |

GMM finished : 16:23:11

Starting Monte-Carlo loop : 16:23:12 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 16:23:18
```

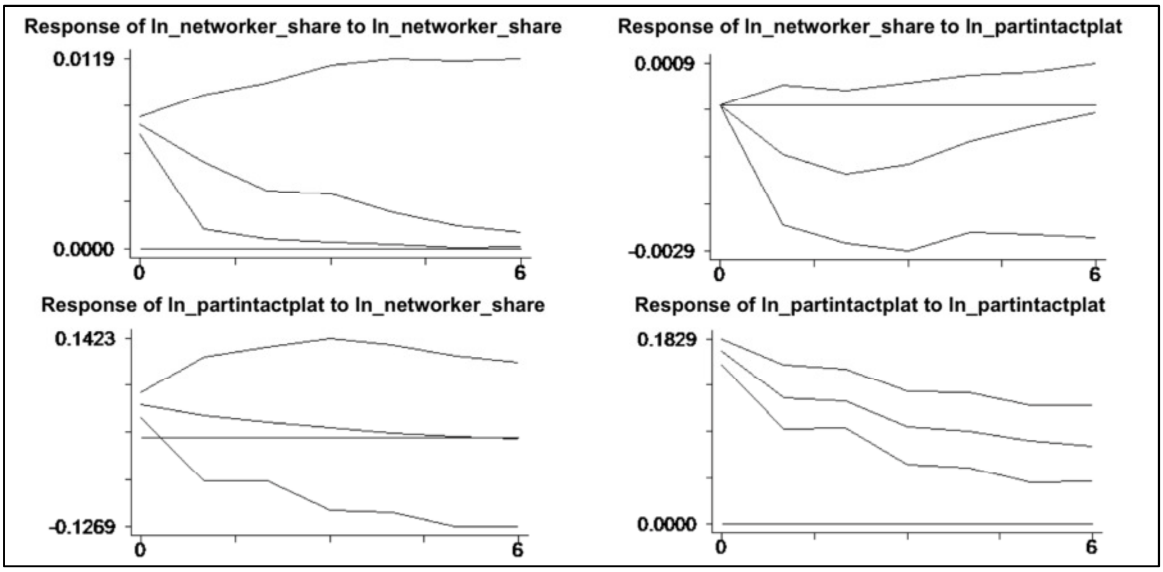
```
. pvar ln_networker_share ln_partintactplat, lag(2) gmm monte 1000
GMM started : 16:28:20
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 264
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   .93971331   .30289955   3.1023925
  L.h_ln_partintactplat   .00494909   .00303057   1.6330562
L2.h_ln_networker_share  -.05364951   .15980745  -.33571348
 L2.h_ln_partintactplat  -.00285781   .00428159   -.6674648
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   2.3736764   5.6090745   .42318503
  L.h_ln_partintactplat   .82445524   .08674317   9.5045551
L2.h_ln_networker_share  -.60289256   3.0683227   -.1964893
 L2.h_ln_partintactplat   .05519765   .06815191   .80992083
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share   ln_partintactplat
ln_networker_share           .00008169
 ln_partintactplat           .00060118           .05679835

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.2792   1.0000
             |   0.0000
             |

GMM finished : 16:28:21

Starting Monte-Carlo loop : 16:28:21 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 16:28:27
```



```
. pvar ln_networker_share ln_partintactplat, lag(3) gmm monte 1000
GMM started : 16:32:10
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 256
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   .98548953   .32727084   3.0112354
  L.h_ln_partintactplat   .00320314   .00549518   .58289955
L2.h_ln_networker_share  -.12501575   .12403355  -1.0079188
 L2.h_ln_partintactplat  -.00495516   .00582212   -.8510921
L3.h_ln_networker_share   .00286078   .12137632   .02356948
 L3.h_ln_partintactplat   .00239546    .0032463   .73790468
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   .64191679   6.5842386   .09749294
  L.h_ln_partintactplat    .7043183   .10177902   6.9200732
L2.h_ln_networker_share   5.0120895   2.9077084   1.7237249
 L2.h_ln_partintactplat   .13251702   .09561773   1.3859044
L3.h_ln_networker_share   -4.873964   2.5819546  -1.8877032
 L3.h_ln_partintactplat  -.00376654   .05214872  -.07222694
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share   ln_partintactplat
ln_networker_share           .00006044
 ln_partintactplat           .00019332           .03815442

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1280   1.0000
             |   0.0407
             |

GMM finished : 16:32:11

Starting Monte-Carlo loop : 16:32:12 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 16:32:18
```



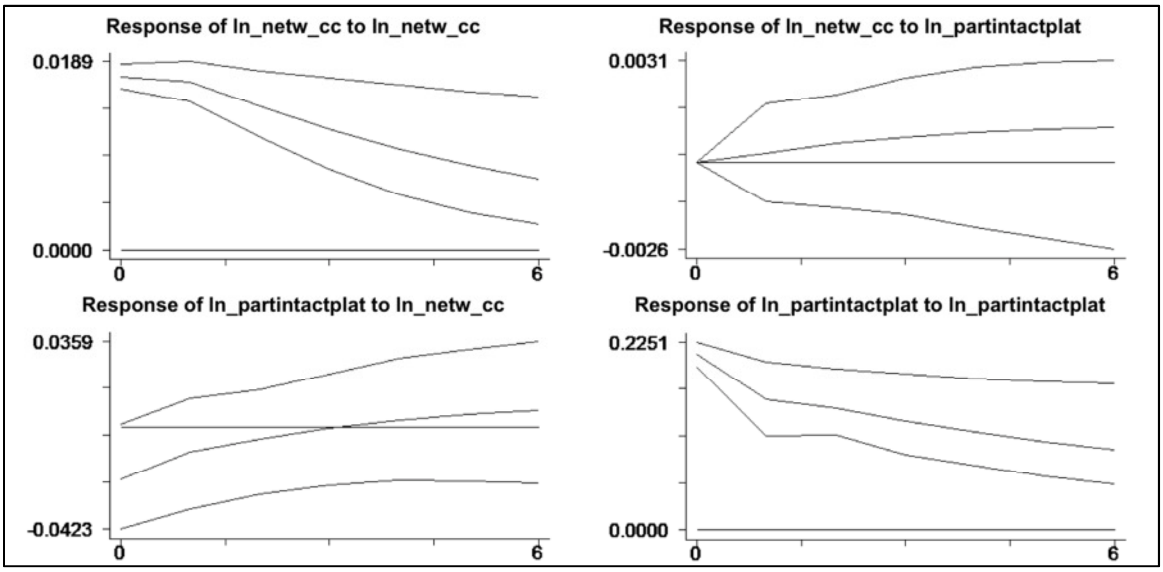
```
. pvar ln_networker_share ln_partintactplat, lag(4) gmm monte 1000
GMM started : 16:36:37
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 248
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   .73697615   .32277953   2.2832184
  L.h_ln_partintactplat  -.00572791   .00517562  -1.1067087
L2.h_ln_networker_share   -.0265356   .21708222  -.12223755
 L2.h_ln_partintactplat    .0003759   .00626204    .0600291
L3.h_ln_networker_share   .11763866   .11582998    1.015615
 L3.h_ln_partintactplat   .00256815   .00534063   .48087059
L4.h_ln_networker_share  -.12387052   .08431494  -1.4691408
 L4.h_ln_partintactplat   .00245109   .00399877   .61296265
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   -.2648836   6.5461802  -.04046384
  L.h_ln_partintactplat   .73221138   .10732392   6.8224435
L2.h_ln_networker_share  -1.0683203    3.163782  -.33767191
 L2.h_ln_partintactplat    .1720508   .13288137   1.2947699
L3.h_ln_networker_share   .42495591   1.8406026   .23087869
 L3.h_ln_partintactplat  -.09142384   .10457959  -.87420343
L4.h_ln_networker_share  -.56420216   2.0256657  -.27852679
 L4.h_ln_partintactplat   .06529254   .06591348   .99057951
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share   ln_partintactplat
ln_networker_share           .00006009
 ln_partintactplat            .0003605             .031268

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.2598   1.0000
             |   0.0000
             |

GMM finished : 16:36:38

Starting Monte-Carlo loop : 16:36:38 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 16:36:45
```



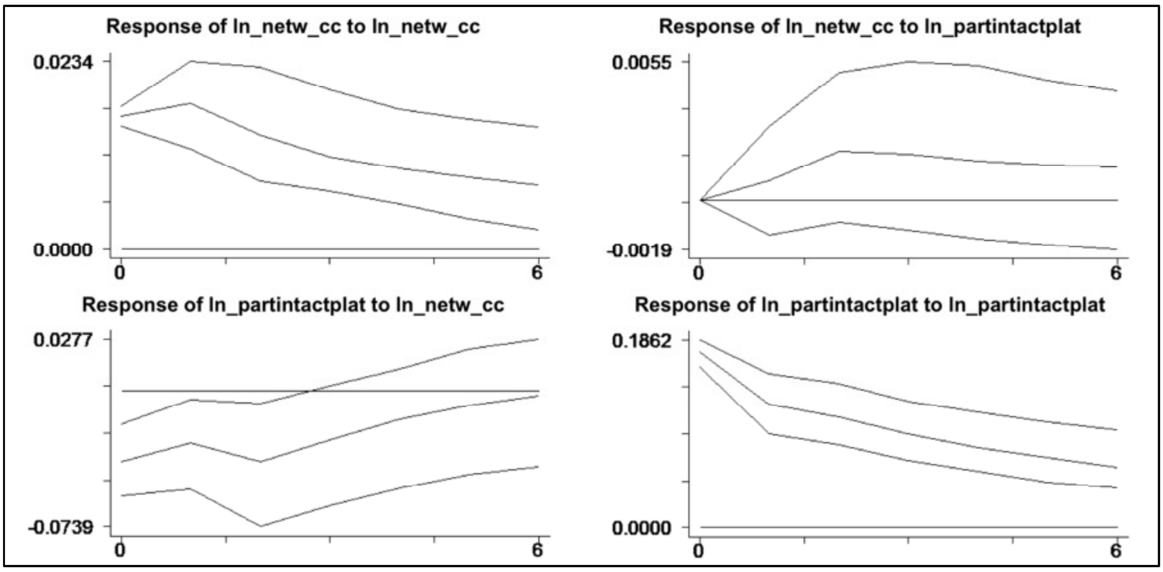
Appendix 39 Estimation Results PVAR(1)-(4) ln_network_cc ln_partintactplat; New Regions

```
. pvar ln_netw_cc ln_partintactplat, lag(1) gmm monte 1000
GMM started : 16:42:14
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 259
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                          b_GMM     se_GMM      t_GMM
       L.h_ln_netw_cc  .74917136  .07335629  10.212776
L.h_ln_partintactplat  .00874819  .00737328  1.1864714
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                           b_GMM      se_GMM       t_GMM
       L.h_ln_netw_cc  -.01465781   .35016301  -.04185997
L.h_ln_partintactplat    .8909906   .05853887   15.220495
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                         ln_netw_cc  ln_partintactplat
       ln_netw_cc          .00121667
ln_partintactplat          .00085892           .0527309

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1054   1.0000
             |   0.0906
             |

GMM finished : 16:42:15

Starting Monte-Carlo loop : 16:42:16 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 16:42:21
```

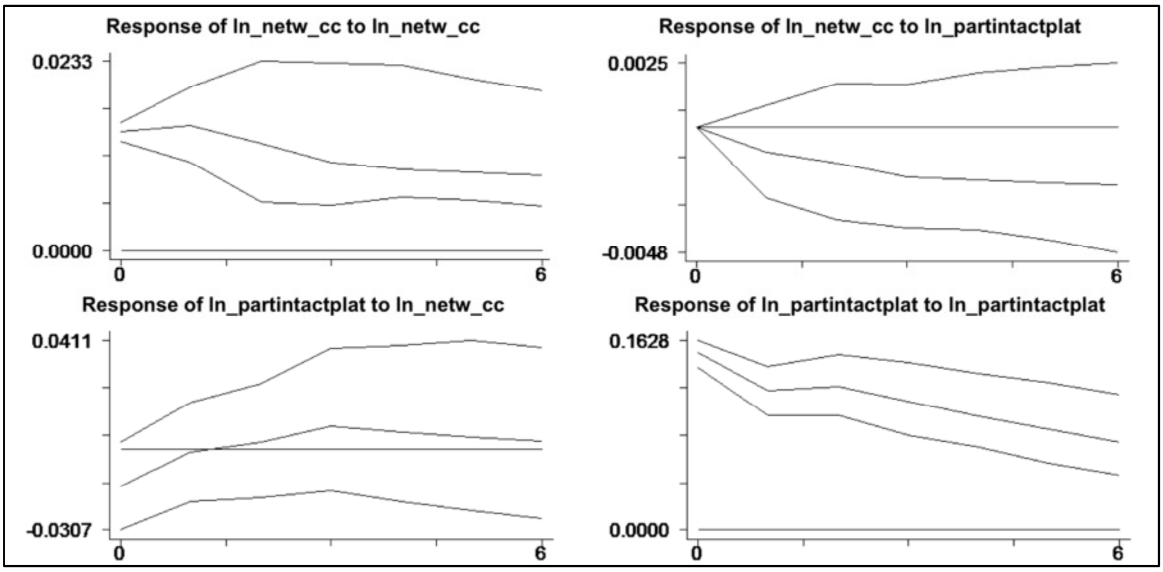
```
. pvar ln_netw_cc ln_partintactplat, lag(2) gmm monte 1000
GMM started : 16:44:31
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 251
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                           b_GMM      se_GMM       t_GMM
        L.h_ln_netw_cc    .9704168   .05878504   16.507887
 L.h_ln_partintactplat   .00137066   .00448815   .30539412
       L2.h_ln_netw_cc  -.11051878   .05215319  -2.1191182
L2.h_ln_partintactplat   .00036389    .0043932   .08282953
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                           b_GMM      se_GMM       t_GMM
        L.h_ln_netw_cc   .34271994   .58760196   .58325187
 L.h_ln_partintactplat   .74011614   .12360734   5.9876392
       L2.h_ln_netw_cc  -.01190314   .70571991  -.01686666
L2.h_ln_partintactplat   .14321581   .08752721   1.6362433
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                        ln_netw_cc  ln_partintactplat
       ln_netw_cc          .00029897
ln_partintactplat         -.00037252          .04485067

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1016   1.0000
             |   0.1084
             |

GMM finished : 16:44:32

Starting Monte-Carlo loop : 16:44:32 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 16:44:38
```



```
. pvar ln_netw_cc ln_partintactplat, lag(3) gmm monte 1000
GMM started : 16:46:24
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 243
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                           b_GMM      se_GMM       t_GMM
        L.h_ln_netw_cc   1.1104604   .19532302   5.6852511
 L.h_ln_partintactplat   .00455575    .0076324   .59689568
       L2.h_ln_netw_cc   -.3460797   .21581842  -1.6035689
L2.h_ln_partintactplat   .00283205    .0062269   .45480919
       L3.h_ln_netw_cc   .12389221    .0861929   1.4373831
L3.h_ln_partintactplat  -.00512578   .00414935  -1.2353201
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                           b_GMM      se_GMM       t_GMM
        L.h_ln_netw_cc  -.08106867   .65618428  -.12354558
 L.h_ln_partintactplat   .70670571   .10441244   6.7684054
       L2.h_ln_netw_cc  -.71545122   .96208464  -.74364685
L2.h_ln_partintactplat   .13477746   .09844406   1.3690766
       L3.h_ln_netw_cc   1.0927926   .78721421    1.388177
L3.h_ln_partintactplat  -.00277597   .06996457  -.03967676
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                        ln_netw_cc  ln_partintactplat
       ln_netw_cc         .00027269
ln_partintactplat        -.00063355          .03171714

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.2149   1.0000
             |   0.0007
             |

GMM finished : 16:46:25

Starting Monte-Carlo loop : 16:46:26 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 16:46:32
```



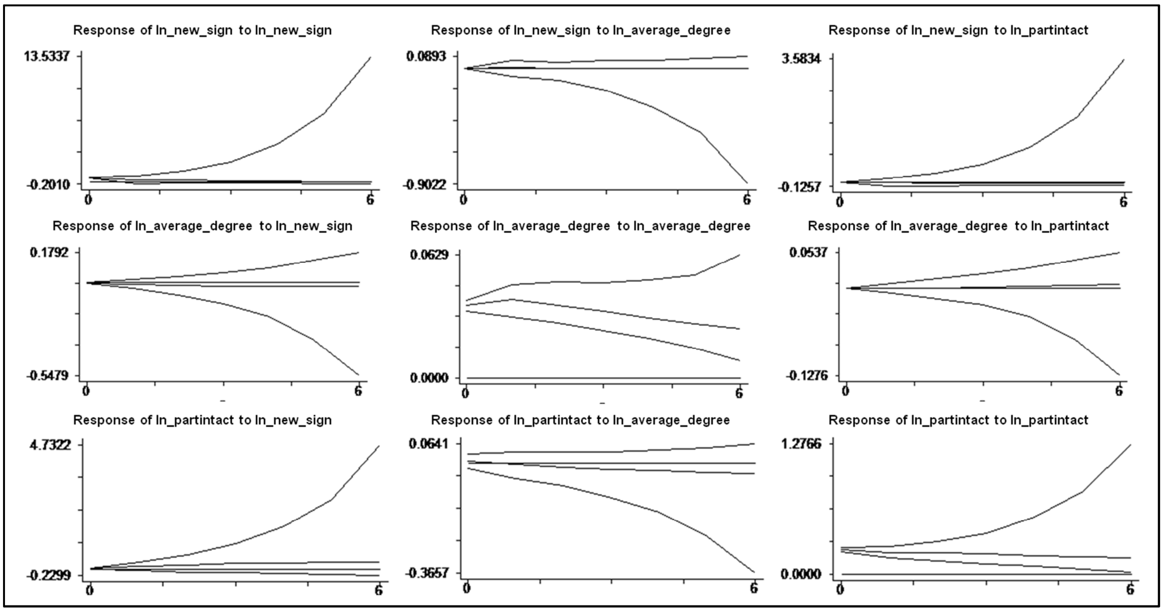
```
. pvar ln_netw_cc ln_partintactplat, lag(4) gmm monte 1000
GMM started : 16:48:26
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 235
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                            b_GMM      se_GMM       t_GMM
        L.h_ln_netw_cc   1.0468734   .19654319   5.3264295
 L.h_ln_partintactplat   -.0063044   .00691071  -.91226464
       L2.h_ln_netw_cc  -.19749001   .17605947  -1.1217233
L2.h_ln_partintactplat   .00258116   .00577564   .44690401
       L3.h_ln_netw_cc   .00622023   .20761532   .02996037
L3.h_ln_partintactplat   -.0013674   .00462084  -.29591993
       L4.h_ln_netw_cc   .08175806   .05256557    1.555354
L4.h_ln_partintactplat   .00165094   .00356516   .46307624
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                            b_GMM      se_GMM       t_GMM
        L.h_ln_netw_cc   .66639023   .50194482   1.3276165
 L.h_ln_partintactplat   .79125245   .07358649   10.752687
       L2.h_ln_netw_cc  -.26901871     .671254  -.40077036
L2.h_ln_partintactplat   .19189443   .07417885   2.5869158
       L3.h_ln_netw_cc   .07416021    .4325059   .17146635
L3.h_ln_partintactplat  -.06144416   .08572816   -.7167325
       L4.h_ln_netw_cc  -.43405375   .23844056  -1.8203856
L4.h_ln_partintactplat  -.03377985   .05425062  -.62266289
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                         ln_netw_cc  ln_partintactplat
       ln_netw_cc          .00021259
ln_partintactplat         -.00020248          .02324114

Residuals correlation matrix

             |        u1       u2
-------------+-------------------
          u1 |    1.0000
             |
             |
          u2 |   -0.0906   1.0000
             |    0.1662
             |

GMM finished : 16:48:28

Starting Monte-Carlo loop : 16:48:29 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 16:48:36
```



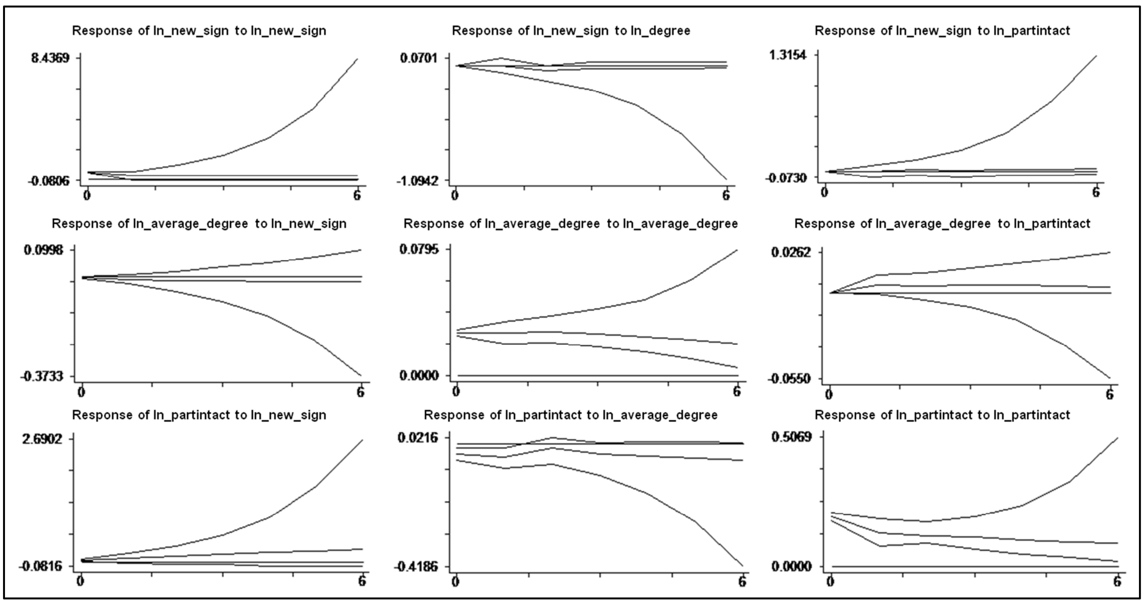
Appendix 40 Estimation Results PVAR(1)-(4) ln_new_signups ln_average_degree ln_partintact; New Regions

```
. pvar ln_new_sign ln_average_degree ln_partintact, lag(1) gmm monte 1000
GMM started : 12:01:44
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 272
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                            b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign   .59773291   .66119673   .90401673
L.h_ln_average_degree   .14511486     .344938   .42069839
    L.h_ln_partintact  -.10044383   .32952526  -.30481375
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                           b_GMM     se_GMM      t_GMM
      L.h_ln_new_sign  .00532656  .03281805  .16230593
L.h_ln_average_degree  .90550984   .0282947  32.002808
    L.h_ln_partintact  .01984239   .0148778  1.3336912
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                            b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign   .37908096   .33640749   1.1268505
L.h_ln_average_degree  -.13099576   .25170382  -.52043615
    L.h_ln_partintact   1.0315279   .16717945   6.1701835
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                         ln_new_sign  ln_average_degree      ln_partintact
      ln_new_sign          .26095163
ln_average_degree          .00256425          .00164113
    ln_partintact          .03545753           .0040148          .23656234

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1236   1.0000
             |   0.0416
             |
          u3 |   0.1418   0.2027   1.0000
             |   0.0193   0.0008
             |

GMM finished : 12:01:46

Starting Monte-Carlo loop : 12:01:48 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 12:01:54
```

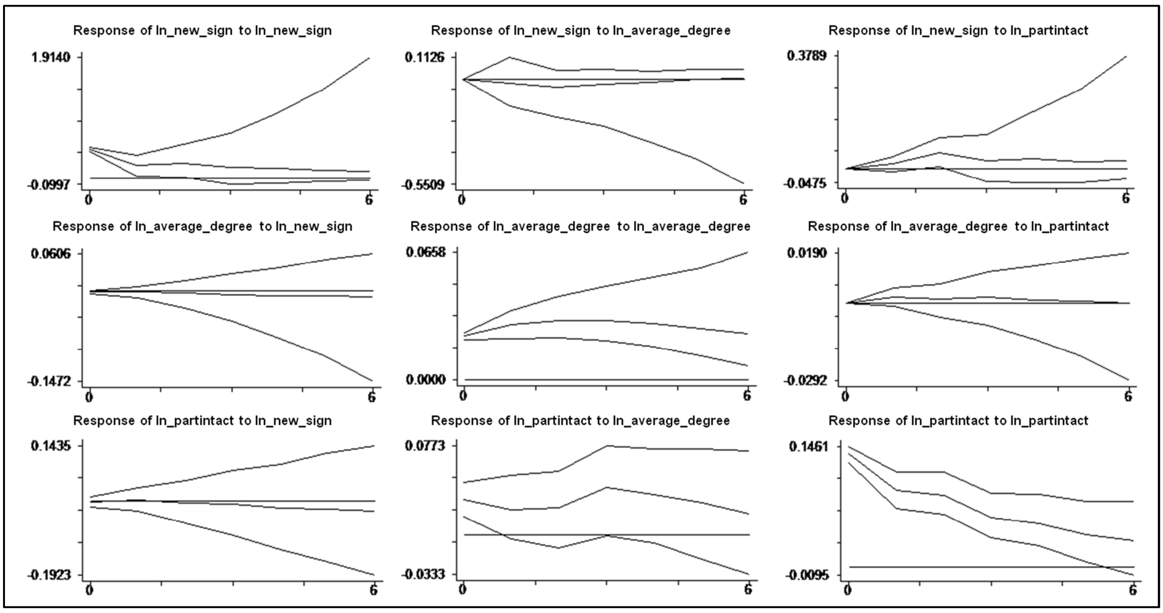
```
. pvar ln_new_sign ln_average_degree ln_partintact, lag(2) gmm monte 1000
GMM started : 12:30:50
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 264
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                               b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .50491673   .52686264   .95834604
 L.h_ln_average_degree   .01957551   1.0431218   .01876627
     L.h_ln_partintact  -.01333008   .30156768  -.04420262
      L2.h_ln_new_sign   .20504749   .19096177    1.073762
L2.h_ln_average_degree  -.06466505   .82205855  -.07866234
    L2.h_ln_partintact  -.04732154   .13819529  -.34242514
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                               b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   -.0140955     .029057  -.48509815
 L.h_ln_average_degree    1.076764   .13334112   8.0752586
     L.h_ln_partintact    .0006664   .02010546   .03314533
      L2.h_ln_new_sign   -.0047479   .01222838  -.38826891
L2.h_ln_average_degree  -.15492946   .12474613  -1.2419581
    L2.h_ln_partintact   .00357822   .00982053   .36436055
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                               b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .17367601   .20783842   .83562998
 L.h_ln_average_degree  -.33741788   .62243973  -.54208924
     L.h_ln_partintact   .88787632   .13914786    6.380812
      L2.h_ln_new_sign   .04002215    .0790865   .50605542
L2.h_ln_average_degree   .12536589    .4955505   .25298307
    L2.h_ln_partintact   .07324822   .08405752   .87140591
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                         ln_new_sign  ln_average_degree      ln_partintact
      ln_new_sign           .2442565
ln_average_degree         -.00133054          .00137593
    ln_partintact          .01394837          .00017267          .05734181

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0724   1.0000
             |   0.2411
             |
          u3 |   0.1176   0.0212   1.0000
             |   0.0562   0.7323
             |

GMM finished : 12:30:51

Starting Monte-Carlo loop : 12:30:53 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 12:31:00
```



```
. pvar ln_new_sign ln_average_degree ln_partintact, lag(3) gmm monte 1000
GMM started : 12:32:58
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 256
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign   .51311128   .38148776   1.3450269
 L.h_ln_average_degree  -.02160455    1.451193  -.01488744
     L.h_ln_partintact  -.04760157   .20236289  -.23522875
     L2.h_ln_new_sign   .32277252   .23984859   1.3457345
L2.h_ln_average_degree  -1.6774127    1.173095  -1.4299036
    L2.h_ln_partintact   .12188236   .20380394   .59803734
     L3.h_ln_new_sign   .08146036   .09661563   .84313851
L3.h_ln_average_degree   1.7440454   .60667271   2.8747715
    L3.h_ln_partintact   .00649479    .1081389   .06005971
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                             b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign  -.01330037   .01968577  -.67563381
 L.h_ln_average_degree   1.0220099   .13340297   7.6610736
     L.h_ln_partintact   .02681963   .01929988   1.3896264
     L2.h_ln_new_sign   -.0061518   .01341424  -.45860225
L2.h_ln_average_degree   .01822394   .14097288   .12927267
    L2.h_ln_partintact  -.02203561   .01555337  -1.4167735
     L3.h_ln_new_sign   .00515804   .00514946   1.0016659
L3.h_ln_average_degree  -.11618509   .05514726  -2.1068154
    L3.h_ln_partintact  -.00018886   .00750097  -.02517852
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                             b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign   .12227001   .12654809   .96619403
 L.h_ln_average_degree  -.84209563   .59914022  -1.4055068
     L.h_ln_partintact   .67298316   .15972262   4.2134492
     L2.h_ln_new_sign   .07553338   .07561001   .99898649
L2.h_ln_average_degree   1.6815874   .90972571   1.8484554
    L2.h_ln_partintact   .18528973   .15057466   1.2305505
     L3.h_ln_new_sign   .02986716   .03837004   .77839804
L3.h_ln_average_degree  -1.1277142   .59609215  -1.8918454
    L3.h_ln_partintact   .02969184   .04916173   .60396243
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                        ln_new_sign  ln_average_degree      ln_partintact
      ln_new_sign          .23131268
ln_average_degree         -.00290963          .00076655
    ln_partintact          .01846521         -.00121422          .04102628

Residuals correlation matrix

             |       u1        u2        u3
-------------+------------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.2185    1.0000
             |   0.0004
             |
          u3 |   0.1895   -0.2149    1.0000
             |   0.0023    0.0005
             |

GMM finished : 12:33:00

Starting Monte-Carlo loop : 12:33:01 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 12:33:09
```



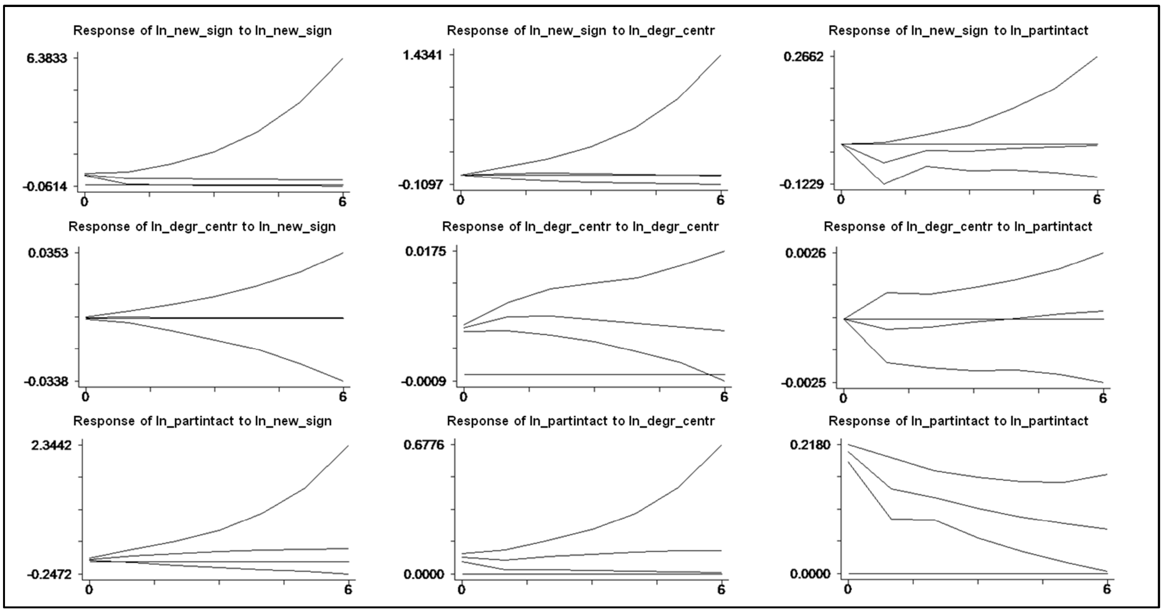
```
. pvar ln_new_sign ln_average_degree ln_partintact, lag(4) gmm monte 1000
GMM started : 12:35:57
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
________ Results of the Estimation by system GMM__________
number of observations used : 248
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .44254473   .19766645   2.2388459
 L.h_ln_average_degree  -1.1098278   3.4389355  -.32272423
     L.h_ln_partintact    .1205642   .11737787   1.0271459
      L2.h_ln_new_sign   .29607333   .17699393   1.6727881
L2.h_ln_average_degree  -.62220186   2.6345894  -.23616654
    L2.h_ln_partintact   .28109103   .24679296   1.1389751
      L3.h_ln_new_sign   .01978552   .13234988   .14949407
L3.h_ln_average_degree   2.2243776   1.3389776   1.6612508
    L3.h_ln_partintact  -.25304432   .12105194  -2.0903781
      L4.h_ln_new_sign   .01225295   .08382866   .14616657
L4.h_ln_average_degree  -.39038841   .83503872  -.46750935
    L4.h_ln_partintact  -.03146774   .09909939  -.31753715
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign    .0016028   .01054272   .15202957
 L.h_ln_average_degree   1.2315441   .18761692   6.5641419
     L.h_ln_partintact    .0160116   .01518338   1.0545479
      L2.h_ln_new_sign  -.00528501   .01122102  -.47099212
L2.h_ln_average_degree  -.18663714   .18478083   -1.010046
    L2.h_ln_partintact  -.02057741   .01675454  -1.2281692
      L3.h_ln_new_sign   -.0021202   .00684351  -.30981223
L3.h_ln_average_degree  -.08527238   .08610277  -.99035577
    L3.h_ln_partintact   .00980248   .01254975   .78108972
      L4.h_ln_new_sign   .00087448   .00471061   .18564135
L4.h_ln_average_degree   -.0372183   .05155155  -.72196283
    L4.h_ln_partintact  -.00507055   .00818775   -.6192844
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00943819   .03633287   .25977013
 L.h_ln_average_degree    .0820306   .69178339   .11857845
     L.h_ln_partintact   .67460519    .0884048   7.6308661
      L2.h_ln_new_sign  -.01682154    .0333474  -.50443326
L2.h_ln_average_degree   .03637972    .8043507   .04522868
    L2.h_ln_partintact   .17626787   .10030717   1.7572809
      L3.h_ln_new_sign   -.0061845   .02459581  -.25144517
L3.h_ln_average_degree   .93475931   1.1467405   .81514458
    L3.h_ln_partintact  -.11472206   .08015935  -1.4311751
      L4.h_ln_new_sign  -.01626332   .02423385  -.67109931
L4.h_ln_average_degree  -1.1771393   .80682674  -1.4589741
    L4.h_ln_partintact   .04691959   .04204459   1.1159485
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                         ln_new_sign  ln_average_degree      ln_partintact
      ln_new_sign          .21156442
ln_average_degree         -.00103156          .00051721
    ln_partintact         -.00088395          .00069925          .01967966

Residuals correlation matrix

             |       u1        u2        u3
-------------+------------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0988    1.0000
             |   0.1206
             |
          u3 |  -0.0137    0.2191    1.0000
             |   0.8295    0.0005
             |

GMM finished : 12:35:59

Starting Monte-Carlo loop : 12:36:01 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 12:36:10
```



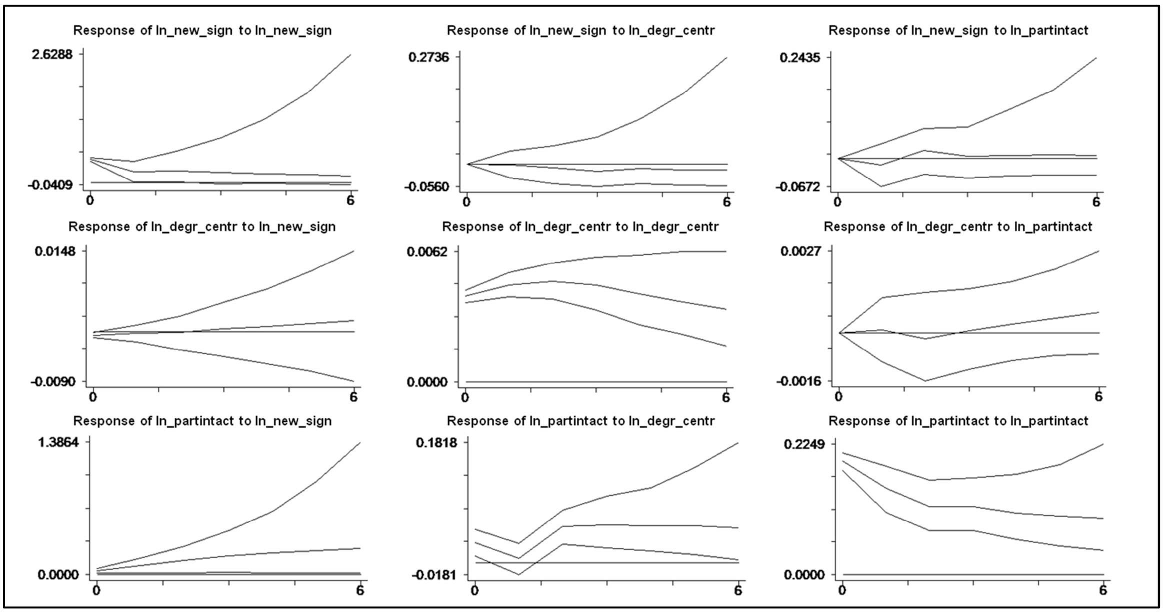
Appendix 41 Estimation Results PVAR(1)-(4) ln_new_signups ln_degree_centralization ln_partintact; New Regions

```
. pvar ln_new_sign ln_degr_centr ln_partintact, lag(1) gmm monte 1000
GMM started : 12:59:10
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 271
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                        b_GMM      se_GMM       t_GMM
  L.h_ln_new_sign   .60481848   .45927667   1.3168935
L.h_ln_degr_centr   -1.608889   2.8454126  -.56543257
L.h_ln_partintact  -.07846513   .19397871  -.40450383
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                       b_GMM     se_GMM      t_GMM
  L.h_ln_new_sign  .00796303  .00893136  .89158039
L.h_ln_degr_centr  .91823025  .07489305  12.260554
L.h_ln_partintact  .00475335  .00377518  1.2591052
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                       b_GMM     se_GMM      t_GMM
  L.h_ln_new_sign  .20858302  .21212653  .98329528
L.h_ln_degr_centr  2.6767859  1.5842332  1.6896414
L.h_ln_partintact  .91101123  .07830267  11.634484
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                ln_new_sign  ln_degr_centr  ln_partintact
  ln_new_sign      .25424161
ln_degr_centr      .00053607      .00015519
ln_partintact       .0219098      .00141076      .06933151

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0842   1.0000
             |   0.1668
             |
          u3 |   0.1643   0.4275   1.0000
             |   0.0067   0.0000
             |

GMM finished : 12:59:11

Starting Monte-Carlo loop : 12:59:13 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 12:59:19
```

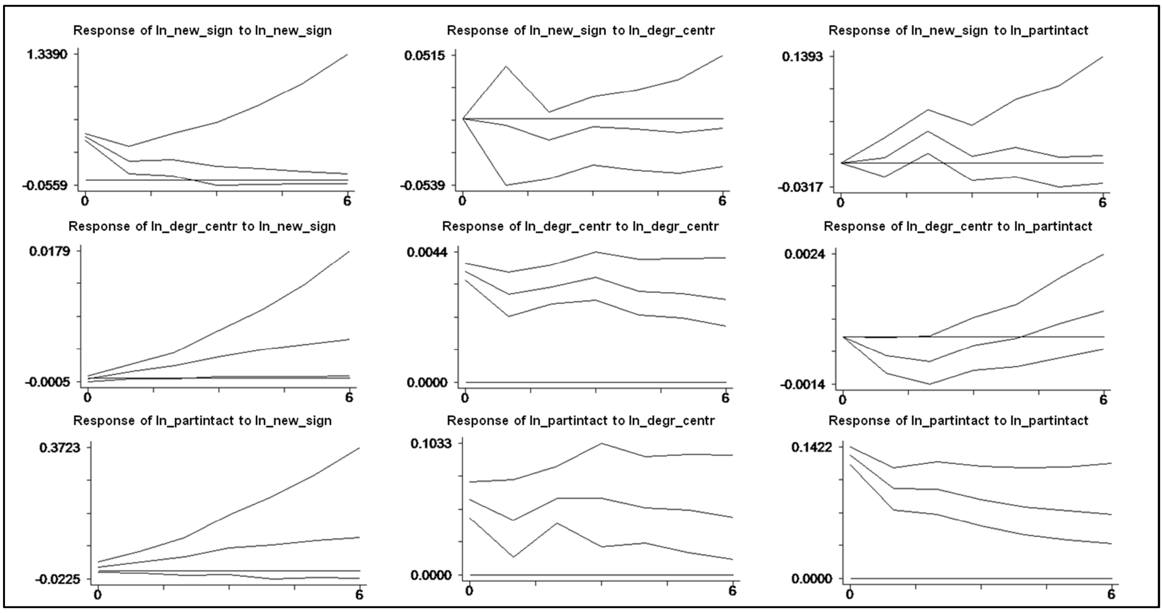
```
. pvar ln_new_sign ln_degr_centr ln_partintact, lag(2) gmm monte 1000
GMM started : 13:08:57
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 263
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .65084913   .39954294   1.6289842
 L.h_ln_degr_centr   8.5137866   5.8814764   1.4475594
 L.h_ln_partintact  -.29201101   .19585552  -1.4909512
  L2.h_ln_new_sign    .2934394   .16245035   1.8063328
L2.h_ln_degr_centr  -9.2017038   3.6559782  -2.5168924
L2.h_ln_partintact   .30964451    .2874168   1.0773361
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .00350955    .0071482    .49097026
 L.h_ln_degr_centr    .9781052   .27040556   3.6171786
 L.h_ln_partintact   .00051658   .00383289    .13477421
  L2.h_ln_new_sign  -.00175617   .00331607  -.52959292
L2.h_ln_degr_centr  -.05263871    .2168882  -.24269976
L2.h_ln_partintact   .00110798   .00579434     .191217
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                        b_GMM     se_GMM      t_GMM
   L.h_ln_new_sign  .16633774  .16941927   .9818112
 L.h_ln_degr_centr  2.0607309  3.7964121  .54281011
 L.h_ln_partintact  .69939612  .14480701  4.8298499
  L2.h_ln_new_sign  .04107604  .07229569  .56816716
L2.h_ln_degr_centr  .67638962  2.9286406  .23095686
L2.h_ln_partintact  .19158491  .16490407  1.1617961
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                ln_new_sign  ln_degr_centr  ln_partintact
  ln_new_sign     .27258631
ln_degr_centr     .00011845      .00009357
ln_partintact     .02748638       .0006701      .05360016

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0228   1.0000
             |   0.7124
             |
          u3 |   0.2267   0.2986   1.0000
             |   0.0002   0.0000
             |

GMM finished : 13:08:59

Starting Monte-Carlo loop : 13:09:00 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 13:09:07
```



```
. pvar ln_new_sign ln_degr_centr ln_partintact, lag(3) gmm monte 1000
GMM started : 13:17:43
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 255
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                          b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .50201991   .27117886   1.8512502
 L.h_ln_degr_centr   5.4991603   3.5012337    1.570635
 L.h_ln_partintact  -.13602213    .1751549  -.77658189
  L2.h_ln_new_sign   .25310707   .17090567   1.4809752
L2.h_ln_degr_centr  -12.071798    4.418259  -2.7322522
L2.h_ln_partintact   .26853531   .13468598   1.9937881
  L3.h_ln_new_sign   .08387335   .08722019    .96162773
L3.h_ln_degr_centr    5.603424   3.0642016   1.8286734
L3.h_ln_partintact  -.10985393   .16330922  -.67267434
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                          b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .00176922   .00520472   .33992622
 L.h_ln_degr_centr   .83255846   .23262285   3.5790055
 L.h_ln_partintact   .00346794   .00361454   .95944134
  L2.h_ln_new_sign  -.00026855   .00330791  -.08118352
L2.h_ln_degr_centr   .17422128   .21008522   .82928862
L2.h_ln_partintact  -.00386714   .00396329  -.97573933
  L3.h_ln_new_sign   -.0006749   .00140317  -.48097846
L3.h_ln_degr_centr  -.10969565   .07651114  -1.4337211
L3.h_ln_partintact   .00195301   .00306769   .63663949
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                          b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .15122238   .11438921   1.3219987
 L.h_ln_degr_centr   1.6232387   2.6670441   .60862835
 L.h_ln_partintact   .68333685   .12539913   5.4492952
  L2.h_ln_new_sign   .12071516   .07503714   1.6087389
L2.h_ln_degr_centr   5.4534849    4.579662   1.1908051
L2.h_ln_partintact   .12972076   .16040659   .80869973
  L3.h_ln_new_sign   .03400944   .04643164   .73246247
L3.h_ln_degr_centr  -4.4481298   2.8164062  -1.5793638
L3.h_ln_partintact   .07928705   .10343168   .76656446
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                 ln_new_sign  ln_degr_centr  ln_partintact
  ln_new_sign       .2206037
ln_degr_centr     -.00049086      .00006021
ln_partintact      .02150705      .00011046       .0473374

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1347   1.0000
             |   0.0316
             |
          u3 |   0.2106   0.0654   1.0000
             |   0.0007   0.2984
             |

GMM finished : 13:17:45

Starting Monte-Carlo loop : 13:17:46 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 13:17:54
```



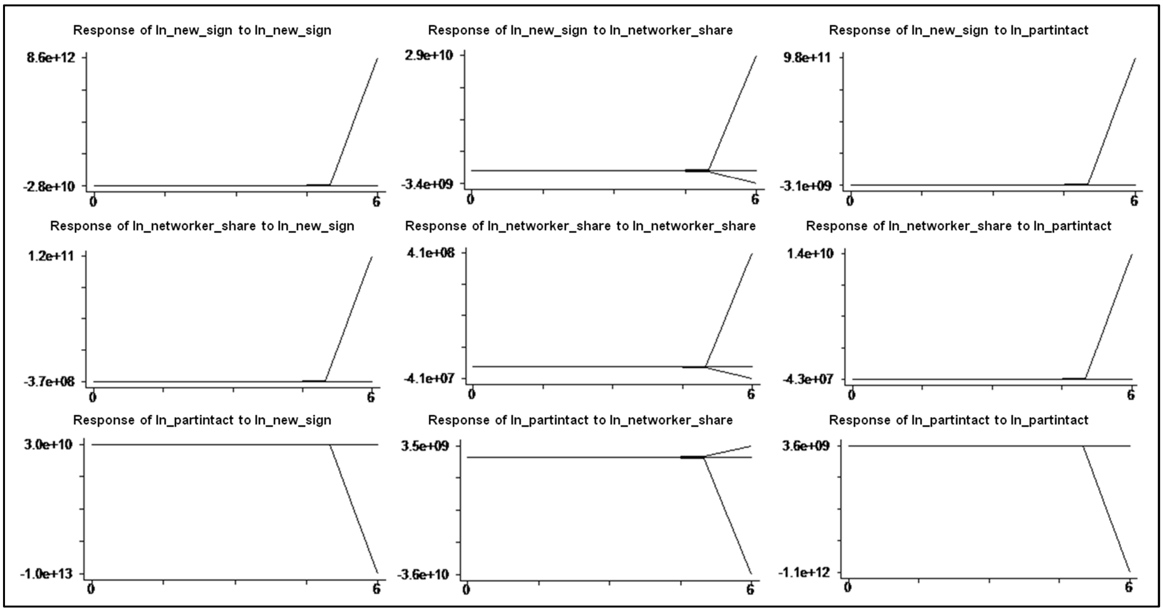
```
. pvar ln_new_sign ln_degr_centr ln_partintact, lag(4) gmm monte 1000
GMM started : 13:31:50
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 247
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .46549979    .1954186   2.3820649
 L.h_ln_degr_centr    5.351114   2.6932344   1.9868727
 L.h_ln_partintact   .08037182   .12262109   .65544858
  L2.h_ln_new_sign   .23729627   .14339866   1.6548012
L2.h_ln_degr_centr  -14.088355   3.5607805  -3.9565357
L2.h_ln_partintact   .19733309   .12996669   1.5183359
  L3.h_ln_new_sign   .02035443   .10730097   .18969478
L3.h_ln_degr_centr   6.4278985   3.7302257   1.7231929
L3.h_ln_partintact  -.29209906   .12771717  -2.2870775
  L4.h_ln_new_sign  -.00302438    .0655279  -.04615403
L4.h_ln_degr_centr   1.4260578    1.992258   .71579976
L4.h_ln_partintact   .04535061   .15733665   .28823935
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .00322836   .00400953   .80517104
 L.h_ln_degr_centr   .65197344   .23814017   2.7377717
 L.h_ln_partintact  -.00234047   .00210729  -1.1106574
  L2.h_ln_new_sign   .00119831   .00264872   .45241302
L2.h_ln_degr_centr    .3280597   .25445139   1.2892824
L2.h_ln_partintact   .00066436   .00291144   .22819044
  L3.h_ln_new_sign   .00040323   .00153205   .26319517
L3.h_ln_degr_centr   .06783045   .09392678   .72216306
L3.h_ln_partintact    .0042156    .0026409   1.5962756
  L4.h_ln_new_sign   .00010702   .00076643   .13963852
L4.h_ln_degr_centr  -.17049395   .06235429  -2.7342778
L4.h_ln_partintact  -.00004051   .00245114  -.01652798
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .04184382   .04588061   .91201548
 L.h_ln_degr_centr   1.8922619   1.9914055   .95021425
 L.h_ln_partintact    .7327766   .10090364    7.262142
  L2.h_ln_new_sign   .02325863    .0344429    .6752808
L2.h_ln_degr_centr   1.2907302    1.982074   .65120182
L2.h_ln_partintact   .19409638   .11335598    1.712273
  L3.h_ln_new_sign   .03136496   .02690312   1.1658483
L3.h_ln_degr_centr   .07687476   2.0074759   .03829424
L3.h_ln_partintact  -.02060223   .10794456  -.19085933
  L4.h_ln_new_sign  -.01813115   .02146356  -.84474101
L4.h_ln_degr_centr  -2.8213449   2.3043025  -1.2243813
L4.h_ln_partintact  -.01511551   .07584287  -.19930031
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                ln_new_sign  ln_degr_centr  ln_partintact
  ln_new_sign      .20300334
ln_degr_centr     -.00022205      .00005168
ln_partintact      .00592237      .00026859      .02157651

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0685   1.0000
             |   0.2837
             |
          u3 |   0.0896   0.2542   1.0000
             |   0.1603   0.0001
             |

GMM finished : 13:31:51

Starting Monte-Carlo loop : 13:31:54 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 13:32:03
```



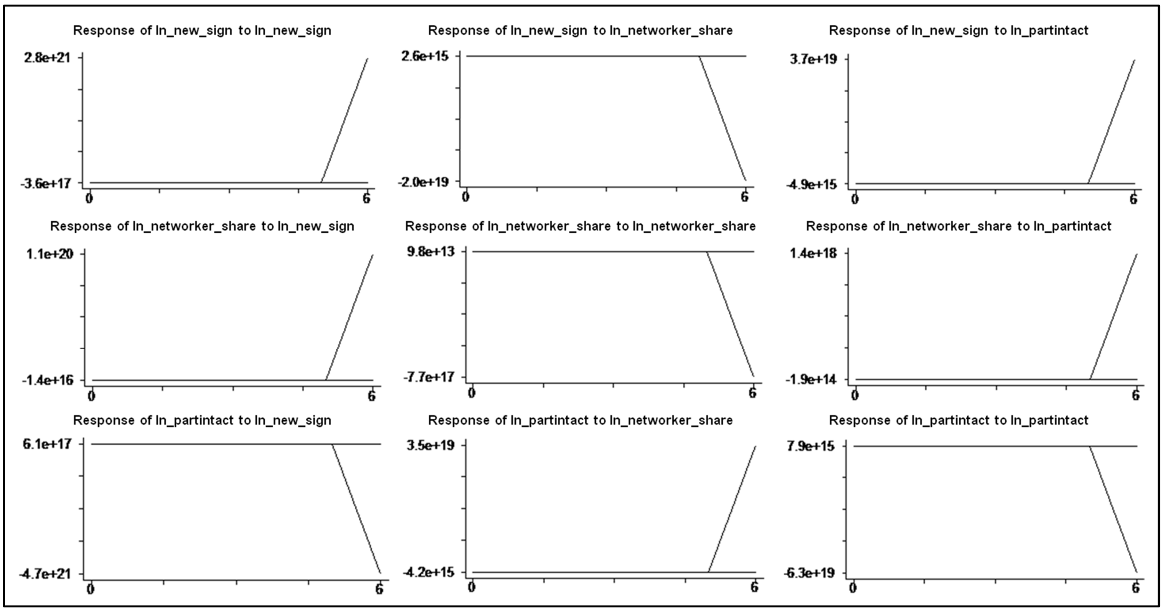
Appendix 42 Estimation Results PVAR(1)-(4) ln_new_signups ln_networker_share ln_partintact; New Regions

```
. pvar ln_new_sign ln_networker_share ln_partintact, lag(1) gmm monte 1000
GMM started : 14:15:05
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 272
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                           b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -1.4351794   10.719325   -.1338871
L.h_ln_networker_share  -10.140458   50.089944  -.20244498
     L.h_ln_partintact  -1.0633497   5.0620791  -.21006186
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                           b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   -.0784794   .42714593  -.18372972
L.h_ln_networker_share   .41635001   1.9919974   .20901132
     L.h_ln_partintact  -.03493148   .20117114  -.17364062
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                          b_GMM     se_GMM      t_GMM
       L.h_ln_new_sign  4.0805138  22.125738  .18442385
L.h_ln_networker_share  19.027517  103.07107   .1846058
     L.h_ln_partintact  2.7755414  10.430956  .26608697
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                    ln_new_sign  ln_networker_share       ln_partintact
       ln_new_sign    2.1436514
ln_networker_share    .07904716             .003458
     ln_partintact   -4.3525078          -.18088307           9.9741406

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.9163   1.0000
             |   0.0000
             |
          u3 |  -0.9400  -0.9734   1.0000
             |   0.0000   0.0000
             |

GMM finished : 14:15:07

Starting Monte-Carlo loop : 14:15:08 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 14:15:15
```

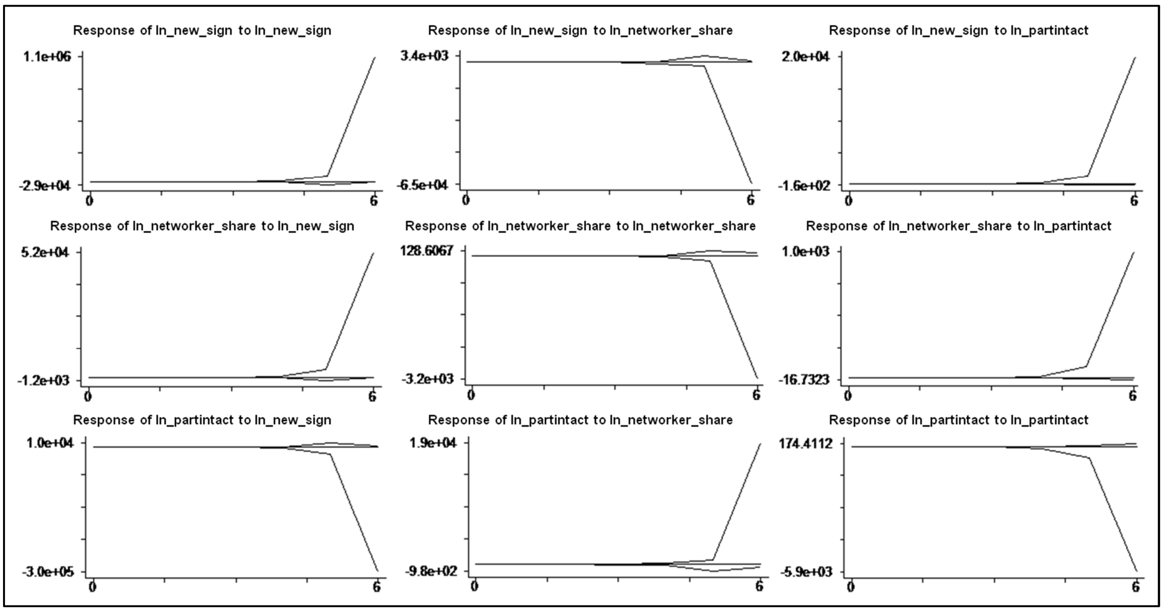
```
. pvar ln_new_sign ln_networker_share ln_partintact, lag(2) gmm monte 1000
GMM started : 14:23:24
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 264
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign  -5.5116024   97.186449  -.05671164
 L.h_ln_networker_share  -86.291807   1386.4859  -.06223778
      L.h_ln_partintact  -3.1844191   51.196489  -.06219995
       L2.h_ln_new_sign  -1.5465712   28.638978  -.05400232
L2.h_ln_networker_share   37.304809   618.96911   .06026926
     L2.h_ln_partintact  -.30935014   4.8376789  -.06394598
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign  -.07761708   1.3579597  -.05715713
 L.h_ln_networker_share  -.18196157   19.377954  -.00939013
      L.h_ln_partintact  -.03699215   .71522803  -.05172078
       L2.h_ln_new_sign  -.02508878   .39965575  -.06277598
L2.h_ln_networker_share   .45002492   8.6558849   .05199063
     L2.h_ln_partintact  -.00619923   .06694136  -.09260693
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   6.8445271   114.39324   .05983332
 L.h_ln_networker_share   95.509288   1631.5569   .05853874
      L.h_ln_partintact   4.4104843   60.244308   .07320998
       L2.h_ln_new_sign   1.9863429    33.71683   .05891251
L2.h_ln_networker_share  -42.152343   728.37046  -.05787212
     L2.h_ln_partintact   .37084781    5.722773   .06480212
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                       ln_new_sign  ln_networker_share       ln_partintact
       ln_new_sign       16.415993
ln_networker_share        .2201524           .00308035
     ln_partintact      -19.215449           -.2609482           22.819861

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.9788   1.0000
             |   0.0000
             |
          u3 |  -0.9927  -0.9840   1.0000
             |   0.0000   0.0000
             |

GMM finished : 14:23:26

Starting Monte-Carlo loop : 14:23:26 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 14:23:34
```



```
. pvar ln_new_sign ln_networker_share ln_partintact, lag(3) gmm monte 1000
GMM started : 14:25:53
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 256
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign     16.3373    1635.273   .00999056
 L.h_ln_networker_share   131.49003   14154.152   .00928986
      L.h_ln_partintact   5.3300725    553.0658   .00963732
       L2.h_ln_new_sign   9.1623634    913.8689   .01002591
L2.h_ln_networker_share   132.42334   13340.977   .00992606
     L2.h_ln_partintact   4.2782753   433.09723   .00987833
       L3.h_ln_new_sign   1.9091158   188.52986   .01012633
L3.h_ln_networker_share  -89.687663   9434.1167  -.00950674
     L3.h_ln_partintact   1.3241045   137.94969   .00959846
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .61809378   62.662774   .00986381
 L.h_ln_networker_share    6.363546   542.36095   .01173305
      L.h_ln_partintact   .21354839   21.193301   .01007622
       L2.h_ln_new_sign   .34374963   35.018329   .00981628
L2.h_ln_networker_share   4.9087423   511.20519   .00960229
     L2.h_ln_partintact   .15682001    16.59597   .00944928
       L3.h_ln_new_sign   .07152054   7.2246067   .00989958
L3.h_ln_networker_share  -3.5701059   361.48842  -.00987613
     L3.h_ln_partintact   .05504177   5.2861235    .0104125
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign  -27.376718   2780.8217  -.00984483
 L.h_ln_networker_share  -238.51796   24068.728  -.00990987
      L.h_ln_partintact  -8.5605134   940.53502  -.00910175
       L2.h_ln_new_sign  -15.288667   1554.0556  -.00983791
L2.h_ln_networker_share  -217.50147   22686.968  -.00958707
     L2.h_ln_partintact  -7.1239497   736.49567  -.00967277
       L3.h_ln_new_sign  -3.1531626   320.60131  -.00983515
L3.h_ln_networker_share   153.21713   16042.783   .00955053
     L3.h_ln_partintact  -2.3157137   234.56245  -.00987248
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                       ln_new_sign  ln_networker_share       ln_partintact
       ln_new_sign       142.97192
ln_networker_share       5.4795494           .21039483
     ln_partintact      -243.38709          -9.3418181           414.95121

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.9991   1.0000
             |   0.0000
             |
          u3 |  -0.9992  -0.9998   1.0000
             |   0.0000   0.0000
             |

GMM finished : 14:25:55

Starting Monte-Carlo loop : 14:25:56 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 14:26:04
```



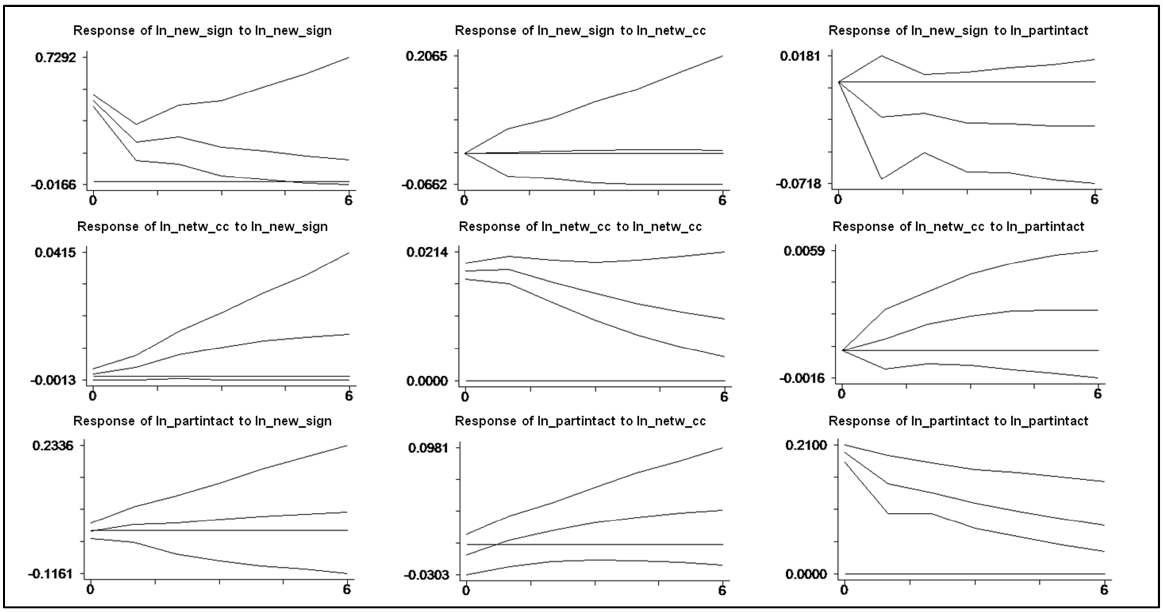
```
. pvar ln_new_sign ln_networker_share ln_partintact, lag(4) gmm monte 1000
GMM started : 14:28:26
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 248
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign  -.58299725    6.112433  -.09537892
 L.h_ln_networker_share  -5.7417985   12.729522   -.4510616
      L.h_ln_partintact   .03915861   .54249485   .07218246
       L2.h_ln_new_sign  -.47158237   4.8011505  -.09822278
L2.h_ln_networker_share   -20.68221   110.28306   -.1875375
     L2.h_ln_partintact  -.12331311   2.5361078  -.04862298
       L3.h_ln_new_sign  -.36918154   2.5091921  -.14713163
L3.h_ln_networker_share    2.481389   42.120521   .05891164
     L3.h_ln_partintact  -.48969049   1.4724806  -.33256159
       L4.h_ln_new_sign  -.06051778   .35883649  -.16865001
L4.h_ln_networker_share   8.2143031    52.97532   .15505906
     L4.h_ln_partintact  -.17745039   .82772104   -.2143843
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign  -.06087482    .3970908  -.15330202
 L.h_ln_networker_share   1.1433113   .86166725   1.3268595
      L.h_ln_partintact  -.00983887   .03704975  -.26555841
       L2.h_ln_new_sign  -.05229543   .31168084   -.1677852
L2.h_ln_networker_share  -1.2350353   7.1941852  -.17167132
     L2.h_ln_partintact  -.02699442   .16388813  -.16471246
       L3.h_ln_new_sign  -.02690667    .1635744  -.16449195
L3.h_ln_networker_share  -.29478321   2.7405322  -.10756422
     L3.h_ln_partintact  -.01044777   .09578483  -.10907543
       L4.h_ln_new_sign  -.00219273   .02312573   -.0948178
L4.h_ln_networker_share   .34251253   3.4327127   .09977897
     L4.h_ln_partintact  -.00732847   .05555849  -.13190542
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign    .4389831    2.798857   .15684371
 L.h_ln_networker_share   1.5797195   6.4825732   .24368711
      L.h_ln_partintact   .79240516   .27637081    2.867181
       L2.h_ln_new_sign    .3311897   2.1980013   .15067766
L2.h_ln_networker_share   6.5473413   50.142333   .13057512
     L2.h_ln_partintact   .32122016   1.1597415   .27697565
       L3.h_ln_new_sign   .19121946   1.1535208   .16577027
L3.h_ln_networker_share   2.6182764   19.491421   .13432969
     L3.h_ln_partintact  -.00511069   .69907397  -.00731065
       L4.h_ln_new_sign    .0018741    .1605799   .01167085
L4.h_ln_networker_share  -4.3515355   24.433176  -.17809946
     L4.h_ln_partintact   .10358662    .3641623    .2844518
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                     ln_new_sign  ln_networker_share       ln_partintact
       ln_new_sign     .81593797
ln_networker_share      .0463486           .00348231
     ln_partintact    -.31829025          -.02329393           .18432537

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |  1.0000
             |
             |
          u2 |  0.8684   1.0000
             |  0.0000
             |
          u3 | -0.8194  -0.9188   1.0000
             |  0.0000   0.0000
             |

GMM finished : 14:28:28

Starting Monte-Carlo loop : 14:28:30 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 14:28:39
```



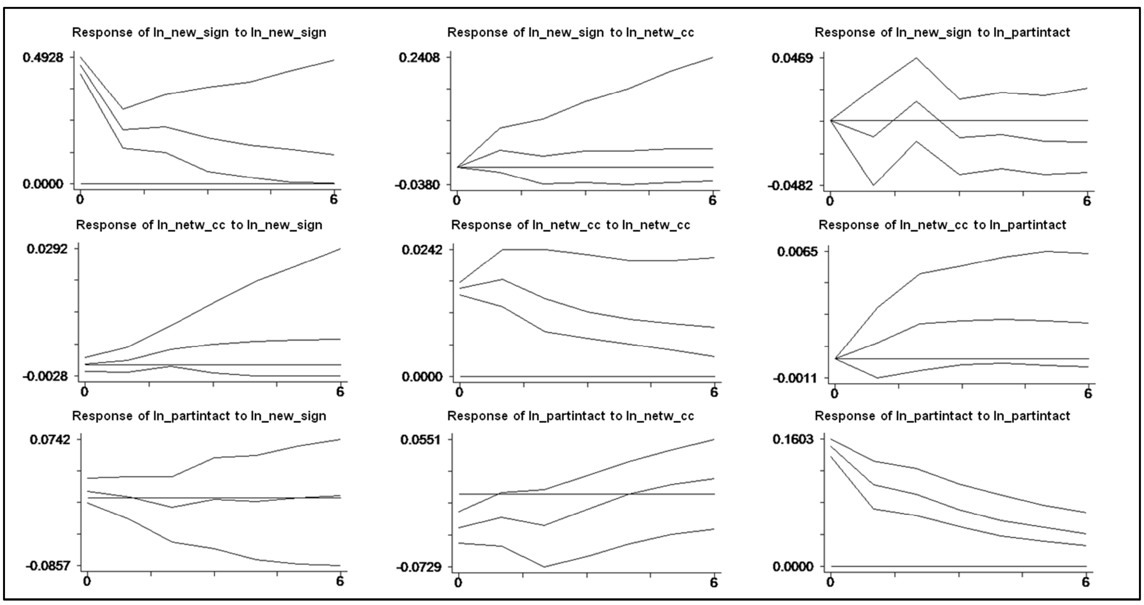
Appendix 43 Estimation Results PVAR(1)-(4) ln_new_signups ln_network_cc ln_partintact; New Regions

```
. pvar ln_new_sign ln_netw_cc ln_partintact, lag(1) gmm monte 1000
GMM started : 14:30:30
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 259
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                        b_GMM      se_GMM       t_GMM
  L.h_ln_new_sign   .62190671   .22267744    2.792859
   L.h_ln_netw_cc  -.50218085   1.1324296  -.44345437
L.h_ln_partintact  -.10606553   .07862925  -1.3489323
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                       b_GMM     se_GMM      t_GMM
  L.h_ln_new_sign  .02451265  .01731561   1.415639
   L.h_ln_netw_cc  .78902309  .10246233  7.7006166
L.h_ln_partintact  .01976957  .01124169  1.7585949
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                       b_GMM     se_GMM      t_GMM
  L.h_ln_new_sign  .13052166  .11871362  1.0994666
   L.h_ln_netw_cc  .42742502  .56311218  .75904063
L.h_ln_partintact  .90596468  .05827351  15.546768
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                 ln_new_sign     ln_netw_cc  ln_partintact
  ln_new_sign      .24022366
   ln_netw_cc      .00007004      .00159615
ln_partintact      .00034162      .00283655      .05453527

Residuals correlation matrix

             |        u1       u2       u3
-------------+-----------------------------
          u1 |    1.0000
             |
             |
          u2 |    0.0037   1.0000
             |    0.9529
             |
          u3 |    0.0030   0.3030   1.0000
             |    0.9611   0.0000
             |

GMM finished : 14:30:31

Starting Monte-Carlo loop : 14:30:32 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 14:30:39
```

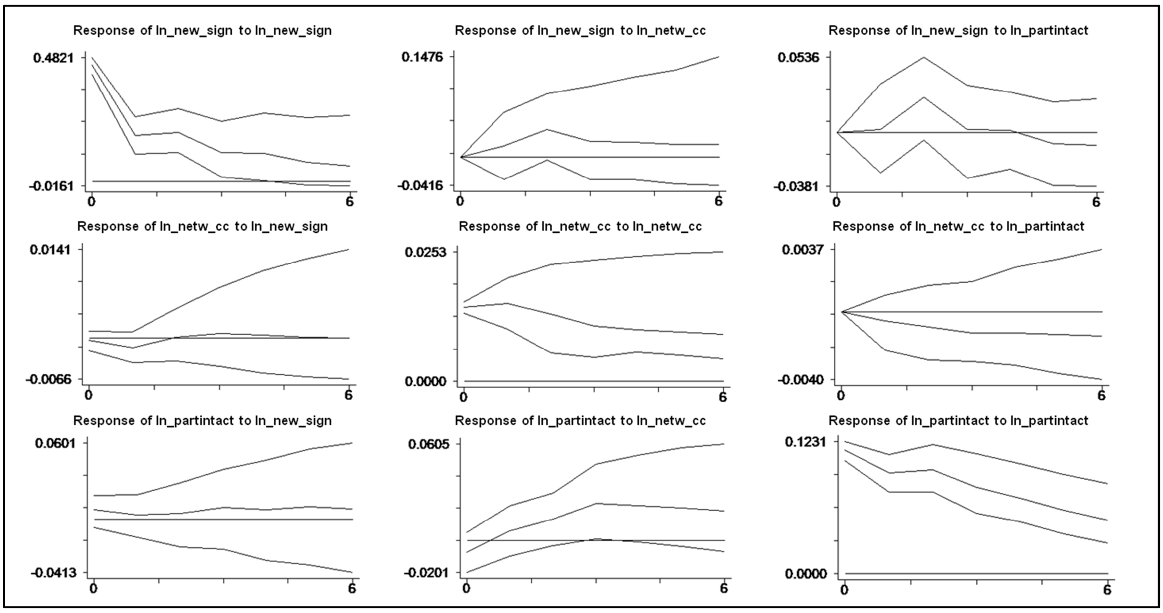
```
. pvar ln_new_sign ln_netw_cc ln_partintact, lag(2) gmm monte 1000
GMM started : 15:04:09
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 251
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign    .4852026   .13432105   3.6122602
    L.h_ln_netw_cc    .0427045   1.6386843   .02606024
 L.h_ln_partintact  -.12779427   .13778106  -.92751691
  L2.h_ln_new_sign    .3223728   .10439252   3.0880832
   L2.h_ln_netw_cc   .24230097   .64959782   .37300151
L2.h_ln_partintact   .04382801    .1322377   .33143356
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .00494763   .00462809   1.0690445
    L.h_ln_netw_cc   1.0105793   .06303905   16.031005
 L.h_ln_partintact   .00357213   .00532596   .67070223
  L2.h_ln_new_sign   .00626989   .00366032   1.7129376
   L2.h_ln_netw_cc  -.12109118   .05629406  -2.1510472
L2.h_ln_partintact   .00236569   .00608776   .38859817
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign    .0369697   .06005477   .61559981
    L.h_ln_netw_cc   .67052753   .67139514   .99870775
 L.h_ln_partintact    .7404553   .14600637   5.0713903
  L2.h_ln_new_sign  -.00416136     .041192  -.10102351
   L2.h_ln_netw_cc   -.0098895   .72693492  -.01360437
L2.h_ln_partintact   .11965111   .10835318   1.1042695
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                ln_new_sign     ln_netw_cc  ln_partintact
  ln_new_sign      .22617012
   ln_netw_cc      .00026338      .00032976
ln_partintact     -.00027556     -.00018439      .03929837

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0306   1.0000
             |   0.6296
             |
          u3 |  -0.0029  -0.0513   1.0000
             |   0.9633   0.4186
             |

GMM finished : 15:04:11

Starting Monte-Carlo loop : 15:04:11 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 15:04:19
```



```
. pvar ln_new_sign ln_netw_cc ln_partintact, lag(3) gmm monte 1000
GMM started : 15:13:36
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 243
--------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                          b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .45752189   .10208701   4.4816858
    L.h_ln_netw_cc   2.0595722   1.7172882   1.1993166
 L.h_ln_partintact  -.08140767   .15091587   -.5394242
  L2.h_ln_new_sign   .26575448   .08353574   3.1813268
   L2.h_ln_netw_cc  -1.5817852   1.1887898  -1.3305844
L2.h_ln_partintact   .17622323   .13617108   1.2941311
  L3.h_ln_new_sign   .03372479   .08416738   .40068721
   L3.h_ln_netw_cc   .50548205   .65520857   .77148266
L3.h_ln_partintact  -.19634842   .10838719  -1.8115464
--------------------------------------------------------------------------
--------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                          b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .00166676   .00324395   .51380639
    L.h_ln_netw_cc   1.1173952   .19560848   5.7124067
 L.h_ln_partintact   .00655999   .00846552   .77490637
  L2.h_ln_new_sign   .00541988   .00257305   2.1063998
   L2.h_ln_netw_cc  -.34112063   .19984457  -1.7069297
L2.h_ln_partintact   .00243012    .0068409   .35523361
  L3.h_ln_new_sign   -.0007909   .00288592  -.27405573
   L3.h_ln_netw_cc   .11867968   .08375497   1.4169868
L3.h_ln_partintact  -.00333803   .00538285  -.62012301
--------------------------------------------------------------------------
--------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                          b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign  -.01175087    .0332322   -.3535989
    L.h_ln_netw_cc  -.05322059   .78041711  -.06819505
 L.h_ln_partintact   .67987758    .1182091   5.7514828
  L2.h_ln_new_sign  -.02319929   .02073901  -1.1186307
   L2.h_ln_netw_cc  -.56798624   .95840658  -.59263599
L2.h_ln_partintact   .13798463   .11357128   1.2149606
  L3.h_ln_new_sign   .03192905   .02287059   1.3960743
   L3.h_ln_netw_cc   1.2653123   .78440237   1.6130909
L3.h_ln_partintact  -.02505252   .06687288  -.37462896
--------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                ln_new_sign     ln_netw_cc  ln_partintact
  ln_new_sign      .21241327
   ln_netw_cc      .00005205      .00028073
ln_partintact      .00407858     -.00056393      .02382013

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0069   1.0000
             |   0.9149
             |
          u3 |   0.0573  -0.2180   1.0000
             |   0.3740   0.0006
             |

GMM finished : 15:13:37

Starting Monte-Carlo loop : 15:13:38 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 15:13:46
```



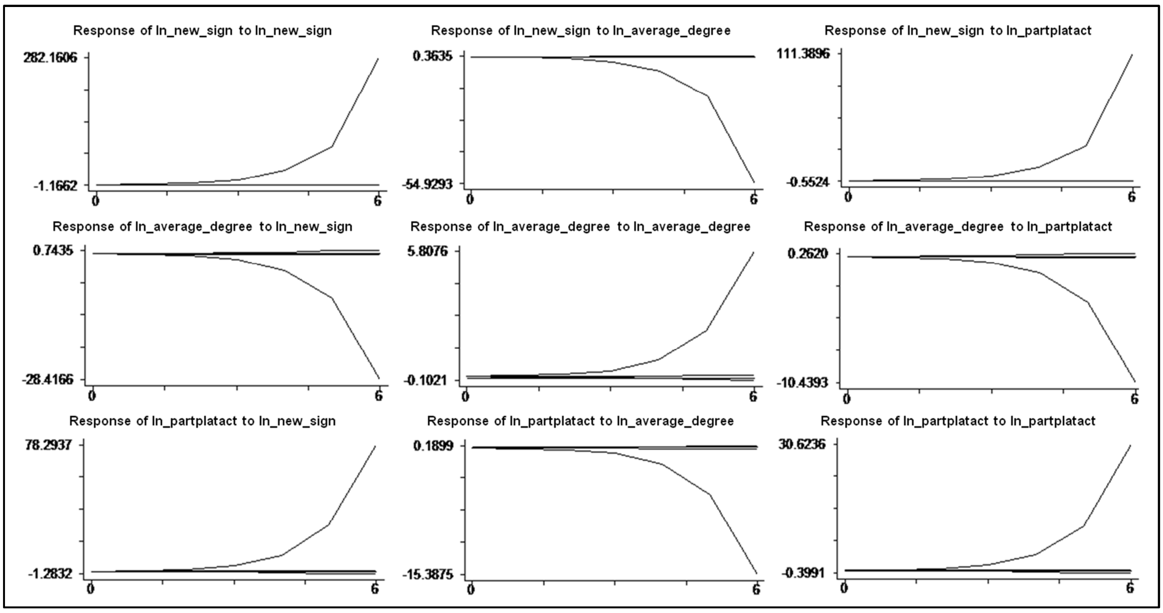
```
. pvar ln_new_sign ln_netw_cc ln_partintact, lag(4) gmm monte 1000
GMM started : 15:32:33
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 235
-------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                       b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .40109053    .0935147   4.2890637
    L.h_ln_netw_cc   1.1474598   2.0008647   .57348196
 L.h_ln_partintact   .01913063   .16497391   .11596157
  L2.h_ln_new_sign   .26131942   .07613874    3.432148
   L2.h_ln_netw_cc   1.2164942   2.1334509   .57020022
L2.h_ln_partintact   .19909882   .16729871   1.1900798
  L3.h_ln_new_sign  -.02068068   .07410857  -.27905919
   L3.h_ln_netw_cc  -2.3694625   1.5037556  -1.5756966
L3.h_ln_partintact  -.23605117   .16140241  -1.4625009
  L4.h_ln_new_sign   .03394124    .0770545   .44048351
   L4.h_ln_netw_cc   .58153632   .56260428   1.0336507
L4.h_ln_partintact  -.02584382   .13465061  -.19193244
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                       b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign  -.00240657    .0023639  -1.0180502
    L.h_ln_netw_cc   1.0503741   .20260221   5.1844159
 L.h_ln_partintact  -.00489107   .00840582   -.5818673
  L2.h_ln_new_sign   .00481537   .00310907    1.548817
   L2.h_ln_netw_cc    -.191112   .17145302   -1.114661
L2.h_ln_partintact   .00129086   .00626274   .20611817
  L3.h_ln_new_sign   -.0002879   .00284734  -.10111103
   L3.h_ln_netw_cc   .00040651   .19692199   .00206432
L3.h_ln_partintact  -.00019375   .00491773  -.03939801
  L4.h_ln_new_sign  -.00178648    .0024447  -.73075595
   L4.h_ln_netw_cc   .08114485   .05456309   1.4871748
L4.h_ln_partintact   .00050501   .00460717   .10961337
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                       b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign  -.00482931   .01746658  -.27648835
    L.h_ln_netw_cc   .84130512   .44702264   1.8820191
 L.h_ln_partintact   .81457387   .08439573   9.6518373
  L2.h_ln_new_sign   .00541507   .01618823   .33450663
   L2.h_ln_netw_cc  -.21038128   .63952331  -.32896578
L2.h_ln_partintact   .17754699   .08607078   2.0628022
  L3.h_ln_new_sign   .01258626   .01307587   .96255678
   L3.h_ln_netw_cc   .16975321   .46399827   .36584881
L3.h_ln_partintact  -.12035194    .0896371  -1.3426576
  L4.h_ln_new_sign  -.00766608   .01375191  -.55745541
   L4.h_ln_netw_cc  -.55518686   .25387645  -2.1868388
L4.h_ln_partintact  -.00563698   .05661445  -.09956791
-------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                 ln_new_sign     ln_netw_cc  ln_partintact
  ln_new_sign      .20346317
   ln_netw_cc      -.0001911      .00020905
ln_partintact      .00342253     -.00011177       .0133876

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0291   1.0000
             |   0.6573
             |
          u3 |   0.0654  -0.0667   1.0000
             |   0.3178   0.3089
             |

GMM finished : 15:32:35

Starting Monte-Carlo loop : 15:32:37 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 15:32:46
```



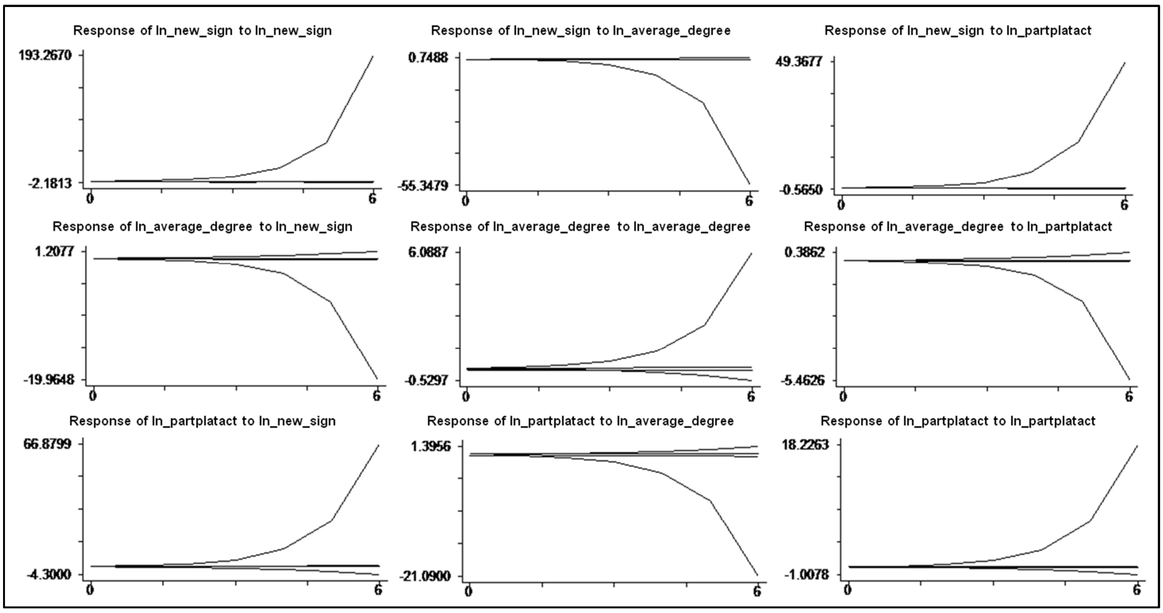
Appendix 44 Estimation Results PVAR(1)-(4) ln_new_signups ln_average_degree ln_partplatact; New Regions

```
. pvar ln_new_sign ln_average_degree ln_partplatact, lag(1) gmm monte 1000
GMM started : 09:28:24
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 272
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                           b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign  1.0199079  1.2988547  .78523629
L.h_ln_average_degree  .21868399  .57653299  .37930871
   L.h_ln_partplatact  .17617162  1.2069164  .14596837
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                            b_GMM      se_GMM        t_GMM
      L.h_ln_new_sign  -.14344741    .1893675  -.75750809
L.h_ln_average_degree   .86299373   .08527609   10.119997
   L.h_ln_partplatact  -.11448622   .17298674  -.66182076
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                            b_GMM      se_GMM        t_GMM
      L.h_ln_new_sign  -.13580524   .31631627  -.42933373
L.h_ln_average_degree  -.14949662   .10100821  -1.4800442
   L.h_ln_partplatact   .74536076   .33040012   2.2559337
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                      ln_new_sign  ln_average_degree     ln_partplatact
      ln_new_sign          .43627088
ln_average_degree         -.04394641          .01226068
   ln_partplatact         -.02408354          .00589681          .02831193

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.5971   1.0000
             |   0.0000
             |
          u3 |  -0.2124   0.3110   1.0000
             |   0.0004   0.0000
             |

GMM finished : 09:28:26

Starting Monte-Carlo loop : 09:28:27 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 09:28:34
```

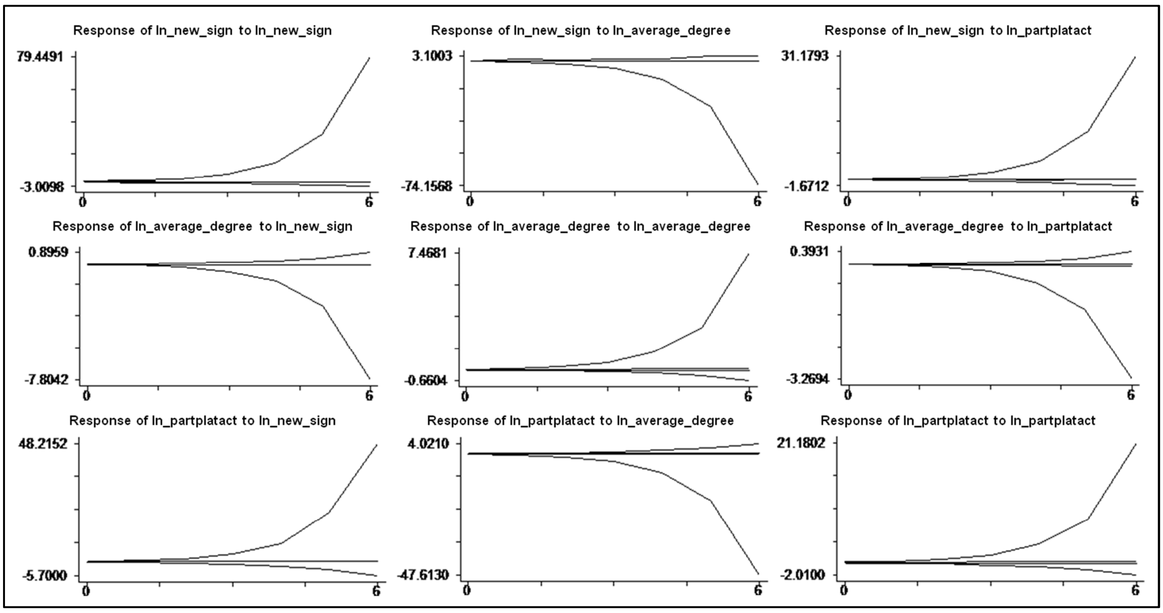
```
. pvar ln_new_sign ln_average_degree ln_partplatact, lag(2) gmm monte 1000
GMM started : 09:42:40
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 264
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .51914388   1.1043701   .47008145
 L.h_ln_average_degree  -.23131845    1.515831  -.15260174
    L.h_ln_partplatact   .17522634    1.433647   .12222419
      L2.h_ln_new_sign   .22668959   .38221406   .59309589
L2.h_ln_average_degree    .1403534   .98582487   .14237154
   L2.h_ln_partplatact  -.29328689   .18664395   -1.571371
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.08690828   .14151907  -.61411002
 L.h_ln_average_degree   1.0158492   .26296244   3.8630964
    L.h_ln_partplatact  -.10299716   .18425252  -.55899999
      L2.h_ln_new_sign  -.02968373   .04834151  -.61404222
L2.h_ln_average_degree  -.12942673   .20503365  -.63124628
   L2.h_ln_partplatact    .0053309   .04321325   .12336258
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .19858349   .39767658   .49935927
 L.h_ln_average_degree   .11878074   .51656766   .22994227
    L.h_ln_partplatact   .87155738    .5241517   1.6627961
      L2.h_ln_new_sign   .06330891   .13713867   .46164153
L2.h_ln_average_degree   -.1408405   .36521927  -.38563272
   L2.h_ln_partplatact    .2887473   .12424852   2.3239496
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                        ln_new_sign  ln_average_degree     ln_partplatact
      ln_new_sign          .24585497
ln_average_degree         -.00932281          .00532311
   ln_partplatact           .0255125         -.00966521           .0445785

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.2581   1.0000
             |   0.0000
             |
          u3 |   0.2437  -0.6248   1.0000
             |   0.0001   0.0000
             |

GMM finished : 09:42:42

Starting Monte-Carlo loop : 09:42:43 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 09:42:51
```



```
. pvar ln_new_sign ln_average_degree ln_partplatact, lag(3) gmm monte 1000
GMM started : 09:50:23
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 256
----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .18998123   1.2295162   .15451706
 L.h_ln_average_degree     .058109   1.0251605   .05668283
    L.h_ln_partplatact  -.18250905   .77623755  -.23512011
      L2.h_ln_new_sign   .12489556   .73990365   .16879976
L2.h_ln_average_degree  -1.8953885   1.3444619  -1.4097748
   L2.h_ln_partplatact  -.33019784   1.1275419  -.29284751
      L3.h_ln_new_sign   .01812219   .19156228   .09460208
L3.h_ln_average_degree   1.7465037   1.0393765   1.6803378
   L3.h_ln_partplatact    .1508058   .20258612    .7444034
----------------------------------------------------------------------------
----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.08595268     .175525  -.48968911
 L.h_ln_average_degree   1.0144429   .29472473   3.4420012
    L.h_ln_partplatact  -.04155335   .11892616  -.34940467
      L2.h_ln_new_sign  -.04876022   .10489089  -.46486605
L2.h_ln_average_degree  -.08268575   .32260481  -.25630664
   L2.h_ln_partplatact  -.05811883    .1602796  -.36260902
      L3.h_ln_new_sign  -.00522253   .02926342  -.17846633
L3.h_ln_average_degree  -.06262277   .17543995  -.35694705
   L3.h_ln_partplatact  -.02098484   .04547666  -.46144207
----------------------------------------------------------------------------
----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .30224623   .66355869   .45549283
 L.h_ln_average_degree   .03907776   .72662073   .05378013
    L.h_ln_partplatact    .7592822   .43046087    1.763882
      L2.h_ln_new_sign   .19497719   .39900152   .48866276
L2.h_ln_average_degree   .39268234   .96585137   .40656601
   L2.h_ln_partplatact   .59499053   .61160742   .97283078
      L3.h_ln_new_sign     .018527   .10829703   .17107582
L3.h_ln_average_degree  -.32632801   .66033632  -.49418455
   L3.h_ln_partplatact  -.00642573   .23839904  -.02695368
----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                         ln_new_sign  ln_average_degree     ln_partplatact
      ln_new_sign          .22813752
ln_average_degree          .00857827          .00597918
   ln_partplatact         -.02941021         -.01883312          .08414154

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.2287   1.0000
             |   0.0002
             |
          u3 |  -0.2092  -0.8386   1.0000
             |   0.0008   0.0000
             |

GMM finished : 09:50:25

Starting Monte-Carlo loop : 09:50:26 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 09:50:34
```



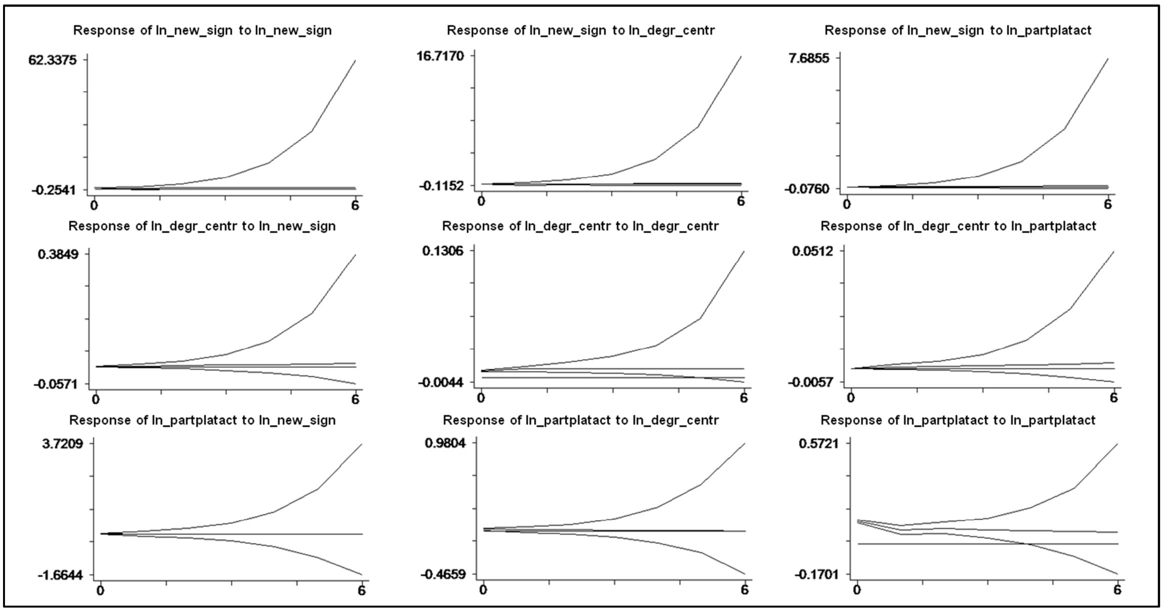
```
. pvar ln_new_sign ln_average_degree ln_partplatact, lag(4) gmm monte 1000
GMM started : 10:04:40
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 248
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.00693343   1.2795058  -.00541884
 L.h_ln_average_degree   3.4423634   10.502656   .32776124
    L.h_ln_partplatact  -.13548143    .5779833   -.2344037
      L2.h_ln_new_sign  -.04273067   .94027269  -.04544498
L2.h_ln_average_degree  -5.1418463   11.601081  -.44322131
   L2.h_ln_partplatact  -.26254302   .87498597  -.30005397
      L3.h_ln_new_sign  -.18397669   .57138606  -.32198316
L3.h_ln_average_degree   .66436261   3.4869419   .19052873
   L3.h_ln_partplatact  -.39446673   1.5008094    -.262836
      L4.h_ln_new_sign  -.07638864   .23898053  -.31964377
L4.h_ln_average_degree   1.1122111   4.2671344   .26064591
   L4.h_ln_partplatact  -.03976855   .45195182  -.08799289
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.02826781   .08099954  -.34898733
 L.h_ln_average_degree   1.4614083   .68426176   2.1357445
    L.h_ln_partplatact  -.01611503   .03856532  -.41786327
      L2.h_ln_new_sign  -.02797268   .05977328  -.46797965
L2.h_ln_average_degree  -.48852843   .74638622  -.65452498
   L2.h_ln_partplatact   .00654581   .06164077    .1061929
      L3.h_ln_new_sign  -.01504386    .0368143  -.40864161
L3.h_ln_average_degree  -.09198425   .26168659  -.35150541
   L3.h_ln_partplatact  -.06562769   .09384597  -.69931282
      L4.h_ln_new_sign    -.005043   .01658106  -.30414185
L4.h_ln_average_degree   .02780444   .28674081   .09696715
   L4.h_ln_partplatact   .00620005   .03432918   .18060578
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .33826851   .73669837   .45916826
 L.h_ln_average_degree  -2.5674564   6.1958149  -.41438558
    L.h_ln_partplatact   .70367923   .35423482   1.9864767
      L2.h_ln_new_sign   .26205268   .54397479   .48173681
L2.h_ln_average_degree   3.0997114   6.8182356   .45462075
   L2.h_ln_partplatact   .39233686   .52465289   .74780273
      L3.h_ln_new_sign   .11197335   .33117695    .3381073
L3.h_ln_average_degree   .46128646   2.1770545   .21188558
   L3.h_ln_partplatact   .45846664   .89021426   .51500708
      L4.h_ln_new_sign   .06316719   .14584648   .43310742
L4.h_ln_average_degree  -1.0470609   2.5044341  -.41808283
   L4.h_ln_partplatact  -.05105044   .28132729   -.1814628
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                        ln_new_sign  ln_average_degree     ln_partplatact
      ln_new_sign          .36364594
ln_average_degree          .01418773          .00188034
   ln_partplatact         -.13527356         -.01318754          .14265006

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.5397   1.0000
             |   0.0000
             |
          u3 |  -0.5914  -0.8040   1.0000
             |   0.0000   0.0000
             |

GMM finished : 10:04:43

Starting Monte-Carlo loop : 10:04:44 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 10:04:54
```



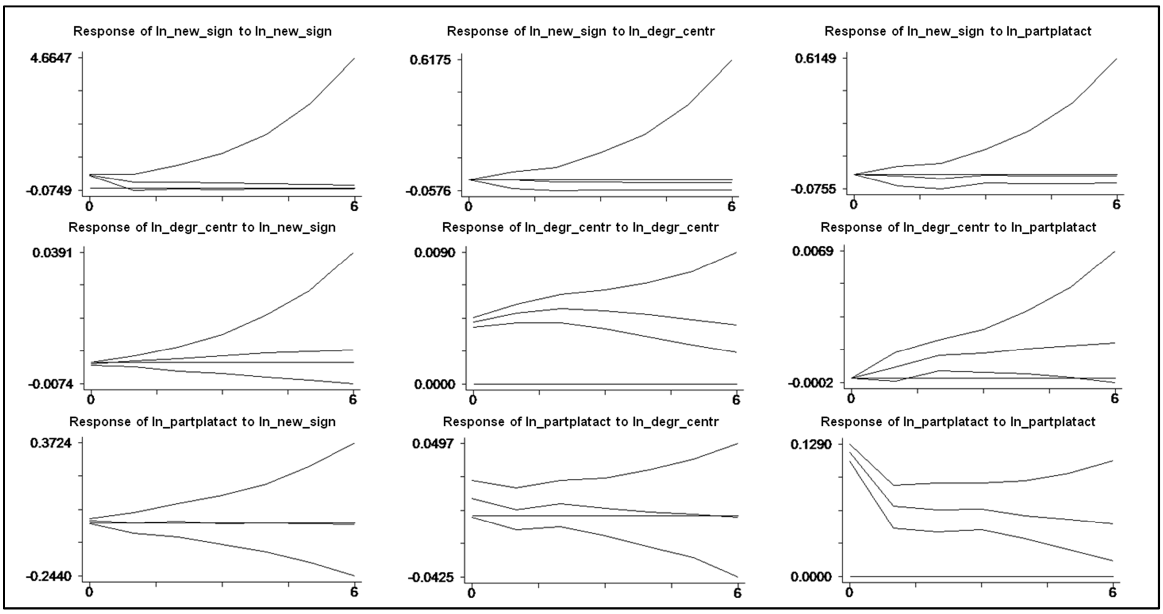
Appendix 45 Estimation Results PVAR(1)-(4) ln_new_signups ln_degree_centralization ln_partplatact; New Regions

```
. pvar ln_new_sign ln_degr_centr ln_partplatact, lag(1) gmm monte 1000
GMM started : 10:33:00
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 271
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                        b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign    .5013986   .83913238   .59752026
 L.h_ln_degr_centr  -2.9748088   7.4717248  -.39814219
L.h_ln_partplatact  -.22340253   .54800275  -.40766681
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                       b_GMM     se_GMM      t_GMM
   L.h_ln_new_sign  .01457191  .02045236  .71248091
 L.h_ln_degr_centr  1.0050114  .18930029  5.3090856
L.h_ln_partplatact  .01356664  .01336252  1.0152755
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                       b_GMM     se_GMM      t_GMM
   L.h_ln_new_sign  .12679352   .2065699  .61380442
 L.h_ln_degr_centr  1.5548888  1.8311745  .84912102
L.h_ln_partplatact  .95164949  .15214317  6.2549601
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                 ln_new_sign   ln_degr_centr  ln_partplatact
   ln_new_sign       .23923885
 ln_degr_centr       .00027049       .00025013
ln_partplatact       .00991651       .00144231       .03179205

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0354   1.0000
             |   0.5619
             |
          u3 |   0.1141   0.5085   1.0000
             |   0.0607   0.0000
             |

GMM finished : 10:33:01

Starting Monte-Carlo loop : 10:33:03 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 10:33:09
```

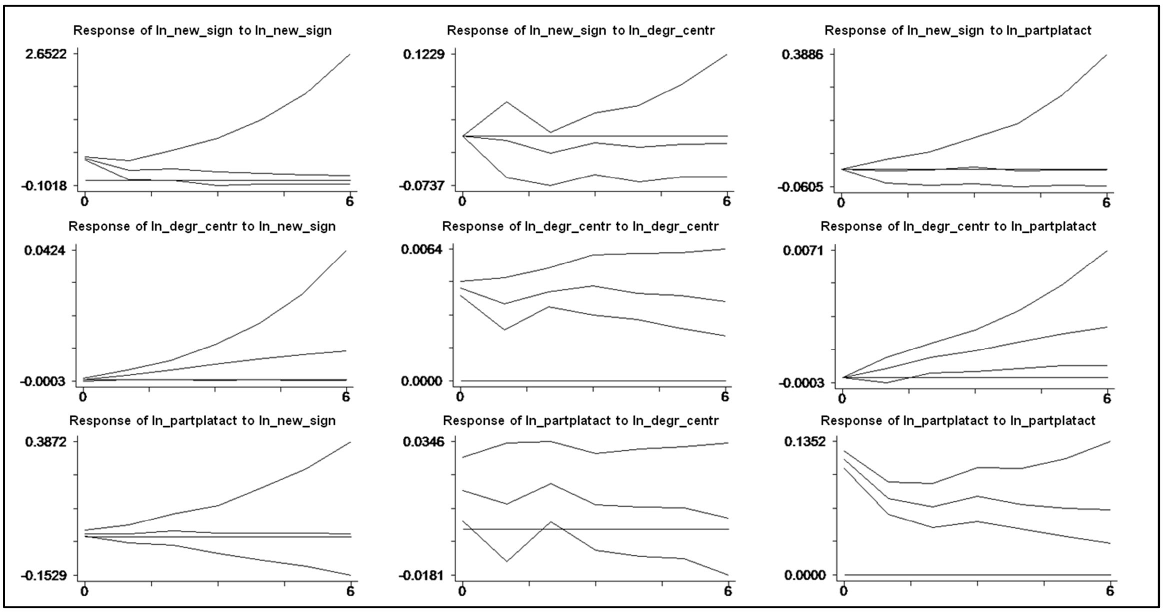
```
. pvar ln_new_sign ln_degr_centr ln_partplatact, lag(2) gmm monte 1000
GMM started : 10:44:58
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 263
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .81895962   .78063745   1.0490909
  L.h_ln_degr_centr   9.9972705   11.149587   .89664942
 L.h_ln_partplatact   .16130224   .47878303    .3369005
   L2.h_ln_new_sign    .3491241   .28440472   1.2275608
 L2.h_ln_degr_centr  -8.2477007   4.4796332  -1.8411554
L2.h_ln_partplatact  -.00053031   .31602823  -.00167805
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .00582585   .01336734   .43582715
  L.h_ln_degr_centr   1.0095802   .35460739   2.8470366
 L.h_ln_partplatact   .00863216   .00793468   1.0879022
   L2.h_ln_new_sign  -.00078504   .00518952  -.15127473
 L2.h_ln_degr_centr  -.04436079    .2175291  -.20393038
L2.h_ln_partplatact   -.0034556   .00637361  -.54217367
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign  -.00550932   .11634004  -.04735536
  L.h_ln_degr_centr   .25399438   1.9552131   .12990624
 L.h_ln_partplatact   .60291331   .12194891   4.9439829
   L2.h_ln_new_sign  -.00859884   .04767396  -.18036772
 L2.h_ln_degr_centr  -.57939597   1.1249894  -.51502351
L2.h_ln_partplatact   .32402468   .09677155   3.3483464
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                   ln_new_sign   ln_degr_centr  ln_partplatact
   ln_new_sign       .35137383
 ln_degr_centr       .00102748       .00010372
ln_partplatact       .00637409       .00020252       .01762347

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1687   1.0000
             |   0.0061
             |
          u3 |   0.0815   0.1503   1.0000
             |   0.1874   0.0147
             |

GMM finished : 10:44:59

Starting Monte-Carlo loop : 10:45:00 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 10:45:07
```



```
. pvar ln_new_sign ln_degr_centr ln_partplatact, lag(3) gmm monte 1000
GMM started : 10:55:55
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 255
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .47211684   .38822374   1.2160947
  L.h_ln_degr_centr   5.1393817   4.3189239   1.1899681
 L.h_ln_partplatact  -.10966195   .29630934  -.37009279
   L2.h_ln_new_sign   .24417445   .22939627   1.0644221
 L2.h_ln_degr_centr  -11.024042   4.5968267  -2.3981853
L2.h_ln_partplatact  -.10484519   .26190189  -.40032238
   L3.h_ln_new_sign   .07863301   .09741494   .80719662
 L3.h_ln_degr_centr   4.5609434   3.8258485   1.1921391
L3.h_ln_partplatact   .24057125   .23592765   1.0196823
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .00338919   .00755778   .44843671
  L.h_ln_degr_centr   .84833361   .25681598   3.3032742
 L.h_ln_partplatact   .00825804   .00547477   1.5083807
   L2.h_ln_new_sign   .00065059    .0045399   .14330453
 L2.h_ln_degr_centr   .16242411   .21044875   .77179889
L2.h_ln_partplatact   .00210934    .0063527   .33203841
   L3.h_ln_new_sign  -.00031991    .0015983  -.20015853
 L3.h_ln_degr_centr  -.07536674   .08474475  -.88933811
L3.h_ln_partplatact  -.00582711   .00396656  -1.4690582
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign  -.01259386    .0690923   -.1822759
  L.h_ln_degr_centr  -.01098291   1.1319521  -.00970263
 L.h_ln_partplatact   .55500476   .10521241   5.2750882
   L2.h_ln_new_sign   .01684209   .04129042   .40789334
 L2.h_ln_degr_centr   .36871523   1.1960022   .30828976
L2.h_ln_partplatact   .22556978   .10794029   2.0897645
   L3.h_ln_new_sign  -.02365395   .01833326   -1.290221
 L3.h_ln_degr_centr  -.98374281   1.2198088  -.80647297
L3.h_ln_partplatact    .1158582   .12196921   .94989716
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                   ln_new_sign   ln_degr_centr  ln_partplatact
   ln_new_sign       .21716689
 ln_degr_centr      -.00034625       .00006189
ln_partplatact       .00471484       .00002957       .01501524

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0944   1.0000
             |   0.1326
             |
          u3 |   0.0826   0.0310   1.0000
             |   0.1888   0.6222
             |

GMM finished : 10:55:57

Starting Monte-Carlo loop : 10:55:57 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 10:56:05
```



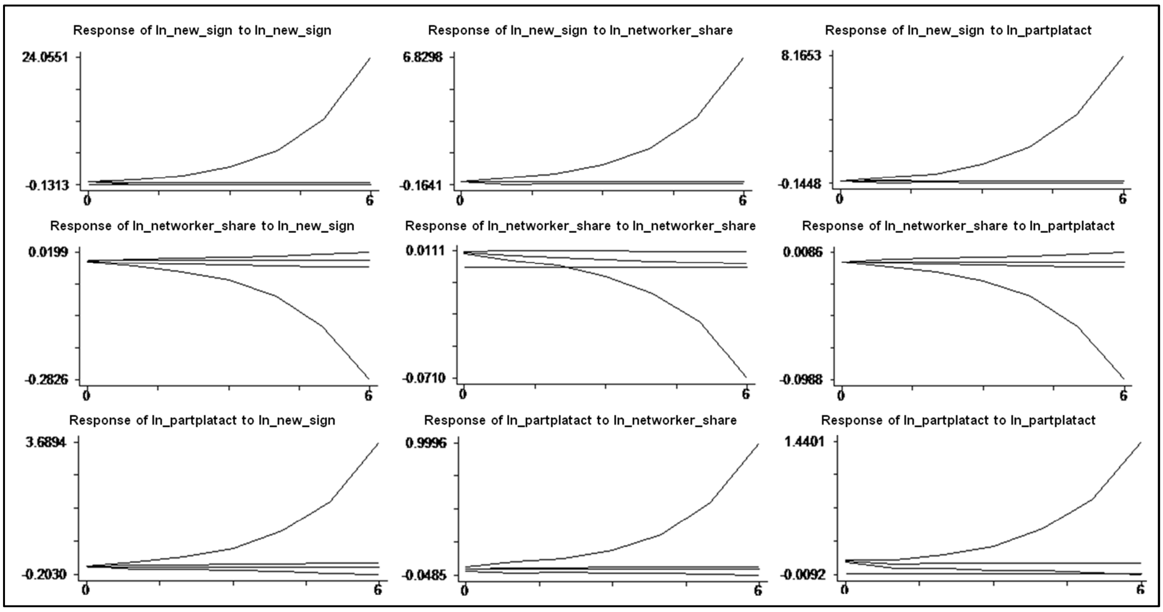
```
. pvar ln_new_sign ln_degr_centr ln_partplatact, lag(4) gmm monte 1000
GMM started : 11:05:26
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 247
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .49605628   .28433627   1.7446114
  L.h_ln_degr_centr   6.4127578   2.9795618   2.1522486
 L.h_ln_partplatact  -.05901338   .20111044  -.29343769
   L2.h_ln_new_sign   .26789971   .20114384   1.3318812
 L2.h_ln_degr_centr  -13.484004   4.3286245  -3.1150783
L2.h_ln_partplatact   .02390623   .30656486   .07798099
   L3.h_ln_new_sign   .03754584    .1382683   .27154339
 L3.h_ln_degr_centr   5.3787924   4.1088899   1.3090622
L3.h_ln_partplatact   .10771188   .24537815   .43896278
   L4.h_ln_new_sign  -.00050988   .07254489  -.00702852
 L4.h_ln_degr_centr    1.929523   2.3647981   .81593562
L4.h_ln_partplatact  -.08257607   .19847685  -.41604886
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .00465448   .00566151   .82212633
  L.h_ln_degr_centr   .63756759   .24511103    2.601138
 L.h_ln_partplatact   .00524834   .00399825   1.3126581
   L2.h_ln_new_sign   .00201765    .0038538   .52354832
 L2.h_ln_degr_centr   .33800664   .26409604   1.2798626
L2.h_ln_partplatact   .00572977   .00642162   .89226309
   L3.h_ln_new_sign   .00091395   .00214052   .42697626
 L3.h_ln_degr_centr   .09616755   .10653389   .90269443
L3.h_ln_partplatact  -.00086422   .00410289  -.21063574
   L4.h_ln_new_sign   .00044176   .00098537   .44832092
 L4.h_ln_degr_centr  -.14381196   .07153275  -2.0104354
L4.h_ln_partplatact  -.00257936    .0031455  -.82001391
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .00153286   .05111038   .02999118
  L.h_ln_degr_centr   .62587277   .94704622   .66086824
 L.h_ln_partplatact   .65982093    .0808213    8.163948
   L2.h_ln_new_sign   .02759048   .03674517   .75086011
 L2.h_ln_degr_centr   .26240657   1.0186295   .25760747
L2.h_ln_partplatact   .15856948   .10302709   1.5391048
   L3.h_ln_new_sign  -.03887436   .02409831   -1.613157
 L3.h_ln_degr_centr  -1.5667241   1.2271858  -1.2766805
L3.h_ln_partplatact   .17449387   .12897595   1.3529179
   L4.h_ln_new_sign  -.00347195    .0142897  -.24296847
 L4.h_ln_degr_centr   .06646462   .91705773   .07247594
L4.h_ln_partplatact  -.06000921    .0713587  -.84095152
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                ln_new_sign   ln_degr_centr  ln_partplatact
   ln_new_sign       .21396471
 ln_degr_centr      -.00002989       .00005895
ln_partplatact        .0064554       .00006461       .01415787

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0084   1.0000
             |   0.8957
             |
          u3 |   0.1173   0.0711   1.0000
             |   0.0657   0.2657
             |

GMM finished : 11:05:28

Starting Monte-Carlo loop : 11:05:29 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 11:05:38
```



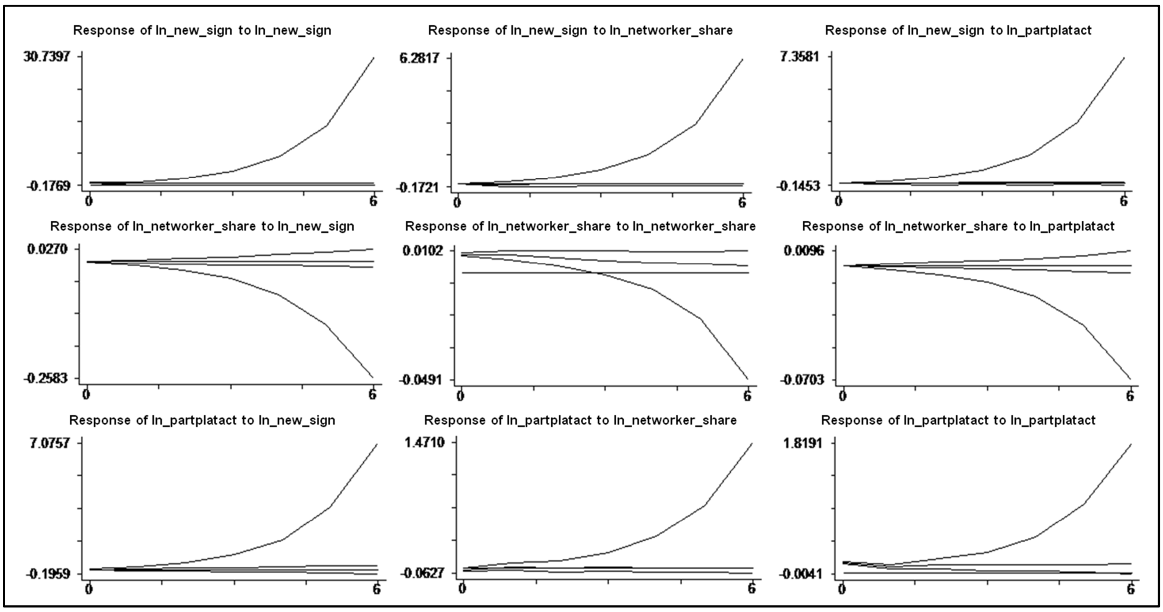
Appendix 46 Estimation Results PVAR(1)-(4) ln_new_signups ln_networker_share ln_partplatact; New Regions

```
. pvar ln_new_sign ln_networker_share ln_partplatact, lag(1) gmm monte 1000
GMM started : 11:14:41
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 272
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                            b_GMM     se_GMM      t_GMM
       L.h_ln_new_sign  .99215636  .65664224  1.5109542
L.h_ln_networker_share  1.4185964  4.4971354  .31544444
    L.h_ln_partplatact  .13480724   .6266832  .21511226
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.00435058   .01045442  -.41614792
L.h_ln_networker_share   .76074984   .05915667   12.859917
    L.h_ln_partplatact   -.0034878   .00949685  -.36725898
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   -.1377547   .15378728  -.89574835
L.h_ln_networker_share  -.91846639   .89805325  -1.0227304
    L.h_ln_partplatact   .75543711   .19018581   3.9721002
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                           ln_new_sign  ln_networker_share      ln_partplatact
       ln_new_sign           .42585879
ln_networker_share          -.00144419           .00015287
    ln_partplatact          -.02624333           .00003119           .02912534

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1775   1.0000
             |   0.0033
             |
          u3 |  -0.2316   0.0130   1.0000
             |   0.0001   0.8304
             |

GMM finished : 11:14:42

Starting Monte-Carlo loop : 11:14:43 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 11:14:49
```

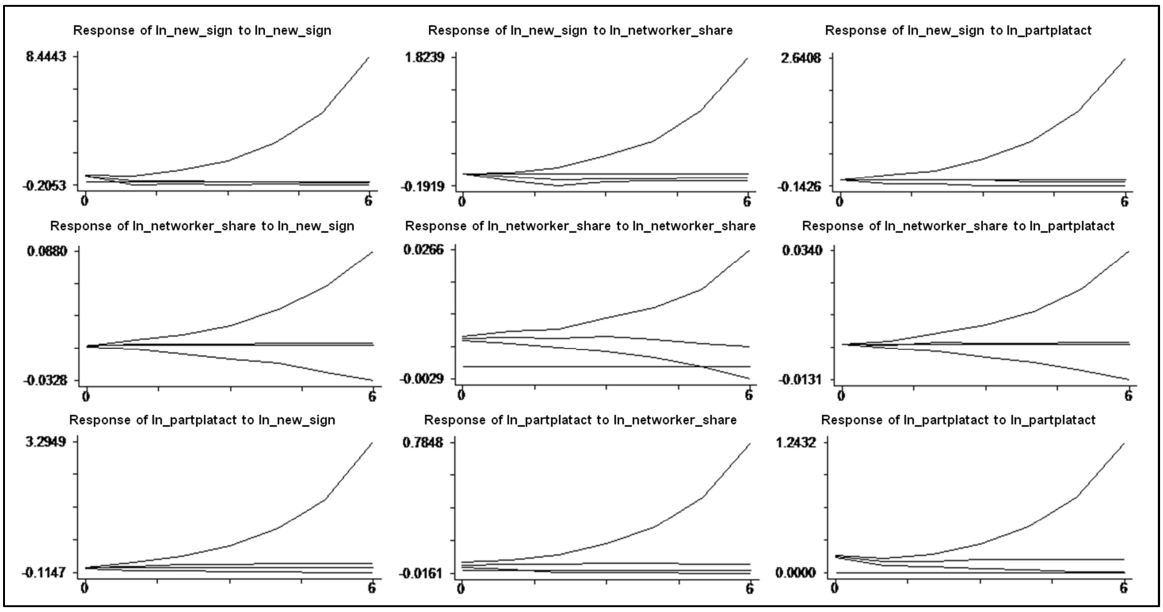
```
. pvar ln_new_sign ln_networker_share ln_partplatact, lag(2) gmm monte 1000
GMM started : 11:19:08
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 264
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .63988957   .58630723   1.0913895
 L.h_ln_networker_share   1.6156942   11.642493   .13877563
     L.h_ln_partplatact   .32464426   .81927934   .39625589
       L2.h_ln_new_sign   .27397233   .16812183   1.6296059
L2.h_ln_networker_share  -1.8278567   5.5079012  -.33186084
    L2.h_ln_partplatact  -.29286935   .23431301  -1.2499065
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign  -.00638385   .00975889  -.65415684
 L.h_ln_networker_share   .80848427   .20170069   4.0083367
     L.h_ln_partplatact  -.00581978   .01325173  -.43917133
       L2.h_ln_new_sign  -.00415009    .0031232   -1.328793
L2.h_ln_networker_share   .00764977   .12369247   .06184511
    L2.h_ln_partplatact  -.00285478   .00591999  -.48222692
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .06177909     .131944   .46822208
 L.h_ln_networker_share   1.0466212   2.8561837   .36644042
     L.h_ln_partplatact   .70460265   .19296757   3.6514045
       L2.h_ln_new_sign   .01169817   .04074286   .28712192
L2.h_ln_networker_share  -.67428099   1.7820057  -.37838319
    L2.h_ln_partplatact   .29401933   .07844503   3.7480937
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                        ln_new_sign  ln_networker_share      ln_partplatact
       ln_new_sign           .27983612
ln_networker_share            -.001771           .00010634
    ln_partplatact           .01804203          -.00012032           .02117684

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.3238   1.0000
             |   0.0000
             |
          u3 |   0.2338  -0.0791   1.0000
             |   0.0001   0.2003
             |

GMM finished : 11:19:10

Starting Monte-Carlo loop : 11:19:10 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 11:19:18
```



```
. pvar ln_new_sign ln_networker_share ln_partplatact, lag(3) gmm monte 1000
GMM started : 11:22:12
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 256
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .52602399   .58979538    .8918754
 L.h_ln_networker_share  -4.5589807   10.954845  -.41616114
     L.h_ln_partplatact   .06627458   .40167522   .16499543
       L2.h_ln_new_sign   .32233081   .32128595   1.0032521
L2.h_ln_networker_share   3.0023196   5.5417487   .54176395
    L2.h_ln_partplatact  -.10176037   .54721483  -.18596055
       L3.h_ln_new_sign   .07176047   .07490778   .95798422
L3.h_ln_networker_share   1.3995332   4.9542521   .28249132
    L3.h_ln_partplatact   .14053651   .13910652   1.0102798
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign  -.00354157   .00749597  -.47246395
 L.h_ln_networker_share   .96174476   .14773343    6.510001
     L.h_ln_partplatact   -.0047095   .00742379  -.63437987
       L2.h_ln_new_sign  -.00364662   .00406514   -.8970468
L2.h_ln_networker_share  -.16138633    .1389557  -1.1614228
    L2.h_ln_partplatact  -.00121455    .0129347  -.09389843
       L3.h_ln_new_sign   .00014334   .00146763   .09767023
L3.h_ln_networker_share   .02415066   .08709535   .27728989
    L3.h_ln_partplatact  -.00159174   .00717386  -.22188063
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .11503822   .15823973   .72698693
 L.h_ln_networker_share   2.8440491   3.1801453   .89431421
     L.h_ln_partplatact   .62841284   .11975576   5.2474542
       L2.h_ln_new_sign   .07553737   .08694667   .86877827
L2.h_ln_networker_share  -1.6820162   1.6065361  -1.0469831
    L2.h_ln_partplatact   .43411275   .18648407   2.3278812
       L3.h_ln_new_sign   -.0160573   .01998631  -.80341478
L3.h_ln_networker_share  -.01422766   1.1929052   -.0119269
    L3.h_ln_partplatact  -.00501167   .14894907  -.03364687
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                     ln_new_sign  ln_networker_share      ln_partplatact
       ln_new_sign     .23470854
ln_networker_share    -.00110367           .00007586
    ln_partplatact     .02126065          -.00031484           .02492429

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |  1.0000
             |
             |
          u2 | -0.2614   1.0000
             |  0.0000
             |
          u3 |  0.2779  -0.2281   1.0000
             |  0.0000   0.0002
             |

GMM finished : 11:22:14

Starting Monte-Carlo loop : 11:22:15 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 11:22:23
```



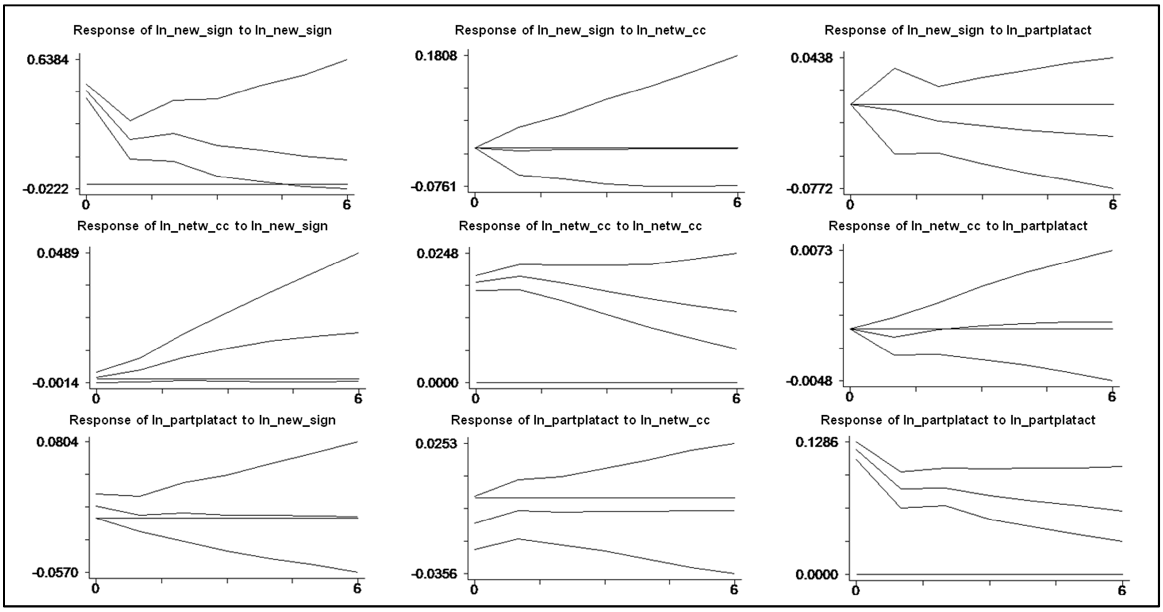
```
. pvar ln_new_sign ln_networker_share ln_partplatact, lag(4) gmm monte 1000
GMM started : 11:25:05
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 248
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign    .25511379   .47826299   .53341738
 L.h_ln_networker_share  -6.8914912    5.147964  -1.3386829
     L.h_ln_partplatact    .00485953   .38187165   .01272556
       L2.h_ln_new_sign    .18562754   .36598741   .50719651
L2.h_ln_networker_share  -5.3568726    10.32226  -.51896316
    L2.h_ln_partplatact  -.06919515   .26243015  -.26367072
       L3.h_ln_new_sign     -.017247   .17589276  -.09805407
L3.h_ln_networker_share   6.9298963    3.315883   2.0899098
    L3.h_ln_partplatact  -.01848032   .45584157   -.0405411
       L4.h_ln_new_sign  -.00530641   .04342031   -.1222103
L4.h_ln_networker_share   1.2499941   4.9232295   .25389718
    L4.h_ln_partplatact  -.19227298   .16713809  -1.1503839
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign     .0042312   .00596162   .70973967
 L.h_ln_networker_share   1.0312749    .1010203   10.208591
     L.h_ln_partplatact   -.0026443   .00469665  -.56301757
       L2.h_ln_new_sign  -.00125376   .00405237  -.30938947
L2.h_ln_networker_share  -.06019199   .19092494   -.3152652
    L2.h_ln_partplatact    .00814963   .00925092   .88095349
       L3.h_ln_new_sign  -.00016561   .00251426  -.06586852
L3.h_ln_networker_share    .13944554   .12249262   1.1383995
    L3.h_ln_partplatact  -.00466803   .00539368  -.86546316
       L4.h_ln_new_sign    .00098195   .00107434   .91400516
L4.h_ln_networker_share  -.20160379   .08729365  -2.3094896
    L4.h_ln_partplatact    .00040481   .00311887   .12979445
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign    .11174103   .14118376   .79145811
 L.h_ln_networker_share   2.2869563   2.0739908   1.1026839
     L.h_ln_partplatact    .65992944   .13562564   4.8658163
       L2.h_ln_new_sign    .09352968   .11038259   .84732274
L2.h_ln_networker_share  -1.0584791   3.6380626  -.29094583
    L2.h_ln_partplatact    .24994859   .11935111   2.0942294
       L3.h_ln_new_sign    .00692662   .05459261   .12687836
L3.h_ln_networker_share   2.4065719   1.6316333   1.4749466
    L3.h_ln_partplatact    .15636689   .21178652   .73832315
       L4.h_ln_new_sign    .00366878   .01933771   .18972153
L4.h_ln_networker_share  -1.8351354   1.6206245  -1.1323631
    L4.h_ln_partplatact    .01557276   .07732761   .20138684
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                           ln_new_sign  ln_networker_share      ln_partplatact
       ln_new_sign           .18988168
ln_networker_share          -.00031181           .00004224
    ln_partplatact            .0023092           .00022057            .0255642

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1095   1.0000
             |   0.0854
             |
          u3 |   0.0343   0.2116   1.0000
             |   0.5904   0.0008
             |

GMM finished : 11:27:16

Starting Monte-Carlo loop : 11:27:17 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 11:27:26
```



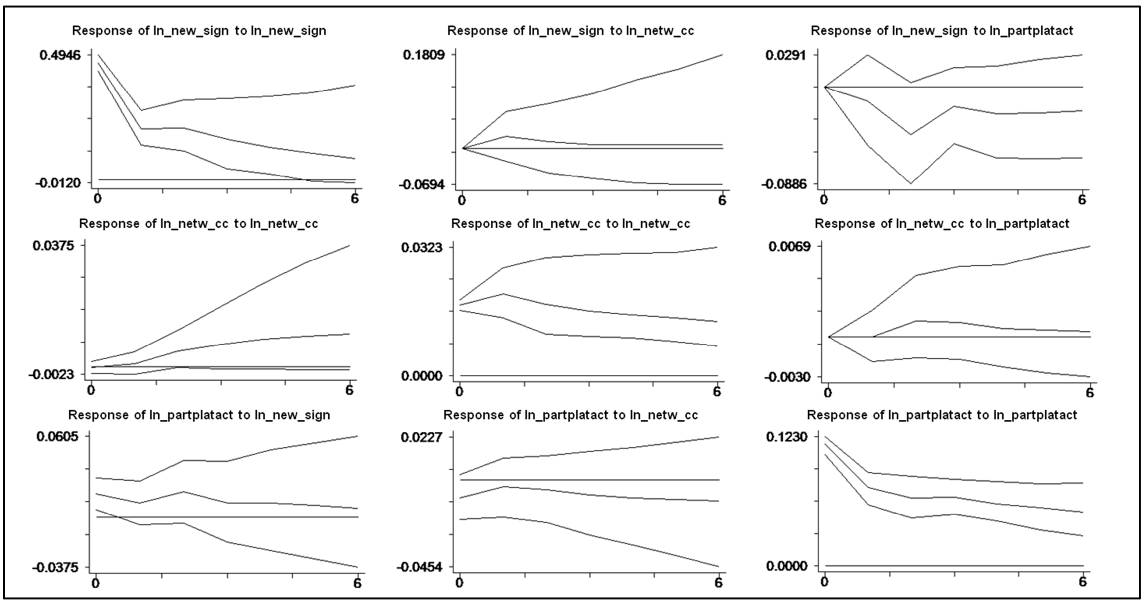
Appendix 47 Estimation Results PVAR(1)-(4) ln_new_signups ln_network_cc ln_partplatact; New Regions

```
. pvar ln_new_sign ln_netw_cc ln_partplatact, lag(1) gmm monte 1000
GMM started : 11:29:57
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 259
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                        b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .63250878   .21687045   2.9165282
    L.h_ln_netw_cc  -.77092151   1.2261386  -.62873927
L.h_ln_partplatact  -.20644728   .14653005  -1.4089075
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                       b_GMM     se_GMM      t_GMM
   L.h_ln_new_sign  .03675835   .0211046  1.7417223
    L.h_ln_netw_cc  .94084612  .08688789  10.828277
L.h_ln_partplatact   .0189443  .01637959  1.1565798
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                       b_GMM     se_GMM      t_GMM
   L.h_ln_new_sign  .01568341   .0377358  .41561104
    L.h_ln_netw_cc  .07636551   .2184031  .34965396
L.h_ln_partplatact  .91647345  .07059374  12.982361
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                  ln_new_sign      ln_netw_cc  ln_partplatact
   ln_new_sign       .24189347
    ln_netw_cc      -.00005568       .00234597
ln_partplatact       .00689705       .00082766        .0171846

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0023   1.0000
             |   0.9701
             |
          u3 |   0.1070   0.1308   1.0000
             |   0.0858   0.0354
             |

GMM finished : 11:29:59

Starting Monte-Carlo loop : 11:30:00 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 11:30:07
```

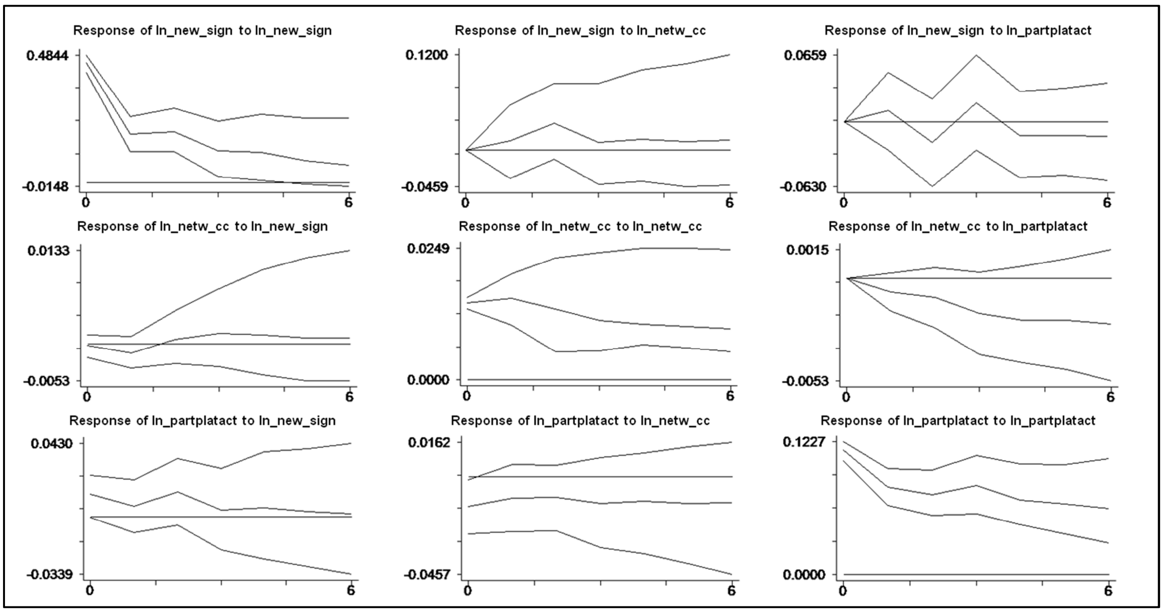
```
. pvar ln_new_sign ln_netw_cc ln_partplatact, lag(2) gmm monte 1000
GMM started : 11:41:52
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 251
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .48397102   .12253222   3.9497448
     L.h_ln_netw_cc  -.37008799        1.48  -.25005946
 L.h_ln_partplatact  -.04120896   .20155279  -.20445742
   L2.h_ln_new_sign   .31928726   .09366382   3.4088642
    L2.h_ln_netw_cc   .31988746   .60860141    .52561078
L2.h_ln_partplatact  -.07738564   .21499245  -.35994587
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .00647137   .00524978   1.2326928
     L.h_ln_netw_cc    1.058341   .06496909   16.289916
 L.h_ln_partplatact  -.00604308    .0087695  -.68910206
   L2.h_ln_new_sign   .00697523   .00372006   1.8750306
    L2.h_ln_netw_cc   -.1237596   .06011728  -2.0586359
L2.h_ln_partplatact   .01068279   .00907524   1.1771361
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   -.0115442   .02101398  -.54935786
     L.h_ln_netw_cc   .11140736   .37195449   .29951879
 L.h_ln_partplatact   .68288898   .08507015   8.0273633
   L2.h_ln_new_sign   .00620009   .02168061   .28597383
    L2.h_ln_netw_cc  -.12239996   .30058723   -.4072028
L2.h_ln_partplatact   .22763296   .08163279   2.7884989
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                   ln_new_sign      ln_netw_cc  ln_partplatact
   ln_new_sign       .22651205
    ln_netw_cc       .00023267       .00036539
ln_partplatact       .00593557      -.00022325       .01498808

Residuals correlation matrix

             |      u1       u2       u3
_____________|____________________________
          u1 |   1.0000
             |
             |
          u2 |   0.0257   1.0000
             |   0.6857
             |
          u3 |   0.1018  -0.0949   1.0000
             |   0.1075   0.1337
             |

GMM finished : 11:41:54

Starting Monte-Carlo loop : 11:41:54 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 11:42:02
```



```
. pvar ln_new_sign ln_netw_cc ln_partplatact, lag(3) gmm monte 1000
GMM started : 11:49:42
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 243
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign    .4431902   .09374834    4.727446
     L.h_ln_netw_cc   1.2028065   1.6586271   .72518199
 L.h_ln_partplatact  -.11769481   .22312079  -.52749371
   L2.h_ln_new_sign   .25854637   .08158695   3.1689672
    L2.h_ln_netw_cc  -1.4214296   1.2556005  -1.1320716
L2.h_ln_partplatact  -.25509698    .2406959   -1.059831
   L3.h_ln_new_sign   .02741427   .07986954   .34323809
    L3.h_ln_netw_cc    .2619273   .73539445   .35617253
L3.h_ln_partplatact   .26300186   .18686768    1.407423
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .00268189   .00347087   .77268469
     L.h_ln_netw_cc    1.158157   .21101966   5.4883845
 L.h_ln_partplatact    .0002206   .01061073   .02079011
   L2.h_ln_new_sign   .00617637   .00291939    2.115633
    L2.h_ln_netw_cc  -.33317068   .21111838  -1.5781226
L2.h_ln_partplatact   .01057979   .00919505   1.1505964
   L3.h_ln_new_sign   .00013349   .00294753   .04528799
    L3.h_ln_netw_cc   .11968611   .09191694   1.3021116
L3.h_ln_partplatact  -.00800399   .00697345  -1.1477796
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign  -.00133799   .01834493    -.072935
     L.h_ln_netw_cc   .14050001    .4195891   .33485144
 L.h_ln_partplatact   .64353565    .0768569   8.3731672
   L2.h_ln_new_sign   .02078073   .01793852   1.1584416
    L2.h_ln_netw_cc  -.24372029   .34824791   -.6998471
L2.h_ln_partplatact   .14808588   .10928167   1.3550844
   L3.h_ln_new_sign  -.02000718   .01383381   -1.446252
    L3.h_ln_netw_cc  -.03864849   .15013631  -.25742268
L3.h_ln_partplatact   .10943799   .13128272   .83360542
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                   ln_new_sign      ln_netw_cc  ln_partplatact
   ln_new_sign       .21398016
    ln_netw_cc      -.00013559       .00031429
ln_partplatact       .00806489      -.00017059       .01369555

Residuals correlation matrix

             |      u1        u2        u3
-------------+------------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0163   1.0000
             |   0.8009
             |
          u3 |   0.1488  -0.0817   1.0000
             |   0.0203   0.2044
             |

GMM finished : 11:49:45

Starting Monte-Carlo loop : 11:49:46 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 11:49:54
```



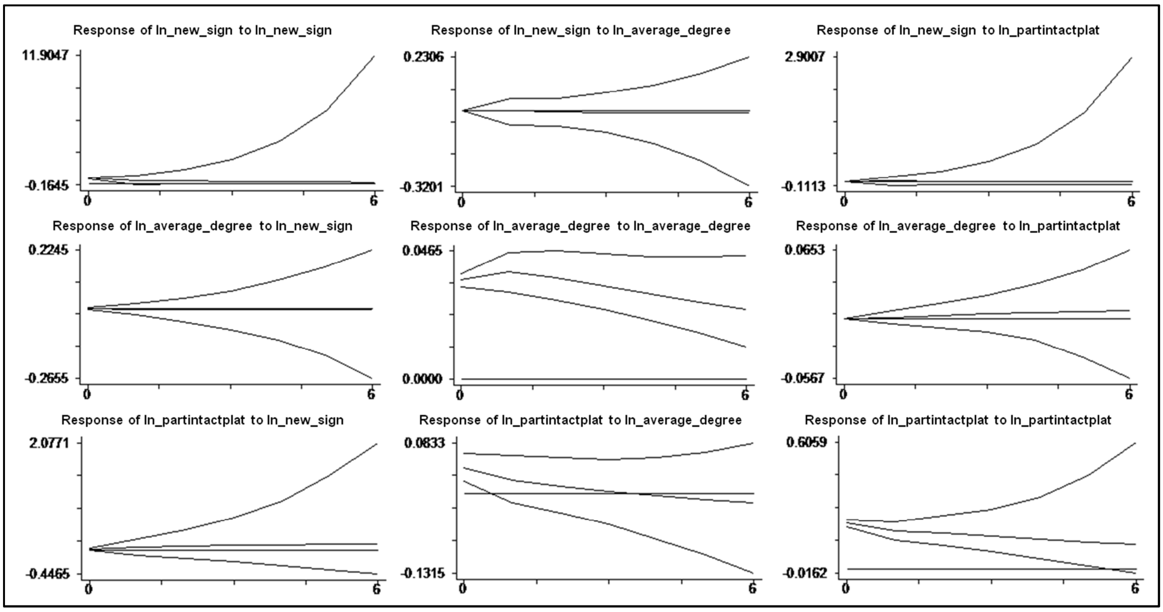
```
. pvar ln_new_sign ln_netw_cc ln_partplatact, lag(4) gmm monte 1000
GMM started : 11:57:38
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 235
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .40609001   .08407355   4.8301757
     L.h_ln_netw_cc   .86370839    1.905504   .45327032
 L.h_ln_partplatact   .09669748     .194786   .49642929
   L2.h_ln_new_sign   .26684306   .08008983   3.3317972
    L2.h_ln_netw_cc   .91979018   2.1500088   .42780763
L2.h_ln_partplatact  -.27778849   .23290391  -1.1927171
   L3.h_ln_new_sign   -.0272355   .07505401  -.36287864
    L3.h_ln_netw_cc  -2.0538096   1.5420753  -1.3318479
L3.h_ln_partplatact   .35286532   .23805415   1.4822901
   L4.h_ln_new_sign   .04346833   .07015353   .61961719
    L4.h_ln_netw_cc   .60592466   .51545826   1.1755068
L4.h_ln_partplatact  -.26378576   .21349719  -1.2355468
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign  -.00198089   .00201194  -.98456385
     L.h_ln_netw_cc   1.0557714   .19636664   5.3765314
 L.h_ln_partplatact  -.00592967   .00523757  -1.1321423
   L2.h_ln_new_sign    .0051151   .00281355   1.8180235
    L2.h_ln_netw_cc  -.20125696   .17061801  -1.1795763
L2.h_ln_partplatact   .00226493   .00932477   .24289374
   L3.h_ln_new_sign   .00019078   .00289896   .06580856
    L3.h_ln_netw_cc   .00636825   .20231765   .03147651
L3.h_ln_partplatact  -.00686206   .00593034   -1.157111
   L4.h_ln_new_sign  -.00208148   .00240547  -.86531198
    L4.h_ln_netw_cc   .07352635    .0489913   1.5008044
L4.h_ln_partplatact   .00513497    .0052999   .96888197
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign  -.00647863   .01713267  -.37814454
     L.h_ln_netw_cc  -.00435028   .48435011  -.00898169
 L.h_ln_partplatact   .70392557   .08411367   8.3687414
   L2.h_ln_new_sign   .02079626   .01709132   1.2167731
    L2.h_ln_netw_cc  -.03734434   .56786545  -.06576266
L2.h_ln_partplatact   .14378144   .10969647   1.3107208
   L3.h_ln_new_sign  -.02705409   .01428746  -1.8935552
    L3.h_ln_netw_cc  -.11082021   .36763468  -.30144111
L3.h_ln_partplatact    .1596822   .15245837   1.0473823
   L4.h_ln_new_sign   .00528101   .01513721    .3488761
    L4.h_ln_netw_cc   .05536046   .15080607   .36709702
L4.h_ln_partplatact  -.10151993   .07953034  -1.2764931
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                  ln_new_sign      ln_netw_cc  ln_partplatact
   ln_new_sign       .20544541
    ln_netw_cc      -.00013572       .00020922
ln_partplatact       .00590326      -.00020576       .01355591

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0204   1.0000
             |   0.7554
             |
          u3 |   0.1116  -0.1218   1.0000
             |   0.0878   0.0624
             |

GMM finished : 11:57:41

Starting Monte-Carlo loop : 11:57:42 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 11:57:51
```



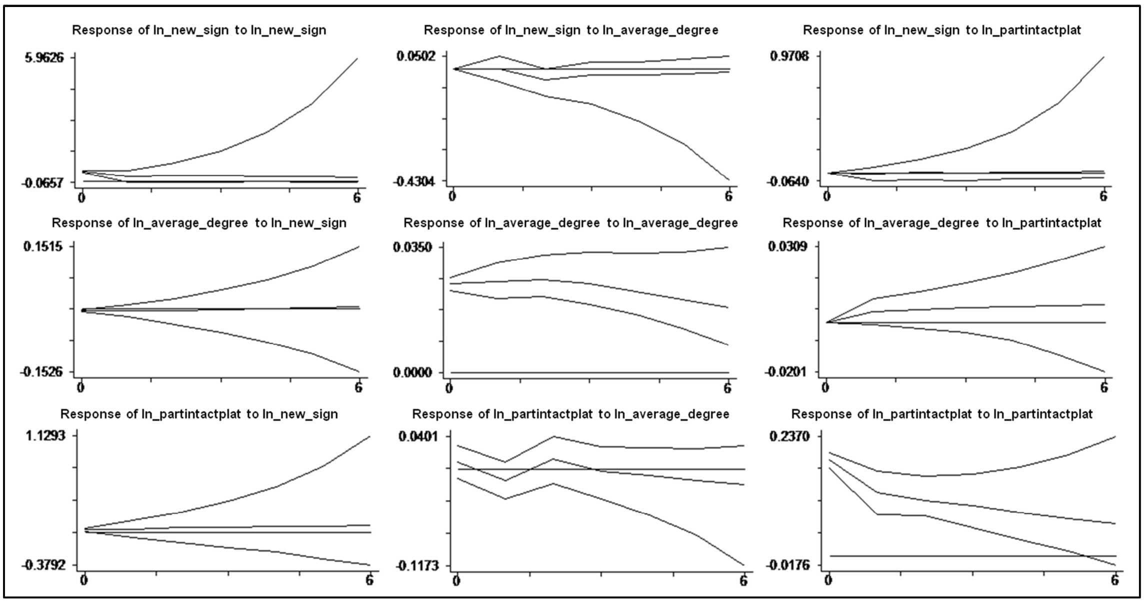
Appendix 48 Estimation Results PVAR(1)-(4) ln_new_signups ln_average_degree ln_partintactplat; New Regions

```
. pvar ln_new_sign ln_average_degree ln_partintactplat, lag(1) gmm monte 1000
GMM started : 16:28:36
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 272
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                          b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign   .62895359   .62206574   1.0110725
L.h_ln_average_degree   .13295688   .36023464   .36908411
L.h_ln_partintactplat  -.08617205   .30593925  -.28166393
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                         b_GMM     se_GMM      t_GMM
      L.h_ln_new_sign  .01469129  .02928601  .50164884
L.h_ln_average_degree   .9094156  .02986857   30.44724
L.h_ln_partintactplat  .02245464  .01350271  1.6629728
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                          b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign   .28668709   .28337777   1.0116781
L.h_ln_average_degree  -.1449952    .23321315  -.62172823
L.h_ln_partintactplat   .99833858   .14010989    7.125397
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                        ln_new_sign  ln_average_degree  ln_partintactplat
      ln_new_sign          .26607474
ln_average_degree          .00377759           .0018319
ln_partintactplat          .04045243          .00624025          .20588303

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |  1.0000
             |
             |
          u2 |  0.1703   1.0000
             |  0.0049
             |
          u3 |  0.1716   0.3188   1.0000
             |  0.0045   0.0000
             |

GMM finished : 16:28:37

Starting Monte-Carlo loop : 16:28:38 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 16:28:45
```

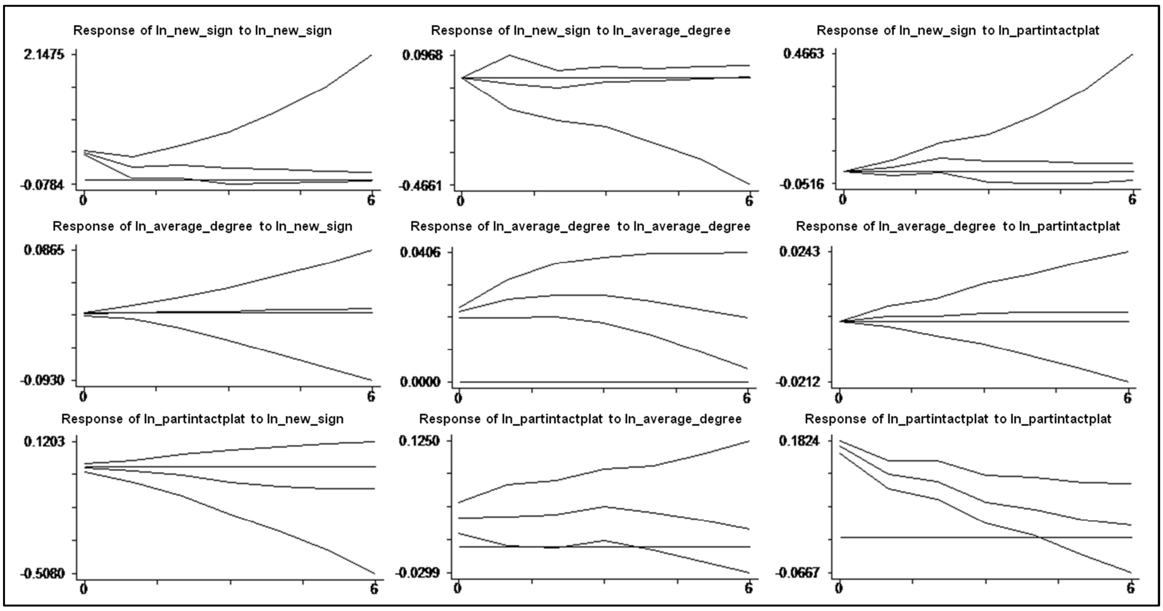
```
. pvar ln_new_sign ln_average_degree ln_partintactplat, lag(2) gmm monte 1000
GMM started : 17:32:14
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 264
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .53646183   .50427482   1.0638283
 L.h_ln_average_degree  -.03368887   .97809087  -.03444349
 L.h_ln_partintactplat   .01541847   .30585372   .05041125
      L2.h_ln_new_sign    .2189543   .18203278    1.202829
L2.h_ln_average_degree   -.0210682    .7774794  -.02709808
L2.h_ln_partintactplat  -.05542531   .12270079   -.4517111
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.00395269   .02428311  -.16277545
 L.h_ln_average_degree   1.0791983   .12220618   8.8309636
 L.h_ln_partintactplat   .00509895   .01795248   .28402478
      L2.h_ln_new_sign   -.0013916   .01119689  -.12428415
L2.h_ln_average_degree  -.15622284   .11606731  -1.3459676
L2.h_ln_partintactplat   .00357649   .00809773    .4416651
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .07480339   .18613504   .40187699
 L.h_ln_average_degree  -.39865754   .54602659  -.73010645
 L.h_ln_partintactplat   .83260585   .12184166   6.8335071
      L2.h_ln_new_sign   .01775792   .06866273   .25862523
L2.h_ln_average_degree   .16360116   .43410381   .37687105
L2.h_ln_partintactplat   .08762913   .06295106   1.3920198
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                     ln_new_sign  ln_average_degree  ln_partintactplat
      ln_new_sign      .25039482
ln_average_degree     -.00049519          .00128508
ln_partintactplat      .01284213          .00150697          .05111619

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0275   1.0000
             |   0.6565
             |
          u3 |   0.1133   0.1861   1.0000
             |   0.0660   0.0024
             |

GMM finished : 17:32:16

Starting Monte-Carlo loop : 17:32:16 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 17:32:24
```



```
. pvar ln_new_sign ln_average_degree ln_partintactplat, lag(3) gmm monte 1000
GMM started : 17:33:54
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 256
---------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                          b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign   .50531278   .37216275   1.3577737
 L.h_ln_average_degree   .06674296   1.2061533   .05533539
 L.h_ln_partintactplat  -.04405075   .18246879  -.24141527
     L2.h_ln_new_sign     .314396   .22901008   1.3728479
L2.h_ln_average_degree  -1.7168071   1.0771374  -1.5938608
L2.h_ln_partintactplat   .09265408   .20053328    .4620384
     L3.h_ln_new_sign   .07766473   .09062157   .85702251
L3.h_ln_average_degree   1.7145864   .57395261    2.987331
L3.h_ln_partintactplat   .01855153   .08445394   .21966445
---------------------------------------------------------------------------
---------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                          b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign  -.00361562   .01739855  -.20781129
 L.h_ln_average_degree   1.0146286   .10633994   9.5413689
 L.h_ln_partintactplat   .02373746   .01706573   1.3909435
     L2.h_ln_new_sign   .00052719   .01230191   .04285446
L2.h_ln_average_degree   .02820623   .11725689   .24055069
L2.h_ln_partintactplat  -.01319681   .01310332  -1.0071346
     L3.h_ln_new_sign   .00673768    .0044829   1.5029734
L3.h_ln_average_degree  -.11774946   .04904674  -2.4007601
L3.h_ln_partintactplat  -.00062638    .0058435  -.10719198
---------------------------------------------------------------------------
---------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                          b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign   .03333738   .12833143   .25977565
 L.h_ln_average_degree  -.77550269   .47774182  -1.6232673
 L.h_ln_partintactplat   .66250647   .13114453   5.0517279
     L2.h_ln_new_sign   .03557552   .07262365    .4898614
L2.h_ln_average_degree   1.6061978   .72115337   2.2272625
L2.h_ln_partintactplat   .16051976   .11434952   1.4037642
     L3.h_ln_new_sign   .00074202   .03546041   .02092534
L3.h_ln_average_degree  -1.1279039   .47337139  -2.3827039
L3.h_ln_partintactplat   .01816056   .03785763   .47970662
---------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                        ln_new_sign  ln_average_degree  ln_partintactplat
      ln_new_sign          .22950491
ln_average_degree         -.00165199          .00062403
ln_partintactplat          .01320074          .00012295          .03700934

Residuals correlation matrix

             |     u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1380   1.0000
             |   0.0273
             |
          u3 |   0.1432   0.0256   1.0000
             |   0.0219   0.6840
             |

GMM finished : 17:33:56

Starting Monte-Carlo loop : 17:33:56 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 17:34:05
```



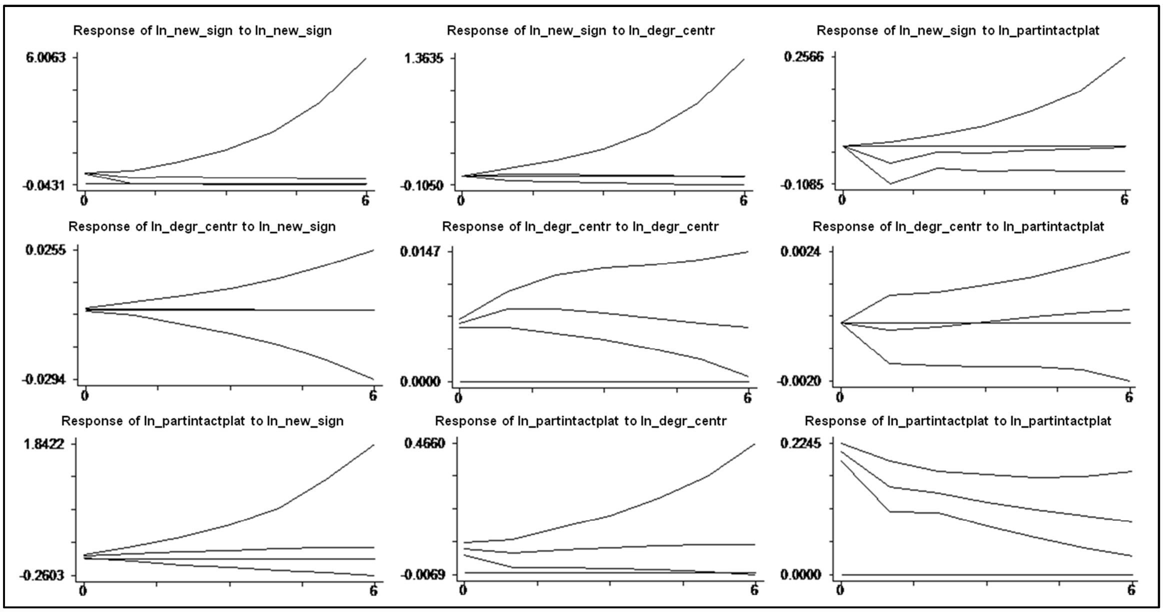
```
. pvar ln_new_sign ln_average_degree ln_partintactplat, lag(4) gmm monte 1000
GMM started : 17:35:34
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 248
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .48250548   .22403278   2.1537271
 L.h_ln_average_degree  -1.2588496   3.2033032  -.39298484
 L.h_ln_partintactplat   .07478835   .11538439   .64816694
      L2.h_ln_new_sign   .32414953   .18783811   1.7256857
L2.h_ln_average_degree  -.43601312   2.6153909   -.1667105
L2.h_ln_partintactplat   .23294065   .22160647   1.0511455
      L3.h_ln_new_sign   .04510331   .13894134   .32462124
L3.h_ln_average_degree   2.3185437   1.3822554   1.6773628
L3.h_ln_partintactplat  -.14115473   .14134499  -.99865395
      L4.h_ln_new_sign   .01845762     .081815   .22560191
L4.h_ln_average_degree  -.53246709   .91357095  -.58284152
L4.h_ln_partintactplat   -.0443774   .09046964  -.49052256
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00574059   .01062017   .54053621
 L.h_ln_average_degree   1.1697063   .16336974   7.1598711
 L.h_ln_partintactplat   .00995547   .01331151   .74788426
      L2.h_ln_new_sign  -.00185409   .01132226   -.1637557
L2.h_ln_average_degree  -.13972335   .17089345  -.81760505
L2.h_ln_partintactplat  -.00945301   .01382877  -.68357592
      L3.h_ln_new_sign  -.00030589   .00654806  -.04671398
L3.h_ln_average_degree  -.05414744   .08307444  -.65179422
L3.h_ln_partintactplat   .00633934   .01034852   .61258394
      L4.h_ln_new_sign   .00226286   .00448146   .50493926
L4.h_ln_average_degree  -.05987711   .05020386  -1.1926795
L4.h_ln_partintactplat  -.00383657   .00694755  -.55221967
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.03900932   .06546546  -.59587646
 L.h_ln_average_degree    .5214205   .91077925   .57249932
 L.h_ln_partintactplat   .69441474   .08381791   8.2848013
      L2.h_ln_new_sign  -.03796838   .05629037  -.67450928
L2.h_ln_average_degree  -.25635784   .93208549  -.27503683
L2.h_ln_partintactplat   .13083956   .08855745   1.4774539
      L3.h_ln_new_sign  -.04677166   .03695114  -1.2657706
L3.h_ln_average_degree    .5189823   1.0220439   .50778867
L3.h_ln_partintactplat   -.1192777   .08442315  -1.4128554
      L4.h_ln_new_sign  -.02827674   .02627286  -1.0762719
L4.h_ln_average_degree  -.91034981   .71215099  -1.2783101
L4.h_ln_partintactplat   .05188022   .05885878    .8814354
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                         ln_new_sign  ln_average_degree  ln_partintactplat
      ln_new_sign          .22322569
ln_average_degree         -.00078784          .00048115
ln_partintactplat         -.00213337          .00075537          .03039804

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0760   1.0000
             |   0.2330
             |
          u3 |  -0.0259   0.1974   1.0000
             |   0.6851   0.0018
             |

GMM finished : 17:35:36

Starting Monte-Carlo loop : 17:35:38 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 17:35:47
```



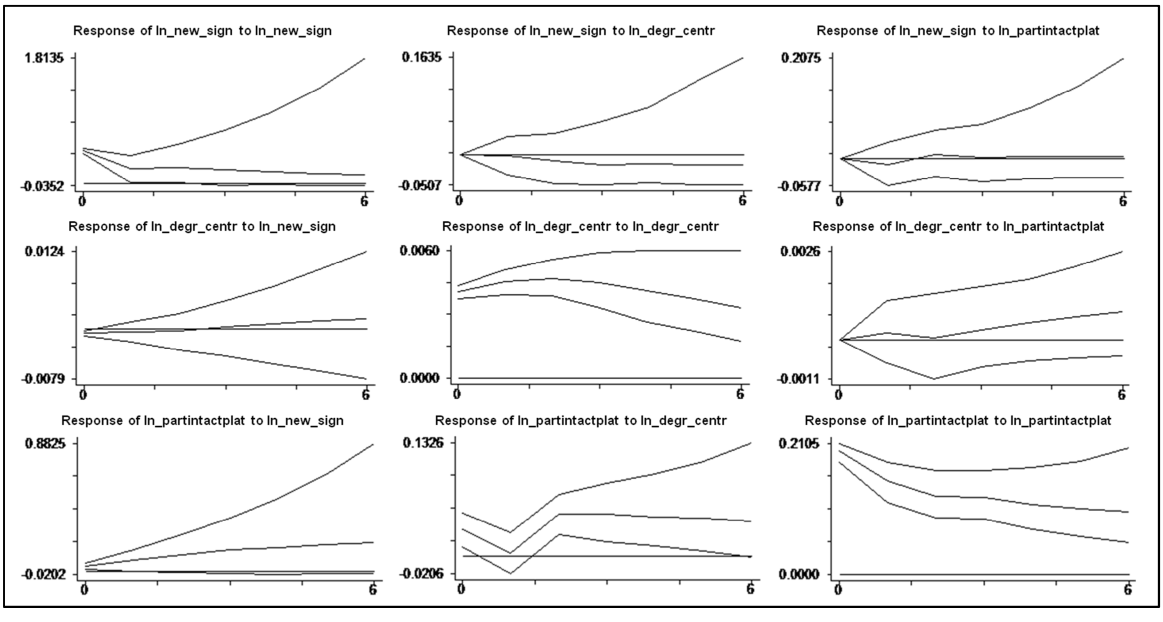
Appendix 49 Estimation Results PVAR(1)-(4) ln_new_signups ln_degree_centralization ln_partintactplat; New Regions

```
. pvar ln_new_sign ln_degr_centr ln_partintactplat, lag(1) gmm monte 1000
GMM started : 13:29:40
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 271
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                            b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign   .62363648    .4384312   1.4224272
    L.h_ln_degr_centr  -1.3932905   2.6847529  -.51896417
L.h_ln_partintactplat  -.07327217   .18299099   -.4004141
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                           b_GMM     se_GMM      t_GMM
      L.h_ln_new_sign  .00677716  .00839731  .80706301
    L.h_ln_degr_centr  .90463399  .07327351  12.345989
L.h_ln_partintactplat  .00443723  .00346428  1.2808509
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                           b_GMM     se_GMM      t_GMM
      L.h_ln_new_sign  .17706686  .19437392  .91095994
    L.h_ln_degr_centr  2.3479596  1.4968356  1.5686155
L.h_ln_partintactplat  .91562129   .0750797  12.195325
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                         ln_new_sign      ln_degr_centr  ln_partintactplat
      ln_new_sign          .25800847
    ln_degr_centr          .00049974          .00014474
ln_partintactplat          .02756343          .00128932          .07286578

Residuals correlation matrix

             |        u1       u2       u3
-------------+-----------------------------
          u1 |    1.0000
             |
             |
          u2 |    0.0805   1.0000
             |    0.1865
             |
          u3 |    0.2003   0.3951   1.0000
             |    0.0009   0.0000
             |

GMM finished : 13:29:41

Starting Monte-Carlo loop : 13:29:43 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 13:29:50
```

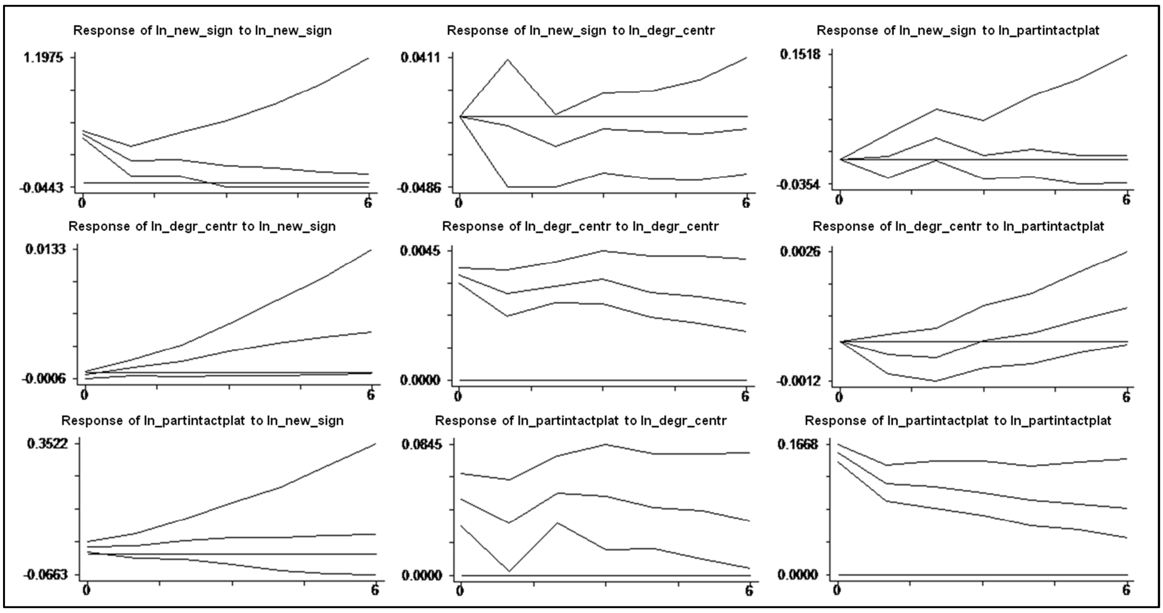
```
. pvar ln_new_sign ln_degr_centr ln_partintactplat, lag(2) gmm monte 1000
GMM started : 13:34:04
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 263
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                           b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign   .64615047   .37408234   1.7272947
    L.h_ln_degr_centr   8.2453941   5.4813263   1.5042699
 L.h_ln_partintactplat  -.24136981   .17552782  -1.3751085
     L2.h_ln_new_sign   .28055116   .14702329    1.908209
   L2.h_ln_degr_centr  -9.1225887   3.6153328  -2.5233054
L2.h_ln_partintactplat   .25982533   .24912848   1.0429371
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                           b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign   .00316176   .00684061   .46220439
    L.h_ln_degr_centr   .96832247   .26588742   3.6418514
 L.h_ln_partintactplat   .00142279   .00334704   .42508862
     L2.h_ln_new_sign   -.0018858   .00308603  -.61107567
   L2.h_ln_degr_centr  -.04936302   .21416707  -.23048837
L2.h_ln_partintactplat   .00019631   .00512133   .03833194
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                          b_GMM     se_GMM      t_GMM
      L.h_ln_new_sign   .1103476  .14830927  .74403712
    L.h_ln_degr_centr  1.4819586  3.4679632  .42732822
 L.h_ln_partintactplat  .70888558  .12017671  5.8986935
     L2.h_ln_new_sign  .02925106  .06135555  .47674682
   L2.h_ln_degr_centr  .47697592  2.7770493  .17175637
L2.h_ln_partintactplat  .18795729  .13644442  1.3775374
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                         ln_new_sign      ln_degr_centr  ln_partintactplat
      ln_new_sign          .26999496
    ln_degr_centr          .00005881          .00009253
ln_partintactplat          .02473917          .00062201          .05476356

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0112   1.0000
             |   0.8566
             |
          u3 |   0.2031   0.2760   1.0000
             |   0.0009   0.0000
             |

GMM finished : 13:34:06

Starting Monte-Carlo loop : 13:34:06 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 13:34:14
```



```
. pvar ln_new_sign ln_degr_centr ln_partintactplat, lag(3) gmm monte 1000
GMM started : 13:39:35
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 255
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .48907915   .25529746   1.9157227
     L.h_ln_degr_centr   5.3313336   3.3345155   1.5988331
 L.h_ln_partintactplat  -.12168739   .15291146  -.79580292
      L2.h_ln_new_sign   .24397732   .15928648   1.5316888
    L2.h_ln_degr_centr   -11.76302   4.4662425   -2.633762
L2.h_ln_partintactplat   .18903117   .13747232   1.3750489
      L3.h_ln_new_sign   .08670418   .08140934   1.0650396
    L3.h_ln_degr_centr   5.2947916   3.0976085   1.7093159
L3.h_ln_partintactplat  -.05252593   .15090122  -.34808152
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00171853     .005015   .34267765
     L.h_ln_degr_centr   .82773443   .23064366   3.5888021
 L.h_ln_partintactplat   .00398186   .00329145   1.2097574
      L2.h_ln_new_sign  -.00021661   .00314295  -.06892087
    L2.h_ln_degr_centr   .17381909   .20896409   .83181322
L2.h_ln_partintactplat  -.00330902   .00365397  -.90559773
      L3.h_ln_new_sign   -.0007654   .00131702  -.58116161
    L3.h_ln_degr_centr  -.10746841   .07506375  -1.4316951
L3.h_ln_partintactplat   .00097533    .0027623   .35308728
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .10076443   .10124475   .99525588
     L.h_ln_degr_centr   .96520763   2.5957936   .37183528
 L.h_ln_partintactplat   .69095117     .104957   6.5831834
      L2.h_ln_new_sign   .10496408    .0638096   1.6449574
    L2.h_ln_degr_centr   5.2859306    4.262266   1.2401691
L2.h_ln_partintactplat   .15237647   .12969534   1.1748801
      L3.h_ln_new_sign   .00892984   .04135643   .21592378
    L3.h_ln_degr_centr   -4.684123   2.6921882  -1.7398943
L3.h_ln_partintactplat   .05576752   .09027518   .61775035
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                   ln_new_sign      ln_degr_centr  ln_partintactplat
      ln_new_sign    .21943736
    ln_degr_centr   -.00050427          .00006014
ln_partintactplat    .02073465          .00010079           .0465711

Residuals correlation matrix

             |     u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1388   1.0000
             |   0.0267
             |
          u3 |   0.2051   0.0602   1.0000
             |   0.0010   0.3383
             |

GMM finished : 13:39:37

Starting Monte-Carlo loop : 13:39:37 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 13:39:45
```



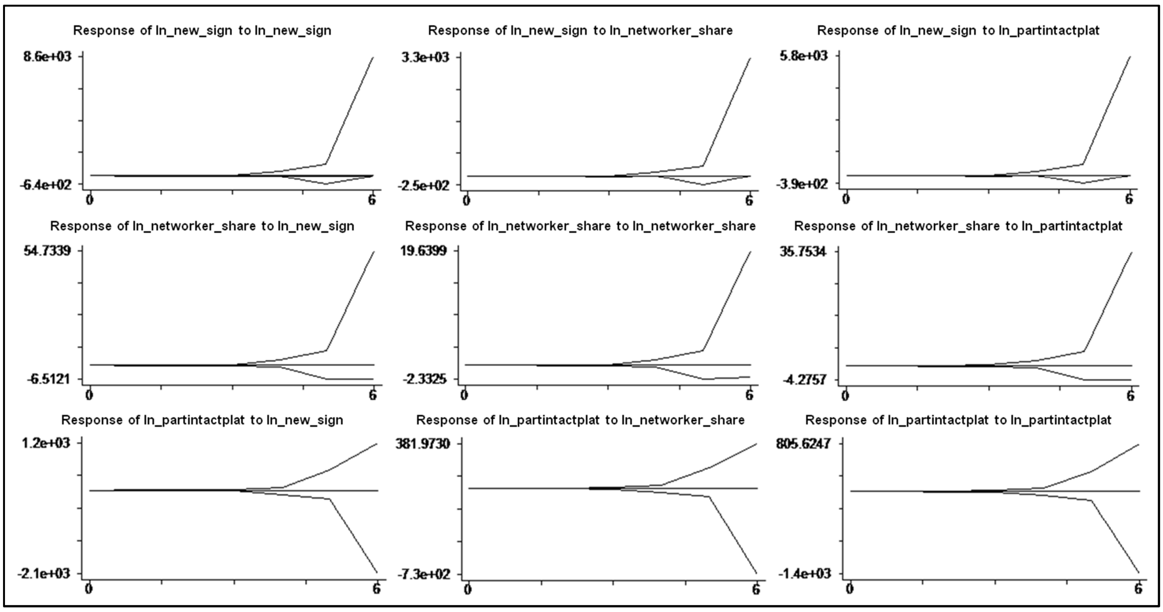
```
. pvar ln_new_sign ln_degr_centr ln_partintactplat, lag(4) gmm monte 1000
GMM started : 13:43:13
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 247
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .47658285   .18903818   2.5210932
     L.h_ln_degr_centr   5.6819992   2.8523934   1.9920111
 L.h_ln_partintactplat   .04738163    .1175509   .40307335
      L2.h_ln_new_sign    .2500467   .14059159   1.7785324
    L2.h_ln_degr_centr  -13.807627   3.7652528  -3.6671182
L2.h_ln_partintactplat   .13301157   .13924364   .95524343
      L3.h_ln_new_sign   .03334667   .10537009   .31647188
    L3.h_ln_degr_centr   6.1130357   3.6660037    1.667493
L3.h_ln_partintactplat  -.18425105   .13586229  -1.3561603
      L4.h_ln_new_sign  -.00340225   .06399466  -.05316461
    L4.h_ln_degr_centr   1.6103048   2.0385369   .78993167
L4.h_ln_partintactplat   .02256947   .14451208   .15617702
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00284412   .00393309   .72312628
     L.h_ln_degr_centr   .64577818   .23408219   2.7587668
 L.h_ln_partintactplat  -.00100515   .00211246  -.47581888
      L2.h_ln_new_sign   .00084996    .0026091   .32576796
    L2.h_ln_degr_centr   .32181482   .24692136   1.3033089
L2.h_ln_partintactplat   .00097935   .00264952   .36963468
      L3.h_ln_new_sign   .00009987   .00145251   .06875776
    L3.h_ln_degr_centr   .06313944   .09218446   .68492503
L3.h_ln_partintactplat   .00310886   .00234127   1.3278499
      L4.h_ln_new_sign   .00004565   .00073877   .06178958
    L4.h_ln_degr_centr  -.16658168   .06280168  -2.6525036
L4.h_ln_partintactplat  -.00045393   .00213077  -.21303676
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .02023001   .04735312   .42721609
     L.h_ln_degr_centr   1.9191301   1.8779174   1.0219459
 L.h_ln_partintactplat   .73900367   .08271636   8.9341895
      L2.h_ln_new_sign   .02705791   .03743809   .72273738
    L2.h_ln_degr_centr   1.3215317   1.9987035   .66119445
L2.h_ln_partintactplat   .17946892   .09006423    1.992677
      L3.h_ln_new_sign  -.00009722   .02806127   -.0034646
    L3.h_ln_degr_centr  -.91283778   1.8513068  -.49307754
L3.h_ln_partintactplat   .01647907   .09059798   .18189219
      L4.h_ln_new_sign  -.02230398   .02032626  -1.0972987
    L4.h_ln_degr_centr  -2.5827862   1.9018873  -1.3580122
L4.h_ln_partintactplat   -.0324425   .06138493  -.52850916
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                    ln_new_sign      ln_degr_centr  ln_partintactplat
      ln_new_sign          .20804783
    ln_degr_centr         -.00027068          .00005108
ln_partintactplat          .01001034          .00021183          .02748637

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0830   1.0000
             |   0.1936
             |
          u3 |   0.1324   0.1788   1.0000
             |   0.0376   0.0048
             |

GMM finished : 13:43:15

Starting Monte-Carlo loop : 13:43:17 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 13:43:26
```



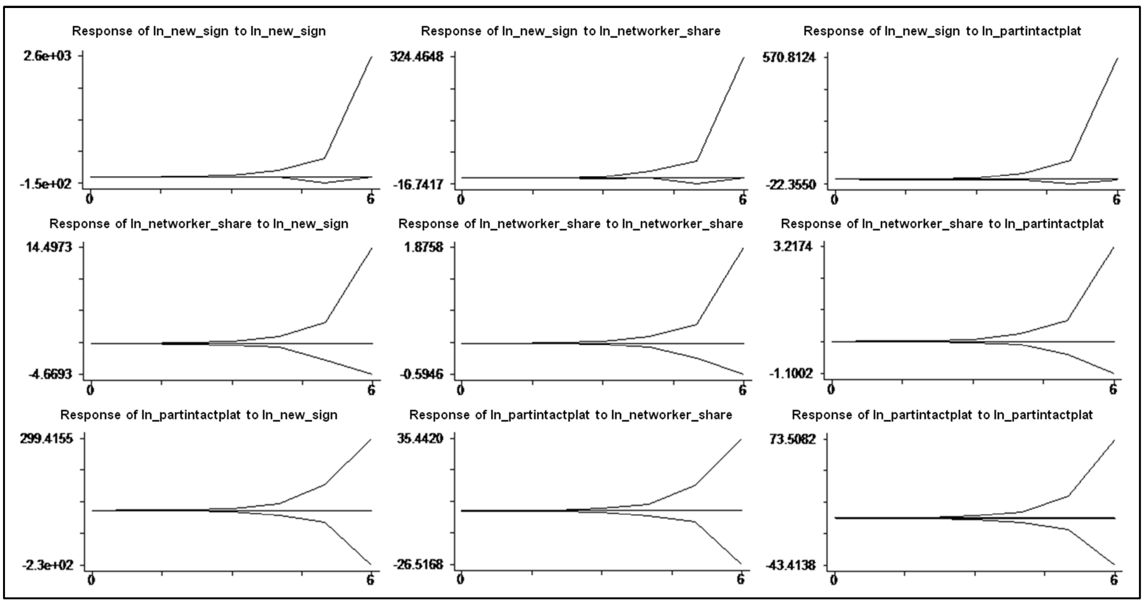
Appendix 50 Estimation Results PVAR(1)-(4) ln_new_signups ln_networker_share ln_partintactplat; New Regions

```
. pvar ln_new_sign ln_networker_share ln_partintactplat, lag(1) gmm monte 1000
GMM started : 13:47:27
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 272
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.16837468   2.6779128  -.06287534
L.h_ln_networker_share  -4.4705825    13.14931  -.33998607
 L.h_ln_partintactplat  -.46409477   1.2572603   -.3691318
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.02472746   .07459107  -.33150699
L.h_ln_networker_share   .66286753   .37579518   1.7639064
 L.h_ln_partintactplat   -.0099568   .03451764  -.28845527
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                           b_GMM     se_GMM      t_GMM
       L.h_ln_new_sign   1.652652  4.4251125  .37347117
L.h_ln_networker_share  8.0102971  21.629661  .37033853
 L.h_ln_partintactplat  1.6404071   2.068054  .79321293
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                       ln_new_sign  ln_networker_share   ln_partintactplat
       ln_new_sign          .43476488
ln_networker_share          .00739767           .00045747
 ln_partintactplat         -.61911476          -.02410419           1.9706535

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.5176   1.0000
             |   0.0000
             |
          u3 |  -0.6635  -0.7995   1.0000
             |   0.0000   0.0000
             |

GMM finished : 13:47:29

Starting Monte-Carlo loop : 13:47:31 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 13:47:38
```

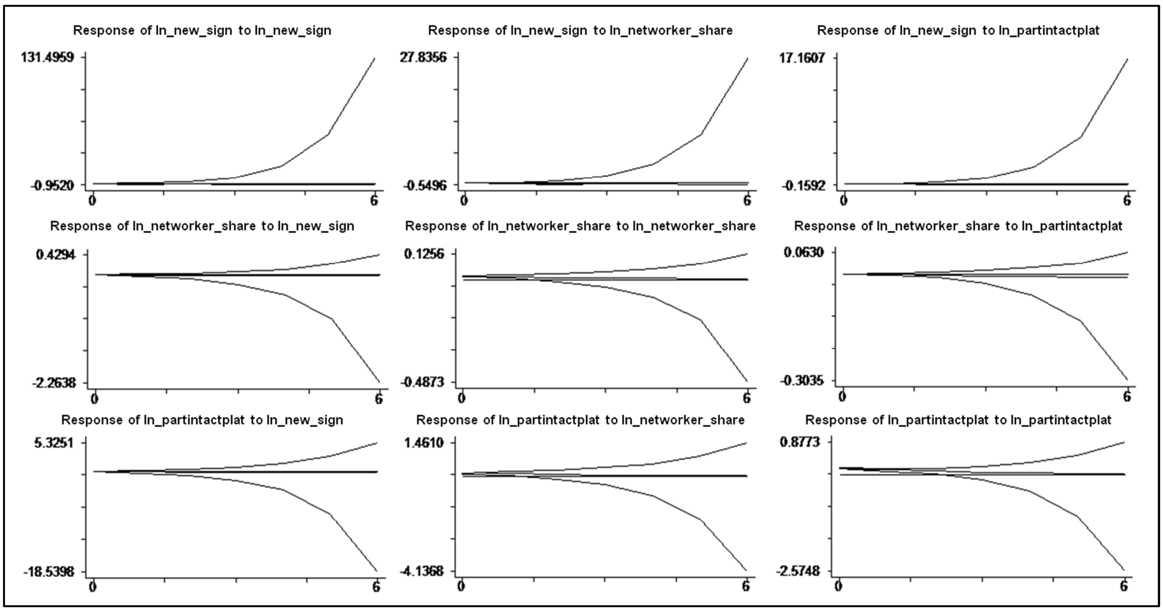
```
. pvar ln_new_sign ln_networker_share ln_partintactplat, lag(2) gmm monte 1000
GMM started : 13:50:38
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 264
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign  -.33793419   3.0699602  -.11007771
 L.h_ln_networker_share  -13.281847   46.163742  -.28771166
  L.h_ln_partintactplat  -.47354792   1.7128659  -.27646526
       L2.h_ln_new_sign  -.02479337   .90744611  -.02732214
L2.h_ln_networker_share   4.7311252   20.628671   .22934707
 L2.h_ln_partintactplat  -.05444409   .15685502  -.34709815
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .00048733   .04525608   .01076836
 L.h_ln_networker_share   .93394169   .71637808   1.3036994
  L.h_ln_partintactplat   .00378743   .02609009   .14516734
       L2.h_ln_new_sign  -.00210997   .01352332  -.15602482
L2.h_ln_networker_share  -.04696062   .33080565  -.14195833
 L2.h_ln_partintactplat  -.00265473   .00278927  -.95176789
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .78989153   2.5520429   .30951342
 L.h_ln_networker_share   9.7993419    38.50826   .25447376
  L.h_ln_partintactplat     1.23707    1.434897   .86213157
       L2.h_ln_new_sign    .2212755   .76355078   .28979801
L2.h_ln_networker_share  -3.9382087   17.527179  -.22469153
 L2.h_ln_partintactplat   .09531944    .2448545   .38929015
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                           ln_new_sign  ln_networker_share   ln_partintactplat
       ln_new_sign           .39657253
ln_networker_share          -.00027123           .00008085
 ln_partintactplat          -.24781975           .00036822           .38079605

Residuals correlation matrix

             |        u1        u2        u3
-------------+------------------------------
          u1 |    1.0000
             |
             |
          u2 |   -0.0479    1.0000
             |    0.4385
             |
          u3 |   -0.6345    0.0664    1.0000
             |    0.0000    0.2822
             |

GMM finished : 13:50:40

Starting Monte-Carlo loop : 13:50:41 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 13:50:48
```



```
. pvar ln_new_sign ln_networker_share ln_partintactplat, lag(3) gmm monte 1000
GMM started : 14:02:15
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 256
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                               b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .00670493   2.1384042   .00313548
 L.h_ln_networker_share  -10.541885   22.570649  -.46706165
  L.h_ln_partintactplat  -.16941345   .68582892  -.24701998
       L2.h_ln_new_sign   .03756768   1.1721811   .03204938
L2.h_ln_networker_share   -.4693844    16.46949  -.02850024
 L2.h_ln_partintactplat  -.09876433   .66956776  -.14750461
       L3.h_ln_new_sign   .02693422   .24988782   .10778525
L3.h_ln_networker_share   4.6120711   13.175065   .35006059
 L3.h_ln_partintactplat  -.02455211    .1786807  -.13740772
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                               b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign    -.004027   .04174326  -.09647065
 L.h_ln_networker_share    .9791259   .48159512   2.0330893
  L.h_ln_partintactplat   .00163267   .01573679   .10374861
       L2.h_ln_new_sign  -.00379776   .02326566  -.16323469
L2.h_ln_networker_share  -.16772422   .32090316  -.52266305
 L2.h_ln_partintactplat  -.00642824   .01232234  -.52167386
       L3.h_ln_new_sign   -.0003155   .00470576  -.06704591
L3.h_ln_networker_share   .01949723   .26560375   .07340721
 L3.h_ln_partintactplat   .00196989   .00355651   .55388425
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                               b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .34299184   1.2779732   .26838735
 L.h_ln_networker_share   1.7556565   13.742028   .12775819
  L.h_ln_partintactplat   .80852809   .43628601   1.8532066
       L2.h_ln_new_sign    .2188289    .7034319   .31108754
L2.h_ln_networker_share   7.8163361   10.100857   .77382899
 L2.h_ln_partintactplat   .24629796   .39381863   .62540963
       L3.h_ln_new_sign   .02874775   .14632864   .19646015
L3.h_ln_networker_share  -6.1666374   8.0258952  -.76834263
 L3.h_ln_partintactplat   .02559264   .10322248   .24793669
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                         ln_new_sign  ln_networker_share   ln_partintactplat
       ln_new_sign         .24514358
ln_networker_share         .00050025           .00007842
 ln_partintactplat        -.04986062           -.0009482           .10853198

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |  1.0000
             |
             |
          u2 |  0.1118   1.0000
             |  0.0741
             |
          u3 | -0.3029  -0.3234   1.0000
             |  0.0000   0.0000
             |

GMM finished : 14:02:17

Starting Monte-Carlo loop : 14:02:18 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 14:02:26
```



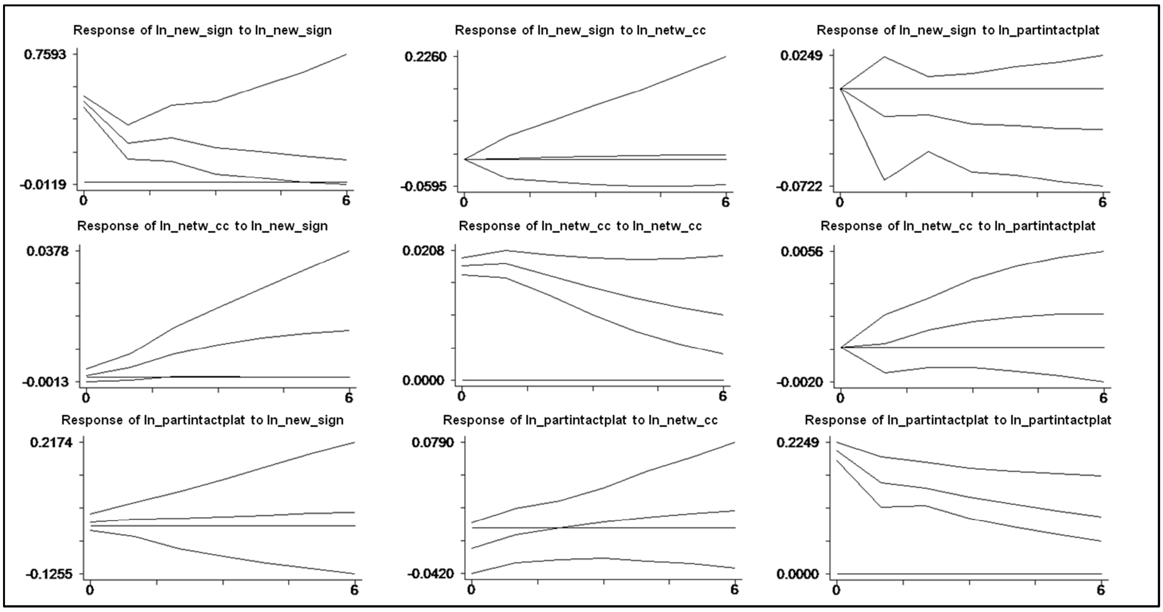
```
. pvar ln_new_sign ln_networker_share ln_partintactplat, lag(4) gmm monte 1000
GMM started : 14:14:29
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 248
----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .39363986   1.0950197   .35948198
 L.h_ln_networker_share  -6.4448379   3.9151039  -1.6461473
  L.h_ln_partintactplat   .08587439   .18000482   .47706714
       L2.h_ln_new_sign   .29212114   .83757358   .34877072
L2.h_ln_networker_share  -3.4705059    19.01123  -.18255031
 L2.h_ln_partintactplat   .19952762   .38418517   .51935275
       L3.h_ln_new_sign   .03774424   .43841009   .08609346
L3.h_ln_networker_share   8.7965204   7.1262547    1.234382
 L3.h_ln_partintactplat   -.1664295   .36545418  -.45540457
       L4.h_ln_new_sign  -.00807845   .07722099  -.10461463
L4.h_ln_networker_share  -.23531264    9.425388  -.02496583
 L4.h_ln_partintactplat  -.07352744   .10427086  -.70515812
----------------------------------------------------------------------------
----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                             b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign  -.01339515   .03421874  -.39145645
 L.h_ln_networker_share   1.0217942   .20344697   5.0224104
  L.h_ln_partintactplat  -.00697244   .00798394  -.87330788
       L2.h_ln_new_sign  -.01484941   .02636273  -.56327288
L2.h_ln_networker_share  -.36753088   .66933829  -.54909585
 L2.h_ln_partintactplat  -.00514255   .01244819  -.41311588
       L3.h_ln_new_sign  -.00729311   .01378821  -.52893861
L3.h_ln_networker_share   .03791104   .29542316   .12832794
 L3.h_ln_partintactplat  -.00196017   .01270317  -.15430524
       L4.h_ln_new_sign    .0003414   .00282493   .12085206
L4.h_ln_networker_share  -.06342146   .30624119  -.20709643
 L4.h_ln_partintactplat  -.00018393   .00668899  -.02749766
----------------------------------------------------------------------------
----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                             b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign  -.10321983   .35552591  -.29032998
 L.h_ln_networker_share   1.9424418   3.0971434   .62717205
  L.h_ln_partintactplat   .72527551   .12257241   5.9171186
       L2.h_ln_new_sign  -.07714275   .27491145  -.28060944
L2.h_ln_networker_share  -3.5828209   6.1313618  -.58434341
 L2.h_ln_partintactplat   .12659174   .14382578   .88017417
       L3.h_ln_new_sign  -.04654484   .14200455  -.32777003
L3.h_ln_networker_share   .00714876     3.24758   .00220126
 L3.h_ln_partintactplat  -.12933753   .15343272  -.84295923
       L4.h_ln_new_sign  -.02760783   .03092728  -.89266944
L4.h_ln_networker_share  -.12422423   3.5113259  -.03537815
 L4.h_ln_partintactplat    .0495482   .08403328   .58962599
----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                       ln_new_sign  ln_networker_share   ln_partintactplat
       ln_new_sign        .19995631
ln_networker_share        -.0018138           .00026805
 ln_partintactplat       -.00477359            .0015873           .03777214

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.2492   1.0000
             |   0.0001
             |
          u3 |  -0.0555   0.4968   1.0000
             |   0.3844   0.0000
             |

GMM finished : 14:14:31

Starting Monte-Carlo loop : 14:14:32 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 14:14:42
```



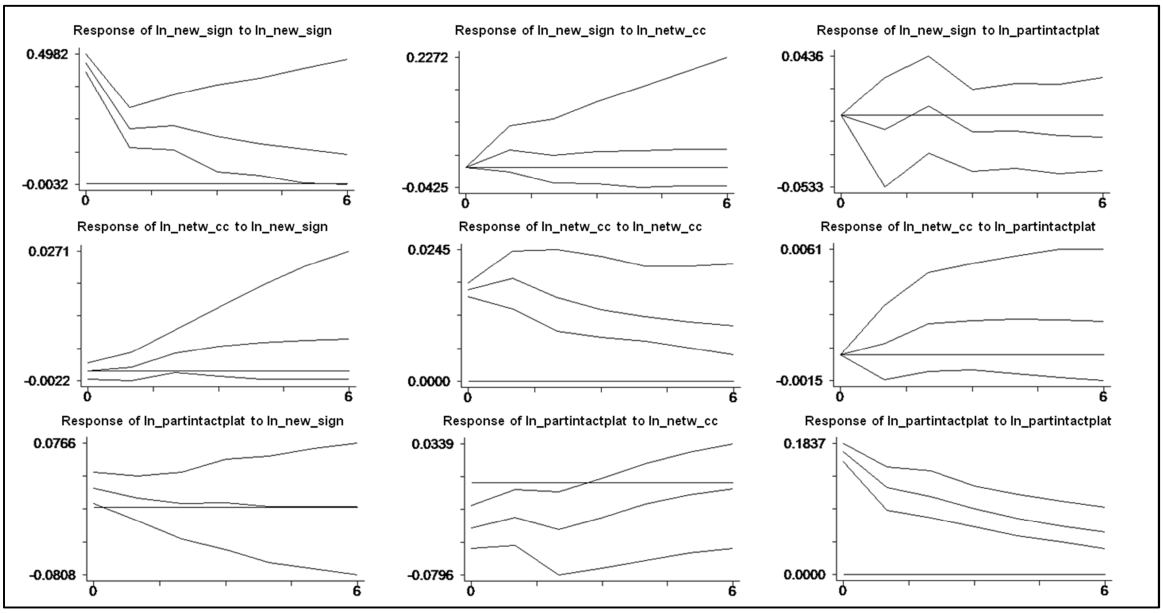
Appendix 51 Estimation Results PVAR(1)-(4) ln_new_signups ln_network_cc ln_partintactplat; New Regions

```
. pvar ln_new_sign ln_netw_cc ln_partintactplat, lag(1) gmm monte 1000
GMM started : 14:19:01
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 259
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                           b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign   .63992619   .20917236   3.0593248
       L.h_ln_netw_cc  -.46022414   1.0853448  -.42403496
L.h_ln_partintactplat  -.09810274   .07323701  -1.3395241
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                          b_GMM     se_GMM      t_GMM
      L.h_ln_new_sign  .02485463  .01684344  1.4756262
       L.h_ln_netw_cc  .81371972   .0948319  8.5806545
L.h_ln_partintactplat  .01598344  .00973336  1.6421308
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                          b_GMM     se_GMM      t_GMM
      L.h_ln_new_sign  .10106513   .1081467  .93451889
       L.h_ln_netw_cc  .24781199  .47417627  .52261576
L.h_ln_partintactplat  .92041097  .04822188  19.086997
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                         ln_new_sign         ln_netw_cc  ln_partintactplat
      ln_new_sign          .24174679
       ln_netw_cc          .00025315           .0016706
ln_partintactplat          .00638862          .00230446          .05698139

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0126   1.0000
             |   0.8406
             |
          u3 |   0.0544   0.2357   1.0000
             |   0.3831   0.0001
             |

GMM finished : 14:19:02

Starting Monte-Carlo loop : 14:19:03 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 14:19:09
```

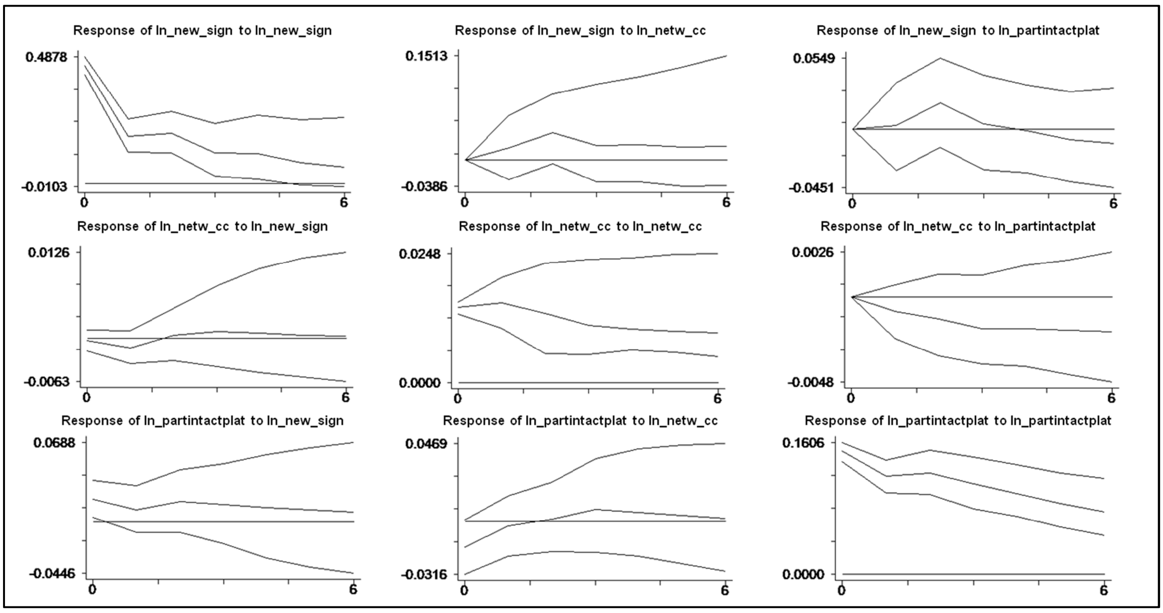
```
. pvar ln_new_sign ln_netw_cc ln_partintactplat, lag(2) gmm monte 1000
GMM started : 14:38:30
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 251
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                          b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .48982421   .12690188   3.8598657
        L.h_ln_netw_cc  -.03740295   1.4985061  -.02496016
 L.h_ln_partintactplat  -.09736467   .12758942  -.76310931
      L2.h_ln_new_sign   .32171668   .09704789   3.3150301
       L2.h_ln_netw_cc   .26521496   .63012505   .42089258
L2.h_ln_partintactplat   .02751899   .12563835   .21903334
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                          b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00491662   .00451469    1.089028
        L.h_ln_netw_cc   1.0199777   .06087489   16.755309
 L.h_ln_partintactplat    .0011795   .00497712   .23698391
      L2.h_ln_new_sign   .00628432   .00342717    1.833675
       L2.h_ln_netw_cc  -.12213403    .0565544  -2.1595849
L2.h_ln_partintactplat   .00336634   .00558272    .6029929
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                          b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign    .0182582   .05797386   .31493843
        L.h_ln_netw_cc   .41501979   .62807884   .66077659
 L.h_ln_partintactplat   .73943656   .12419469   5.9538502
      L2.h_ln_new_sign  -.00068612    .0401524  -.01708782
       L2.h_ln_netw_cc   -.0292093   .69118557  -.04225971
L2.h_ln_partintactplat   .14818366   .09841152   1.5057552
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                        ln_new_sign         ln_netw_cc  ln_partintactplat
      ln_new_sign          .22686557
       ln_netw_cc          .00024364          .00033421
ln_partintactplat           .0047089         -.00034405           .04483083

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0280   1.0000
             |   0.6584
             |
          u3 |   0.0467  -0.0887   1.0000
             |   0.4616   0.1611
             |

GMM finished : 14:38:32

Starting Monte-Carlo loop : 14:38:33 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 14:38:40
```



```
. pvar ln_new_sign ln_netw_cc ln_partintactplat, lag(3) gmm monte 1000
GMM started : 14:46:40
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 243
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .45834952   .09782802   4.6852579
        L.h_ln_netw_cc   1.9687959   1.6519313   1.1918147
 L.h_ln_partintactplat   -.0643894   .14038093  -.45867627
      L2.h_ln_new_sign   .26317492   .08046312   3.2707521
       L2.h_ln_netw_cc  -1.6032465   1.2056832   -1.329741
L2.h_ln_partintactplat   .10462305    .1442289   .72539588
      L3.h_ln_new_sign   .04036512   .08183229   .49326638
       L3.h_ln_netw_cc   .43023633   .67861245   .63399415
L3.h_ln_partintactplat  -.11938143   .11234605  -1.0626224
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00168438   .00320834   .52499906
        L.h_ln_netw_cc   1.1282905   .19664339   5.7377494
 L.h_ln_partintactplat   .00401996   .00773876   .51945848
      L2.h_ln_new_sign   .00558205   .00257441   2.1682867
       L2.h_ln_netw_cc   -.3380565   .20355695  -1.6607465
L2.h_ln_partintactplat   .00319459   .00630549   .50663542
      L3.h_ln_new_sign  -.00061958   .00282184  -.21956476
       L3.h_ln_netw_cc   .11907836    .0864653   1.3771809
L3.h_ln_partintactplat  -.00334564   .00466037  -.71789232
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.01115998   .03312796  -.33687509
        L.h_ln_netw_cc  -.11499606   .69761177  -.16484249
 L.h_ln_partintactplat    .7079291   .10540239   6.7164425
      L2.h_ln_new_sign  -.00927616    .0241033  -.38485029
       L2.h_ln_netw_cc  -.69524394   .94088005  -.73892941
L2.h_ln_partintactplat   .13320818   .09893837   1.3463754
      L3.h_ln_new_sign   .01432298    .0264594   .54131913
       L3.h_ln_netw_cc   1.0948993   .77412743   1.4143658
L3.h_ln_partintactplat  -.00384398   .07119267  -.05399402
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                     ln_new_sign         ln_netw_cc  ln_partintactplat
      ln_new_sign          .21461779
       ln_netw_cc          .00001201          .00028901
ln_partintactplat          .01061554         -.00066502          .03169359

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0017   1.0000
             |   0.9794
             |
          u3 |   0.1286  -0.2195   1.0000
             |   0.0452   0.0006
             |

GMM finished : 14:46:42

Starting Monte-Carlo loop : 14:46:43 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 14:46:51
```



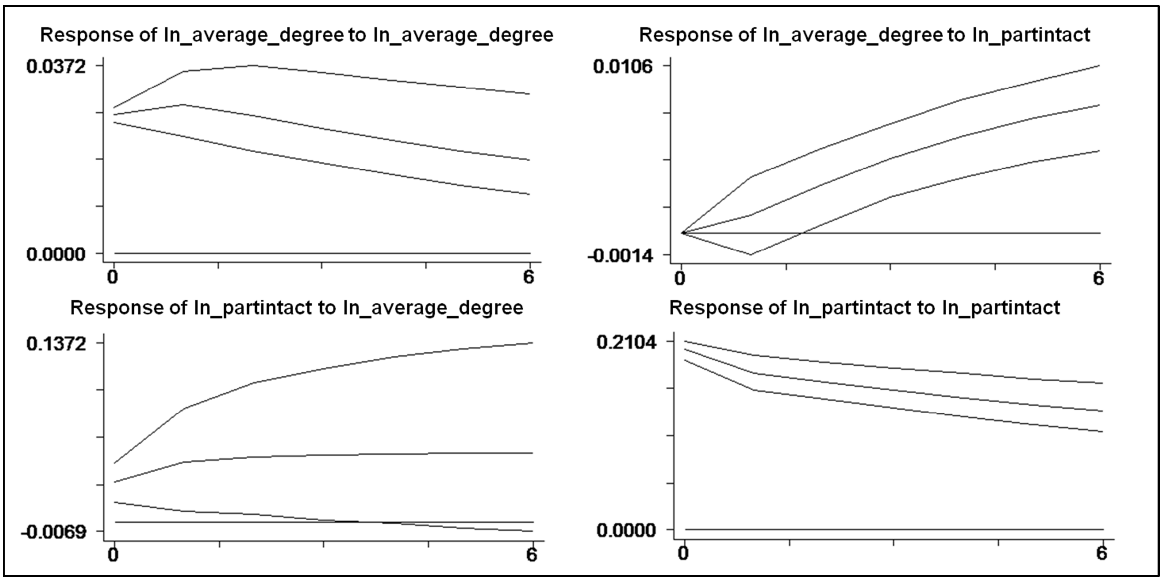
```
. pvar ln_new_sign ln_netw_cc ln_partintactplat, lag(4) gmm monte 1000
GMM started : 14:54:51
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 235
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .40211996   .08885754   4.5254456
        L.h_ln_netw_cc   1.1956733      1.9405   .61616766
 L.h_ln_partintactplat   .02024892   .13522254   .14974517
      L2.h_ln_new_sign   .26213709   .07608665   3.4452442
       L2.h_ln_netw_cc   1.0671625   2.1425001   .49809218
L2.h_ln_partintactplat   .11557495   .16593794   .69649504
      L3.h_ln_new_sign  -.01298414   .07376229  -.17602684
       L3.h_ln_netw_cc  -2.2630191    1.509767  -1.4989194
L3.h_ln_partintactplat  -.12525599   .16704256  -.74984478
      L4.h_ln_new_sign   .03304548   .07266338   .45477486
       L4.h_ln_netw_cc   .59470364   .54810268   1.0850223
L4.h_ln_partintactplat  -.05235632   .12753484   -.4105256
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.00204161   .00206985  -.98635837
        L.h_ln_netw_cc   1.0505984   .19868073   5.2878728
 L.h_ln_partintactplat  -.00518101   .00615758  -.84140325
      L2.h_ln_new_sign   .00487216   .00302754   1.6092804
       L2.h_ln_netw_cc  -.19214556   .17162813  -1.1195459
L2.h_ln_partintactplat   .00137531   .00520806   .26407231
      L3.h_ln_new_sign  -.00017421   .00280117  -.06219193
       L3.h_ln_netw_cc   .00184578   .20040533   .00921022
L3.h_ln_partintactplat  -.00079446   .00438261  -.18127462
      L4.h_ln_new_sign  -.00181972   .00238935  -.76159966
       L4.h_ln_netw_cc   .07992148   .05196611    1.537954
L4.h_ln_partintactplat   .00154775   .00380756   .40649404
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.01066449   .02121428  -.50270327
        L.h_ln_netw_cc     .662065   .54783536   1.2085109
 L.h_ln_partintactplat   .79746716    .0745815    10.69256
      L2.h_ln_new_sign   .01876775   .02141424    .8764143
       L2.h_ln_netw_cc  -.23797861   .71530417  -.33269568
L2.h_ln_partintactplat   .18634758   .07676116   2.4276285
      L3.h_ln_new_sign   -.0044717   .01825965   -.2448951
       L3.h_ln_netw_cc   .03437426   .48539086   .07081769
L3.h_ln_partintactplat  -.05951216   .08748693  -.68024062
      L4.h_ln_new_sign  -.00851361   .01843056  -.46192927
       L4.h_ln_netw_cc  -.43365349   .25376339  -1.7088891
L4.h_ln_partintactplat  -.03661675   .05617724  -.65180757
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                         ln_new_sign         ln_netw_cc  ln_partintactplat
      ln_new_sign          .20538047
       ln_netw_cc         -.00016001          .00020967
ln_partintactplat          .00882081         -.00022887          .02316553

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0242   1.0000
             |   0.7126
             |
          u3 |   0.1276  -0.1035   1.0000
             |   0.0507   0.1136
             |

GMM finished : 14:54:53

Starting Monte-Carlo loop : 14:54:55 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 14:55:04
```



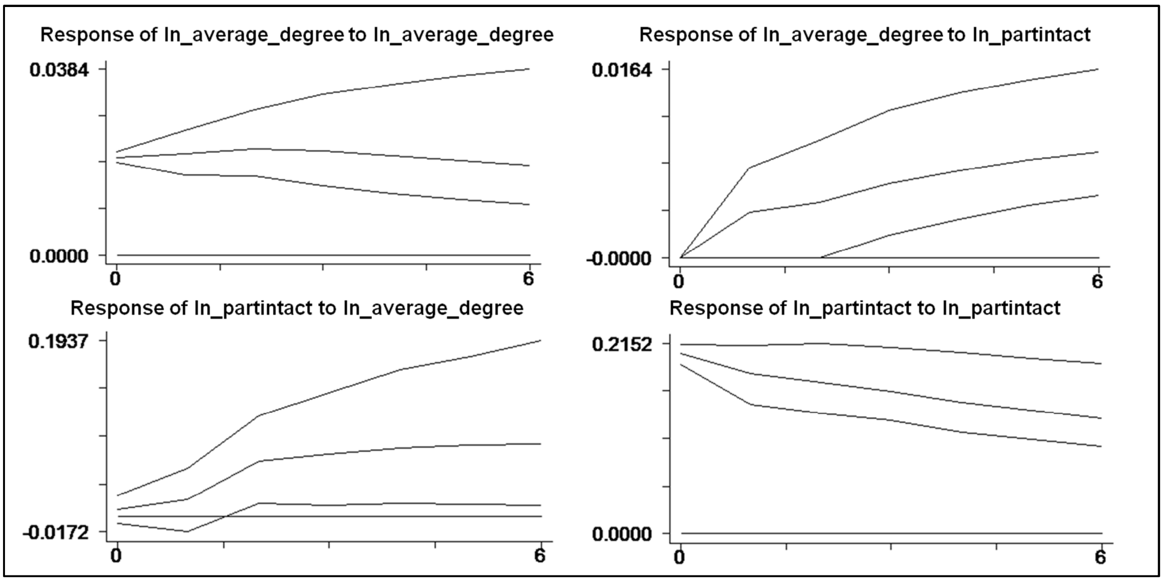
Appendix 52 Estimation Results PVAR(1)-(4) ln_average_degree ln_partintact; All Regions

```
. pvar ln_average_degree ln_partintact, lag(1) gmm monte 1000
GMM started : 17:42:59
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 488
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                           b_GMM      se_GMM       t_GMM
L.h_ln_average_degree  .88395161  .02420585    36.5181
    L.h_ln_partintact  .01129062  .00227586  4.9610293
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                           b_GMM      se_GMM       t_GMM
L.h_ln_average_degree    .323756  .25364144  1.2764318
    L.h_ln_partintact  .92755987  .02174857  42.649225
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree      ln_partintact
ln_average_degree          .00098961
    ln_partintact          .00113101          .08777402

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1203   1.0000
             |   0.0078
             |

GMM finished : 17:43:00

Starting Monte-Carlo loop : 17:43:01 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 17:43:07
```

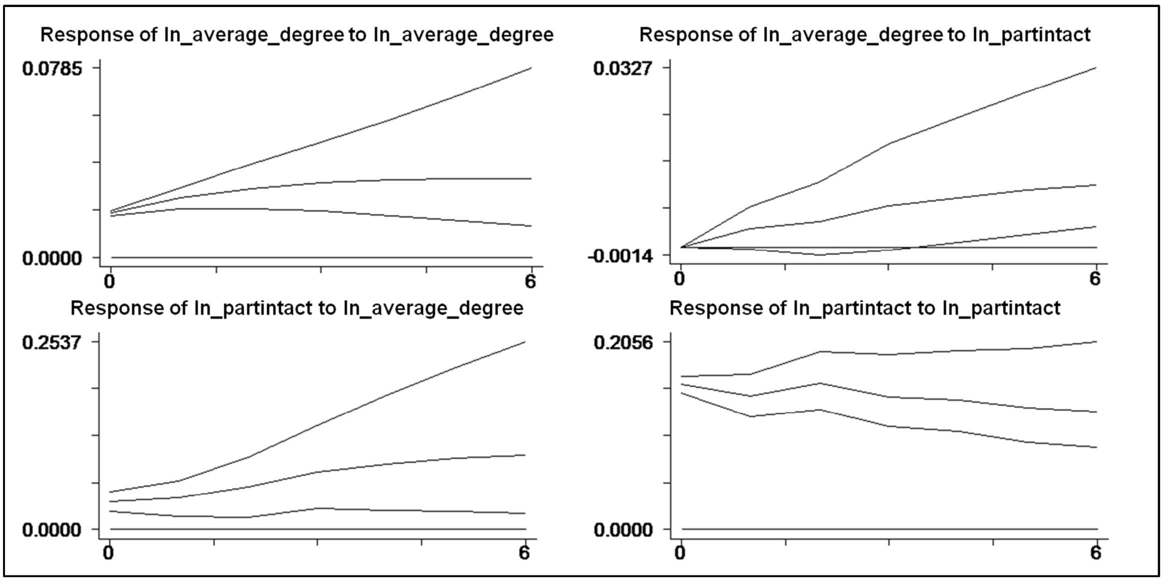
```
. pvar ln_average_degree ln_partintact, lag(2) gmm monte 1000
GMM started : 17:56:04
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 475
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.0689474   .14031555   7.6181676
     L.h_ln_partintact   .00544056   .00714347   .76161247
L2.h_ln_average_degree  -.16795437   .12006868  -1.3988192
    L2.h_ln_partintact   .00434697   .00794696   .54699795
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   .69140176   .83667126   .82637207
     L.h_ln_partintact   .87302786   .04971361   17.561143
L2.h_ln_average_degree   -.4562668   .61646075  -.74013926
    L2.h_ln_partintact   .05727174   .04421408   1.2953282
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree      ln_partintact
ln_average_degree           .00075349
    ln_partintact           .00085706          .04125817

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 |  0.1537   1.0000
             |  0.0008
             |

GMM finished : 17:56:06

Starting Monte-Carlo loop : 17:56:06 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 17:56:12
```



```
. pvar ln_average_degree ln_partintact, lag(3) gmm monte 1000
GMM started : 17:57:52
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 462
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree    1.032153   .13311845    7.753643
     L.h_ln_partintact   .01910519   .01152782   1.6573112
L2.h_ln_average_degree   .00323089    .1329104   .02430879
    L2.h_ln_partintact  -.01321346    .0116168  -1.1374448
L3.h_ln_average_degree  -.11081386   .06199807   -1.787376
    L3.h_ln_partintact   .00281533   .00708426   .39740624
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree    .5840507   .94557323    .6176684
     L.h_ln_partintact   .89268638   .09639241   9.2609611
L2.h_ln_average_degree   1.5532048   1.0049668   1.5455284
    L2.h_ln_partintact    .0328457   .09162619   .35847503
L3.h_ln_average_degree  -1.5908237   .57690187  -2.7575291
    L3.h_ln_partintact  -.03143594   .05409209  -.58115586
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree      ln_partintact
ln_average_degree           .0004083
    ln_partintact          .00016224          .04128458

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 |  0.0394   1.0000
             |  0.3985
             |

GMM finished : 17:57:54

Starting Monte-Carlo loop : 17:57:54 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 17:58:00
```



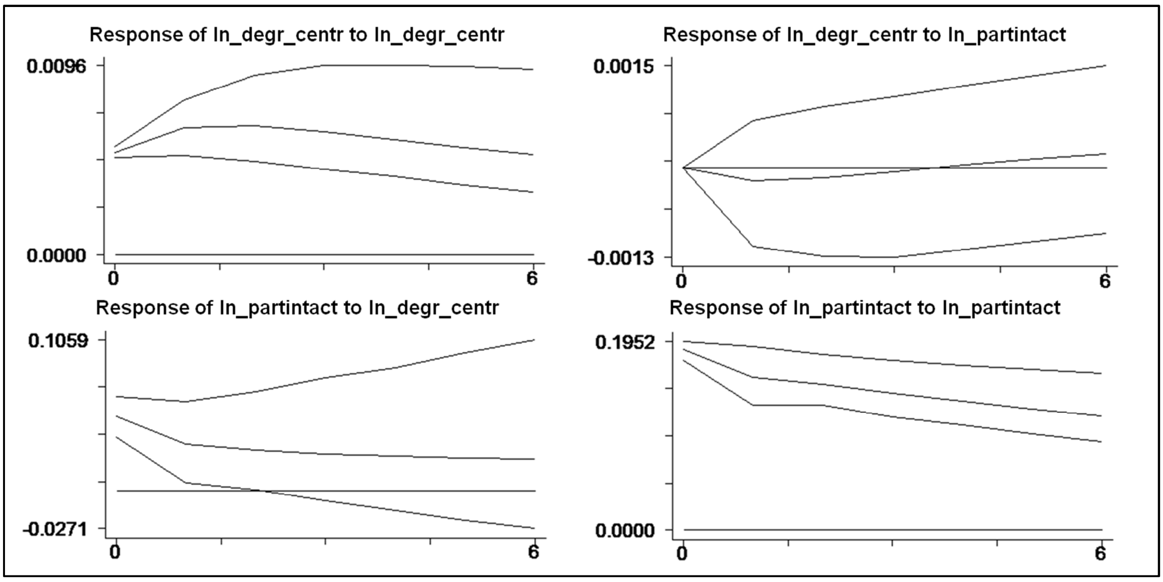
```
. pvar ln_average_degree ln_partintact, lag(4) gmm monte 1000
GMM started : 17:59:57
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 449
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                            b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.2926486   .11840769   10.916931
     L.h_ln_partintact   .02187238   .01550786   1.4104062
L2.h_ln_average_degree  -.19745519   .09594344  -2.0580374
    L2.h_ln_partintact  -.01855084   .01459594  -1.2709591
L3.h_ln_average_degree  -.08565124   .09413867   -.9098412
    L3.h_ln_partintact   .00790271   .01043395   .75740297
L4.h_ln_average_degree  -.04732174   .04570446  -1.0353856
    L4.h_ln_partintact  -.00555142   .00906246  -.61257244
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                            b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   .43537743   .64066246   .67957382
     L.h_ln_partintact   .92158551   .07874262    11.70377
L2.h_ln_average_degree   .08706566   .74129111   .11745138
    L2.h_ln_partintact    .1499082   .07886403   1.9008437
L3.h_ln_average_degree   .56149586   1.1833065   .47451432
    L3.h_ln_partintact  -.16976636   .08242945  -2.0595352
L4.h_ln_average_degree  -.83447434   .79903864  -1.0443479
    L4.h_ln_partintact   .02337589   .05989237   .39029837
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree      ln_partintact
ln_average_degree          .00033334
    ln_partintact          .00068802           .02661156

Residuals correlation matrix

             |        u1       u2
-------------+------------------
          u1 |    1.0000
             |
             |
          u2 |    0.2314   1.0000
             |    0.0000
             |

GMM finished : 17:59:58

Starting Monte-Carlo loop : 17:59:59 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 18:00:05
```



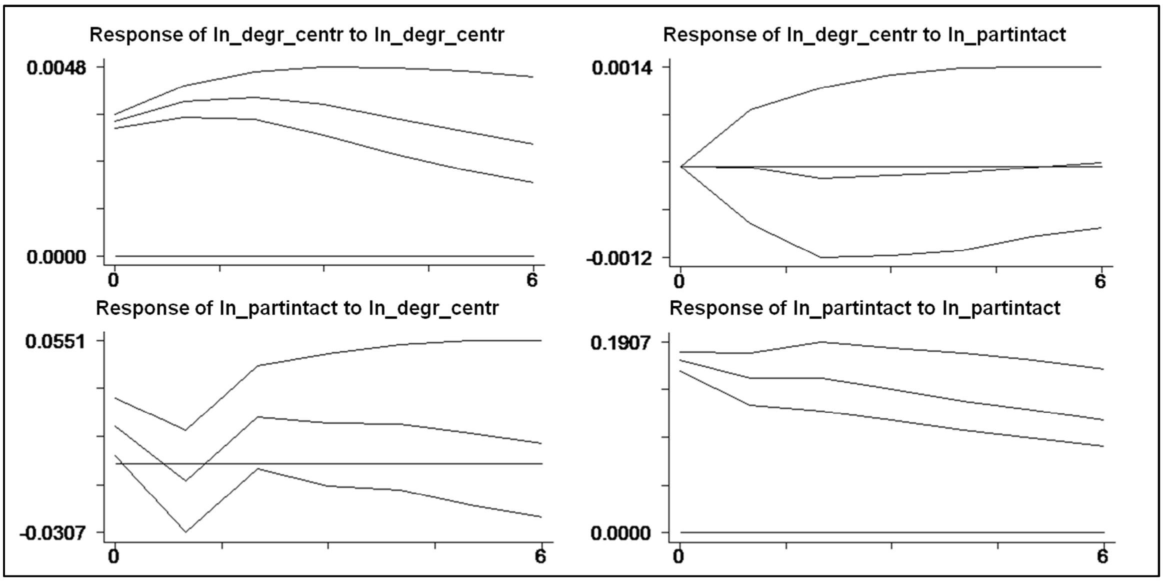
Appendix 53 Estimation Results PVAR(1)-(4) ln_degree_centralization ln_partintact; All Regions

```
. pvar ln_degr_centr ln_partintact, lag(1) gmm monte 1000
GMM started : 18:02:03
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 487
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                      b_GMM     se_GMM      t_GMM
L.h_ln_degr_centr  .89869397  .04429507  20.288804
L.h_ln_partintact  .00031948  .00051273  .62308453
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                      b_GMM     se_GMM      t_GMM
L.h_ln_degr_centr  .64231667   1.057102  .60762034
L.h_ln_partintact  .92650734  .02224271  41.654425
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
               ln_degr_centr  ln_partintact
ln_degr_centr      .00006711
ln_partintact      .00015865      .04483016

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0918   1.0000
             |   0.0430
             |

GMM finished : 18:02:05

Starting Monte-Carlo loop : 18:02:06 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 18:02:11
```

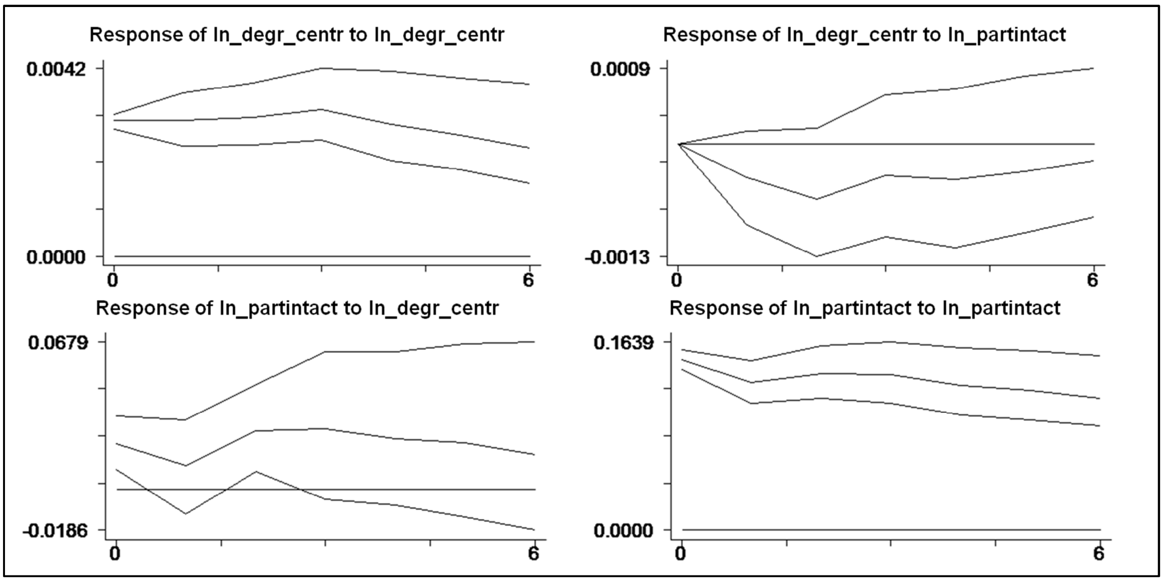
```
. pvar ln_degr_centr ln_partintact, lag(2) gmm monte 1000
GMM started : 18:06:22
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 474
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                         b_GMM      se_GMM       t_GMM
 L.h_ln_degr_centr   .99357789   .21316886   4.6609899
 L.h_ln_partintact   -.0000117   .00263156  -.00444608
L2.h_ln_degr_centr  -.06398771   .19004249   -.3367021
L2.h_ln_partintact   .00053076   .00256789     .206692
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                         b_GMM      se_GMM       t_GMM
 L.h_ln_degr_centr  -1.4872364   2.2429935  -.66305873
 L.h_ln_partintact    .8476128   .09218217   9.1949758
L2.h_ln_degr_centr   1.3715467   1.8849706   .72762237
L2.h_ln_partintact   .08851294    .0790062   1.1203291
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
               ln_degr_centr  ln_partintact
ln_degr_centr      .00005441
ln_partintact      .00023014      .03749957

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1612   1.0000
             |   0.0004
             |

GMM finished : 18:06:23

Starting Monte-Carlo loop : 18:06:24 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 18:06:30
```



```
. pvar ln_degr_centr ln_partintact, lag(3) gmm monte 1000
GMM started : 18:09:09
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 461
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                         b_GMM       se_GMM       t_GMM
 L.h_ln_degr_centr   .86925618   .20759341   4.1873013
 L.h_ln_partintact   .00188331   .00272932   .69002724
L2.h_ln_degr_centr   .15358069   .20520067   .74844147
L2.h_ln_partintact  -.00275604   .00278105  -.99100594
L3.h_ln_degr_centr  -.11192584   .06008234   -1.862874
L3.h_ln_partintact   .00136825   .00164174   .83341029
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                         b_GMM       se_GMM       t_GMM
 L.h_ln_degr_centr  -1.0896962    2.666752  -.40862302
 L.h_ln_partintact   .85105024   .09864973   8.6269899
L2.h_ln_degr_centr   5.4127872    3.888076   1.3921506
L2.h_ln_partintact   .14279216   .10047329   1.4211952
L3.h_ln_degr_centr  -4.9390873   2.8513481  -1.7321938
L3.h_ln_partintact  -.06886512   .06739255  -1.0218506
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
               ln_degr_centr  ln_partintact
ln_degr_centr      .00003679
ln_partintact      .00002926      .03191761

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0269   1.0000
             |   0.5648
             |

GMM finished : 18:09:10

Starting Monte-Carlo loop : 18:09:11 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 18:09:17
```



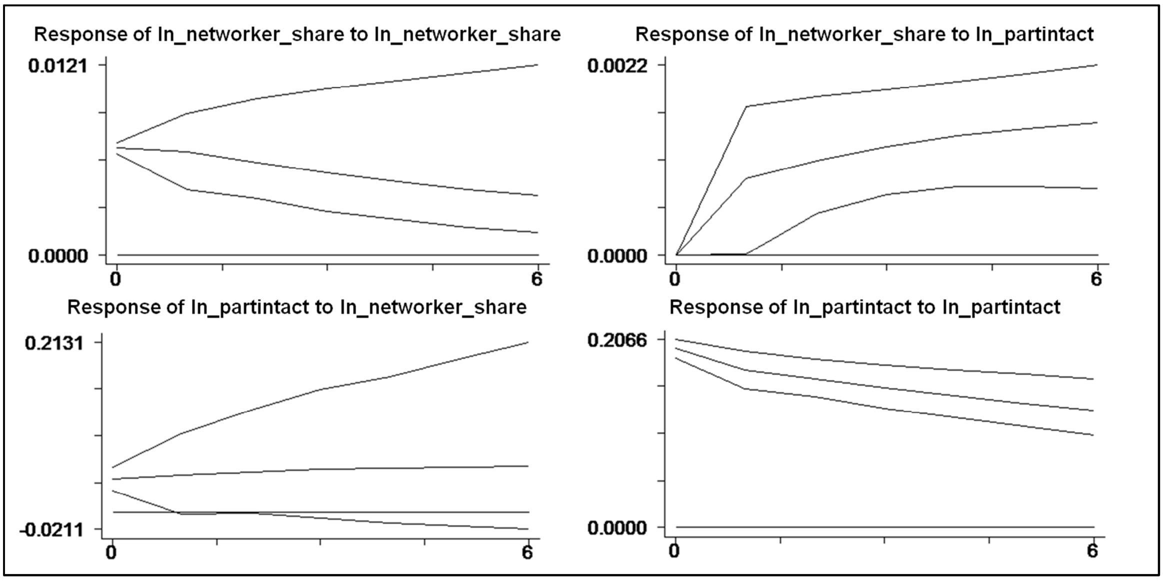
```
. pvar ln_degr_centr ln_partintact, lag(4) gmm monte 1000
GMM started : 18:10:45
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 448
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                         b_GMM      se_GMM       t_GMM
 L.h_ln_degr_centr   .70660005   .23048993   3.0656439
 L.h_ln_partintact  -.00180938   .00186057  -.97248542
L2.h_ln_degr_centr   .29049804   .23160073   1.2543053
L2.h_ln_partintact   .00008955   .00211619   .04231639
L3.h_ln_degr_centr   .02790785   .08214424   .33974204
L3.h_ln_partintact   .00347384   .00209087   1.6614312
L4.h_ln_degr_centr  -.14843679   .05481286   -2.708065
L4.h_ln_partintact  -.00140138   .00153355  -.91381259
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                         b_GMM      se_GMM       t_GMM
 L.h_ln_degr_centr   .66857796   1.6688838   .40061384
 L.h_ln_partintact   .85339836   .07413787   11.510965
L2.h_ln_degr_centr   1.7428521   1.7711004   .98405047
L2.h_ln_partintact   .18557817   .08148653   2.2774093
L3.h_ln_degr_centr  -1.1548562   2.0439796  -.56500378
L3.h_ln_partintact  -.02313559   .07983279  -.28980052
L4.h_ln_degr_centr    -2.26783   2.2929285  -.98905395
L4.h_ln_partintact  -.06994353   .05394582  -1.2965514
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
               ln_degr_centr  ln_partintact
ln_degr_centr      .00003128
ln_partintact      .00007493      .02282323

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
          u2 |  0.0885   1.0000
             |  0.0613

GMM finished : 18:10:47

Starting Monte-Carlo loop : 18:10:47 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 18:10:54
```



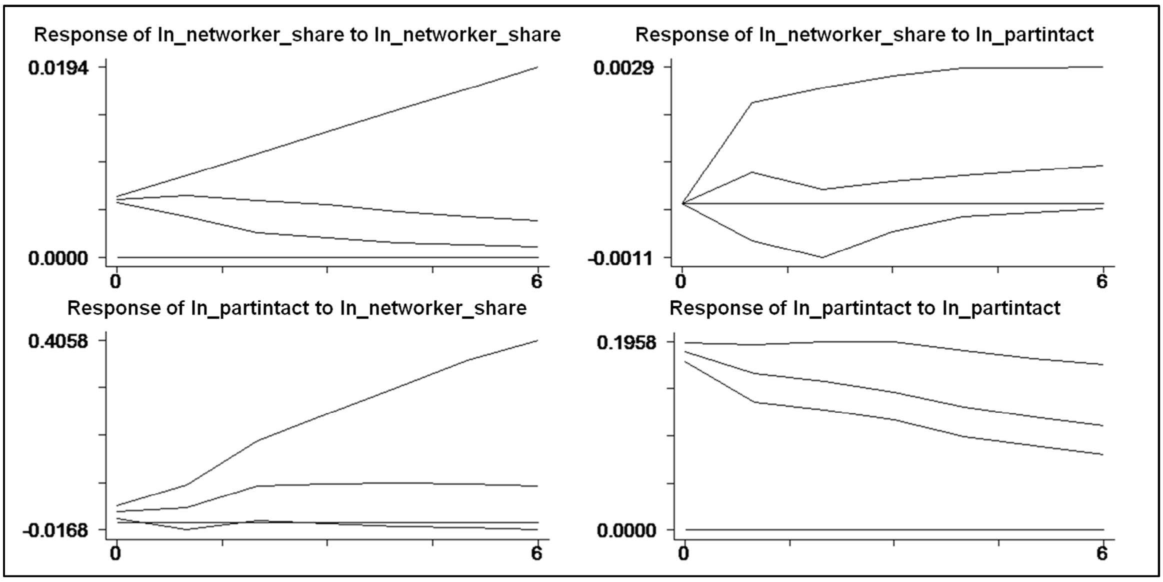
Appendix 54 Estimation Results PVAR(1)-(4) ln_networker_share ln_partintact; All Regions

```
. pvar ln_networker_share ln_partintact, lag(1) gmm monte 1000
GMM started : 18:19:46
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 488
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                            b_GMM     se_GMM      t_GMM
L.h_ln_networker_share  .82708875  .05906424  14.003206
     L.h_ln_partintact  .00179009  .00121495  1.4733875
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                            b_GMM     se_GMM      t_GMM
L.h_ln_networker_share  2.5022193     1.5365   1.628519
     L.h_ln_partintact  .90720722  .03070633  29.544635
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share       ln_partintact
ln_networker_share           .00009104
     ln_partintact           .00013304            .0913204

Residuals correlation matrix

             |        u1       u2
-------------+------------------
          u1 |    1.0000
             |
             |
          u2 |    0.0448   1.0000
             |    0.3230
             |

GMM finished : 18:19:48

Starting Monte-Carlo loop : 18:19:48 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 18:19:54
```

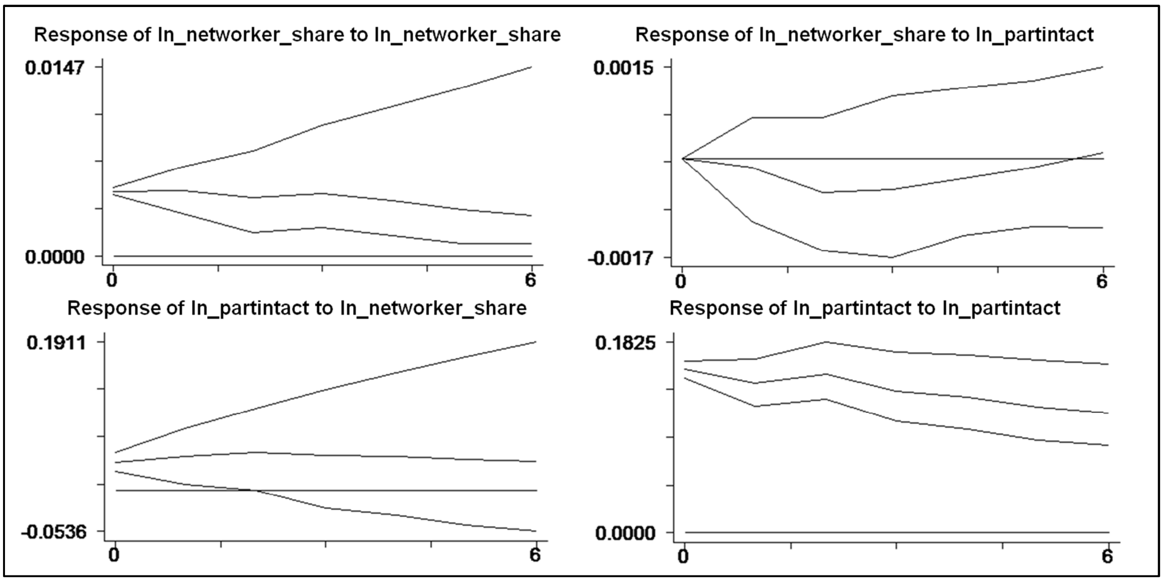
```
. pvar ln_networker_share ln_partintact, lag(2) gmm monte 1000
GMM started : 18:23:48
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 475
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share    .9339872   .20069421   4.6537825
      L.h_ln_partintact   .00454091   .00271243    1.674109
L2.h_ln_networker_share    -.054256   .13207028  -.41081155
     L2.h_ln_partintact  -.00261577   .00357275  -.73214328
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   1.4159885   4.2123106   .33615483
      L.h_ln_partintact   .87778778   .05499176    15.96217
L2.h_ln_networker_share  -.24193037   2.5743153  -.09397853
     L2.h_ln_partintact   .05044828   .05393834   .93529532
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share       ln_partintact
ln_networker_share             .000047
     ln_partintact           .00029057           .04048573

Residuals correlation matrix

             |        u1       u2
-------------+------------------
          u1 |    1.0000
             |
             |
          u2 |    0.2105   1.0000
             |    0.0000
             |

GMM finished : 18:23:49

Starting Monte-Carlo loop : 18:23:50 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 18:23:56
```



```
. pvar ln_networker_share ln_partintact, lag(3) gmm monte 1000
GMM started : 18:25:25
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 462
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                             b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   1.0473096   .20196803   5.1855214
      L.h_ln_partintact   .00356173    .0047151   .75538824
L2.h_ln_networker_share  -.13017626   .11210736   -1.161175
     L2.h_ln_partintact  -.00521274   .00515007  -1.0121684
L3.h_ln_networker_share  -.01890959   .08524791  -.22181878
     L3.h_ln_partintact   .00281282   .00285589   .98492073
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                             b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   1.9989437   4.6333782   .43142253
      L.h_ln_partintact    .8754383   .09080152   9.6412301
L2.h_ln_networker_share   6.4910182   3.6205543   1.7928244
     L2.h_ln_partintact   .05652329   .09465878   .59712672
L3.h_ln_networker_share  -6.3815298   2.8225121  -2.2609397
     L3.h_ln_partintact  -.03050333    .0572478   -.5328297
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share       ln_partintact
ln_networker_share            .0000347
     ln_partintact           .00014074            .03493685

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1278   1.0000
             |   0.0060
             |

GMM finished : 18:25:28

Starting Monte-Carlo loop : 18:25:28 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 18:25:35
```



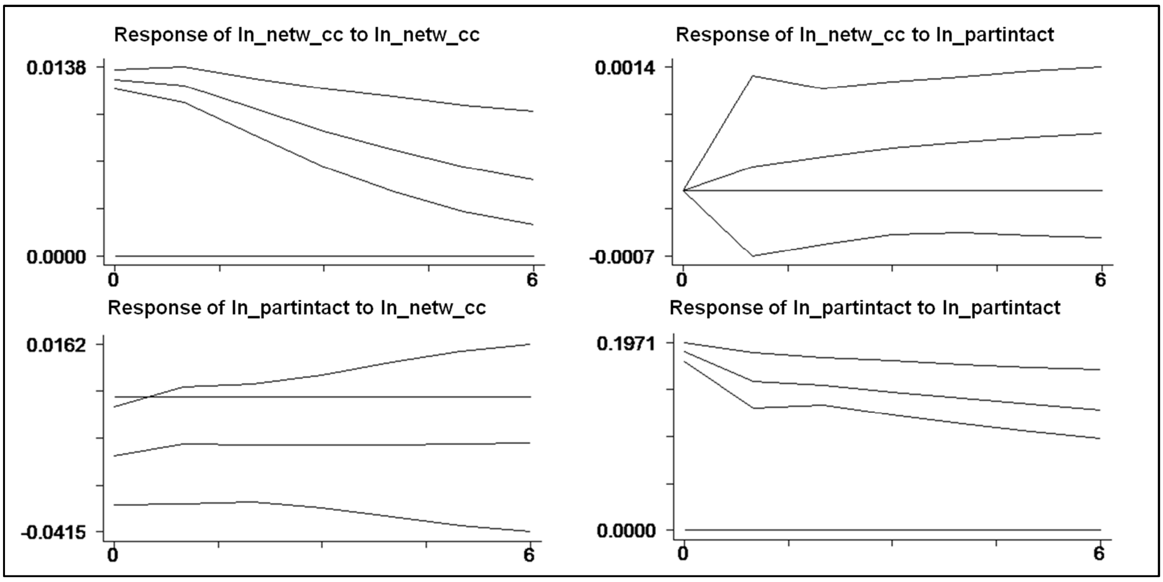
```
. pvar ln_networker_share ln_partintact, lag(4) gmm monte 1000
GMM started : 18:31:05
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 449
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   1.0203332   .20905123   4.8807804
      L.h_ln_partintact  -.00095892   .00351097  -.27312107
L2.h_ln_networker_share  -.10218456    .1710429  -.59742063
     L2.h_ln_partintact  -.00179896   .00386088  -.46594514
L3.h_ln_networker_share   .13918647   .13567386   1.0258901
     L3.h_ln_partintact   .00293591    .0038584   .76091374
L4.h_ln_networker_share   -.1806843   .06322369  -2.8578574
     L4.h_ln_partintact   .00086121   .00348092   .24740889
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   2.0532119   4.0891807   .50210839
      L.h_ln_partintact   .91437981   .08260556   11.069228
L2.h_ln_networker_share  -1.3051038    2.852694  -.45749872
     L2.h_ln_partintact   .13600788   .10040005   1.3546594
L3.h_ln_networker_share  -.55164507   2.2002853  -.25071524
     L3.h_ln_partintact  -.13803526   .10064508  -1.3715053
L4.h_ln_networker_share  -.08060845   1.5925718  -.05061527
     L4.h_ln_partintact   .03077465    .0695907   .44222358
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share       ln_partintact
ln_networker_share           .00002509
     ln_partintact           .00017832             .025659

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 |  0.2212   1.0000
             |  0.0000
             |

GMM finished : 18:31:06

Starting Monte-Carlo loop : 18:31:07 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 18:31:14
```



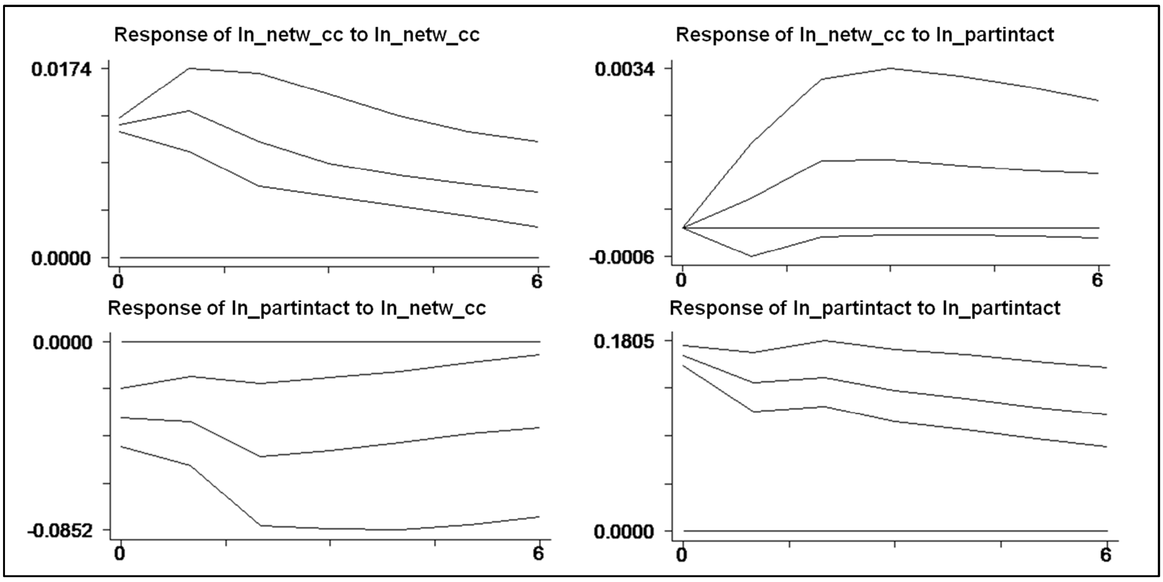
Appendix 55 Estimation Results PVAR(1)-(4) ln_network_cc ln_partintact; All Regions

```
. pvar ln_netw_cc ln_partintact, lag(1) gmm monte 1000
GMM started : 18:39:23
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 475
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                       b_GMM     se_GMM      t_GMM
   L.h_ln_netw_cc  .75760113  .06565131  11.539772
L.h_ln_partintact  .00376086  .00249309   1.508515
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                        b_GMM      se_GMM       t_GMM
   L.h_ln_netw_cc  -.33769644   .35101263  -.96206349
L.h_ln_partintact   .94521353    .0220841   42.800632
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                  ln_netw_cc  ln_partintact
   ln_netw_cc      .00083944
ln_partintact      .00058057      .04071048

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0984   1.0000
             |   0.0320
             |

GMM finished : 18:39:25

Starting Monte-Carlo loop : 18:39:25 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 18:39:31
```

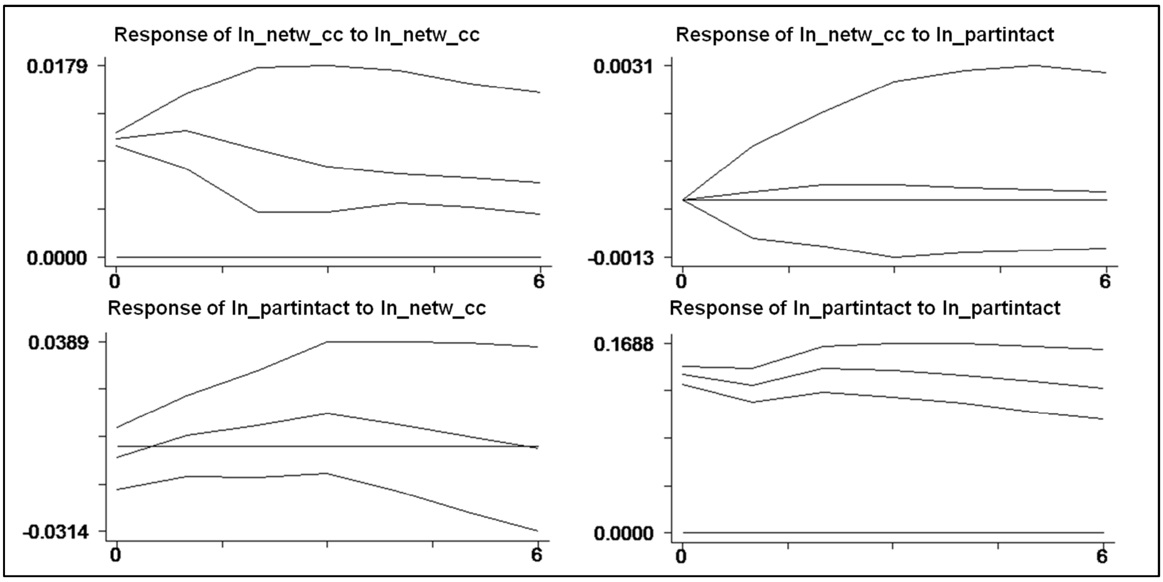
```
. pvar ln_netw_cc ln_partintact, lag(2) gmm monte 1000
GMM started : 18:42:31
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 462
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                         b_GMM      se_GMM       t_GMM
    L.h_ln_netw_cc   .89372763    .0943462   9.4728526
 L.h_ln_partintact   .00215062   .00323724   .66433734
   L2.h_ln_netw_cc  -.04200119    .0692764  -.60628421
L2.h_ln_partintact   -.0009812    .0032486  -.30203636
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                         b_GMM      se_GMM       t_GMM
    L.h_ln_netw_cc  -.00267573   .48935631  -.00546786
 L.h_ln_partintact   .83672458   .09352266   8.9467574
   L2.h_ln_netw_cc  -.06294173   .54609712  -.11525739
L2.h_ln_partintact   .11302083   .08098325   1.3956075
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                  ln_netw_cc  ln_partintact
   ln_netw_cc      .00030085
ln_partintact     -.00014848      .03551978

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0449   1.0000
             |   0.3356
             |

GMM finished : 18:42:33

Starting Monte-Carlo loop : 18:42:33 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 18:42:39
```



```
. pvar ln_netw_cc ln_partintact, lag(3) gmm monte 1000
GMM started : 18:45:06
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 449
----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                         b_GMM      se_GMM       t_GMM
    L.h_ln_netw_cc   .78038175   .22504944   3.4676014
 L.h_ln_partintact   .00105299   .00439548   .23956264
   L2.h_ln_netw_cc  -.00828348   .20753065   -.0399145
L2.h_ln_partintact   .00285913   .00470496   .60768439
   L3.h_ln_netw_cc   .07933057   .07751063     1.02348
L3.h_ln_partintact  -.00268732   .00312191  -.86079374
----------------------------------------------------------------------------
----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                         b_GMM      se_GMM       t_GMM
    L.h_ln_netw_cc  -.71292939   .54247025  -1.3142276
 L.h_ln_partintact    .8464198   .09591077   8.8250756
   L2.h_ln_netw_cc  -.43199564   .71384856  -.60516427
L2.h_ln_partintact   .16159441   .09321362   1.7335923
   L3.h_ln_netw_cc   .94745578   .87980342   1.0768949
L3.h_ln_partintact  -.06991291   .06068047  -1.1521485
----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                  ln_netw_cc  ln_partintact
   ln_netw_cc       .0002833
ln_partintact     -.00035505      .02881945

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1236   1.0000
             |   0.0087
             |

GMM finished : 18:45:07

Starting Monte-Carlo loop : 18:45:07 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 18:45:14
```



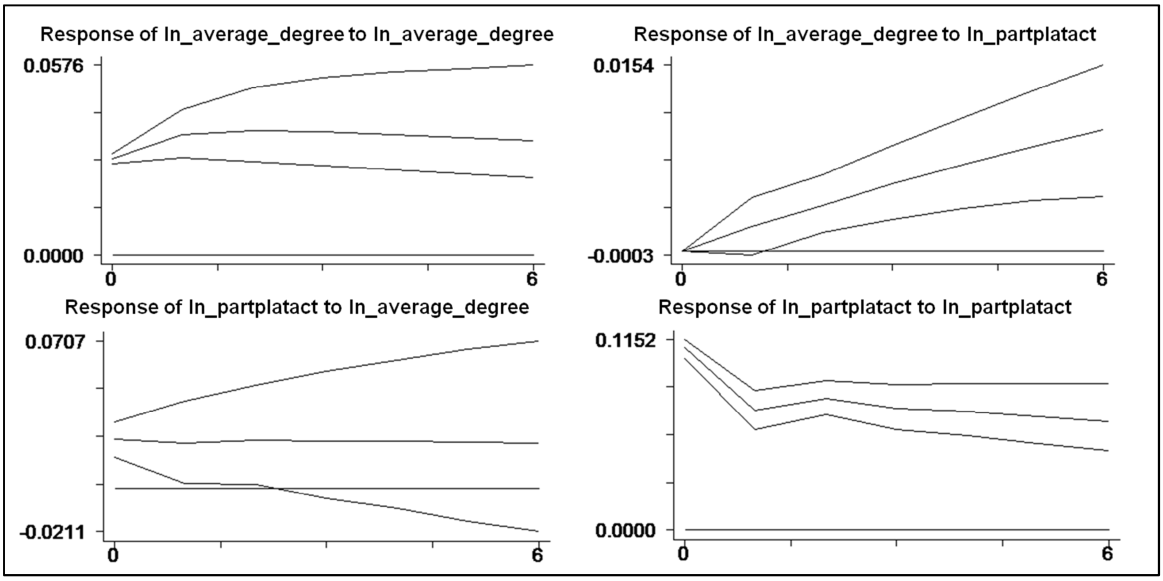
```
. pvar ln_netw_cc ln_partintact, lag(4) gmm monte 1000
GMM started : 18:47:48
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 436
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                         b_GMM      se_GMM       t_GMM
    L.h_ln_netw_cc   .74879884   .23966186   3.1243972
 L.h_ln_partintact  -.00341486   .00607095  -.56249131
   L2.h_ln_netw_cc   .07331515   .15866161   .46208501
L2.h_ln_partintact   .00330456    .0064947   .50880853
   L3.h_ln_netw_cc  -.01666934   .12741889  -.13082319
L3.h_ln_partintact   .00172998   .00383933   .45059517
   L4.h_ln_netw_cc   .08556257   .07108242   1.2037092
L4.h_ln_partintact  -.00170054   .00366269  -.46428742
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintact

                         b_GMM      se_GMM       t_GMM
    L.h_ln_netw_cc   .29704703   .43372574   .68487296
 L.h_ln_partintact   .92563272   .05833828   15.866644
   L2.h_ln_netw_cc    .0150196   .36793315   .04082156
L2.h_ln_partintact   .17444895   .06688928   2.6080254
   L3.h_ln_netw_cc   .00068887   .22834246   .00301681
L3.h_ln_partintact  -.10081411   .07672765  -1.3139215
   L4.h_ln_netw_cc  -.63372103   .25716618  -2.4642471
L4.h_ln_partintact  -.03988108   .05289786  -.75392612
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                  ln_netw_cc  ln_partintact
   ln_netw_cc      .00025454
ln_partintact      .00007045      .02001672

Residuals correlation matrix

             |     u1       u2
-------------+-----------------
          u1 |  1.0000
             |
             |
          u2 |  0.0315   1.0000
             |  0.5116
             |

GMM finished : 18:47:49

Starting Monte-Carlo loop : 18:47:50 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 18:47:57
```



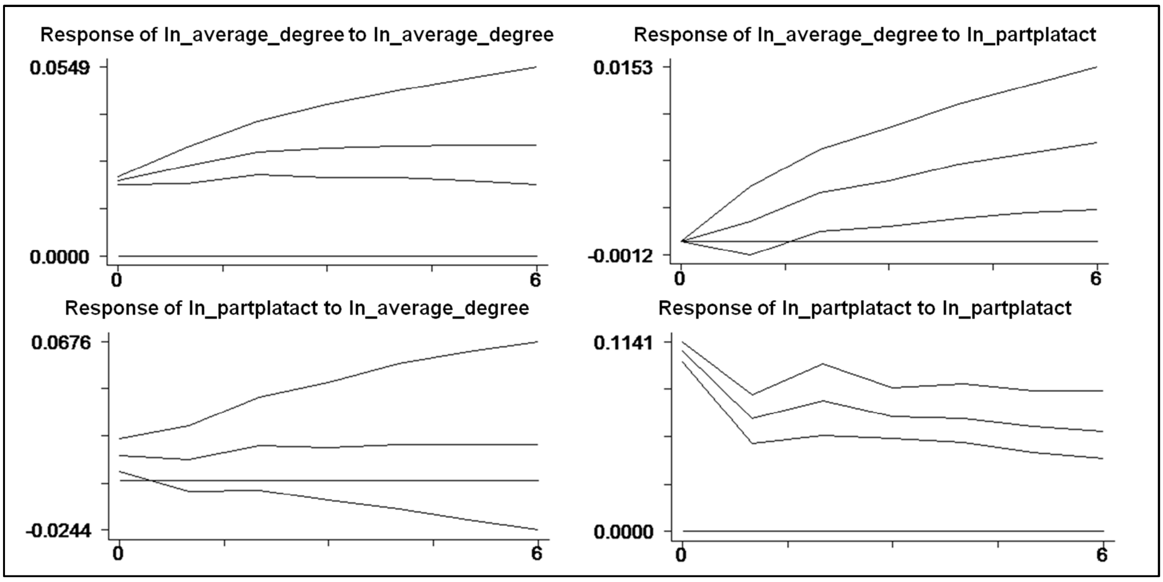
Appendix 56 Estimation Results PVAR(1)-(4) ln_average_degree ln_partplatact; All Regions

```
. pvar ln_average_degree ln_partplatact, lag(1) gmm monte 1000
GMM started : 12:03:25
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 488
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                           b_GMM     se_GMM      t_GMM
L.h_ln_average_degree  .94604397  .02160445  43.789304
   L.h_ln_partplatact  .02822858  .00658604  4.2861249
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                           b_GMM     se_GMM      t_GMM
L.h_ln_average_degree  .15212377   .1601807  .94970101
   L.h_ln_partplatact  .92690035  .04274966  21.682051
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree     ln_partplatact
ln_average_degree          .00115222
   ln_partplatact          .00113509          .02085542

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.2281   1.0000
             |   0.0000
             |

GMM finished : 12:03:27

Starting Monte-Carlo loop : 12:03:27 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:03:33
```

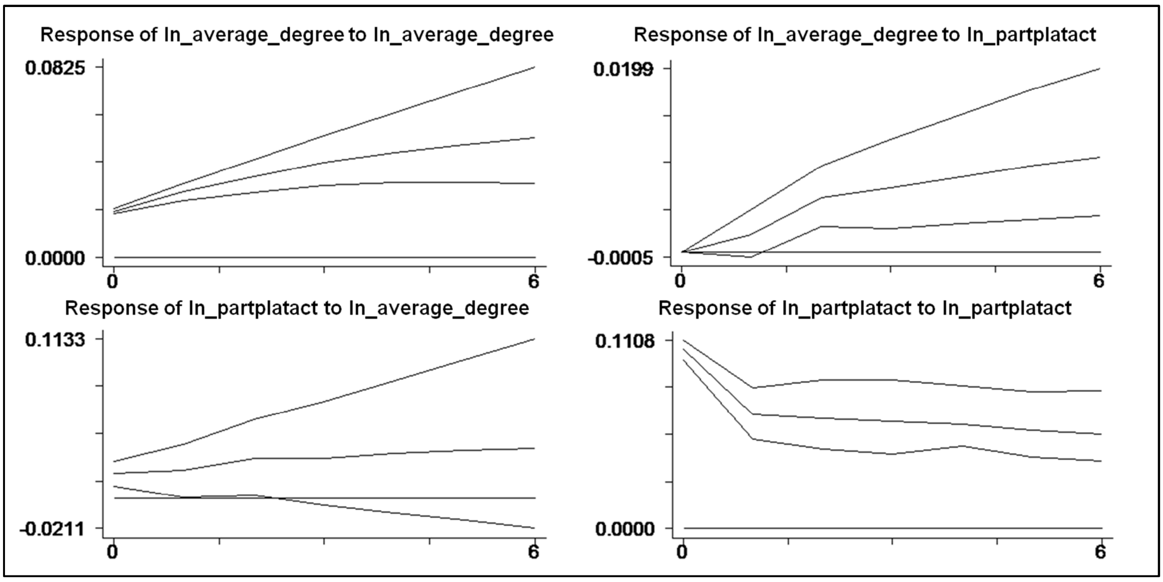
```
. pvar ln_average_degree ln_partplatact, lag(2) gmm monte 1000
GMM started : 12:07:24
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 475
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                            b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.2367068   .14637028   8.4491655
    L.h_ln_partplatact    .0189876   .01276516   1.4874547
L2.h_ln_average_degree  -.26744429   .13583169  -1.9689388
   L2.h_ln_partplatact  -.00110358   .01639371  -.06731721
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                            b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   .20163445   .39841726   .50608864
    L.h_ln_partplatact   .65530321   .06128582   10.692575
L2.h_ln_average_degree  -.17580547   .27723663  -.63413509
   L2.h_ln_partplatact   .28849061   .06365213   4.5323013
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree     ln_partplatact
ln_average_degree          .00085466
   ln_partplatact          .00068727          .01261612

Residuals correlation matrix

             |     u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.2102   1.0000
             |   0.0000
             |

GMM finished : 12:07:26

Starting Monte-Carlo loop : 12:07:27 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:07:33
```



```
. pvar ln_average_degree ln_partplatact, lag(3) gmm monte 1000
GMM started : 12:09:00
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 462
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.1824534   .13985899   8.4546114
    L.h_ln_partplatact   .01654081   .01660958   .99585985
L2.h_ln_average_degree  -.04585855     .162018    -.283046
   L2.h_ln_partplatact   .00931223   .02243532     .4150703
L3.h_ln_average_degree  -.14930752   .06034431  -2.4742601
   L3.h_ln_partplatact  -.01443709   .01180369  -1.2230995
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree      .11666   .40521236   .28789842
    L.h_ln_partplatact   .62742046   .07858522   7.9839502
L2.h_ln_average_degree   .14751408   .47675419   .30941328
   L2.h_ln_partplatact   .32924501   .10710201   3.0741254
L3.h_ln_average_degree  -.22541155   .28046614  -.80370326
   L3.h_ln_partplatact  -.03337699   .12187827  -.27385511
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree     ln_partplatact
ln_average_degree           .0004773
   ln_partplatact          .00026557          .01190852

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 |  0.1120   1.0000
             |  0.0160
             |

GMM finished : 12:09:01

Starting Monte-Carlo loop : 12:09:02 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:09:08
```



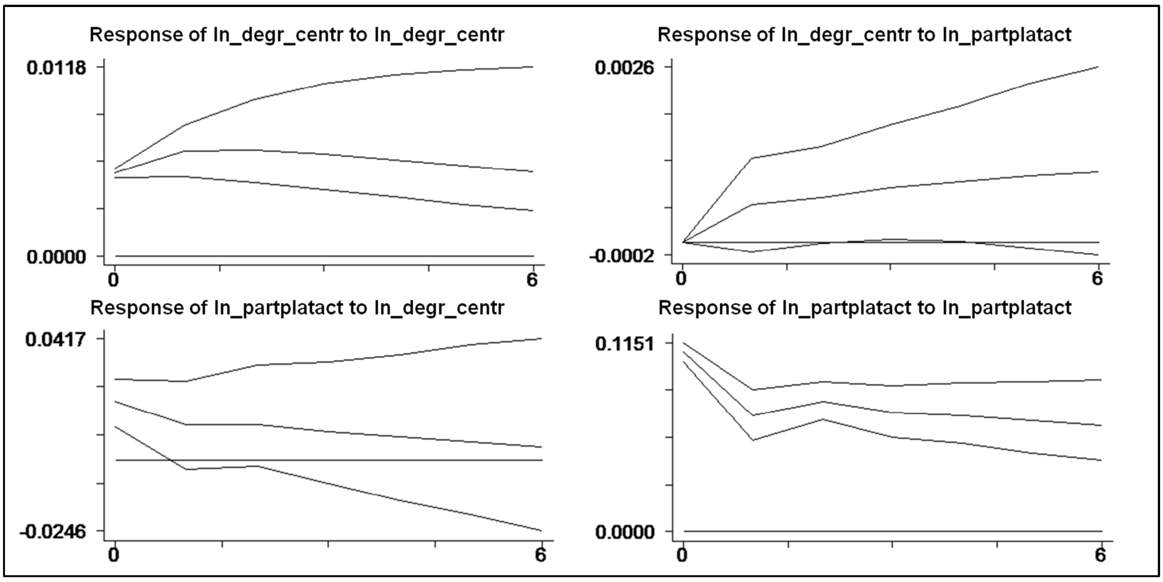
```
. pvar ln_average_degree ln_partplatact, lag(4) gmm monte 1000
GMM started : 12:10:59
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 449
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                            b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.4022126   .09421506   14.883104
    L.h_ln_partplatact   .01800925   .01508917   1.1935219
L2.h_ln_average_degree  -.27566768   .10714103  -2.5729423
   L2.h_ln_partplatact   .01932868   .02494376   .77489055
L3.h_ln_average_degree  -.03055186   .09194525  -.33228316
   L3.h_ln_partplatact  -.03111655    .0132124  -2.3551011
L4.h_ln_average_degree  -.09527844   .04544507  -2.0965627
   L4.h_ln_partplatact  -.00179248   .01089393   -.1645389
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                            b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   .45167346   .54317777   .83153893
    L.h_ln_partplatact    .6388274   .08199801    7.790767
L2.h_ln_average_degree   -.0497821   .69827783  -.07129268
   L2.h_ln_partplatact   .19803036   .08309435   2.3831987
L3.h_ln_average_degree  -.43669695   .46531041  -.93850672
   L3.h_ln_partplatact   .05278081   .12561569   .42017692
L4.h_ln_average_degree   .09883065   .23632856   .41819175
   L4.h_ln_partplatact   .02520323   .08096776    .3112749
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree     ln_partplatact
ln_average_degree          .00039945
   ln_partplatact           .0003514           .0113825

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 |  0.1660   1.0000
             |  0.0004
             |

GMM finished : 12:11:00

Starting Monte-Carlo loop : 12:11:01 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:11:07
```



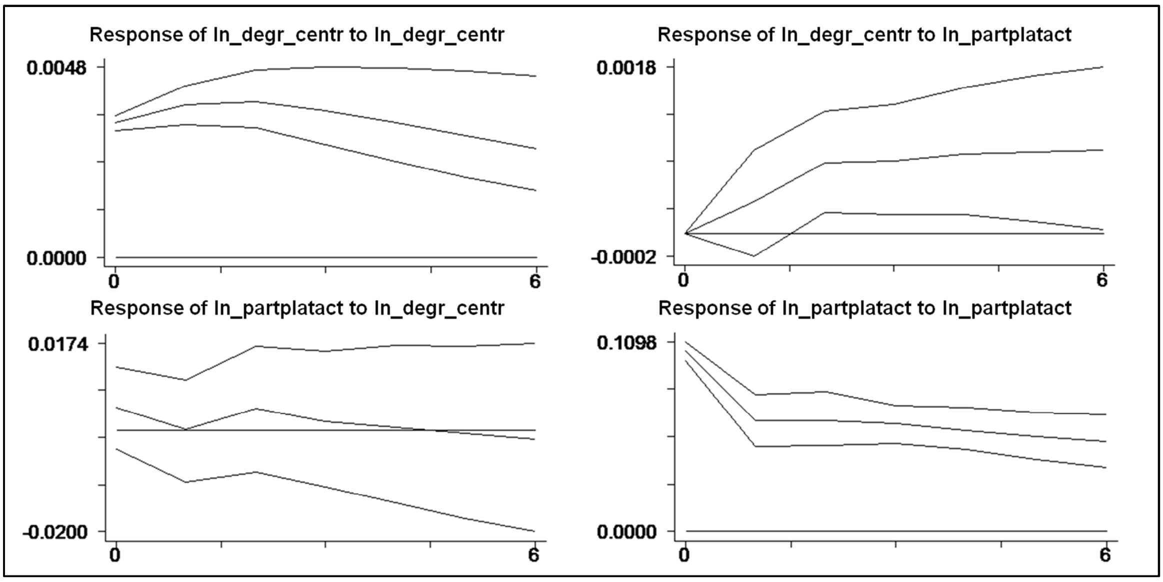
Appendix 57 Estimation Results PVAR(1)-(4) ln_degree_centralization ln_partplatact; All Regions

```
. pvar ln_degr_centr ln_partplatact, lag(1) gmm monte 1000
GMM started : 12:21:23
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 487
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                        b_GMM     se_GMM      t_GMM
 L.h_ln_degr_centr   .8738851  .05183686  16.858372
L.h_ln_partplatact  .00277492   .0014161  1.9595462
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                        b_GMM     se_GMM      t_GMM
 L.h_ln_degr_centr  .73954085  .76599445  .96546501
L.h_ln_partplatact  .91210848  .05123683  17.801814
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                 ln_degr_centr  ln_partplatact
 ln_degr_centr       .00006574
ln_partplatact       .00005741       .01460113

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0580   1.0000
             |   0.2015
             |

GMM finished : 12:21:25

Starting Monte-Carlo loop : 12:21:25 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:21:31
```

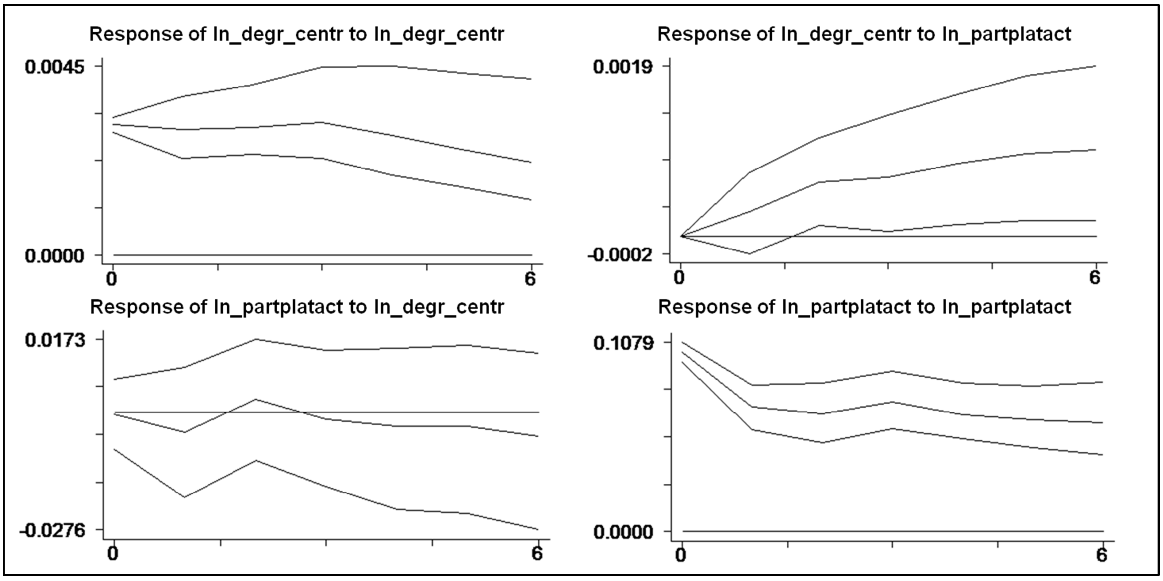
```
. pvar ln_degr_centr ln_partplatact, lag(2) gmm monte 1000
GMM started : 12:24:04
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 474
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                       b_GMM      se_GMM       t_GMM
  L.h_ln_degr_centr   .98587492   .21866924   4.5085213
 L.h_ln_partplatact   .00634855    .0041131    1.543494
 L2.h_ln_degr_centr  -.05858827   .18516774  -.31640647
L2.h_ln_partplatact  -.00417305   .00450462  -.92639264
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                       b_GMM      se_GMM       t_GMM
  L.h_ln_degr_centr  -.00962397   1.1857831  -.00811613
 L.h_ln_partplatact   .64813254   .08144914   7.9575122
 L2.h_ln_degr_centr   -.2953479   1.0126373  -.29166207
L2.h_ln_partplatact   .30220292   .07897081   3.8267674
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                 ln_degr_centr  ln_partplatact
 ln_degr_centr       .00005386
ln_partplatact       .00009064       .01242272

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1109   1.0000
             |   0.0158
             |

GMM finished : 12:24:06

Starting Monte-Carlo loop : 12:24:06 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:24:12
```



```
. pvar ln_degr_centr ln_partplatact, lag(3) gmm monte 1000
GMM started : 12:25:49
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 461
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                        b_GMM      se_GMM       t_GMM
  L.h_ln_degr_centr   .85854894   .20700879   4.1474033
 L.h_ln_partplatact   .00589311   .00396009   1.4881264
 L2.h_ln_degr_centr   .15306225   .19859905   .77070986
L2.h_ln_partplatact   .00184915   .00490833   .37673609
 L3.h_ln_degr_centr  -.10079347   .05412989  -1.8620668
L3.h_ln_partplatact  -.00563151   .00266685  -2.1116679
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                        b_GMM      se_GMM       t_GMM
  L.h_ln_degr_centr   .05031952   .98337282   .05117034
 L.h_ln_partplatact   .60848431    .0773129   7.8704113
 L2.h_ln_degr_centr   .31117328   1.1694467   .26608589
L2.h_ln_partplatact    .2386923   .08984514   2.6567078
 L3.h_ln_degr_centr  -.80519559   1.0098678  -.79732775
L3.h_ln_partplatact   .07828936   .10519612   .74422285
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                 ln_degr_centr  ln_partplatact
 ln_degr_centr       .00003625
ln_partplatact       6.451e-06       .01093932

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0103   1.0000
             |   0.8253
             |

GMM finished : 12:25:51

Starting Monte-Carlo loop : 12:25:51 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:25:58
```



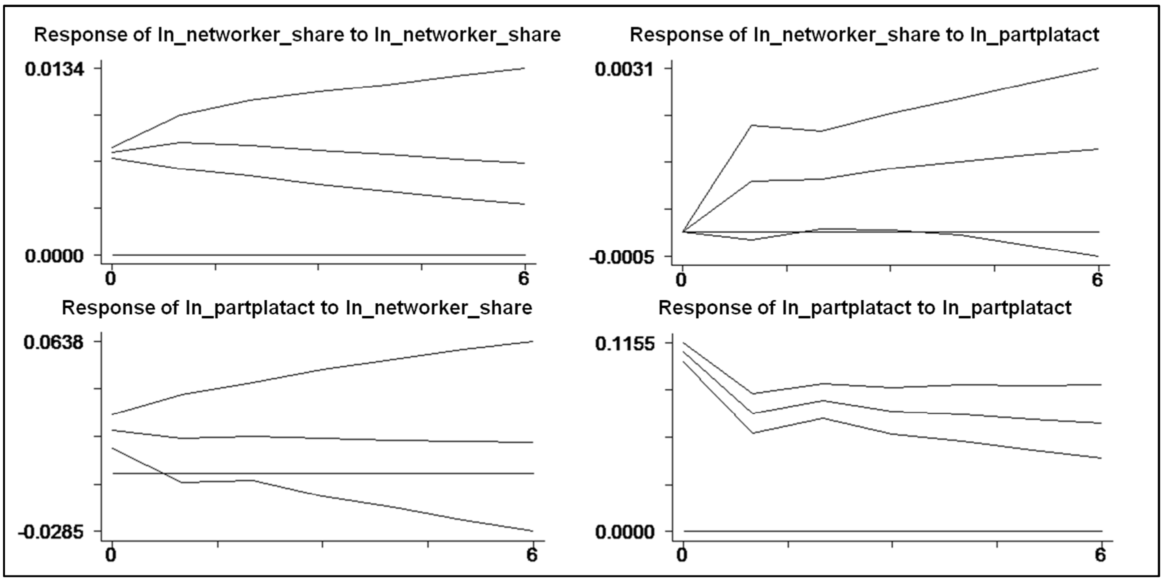
```
. pvar ln_degr_centr ln_partplatact, lag(4) gmm monte 1000
GMM started : 12:27:30
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 448
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                         b_GMM      se_GMM       t_GMM
  L.h_ln_degr_centr   .67602745   .22575206   2.9945571
 L.h_ln_partplatact    .0037275     .003053   1.2209316
 L2.h_ln_degr_centr   .29754538   .22507206   1.3220005
L2.h_ln_partplatact   .00277891   .00381714   .72800923
 L3.h_ln_degr_centr    .0420456   .08395962    .5007836
L3.h_ln_partplatact  -.00215998    .0027585  -.78302539
 L4.h_ln_degr_centr  -.14387172   .05715339   -2.517291
L4.h_ln_partplatact  -.00174486   .00228499  -.76361891
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                         b_GMM      se_GMM       t_GMM
  L.h_ln_degr_centr   .28878791    1.195286   .24160571
 L.h_ln_partplatact    .6867864   .07310635   9.3943474
 L2.h_ln_degr_centr   .38414218   1.1418426   .33642306
L2.h_ln_partplatact   .18569052   .08026377   2.3135036
 L3.h_ln_degr_centr  -1.0795935   1.1537833  -.93569862
L3.h_ln_partplatact   .14281509   .11673508    1.223412
 L4.h_ln_degr_centr  -.16467993   .86606311  -.19014772
L4.h_ln_partplatact  -.06861668   .05891871  -1.1645992
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                 ln_degr_centr  ln_partplatact
 ln_degr_centr       .00003112
ln_partplatact      -6.068e-06       .01052674

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0107   1.0000
             |   0.8221
             |

GMM finished : 12:27:32

Starting Monte-Carlo loop : 12:27:32 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:27:39
```



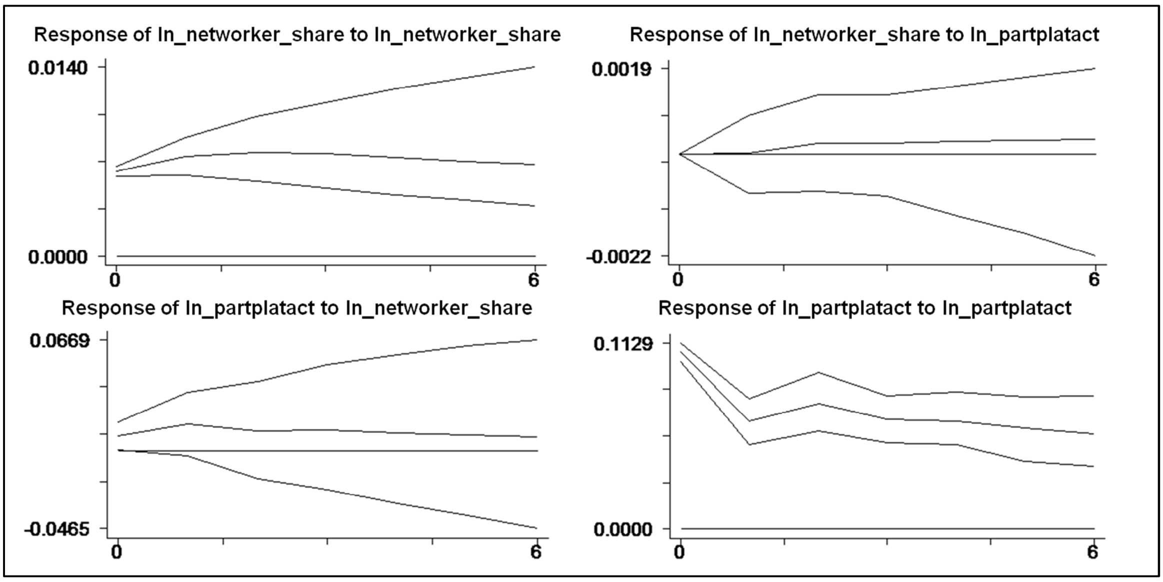
Appendix 58 Estimation Results PVAR(1)-(4) ln_networker_share ln_partplatact; All Regions

```
. pvar ln_networker_share ln_partplatact, lag(1) gmm monte 1000
GMM started : 12:33:44
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 488
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                            b_GMM     se_GMM      t_GMM
L.h_ln_networker_share  .89296442  .04274417  20.890907
    L.h_ln_partplatact  .00292788  .00273538  1.0703735
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                            b_GMM     se_GMM      t_GMM
L.h_ln_networker_share  .92844443  .77597585  1.1964862
    L.h_ln_partplatact  .91201518  .05100978  17.879221
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share      ln_partplatact
ln_networker_share           .00010512
    ln_partplatact           .00018673            .0210238

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1227   1.0000
             |   0.0066
             |

GMM finished : 12:33:46

Starting Monte-Carlo loop : 12:33:46 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:33:52
```

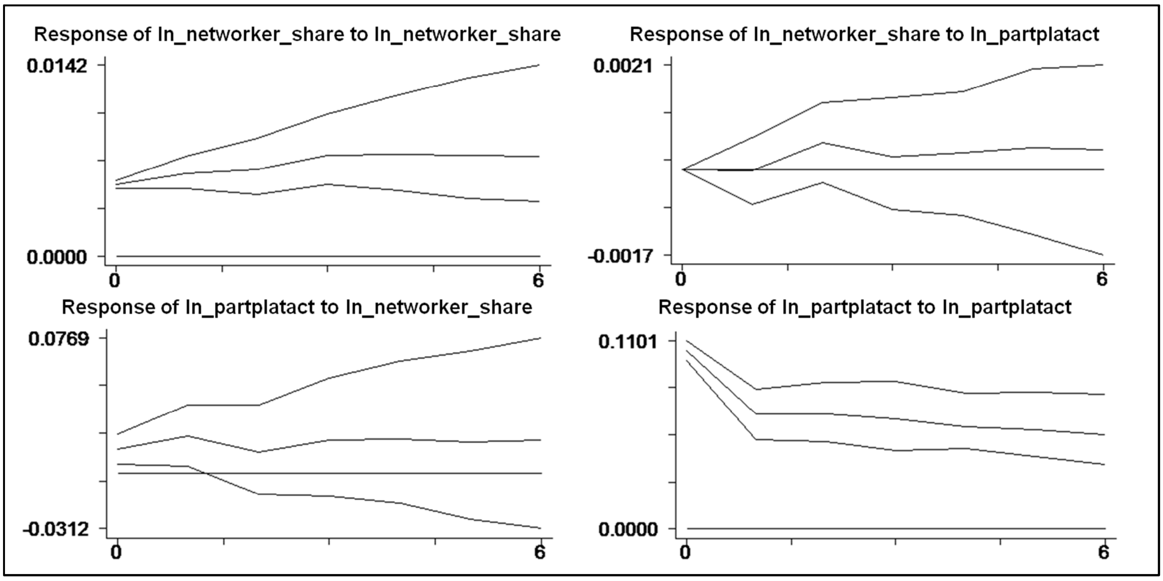
```
. pvar ln_networker_share ln_partplatact, lag(2) gmm monte 1000
GMM started : 12:37:02
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 475
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   1.0702407   .14894342    7.185552
     L.h_ln_partplatact   .00857273   .00602266   1.4234115
L2.h_ln_networker_share  -.11293912   .11767118  -.95978574
    L2.h_ln_partplatact    -.005972   .00733156  -.81456174
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share    .4408349   1.7227011    .2558975
     L.h_ln_partplatact   .65964926   .06228695   10.590489
L2.h_ln_networker_share  -.41961512   1.1916667  -.35212456
    L2.h_ln_partplatact   .28816668   .06741704   4.2743895
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share      ln_partplatact
ln_networker_share           .00005422
    ln_partplatact           .00015223           .01252079

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1857   1.0000
             |   0.0000
             |

GMM finished : 12:37:03

Starting Monte-Carlo loop : 12:37:04 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:37:10
```



```
. pvar ln_networker_share ln_partplatact, lag(3) gmm monte 1000
GMM started : 12:39:51
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 462
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   1.1675625   .12678977   9.2086493
     L.h_ln_partplatact   .00007436   .00478658   .01553604
L2.h_ln_networker_share  -.14751397    .1114259  -1.3238751
    L2.h_ln_partplatact   .00203025   .00898299   .22601028
L3.h_ln_networker_share  -.05139854   .06076466  -.84586242
    L3.h_ln_partplatact  -.00170138   .00470457  -.36164479
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   1.7222183   1.6866219   1.0211052
     L.h_ln_partplatact   .60756174   .07622642   7.9704877
L2.h_ln_networker_share  -2.1760223   1.5233538  -1.4284418
    L2.h_ln_partplatact   .33895018   .09880757    3.430407
L3.h_ln_networker_share   .39951749    .8682111   .46016169
    L3.h_ln_partplatact  -.01730711   .10949664  -.15806066
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share      ln_partplatact
ln_networker_share           .00003971
    ln_partplatact           .00005723           .01159338

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 |  0.0850   1.0000
             |  0.0681
             |

GMM finished : 12:39:53

Starting Monte-Carlo loop : 12:39:54 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:40:00
```



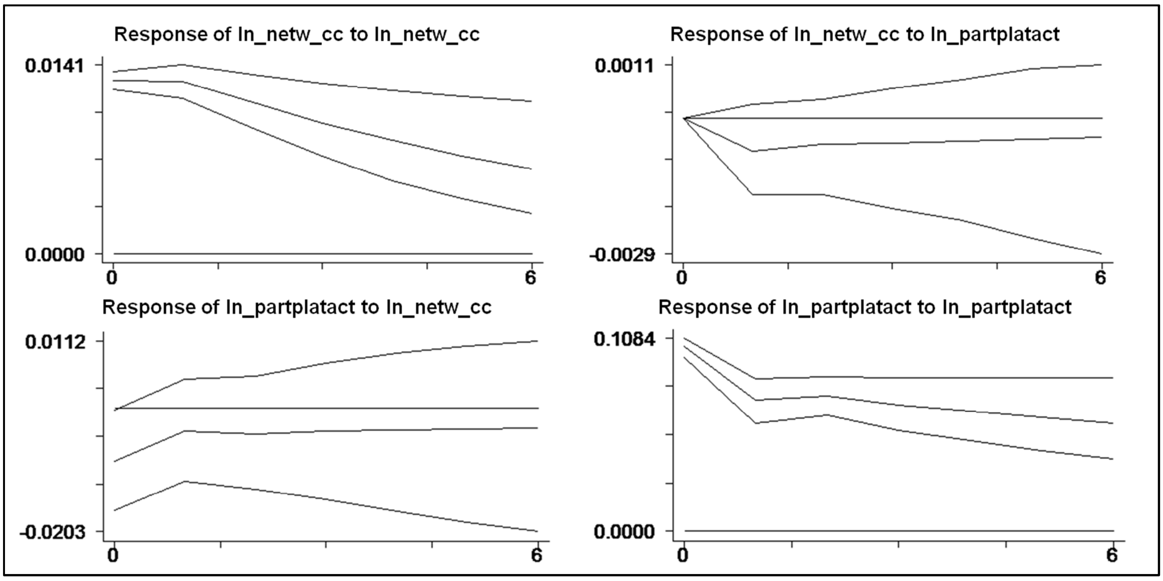
```
. pvar ln_networker_share ln_partplatact, lag(4) gmm monte 1000
GMM started : 12:42:33
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 449
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   1.1541237   .12572464   9.1797737
     L.h_ln_partplatact  -.00003922   .00401519  -.00976811
L2.h_ln_networker_share  -.13353418   .16861954  -.79192585
    L2.h_ln_partplatact   .00541068   .00724929   .74637332
L3.h_ln_networker_share   .16073673   .15692497   1.0242903
    L3.h_ln_partplatact  -.00695222   .00421142  -1.6508038
L4.h_ln_networker_share  -.21786901   .07855094  -2.7736017
    L4.h_ln_partplatact   .00194188   .00320396    .6060883
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   2.3177151   1.8215614   1.2723782
     L.h_ln_partplatact   .64296103   .08050761   7.9863386
L2.h_ln_networker_share  -3.5434985   1.9025207  -1.8625283
    L2.h_ln_partplatact   .22986064   .08356163   2.7507918
L3.h_ln_networker_share   2.2753273   1.0754905   2.1156182
    L3.h_ln_partplatact   .04465983   .11459895   .38970543
L4.h_ln_networker_share  -.90779414   .70328467  -1.2907919
    L4.h_ln_partplatact   .01250024    .0730548   .17110777
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share      ln_partplatact
ln_networker_share           .00002843
    ln_partplatact           .00007341           .01103592

Residuals correlation matrix

             |      u1       u2
-------------+-------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1314   1.0000
             |   0.0053
             |

GMM finished : 12:42:34

Starting Monte-Carlo loop : 12:42:34 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 12:42:41
```



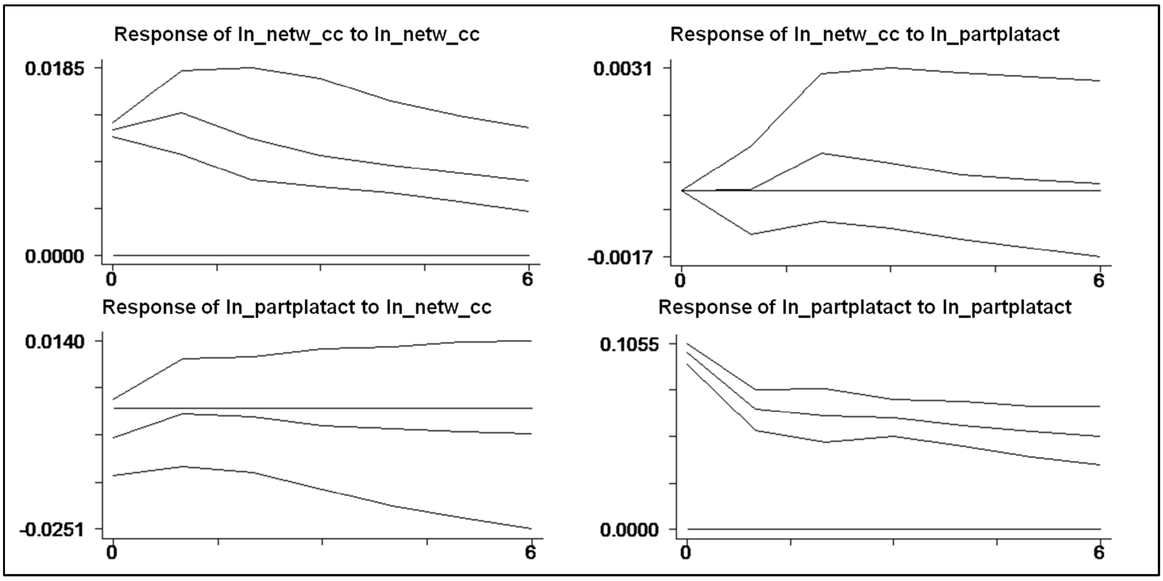
Appendix 59 Estimation Results PVAR(1)-(4) ln_network_cc ln_partplatact; All Regions

```
. pvar ln_netw_cc ln_partplatact, lag(1) gmm monte 1000
GMM started : 13:02:37
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 475
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                        b_GMM     se_GMM      t_GMM
    L.h_ln_netw_cc  .79959317  .05959101  13.418017
L.h_ln_partplatact  .00331794  .00533213  .62225349
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                        b_GMM     se_GMM      t_GMM
    L.h_ln_netw_cc  .06052555   .1668602  .36273208
L.h_ln_partplatact  .93071505  .04496494  20.698682
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_netw_cc  ln_partplatact
    ln_netw_cc       .00089251
ln_partplatact       .00025062       .01204809

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0761   1.0000
             |   0.0975
             |

GMM finished : 13:02:39

Starting Monte-Carlo loop : 13:02:39 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 13:02:45
```

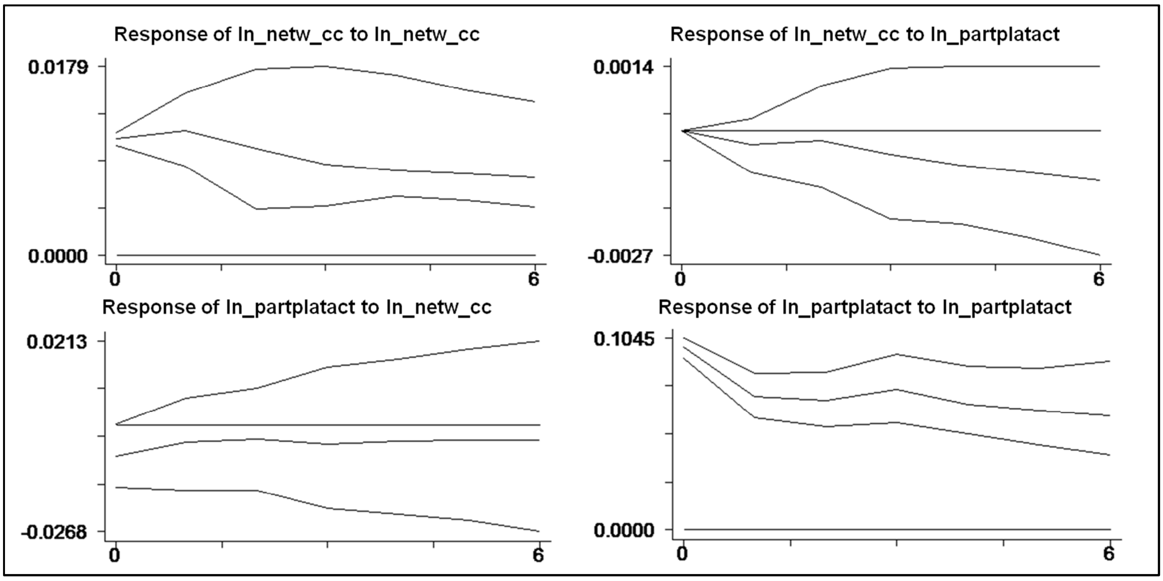
```
. pvar ln_netw_cc ln_partplatact, lag(2) gmm monte 1000
GMM started : 13:04:32
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 462
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                         b_GMM      se_GMM       t_GMM
     L.h_ln_netw_cc   .91184267   .09093119   10.027832
 L.h_ln_partplatact  -.00589806   .00608073  -.96995929
    L2.h_ln_netw_cc  -.04196582   .06938769  -.60480206
L2.h_ln_partplatact   .00545534   .00560026   .97412244
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                         b_GMM      se_GMM       t_GMM
     L.h_ln_netw_cc   .16661205   .26151114   .63711262
 L.h_ln_partplatact   .70939685   .06943765   10.216314
    L2.h_ln_netw_cc  -.14003663   .24298699  -.57631331
L2.h_ln_partplatact   .22916014   .06780046   3.3799204
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_netw_cc  ln_partplatact
    ln_netw_cc       .00030646
ln_partplatact      -.00009063       .01079055

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0492   1.0000
             |   0.2914
             |

GMM finished : 13:04:33

Starting Monte-Carlo loop : 13:04:34 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 13:04:40
```



```
. pvar ln_netw_cc ln_partplatact, lag(3) gmm monte 1000
GMM started : 13:11:40
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 449
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                        b_GMM      se_GMM       t_GMM
     L.h_ln_netw_cc   .80077274   .22670243   3.5322636
 L.h_ln_partplatact  -.00393714   .00753926  -.52221925
    L2.h_ln_netw_cc  -.00735643   .21363253  -.03443496
L2.h_ln_partplatact   .00958035   .00752161   1.2737105
    L3.h_ln_netw_cc   .08128624   .08006729    1.015224
L3.h_ln_partplatact  -.00670016   .00537189  -1.2472621
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                        b_GMM      se_GMM       t_GMM
     L.h_ln_netw_cc    .1237157   .28577881   .43290719
 L.h_ln_partplatact   .67799282   .06745627    10.05085
    L2.h_ln_netw_cc  -.15347131   .19575951  -.78397879
L2.h_ln_partplatact   .17763928   .08830561   2.0116419
    L3.h_ln_netw_cc  -.06431335   .13706207  -.46922794
L3.h_ln_partplatact   .07199151   .10140081   .70996972
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_netw_cc  ln_partplatact
    ln_netw_cc       .00028968
ln_partplatact      -.00005308       .01011566

Residuals correlation matrix

             |     u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0303   1.0000
             |   0.5213
             |

GMM finished : 13:11:41

Starting Monte-Carlo loop : 13:11:41 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 13:11:48
```



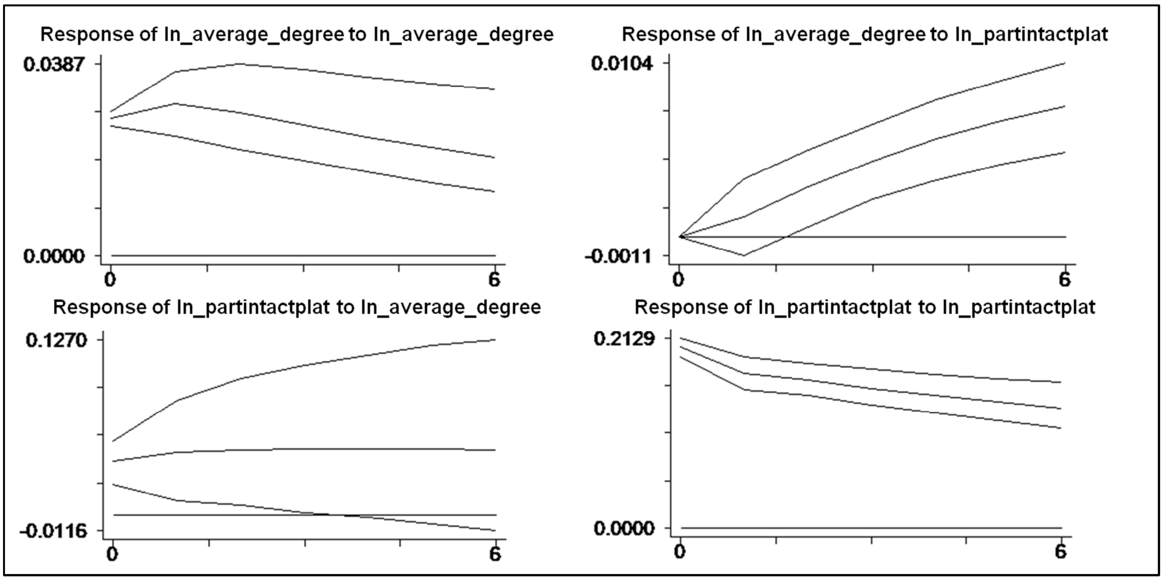
```
. pvar ln_netw_cc ln_partplatact, lag(4) gmm monte 1000
GMM started : 13:13:26
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 436
----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                        b_GMM      se_GMM       t_GMM
     L.h_ln_netw_cc   .76646184   .23701294   3.2338396
 L.h_ln_partplatact   -.0053727   .00474101  -1.1332382
    L2.h_ln_netw_cc   .07626656   .16235578    .46974956
L2.h_ln_partplatact   .00465898   .00768454    .60627988
    L3.h_ln_netw_cc   -.0163554   .12971881  -.12608347
L3.h_ln_partplatact   .00017825   .00573126    .03110114
    L4.h_ln_netw_cc   .08303084   .06987267   1.1883165
L4.h_ln_partplatact  -.00303738   .00548546  -.55371445
----------------------------------------------------------------------------
----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partplatact

                        b_GMM      se_GMM       t_GMM
     L.h_ln_netw_cc   .07693896   .30811151    .2497114
 L.h_ln_partplatact   .72992357   .06974414   10.465734
    L2.h_ln_netw_cc  -.02825097   .20929388  -.13498232
L2.h_ln_partplatact   .17578374   .08823806   1.9921533
    L3.h_ln_netw_cc  -.08362088   .15790013  -.52958083
L3.h_ln_partplatact   .12317888   .12343845    .99789721
    L4.h_ln_netw_cc   .03927568    .1258208    .31215569
L4.h_ln_partplatact    -.093322   .06328296  -1.4746783
----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_netw_cc  ln_partplatact
    ln_netw_cc       .00025798
ln_partplatact      -.00006979       .00996897

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0430   1.0000
             |   0.3700
             |

GMM finished : 13:13:27

Starting Monte-Carlo loop : 13:13:28 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 13:13:35
```



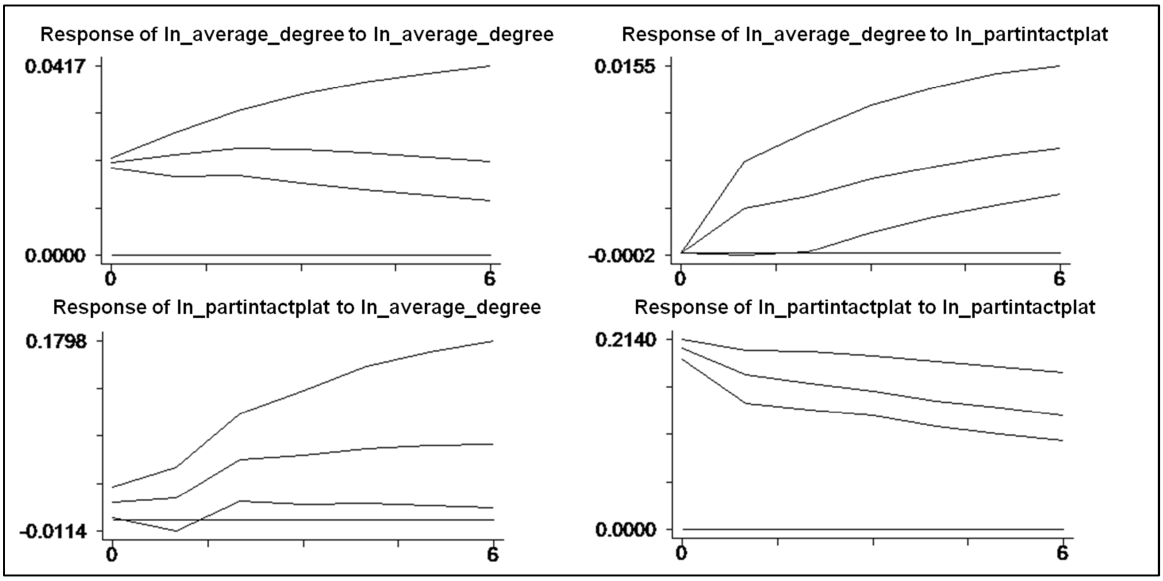
Appendix 60 Estimation Results PVAR(1)-(4) ln_average_degree ln_partintactplat; All Regions

```
. pvar ln_average_degree ln_partintactplat, lag(1) gmm monte 1000
GMM started : 13:22:29
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 488
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                           b_GMM     se_GMM      t_GMM
L.h_ln_average_degree  .88929072  .02293543   38.77366
L.h_ln_partintactplat  .01084766   .0021707  4.9973035
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                           b_GMM     se_GMM      t_GMM
L.h_ln_average_degree  .26605246  .23527186  1.1308299
L.h_ln_partintactplat  .93272181  .01997231  46.700744
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree  ln_partintactplat
ln_average_degree          .00100048
ln_partintactplat           .0014234          .08984335

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1491   1.0000
             |   0.0010
             |

GMM finished : 13:22:31

Starting Monte-Carlo loop : 13:22:31 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 13:22:37
```

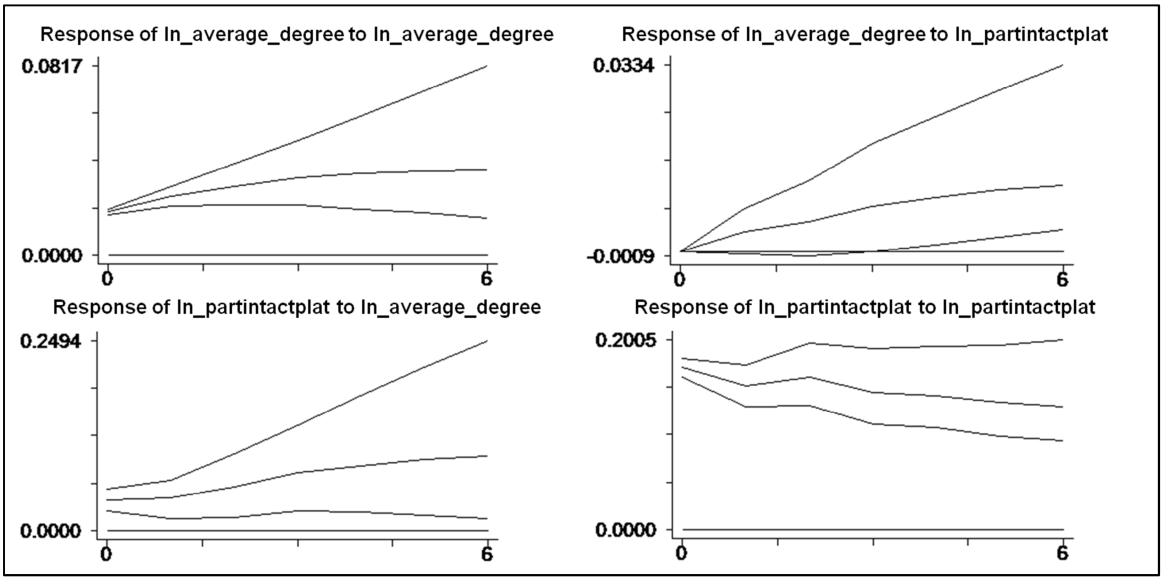
```
. pvar ln_average_degree ln_partintactplat, lag(2) gmm monte 1000
GMM started : 14:12:07
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 475
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                             b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.0958445   .13917477   7.8738732
 L.h_ln_partintactplat   .00602672   .00657816    .9161714
L2.h_ln_average_degree  -.18432659   .12186687  -1.5125242
L2.h_ln_partintactplat   .00291566    .0073424   .39709869
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                             b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   .44063273   .76986392   .57235145
 L.h_ln_partintactplat    .8532344   .04585459   18.607392
L2.h_ln_average_degree  -.29290977   .56973639  -.51411455
L2.h_ln_partintactplat    .0838145   .04156283   2.0165732
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree  ln_partintactplat
ln_average_degree            .000762
ln_partintactplat          .00106293          .04269564

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1864   1.0000
             |   0.0000
             |

GMM finished : 14:12:08

Starting Monte-Carlo loop : 14:12:08 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 14:12:14
```



```
. pvar ln_average_degree ln_partintactplat, lag(3) gmm monte 1000
GMM started : 14:17:51
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 462
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                            b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.0637382   .13497449   7.8810314
 L.h_ln_partintactplat   .01797572   .01142633   1.5731832
L2.h_ln_average_degree  -.00094312   .13969409  -.00675132
L2.h_ln_partintactplat  -.01144974   .01137949  -1.0061728
L3.h_ln_average_degree  -.12365687   .06144308  -2.0125436
L3.h_ln_partintactplat   .00093204   .00653756   .14256713
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                            b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   .33649786   .84933546   .39618958
 L.h_ln_partintactplat   .85344133   .08535782   9.9983966
L2.h_ln_average_degree   1.6189196   .91121517   1.7766601
L2.h_ln_partintactplat    .0744483   .07737685   .96215208
L3.h_ln_average_degree  -1.5273898    .5122795  -2.9815556
L3.h_ln_partintactplat  -.02476208   .04996777  -.49556101
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree  ln_partintactplat
ln_average_degree          .00041616
ln_partintactplat          .00035176          .04170635

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 |  0.0842   1.0000
             |  0.0707
             |

GMM finished : 14:17:52

Starting Monte-Carlo loop : 14:17:53 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 14:17:59
```



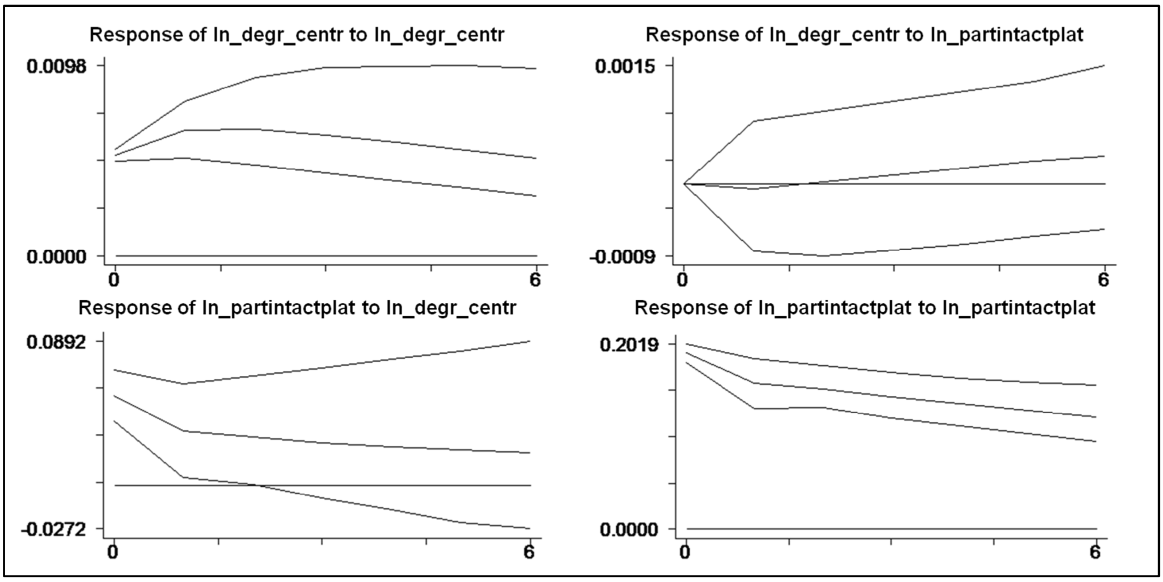
```
. pvar ln_average_degree ln_partintactplat, lag(4) gmm monte 1000
GMM started : 14:22:27
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 449
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_average_degree

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   1.3149601   .11278928   11.658556
 L.h_ln_partintactplat   .02017364   .01507857   1.3379015
L2.h_ln_average_degree  -.20618117   .09962915  -2.0694865
L2.h_ln_partintactplat   -.0135218   .01401466  -.96483249
L3.h_ln_average_degree  -.08126177   .09542447  -.85158205
L3.h_ln_partintactplat   .00349399   .00917603   .38077353
L4.h_ln_average_degree  -.05458084   .04628902  -1.1791313
L4.h_ln_partintactplat  -.00538722   .00835431  -.64484345
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                           b_GMM      se_GMM       t_GMM
 L.h_ln_average_degree   .40131211   .66454643   .60388874
 L.h_ln_partintactplat   .88712683   .06861744   12.928591
L2.h_ln_average_degree   .21015272   .83453786   .25181927
L2.h_ln_partintactplat   .14800105   .06689293   2.2125065
L3.h_ln_average_degree   .34921692  1.0087698    .34618099
L3.h_ln_partintactplat  -.13988446   .08111691  -1.7244797
L4.h_ln_average_degree  -.75201272   .65101049  -1.1551469
L4.h_ln_partintactplat   .03040853   .06021737   .50497941
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                   ln_average_degree  ln_partintactplat
ln_average_degree          .00035032
ln_partintactplat          .00074113          .03082665

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 |  0.2263   1.0000
             |  0.0000
             |

GMM finished : 14:22:29

Starting Monte-Carlo loop : 14:22:29 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 14:22:36
```



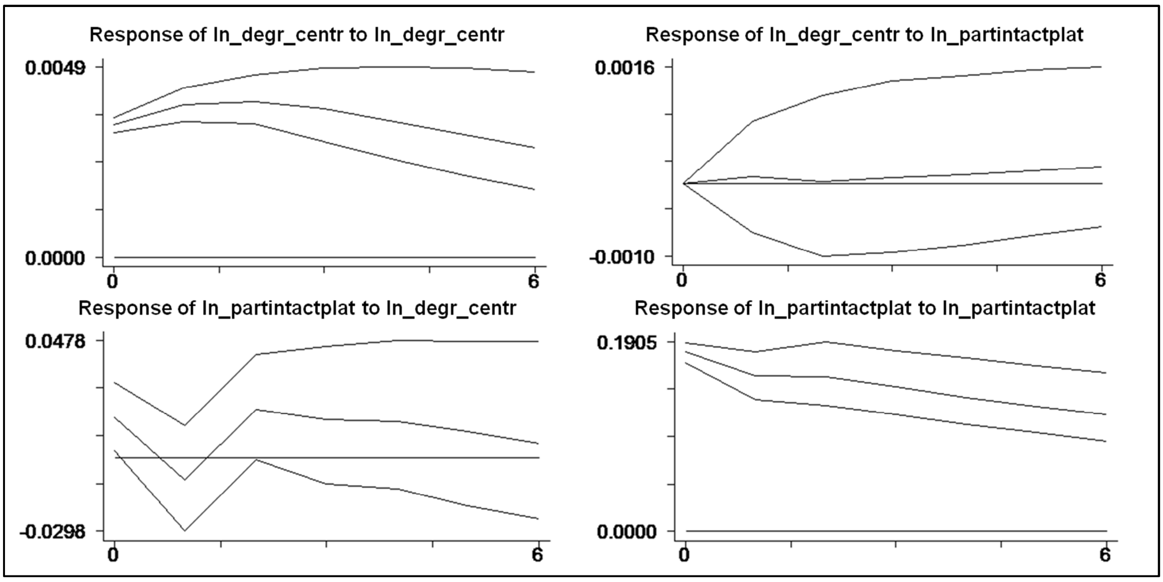
Appendix 61 Estimation Results PVAR(1)-(4) ln_degree_centralization ln_partintactplat; All Regions

```
. pvar ln_degr_centr ln_partintactplat, lag(1) gmm monte 1000
GMM started : 14:27:41
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 487
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                           b_GMM     se_GMM      t_GMM
    L.h_ln_degr_centr  .89219942  .04554647  19.588774
L.h_ln_partintactplat  .00043391  .00049616  .87454941
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                           b_GMM     se_GMM      t_GMM
    L.h_ln_degr_centr  .66830792  1.0783618  .61974371
L.h_ln_partintactplat  .93032054  .02077232  44.786553
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                       ln_degr_centr  ln_partintactplat
    ln_degr_centr          .00006678
ln_partintactplat          .00017656          .04760017

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0993   1.0000
             |   0.0284
             |

GMM finished : 14:27:42

Starting Monte-Carlo loop : 14:27:43 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 14:27:49
```

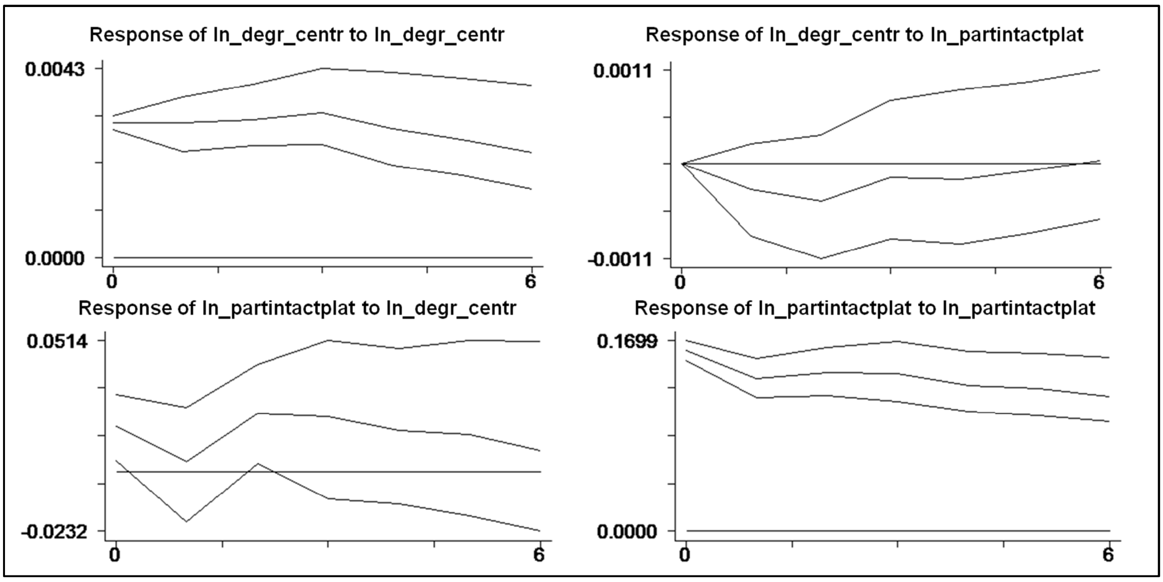
```
. pvar ln_degr_centr ln_partintactplat, lag(2) gmm monte 1000
GMM started : 14:31:20
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 474
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                           b_GMM      se_GMM       t_GMM
     L.h_ln_degr_centr   .98880679   .21344882   4.6325241
 L.h_ln_partintactplat   .00089111   .00232682    .38297451
    L2.h_ln_degr_centr  -.06183046   .18929151  -.32664149
L2.h_ln_partintactplat  -.00029218   .00228053  -.12812029
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                           b_GMM      se_GMM       t_GMM
     L.h_ln_degr_centr  -1.3867926   2.3337148  -.59424252
 L.h_ln_partintactplat   .82202334   .08057502   10.201962
    L2.h_ln_degr_centr   1.1199499   1.9906658    .56260066
L2.h_ln_partintactplat   .11761135   .06973497   1.6865477
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                       ln_degr_centr  ln_partintactplat
    ln_degr_centr          .00005431
ln_partintactplat          .00024109          .04018211

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 |  0.1634   1.0000
             |  0.0004
             |

GMM finished : 14:31:21

Starting Monte-Carlo loop : 14:31:21 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 14:31:27
```



```
. pvar ln_degr_centr ln_partintactplat, lag(3) gmm monte 1000
GMM started : 14:33:34
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 461
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                           b_GMM      se_GMM       t_GMM
     L.h_ln_degr_centr   .86541039   .20744783   4.1717013
 L.h_ln_partintactplat   .00248237   .00259932   .95500607
    L2.h_ln_degr_centr   .15521847   .20448008   .75908848
L2.h_ln_partintactplat  -.00241793     .002582  -.93645647
    L3.h_ln_degr_centr  -.11079638   .05963212  -1.8579984
L3.h_ln_partintactplat   .00052142   .00151083    .3451222
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                           b_GMM      se_GMM       t_GMM
     L.h_ln_degr_centr  -1.0204717   2.7190374  -.37530622
 L.h_ln_partintactplat    .8163246   .08452205   9.6581255
    L2.h_ln_degr_centr   5.0679022   3.8411865   1.3193585
L2.h_ln_partintactplat    .1705624   .08626849   1.9771112
    L3.h_ln_degr_centr  -4.8167513   2.7336229  -1.7620394
L3.h_ln_partintactplat  -.05875324   .06413413  -.91609941
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                       ln_degr_centr  ln_partintactplat
    ln_degr_centr          .00003674
ln_partintactplat          .00002332          .03476998

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0206   1.0000
             |   0.6593
             |

GMM finished : 14:33:35

Starting Monte-Carlo loop : 14:33:36 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 14:33:42
```



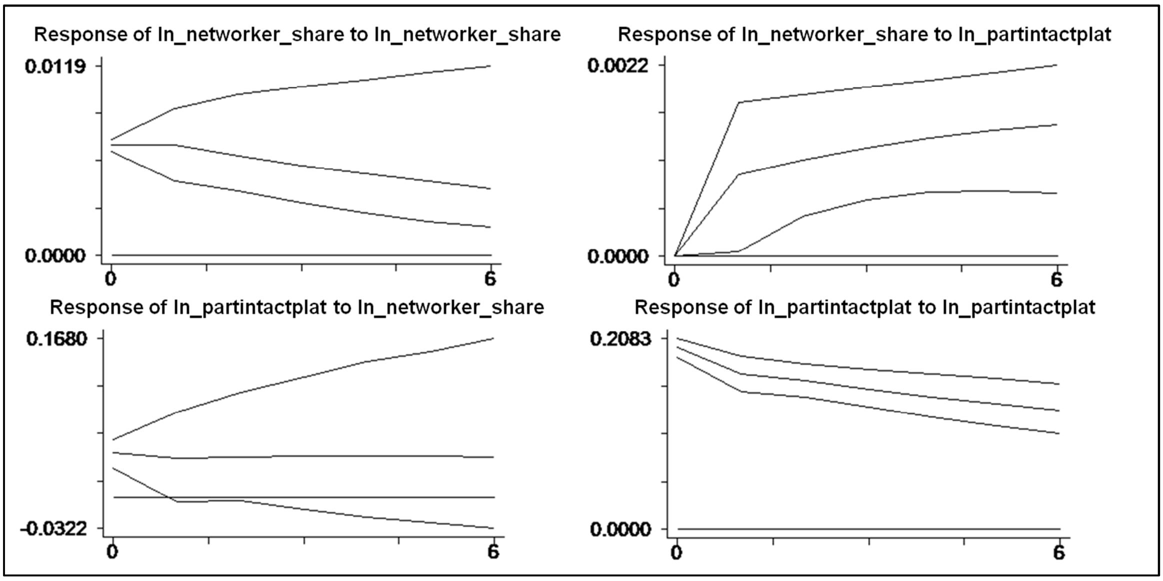
```
. pvar ln_degr_centr ln_partintactplat, lag(4) gmm monte 1000
GMM started : 14:35:43
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 448
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_degr_centr

                             b_GMM      se_GMM       t_GMM
     L.h_ln_degr_centr   .69724717    .2287762   3.0477259
 L.h_ln_partintactplat  -.00097656   .00182348  -.53554861
    L2.h_ln_degr_centr   .29160629    .2297104   1.2694518
L2.h_ln_partintactplat   .00040929    .0019196   .21321552
    L3.h_ln_degr_centr   .03170144   .08272769   .38320223
L3.h_ln_partintactplat   .00236306    .0019027   1.2419503
    L4.h_ln_degr_centr   -.1472266   .05584333  -2.6364224
L4.h_ln_partintactplat  -.00128957   .00146757  -.87871232
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                             b_GMM      se_GMM       t_GMM
     L.h_ln_degr_centr   .72150539    1.750735   .41211571
 L.h_ln_partintactplat    .8277497   .06362337   13.010153
    L2.h_ln_degr_centr   1.8123341    2.035884   .89019516
L2.h_ln_partintactplat   .18174808    .0695476   2.6132903
    L3.h_ln_degr_centr   -1.474709   1.9207039  -.76779613
L3.h_ln_partintactplat   .00396051   .07064206   .05606446
    L4.h_ln_degr_centr  -2.2646583   1.8968661  -1.1938946
L4.h_ln_partintactplat  -.06636729   .04777489  -1.3891667
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                       ln_degr_centr  ln_partintactplat
    ln_degr_centr          .00003139
ln_partintactplat          .00005808          .02681609

Residuals correlation matrix

             |       u1       u2
-------------+-----------------
          u1 |   1.0000
             |
             |
          u2 |   0.0633   1.0000
             |   0.1813
             |

GMM finished : 14:35:45

Starting Monte-Carlo loop : 14:35:45 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 14:35:52
```



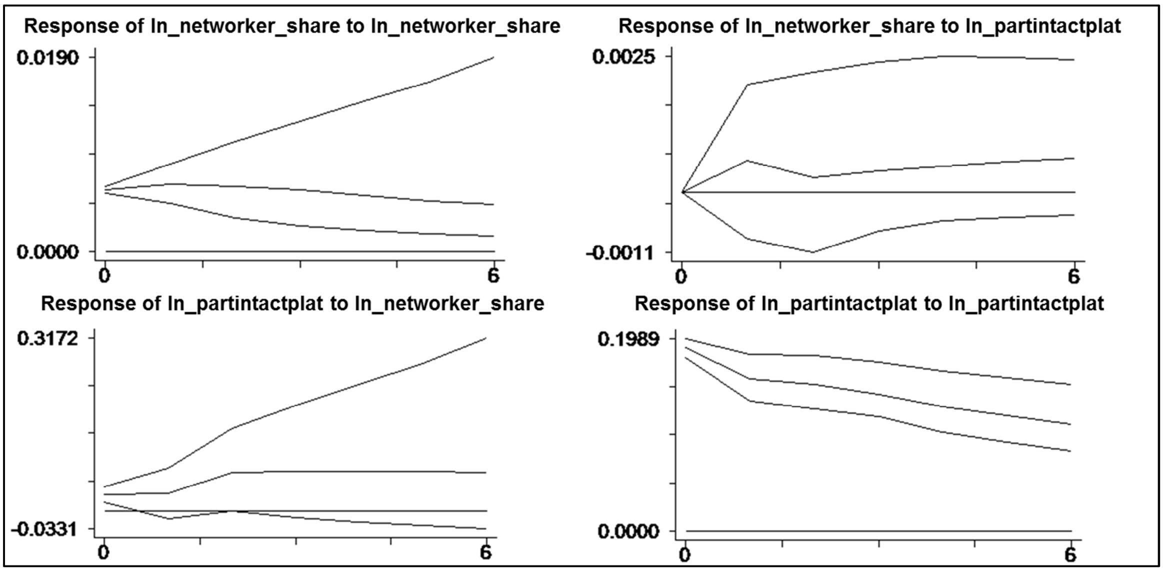
Appendix 62 Estimation Results PVAR(1)-(4) ln_networker_share ln_partintactplat; All Regions

```
. pvar ln_networker_share ln_partintactplat, lag(1) gmm monte 1000
GMM started : 14:39:07
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 488
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                           b_GMM     se_GMM      t_GMM
L.h_ln_networker_share  .83815135  .05220849  16.053927
 L.h_ln_partintactplat  .00159457  .00111622  1.4285519
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                           b_GMM     se_GMM      t_GMM
L.h_ln_networker_share  1.9800994  1.3431222  1.4742512
 L.h_ln_partintactplat  .91766941  .02643065   34.71989
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share   ln_partintactplat
ln_networker_share           .00009293
 ln_partintactplat           .00018738           .09199681

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0627   1.0000
             |   0.1665
             |

GMM finished : 14:39:09

Starting Monte-Carlo loop : 14:39:09 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 14:39:15
```

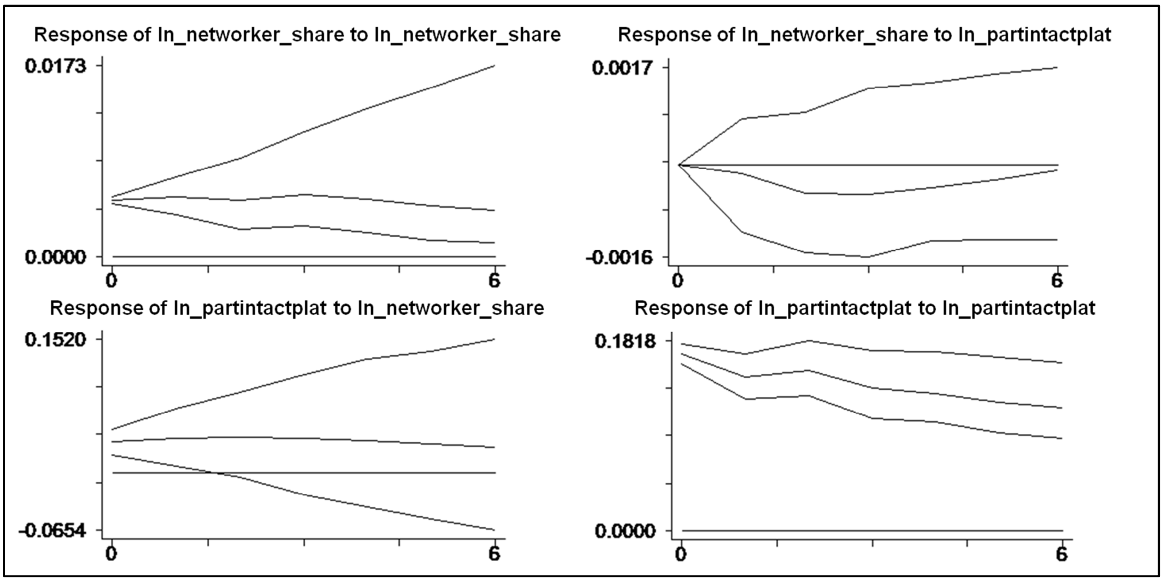
```
. pvar ln_networker_share ln_partintactplat, lag(2) gmm monte 1000
GMM started : 14:48:45
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 475
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   .96527313   .18385087    5.250305
  L.h_ln_partintactplat   .00466391   .00263375   1.7708272
L2.h_ln_networker_share  -.06702253   .12715798  -.52708075
 L2.h_ln_partintactplat  -.00301599   .00334891  -.90058771
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                             b_GMM     se_GMM      t_GMM
 L.h_ln_networker_share  .20437336   3.867395  .05284523
  L.h_ln_partintactplat  .85606289  .04925298  17.380937
L2.h_ln_networker_share  .28480385  2.4750757  .11506874
 L2.h_ln_partintactplat  .08190154  .04887741  1.6756523
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share   ln_partintactplat
ln_networker_share           .00004796
 ln_partintactplat           .00032771           .04157524

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.2324   1.0000
             |   0.0000
             |

GMM finished : 14:48:47

Starting Monte-Carlo loop : 14:48:47 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 14:48:53
```



```
. pvar ln_networker_share ln_partintactplat, lag(3) gmm monte 1000
GMM started : 14:54:32
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 462
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   1.0893118   .18174794   5.9935302
  L.h_ln_partintactplat   .00307722    .0045935   .66990699
L2.h_ln_networker_share  -.13343184   .11047019  -1.2078537
 L2.h_ln_partintactplat  -.00442083    .0049793  -.88784162
L3.h_ln_networker_share  -.03301951    .0797753  -.41390644
 L3.h_ln_partintactplat   .00214544   .00260213   .82449398
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   1.0326975   4.2717647   .24174963
  L.h_ln_partintactplat   .83287063   .07606685   10.949194
L2.h_ln_networker_share   5.6358491   3.4481708    1.634446
 L2.h_ln_partintactplat   .10147228   .07938494    1.278231
L3.h_ln_networker_share  -5.3761588   2.5290344  -2.1257753
 L3.h_ln_partintactplat  -.02132803    .0530866  -.40175913
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share   ln_partintactplat
ln_networker_share            .0000359
 ln_partintactplat           .00017677           .03657723

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1544   1.0000
             |   0.0009
             |

GMM finished : 14:54:33

Starting Monte-Carlo loop : 14:54:34 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 14:54:41
```



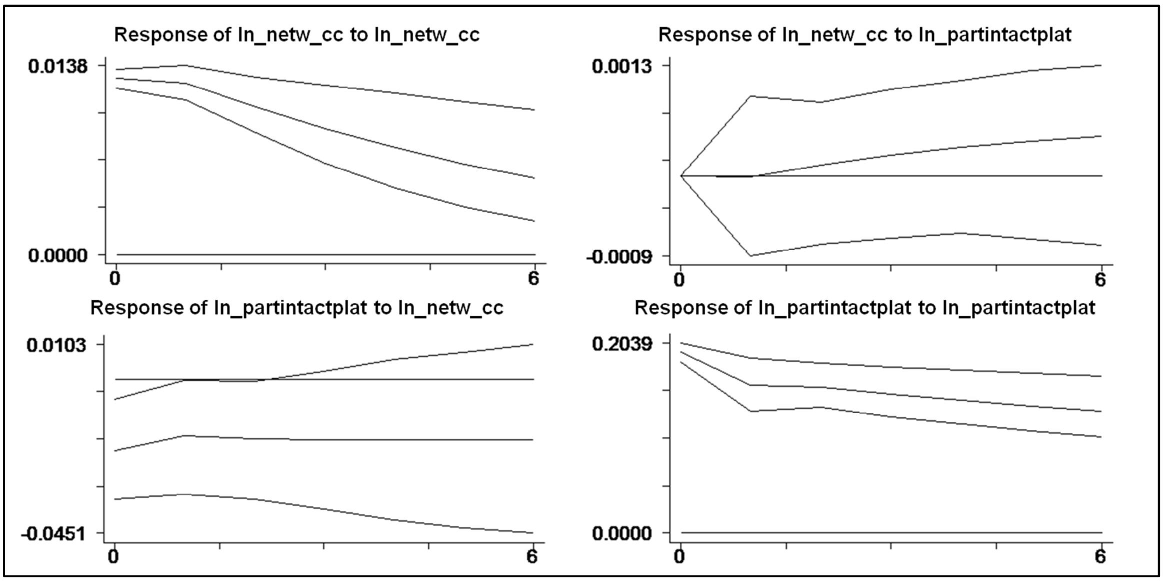
```
. pvar ln_networker_share ln_partintactplat, lag(4) gmm monte 1000
GMM started : 15:02:31
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 449
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share   1.0647989   .18872703   5.6420054
  L.h_ln_partintactplat  -.00099039   .00341946  -.28963457
L2.h_ln_networker_share  -.10664316   .17100782   -.6236157
 L2.h_ln_partintactplat  -.00106832   .00350274  -.30499521
L3.h_ln_networker_share   .14118072   .14299991   .98727842
 L3.h_ln_partintactplat   .00187375    .0032679    .5733807
L4.h_ln_networker_share  -.19381423   .06572573  -2.9488336
 L4.h_ln_partintactplat   .00083406   .00302306   .27589793
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                              b_GMM      se_GMM       t_GMM
 L.h_ln_networker_share    1.850057   3.4513024   .53604604
  L.h_ln_partintactplat   .86595326   .07179077   12.062182
L2.h_ln_networker_share  -1.8821727   2.5284165  -.74440767
 L2.h_ln_partintactplat   .15706688   .08652743   1.8152264
L3.h_ln_networker_share   .43538331    1.867205   .23317381
 L3.h_ln_partintactplat  -.11252474   .09334129  -1.2055194
L4.h_ln_networker_share  -.59609012   1.4301288   -.4168087
 L4.h_ln_partintactplat   .03407004   .06732601    .5060457
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                    ln_networker_share   ln_partintactplat
ln_networker_share           .00002584
 ln_partintactplat           .00017486           .02976265

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 |  0.1986   1.0000
             |  0.0000
             |

GMM finished : 15:02:33

Starting Monte-Carlo loop : 15:02:33 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 15:02:40
```



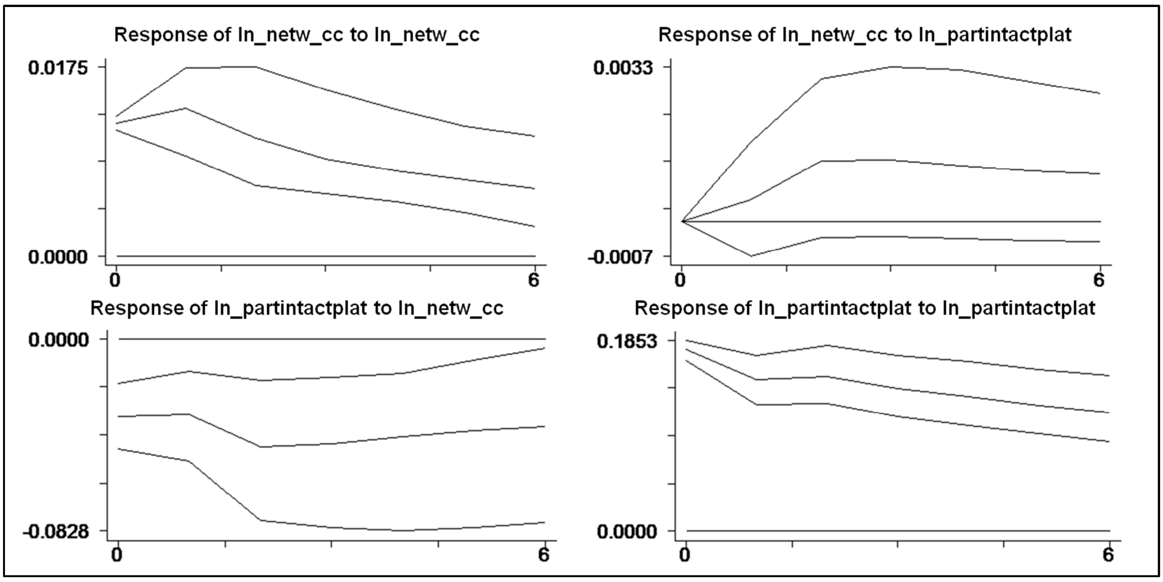
Appendix 63 Estimation Results PVAR(1)-(4) ln_network_cc ln_partintactplat; All Regions

```
. pvar ln_netw_cc ln_partintactplat, lag(1) gmm monte 1000
GMM started : 15:11:16
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 475
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                           b_GMM     se_GMM      t_GMM
       L.h_ln_netw_cc  .76052441  .06592408  11.536367
L.h_ln_partintactplat  .00348952  .00242136  1.4411417
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                            b_GMM      se_GMM       t_GMM
       L.h_ln_netw_cc  -.33270154   .34183684  -.97327582
L.h_ln_partintactplat   .94850428    .0203189   46.680893
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                          ln_netw_cc  ln_partintactplat
       ln_netw_cc          .00084386
ln_partintactplat          .00054338          .04313025

Residuals correlation matrix

             |        u1       u2
-------------+------------------
          u1 |    1.0000
             |
             |
          u2 |    0.0897   1.0000
             |    0.0507
             |

GMM finished : 15:11:18

Starting Monte-Carlo loop : 15:11:19 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 15:11:25
```

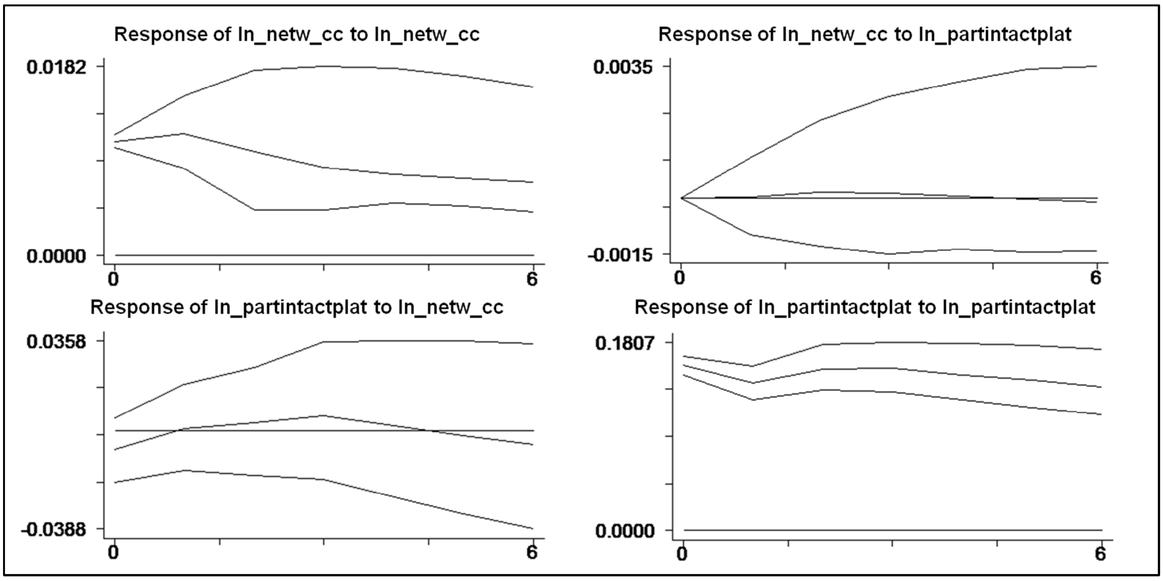
```
. pvar ln_netw_cc ln_partintactplat, lag(2) gmm monte 1000
GMM started : 15:16:50
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 462
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                            b_GMM      se_GMM       t_GMM
        L.h_ln_netw_cc   .89638028   .09423738   9.5119398
 L.h_ln_partintactplat    .0004789   .00311461   .15376017
       L2.h_ln_netw_cc  -.04322559   .06917921  -.62483498
L2.h_ln_partintactplat   .00047415   .00310694   .15261019
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                            b_GMM      se_GMM       t_GMM
        L.h_ln_netw_cc   .00023723   .49809739   .00047627
 L.h_ln_partintactplat   .82116565   .08236436   9.9699151
       L2.h_ln_netw_cc  -.09898159   .54005172  -.18328169
L2.h_ln_partintactplat   .13042262   .07160155   1.8215056
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                         ln_netw_cc  ln_partintactplat
       ln_netw_cc          .00030151
ln_partintactplat         -.00017921          .03810207

Residuals correlation matrix

             |       u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0521   1.0000
             |   0.2636
             |

GMM finished : 15:16:51

Starting Monte-Carlo loop : 15:16:52 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 15:16:58
```



```
. pvar ln_netw_cc ln_partintactplat, lag(3) gmm monte 1000
GMM started : 15:18:53
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 449
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                            b_GMM      se_GMM       t_GMM
        L.h_ln_netw_cc   .78292558   .22482961   3.4823063
 L.h_ln_partintactplat  -.00034701   .00428107  -.08105701
       L2.h_ln_netw_cc  -.00759388   .20846699  -.03642726
L2.h_ln_partintactplat   .00371967   .00455129   .81727844
       L3.h_ln_netw_cc   .07928058    .0780639   1.0155857
L3.h_ln_partintactplat  -.00243538   .00304311   -.8002921
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                            b_GMM      se_GMM       t_GMM
        L.h_ln_netw_cc  -.57326894   .50547117  -1.1341279
 L.h_ln_partintactplat   .83415261   .08224565   10.142209
       L2.h_ln_netw_cc  -.46495104   .66323527  -.70103485
L2.h_ln_partintactplat   .15684412    .0792659   1.9787085
       L3.h_ln_netw_cc   .80983779   .79555906    1.017948
L3.h_ln_partintactplat  -.05216696   .05846577  -.89226506
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                      ln_netw_cc  ln_partintactplat
       ln_netw_cc       .00028433
ln_partintactplat      -.00033381          .03212163

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |  1.0000
             |
             |
          u2 | -0.1096   1.0000
             |  0.0201
             |

GMM finished : 15:18:54

Starting Monte-Carlo loop : 15:18:55 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 15:19:01
```



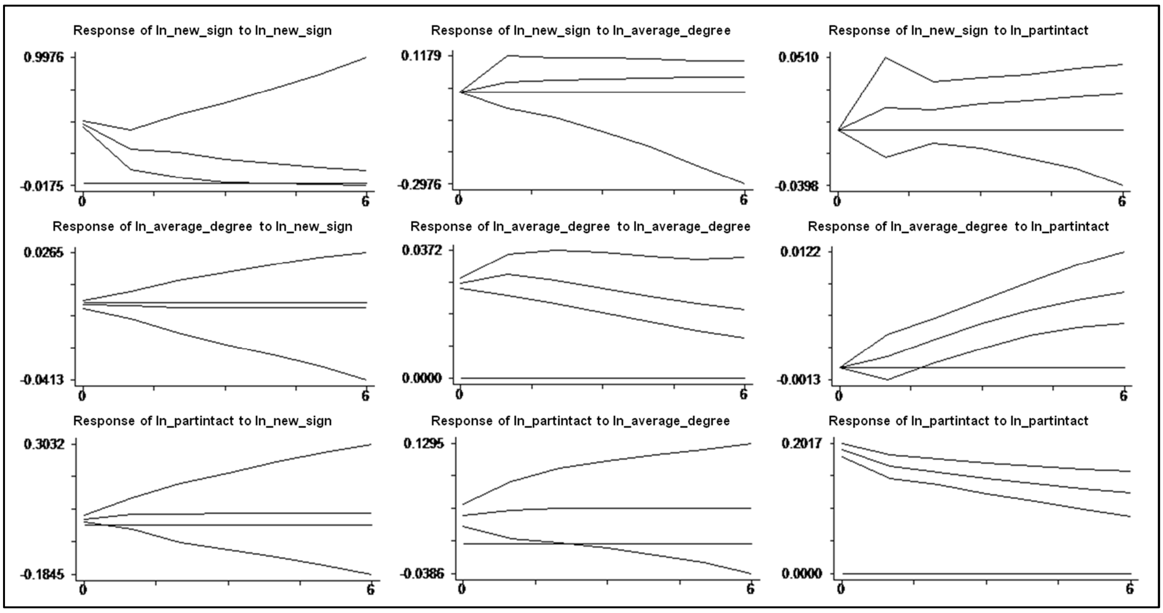
```
. pvar ln_netw_cc ln_partintactplat, lag(4) gmm monte 1000
GMM started : 15:21:06
accumulating matrices equation 1,2,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 436
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_netw_cc

                             b_GMM      se_GMM       t_GMM
        L.h_ln_netw_cc   .75139076   .23838653    3.151985
 L.h_ln_partintactplat  -.00413509   .00509124  -.81219656
       L2.h_ln_netw_cc   .07463712   .15926477   .46863543
L2.h_ln_partintactplat   .00344655   .00563457   .61167887
       L3.h_ln_netw_cc  -.01711709   .12800712  -.13371982
L3.h_ln_partintactplat   .00210278   .00380648    .5524196
       L4.h_ln_netw_cc   .08597575   .06997869   1.2285991
L4.h_ln_partintactplat  -.00176833   .00366487  -.48250817
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_partintactplat

                             b_GMM      se_GMM       t_GMM
        L.h_ln_netw_cc   .27791095   .46067302   .60327159
 L.h_ln_partintactplat   .88746278   .05465592   16.237269
       L2.h_ln_netw_cc  -.04723068   .35870118  -.13167138
L2.h_ln_partintactplat   .18325828   .06188155   2.9614366
       L3.h_ln_netw_cc  -.03315966   .20932498  -.15841232
L3.h_ln_partintactplat  -.05094993   .07155229  -.71206567
       L4.h_ln_netw_cc  -.50875837   .24366646  -2.0879294
L4.h_ln_partintactplat  -.06232388   .04795757  -1.2995629
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[2,2]
                        ln_netw_cc  ln_partintactplat
       ln_netw_cc          .00025503
ln_partintactplat          .00003671          .02541402

Residuals correlation matrix

             |      u1       u2
-------------+------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0149   1.0000
             |   0.7561
             |

GMM finished : 15:21:07

Starting Monte-Carlo loop : 15:21:08 , total 1000 repetitions requested
i=57, i=114, i=171, i=228, i=285, i=342, i=399, i=456, i=513, i=570, i=627, i=684, i=741, i=798, i=8
> 55, i=912, i=969, i=1000, finished Monte-Carlo loop : 15:21:14
```



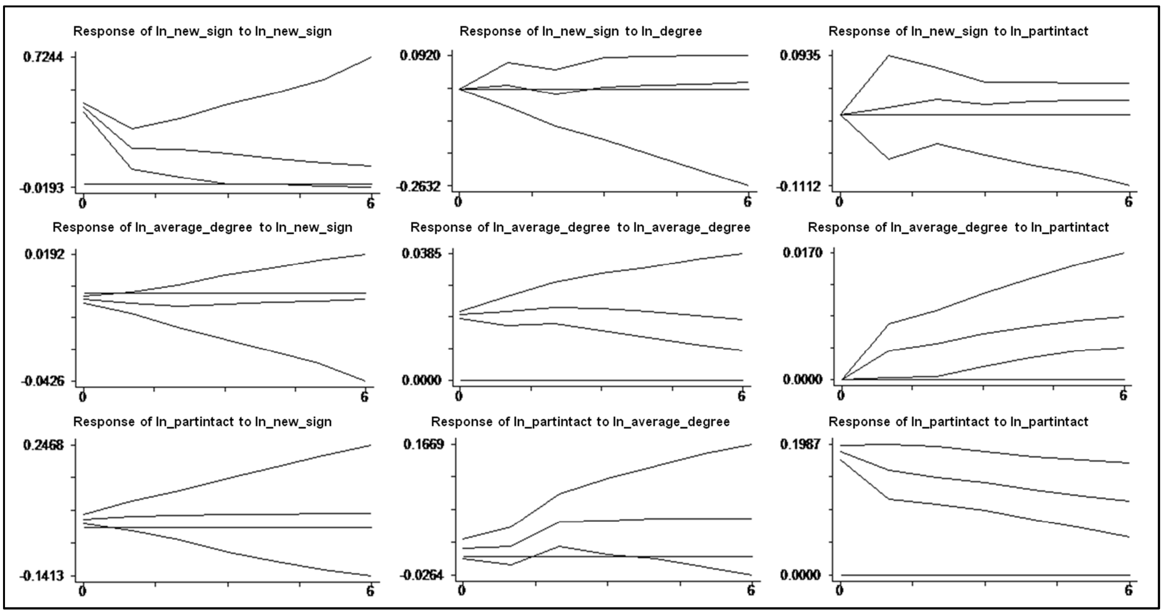
Appendix 64 Estimation Results PVAR(1)-(4) ln_new_signups ln_average_degree ln_partintact; All Regions

```
. pvar ln_new_sign ln_average_degree ln_partintact, lag(1) gmm monte 1000
GMM started : 08:37:43
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 488
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                          b_GMM     se_GMM      t_GMM
      L.h_ln_new_sign  .72102463  .24323866  2.9642682
L.h_ln_average_degree  .57278351  .78661708  .72816053
    L.h_ln_partintact  .05447265  .04002934  1.3608179
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                          b_GMM     se_GMM      t_GMM
      L.h_ln_new_sign  .00333264  .01110447  .30011673
L.h_ln_average_degree  .87055128  .03999943  21.764093
    L.h_ln_partintact  .01089403  .00306951  3.5491049
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                           b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign   .09005001   .09071758   .99264115
L.h_ln_average_degree  -.03832958   .26737167  -.14335692
    L.h_ln_partintact   .91684389   .02596858   35.305886
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                     ln_new_sign  ln_average_degree      ln_partintact
      ln_new_sign          .27856816
ln_average_degree          .00137616          .00101297
    ln_partintact          .02841372          .00148032          .08959299

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0809   1.0000
             |   0.0741
             |
          u3 |   0.1785   0.1544   1.0000
             |   0.0001   0.0006
             |

GMM finished : 08:37:44

Starting Monte-Carlo loop : 08:37:46 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 08:37:52
```

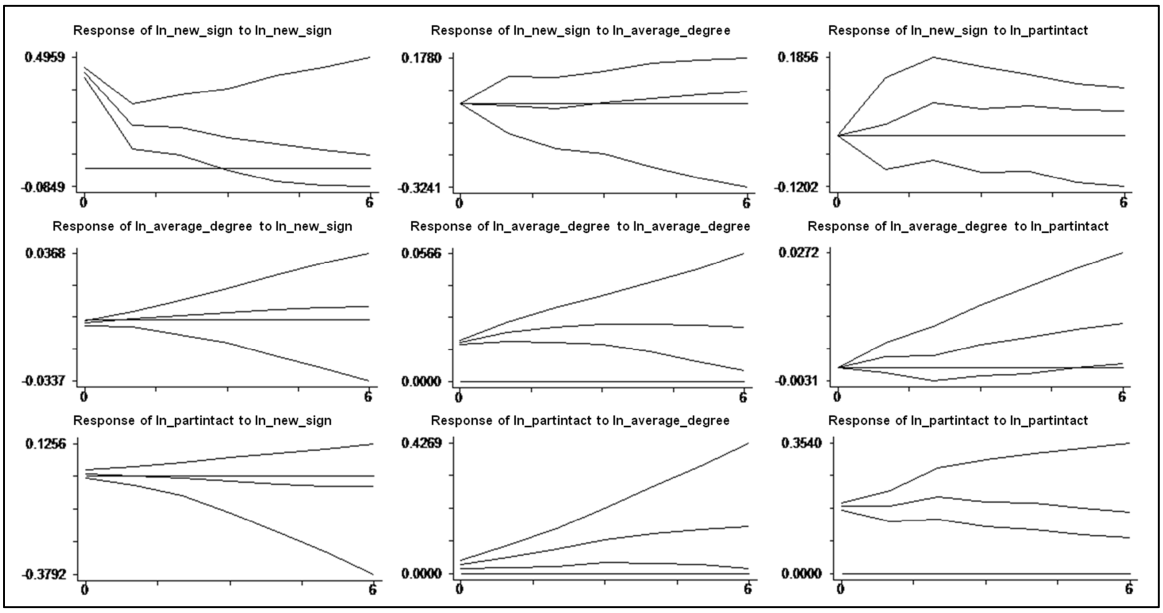
```
. pvar ln_new_sign ln_average_degree ln_partintact, lag(2) gmm monte 1000
GMM started : 08:58:21
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 475
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                              b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .57989186   .19791661   2.9299807
 L.h_ln_average_degree   1.1194422   1.7791387   .62920456
     L.h_ln_partintact   .08002048   .11028456   .72558185
      L2.h_ln_new_sign   .18924918   .10148549   1.8647905
L2.h_ln_average_degree   -.5930823   .91312344  -.64950945
    L2.h_ln_partintact  -.04925728   .10066326  -.48932726
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                              b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.00164075   .00882294  -.18596371
 L.h_ln_average_degree   1.0922141   .13143553   8.3098851
     L.h_ln_partintact   .00582572   .00754324   .77230996
      L2.h_ln_new_sign  -.00160617   .00500079  -.32118403
L2.h_ln_average_degree  -.17655793   .11497235  -1.5356556
    L2.h_ln_partintact    .0041481   .00826223   .50205606
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                              b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .04403428   .07758654   .56755049
 L.h_ln_average_degree   .41804373   .73315299   .57019986
     L.h_ln_partintact   .86396138   .05517381   15.658905
      L2.h_ln_new_sign  -.01486863   .03615963  -.41119431
L2.h_ln_average_degree  -.30496619   .51998001  -.58649598
    L2.h_ln_partintact   .06436371   .04517639   1.4247201
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                       ln_new_sign  ln_average_degree      ln_partintact
      ln_new_sign          .21979339
ln_average_degree         -.00053102          .00075584
    ln_partintact          .01097028          .00097705          .03869603

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0412   1.0000
             |   0.3703
             |
          u3 |   0.1190   0.1807   1.0000
             |   0.0094   0.0001
             |

GMM finished : 08:58:23

Starting Monte-Carlo loop : 08:58:23 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 08:58:31
```



```
. pvar ln_new_sign ln_average_degree ln_partintact, lag(3) gmm monte 1000
GMM started : 09:00:36
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 462
---------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                           b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .46219006    .1670025   2.7675637
 L.h_ln_average_degree   .53865052   1.6860423   .31947627
     L.h_ln_partintact   .06067007   .26882478   .22568629
      L2.h_ln_new_sign   .22199644   .10128249   2.1918542
L2.h_ln_average_degree  -1.6144865   .78204578  -2.0644398
    L2.h_ln_partintact   .03848866   .21920602   .17558215
      L3.h_ln_new_sign    .0832514   .06572485   1.2666656
L3.h_ln_average_degree    1.403991   .57160285   2.4562352
    L3.h_ln_partintact  -.04772583   .09737008  -.49014887
---------------------------------------------------------------------------
---------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                           b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.00515902   .00699588  -.73743691
 L.h_ln_average_degree   1.0406038   .12582716   8.2701048
     L.h_ln_partintact   .02110813   .01210401   1.7438958
      L2.h_ln_new_sign  -.00099689   .00444623  -.22421049
L2.h_ln_average_degree   .00952405    .1275191   .07468721
    L2.h_ln_partintact   -.0138372   .01172173  -1.1804741
      L3.h_ln_new_sign    .0044365    .0030874   1.4369679
L3.h_ln_average_degree  -.12176859   .05278237  -2.3069937
    L3.h_ln_partintact   .00172776    .0061524   .28082648
---------------------------------------------------------------------------
---------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                           b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .03186909   .06561963   .48566395
 L.h_ln_average_degree   .26026392   .75227802   .34596773
     L.h_ln_partintact   .84942501   .13565066   6.2618567
      L2.h_ln_new_sign   .01446488   .03110684   .46500629
L2.h_ln_average_degree   1.5767937    .8832767    1.785164
    L2.h_ln_partintact   .06266577    .1102547   .56837276
      L3.h_ln_new_sign   .00154912   .02903324   .05335671
L3.h_ln_average_degree  -1.5074252   .50579865   -2.980287
    L3.h_ln_partintact  -.02128189   .04668612  -.45585039
---------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                       ln_new_sign  ln_average_degree      ln_partintact
      ln_new_sign          .19060758
ln_average_degree         -.00132152          .00040648
    ln_partintact          .01174817          .00016907           .0357442

Residuals correlation matrix

             |       u1       u2       u3
_____________|____________________________
          u1 |   1.0000
             |
             |
          u2 |  -0.1502   1.0000
             |   0.0012
             |
          u3 |   0.1423   0.0442   1.0000
             |   0.0022   0.3435
             |

GMM finished : 09:00:38

Starting Monte-Carlo loop : 09:00:38 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 09:00:47
```



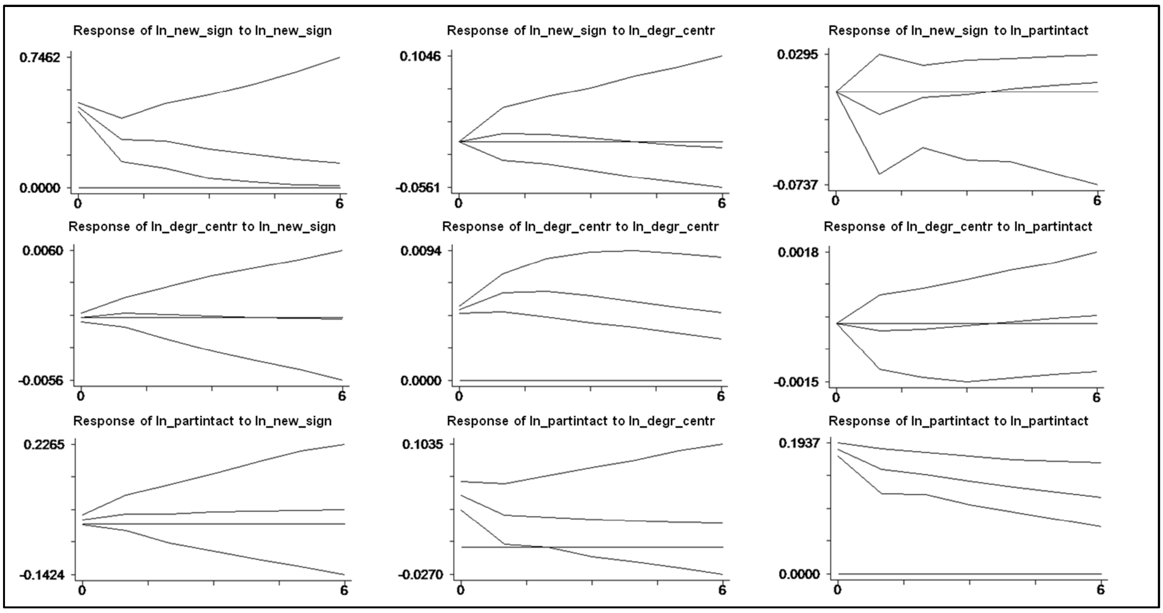
```
. pvar ln_new_sign ln_average_degree ln_partintact, lag(4) gmm monte 1000
GMM started : 09:04:01
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 449
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .44074756    .1382435   3.1881973
 L.h_ln_average_degree  -.63693395   3.1959407  -.19929467
     L.h_ln_partintact    .1426818   .34570286   .41272959
      L2.h_ln_new_sign   .21528695   .09473254   2.2725765
L2.h_ln_average_degree  -.83837998   2.0051961  -.41810374
    L2.h_ln_partintact   .22419268   .17502177   1.2809417
      L3.h_ln_new_sign   .05083954   .07541704   .67411212
L3.h_ln_average_degree   1.8751883    1.330385    1.409508
    L3.h_ln_partintact   -.2352278   .16529688  -1.4230626
      L4.h_ln_new_sign   .01995387   .06300244   .31671584
L4.h_ln_average_degree  -.20872785   1.0430023  -.20012214
    L4.h_ln_partintact  -.03387902   .08571783  -.39523897
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00559836   .00539534   1.0376298
 L.h_ln_average_degree   1.2279269   .13198933    9.303229
     L.h_ln_partintact   .01383048   .01220332   1.1333373
      L2.h_ln_new_sign   .00048389   .00472903   .10232347
L2.h_ln_average_degree  -.16842284   .12617718  -1.3348122
    L2.h_ln_partintact  -.01565094    .0116254  -1.3462713
      L3.h_ln_new_sign   .00111264    .0032337    .3440773
L3.h_ln_average_degree   -.0609601   .07443283  -.81899469
    L3.h_ln_partintact   .01067486   .01034121   1.0322636
      L4.h_ln_new_sign  -.00018828    .0029069  -.06476835
L4.h_ln_average_degree  -.06493303   .04806369   -1.350979
    L4.h_ln_partintact  -.00413087   .00701976  -.58846368
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.01236007   .04436545  -.27859674
 L.h_ln_average_degree   1.3977199   1.0534248   1.3268341
     L.h_ln_partintact   1.0050186    .1360785   7.3855793
      L2.h_ln_new_sign  -.02468384   .02991338  -.82517724
L2.h_ln_average_degree  -.47104308   .88010211  -.53521413
    L2.h_ln_partintact   .11737062   .09725426    1.206843
      L3.h_ln_new_sign   -.0118657   .02779856  -.42684569
L3.h_ln_average_degree    .3416068   1.2206152   .27986446
    L3.h_ln_partintact  -.20376294   .11095733  -1.8364081
      L4.h_ln_new_sign   -.0219461    .0228094  -.96215146
L4.h_ln_average_degree  -.65993747   .84508608  -.78091154
    L4.h_ln_partintact   .01143195   .06913507   .16535669
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                         ln_new_sign  ln_average_degree      ln_partintact
      ln_new_sign          .18369437
ln_average_degree         -.00066532          .00030618
    ln_partintact          .00407931          .00048701          .03415302

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0887   1.0000
             |   0.0603
             |
          u3 |   0.0516   0.1506   1.0000
             |   0.2756   0.0014
             |

GMM finished : 09:04:03

Starting Monte-Carlo loop : 09:04:04 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 09:04:13
```



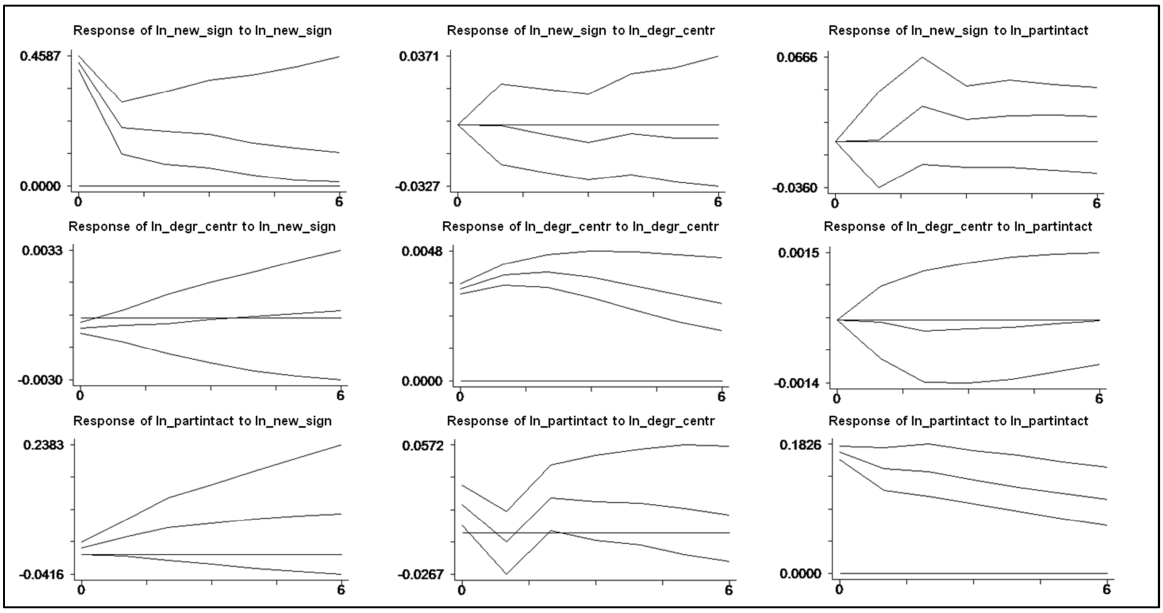
Appendix 65 Estimation Results PVAR(1)-(4) ln_new_signups ln_degree_centralization ln_partintact; All Regions

```
. pvar ln_new_sign ln_degr_centr ln_partintact, lag(1) gmm monte 1000
GMM started : 09:06:43
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 487
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                      b_GMM     se_GMM      t_GMM
  L.h_ln_new_sign  .68723187  .18426429  3.7295989
L.h_ln_degr_centr  .26972475  2.2724202  .11869493
L.h_ln_partintact  .05582745  .03339889  1.6715359
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                      b_GMM     se_GMM      t_GMM
  L.h_ln_new_sign  .00278095   .0029034  .95782526
L.h_ln_degr_centr  .91148346  .04663126  19.546619
L.h_ln_partintact  .00003606  .00068816  .05239941
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                      b_GMM     se_GMM      t_GMM
  L.h_ln_new_sign  .03524606  .07482042  .47107539
L.h_ln_degr_centr  .80441193  1.0545953  .76276833
L.h_ln_partintact  .92291527  .02661268  34.679526
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                 ln_new_sign  ln_degr_centr  ln_partintact
  ln_new_sign      .25225661
ln_degr_centr     -.00013016      .00007318
ln_partintact      .01308228      .00018689       .0445707

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0315   1.0000
             |   0.4882
             |
          u3 |   0.1235   0.1038   1.0000
             |   0.0063   0.0220
             |

GMM finished : 09:06:44

Starting Monte-Carlo loop : 09:06:46 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 09:06:52
```

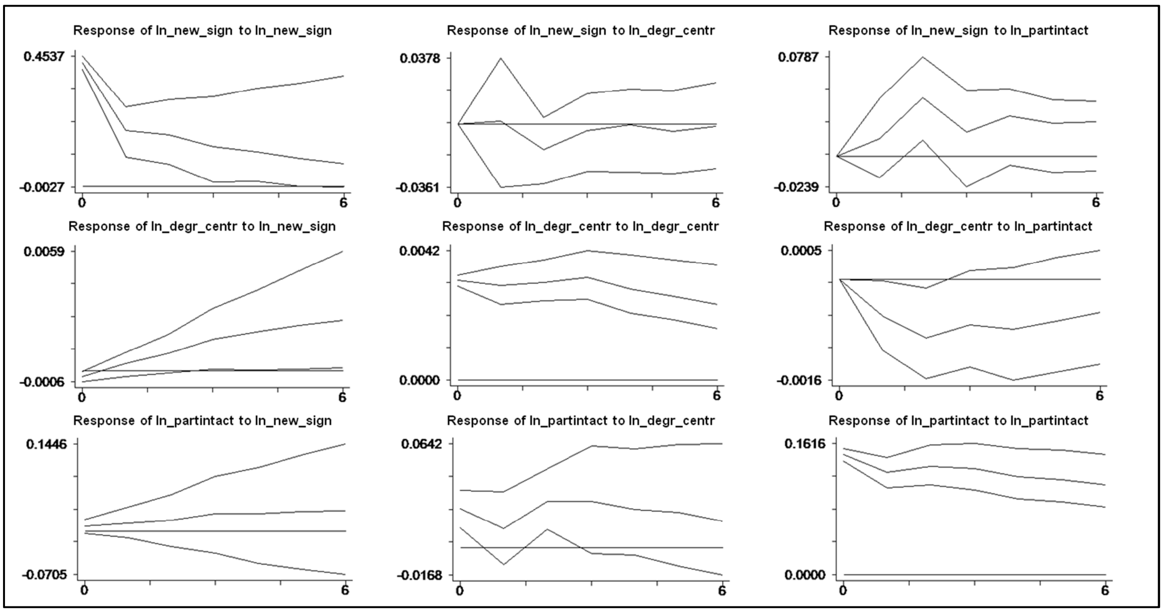
```
. pvar ln_new_sign ln_degr_centr ln_partintact, lag(2) gmm monte 1000
GMM started : 09:21:47
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 474
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .61561498   .16701361   3.6860167
 L.h_ln_degr_centr   6.0263769    3.759494   1.6029755
 L.h_ln_partintact  -.11902241   .15494899   -.7681393
  L2.h_ln_new_sign    .2145613   .06998303   3.0659045
L2.h_ln_degr_centr  -6.8683759   3.4892514  -1.9684383
L2.h_ln_partintact   .13667563   .13462012   1.0152689
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .00174527   .00279821   .62370837
 L.h_ln_degr_centr   .99969892   .21715916    4.603531
 L.h_ln_partintact  -.00038786   .00305494  -.12696315
  L2.h_ln_new_sign  -.00136523   .00123762  -1.1031102
L2.h_ln_degr_centr  -.07058091   .18894901  -.37354476
L2.h_ln_partintact   .00079691   .00270263   .29486584
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .04064212   .06837764   .59437738
 L.h_ln_degr_centr  -1.2953098   2.3438081  -.55265179
 L.h_ln_partintact   .83330007   .11006011   7.5713177
  L2.h_ln_new_sign  -.01178797   .02487189  -.47394728
L2.h_ln_degr_centr   1.2705874   1.9459721   .65293198
L2.h_ln_partintact   .09779919   .08759121   1.1165411
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                 ln_new_sign  ln_degr_centr  ln_partintact
  ln_new_sign      .21109986
ln_degr_centr     -.00012955      .00005385
ln_partintact      .00618692      .00022634      .03700755

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0387   1.0000
             |   0.4003
             |
          u3 |   0.0701   0.1604   1.0000
             |   0.1275   0.0005
             |

GMM finished : 09:21:48

Starting Monte-Carlo loop : 09:21:49 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 09:21:57
```



```
. pvar ln_new_sign ln_degr_centr ln_partintact, lag(3) gmm monte 1000
GMM started : 09:29:23
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 461
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .48903928   .13521786   3.6166768
 L.h_ln_degr_centr   5.4494548   2.7518752   1.9802696
 L.h_ln_partintact  -.04078514   .14502425  -.28122978
  L2.h_ln_new_sign   .19325729   .08561496    2.257284
L2.h_ln_degr_centr  -11.217393   4.5740057  -2.4524222
L2.h_ln_partintact   .20482645   .10655803   1.9222056
  L3.h_ln_new_sign     .111439   .04523453   2.4635826
L3.h_ln_degr_centr   5.0393528   2.9061464   1.7340327
L3.h_ln_partintact  -.12534701      .08916   -1.405866
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .00123413   .00235319   .52445205
 L.h_ln_degr_centr   .86934284   .21080568   4.1239061
 L.h_ln_partintact   .00157145    .0032429    .4845815
  L2.h_ln_new_sign  -.00019947    .0013724  -.14534744
L2.h_ln_degr_centr   .14808811   .20782537   .71256031
L2.h_ln_partintact  -.00250226    .0027215  -.91944042
  L3.h_ln_new_sign  -.00056185   .00064841  -.86649706
L3.h_ln_degr_centr  -.10473245   .06345052  -1.6506161
L3.h_ln_partintact   .00133227   .00166984   .79783871
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .04628999   .05527942   .83738194
 L.h_ln_degr_centr   -1.035143   2.4681879  -.41939395
 L.h_ln_partintact   .81665984   .11013803   7.4148764
  L2.h_ln_new_sign   .04496047   .03463864   1.2979858
L2.h_ln_degr_centr   5.4331134   3.8415155   1.4143151
L2.h_ln_partintact   .14578434   .11004909    1.324721
  L3.h_ln_new_sign  -.01016196   .02926752   -.3472095
L3.h_ln_degr_centr  -4.6955923   2.6467005  -1.7741306
L3.h_ln_partintact  -.05218779   .06821337  -.76506678
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                ln_new_sign  ln_degr_centr  ln_partintact
  ln_new_sign      .18721131
ln_degr_centr     -.00033214      .00003652
ln_partintact      .00760825      .00002797      .03181032

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1271   1.0000
             |   0.0063
             |
          u3 |   0.0986   0.0259   1.0000
             |   0.0344   0.5787
             |

GMM finished : 09:29:25

Starting Monte-Carlo loop : 09:29:26 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 09:29:34
```



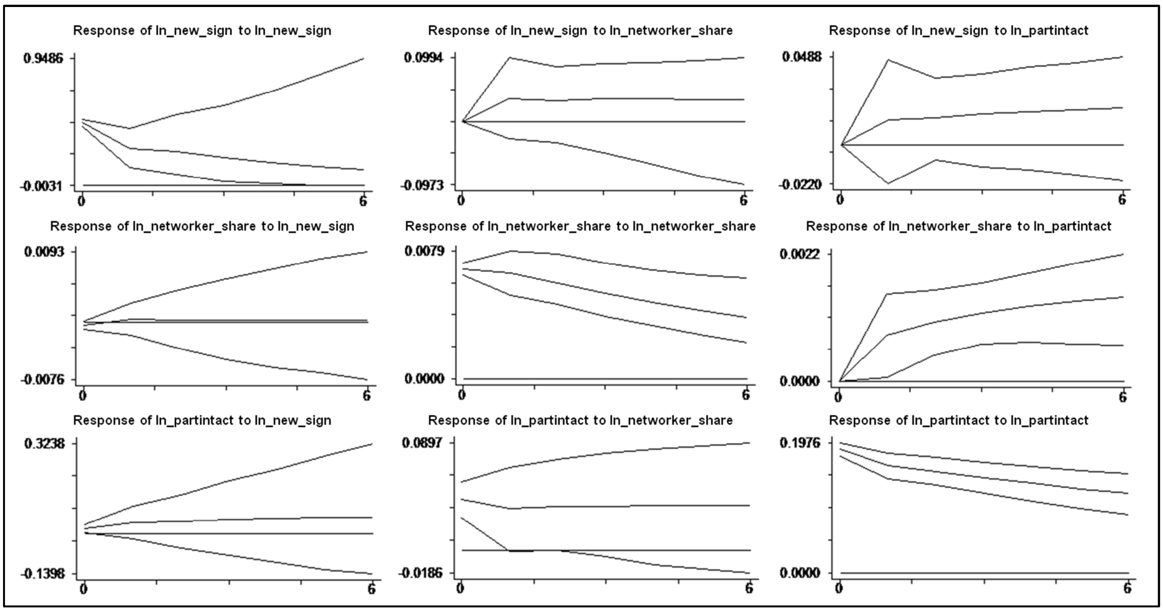
```
. pvar ln_new_sign ln_degr_centr ln_partintact, lag(4) gmm monte 1000
GMM started : 09:40:00
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 448
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .46753076   .12376394   3.7776008
 L.h_ln_degr_centr   6.3637754   2.9110998   2.1860382
 L.h_ln_partintact   .10317022   .13303087   .77553588
  L2.h_ln_new_sign   .17905579    .0844442   2.1204037
L2.h_ln_degr_centr  -13.737476   3.7071574   -3.705663
L2.h_ln_partintact   .17768095   .11167395   1.5910689
  L3.h_ln_new_sign   .05404149   .06735894   .80229127
L3.h_ln_degr_centr   6.6504529   3.3644453   1.9766863
L3.h_ln_partintact  -.28735508   .11271196  -2.5494639
  L4.h_ln_new_sign    .0285444   .03919271    .7283089
L4.h_ln_degr_centr   .57041636   1.9357222   .29467883
L4.h_ln_partintact    .0713429   .09646702   .73955746
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .00217052   .00225946   .96063831
 L.h_ln_degr_centr   .69971815   .22697141   3.0828471
 L.h_ln_partintact  -.00309072    .0020535  -1.5051025
  L2.h_ln_new_sign   .00059277    .0012265   .48329778
L2.h_ln_degr_centr   .28898146   .23611012   1.2239266
L2.h_ln_partintact   .00036413   .00200741   .18139403
  L3.h_ln_new_sign   .00017305   .00073841    .2343627
L3.h_ln_degr_centr   .05287913   .08367568   .63195341
L3.h_ln_partintact    .0033741   .00185966   1.8143661
  L4.h_ln_new_sign  -.00027485   .00042188  -.65149352
L4.h_ln_degr_centr  -.15540403   .05782395  -2.6875375
L4.h_ln_partintact  -.00085961   .00133055  -.64605315
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .01485874   .03258706   .45597077
 L.h_ln_degr_centr   .56578537   1.7330776    .3264628
 L.h_ln_partintact   .84145175   .07725089   10.892454
  L2.h_ln_new_sign   .00599588    .0234489   .25569999
L2.h_ln_degr_centr   1.6371526   1.8157764   .90162674
L2.h_ln_partintact   .18833276   .08186218   2.3006076
  L3.h_ln_new_sign   .01352934   .02320177    .5831169
L3.h_ln_degr_centr  -.79121076   2.1795554  -.36301474
L3.h_ln_partintact  -.02302934   .07955744  -.28946808
  L4.h_ln_new_sign  -.01774269   .01730466   -1.025313
L4.h_ln_degr_centr  -2.3925494   2.3532338   -1.016707
L4.h_ln_partintact   -.0652601   .05493104  -1.1880369
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                 ln_new_sign  ln_degr_centr  ln_partintact
  ln_new_sign      .18099142
ln_degr_centr     -.00021782      .00003224
ln_partintact      .00414281      .00008175       .0227698

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0902   1.0000
             |   0.0565
             |
          u3 |   0.0645   0.0953   1.0000
             |   0.1728   0.0437
             |

GMM finished : 09:40:02

Starting Monte-Carlo loop : 09:40:03 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 09:40:12
```



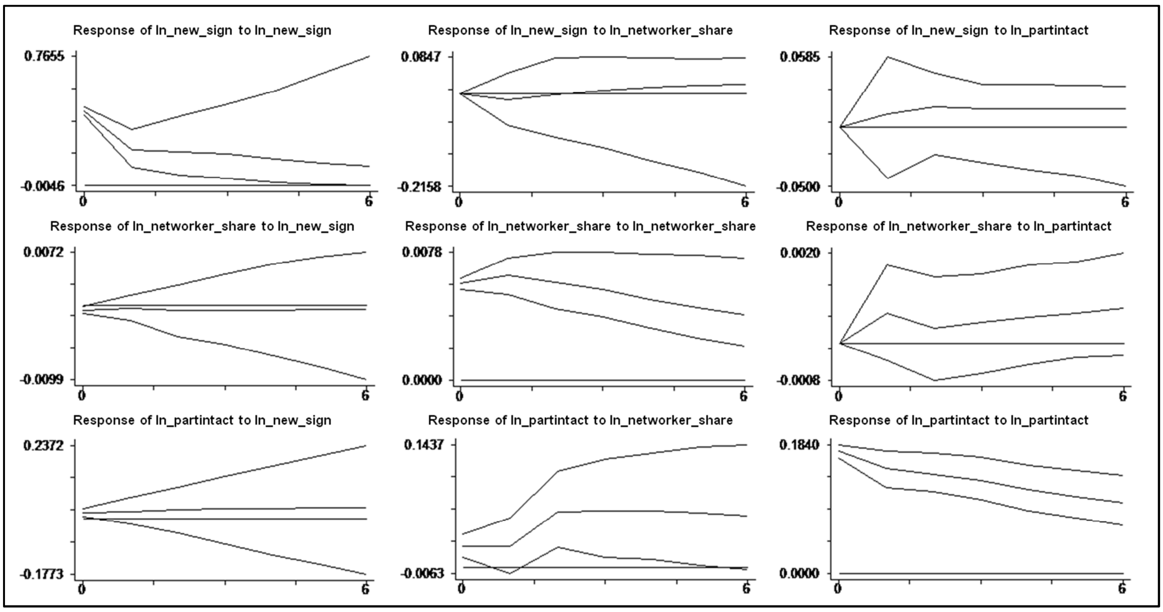
Appendix 66 Estimation Results PVAR(1)-(4) ln_new_signups ln_networker_share ln_partintact; All Regions

```
. pvar ln_new_sign ln_networker_share ln_partintact, lag(1) gmm monte 1000
GMM started : 09:58:02
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 488
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                           b_GMM     se_GMM      t_GMM
       L.h_ln_new_sign  .77124877  .22928041  3.3637796
L.h_ln_networker_share  2.3176568   2.015017  1.1501921
     L.h_ln_partintact  .02936888  .03596109  .81668493
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                           b_GMM     se_GMM      t_GMM
       L.h_ln_new_sign   .0011554  .00336266   .3435974
L.h_ln_networker_share   .8039212   .0428155  18.776406
     L.h_ln_partintact  .00184744  .00108601  1.7011257
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                           b_GMM     se_GMM      t_GMM
       L.h_ln_new_sign  .10375901  .08484454  1.2229308
L.h_ln_networker_share  .42169116   .8134963  .51836888
     L.h_ln_partintact  .91235747  .02421189  37.682206
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                          ln_new_sign  ln_networker_share       ln_partintact
       ln_new_sign          .28834386
ln_networker_share          .00002409           .00008979
     ln_partintact          .03430495           .00008574           .09292914

Residuals correlation matrix

             |       u1        u2        u3
-------------+------------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0037    1.0000
             |   0.9345
             |
          u3 |   0.2078    0.0286    1.0000
             |   0.0000    0.5280
             |

GMM finished : 09:58:06

Starting Monte-Carlo loop : 09:58:07 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 09:58:14
```

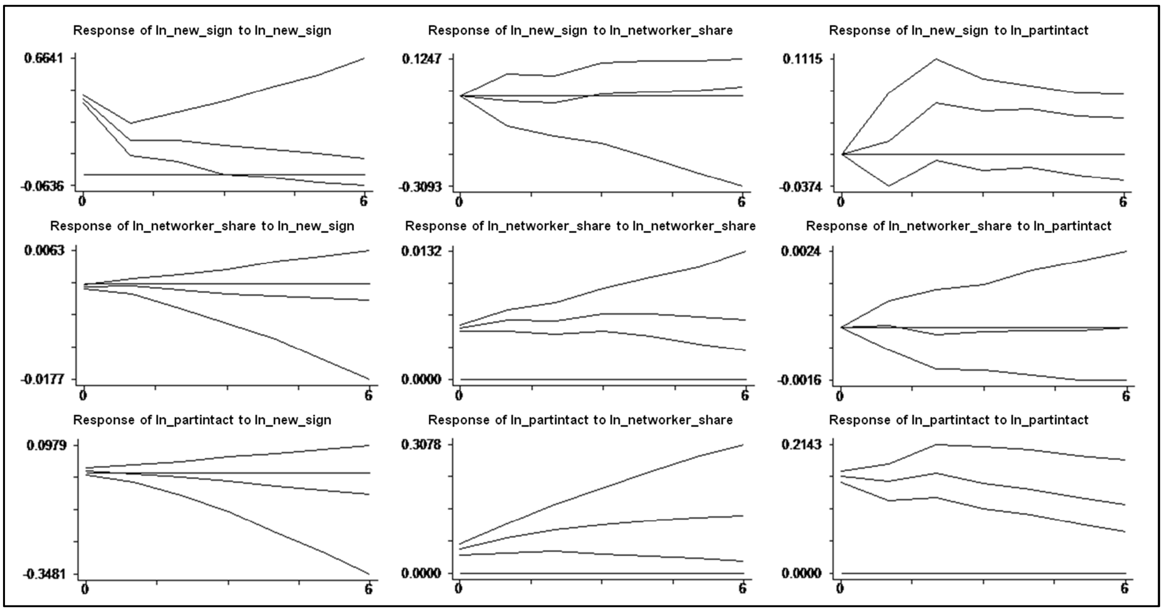
```
. pvar ln_new_sign ln_networker_share ln_partintact, lag(2) gmm monte 1000
GMM started : 10:02:57
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 475
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .58544736   .18762285   3.1203415
 L.h_ln_networker_share    4.933843    5.734051   .86044631
      L.h_ln_partintact   .07349427   .11160925   .65849625
       L2.h_ln_new_sign     .194658   .08443719   2.3053586
L2.h_ln_networker_share  -3.1789697   3.3009333  -.96305177
     L2.h_ln_partintact  -.04908886   .11055661  -.44401566
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .00147509   .00264149   .55842989
 L.h_ln_networker_share     .942067   .12723765   7.4039954
      L.h_ln_partintact   .00419415   .00239739   1.7494666
       L2.h_ln_new_sign  -.00155364   .00139519  -1.1135703
L2.h_ln_networker_share  -.05499464     .109232  -.50346641
     L2.h_ln_partintact  -.00238061   .00295636  -.80525012
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .05428057   .07288084   .74478523
 L.h_ln_networker_share  -.29757867   2.8899102   -.1029716
      L.h_ln_partintact   .86575344   .05579937    15.51547
       L2.h_ln_new_sign  -.01374554   .02988841  -.45989546
L2.h_ln_networker_share   .51946051   2.2427529   .23161736
     L2.h_ln_partintact   .06421049   .04958468   1.2949664
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                           ln_new_sign  ln_networker_share       ln_partintact
       ln_new_sign           .21903723
ln_networker_share          -.00017672           .00004632
     ln_partintact            .0093068           .00028058           .03759559

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |  1.0000
             |
             |
          u2 | -0.0557   1.0000
             |  0.2255
             |
          u3 |  0.1026   0.2126   1.0000
             |  0.0254   0.0000
             |

GMM finished : 10:02:58

Starting Monte-Carlo loop : 10:02:59 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 10:03:06
```



```
. pvar ln_new_sign ln_networker_share ln_partintact, lag(3) gmm monte 1000
GMM started : 10:06:14
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 462
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign    .4729826   .15627184   3.0266655
 L.h_ln_networker_share  -2.8420935   5.9714084  -.47595029
      L.h_ln_partintact   .06127419   .17864183   .34300026
       L2.h_ln_new_sign   .22343487   .10275367    2.174471
L2.h_ln_networker_share   3.5727704   5.6852652   .62842633
     L2.h_ln_partintact   .02508999    .1718203   .14602459
       L3.h_ln_new_sign   .09397967   .05453161    1.723398
L3.h_ln_networker_share   .39669751   3.7555416   .10562991
     L3.h_ln_partintact  -.05388308   .07477109  -.72064053
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .00043132   .00222964    .1934499
 L.h_ln_networker_share   1.0674146   .10914603   9.7796927
      L.h_ln_partintact   .00374787   .00362582   1.0336612
       L2.h_ln_new_sign  -.00094829   .00155876  -.60836051
L2.h_ln_networker_share  -.13638153   .11023163  -1.2372269
     L2.h_ln_partintact  -.00534371   .00449483  -1.1888571
       L3.h_ln_new_sign   .00023744   .00072757    .3263514
L3.h_ln_networker_share  -.02343644   .06152845  -.38090409
     L3.h_ln_partintact    .0027206   .00256567   1.0603866
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .02094566   .05724614   .36588781
 L.h_ln_networker_share   .54620447   2.9127611   .18752121
      L.h_ln_partintact   .85405245    .0861036   9.9188933
       L2.h_ln_new_sign   .01814059   .03319273     .546523
L2.h_ln_networker_share   6.5675655   3.3414434   1.9654876
     L2.h_ln_partintact   .07376166   .09047773   .81524665
       L3.h_ln_new_sign  -.00615823   .02597524  -.23708065
L3.h_ln_networker_share  -5.8754022   2.2979858  -2.5567617
     L3.h_ln_partintact  -.02394186   .04922618   -.4863645
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                      ln_new_sign  ln_networker_share       ln_partintact
       ln_new_sign      .19306323
ln_networker_share     -.00028398            .00003493
     ln_partintact      .00840909            .00013711           .03171906

Residuals correlation matrix

             |      u1        u2        u3
-------------+------------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1094    1.0000
             |   0.0187
             |
          u3 |   0.1075    0.1302    1.0000
             |   0.0208    0.0051
             |

GMM finished : 10:06:15

Starting Monte-Carlo loop : 10:06:16 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 10:06:24
```



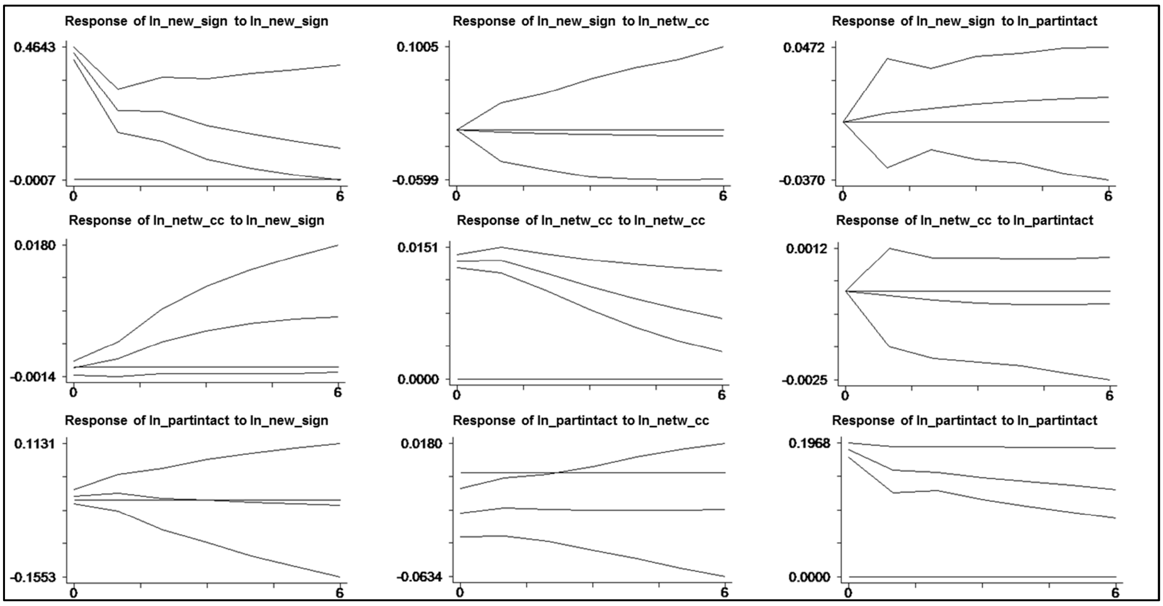
```
. pvar ln_new_sign ln_networker_share ln_partintact, lag(4) gmm monte 1000
GMM started : 10:09:07
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 449
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .45281709   .13353537   3.3909897
 L.h_ln_networker_share  -4.2224666    8.576289  -.49234191
      L.h_ln_partintact   .09899779   .21073597   .46977166
       L2.h_ln_new_sign   .24096151   .09979959   2.4144539
L2.h_ln_networker_share  -2.8456159   6.8685455  -.41429673
     L2.h_ln_partintact   .23765166   .14881792   1.5969291
       L3.h_ln_new_sign   .06870345   .07402444   .92811852
L3.h_ln_networker_share   8.6448889   3.5769694   2.4168194
     L3.h_ln_partintact  -.21287629   .13979949  -1.5227258
       L4.h_ln_new_sign   .01148112   .04133571   .27775302
L4.h_ln_networker_share  -1.0787494    1.662792  -.64875789
     L4.h_ln_partintact  -.05298754   .09586189   -.5527488
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .00064053   .00184553   .34707004
 L.h_ln_networker_share   1.1450542   .11321422   10.114049
      L.h_ln_partintact   .00032688   .00281097   .11628646
       L2.h_ln_new_sign  -.00213871   .00154571  -1.3836451
L2.h_ln_networker_share  -.15235141   .19060028  -.79932417
     L2.h_ln_partintact  -.00213199   .00349305  -.61035215
       L3.h_ln_new_sign  -.00076607   .00093074   -.8230769
L3.h_ln_networker_share   .14112125   .16518014   .85434757
     L3.h_ln_partintact    .0025151   .00400361   .62820849
       L4.h_ln_new_sign   .00047367    .0008502   .55713148
L4.h_ln_networker_share  -.19981346   .07211005  -2.7709516
     L4.h_ln_partintact   .00018519   .00292322   .06335305
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign  -.00937264   .03715886   -.2522316
 L.h_ln_networker_share   5.3464861   3.0636335   1.7451455
      L.h_ln_partintact   .95147288   .10820389    8.793333
       L2.h_ln_new_sign  -.02452023   .02772179  -.88451107
L2.h_ln_networker_share  -2.8372209   3.1558706  -.89902956
     L2.h_ln_partintact   .12228024   .10212146   1.1974001
       L3.h_ln_new_sign  -.00094009    .0256297  -.03667967
L3.h_ln_networker_share  -.15217612   2.8161464  -.05403701
     L3.h_ln_partintact  -.15158477   .10907786  -1.3896933
       L4.h_ln_new_sign  -.01565528   .01947616  -.80381776
L4.h_ln_networker_share  -.55991413   1.3952723   -.4012938
     L4.h_ln_partintact   .01548439   .06807623    .2274566
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                      ln_new_sign  ln_networker_share       ln_partintact
       ln_new_sign      .18430407
ln_networker_share     -.00023743            .0000284
     ln_partintact      .00299808           .00029996           .02932091

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1036   1.0000
             |   0.0281
             |
          u3 |   0.0410   0.3284   1.0000
             |   0.3865   0.0000
             |

GMM finished : 10:09:09

Starting Monte-Carlo loop : 10:09:10 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 10:09:19
```



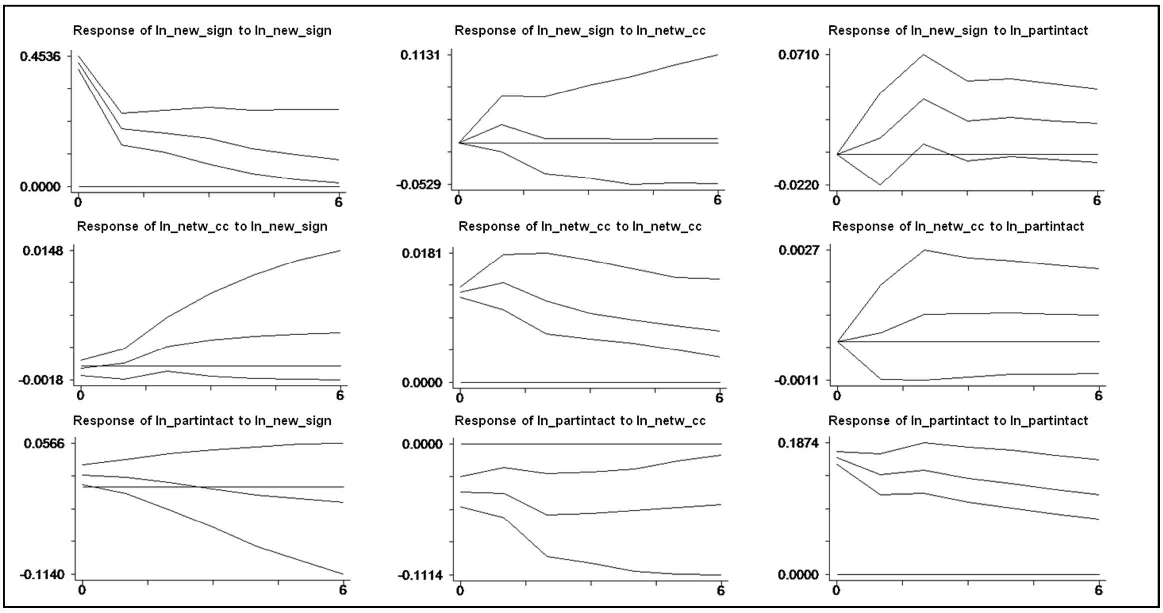
Appendix 67 Estimation Results PVAR(1)-(4) ln_new_signups ln_network_cc ln_partintact; All Regions

```
. pvar ln_new_sign ln_netw_cc ln_partintact, lag(1) gmm monte 1000
GMM started : 10:33:47
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 475
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                       b_GMM      se_GMM       t_GMM
  L.h_ln_new_sign   .70289565   .14857524   4.7309071
   L.h_ln_netw_cc  -.54322658   .99295578  -.54708034
L.h_ln_partintact   .06420761   .04855595   1.3223427
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                       b_GMM      se_GMM       t_GMM
  L.h_ln_new_sign   .01868597   .01053528   1.7736572
   L.h_ln_netw_cc   .79824902    .0766262   10.417443
L.h_ln_partintact  -.00029543   .00449567  -.06571324
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                       b_GMM      se_GMM       t_GMM
  L.h_ln_new_sign   .05580762    .0719086   .77609101
   L.h_ln_netw_cc  -.21629723   .37217999  -.58116299
L.h_ln_partintact     .933099   .03328573   28.033007
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                ln_new_sign     ln_netw_cc  ln_partintact
  ln_new_sign      .23612369
   ln_netw_cc      .00170336      .00115229
ln_partintact      .00907964      .00116243       .0413955

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1024   1.0000
             |   0.0257
             |
          u3 |   0.0917   0.1680   1.0000
             |   0.0459   0.0002
             |

GMM finished : 10:33:49

Starting Monte-Carlo loop : 10:33:50 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 10:33:57
```

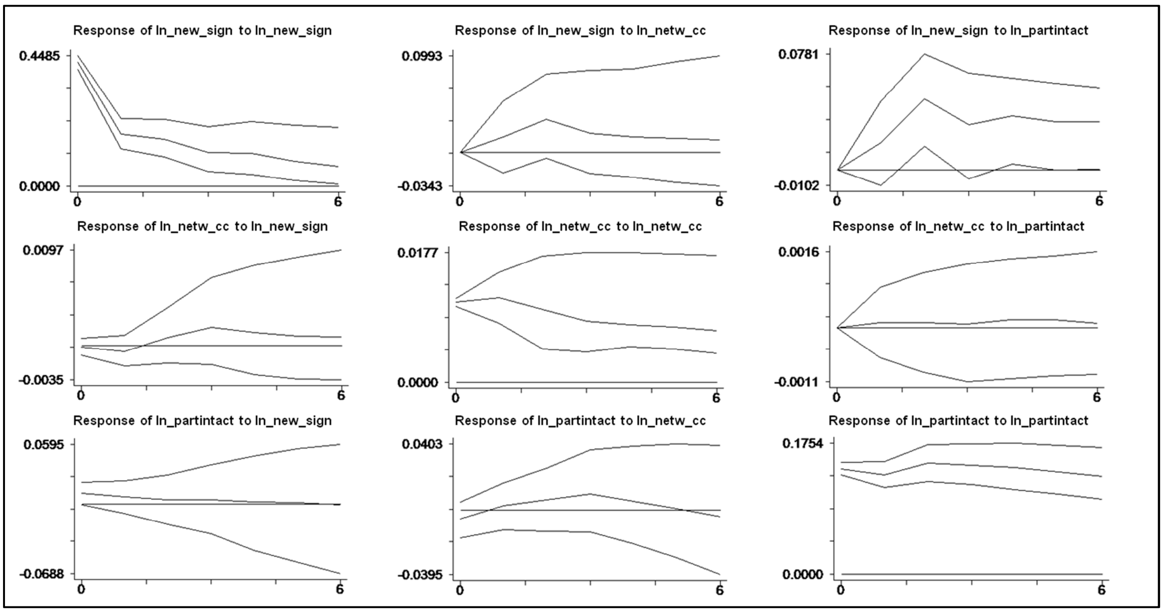
```
. pvar ln_new_sign ln_netw_cc ln_partintact, lag(2) gmm monte 1000
GMM started : 10:42:49
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 462
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .54874229   .10084665   5.4413539
    L.h_ln_netw_cc  -.19662764   1.3272353  -.14814829
 L.h_ln_partintact   .02829979   .11340692   .24954201
  L2.h_ln_new_sign   .24907142   .06863351   3.6290062
   L2.h_ln_netw_cc   .00854028   .70281253   .01215158
L2.h_ln_partintact   .00364804   .09246456   .03945342
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .00449602   .00351792   1.2780328
    L.h_ln_netw_cc   .92969147   .10091402   9.2127088
 L.h_ln_partintact     -.00047   .00484487  -.09700928
  L2.h_ln_new_sign   .00431265   .00246542   1.7492598
   L2.h_ln_netw_cc  -.05174581   .07410236  -.69830175
L2.h_ln_partintact  -.00054552   .00428227  -.12739057
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                         b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .01882582   .04802106   .39203265
    L.h_ln_netw_cc  -.10525554   .48120228   -.2187345
 L.h_ln_partintact   .83869593    .1052738    7.966806
  L2.h_ln_new_sign  -.03142448   .02261501   -1.389541
   L2.h_ln_netw_cc   -.0116612   .51007992  -.02286151
L2.h_ln_partintact   .11424916   .08270021   1.3814857
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                ln_new_sign     ln_netw_cc  ln_partintact
  ln_new_sign      .19640642
   ln_netw_cc       .0001576        .000331
ln_partintact      .00306632     -.00027289       .0356159

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0194   1.0000
             |   0.6768
             |
          u3 |   0.0367  -0.0792   1.0000
             |   0.4310   0.0889
             |

GMM finished : 10:42:51

Starting Monte-Carlo loop : 10:42:51 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 10:42:59
```



```
. pvar ln_new_sign ln_netw_cc ln_partintact, lag(3) gmm monte 1000
GMM started : 10:52:10
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 449
----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                        b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .46373303   .07806299    5.940498
    L.h_ln_netw_cc   1.0657473   1.4609957   .72946639
 L.h_ln_partintact   .05743118   .11936009     .481159
  L2.h_ln_new_sign   .20749157   .06045794    3.431999
   L2.h_ln_netw_cc  -1.4014669   1.2147563  -1.1537021
L2.h_ln_partintact   .16028678   .12242901   1.3092222
  L3.h_ln_new_sign   .08219341   .05146734   1.5970012
   L3.h_ln_netw_cc   .74506667   .77183661   .96531658
L3.h_ln_partintact  -.17801169   .08964753  -1.9856843
----------------------------------------------------------------------------
----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                        b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .00235346   .00271262   .86759601
    L.h_ln_netw_cc   .78372554   .22791315   3.4387025
 L.h_ln_partintact  -.00209789   .00578076  -.36290936
  L2.h_ln_new_sign    .0046034   .00235387   1.9556733
   L2.h_ln_netw_cc   .01229622    .2029878   .06057615
L2.h_ln_partintact   .00319225   .00573911   .55622657
  L3.h_ln_new_sign   .00043855   .00198846   .22054962
   L3.h_ln_netw_cc   .07500098   .08096318   .92635904
L3.h_ln_partintact   -.0018099   .00369421  -.48992943
----------------------------------------------------------------------------
----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                        b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign  -.00226304   .03118707  -.07256352
    L.h_ln_netw_cc  -.71991716    .5516976  -1.3049126
 L.h_ln_partintact   .85512681   .10619501   8.0524196
  L2.h_ln_new_sign  -.01427501   .02143103  -.66609068
   L2.h_ln_netw_cc  -.50446323   .67878107  -.74318989
L2.h_ln_partintact   .16118486      .09393   1.7160105
  L3.h_ln_new_sign  -.00564678   .02565043   -.2201437
   L3.h_ln_netw_cc   .96558506   .87860059   1.0990034
L3.h_ln_partintact  -.07234157   .06108335  -1.1843092
----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                ln_new_sign     ln_netw_cc  ln_partintact
  ln_new_sign      .18596482
   ln_netw_cc      .00015145      .00030334
ln_partintact       .0062674     -.00050023      .02950073

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0202   1.0000
             |   0.6698
             |
          u3 |   0.0846  -0.1670   1.0000
             |   0.0733   0.0004
             |

GMM finished : 10:52:11

Starting Monte-Carlo loop : 10:52:12 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 10:52:20
```



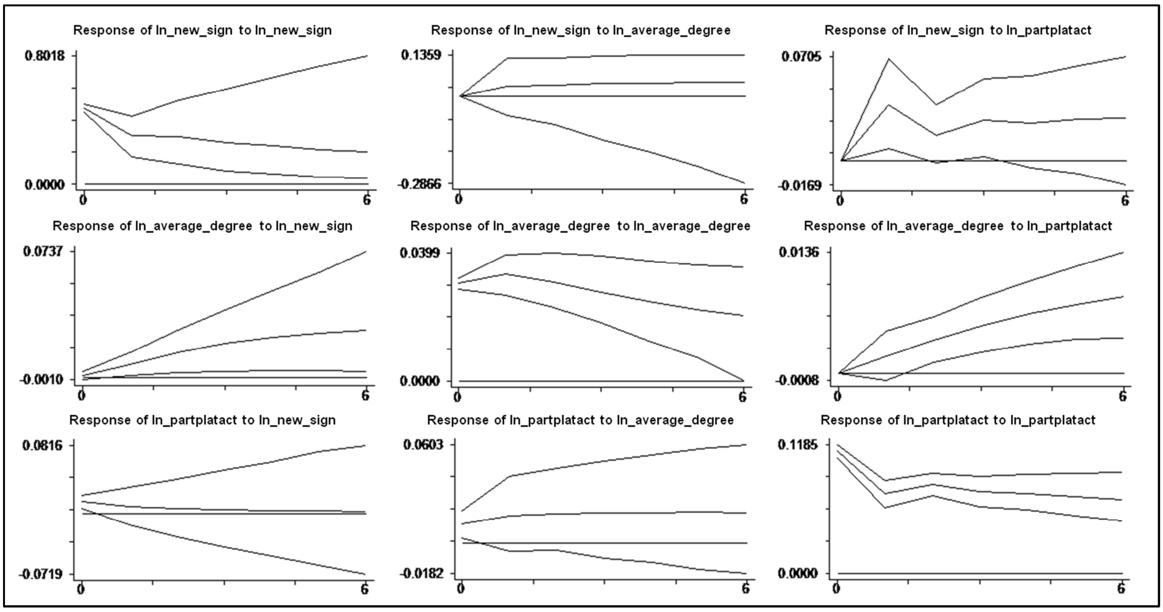
```
. pvar ln_new_sign ln_netw_cc ln_partintact, lag(4) gmm monte 1000
GMM started : 10:58:49
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 436
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                        b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign   .42754121   .07517385   5.6873665
    L.h_ln_netw_cc   1.0092462   1.5592343   .64727042
 L.h_ln_partintact   .12527498   .12593603   .99475093
  L2.h_ln_new_sign   .19505154   .06084398   3.2057656
   L2.h_ln_netw_cc  -1.0265109   1.6003467  -.64143028
L2.h_ln_partintact   .14401235   .14016812   1.0274258
  L3.h_ln_new_sign   .03122365   .05690854   .54866366
   L3.h_ln_netw_cc   .37815094   1.6210425   .23327639
L3.h_ln_partintact  -.22851469    .1325494  -1.7239964
  L4.h_ln_new_sign   .05915774   .04440333   1.3322817
   L4.h_ln_netw_cc  -.16212569   .58420565  -.27751476
L4.h_ln_partintact   .02353381   .09092215   .25883476
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                        b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign  -.00026786   .00221939  -.12069227
    L.h_ln_netw_cc   .74394908   .23705277   3.1383269
 L.h_ln_partintact  -.00506275   .00541259   -.9353663
  L2.h_ln_new_sign    .0044006   .00235317   1.8700771
   L2.h_ln_netw_cc   .08079655   .15820563   .51070591
L2.h_ln_partintact   .00263942   .00628537   .41993068
  L3.h_ln_new_sign   .00300691   .00251433   1.1959089
   L3.h_ln_netw_cc  -.02137146   .11946475  -.17889343
L3.h_ln_partintact   .00280322   .00422492   .66349717
  L4.h_ln_new_sign  -.00433544   .00223004  -1.9441055
   L4.h_ln_netw_cc   .09184545   .06631797   1.3849255
L4.h_ln_partintact  -.00127873   .00360481  -.35473007
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintact

                        b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign  -.00564969   .01895833   -.2980057
    L.h_ln_netw_cc   .29397593   .42964672   .68422709
 L.h_ln_partintact   .93240667   .06552029   14.230808
  L2.h_ln_new_sign  -.00596309   .01456667  -.40936518
   L2.h_ln_netw_cc   .02818454   .36024265   .07823765
L2.h_ln_partintact   .17192317   .06788785   2.5324586
  L3.h_ln_new_sign   .00512875   .01547022   .33152401
   L3.h_ln_netw_cc  -.04368442   .27062668  -.16141948
L3.h_ln_partintact  -.10099449   .07763583  -1.3008747
  L4.h_ln_new_sign  -.00445741    .0122639  -.36345787
   L4.h_ln_netw_cc   -.6218317    .2652221  -2.3445697
L4.h_ln_partintact  -.04094511   .05363606  -.76338772
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                 ln_new_sign     ln_netw_cc  ln_partintact
  ln_new_sign      .18277639
   ln_netw_cc      .00024927      .00025129
ln_partintact       .0048491      .00003322      .02019357

Residuals correlation matrix

             |       u1        u2        u3
-------------+------------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0368    1.0000
             |   0.4432
             |
          u3 |   0.0798    0.0149    1.0000
             |   0.0961    0.7562
             |

GMM finished : 10:58:51

Starting Monte-Carlo loop : 10:58:52 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 10:59:01
```



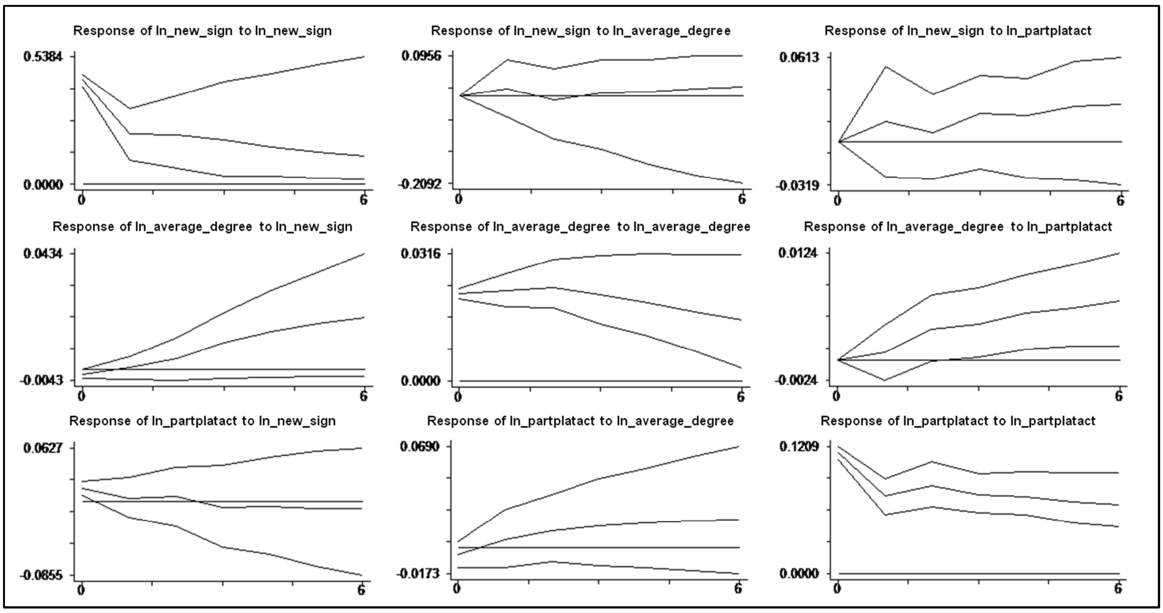
Appendix 68 Estimation Results PVAR(1)-(4) ln_new_signups ln_average_degree ln_partplatact; All Regions

```
. pvar ln_new_sign ln_average_degree ln_partplatact, lag(1) gmm monte 1000
GMM started : 17:02:48
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 488
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                            b_GMM     se_GMM      t_GMM
      L.h_ln_new_sign  .82403337  .19610782  4.2019405
L.h_ln_average_degree  .43780671  .75152436  .58255824
   L.h_ln_partplatact  .09361424  .09095629  1.0292223
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                            b_GMM     se_GMM      t_GMM
      L.h_ln_new_sign  .02175065  .00998581   2.178157
L.h_ln_average_degree  .84766625  .04281257  19.799472
   L.h_ln_partplatact  .02091692  .00829712  2.5209869
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                             b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign   .05619751    .0389294   1.4435749
L.h_ln_average_degree  -.10205633   .13944262  -.73188764
   L.h_ln_partplatact    .9080091   .04738439    19.16262
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                         ln_new_sign  ln_average_degree     ln_partplatact
      ln_new_sign          .30321932
ln_average_degree          .00474992          .00141559
   ln_partplatact           .0213551          .00177589          .02240856

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.2264   1.0000
             |   0.0000
             |
          u3 |   0.2570   0.3129   1.0000
             |   0.0000   0.0000
             |

GMM finished : 17:02:50

Starting Monte-Carlo loop : 17:02:51 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 17:02:57
```

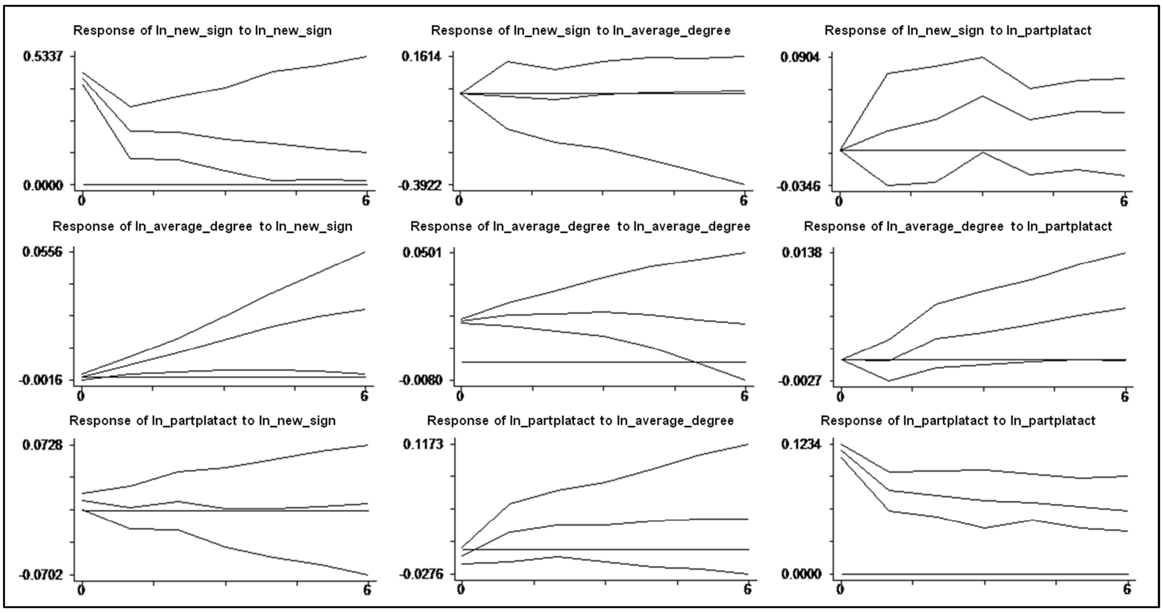
```
. pvar ln_new_sign ln_average_degree ln_partplatact, lag(2) gmm monte 1000
GMM started : 17:06:39
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 475
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign    .6239559   .16618775   3.7545241
 L.h_ln_average_degree   .94281303   1.8180077   .51859683
    L.h_ln_partplatact   .33345815    .1682484   1.9819395
      L2.h_ln_new_sign   .22070888   .09054746   2.4374939
L2.h_ln_average_degree  -.55228465   .95299702  -.57952401
   L2.h_ln_partplatact  -.28879937   .18074033  -1.5978691
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .01317316   .00765543   1.7207598
 L.h_ln_average_degree   1.0846646   .12629984   8.5880124
    L.h_ln_partplatact   .01750684   .01470446   1.1905801
      L2.h_ln_new_sign   .00492168   .00484936   1.0149135
L2.h_ln_average_degree  -.20018918   .10726505  -1.8663039
   L2.h_ln_partplatact  -.00197084   .01681986  -.11717357
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.00171397   .02897398  -.05915563
 L.h_ln_average_degree   .30247395    .4273473   .70779422
    L.h_ln_partplatact   .65080182   .06362876   10.228108
      L2.h_ln_new_sign  -.01234263   .01742741  -.70823063
L2.h_ln_average_degree  -.20813847   .29183446   -.7132073
   L2.h_ln_partplatact   .29459712   .06547115   4.4996475
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                        ln_new_sign  ln_average_degree     ln_partplatact
      ln_new_sign          .22407201
ln_average_degree          .00066839          .00092626
   ln_partplatact          .00672861          .00037746           .0130443

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0456   1.0000
             |   0.3211
             |
          u3 |   0.1248   0.1093   1.0000
             |   0.0065   0.0172
             |

GMM finished : 17:06:40

Starting Monte-Carlo loop : 17:06:41 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 17:06:48
```



```
. pvar ln_new_sign ln_average_degree ln_partplatact, lag(3) gmm monte 1000
GMM started : 17:09:33
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 462
----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .48459053   .14954411   3.2404521
 L.h_ln_average_degree   .75906477   1.9970723   .38008877
    L.h_ln_partplatact   .12336913   .21387411   .57683057
      L2.h_ln_new_sign   .23652168    .0910207   2.5985481
L2.h_ln_average_degree  -1.6305816   .90035494  -1.8110431
   L2.h_ln_partplatact  -.08928771   .20472305  -.43613903
      L3.h_ln_new_sign   .07868172   .06580858   1.1956148
L3.h_ln_average_degree   1.2389969   .57067908   2.1710922
   L3.h_ln_partplatact   .08046716   .14171999   .56778976
----------------------------------------------------------------------------
----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00543369   .00547935   .99166675
 L.h_ln_average_degree   1.0371064   .11013048   9.4170695
    L.h_ln_partplatact   .00788536   .01698007   .46438943
      L2.h_ln_new_sign   .00482623   .00426269   1.1322023
L2.h_ln_average_degree  -.00561828   .10922822   -.0514362
   L2.h_ln_partplatact   .01739914   .01941451   .89619244
      L3.h_ln_new_sign   .00775973    .0029332   2.6454881
L3.h_ln_average_degree  -.13247658   .05194103  -2.5505191
   L3.h_ln_partplatact  -.01418392   .01077543    -1.31632
----------------------------------------------------------------------------
----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.01024805   .03096422  -.33096432
 L.h_ln_average_degree    .3962312   .55245792   .71721517
    L.h_ln_partplatact   .64329963   .08604073   7.4766874
      L2.h_ln_new_sign   .00085125   .01753278   .04855217
L2.h_ln_average_degree   .05476693   .54282892    .1008917
   L2.h_ln_partplatact   .30740744   .10916887   2.8158892
      L3.h_ln_new_sign  -.02572181   .01502194   -1.712283
L3.h_ln_average_degree  -.23577674    .2616871  -.90098727
   L3.h_ln_partplatact   -.0270603   .10978312  -.24648867
----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                        ln_new_sign  ln_average_degree     ln_partplatact
      ln_new_sign          .19339557
ln_average_degree         -.00089055          .00046802
   ln_partplatact          .00672883         -.00013037          .01346186

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0937   1.0000
             |   0.0442
             |
          u3 |   0.1320  -0.0514   1.0000
             |   0.0045   0.2703
             |

GMM finished : 17:09:35

Starting Monte-Carlo loop : 17:09:35 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 17:09:43
```



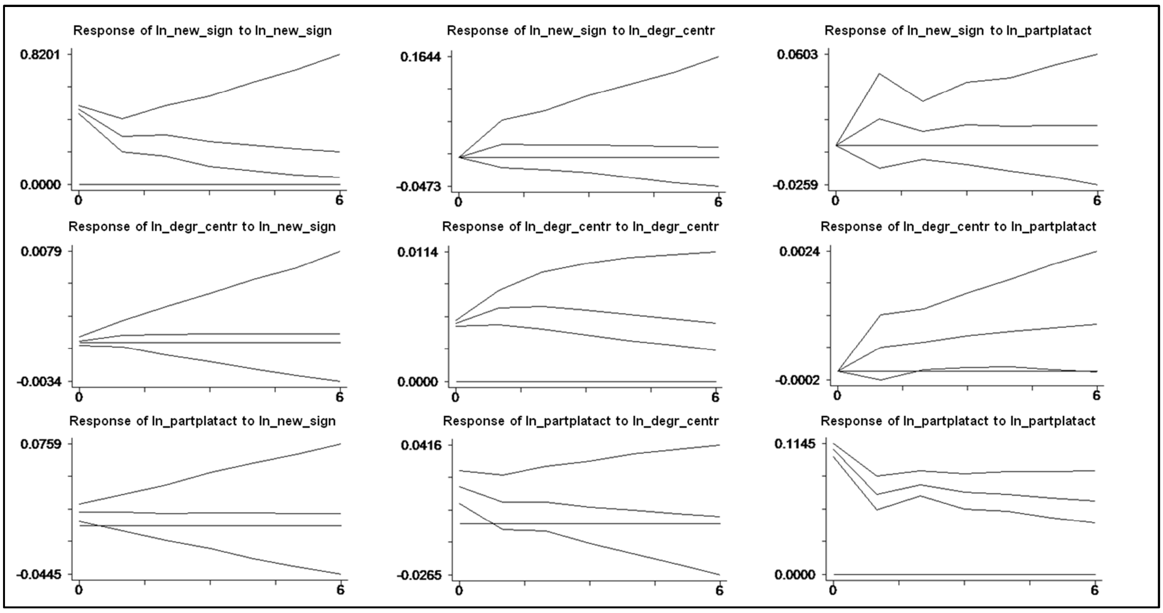
```
. pvar ln_new_sign ln_average_degree ln_partplatact, lag(4) gmm monte 1000
GMM started : 17:12:10
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 449
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .50094132   .15044852   3.3296526
 L.h_ln_average_degree  -.48807808   4.6821233  -.10424289
    L.h_ln_partplatact   .15704461   .27975193   .56137095
      L2.h_ln_new_sign   .24533558   .10236616   2.3966472
L2.h_ln_average_degree  -.66897556   3.2137788  -.20815856
   L2.h_ln_partplatact   .06955052   .22135968   .31419689
      L3.h_ln_new_sign   .07241069   .08086243   .89548001
L3.h_ln_average_degree   1.7272862   1.3697981   1.2609787
   L3.h_ln_partplatact   .14737755   .30788546   .47867656
      L4.h_ln_new_sign   .03599956   .07843215   .45898988
L4.h_ln_average_degree  -.44470765   .97617082  -.45556335
   L4.h_ln_partplatact  -.25243157   .15693574  -1.6085027
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .01208837   .00497004   2.4322491
 L.h_ln_average_degree   1.1397143   .17034096   6.6907826
    L.h_ln_partplatact  -.00065995   .01383212  -.04771165
      L2.h_ln_new_sign   .00363425   .00434035   .83731724
L2.h_ln_average_degree  -.11902593   .14760258  -.80639464
   L2.h_ln_partplatact   .02287524   .02123495   1.0772448
      L3.h_ln_new_sign   .00380554   .00314902   1.2084834
L3.h_ln_average_degree   .01229272   .07721328   .15920477
   L3.h_ln_partplatact   -.0160907   .01772986  -.90754802
      L4.h_ln_new_sign   .00127522   .00327582   .38928244
L4.h_ln_average_degree  -.12599645   .04462685  -2.8233328
   L4.h_ln_partplatact  -.00222902   .00856506  -.26024603
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.00860737   .03037098  -.28340775
 L.h_ln_average_degree   1.2281728   1.0258979   1.1971687
    L.h_ln_partplatact   .67221708   .08917799   7.5379256
      L2.h_ln_new_sign   .00371562   .02005499   .18527156
L2.h_ln_average_degree  -.55550398   .87782425  -.63281913
   L2.h_ln_partplatact   .18315369   .09280688   1.9734926
      L3.h_ln_new_sign  -.03256077   .01587037  -2.0516709
L3.h_ln_average_degree  -.52094851   .48583362  -1.0722776
   L3.h_ln_partplatact   .01793119   .12652942   .14171561
      L4.h_ln_new_sign  -.01253922   .01622076  -.77303558
L4.h_ln_average_degree   .16327449   .31044565   .52593582
   L4.h_ln_partplatact    .0365455   .08855444   .41268967
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                         ln_new_sign  ln_average_degree     ln_partplatact
      ln_new_sign          .19521009
ln_average_degree         -.00002276          .00036403
   ln_partplatact          .00485403         -.00014606          .01396125

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0030   1.0000
             |   0.9501
             |
          u3 |   0.0933  -0.0640   1.0000
             |   0.0482   0.1759
             |

GMM finished : 17:12:11

Starting Monte-Carlo loop : 17:12:13 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 17:12:22
```



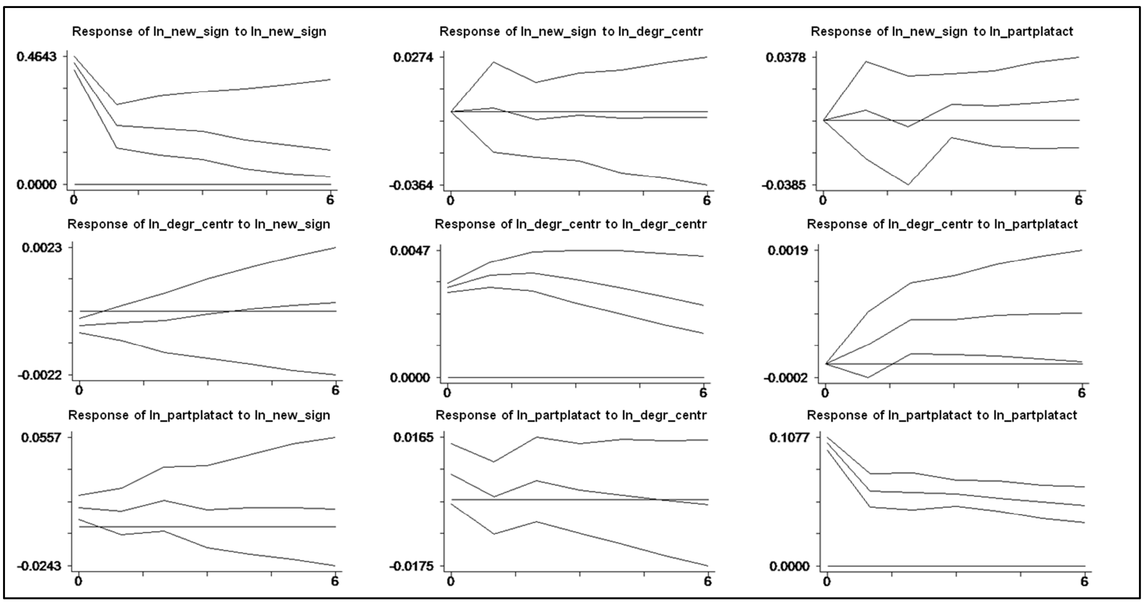
Appendix 69 Estimation Results PVAR(1)-(4) ln_new_signups ln_degree_centralization ln_partplatact; All Regions

```
. pvar ln_new_sign ln_degr_centr ln_partplatact, lag(1) gmm monte 1000
GMM started : 17:15:11
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 487
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                        b_GMM     se_GMM      t_GMM
   L.h_ln_new_sign  .78714576  .14735898  5.3416882
 L.h_ln_degr_centr  2.2967169  2.5516786   .9000808
L.h_ln_partplatact  .05214662  .08895058  .58624261
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                        b_GMM     se_GMM      t_GMM
   L.h_ln_new_sign  .00109298  .00213264  .51250226
 L.h_ln_degr_centr  .87429658  .05135631  17.024133
L.h_ln_partplatact  .00270086  .00147879  1.8263977
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                        b_GMM     se_GMM      t_GMM
   L.h_ln_new_sign  .03279232  .02681571  1.2228773
 L.h_ln_degr_centr  .75188641  .76196086  .98677825
L.h_ln_partplatact  .90988656  .05067912  17.953874
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                   ln_new_sign   ln_degr_centr  ln_partplatact
   ln_new_sign       .27951768
 ln_degr_centr      -.00018734       .00006734
ln_partplatact       .01409085       .00009337       .01532437

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0444   1.0000
             |   0.3279
             |
          u3 |   0.2149   0.0915   1.0000
             |   0.0000   0.0436
             |

GMM finished : 17:15:12

Starting Monte-Carlo loop : 17:15:13 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 17:15:20
```

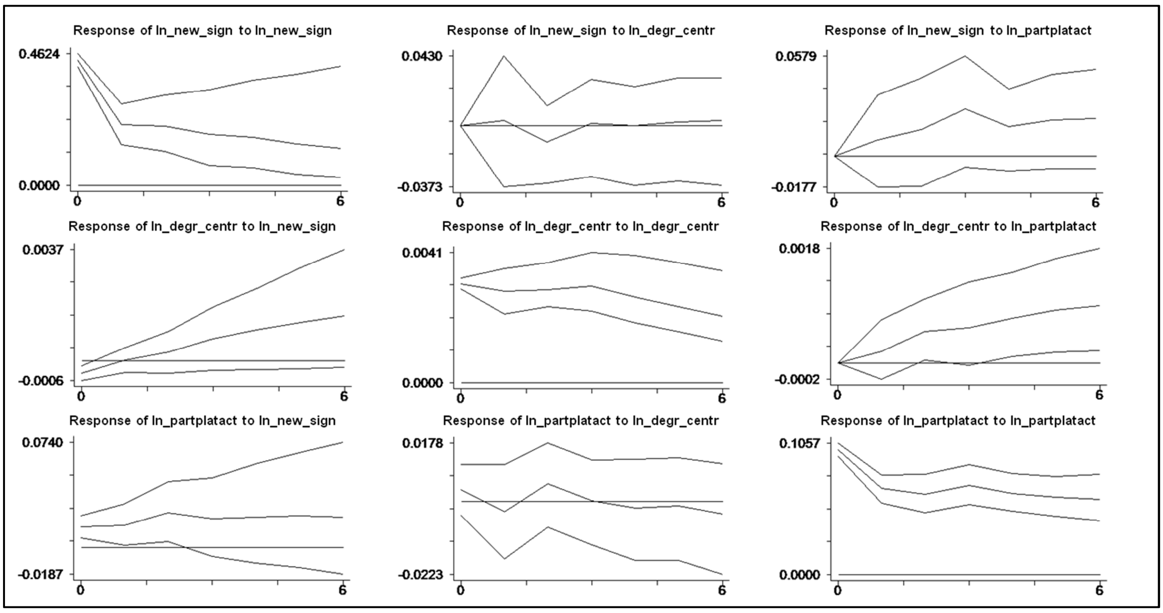
```
. pvar ln_new_sign ln_degr_centr ln_partplatact, lag(2) gmm monte 1000
GMM started : 17:26:34
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 474
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .65369865   .13245589   4.9352178
  L.h_ln_degr_centr   6.6274307   4.0517487   1.6356964
 L.h_ln_partplatact   .14288941    .1760554   .81161617
   L2.h_ln_new_sign   .23552171   .06065925   3.8827006
 L2.h_ln_degr_centr  -6.4465306   3.7089616  -1.7380958
L2.h_ln_partplatact  -.12589009   .18991242  -.66288501
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .00153972   .00222917   .69071151
  L.h_ln_degr_centr   .98927818   .21341224    4.635527
 L.h_ln_partplatact   .00531426   .00390735   1.3600695
   L2.h_ln_new_sign  -.00126643   .00103253  -1.2265325
 L2.h_ln_degr_centr  -.06458905    .1830096  -.35292709
L2.h_ln_partplatact  -.00331101   .00432767  -.76507875
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .01030529   .02200148   .46839095
  L.h_ln_degr_centr   .00892789   1.1880394   .00751481
 L.h_ln_partplatact   .64172452   .08237022   7.7907346
   L2.h_ln_new_sign  -.00740614   .01233549  -.60039285
 L2.h_ln_degr_centr  -.33161363   1.0257135  -.32330044
L2.h_ln_partplatact   .30743838   .07951951   3.8662007
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                ln_new_sign   ln_degr_centr  ln_partplatact
   ln_new_sign        .2215497
 ln_degr_centr      -.00010487       .00005331
ln_partplatact        .0058233       .00008788       .01241314

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0309   1.0000
             |   0.5025
             |
          u3 |   0.1111   0.1081   1.0000
             |   0.0155   0.0186
             |

GMM finished : 17:26:36

Starting Monte-Carlo loop : 17:26:36 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 17:26:44
```



```
. pvar ln_new_sign ln_degr_centr ln_partplatact, lag(3) gmm monte 1000
GMM started : 17:40:19
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 461
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .49578905   .10294034   4.8162756
  L.h_ln_degr_centr   5.7660141   2.9312657   1.9670731
 L.h_ln_partplatact   .01466209   .18158799   .08074371
   L2.h_ln_new_sign   .20746408   .07012996   2.9582802
 L2.h_ln_degr_centr  -10.714381   4.7578803  -2.2519232
L2.h_ln_partplatact  -.09241429   .21670291  -.42645618
   L3.h_ln_new_sign   .11010744   .04189046   2.6284614
 L3.h_ln_degr_centr   4.6186909    2.908436   1.5880325
L3.h_ln_partplatact   .15600897   .18131929    .8604102
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .00112129   .00176353   .63582353
  L.h_ln_degr_centr   .85723922   .19996758    4.286891
 L.h_ln_partplatact   .00534443   .00395031   1.3529139
   L2.h_ln_new_sign  -.00028637   .00102806  -.27855856
 L2.h_ln_degr_centr   .14710979   .19803169   .74285986
L2.h_ln_partplatact   .00185791   .00491129   .37829414
   L3.h_ln_new_sign  -.00040849   .00058291  -.70078912
 L3.h_ln_degr_centr  -.09472354   .05648926  -1.6768415
L3.h_ln_partplatact  -.00518676   .00253041  -2.0497676
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .00325548   .01990911   .16351733
  L.h_ln_degr_centr  -.10797039   .96393648  -.11200986
 L.h_ln_partplatact    .6039343   .07750045   7.7926556
   L2.h_ln_new_sign   .01638837   .01240544   1.3210632
 L2.h_ln_degr_centr   .49741077   1.1911036   .41760494
L2.h_ln_partplatact   .22993289    .0912472   2.5198899
   L3.h_ln_new_sign  -.01656294   .00995726   -1.663404
 L3.h_ln_degr_centr  -.86746725   1.0153825  -.85432559
L3.h_ln_partplatact   .08952139    .1052514   .85054827
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                ln_new_sign   ln_degr_centr  ln_partplatact
   ln_new_sign      .18988867
 ln_degr_centr     -.00033443       .00003599
ln_partplatact      .00531484       4.273e-06       .01081617

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1279   1.0000
             |   0.0059
             |
          u3 |   0.1173   0.0069   1.0000
             |   0.0117   0.8827
             |

GMM finished : 17:40:20

Starting Monte-Carlo loop : 17:40:21 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 17:40:29
```



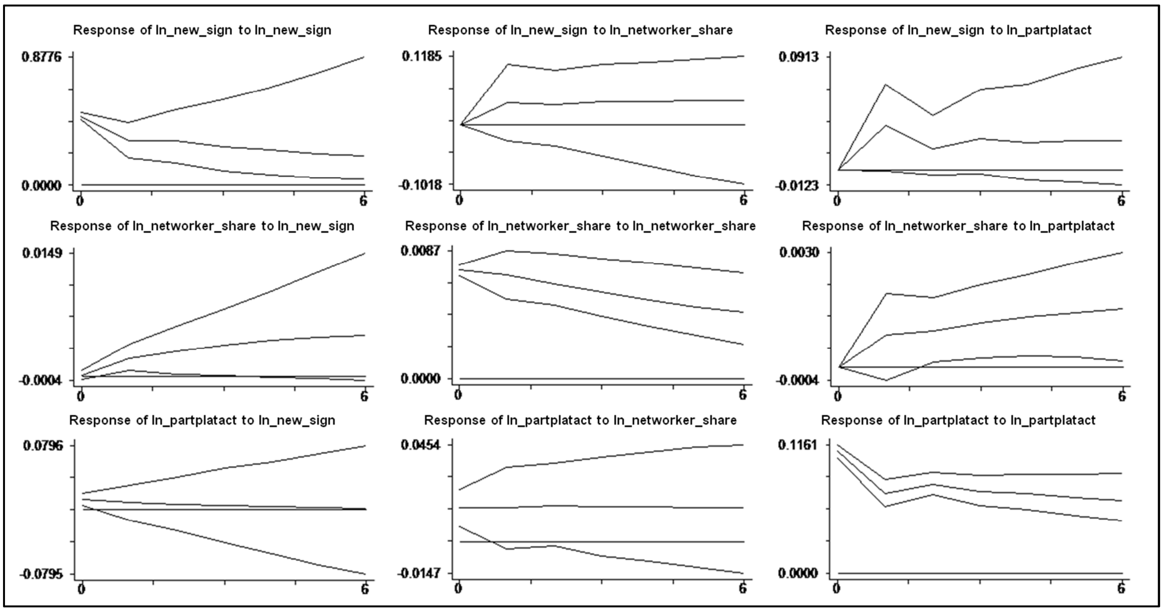
```
. pvar ln_new_sign ln_degr_centr ln_partplatact, lag(4) gmm monte 1000
GMM started : 17:48:44
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 448
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .50325518   .09745655   5.1638929
  L.h_ln_degr_centr   7.5934499     3.74796   2.0260221
 L.h_ln_partplatact   .08573191   .17096907    .5014469
   L2.h_ln_new_sign   .20857834   .07698321   2.7094004
 L2.h_ln_degr_centr  -13.338453   4.2641427  -3.1280504
L2.h_ln_partplatact   .03261889   .22096509    .1476201
   L3.h_ln_new_sign   .06958947   .05973237   1.1650211
 L3.h_ln_degr_centr   5.7687345    3.390663   1.7013588
L3.h_ln_partplatact   .09130116    .2118672    .4309358
   L4.h_ln_new_sign   .03554975    .0428536   .82956281
 L4.h_ln_degr_centr   1.1911449   2.2426656   .53112908
L4.h_ln_partplatact  -.13918699   .17708931  -.78597056
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .00149756   .00170989   .87581912
  L.h_ln_degr_centr   .66422719   .21491833   3.0906029
 L.h_ln_partplatact   .00261491   .00311409   .83970321
   L2.h_ln_new_sign   .00015694   .00096069   .16336003
 L2.h_ln_degr_centr    .2947795   .22505562   1.3098074
L2.h_ln_partplatact   .00319263   .00387272   .82439077
   L3.h_ln_new_sign  -.00009442   .00062138  -.15194599
 L3.h_ln_degr_centr   .05693636   .08649364   .65827219
L3.h_ln_partplatact  -.00174446   .00270897  -.64395824
   L4.h_ln_new_sign  -.00015148   .00046437  -.32620792
 L4.h_ln_degr_centr  -.14731711   .06121232   -2.406658
L4.h_ln_partplatact  -.00176779   .00234484  -.75390699
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .01132713   .01926932    .5878324
  L.h_ln_degr_centr   .12014209   1.1287954    .1064339
 L.h_ln_partplatact   .68269915   .06951029   9.8215547
   L2.h_ln_new_sign   .02312134   .01280561   1.8055635
 L2.h_ln_degr_centr    .5564076   1.1367898   .48945512
L2.h_ln_partplatact   .17756119    .0818944   2.1681725
   L3.h_ln_new_sign  -.02278469   .01148688  -1.9835408
 L3.h_ln_degr_centr  -1.2238367   1.1318642  -1.0812575
L3.h_ln_partplatact   .15076356   .11359583   1.3271927
   L4.h_ln_new_sign  -.00191479   .00750917  -.25499372
 L4.h_ln_degr_centr   -.0266352   .82556132  -.03226314
L4.h_ln_partplatact   -.0663821   .06031584  -1.1005748
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                 ln_new_sign   ln_degr_centr  ln_partplatact
   ln_new_sign       .18982148
 ln_degr_centr      -.00025641       .00003128
ln_partplatact        .0065469      -3.002e-06       .01042921

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1053   1.0000
             |   0.0259
             |
          u3 |   0.1472  -0.0052   1.0000
             |   0.0018   0.9120
             |

GMM finished : 17:48:46

Starting Monte-Carlo loop : 17:48:48 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 17:48:58
```



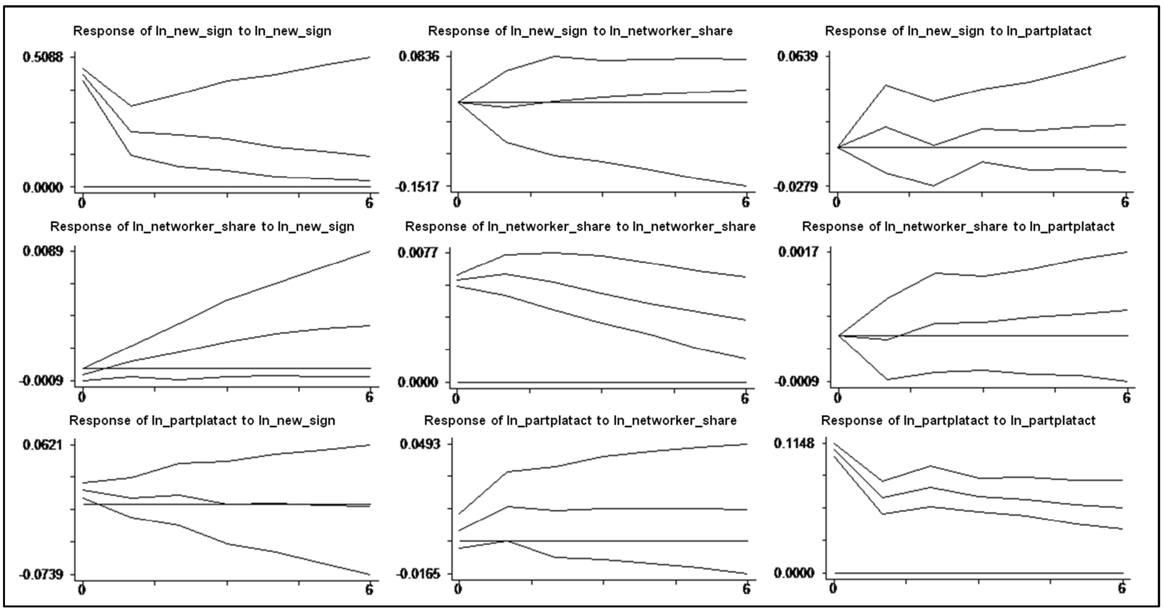
Appendix 70 Estimation Results PVAR(1)-(4) ln_new_signups ln_networker_share ln_partplatact; All Regions

```
. pvar ln_new_sign ln_networker_share ln_partplatact, lag(1) gmm monte 1000
GMM started : 17:56:42
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 488
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  .82645125  .18303725   4.515208
L.h_ln_networker_share  2.3954182  2.0268041  1.1818696
    L.h_ln_partplatact  .05233474   .0929927  .56278338
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                            b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  .00479071  .00247019  1.9394063
L.h_ln_networker_share   .8085819  .04260695  18.977702
    L.h_ln_partplatact  .00314068  .00266534  1.1783431
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                             b_GMM       se_GMM        t_GMM
       L.h_ln_new_sign   .05301605   .03672144   1.4437356
L.h_ln_networker_share  -.00536895   .49586102  -.01082752
    L.h_ln_partplatact   .91437009   .04951518    18.46646
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                       ln_new_sign  ln_networker_share      ln_partplatact
       ln_new_sign       .30647672
ln_networker_share       .00073554            .0001053
    ln_partplatact       .02252687           .00026775           .02279412

Residuals correlation matrix

             |       u1       u2       u3
_____________|___________________________
          u1 |   1.0000
             |
             |
          u2 |   0.1269   1.0000
             |   0.0050
             |
          u3 |   0.2675   0.1705   1.0000
             |   0.0000   0.0002
             |

GMM finished : 17:56:43

Starting Monte-Carlo loop : 17:56:44 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 17:56:50
```

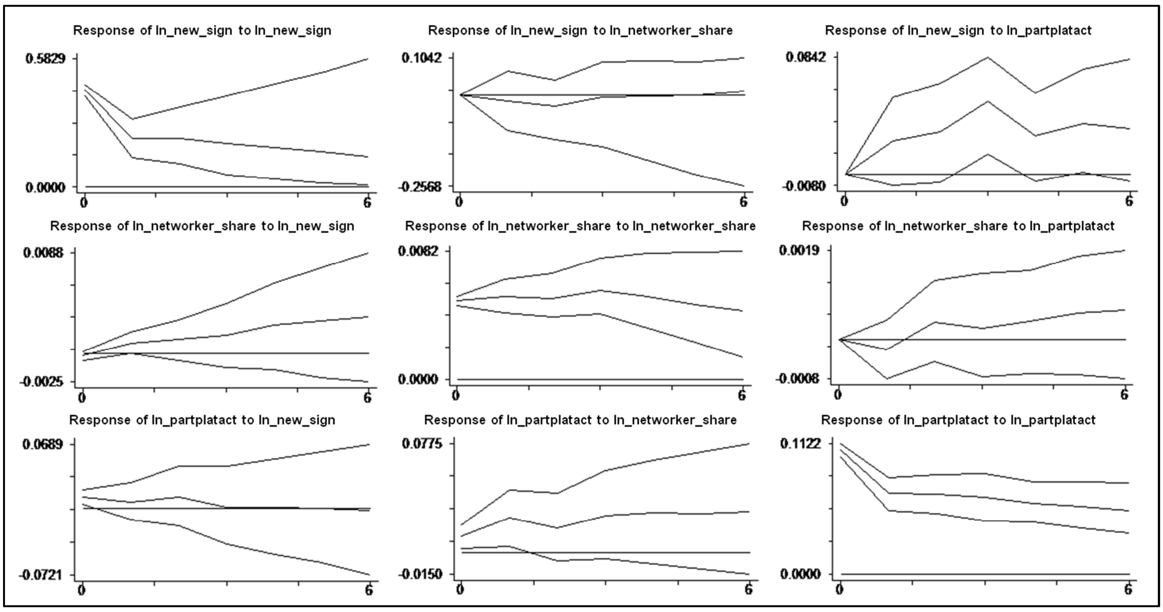
```
. pvar ln_new_sign ln_networker_share ln_partplatact, lag(2) gmm monte 1000
GMM started : 18:00:38
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 475
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .62725218   .15223641   4.1202506
 L.h_ln_networker_share   4.6240144   5.6416256   .81962446
     L.h_ln_partplatact   .32232461   .18946703   1.7012174
       L2.h_ln_new_sign   .22114736   .07664856    2.885212
L2.h_ln_networker_share  -3.0180067   3.2332065  -.93344074
    L2.h_ln_partplatact  -.29321136     .197454  -1.4849603
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                             b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .00416722   .00195357   2.1331295
 L.h_ln_networker_share   .94356155   .13771814   6.8513963
     L.h_ln_partplatact   .00746708   .00624538   1.1956167
       L2.h_ln_new_sign  -.00066673   .00128616  -.51839085
L2.h_ln_networker_share  -.05774867   .12070075  -.47844497
    L2.h_ln_partplatact  -.00468626   .00698155  -.67123514
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                             b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .00171912   .02807545   .06123196
 L.h_ln_networker_share   .78060082   1.5434458   .50575201
     L.h_ln_partplatact   .65206158    .0645503   10.101605
       L2.h_ln_new_sign  -.01128988   .01534721   -.7356306
L2.h_ln_networker_share  -.54710429   1.1551786  -.47361012
    L2.h_ln_partplatact   .29359716    .0665415   4.4122414
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                          ln_new_sign  ln_networker_share      ln_partplatact
       ln_new_sign           .2247753
ln_networker_share          .00008816           .00005409
    ln_partplatact          .00617844           .00011936           .01265057

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0244   1.0000
             |   0.5953
             |
          u3 |   0.1162   0.1450   1.0000
             |   0.0113   0.0015
             |

GMM finished : 18:00:40

Starting Monte-Carlo loop : 18:00:40 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 18:00:48
```



```
. pvar ln_new_sign ln_networker_share ln_partplatact, lag(3) gmm monte 1000
GMM started : 18:05:12
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 462
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .48436737   .12675892     3.82117
 L.h_ln_networker_share  -1.6156114   6.4302174    -.251253
     L.h_ln_partplatact   .13205256   .16786011   .78668219
       L2.h_ln_new_sign    .2315141   .08969164   2.5812227
L2.h_ln_networker_share   2.6703898    5.645187   .47303833
    L2.h_ln_partplatact  -.13778351   .19078041  -.72220995
       L3.h_ln_new_sign   .08637125   .05274437   1.6375442
L3.h_ln_networker_share   .36846531     3.65635   .10077408
    L3.h_ln_partplatact   .07911776   .12677857   .62406258
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                             b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .00238239   .00144092   1.6533848
 L.h_ln_networker_share   1.0623608   .11272914   9.4240122
     L.h_ln_partplatact  -.00080845   .00463244  -.17451893
       L2.h_ln_new_sign   .00006934   .00113455   .06111431
L2.h_ln_networker_share  -.14827844   .12727943  -1.1649835
    L2.h_ln_partplatact   .00331225   .00802946   .41251245
       L3.h_ln_new_sign   .00075093   .00067487    1.112695
L3.h_ln_networker_share  -.01452607   .07192437  -.20196311
    L3.h_ln_partplatact  -.00156729   .00444296  -.35275813
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                             b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign  -.00354816   .02724879  -.13021349
 L.h_ln_networker_share   2.4185237   1.7319991    1.396377
     L.h_ln_partplatact    .6066478   .08024771   7.5596895
       L2.h_ln_new_sign   .00022812    .0167369   .01362951
L2.h_ln_networker_share  -2.0734869   1.6622837  -1.2473725
    L2.h_ln_partplatact   .32187054   .10115135   3.1820687
       L3.h_ln_new_sign  -.01995921   .01083818  -1.8415644
L3.h_ln_networker_share   .14379529   .95439762   .15066601
    L3.h_ln_partplatact  -.00540801    .1036099  -.05219588
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                        ln_new_sign  ln_networker_share      ln_partplatact
       ln_new_sign        .19493753
ln_networker_share       -.00020351           .00003688
    ln_partplatact        .00622668           .00002324           .01217473

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0760   1.0000
             |   0.1030
             |
          u3 |   0.1279   0.0353   1.0000
             |   0.0059   0.4495
             |

GMM finished : 18:05:14

Starting Monte-Carlo loop : 18:05:14 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 18:05:23
```



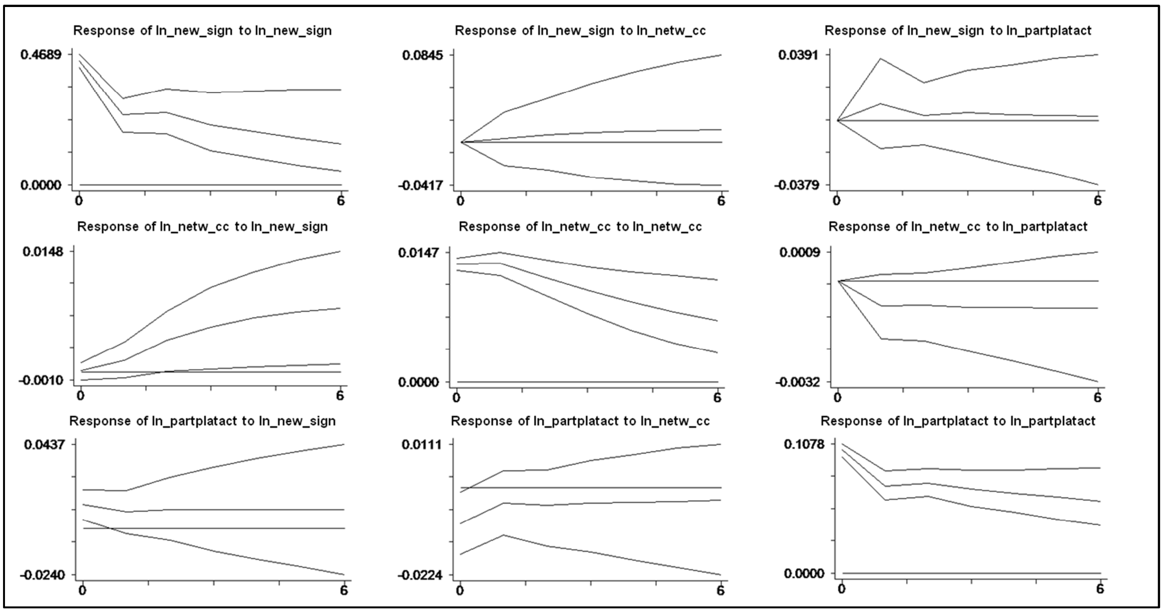
```
. pvar ln_new_sign ln_networker_share ln_partplatact, lag(4) gmm monte 1000
GMM started : 18:13:42
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 449
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                               b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .49042256    .1246872   3.9332229
 L.h_ln_networker_share  -3.9217306   10.321132  -.37997098
     L.h_ln_partplatact   .22481556   .18180154   1.2365987
       L2.h_ln_new_sign   .26014884   .09688746   2.6850622
L2.h_ln_networker_share  -1.7562823   8.1980548  -.21423159
    L2.h_ln_partplatact   .01963647   .21259392    .0923661
       L3.h_ln_new_sign    .0832158   .06939426   1.1991741
L3.h_ln_networker_share   7.5938485   4.2533342   1.7853872
    L3.h_ln_partplatact   .14390087   .23596818    .6098317
       L4.h_ln_new_sign    .0245732   .04653761   .52802885
L4.h_ln_networker_share  -1.2014385   2.3200516  -.51784988
    L4.h_ln_partplatact  -.28729836   .16508636  -1.7402913
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                               b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .00265089   .00109144   2.4287922
 L.h_ln_networker_share   1.0588241   .12008969   8.8169445
     L.h_ln_partplatact   -.0019889   .00347786  -.57187472
       L2.h_ln_new_sign  -.00085846   .00105564   -.8132093
L2.h_ln_networker_share   -.0828647   .16643773  -.49787208
    L2.h_ln_partplatact    .0062047   .00663079   .93573984
       L3.h_ln_new_sign   .00013826   .00075062   .18420013
L3.h_ln_networker_share   .13726388   .12595273   1.0898047
    L3.h_ln_partplatact  -.00486194   .00475101  -1.0233495
       L4.h_ln_new_sign    .0005407   .00081228   .66565538
L4.h_ln_networker_share  -.20113895   .06261073  -3.2125317
    L4.h_ln_partplatact   .00112947   .00297435   .37973583
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                               b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   1.792e-06   .02558058   .00007005
 L.h_ln_networker_share   3.5190622   2.3210541   1.5161483
     L.h_ln_partplatact   .65233478   .07999411   8.1547854
       L2.h_ln_new_sign   .00310186   .01753183   .17692743
L2.h_ln_networker_share  -3.9898666   2.1725819  -1.8364631
    L2.h_ln_partplatact   .22069915   .08697441   2.5375181
       L3.h_ln_new_sign  -.02246577   .01322135   -1.699204
L3.h_ln_networker_share   2.3306225   1.2158787   1.9168215
    L3.h_ln_partplatact   .03261161   .10681523   .30530861
       L4.h_ln_new_sign  -.00468397   .00969453  -.48315589
L4.h_ln_networker_share  -1.1171474   .73935711  -1.5109713
    L4.h_ln_partplatact    .0194817   .07461877   .26108304
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                      ln_new_sign  ln_networker_share      ln_partplatact
       ln_new_sign      .19350175
ln_networker_share     -.00011369           .00002495
    ln_partplatact      .00509972           .00005494           .01165023

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0519   1.0000
             |   0.2725
             |
          u3 |   0.1077   0.1023   1.0000
             |   0.0224   0.0302
             |

GMM finished : 18:13:44

Starting Monte-Carlo loop : 18:13:45 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 18:13:54
```



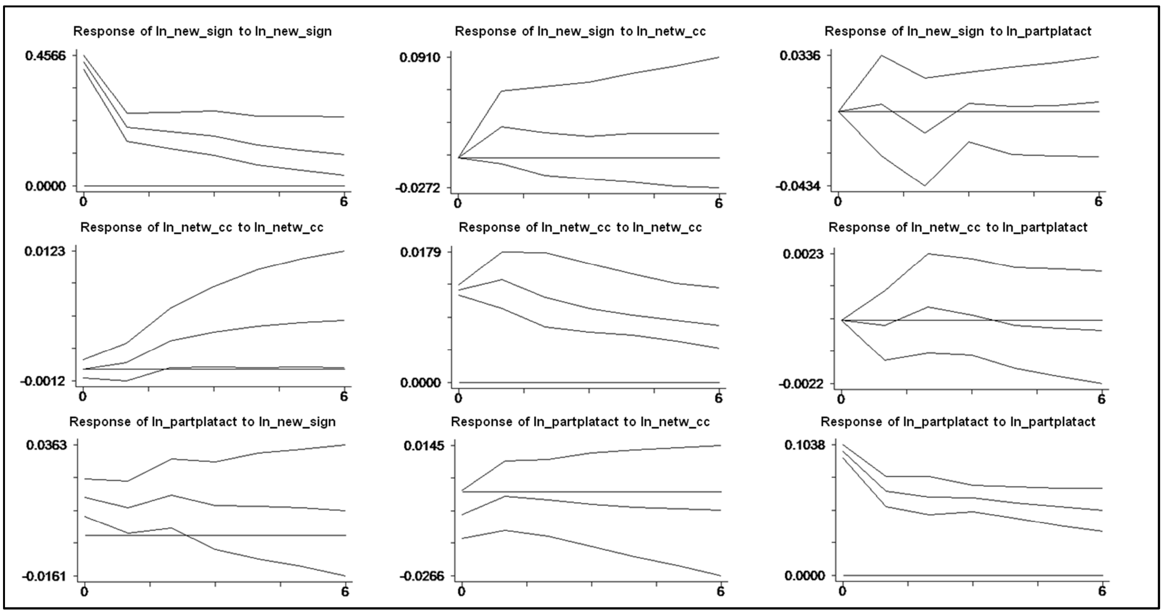
Appendix 71 Estimation Results PVAR(1)-(4) ln_new_signups ln_network_cc ln_partplatact; All Regions

```
. pvar ln_new_sign ln_netw_cc ln_partplatact, lag(1) gmm monte 1000
GMM started : 18:17:29
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 475
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                        b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign  .78598881  .11002601  7.1436634
    L.h_ln_netw_cc   .2516893  .81432228  .30907824
L.h_ln_partplatact  .01394616  .09173177  .15203198
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                         b_GMM       se_GMM        t_GMM
   L.h_ln_new_sign   .01896163   .00781154   2.4273858
    L.h_ln_netw_cc   .79932523   .06182275   12.929306
L.h_ln_partplatact  -.00151991   .00668838  -.22724627
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                        b_GMM      se_GMM       t_GMM
   L.h_ln_new_sign  .01578058  .01851201  .85245074
    L.h_ln_netw_cc  .06030255  .16749009  .36003655
L.h_ln_partplatact  .92668882  .04653794  19.912545
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                   ln_new_sign      ln_netw_cc  ln_partplatact
   ln_new_sign       .25127805
    ln_netw_cc       .00308389        .0011587
ln_partplatact       .00980544       .00047574       .01223844

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1795   1.0000
             |   0.0001
             |
          u3 |   0.1768   0.1265   1.0000
             |   0.0001   0.0058
             |

GMM finished : 18:17:31

Starting Monte-Carlo loop : 18:17:32 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 18:17:38
```

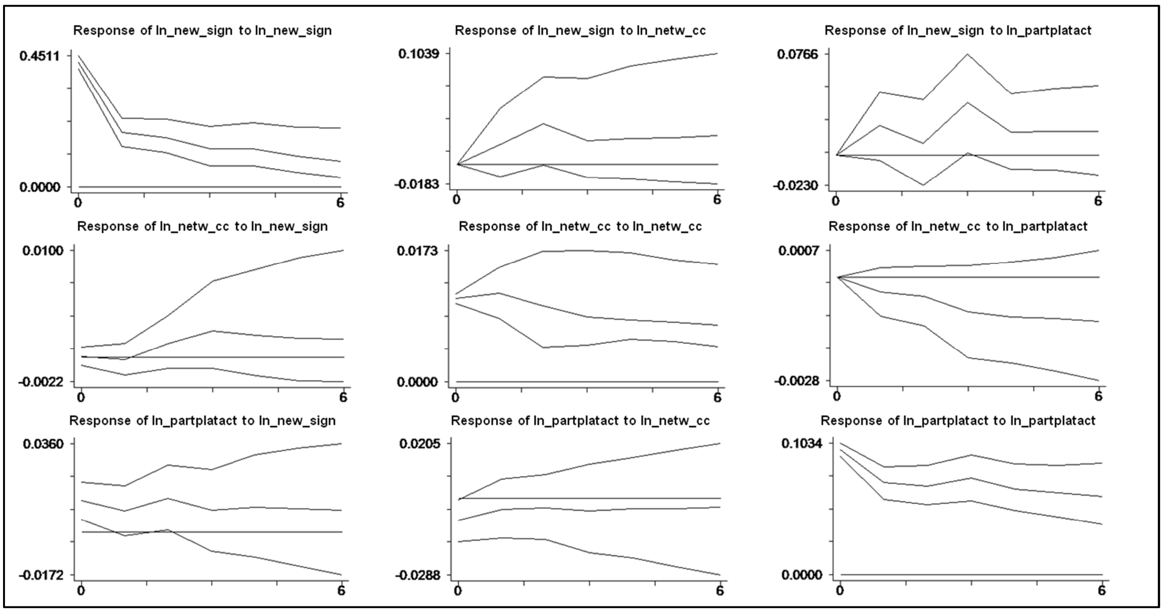
```
. pvar ln_new_sign ln_netw_cc ln_partplatact, lag(2) gmm monte 1000
GMM started : 18:25:21
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 462
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .56800459   .08269895   6.8683407
     L.h_ln_netw_cc   .24813808   1.0919986   .22723296
 L.h_ln_partplatact   .09655555   .15997051   .60358345
   L2.h_ln_new_sign   .26720302   .05758073   4.6404937
    L2.h_ln_netw_cc   .02508435   .70446946   .03560743
L2.h_ln_partplatact  -.08732431   .16589291  -.52638962
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .00452868   .00290684   1.5579391
     L.h_ln_netw_cc   .92355368   .09462987   9.7596423
 L.h_ln_partplatact  -.00751279   .00682608  -1.1006013
   L2.h_ln_new_sign     .004005   .00197659   2.0262205
    L2.h_ln_netw_cc  -.05267518   .07277843  -.72377459
L2.h_ln_partplatact   .00492262   .00601051     .819001
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign  -.00035327   .01296193   -.0272548
     L.h_ln_netw_cc   .17003431   .26426886   .64341408
 L.h_ln_partplatact   .70985832   .07030286   10.097147
   L2.h_ln_new_sign   .00148456   .01123713   .13211171
    L2.h_ln_netw_cc  -.14278342    .2464488  -.57936344
L2.h_ln_partplatact   .22841487   .06758703   3.3795665
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                   ln_new_sign      ln_netw_cc  ln_partplatact
   ln_new_sign       .19940321
    ln_netw_cc       .00030244        .0003272
ln_partplatact       .00559799      -.00010092       .01078663

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |  1.0000
             |
             |
          u2 |  0.0373   1.0000
             |  0.4239
             |
          u3 |  0.1208  -0.0534   1.0000
             |  0.0093   0.2522
             |

GMM finished : 18:25:23

Starting Monte-Carlo loop : 18:25:23 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 18:25:31
```



```
. pvar ln_new_sign ln_netw_cc ln_partplatact, lag(3) gmm monte 1000
GMM started : 18:31:30
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 449
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .47169289   .06762868   6.9747467
     L.h_ln_netw_cc   1.2102875   1.4056158   .86103725
 L.h_ln_partplatact   .04092419    .1727335   .23692098
   L2.h_ln_new_sign   .22159871   .05595075   3.9606031
    L2.h_ln_netw_cc  -1.1817262   1.2050209  -.98066862
L2.h_ln_partplatact   -.1731647   .20179265  -.85813187
   L3.h_ln_new_sign   .07954388   .04720549   1.6850557
    L3.h_ln_netw_cc   .56473135   .70067247   .80598478
L3.h_ln_partplatact   .17304714   .16168648   1.0702635
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign    .0026841   .00238913   1.1234658
     L.h_ln_netw_cc   .78321275   .22293633   3.5131678
 L.h_ln_partplatact  -.00655783   .00866258  -.75702947
   L2.h_ln_new_sign    .0044972    .0021189   2.1224217
    L2.h_ln_netw_cc   .01439433   .20608645   .06984606
L2.h_ln_partplatact   .00830232   .00726067   1.1434653
   L3.h_ln_new_sign   .00071149   .00178455   .39869556
    L3.h_ln_netw_cc     .073612   .07980633   .92238291
L3.h_ln_partplatact  -.00488773   .00534134   -.9150753
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                          b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .00203787    .0124032    .1643017
     L.h_ln_netw_cc   .12859623   .27044418   .47550009
 L.h_ln_partplatact    .6776098   .06749631   10.039213
   L2.h_ln_new_sign   .01293285   .01121372   1.1533059
    L2.h_ln_netw_cc  -.18140383   .19374338  -.93630985
L2.h_ln_partplatact   .16845252   .09022647   1.8669968
   L3.h_ln_new_sign  -.01290232   .00831331  -1.5520078
    L3.h_ln_netw_cc  -.04791752   .13574383  -.35299964
L3.h_ln_partplatact   .08105484   .10200257   .79463528
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                   ln_new_sign      ln_netw_cc  ln_partplatact
   ln_new_sign       .18784736
    ln_netw_cc       .00025583        .0003047
ln_partplatact       .00666171      -.00007041       .01005136

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0339   1.0000
             |   0.4742
             |
          u3 |   0.1533  -0.0399   1.0000
             |   0.0011   0.3991
             |

GMM finished : 18:31:31

Starting Monte-Carlo loop : 18:31:31 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 18:31:40
```



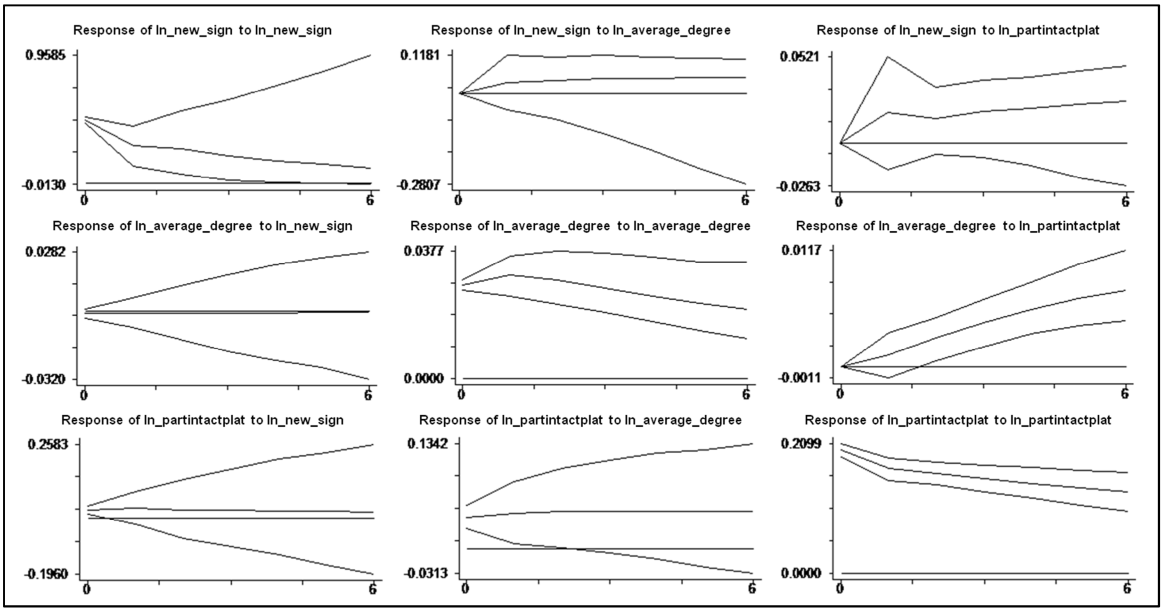
```
. pvar ln_new_sign ln_netw_cc ln_partplatact, lag(4) gmm monte 1000
GMM started : 18:39:35
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 436
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                         b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .43586386   .06695642   6.5096644
     L.h_ln_netw_cc     1.22762   1.5132032    .8112724
 L.h_ln_partplatact    .2268725   .14953043   1.5172329
   L2.h_ln_new_sign   .20792758   .05994373   3.4687129
    L2.h_ln_netw_cc   -.9884185    1.572609  -.62852148
L2.h_ln_partplatact  -.20227845   .19724955  -1.0254951
   L3.h_ln_new_sign   .03198567   .05539614   .57739894
    L3.h_ln_netw_cc   .54583513     1.51681   .35985727
L3.h_ln_partplatact   .30172355   .21436973   1.4074914
   L4.h_ln_new_sign   .07252535   .04141632   1.7511297
    L4.h_ln_netw_cc   .03114658   .52540685   .05928088
L4.h_ln_partplatact  -.26362131   .18428566  -1.4305037
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                         b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign   .00050965   .00199312   .25570609
     L.h_ln_netw_cc   .75289883   .23232706   3.2406851
 L.h_ln_partplatact  -.00841482   .00563003  -1.4946318
   L2.h_ln_new_sign   .00458188   .00213482   2.1462627
    L2.h_ln_netw_cc   .08099484   .16067082   .50410425
L2.h_ln_partplatact   .00396127   .00774547   .51143078
   L3.h_ln_new_sign   .00332423   .00248814   1.3360291
    L3.h_ln_netw_cc  -.01569242   .12425233  -.12629474
L3.h_ln_partplatact  -.00134921   .00530303  -.25442318
   L4.h_ln_new_sign  -.00424739   .00219004   -1.939415
    L4.h_ln_netw_cc   .08502987   .06554787    1.297218
L4.h_ln_partplatact   .00089088   .00459876   .19372279
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partplatact

                         b_GMM      se_GMM       t_GMM
    L.h_ln_new_sign  -.00182711   .01218884  -.14990021
     L.h_ln_netw_cc   .09987722   .29145345   .34268668
 L.h_ln_partplatact    .7346608   .07070667   10.390262
   L2.h_ln_new_sign   .01339715   .01130049   1.1855373
    L2.h_ln_netw_cc  -.05275639   .20899153  -.25243315
L2.h_ln_partplatact   .16623224   .08975202   1.8521282
   L3.h_ln_new_sign  -.01562029   .00932299  -1.6754588
    L3.h_ln_netw_cc  -.06380371   .16359562   -.3900087
L3.h_ln_partplatact    .1307804   .12288878   1.0642176
   L4.h_ln_new_sign   .00499998   .00806342   .62008184
    L4.h_ln_netw_cc   .02611383   .12155748   .21482705
L4.h_ln_partplatact  -.09597165   .06514764  -1.4731409
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                   ln_new_sign      ln_netw_cc  ln_partplatact
   ln_new_sign       .18465264
    ln_netw_cc       .00035283       .00025592
ln_partplatact        .0056404      -.00007391       .00990336

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0514   1.0000
             |   0.2842
             |
          u3 |   0.1319  -0.0461   1.0000
             |   0.0058   0.3367
             |

GMM finished : 18:39:37

Starting Monte-Carlo loop : 18:39:38 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 18:39:47
```



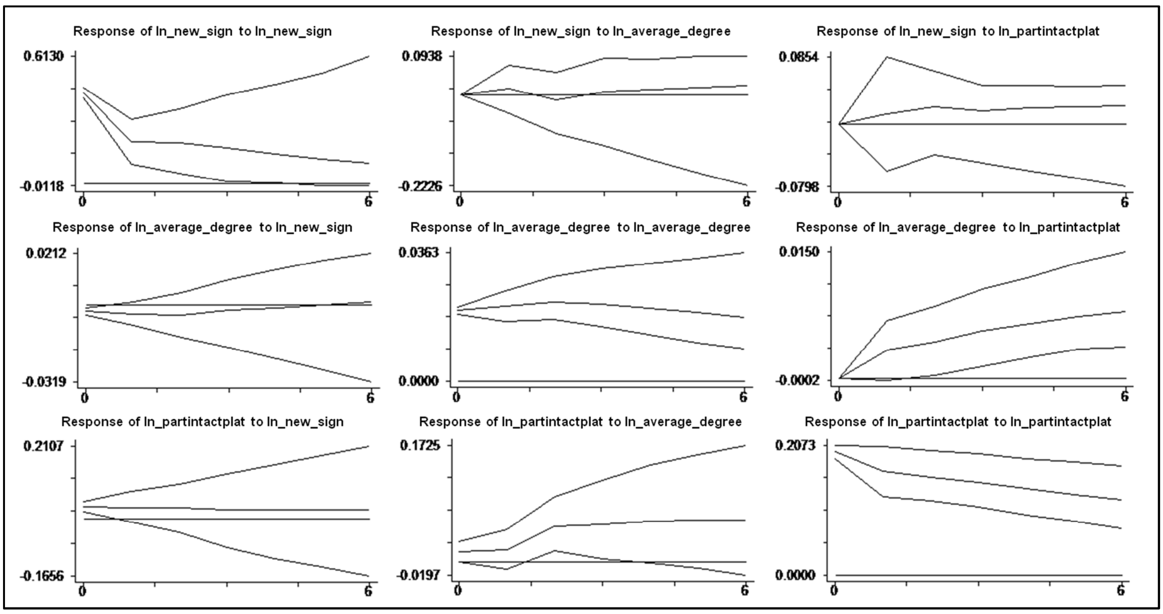
Appendix 72 Estimation Results PVAR(1)-(4) ln_new_signups ln_average_degree ln_partintactplat; All Regions

```
. pvar ln_new_sign ln_average_degree ln_partintactplat, lag(1) gmm monte 1000
GMM started : 07:44:27
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 488
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                         b_GMM     se_GMM      t_GMM
      L.h_ln_new_sign  .72707247  .23219063    3.13136
L.h_ln_average_degree  .57875145  .77820555  .74369998
L.h_ln_partintactplat  .05133002  .03702788  1.3862535
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                         b_GMM     se_GMM      t_GMM
      L.h_ln_new_sign  .00426038  .01034391  .41187376
L.h_ln_average_degree  .87221359  .03947212  22.096955
L.h_ln_partintactplat  .01034163  .00286838  3.6053972
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                          b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign   .07774444   .08697214   .89390049
L.h_ln_average_degree  -.04557478   .27887961  -.16342098
L.h_ln_partintactplat    .9234877   .02356393   39.190734
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                        ln_new_sign  ln_average_degree  ln_partintactplat
      ln_new_sign          .28067595
ln_average_degree          .00161722          .00103081
ln_partintactplat          .03333606           .0017567          .09190784

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0940   1.0000
             |   0.0380
             |
          u3 |   0.2063   0.1795   1.0000
             |   0.0000   0.0001
             |

GMM finished : 07:44:29

Starting Monte-Carlo loop : 07:44:30 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 07:44:37
```

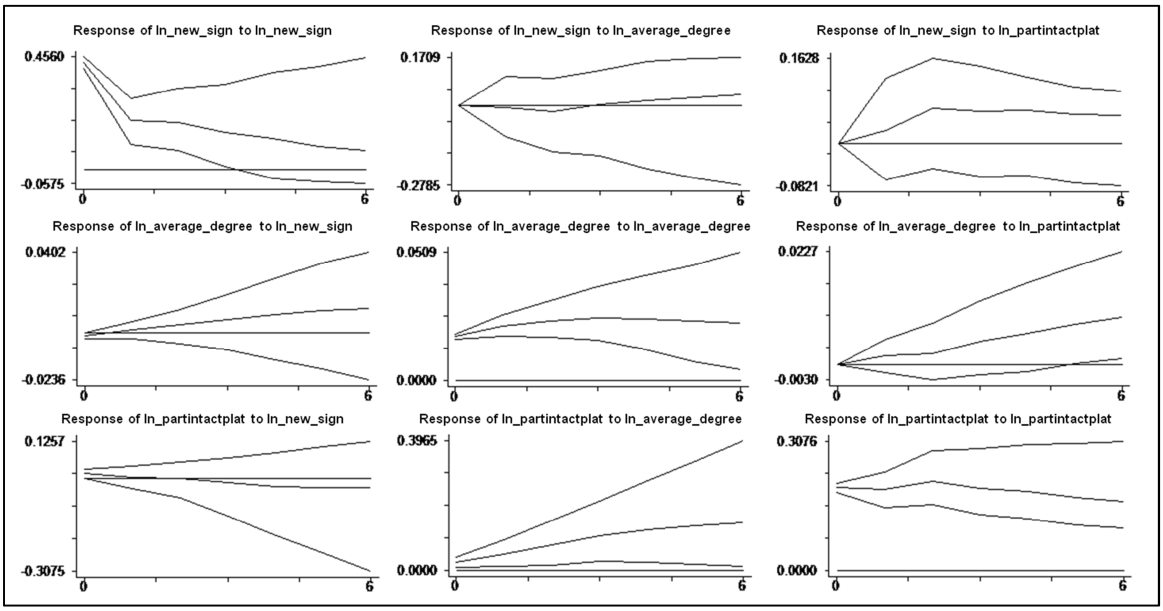
```
. pvar ln_new_sign ln_average_degree ln_partintactplat, lag(2) gmm monte 1000
GMM started : 07:50:21
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 475
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .58547815    .1884214   3.1072806
 L.h_ln_average_degree   1.1052107   1.7798101   .62097116
 L.h_ln_partintactplat   .08992268   .10435794   .86167549
      L2.h_ln_new_sign   .19415979   .09793238   1.9825903
L2.h_ln_average_degree    -.591432   .92147909    -.641829
L2.h_ln_partintactplat  -.06192005   .09801375  -.63174862
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00010718   .00813784   .01317104
 L.h_ln_average_degree   1.1009398   .13110636   8.3973032
 L.h_ln_partintactplat     .005948   .00684053   .86952329
      L2.h_ln_new_sign  -.00097705   .00489433   -.1996293
L2.h_ln_average_degree  -.18533247   .11517133  -1.6091893
L2.h_ln_partintactplat   .00303522    .0074786   .40585426
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .02152083   .07395598   .29099511
 L.h_ln_average_degree   .37494854   .77872636   .48148946
 L.h_ln_partintactplat   .84766272   .05009206   16.922098
      L2.h_ln_new_sign  -.01807409   .03568814   -.5064452
L2.h_ln_average_degree  -.23633935   .54122114  -.43667798
L2.h_ln_partintactplat   .08891088   .04178457     2.12784
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                         ln_new_sign  ln_average_degree  ln_partintactplat
      ln_new_sign          .22043046
ln_average_degree         -.00039397          .00076233
ln_partintactplat          .01346027          .00109475          .04234862

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0305   1.0000
             |   0.5078
             |
          u3 |   0.1395   0.1928   1.0000
             |   0.0023   0.0000
             |

GMM finished : 07:50:23

Starting Monte-Carlo loop : 07:50:24 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 07:50:31
```



```
. pvar ln_new_sign ln_average_degree ln_partintactplat, lag(3) gmm monte 1000
GMM started : 07:52:21
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 462
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .46021891   .15774062   2.9175676
 L.h_ln_average_degree   .62661225    1.674675   .37416947
 L.h_ln_partintactplat    .0616609   .22630002   .27247413
      L2.h_ln_new_sign   .22149947   .09265497   2.3905839
L2.h_ln_average_degree  -1.6303731   .78915697  -2.0659681
L2.h_ln_partintactplat   .02050095   .18838856   .10882267
      L3.h_ln_new_sign   .08165936   .06404315   1.2750679
L3.h_ln_average_degree   1.3716468   .58750954     2.33468
L3.h_ln_partintactplat  -.03374224   .08905261  -.37890239
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.00317806   .00646938  -.49124644
 L.h_ln_average_degree   1.0455857   .12151919   8.6042846
 L.h_ln_partintactplat    .0170999   .01103776   1.5492178
      L2.h_ln_new_sign   .00038221   .00427319   .08944421
L2.h_ln_average_degree   .00807633   .12484239   .06469218
L2.h_ln_partintactplat  -.00976862   .01057533  -.92371845
      L3.h_ln_new_sign   .00487185   .00300859   1.6193142
L3.h_ln_average_degree  -.12814911   .05158778   -2.484098
L3.h_ln_partintactplat   .00021061   .00550031   .03829109
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .01064206   .06442871   .16517574
 L.h_ln_average_degree   .24374967   .81653294   .29851786
 L.h_ln_partintactplat   .84155395   .11971832     7.02945
      L2.h_ln_new_sign   .01443556   .03104425   .46499956
L2.h_ln_average_degree   1.6070561   .86230422   1.8636765
L2.h_ln_partintactplat   .07940715   .09752731   .81420425
      L3.h_ln_new_sign  -.01175214   .02916724   -.4029224
L3.h_ln_average_degree  -1.4776442   .46091384  -3.2059012
L3.h_ln_partintactplat  -.01889888   .04746248  -.39818567
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                     ln_new_sign  ln_average_degree  ln_partintactplat
      ln_new_sign          .19124661
ln_average_degree          -.0012396          .00040294
ln_partintactplat          .01477976          .00019933            .040143

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1412   1.0000
             |   0.0023
             |
          u3 |   0.1687   0.0493   1.0000
             |   0.0003   0.2902
             |

GMM finished : 07:52:24

Starting Monte-Carlo loop : 07:52:24 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 07:52:32
```



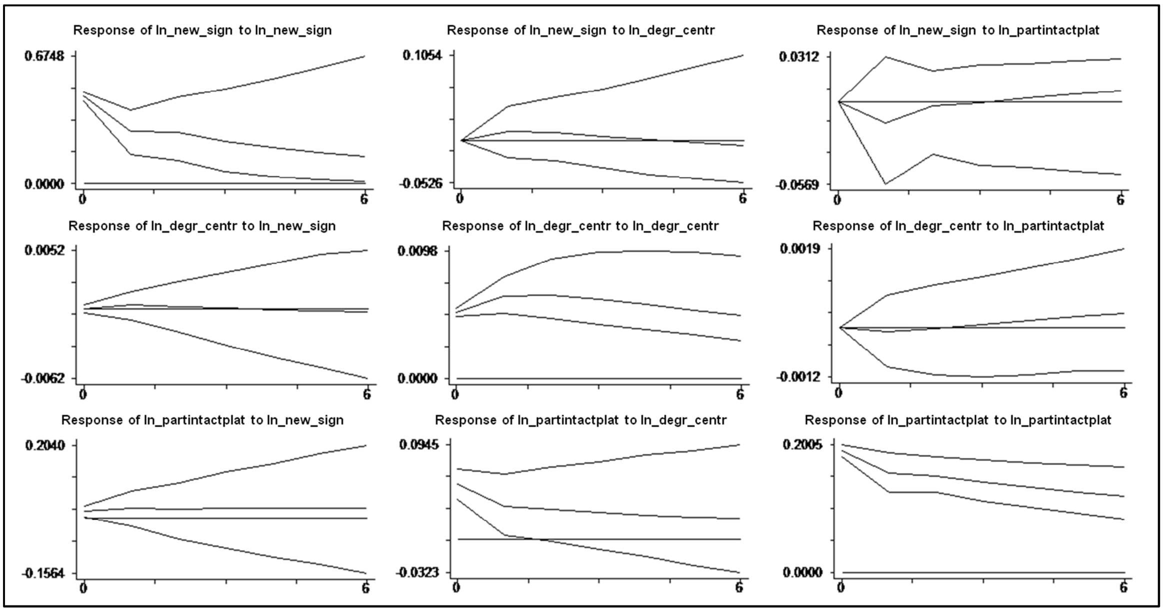
```
. pvar ln_new_sign ln_average_degree ln_partintactplat, lag(4) gmm monte 1000
GMM started : 07:58:08
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 449
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .45349445   .13271092     3.41716
 L.h_ln_average_degree  -.48085176    3.178349   -.1512898
 L.h_ln_partintactplat    .1184102   .28778708   .41145069
      L2.h_ln_new_sign   .22142315   .08930723   2.4793418
L2.h_ln_average_degree  -.91059225   2.0175836  -.45132813
L2.h_ln_partintactplat   .17670956   .15799106   1.1184782
      L3.h_ln_new_sign   .05854875   .07228615   .80995807
L3.h_ln_average_degree   1.8674401   1.3357772   1.3980177
L3.h_ln_partintactplat  -.15680667   .15495564  -1.0119455
      L4.h_ln_new_sign   .02235766   .06056417   .36915659
L4.h_ln_average_degree  -.27342006   .98957504  -.27630048
L4.h_ln_partintactplat  -.05754311   .08234552  -.69880071
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_average_degree

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00693808   .00497128   1.3956327
 L.h_ln_average_degree   1.2134251   .13171285   9.2126554
 L.h_ln_partintactplat   .00959117   .01040381    .9218903
      L2.h_ln_new_sign   .00130897   .00458492   .28549557
L2.h_ln_average_degree  -.15690087   .12683139  -1.2370823
L2.h_ln_partintactplat  -.00968127   .01045932  -.92561178
      L3.h_ln_new_sign   .00135798    .0030727   .44195096
L3.h_ln_average_degree  -.04782769   .07379794  -.64808971
L3.h_ln_partintactplat      .00747   .00905389   .82506006
      L4.h_ln_new_sign   .00029504   .00294532   .10017376
L4.h_ln_average_degree  -.07863182   .04477723  -1.7560671
L4.h_ln_partintactplat  -.00368471   .00624206  -.59030379
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.01875677   .04570587  -.41037996
 L.h_ln_average_degree    1.556297   1.2197189   1.2759472
 L.h_ln_partintactplat   .97313541   .11949099   8.1440068
      L2.h_ln_new_sign  -.01499266   .03091694  -.48493334
L2.h_ln_average_degree    -.461673   1.0031619  -.46021782
L2.h_ln_partintactplat   .11463749   .08870992   1.2922736
      L3.h_ln_new_sign  -.02448784   .02770739  -.88380168
L3.h_ln_average_degree   .10158059   1.0387977   .09778669
L3.h_ln_partintactplat  -.17751196   .10688611   -1.660758
      L4.h_ln_new_sign  -.02473076   .02330041  -1.0613872
L4.h_ln_average_degree   -.5596549   .69799061  -.80180865
L4.h_ln_partintactplat   .01947774   .07167993   .27173209
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                        ln_new_sign  ln_average_degree  ln_partintactplat
      ln_new_sign          .18660126
ln_average_degree         -.00060531          .00031363
ln_partintactplat          .00743208          .00039481          .04001361

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0791   1.0000
             |   0.0939
             |
          u3 |   0.0861   0.1116   1.0000
             |   0.0682   0.0180
             |

GMM finished : 07:58:13

Starting Monte-Carlo loop : 07:58:14 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 07:58:24
```



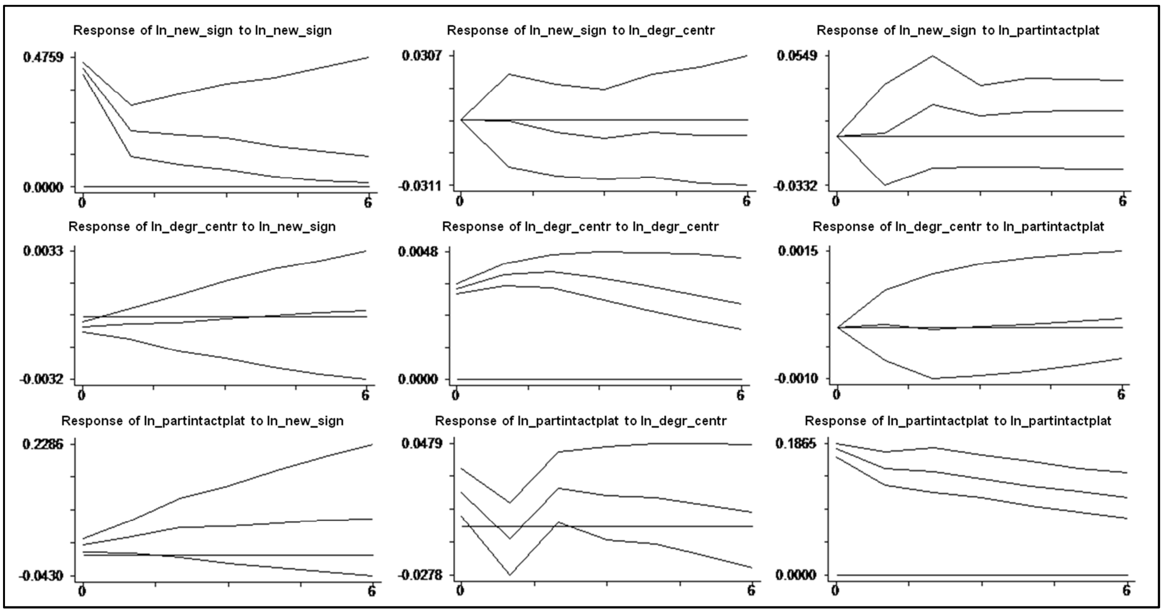
Appendix 73 Estimation Results PVAR(1)-(4) ln_new_signups ln_degree_centralization ln_partintactplat; All Regions

```
. pvar ln_new_sign ln_degr_centr ln_partintactplat, lag(1) gmm monte 1000
GMM started : 08:01:32
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 487
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                         b_GMM     se_GMM      t_GMM
      L.h_ln_new_sign  .69898706  .17706937  3.9475323
    L.h_ln_degr_centr  .52732773  2.2699309  .23231004
L.h_ln_partintactplat  .04928142  .03119676  1.5796966
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                         b_GMM     se_GMM      t_GMM
      L.h_ln_new_sign  .00232538  .00278408  .83524314
    L.h_ln_degr_centr  .90210823  .04714328  19.135456
L.h_ln_partintactplat  .00021828  .00064257  .33969247
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                         b_GMM     se_GMM      t_GMM
      L.h_ln_new_sign  .03081501  .07112721    .433238
    L.h_ln_degr_centr  .79961523  1.0836481    .737892
L.h_ln_partintactplat  .92746301   .0240668  38.537025
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                     ln_new_sign      ln_degr_centr  ln_partintactplat
      ln_new_sign         .25517897
    ln_degr_centr        -.00015714          .00007143
ln_partintactplat         .01815519          .00021245          .04773542

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0380   1.0000
             |   0.4031
             |
          u3 |   0.1647   0.1154   1.0000
             |   0.0003   0.0108
             |

GMM finished : 08:01:34

Starting Monte-Carlo loop : 08:01:35 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 08:01:41
```

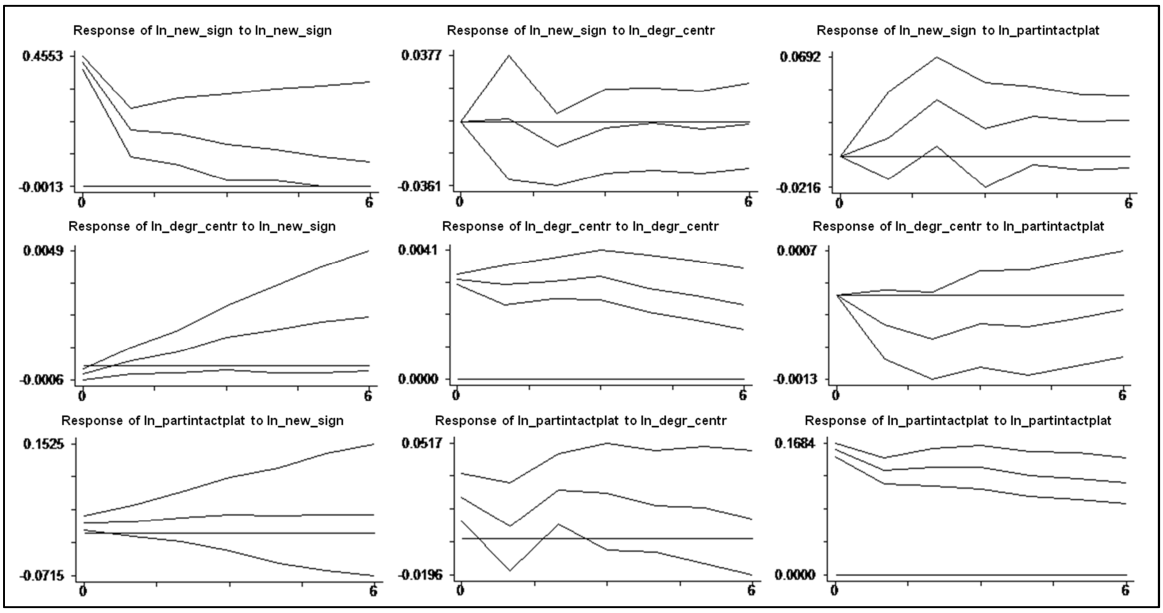
```
. pvar ln_new_sign ln_degr_centr ln_partintactplat, lag(2) gmm monte 1000
GMM started : 08:06:01
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 474
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .61998501   .16083623   3.8547597
     L.h_ln_degr_centr   6.0869297   3.7359338   1.6292927
 L.h_ln_partintactplat  -.09501553    .1400422  -.67847783
      L2.h_ln_new_sign   .21338612   .06744864   3.1636829
    L2.h_ln_degr_centr  -6.8558262   3.5200963  -1.9476246
L2.h_ln_partintactplat    .1120815   .12623802   .88785853
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00160386   .00272135   .58936172
     L.h_ln_degr_centr   .99464711   .21622751   4.6000026
 L.h_ln_partintactplat   .00037147   .00269274   .13795232
      L2.h_ln_new_sign  -.00139916   .00121929  -1.1475187
    L2.h_ln_degr_centr  -.06889272   .18793187  -.36658349
L2.h_ln_partintactplat    .0001361    .0024255   .05611034
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .02539893   .06483885   .39172398
     L.h_ln_degr_centr  -1.2791968    2.408643  -.53108609
 L.h_ln_partintactplat   .81292094    .0942988   8.6206923
      L2.h_ln_new_sign  -.01181341   .02474499  -.47740616
    L2.h_ln_degr_centr   1.0402687   2.0244971   .51384056
L2.h_ln_partintactplat   .12423503    .0762947   1.6283573
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                        ln_new_sign      ln_degr_centr  ln_partintactplat
      ln_new_sign          .21197815
    ln_degr_centr          -.0001357          .00005364
ln_partintactplat          .00855492          .00023549          .03996275

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.0405   1.0000
             |   0.3785
             |
          u3 |   0.0932   0.1610   1.0000
             |   0.0426   0.0004
             |

GMM finished : 08:06:02

Starting Monte-Carlo loop : 08:06:03 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 08:06:10
```



```
. pvar ln_new_sign ln_degr_centr ln_partintactplat, lag(3) gmm monte 1000
GMM started : 08:09:01
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 461
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .48501368   .13001784   3.7303624
     L.h_ln_degr_centr   5.3839907   2.7298725   1.9722499
 L.h_ln_partintactplat  -.03476546   .12696976  -.27380895
      L2.h_ln_new_sign   .19156354   .08159311   2.3477905
    L2.h_ln_degr_centr  -11.053263   4.6204555  -2.3922454
L2.h_ln_partintactplat   .15204673    .1082597   1.4044628
      L3.h_ln_new_sign   .11311794   .04433425   2.5514801
    L3.h_ln_degr_centr   4.9059401   2.9142795   1.6834144
L3.h_ln_partintactplat  -.08141823    .0880689  -.92448329
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00118905   .00228312   .52079779
     L.h_ln_degr_centr    .8652704   .20884699   4.1430829
 L.h_ln_partintactplat   .00214903   .00291891   .73624504
      L2.h_ln_new_sign  -.00020716   .00130693  -.15850706
    L2.h_ln_degr_centr   .14994886    .2064037   .72648338
L2.h_ln_partintactplat  -.00221224   .00256031  -.86405099
      L3.h_ln_new_sign  -.00057794   .00063797  -.90590207
    L3.h_ln_degr_centr  -.10415815   .06275492  -1.6597608
L3.h_ln_partintactplat   .00056526   .00151586   .37290151
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .03198038   .05218575   .61281824
     L.h_ln_degr_centr  -1.1492207   2.5823879   -.4450225
 L.h_ln_partintactplat   .79515287   .09219583   8.6246082
      L2.h_ln_new_sign   .04705839   .03205884   1.4678757
    L2.h_ln_degr_centr   5.2913916    3.811681   1.3882042
L2.h_ln_partintactplat   .16598343   .09255882   1.7932751
      L3.h_ln_new_sign  -.01942621   .02711867  -.71634083
    L3.h_ln_degr_centr  -4.7306842   2.5609632  -1.8472285
L3.h_ln_partintactplat  -.04312977   .06261653  -.68879202
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                         ln_new_sign      ln_degr_centr  ln_partintactplat
      ln_new_sign          .18753672
    ln_degr_centr         -.00033982          .00003646
ln_partintactplat          .01009159          .00002126          .03452386

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1300   1.0000
             |   0.0052
             |
          u3 |   0.1254   0.0190   1.0000
             |   0.0070   0.6847
             |

GMM finished : 08:09:03

Starting Monte-Carlo loop : 08:09:04 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 08:09:12
```



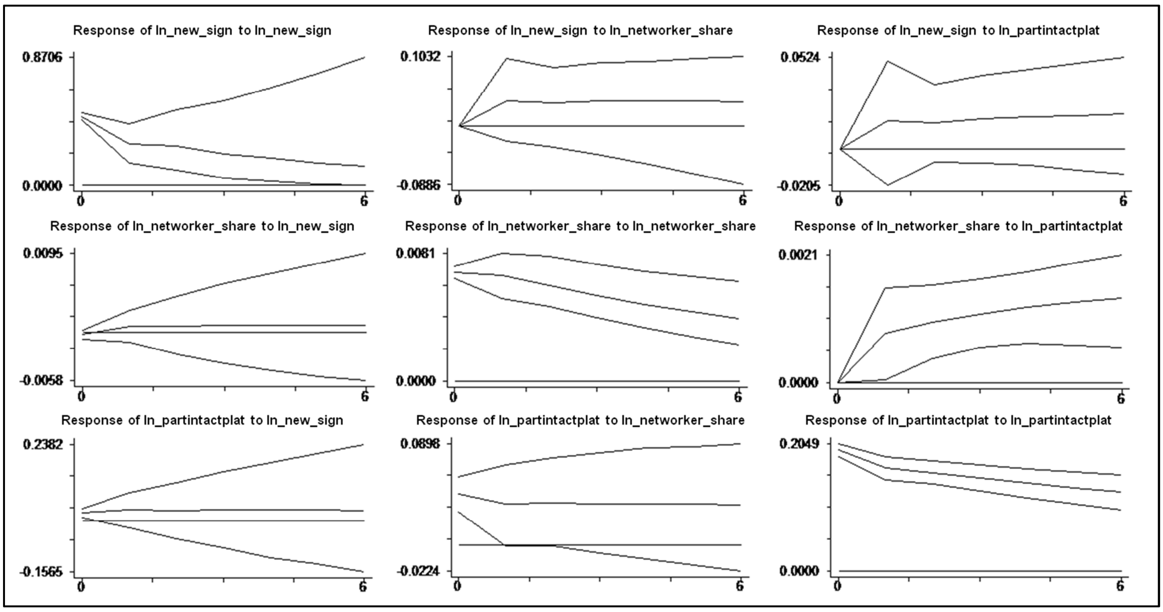
```
. pvar ln_new_sign ln_degr_centr ln_partintactplat, lag(4) gmm monte 1000
GMM started : 08:11:48
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 448
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                          b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .47138346   .11878305   3.9684403
     L.h_ln_degr_centr   6.6670353   3.0645588   2.1755286
 L.h_ln_partintactplat   .08661831   .11577017   .74819195
      L2.h_ln_new_sign   .18528779   .08300073   2.2323635
    L2.h_ln_degr_centr  -13.617826   3.8288804  -3.5566079
L2.h_ln_partintactplat   .12836119   .11460835   1.1199986
      L3.h_ln_new_sign   .06038391   .06554786   .92121868
    L3.h_ln_degr_centr    6.272736   3.3702077   1.8612313
L3.h_ln_partintactplat  -.19575347   .11752039  -1.6656978
      L4.h_ln_new_sign   .02814549   .04036781   .69722617
    L4.h_ln_degr_centr   .76309544   1.9849923   .38443245
L4.h_ln_partintactplat   .03593607   .09391355    .3826506
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_degr_centr

                          b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign    .0020033    .0021893   .91504202
     L.h_ln_degr_centr   .69165677    .2237939   3.0905971
 L.h_ln_partintactplat  -.00200859   .00190133  -1.0564125
      L2.h_ln_new_sign   .00043598   .00120414   .36207033
    L2.h_ln_degr_centr   .28836894     .232648   1.2395075
L2.h_ln_partintactplat   .00069137   .00191777   .36050731
      L3.h_ln_new_sign   .00002663   .00070431   .03781143
    L3.h_ln_degr_centr   .05357894   .08417238    .6365383
L3.h_ln_partintactplat   .00234551   .00174292   1.3457387
      L4.h_ln_new_sign  -.00025649   .00044623  -.57479092
    L4.h_ln_degr_centr  -.15335788   .05901562  -2.5985981
L4.h_ln_partintactplat  -.00094272   .00127791  -.73770889
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                          b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .01240826   .03363377   .36892267
     L.h_ln_degr_centr   .62687739   1.8043988   .34741621
 L.h_ln_partintactplat   .82051311   .06488408   12.645831
      L2.h_ln_new_sign   .01483351   .02475071   .59931667
    L2.h_ln_degr_centr   1.7625747   2.0571254   .85681442
L2.h_ln_partintactplat   .18256669   .06955607   2.6247413
      L3.h_ln_new_sign  -.00161249   .02245852  -.07179867
    L3.h_ln_degr_centr  -1.3014236   2.0184652  -.64475899
L3.h_ln_partintactplat   .00567721   .07021857   .08085055
      L4.h_ln_new_sign  -.01843339   .01530669  -1.2042702
    L4.h_ln_degr_centr  -2.2853013   1.9462152  -1.1742285
L4.h_ln_partintactplat  -.06395457   .04725052  -1.3535208
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                      ln_new_sign      ln_degr_centr  ln_partintactplat
      ln_new_sign         .18315169
    ln_degr_centr        -.00023702          .00003203
ln_partintactplat         .00770296           .0000648          .02671217

Residuals correlation matrix

             |      u1       u2       u3
_____________|___________________________
          u1 |   1.0000
             |
             |
          u2 |  -0.0979   1.0000
             |   0.0384
             |
          u3 |   0.1101   0.0701   1.0000
             |   0.0197   0.1387
             |

GMM finished : 08:11:50

Starting Monte-Carlo loop : 08:11:51 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 08:12:00
```



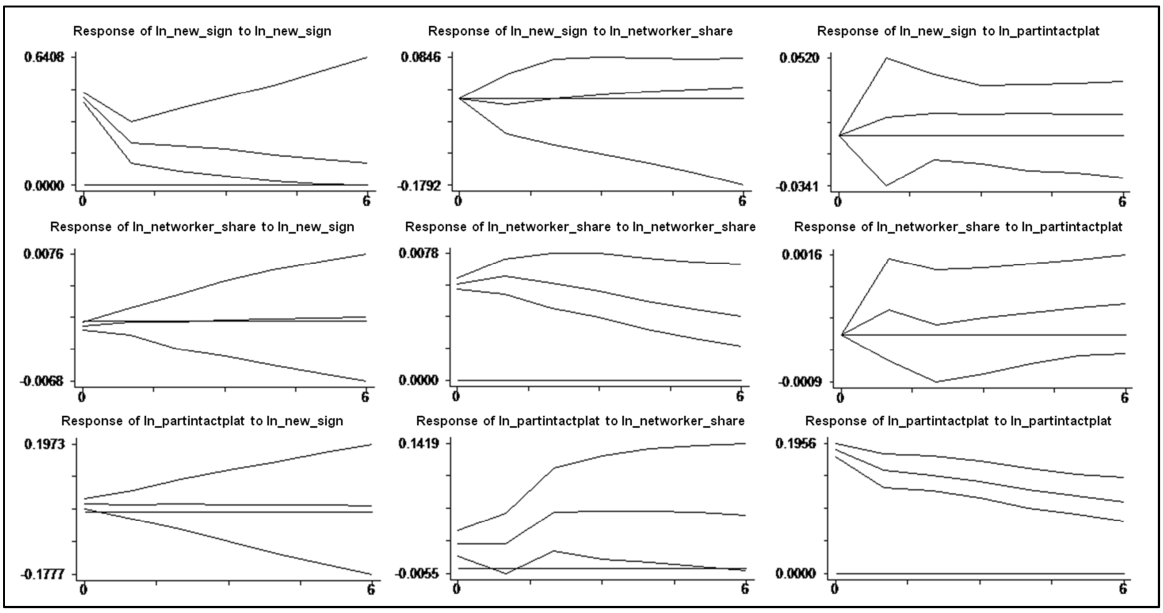
Appendix 74 Estimation Results PVAR(1)-(4) ln_new_signups ln_networker_share ln_partintactplat; All Regions

```
. pvar ln_new_sign ln_networker_share ln_partintactplat, lag(1) gmm monte 1000
GMM started : 09:15:39
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 488
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                            b_GMM     se_GMM      t_GMM
       L.h_ln_new_sign  .77612097  .21065608  3.6843036
L.h_ln_networker_share  2.3538621  2.0126789   1.169517
 L.h_ln_partintactplat  .02713307  .03360313   .8074565
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                            b_GMM     se_GMM      t_GMM
       L.h_ln_new_sign  .00165093  .00307894  .53620154
L.h_ln_networker_share  .80613088  .04292768  18.778815
 L.h_ln_partintactplat  .00165868  .00102082   1.624845
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                            b_GMM     se_GMM      t_GMM
       L.h_ln_new_sign  .08555199  .07817298  1.0943934
L.h_ln_networker_share  .32078434  .84467088  .37977436
 L.h_ln_partintactplat   .9209915  .02227876  41.339433
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                           ln_new_sign  ln_networker_share   ln_partintactplat
       ln_new_sign            .2902856
ln_networker_share           .00011978           .00009136
 ln_partintactplat           .03806253           .00016936           .09436447

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0220   1.0000
             |   0.6272
             |
          u3 |   0.2285   0.0566   1.0000
             |   0.0000   0.2122
             |

GMM finished : 09:15:40

Starting Monte-Carlo loop : 09:15:41 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 09:15:48
```

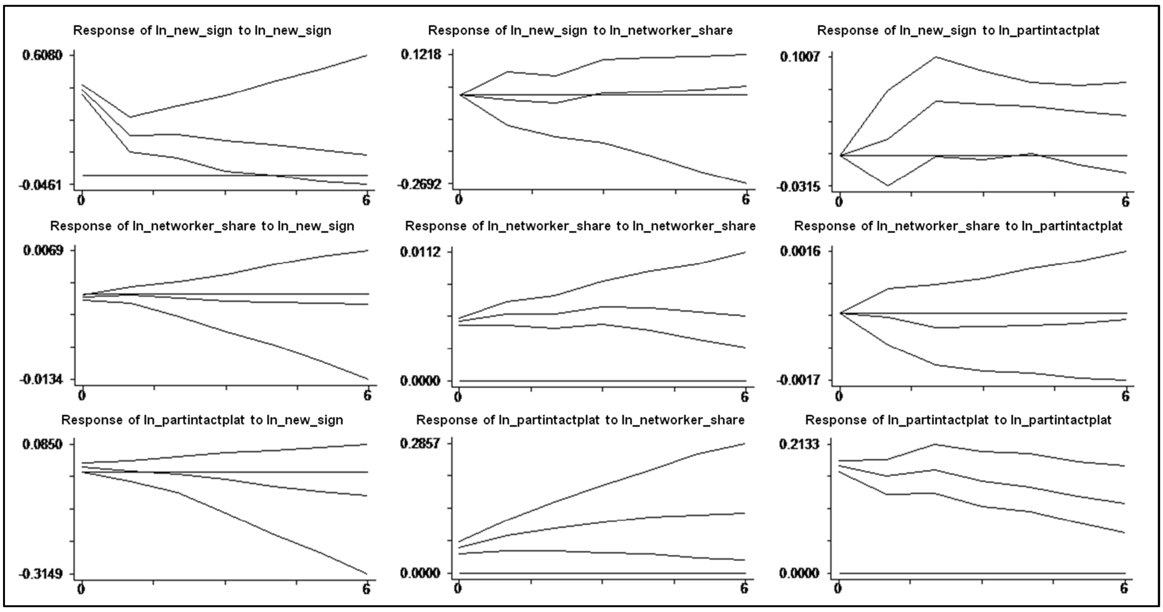
```
. pvar ln_new_sign ln_networker_share ln_partintactplat, lag(2) gmm monte 1000
GMM started : 09:18:48
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 475
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .59401565    .1729051   3.4355009
 L.h_ln_networker_share   4.9084501   5.6724108    .86531992
  L.h_ln_partintactplat    .0824716   .10902678    .75643435
       L2.h_ln_new_sign   .19985259   .08063694   2.4784249
L2.h_ln_networker_share   -3.159639   3.2763783  -.96436943
 L2.h_ln_partintactplat  -.06145859   .10916745   -.5629754
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                             b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .00193903   .00233776    .82943973
 L.h_ln_networker_share    .9440194   .12893492   7.3216737
  L.h_ln_partintactplat   .00411379   .00239434   1.7181308
       L2.h_ln_new_sign   -.0013488   .00138615  -.97305924
L2.h_ln_networker_share   -.0557112    .1115212  -.49955699
 L2.h_ln_partintactplat   -.0025233   .00285029  -.88527843
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                             b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .02908982   .06782938    .42886758
 L.h_ln_networker_share  -.31599573   2.9136775  -.10845254
  L.h_ln_partintactplat   .84832442   .05083332   16.688354
       L2.h_ln_new_sign  -.01563189   .02914923  -.53627097
L2.h_ln_networker_share    .5330611    2.194796    .24287501
 L2.h_ln_partintactplat   .08931927   .04543937     1.96568
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                       ln_new_sign  ln_networker_share   ln_partintactplat
       ln_new_sign       .22030263
ln_networker_share      -.00013351           .00004715
 ln_partintactplat       .01149868            .0003021           .04070308

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |  1.0000
             |
             |
          u2 | -0.0418   1.0000
             |  0.3638
             |
          u3 |  0.1216   0.2184   1.0000
             |  0.0080   0.0000
             |

GMM finished : 09:18:50

Starting Monte-Carlo loop : 09:18:51 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 09:18:58
```



```
. pvar ln_new_sign ln_networker_share ln_partintactplat, lag(3) gmm monte 1000
GMM started : 09:21:39
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 462
------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                            b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .47305234   .14253772   3.3187871
 L.h_ln_networker_share  -2.5839515    5.986077  -.43166025
  L.h_ln_partintactplat   .06527563   .14668592   .44500266
       L2.h_ln_new_sign   .22426748    .0934014   2.4011148
L2.h_ln_networker_share   3.4203139   5.7083601   .59917626
 L2.h_ln_partintactplat   .00108798     .146838   .00740942
       L3.h_ln_new_sign   .09333821   .05384979   1.7333069
L3.h_ln_networker_share   .37564108   3.7175741   .10104468
 L3.h_ln_partintactplat  -.03645752   .06735548   -.5412703
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                            b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .00095635   .00198533   .48170673
 L.h_ln_networker_share   1.0708068   .10894784   9.8286191
  L.h_ln_partintactplat   .00264798   .00335552   .78914195
       L2.h_ln_new_sign  -.00058435   .00149842  -.38998102
L2.h_ln_networker_share  -.14002561   .11372788  -1.2312339
 L2.h_ln_partintactplat  -.00399606   .00411008  -.97225681
       L3.h_ln_new_sign   .00026516   .00072682   .36482005
L3.h_ln_networker_share  -.02339403   .06327551  -.36971705
 L3.h_ln_partintactplat   .00218872   .00239994   .91198697
------------------------------------------------------------------------------
------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                            b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .00333437   .05650155   .05901379
 L.h_ln_networker_share   .70388613   3.0464585   .23105062
  L.h_ln_partintactplat   .83012298   .07756907   10.701727
       L2.h_ln_new_sign   .01884602   .03254895   .57900556
L2.h_ln_networker_share   5.8467142   3.3951483   1.7220792
 L2.h_ln_partintactplat   .09910917   .08165287   1.2137867
       L3.h_ln_new_sign  -.01760799    .0255595  -.68890194
L3.h_ln_networker_share  -5.3200649   2.3303749  -2.2829223
 L3.h_ln_partintactplat  -.01693713   .04895207  -.34599411
------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                       ln_new_sign  ln_networker_share   ln_partintactplat
       ln_new_sign       .19355633
ln_networker_share      -.00026522           .00003496
 ln_partintactplat       .01097423           .00014924            .0361166

Residuals correlation matrix

             |      u1       u2       u3
-------------+---------------------------
          u1 |  1.0000
             |
             |
          u2 | -0.1020   1.0000
             |  0.0284
             |
          u3 |  0.1313   0.1329   1.0000
             |  0.0047   0.0042
             |

GMM finished : 09:21:42

Starting Monte-Carlo loop : 09:21:43 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 09:21:51
```



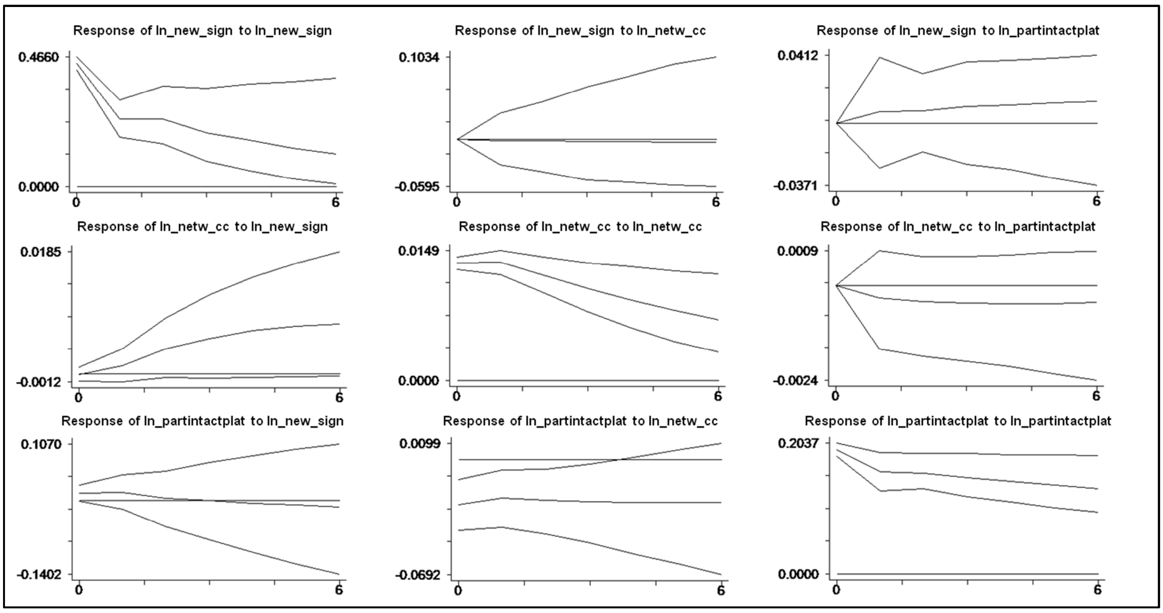
```
. pvar ln_new_sign ln_networker_share ln_partintactplat, lag(4) gmm monte 1000
GMM started : 10:27:12
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 449
-------------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .46384966   .12494506   3.7124288
 L.h_ln_networker_share  -3.9465158   8.4913795  -.46476733
  L.h_ln_partintactplat   .09170832   .16698076   .54921492
       L2.h_ln_new_sign   .24612898   .09418168   2.6133425
L2.h_ln_networker_share  -2.8904602   6.9210227  -.41763484
 L2.h_ln_partintactplat   .18470789   .13715119   1.3467465
       L3.h_ln_new_sign   .07664593   .07046304   1.0877466
L3.h_ln_networker_share   8.5039778   3.8147124   2.2292579
 L3.h_ln_partintactplat  -.13999343     .133962  -1.0450234
       L4.h_ln_new_sign   .01393082   .04183945   .33295898
L4.h_ln_networker_share  -1.0976915   1.7683132  -.62075626
 L4.h_ln_partintactplat  -.07701117   .09213842  -.83582042
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
EQ2: dep.var     : h_ln_networker_share

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign   .00113934   .00161151   .70700201
 L.h_ln_networker_share   1.1348514   .11021599   10.296613
  L.h_ln_partintactplat  -.00063405   .00238529   -.2658165
       L2.h_ln_new_sign  -.00184068   .00145717  -1.2631853
L2.h_ln_networker_share  -.13589981   .18568079  -.73190018
 L2.h_ln_partintactplat  -.00096792   .00316574  -.30574725
       L3.h_ln_new_sign  -.00062421    .0008473  -.73670217
L3.h_ln_networker_share   .14087095   .16002366   .88031326
 L3.h_ln_partintactplat   .00172399   .00336316   .51261178
       L4.h_ln_new_sign   .00046535   .00085926    .5415679
L4.h_ln_networker_share  -.20598471   .07167893  -2.8737136
 L4.h_ln_partintactplat    .0004466    .0025832   .17288501
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                              b_GMM      se_GMM       t_GMM
        L.h_ln_new_sign  -.01670189   .03867803  -.43181841
 L.h_ln_networker_share   5.9088403   3.2350813    1.826489
  L.h_ln_partintactplat   .90891545   .08997072   10.102347
       L2.h_ln_new_sign   -.0189286   .02959367   -.6396164
L2.h_ln_networker_share  -3.6852759   3.1860187  -1.1567025
 L2.h_ln_partintactplat   .14338671   .08427427   1.7014292
       L3.h_ln_new_sign  -.01429085   .02489008  -.57415831
L3.h_ln_networker_share   .91793907    2.676265   .34299259
 L3.h_ln_partintactplat   -.1332067   .10218161   -1.303627
       L4.h_ln_new_sign  -.01806488   .01887111  -.95727666
L4.h_ln_networker_share  -1.2165816   1.3185184  -.92268833
 L4.h_ln_partintactplat   .01958187   .06882312   .28452461
-------------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                           ln_new_sign  ln_networker_share   ln_partintactplat
       ln_new_sign           .18732462
ln_networker_share          -.00022606           .00002714
 ln_partintactplat           .00581927           .00028673           .03474957

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |  -0.1001   1.0000
             |   0.0339
             |
          u3 |   0.0724   0.2949   1.0000
             |   0.1254   0.0000
             |

GMM finished : 10:27:13

Starting Monte-Carlo loop : 10:27:14 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 10:27:24
```



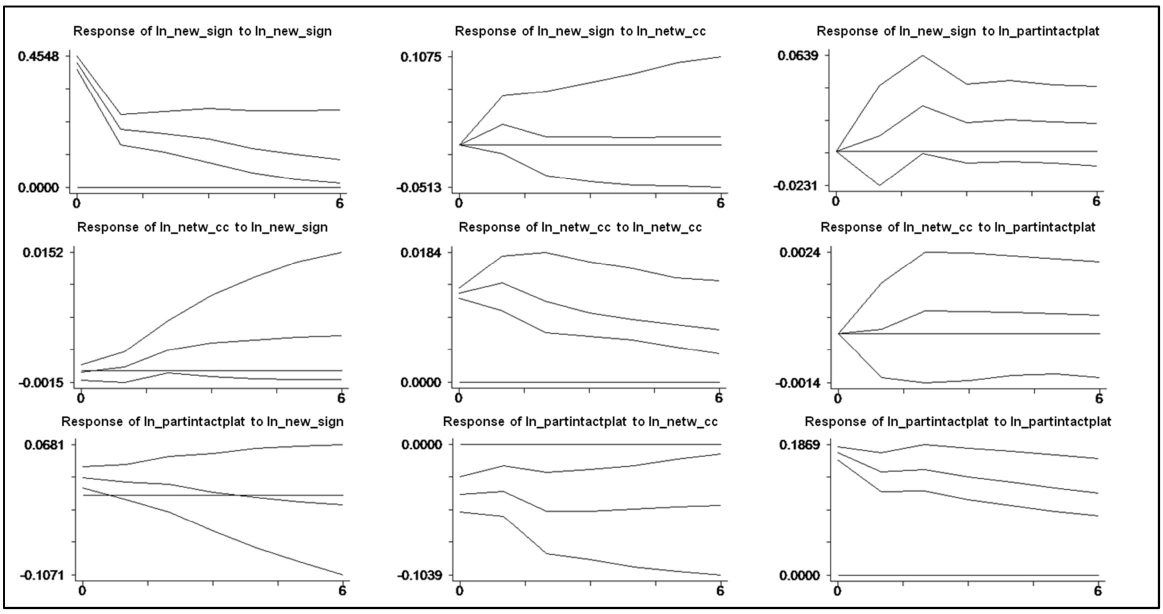
Appendix 75 Estimation Results PVAR(1)-(4) ln_new_signups ln_network_cc ln_partintactplat; All Regions

```
. pvar ln_new_sign ln_netw_cc ln_partintactplat, lag(1) gmm monte 1000
GMM started : 10:30:46
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 475
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                           b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign   .71305386   .14156052   5.0370955
       L.h_ln_netw_cc   -.4126586    .9532151  -.43291236
L.h_ln_partintactplat   .05342801   .04309756   1.2396991
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                           b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign   .01842936   .01009018    1.826465
       L.h_ln_netw_cc   .79576857   .07497106   10.614343
L.h_ln_partintactplat  -.00010432   .00411295  -.02536346
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                           b_GMM      se_GMM       t_GMM
      L.h_ln_new_sign    .0432761   .06772979   .63895226
       L.h_ln_netw_cc  -.24994066   .35811972  -.69792488
L.h_ln_partintactplat   .94006517   .02901953   32.394227
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                        ln_new_sign         ln_netw_cc  ln_partintactplat
      ln_new_sign          .23785201
       ln_netw_cc          .00187751          .00114389
ln_partintactplat          .01291162           .0010362          .04379041

Residuals correlation matrix

             |       u1       u2       u3
-------------+----------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.1129   1.0000
             |   0.0138
             |
          u3 |   0.1265   0.1464   1.0000
             |   0.0058   0.0014
             |

GMM finished : 10:30:48

Starting Monte-Carlo loop : 10:30:48 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 10:30:55
```

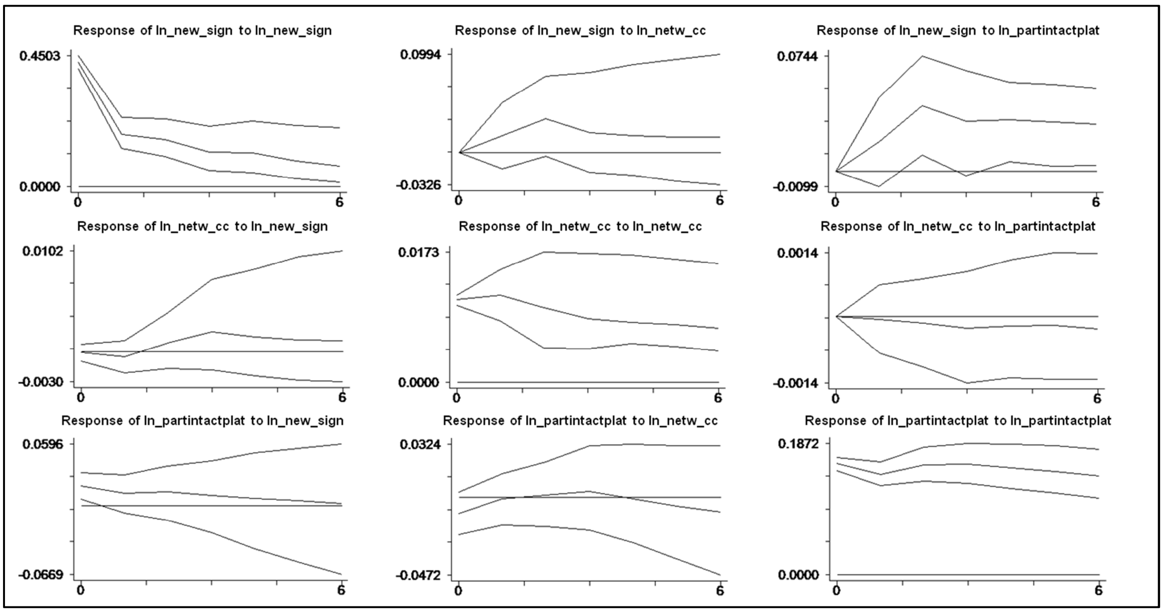
```
. pvar ln_new_sign ln_netw_cc ln_partintactplat, lag(2) gmm monte 1000
GMM started : 11:13:39
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 462
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .55122007   .09791614   5.6295119
        L.h_ln_netw_cc  -.11039967   1.2699004  -.08693569
 L.h_ln_partintactplat   .03537402   .10568398   .33471503
      L2.h_ln_new_sign   .25199091   .06574316     3.83296
       L2.h_ln_netw_cc   .01753878   .70132103   .02500821
L2.h_ln_partintactplat  -.00932223   .09082779  -.10263634
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00452496   .00340286   1.3297545
        L.h_ln_netw_cc   .92885123   .10011263    9.278062
 L.h_ln_partintactplat  -.00163288   .00436987    -.373668
      L2.h_ln_new_sign   .00426587   .00234459    1.819453
       L2.h_ln_netw_cc  -.05271719   .07365251  -.71575548
L2.h_ln_partintactplat   .00066406   .00389451    .1705108
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .01004522   .04629136   .21699983
        L.h_ln_netw_cc  -.10447022   .48478524  -.21549793
 L.h_ln_partintactplat   .82161012   .09247181   8.8849789
      L2.h_ln_new_sign   -.0279773   .02397502  -1.1669351
       L2.h_ln_netw_cc  -.05314855   .50578873  -.10508054
L2.h_ln_partintactplat   .13387101    .0739588   1.8100755
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                       ln_new_sign         ln_netw_cc  ln_partintactplat
      ln_new_sign          .19684574
       ln_netw_cc           .0001829           .0003304
ln_partintactplat          .00603612         -.00029826          .03836237

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0226   1.0000
             |   0.6284
             |
          u3 |   0.0696  -0.0834   1.0000
             |   0.1355   0.0732
             |

GMM finished : 11:13:41

Starting Monte-Carlo loop : 11:13:41 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 11:13:49
```



```
. pvar ln_new_sign ln_netw_cc ln_partintactplat, lag(3) gmm monte 1000
GMM started : 11:27:22
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 449
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .46373582   .07676326   6.0411167
        L.h_ln_netw_cc    1.134489   1.4590465   .77755507
 L.h_ln_partintactplat   .04887588   .11042977   .44259698
      L2.h_ln_new_sign   .20810913   .05905654   3.5238961
       L2.h_ln_netw_cc  -1.3771203   1.2137505  -1.1345992
L2.h_ln_partintactplat   .11046034   .12111517   .91202727
      L3.h_ln_new_sign   .08523752   .05057863   1.6852476
       L3.h_ln_netw_cc   .68884425   .75589976   .91129046
L3.h_ln_partintactplat  -.12653036   .09128754  -1.3860639
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .00243591   .00267708   .90991051
        L.h_ln_netw_cc   .78339896    .2265489   3.4579685
 L.h_ln_partintactplat  -.00294372   .00543899  -.54122493
      L2.h_ln_new_sign   .00457756   .00228105   2.0067764
       L2.h_ln_netw_cc   .01317718   .20357966   .06472739
L2.h_ln_partintactplat    .0036463   .00529364   .68880773
      L3.h_ln_new_sign   .00046781   .00192364   .24318763
       L3.h_ln_netw_cc   .07456626   .08081467   .92268215
L3.h_ln_partintactplat  -.00148542   .00342753  -.43337832
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                             b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -.00397173   .03082455  -.12884963
        L.h_ln_netw_cc  -.56706698   .51700826  -1.0968238
 L.h_ln_partintactplat   .83999733   .09125379   9.2050675
      L2.h_ln_new_sign  -.00569918   .02255913   -.2526331
       L2.h_ln_netw_cc  -.55540336   .63707111  -.87180748
L2.h_ln_partintactplat   .15671237   .08056051   1.9452752
      L3.h_ln_new_sign  -.01260292   .02444516  -.51555889
       L3.h_ln_netw_cc   .83861395   .79662924   1.0527029
L3.h_ln_partintactplat  -.05281651   .05879139  -.89837137
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                         ln_new_sign         ln_netw_cc  ln_partintactplat
      ln_new_sign          .18677084
       ln_netw_cc          .00017294          .00030358
ln_partintactplat           .0097278         -.00046416          .03268373

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0230   1.0000
             |   0.6270
             |
          u3 |   0.1245  -0.1470   1.0000
             |   0.0083   0.0018
             |

GMM finished : 11:27:24

Starting Monte-Carlo loop : 11:27:25 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 11:27:33
```



```
. pvar ln_new_sign ln_netw_cc ln_partintactplat, lag(4) gmm monte 1000
GMM started : 11:45:44
accumulating matrices equation 1,2,3,calculating b2sls
calculating big ZuuZ matrix
finished accumulating ZuuZ
_______ Results of the Estimation by system GMM_________
number of observations used : 436
-----------------------------------------------------------------------------
EQ1: dep.var     : h_ln_new_sign

                           b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   .42425333   .07456665   5.6895858
        L.h_ln_netw_cc    1.090841   1.5561514   .70098645
 L.h_ln_partintactplat   .11632303   .11004177   1.0570808
      L2.h_ln_new_sign   .19635957   .06046262   3.2476194
       L2.h_ln_netw_cc  -1.0429876    1.589797  -.65605081
L2.h_ln_partintactplat   .09091814   .13495331   .67370066
      L3.h_ln_new_sign   .03555562   .05656009    .6286344
       L3.h_ln_netw_cc   .38955664   1.5947969   .24426724
L3.h_ln_partintactplat  -.13557757   .13567918  -.99925109
      L4.h_ln_new_sign   .06016226   .04358346   1.3803921
       L4.h_ln_netw_cc  -.09767162   .56733674   -.1721581
L4.h_ln_partintactplat  -.01654702   .09219791  -.17947285
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ2: dep.var     : h_ln_netw_cc

                           b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign  -6.179e-06   .00218287   -.0028306
        L.h_ln_netw_cc   .74520064   .23557831   3.1632821
 L.h_ln_partintactplat  -.00573679   .00471111  -1.2177148
      L2.h_ln_new_sign   .00440403   .00232278   1.8960173
       L2.h_ln_netw_cc   .08167892   .15877876   .51441972
L2.h_ln_partintactplat   .00279201    .0055928   .49921453
      L3.h_ln_new_sign   .00305015   .00248448    1.227682
       L3.h_ln_netw_cc  -.02035014   .12073807  -.16854782
L3.h_ln_partintactplat   .00249702   .00397675     .627905
      L4.h_ln_new_sign  -.00433678   .00223378  -1.9414554
       L4.h_ln_netw_cc   .09115731   .06551787    1.391335
L4.h_ln_partintactplat  -.00071498   .00334719  -.21360486
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
EQ3: dep.var     : h_ln_partintactplat

                           b_GMM      se_GMM       t_GMM
       L.h_ln_new_sign   -.0105873   .02110996  -.50153085
        L.h_ln_netw_cc   .29950861   .46068784   .65013352
 L.h_ln_partintactplat   .89658329   .05977043   15.000448
      L2.h_ln_new_sign   .00248092   .01778008   .13953375
       L2.h_ln_netw_cc  -.04498931    .3572099  -.12594642
L2.h_ln_partintactplat    .1803839   .06351468   2.8400347
      L3.h_ln_new_sign  -.00530656   .01733652  -.30609171
       L3.h_ln_netw_cc  -.08862861   .26259199  -.33751454
L3.h_ln_partintactplat  -.05106694   .07342518  -.69549637
      L4.h_ln_new_sign    -.002875   .01359835  -.21142299
       L4.h_ln_netw_cc  -.49825934   .25646983  -1.9427601
L4.h_ln_partintactplat  -.06442048   .04959749  -1.2988658
-----------------------------------------------------------------------------
just identified - Hansen statistic is not calculated

symmetric uu[3,3]
                         ln_new_sign         ln_netw_cc  ln_partintactplat
      ln_new_sign          .18371038
       ln_netw_cc          .00026829          .00025207
ln_partintactplat          .00830425         -4.609e-06           .0256543

Residuals correlation matrix

             |       u1       u2       u3
-------------+---------------------------
          u1 |   1.0000
             |
             |
          u2 |   0.0395   1.0000
             |   0.4109
             |
          u3 |   0.1209  -0.0015   1.0000
             |   0.0115   0.9746
             |

GMM finished : 11:45:45

Starting Monte-Carlo loop : 11:45:46 , total 1000 repetitions requested
i=38, i=76, i=114, i=152, i=190, i=228, i=266, i=304, i=342, i=380, i=418, i=456, i=494, i=532, i=57
> 0, i=608, i=646, i=684, i=722, i=760, i=798, i=836, i=874, i=912, i=950, i=988, i=1000, finished M
> onte-Carlo loop : 11:45:55
```



Appendix 76 Summary Results of Project 1

		Average Degree	Degree Centralization	Share of Networkers	Network Clustering Coefficient	Interpersonal Participation	Platform Participation	Overall Participation	Community Growth
Average Degree	est					+	ns	+	ns
	new					+	ns	+	ns
	all					+	+	+	ns
Degree Centralization	est					-	-	-	ns
	new					+	+	+	ns
	all					+	+	+	ns
Share of Networkers	est					ns[1] +	+	ns +	ns
	new					ns	ns	+ ns	ns
	all					+	+	+	ns
Network Clustering Coefficient	est					ns	ns	ns	ns
	new					+ +-	ns +-	ns +-	ns
	all					+	ns +-	-	ns
Interpersonal Participation	est	+	ns	+	ns				3 x + 1 x ns
	new	+ ns	ns	ns	ns				ns
	all	+	ns	ns +	ns				3 x ns 1 x +
Platform Participation	est	+	+	+	ns				+
	new	ns	+	ns	ns				ns
	all	+	+	ns	ns				ns
Overall Participation	est	+	ns +	+	ns				3 x +[2] 1 x ns
	new	+ ns	ns	ns	ns				ns
	all	+	ns	ns +	ns				ns
Community Growth	est	-	2 x ns[3] 1 x -	-	ns	ns	3 x ns 1 x +	ns	
	new	ns	ns	ns	ns	ns	ns	3 x ns 1 x +	
	all	2 x ns 1 x +	1 x +- 1 x - 1 x ns	2 x ns 1 x +	2 x ns 1 x +	3 x ns 1 x +	+	+	

1) In established regions, share of networkers has a non-significant influence on interpersonal participation when VAR models including share of networkers and interpersonal participation are considered. Further, in established regions, share of networkers has a positive influence on interpersonal participation when VAR models including community growth, share of networkers, and interpersonal participation are considered.
2) In established regions, overall participation has a positive influence on community growth in three out of four cases and a non-significant influence in one out of four cases.
3) In established regions, community growth has a non-significant influence on degree centralization in two out of three cases and a negative influence in one out of three cases.

Appendix 77 ADF Tests (constant and linear trend included)

	Augmented Dickey-Fuller Test											
	Region 1		Region 2		Region 3		Region 4		Region 5		Region 6	
Variable	Statistic	p-value	Statistic	p-value	Statistic	p-value	Statistic	p-value	Statistic	p-value	Statistic	p-value
ln_new_signups	-15.6144	0.0000	-9.3395	0.0000	-5.2751	0.0008	-5.7509	0.0002	-4.8798	0.0023	-4.0869	0.0155
ln_posters	-16.6739	0.0000	-7.2544	0.0000	-2.6531	0.2613	-4.0703	0.0161	-5.6425	0.0003	-2.5717	0.2946
ln_participation	-15.6505	0.0000	-7.0829	0.0000	-5.7221	0.0003	-3.7962	0.0299	-3.2903	0.0860	-2.6694	0.2563
ln_team	-3.2739	0.0883	-1.8531	0.6550	-1.5544	0.7885	-1.9836	0.5878	-1.9066	0.6278	-5.2259	0.0009

Appendix 78 Seasonality Test; Region 1

Dependent Variable: ln_new_signups				
	Coefficient	Std. Error	t-Statistic	p-value
Constant	5.987620	0.416383	14.38009	0.0000
M2	0.434079	0.588854	0.737159	0.4688
M3	0.112000	0.588854	0.190200	0.8509
M4	0.064671	0.588854	0.109825	0.9135
M5	0.240340	0.658359	0.365060	0.7186
M6	0.684063	0.658359	1.039044	0.3101
M7	-1.366860	0.588854	-2.321221	0.0299
M8	0.773046	0.588854	1.312798	0.2028
M9	0.143849	0.588854	0.244287	0.8093
M10	0.121286	0.588854	0.205970	0.8387
M11	-0.038010	0.588854	-0.064549	0.9491
M12	-0.019809	0.588854	-0.033639	0.9735

R-squared	0.439961	Mean dependent var	6.061784
Adjusted R-squared	0.159942	S.D. dependent var	0.786862
S.E. of regression	0.721196	Akaike info criterion	2.454752
Sum squared resid	11.44271	Schwarz criterion	2.993468
Log likelihood	-29.73079	Hannan-Quinn criter.	2.638470
F-statistic	1.571183	Durbin-Watson stat	1.364247
Prob(F-statistic)	0.176609		

Sample: 2009M07 - 2012M04
Included observations: 34

Appendix 79 Seasonality Test; Region 2

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	6.062101	0.338428	17.91251	0.0000
M2	0.057634	0.478610	0.120421	0.9053
M3	-0.451738	0.478610	-0.943853	0.3560
M4	-0.257551	0.478610	-0.538122	0.5962
M5	-0.865454	0.535102	-1.617362	0.1207
M6	-0.163274	0.535102	-0.305127	0.7633
M7	-0.549144	0.535102	-1.026241	0.3165
M8	-1.879693	0.478610	-3.927400	0.0008
M9	-0.553157	0.478610	-1.155757	0.2608
M10	-0.565466	0.478610	-1.181476	0.2506
M11	-0.969372	0.478610	-2.025391	0.0557
M12	-0.545969	0.478610	-1.140739	0.2668

R-squared	0.544454	Mean dependent var	5.496898
Adjusted R-squared	0.305834	S.D. dependent var	0.703551
S.E. of regression	0.586175	Akaike info criterion	2.044891
Sum squared resid	7.215627	Schwarz criterion	2.589076
Log likelihood	-21.74071	Hannan-Quinn criter.	2.227993
F-statistic	2.281683	Durbin-Watson stat	1.421183
Prob(F-statistic)	0.050109		

Sample: 2009M08 - 2012M04
Included observations: 33

Appendix 80 Seasonality Test; Region 3

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	4.828067	0.632481	7.633535	0.0000
M2	0.216265	0.894463	0.241782	0.8113
M3	0.039010	0.894463	0.043613	0.9656
M4	-0.253269	0.894463	-0.283152	0.7798
M5	-0.517831	1.000040	-0.517810	0.6100
M6	0.066980	1.000040	0.066978	0.9472
M7	-0.294255	1.000040	-0.294243	0.7715
M8	-1.364372	0.894463	-1.525352	0.1421
M9	-0.812860	0.894463	-0.908768	0.3738
M10	-0.626966	0.894463	-0.700941	0.4910
M11	-0.699349	0.894463	-0.781864	0.4430
M12	-0.644563	0.894463	-0.720614	0.4791

R-squared	0.208443	Mean dependent var	4.405991
Adjusted R-squared	-0.206182	S.D. dependent var	0.997474
S.E. of regression	1.095489	Akaike info criterion	3.295567
Sum squared resid	25.202040	Schwarz criterion	3.839752
Log likelihood	-42.37686	Hannan-Quinn criter.	3.478669
F-statistic	0.502726	Durbin-Watson stat	0.603915
Prob(F-statistic)	0.880270		

Sample: 2009M08 - 2012M04
Included observations: 33

Appendix 81 Seasonality Test; Region 4

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	5.486584	0.414848	13.22551	0.0000
M2	-0.514956	0.586684	-0.877739	0.3900
M3	-0.548108	0.586684	-0.934247	0.3608
M4	-0.561715	0.586684	-0.957441	0.3492
M5	-1.035696	0.655933	-1.578967	0.1293
M6	-0.754868	0.655933	-1.150832	0.2627
M7	-0.660515	0.655933	-1.006986	0.3254
M8	-1.796446	0.586684	-3.062032	0.0059
M9	-1.503503	0.586684	-2.562712	0.0181
M10	-0.428936	0.586684	-0.731120	0.4728
M11	-1.143929	0.586684	-1.949820	0.0647
M12	-0.405023	0.586684	-0.690360	0.4975

R-squared	0.435337	Mean dependent var	4.710523
Adjusted R-squared	0.139561	S.D. dependent var	0.774622
S.E. of regression	0.718539	Akaike info criterion	2.452093
Sum squared resid	10.84225	Schwarz criterion	2.996277
Log likelihood	-28.45953	Hannan-Quinn criter.	2.635194
F-statistic	1.471848	Durbin-Watson stat	1.110178
Prob(F-statistic)	0.214661		

Sample: 2009M08 - 2012M04
Included observations: 33

Appendix 82 Seasonality Test; Region 5

Dependent Variable: ln_new_signups	Coefficient	Std. Error	t-Statistic	p-value
Constant	5.326009	0.231421	23.01440	0.0000
M2	0.339194	0.327278	1.036408	0.3118
M3	0.059758	0.327278	0.182591	0.8569
M4	-0.269927	0.327278	-0.824764	0.4188
M5	-0.333660	0.365908	-0.911868	0.3722
M6	-0.039941	0.365908	-0.109155	0.9141
M7	-0.064677	0.365908	-0.176756	0.8614
M8	-0.525586	0.327278	-1.605929	0.1232
M9	-0.447304	0.327278	-1.366740	0.1862
M10	-0.354663	0.327278	-1.083673	0.2908
M11	-0.343970	0.327278	-1.051002	0.3052
M12	-0.317267	0.327278	-0.969411	0.3434

R-squared	0.373205	Mean dependent var	5.130377
Adjusted R-squared	0.044884	S.D. dependent var	0.410142
S.E. of regression	0.400832	Akaike info criterion	1.284741
Sum squared resid	3.373999	Schwarz criterion	1.828925
Log likelihood	-9.198225	Hannan-Quinn criter.	1.467842
F-statistic	1.136708	Durbin-Watson stat	1.849139
Prob(F-statistic)	0.383483		

Sample: 2009M08 - 2012M04
Included observations: 33

Appendix 83 Seasonality Test; Region 6

Dependent Variable: ln_new_signups				
	Coefficient	Std. Error	t-Statistic	p-value
Constant	4.872624	0.587108	8.299358	0.0000
M2	0.533392	0.830297	0.642411	0.5276
M3	0.250791	0.830297	0.302050	0.7656
M4	0.514708	0.830297	0.619909	0.5420
M5	0.677171	0.928300	0.729474	0.4738
M6	0.081116	0.928300	0.087381	0.9312
M7	0.704794	0.928300	0.759231	0.4562
M8	-0.587496	0.830297	-0.707573	0.4870
M9	0.063013	0.830297	0.075892	0.9402
M10	-0.440191	0.830297	-0.530161	0.6016
M11	-0.625219	0.830297	-0.753006	0.4598
M12	0.024537	0.830297	0.029552	0.9767

R-squared	0.228366	Mean dependent var	4.937071
Adjusted R-squared	-0.175823	S.D. dependent var	0.937795
S.E. of regression	1.016902	Akaike info criterion	3.146686
Sum squared resid	21.71587	Schwarz criterion	3.690870
Log likelihood	-39.92031	Hannan-Quinn criter.	3.329787
F-statistic	0.564998	Durbin-Watson stat	0.458435
Prob(F-statistic)	0.835354		

Sample: 2009M08 - 2012M04
Included observations: 33

Appendix 84 Normality, Autocorrelation, and Heteroskedasticity Tests; Region 1

Model	Jarque-Bera		Breusch-Godfrey Serial Corr LM Test[1)]		White Heteroskedasticity Test[2)]	
	Statistic	p-value	Statistic	p-value	Statistic	p-value
Bass	4.5578	0.1024	0.7418	0.5722	0.8463	0.5287
ARMA	0.5287	0.7677	1.9532	0.1328	1.1420	0.3893
ADL (d_ln_posters)	0.4691	0.7909	2.4352	0.0737	0.6938	0.6567
ADL (d_ln_posters, d_ln_team)	1.0340	0.5963	1.4059	0.2634	1.1605	0.3805
ADL (d_ln_participation)	0.4546	0.7967	1.2029	0.3324	0.5566	0.5790

1) 4 lags included
2) White cross terms included

Appendix 85 ARMA Model Selection, SC; Region 1

	MA(0)	MA(1)	MA(2)
AR(0)	2.432336	2.270752	1.559030
AR(1)	0.881134	0.965654	0.865810
AR(2)	0.983022	0.956833	0.911727

Appendix 86 ADL (d_ln_posters) Model Selection, SC; Region 1

	d_ln_posters	d_ln_posters_t-1	d_ln_posters_t-2
-------	0.715801	0.710304	0.860101
ln_new_signups_t-1	0.646536	0.697221	0.845806
ln_new_signups_t-2	0.650281	0.676833	0.717513

Appendix 87 ADL (d_ln_posters, d_ln_team) Model Selection, SC; Region 1

	d_ln_posters d_ln_team	d_ln_posters_t-1 d_ln_team_t-1	d_ln_posters_t-2 d_ln_team_t-2
-------	0.792620	0.889910	1.101684
ln_new_signups_t-1	0.744639	0.864121	1.059363
ln_new_signups_t-2	0.718979	0.811141	0.983472

Appendix 88 ADL (d_ln_participation) Model Selection, SC; Region 1

	d_ln_participation	d_ln_participation_t-1	d_ln_participation_t-2
-------	0.775356	0.879527	0.991932
ln_new_signups_t-1	0.834219	0.954396	1.057103
ln_new_signups_t-2	0.944427	1.049618	1.080930

Appendix 89 ADL (d_ln_participation, d_ln_team) Estimation Output; Region 1

Dependent Variable: ln_new_signups

	Coefficient	Std. Error	t-Statistic	p-value
Constant	6.122305	0.067306	90.96286	0.0000
d_ln_participation	0.109489	0.059972	1.825673	0.0779
d_ln_team	0.944433	0.991476	0.952552	0.3484

R-squared	0.194947	Mean dependent var	6.182461
Adjusted R-squared	0.141277	S.D. dependent var	0.357613
S.E. of regression	0.331390	Akaike info criterion	0.715468
Sum squared resid	3.294585	Schwarz criterion	0.851514
Log likelihood	-8.805223	Hannan-Quinn criter.	0.761243
F-statistic	3.632324	Durbin-Watson stat	1.773469
Prob(F-statistic)	0.038669		

Sample (adjusted): 2009M08 - 2012M04
Included observations: 33 (after adj.)

Appendix 90 VAR (d_ln_posters) Lag Order Selection, SC; Region 1

Lag	SC
0	1.1261
1	1.0409
2	1.0591
3	1.3942
4	1.6086

Appendix 91 VAR (d_ln_posters) Normality, Autocorrelation, and Heteroskedasticity Tests; Region 1

	Statistic	p-value
Jarque-Bera	3.5849	0.4651
White[1)]	45.1995	0.3398
Autocorrelation LM		
Lags		
1	6.3215	0.1764
2	6.6913	0.1531
3	6.7823	0.1479
4	6.1512	0.1881

1) Cross terms included

Appendix 92 VAR (d_ln_posters) Estimation Output; Region 1

	d_ln_posters	ln_new_signups
d_ln_posters_t-1	-0.352097	0.013539
	(0.22256)	(0.28948)
	[-1.58205]	[0.04677]
d_ln_posters_t-2	-0.000141	-0.109563
	(0.06257)	(0.08139)
	[-0.00226]	[-1.34622]
ln_new_signups_t-1	-0.307220	0.047596
	(0.16470)	(0.21423)
	[-1.86529]	[0.22218]
ln_new_signups_t-2	-0.053201	0.532056
	(0.20297)	(0.26400)
	[-0.26211]	[2.01534]
Constant	2.277290	2.569286
	(1.41336)	(1.83834)
	[1.61125]	[1.39761]
R-squared	0.347356	0.192075
Adj. R-squared	0.246949	0.067778
Sum sq. resids	1.696350	2.869851
S.E. equation	0.255430	0.332233
F-statistic	3.459490	1.545298
Log likelihood	1.048280	-7.101325
Akaike AIC	0.254950	0.780731
Schwarz SC	0.486238	1.012019
Mean dependent	0.031524	6.152585
S.D. dependent	0.294347	0.344099
Determinant resid covariance (dof adj.)		0.004802
Determinant resid covariance		0.003378
Log likelihood		0.228789
Akaike information criterion		0.630401
Schwarz criterion		1.092977

Sample (adjusted): 2009M10 - 2012M04
Included observations: 31 (after adj.)
Std. errors in ( ); t-statistics in [ ]

Appendix 93 VAR (d_ln_participation) Lag Order Selection, SC; Region 1

Lag	SC
0	1.5277
1	1.6877
2	2.0166
3	2.0950
4	2.2442

Appendix 94 Normality, Autocorrelation, and Heteroskedasticity Tests; Region 2

Model	Jarque-Bera		Breusch-Godfrey Serial Corr LM Test[1)]		White Heteroskedasticity Test[2)]	
	Statistic	p-value	Statistic	p-value	Statistic	p-value
Bass	0.6737	0.7140	0.1989	0.9366	0.3642	0.8685
ARMA	3.0342	0.2193	0.1546	0.9592	0.2231	0.8014
ADL (d_ln_posters)	1.3811	0.5013	0.2757	0.8902	0.6054	0.8326
ADL (d_ln_posters, d_ln_team)	0.4148	0.8127	1.3140	0.2931	0.9250	0.5228
ADL (d_ln_participation)	2.5973	0.2729	0.1425	0.9647	0.3660	0.6967

1) 4 lags included
2) White cross terms included

Appendix 95 ARMA Model Selection, SC; Region 2

	MA(0)	MA(1)	MA(2)
AR(0)	2.209832	1.905903	2.009336
AR(1)	1.101018	1.206061	1.105497
AR(2)	1.245603	1.145342	1.223243

Appendix 96 ADL (d_ln_posters) Model Selection, SC; Region 2

	d_ln_posters	d_ln_posters_t-1	d_ln_posters_t-2
-------	1.066480	0.892352	0.615113
ln_new_signups_t-1	0.643939	0.667703	0.489530
ln_new_signups_t-2	0.662093	0.734319	0.482513

Appendix 97 ADL (d_ln_posters, d_ln_team) Model Selection, SC; Region 2

	d_ln_posters d_ln_team	d_ln_posters_t-1 d_ln_team_t-1	d_ln_posters_t-2 d_ln_team_t-2
-------	1.154047	1.095487	0.882807
ln_new_signups_t-1	0.682160	0.862841	0.757570
ln_new_signups_t-2	0.760223	0.935912	0.803341

Appendix 98 ADL (d_ln_participation) Model Selection, SC; Region 2

	d_ln_participation	d_ln_participation_t-1	d_ln_participation_t-2
-------	1.116894	1.241471	1.160391
ln_new_signups_t-1	1.182873	1.331933	1.249453
ln_new_signups_t-2	1.332108	1.441033	1.355845

Appendix 99 ADL (d_ln_participation, d_ln_team) Estimation Output; Region 2

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	5.576517	0.074500	74.85273	0.0000
d_ln_participation	0.002148	0.070537	0.030454	0.9759
d_ln_team	0.457903	0.471656	0.970842	0.3397

R-squared	0.031857	Mean dependent var	5.600013
Adjusted R-squared	-0.034912	S.D. dependent var	0.385688
S.E. of regression	0.392363	Akaike info criterion	1.055801
Sum squared resid	4.464511	Schwarz criterion	1.193214
Log likelihood	-13.89281	Hannan-Quinn criter.	1.101349
F-statistic	0.477125	Durbin-Watson stat	1.613187
Prob(F-statistic)	0.625351		

Sample (adjusted): 2009M09 - 2012M04
Included observations: 32 (after adj.)

Appendix 100 VAR (d_ln_posters) Lag Order Selection, SC; Region 2

Lag	SC
0	1.3659
1	1.2523
2	1.5927
3	1.9515
4	2.3836

Appendix 101 VAR (d_ln_posters) Normality, Autocorrelation, and Heteroskedasticity Tests; Region 2

	Statistic	p-value
Jarque-Bera	5.5053	0.2393
White[1)]	12.4022	0.6484
Autocorrelation LM		
Lags		
1	7.7135	0.1027
2	3.2934	0.5100
3	1.6502	0.7997
4	4.3861	0.3563

1) Cross terms included

Appendix 102 VAR (d_ln_posters) Estimation Output; Region 2

	d_ln_posters	ln_new_signups
d_ln_posters_t-1	0.033653	0.029791
	(0.08894)	(0.10124)
	[0.37839]	[0.29426]
ln_new_signups_t-1	-0.544473	0.098211
	(0.16943)	(0.19287)
	[-3.21361]	[0.50921]
Constant	3.130658	5.050642
	(0.94598)	(1.07687)
	[3.30943]	[4.69013]
R-squared	0.271414	0.015139
Adj. R-squared	0.219372	-0.055208
Sum sq. resids	3.481847	4.511993
S.E. equation	0.352635	0.401426
F-statistic	5.215289	0.215202
Log likelihood	-10.09752	-14.11475
Akaike AIC	0.845001	1.104177
Schwarz SC	0.983774	1.242950
Mean dependent	0.092584	5.605519
S.D. dependent	0.399120	0.390783
Determinant resid covariance (dof adj.)		0.010091
Determinant resid covariance		0.008232
Log likelihood		-13.57893
Akaike information criterion		1.263157
Schwarz criterion		1.540703

Sample (adjusted): 2009M10 - 2012M04
Included observations: 31 (after adj.)
Std. errors in ( ); t-statistics in [ ]

Appendix 103 VAR (d_ln_participation) Lag Order Selection, SC; Region 2

Lag	SC
0	2.8099
1	3.1766
2	3.6058
3	3.7937
4	4.1561

Appendix 104 Normality, Autocorrelation, and Heteroskedasticity Tests; Region 3

Model	Jarque-Bera		Breusch-Godfrey Serial Corr LM Test[1)]		White Heteroskedasticity Test[2)]	
	Statistic	p-value	Statistic	p-value	Statistic	p-value
Bass	3.9956	0.1356	0.8590	0.5014	2.3827	0.0754
ARMA	0.1970	0.9062	0.2125	0.9291	0.2533	0.7779
ADL (d_ln_posters)	0.1526	0.9266	0.3095	0.8682	0.5871	0.8462
ADL (d_ln_posters, d_ln_team)	0.4050	0.8167	0.6618	0.6270	1.1601[3)]	0.3672[3)]
ADL (d_ln_participation)	0.4363	0.8040	0.1225	0.9731	2.4972	0.0565

1) 4 lags included
2) White cross terms included
3) White-test cannot be performed; results of Breusch-Pagan-Godfrey test

Appendix 105 ARMA Model Selection, SC; Region 3

	MA(0)	MA(1)	MA(2)
AR(0)	2.908002	2.380779	1.773791
AR(1)	1.714515	1.791451	1.896663
AR(2)	1.829673	1.785838	1.914623

Appendix 106 ADL (d_ln_posters) Model Selection, SC; Region 3

	d_ln_posters	d_ln_posters_t-1	d_ln_posters_t-2
-------	2.423313	2.235955	2.216684
ln_new_signups_t-1	1.337119	1.430390	1.440324
ln_new_signups_t-2	1.378783	1.487752	1.279547

Appendix 107 ADL (d_ln_posters, d_ln_team) Model Selection, SC; Region 3

	d_ln_posters d_ln_team	d_ln_posters_t-1 d_ln_team_t-1	d_ln_posters_t-2 d_ln_team_t-2
-------	2.481193	2.193544	2.234687
ln_new_signups_t-1	1.443401	1.472489	1.578626
ln_new_signups_t-2	1.465674	1.503584	1.397695

Appendix 108 ADL (d_ln_participation) Model Selection, SC; Region 3

	d_ln_participation	d_ln_participation_t-1	d_ln_participation_t-2
-------	2.167412	2.207627	2.070824
ln_new_signups_t-1	1.809798	1.944382	1.878309
ln_new_signups_t-2	1.930968	2.034204	1.991592

Appendix 109 ADL (d_ln_participation, d_ln_team) Estimation Output; Region 3

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	2.367980	0.586861	4.034989	0.0004
ln_new_signups_t-1	0.491910	0.129459	3.799743	0.0007
d_ln_participation	-0.081519	0.135565	-0.601331	0.5525
d_ln_team	0.038245	0.744828	0.051348	0.9594

R-squared	0.530708	Mean dependent var	4.522017
Adjusted R-squared	0.480427	S.D. dependent var	0.753969
S.E. of regression	0.543472	Akaike info criterion	1.734791
Sum squared resid	8.270128	Schwarz criterion	1.918008
Log likelihood	-23.75666	Hannan-Quinn criter.	1.795522
F-statistic	10.55478	Durbin-Watson stat	2.067765
Prob(F-statistic)	0.000082		

Sample (adjusted): 2009M09 - 2012M04
Included observations: 32 (after adj.)

Appendix 110 VAR (d_ln_posters) Lag Order Selection, SC; Region 3

Lag	SC
0	2.9032
1	2.7323
2	2.9617
3	3.3764
4	3.7808

Appendix 111 VAR (d_ln_posters) Normality, Autocorrelation, and Heteroskedasticity Tests; Region 3

	Statistic	p-value
Jarque-Bera	5.7256	0.2206
White[1)]	6.9844	0.9581
Autocorrelation LM		
Lags		
1	7.6920	0.1035
2	3.9903	0.4073
3	1.4877	0.8288
4	1.6985	0.7910

1) Cross terms included

Appendix 112 VAR (d_ln_posters) Estimation Output; Region 3

	d_ln_posters	ln_new_signups
d_ln_posters_t-1	0.181184	-0.078912
	(0.18259)	(0.22594)
	[0.99228]	[-0.34926]
ln_new_signups_t-1	-0.152646	0.556879
	(0.10690)	(0.13228)
	[-1.42790]	[4.20987]
Constant	0.817395	2.078857
	(0.48548)	(0.60073)
	[1.68368]	[3.46058]
R-squared	0.084907	0.389910
Adj. R-squared	0.019543	0.346332
Sum sq. resids	5.446517	8.339261
S.E. equation	0.441042	0.545739
F-statistic	1.298986	8.947429
Log likelihood	-17.03243	-23.63540
Akaike AIC	1.292415	1.718413
Schwarz SC	1.431187	1.857186
Mean dependent	0.160982	4.585148
S.D. dependent	0.445416	0.675004
Determinant resid covariance (dof adj.)		0.033843
Determinant resid covariance		0.027610
Log likelihood		-32.33550
Akaike information criterion		2.473258
Schwarz criterion		2.750804

Sample (adjusted): 2009M10 - 2012M04
Included observations: 31 (after adj.)
Std. errors in ( ); t-statistics in [ ]

Appendix 113 VAR (d_ln_participation) Lag Order Selection, SC; Region 3

Lag	SC
0	3.7227
1	3.8807
2	4.0785
3	4.3717
4	4.8425

Appendix 114 Normality, Autocorrelation, and Heteroskedasticity Tests; Region 4

Model	Jarque-Bera		Breusch-Godfrey Serial Corr LM Test[1)]		White Heteroskedasticity Test[2)]	
	Statistic	p-value	Statistic	p-value	Statistic	p-value
Bass	1.1340	0.5672	0.9800	0.4355	7.8367	0.0002
ARMA	0.7324	0.6934	1.1367	0.3630	4.1883	0.0067
ADL (d_ln_posters)	0.9997	0.6000	0.7962	0.5389	4.0724	0.0073
ADL (d_ln_posters, d_ln_team)	0.8806	0.6439	0.9821	0.4359	2.7663	0.0294
ADL (d_ln_participation)	0.5096	0.7751	0.8138	0.5294	1.1181	0.3929

1) 4 lags included
2) White cross terms included

Appendix 115 ARMA Model Selection, SC; Region 4

	MA(0)	MA(1)	MA(2)
AR(0)	2.402301	2.329518	2.410981
AR(1)	1.779761	1.660194	1.708370
AR(2)	1.569605	1.650430	1.656891

Appendix 116 ADL (d_ln_posters) Model Selection, SC; Region 4

	d_ln_posters	d_ln_posters_t-1	d_ln_posters_t-2
-------	1.765814	1.351357	1.307376
ln_new_signups_t-1	1.184270	1.263389	1.303840
ln_new_signups_t-2	1.194806	1.289990	1.398109

Appendix 117 ADL (d_ln_posters, d_ln_team) Model Selection, SC; Region 4

	d_ln_posters d_ln_team	d_ln_posters_t-1 d_ln_team_t-1	d_ln_posters_t-2 d_ln_team_t-2
-------	1.861859	1.539250	1.569588
ln_new_signups_t-1	1.291024	1.471520	1.603793
ln_new_signups_t-2	1.303501	1.495080	1.698222

Appendix 118 ADL (d_ln_participation) Model Selection, SC; Region 4

	d_ln_participation	d_ln_participation_t-1	d_ln_participation_t-2
-------	1.778212	1.374256	1.380276
ln_new_signups_t-1	1.330413	1.371047	1.446384
ln_new_signups_t-2	1.301809	1.399568	1.520971

Appendix 119 ADL (d_ln_participation, d_ln_team) Estimation Output; Region 4

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	2.946265	0.871310	3.381421	0.0023
ln_new_signups_t-1	0.228633	0.166688	1.371622	0.1819
ln_new_signups_t-2	0.152831	0.101308	1.508576	0.1435
d_ln_participation	0.417009	0.119044	3.502991	0.0017
d_ln_team	0.304527	0.523988	0.581172	0.5661

R-squared	0.340878	Mean dependent var	4.865235
Adjusted R-squared	0.239475	S.D. dependent var	0.462450
S.E. of regression	0.403294	Akaike info criterion	1.168387
Sum squared resid	4.228794	Schwarz criterion	1.399676
Log likelihood	-13.11000	Hannan-Quinn criter.	1.243782
F-statistic	3.361603	Durbin-Watson stat	2.360104
Prob(F-statistic)	0.024070		

Sample (adjusted): 2009M10 - 2012M04
Included observations: 31 (after adj.)

Appendix 120 VAR (d_ln_posters) Lag Order Selection, SC; Region 4

Lag	SC
0	2.5030
1	2.5596
2	2.9627
3	3.3560
4	3.7110

Appendix 121 VAR (d_ln_participation) Lag Order Selection, SC; Region 4

Lag	SC
0	2.8355
1	3.0936
2	3.5486
3	3.9032
4	4.2896

Appendix 122 Normality, Autocorrelation, and Heteroskedasticity Tests; Region 5

Model	Jarque-Bera		Breusch-Godfrey Serial Corr LM Test[1)]		White Heteroskedasticity Test[2)]	
	Statistic	p-value	Statistic	p-value	Statistic	p-value
Bass	1.4357	0.4878	0.2451	0.9100	0.4279	0.7872
ARMA	0.1655	0.9206	0.2313	0.9175	0.7623[3)]	0.6512[3)]
ADL (d_ln_posters)	0.9199	0.6313	0.0972	0.9823	1.1360	0.3821
ADL (d_ln_posters, d_ln_team)	0.1374	0.9336	0.2549	0.9034	1.2628	0.3208
ADL (d_ln_participation)	5.2616	0.0720	0.6299	0.6455	0.8172	0.4516

1) 4 lags included
2) White cross terms included
3) White-test cannot be performed; results of Breusch-Pagan-Godfrey test

Appendix 123 ARMA Model Selection, SC; Region 5

	MA(0)	MA(1)	MA(2)
AR(0)	1.130559	1.159429	1.263973
AR(1)	0.973464	1.060667	1.068808
AR(2)	1.102872	1.030990	0.612213

Appendix 124 ADL (d_ln_posters) Model Selection, SC; Region 5

	d_ln_posters	d_ln_posters_t-1	d_ln_posters_t-2
-------	0.920628	0.912727	0.864978
ln_new_signups_t-1	0.633947	0.618234	0.621477
ln_new_signups_t-2	0.615635	0.691527	0.729264

Appendix 125 ADL (d_ln_posters, d_ln_team) Model Selection, SC; Region 5

	d_ln_posters d_ln_team	d_ln_posters_t-1 d_ln_team_t-1	d_ln_posters_t-2 d_ln_team_t-2
-------	0.984722	1.086561	1.136658
ln_new_signups_t-1	0.633202	0.584746	0.670444
ln_new_signups_t-2	0.592770	0.629714	0.781777

Appendix 126 ADL (d_ln_participation) Model Selection, SC; Region 5

	d_ln_participation	d_ln_participation_t-1	d_ln_participation_t-2
-------	1.014822	1.148115	1.270211
ln_new_signups_t-1	1.081626	1.212861	1.337907
ln_new_signups_t-2	1.213425	1.313855	1.398350

Appendix 127 ADL (d_ln_participation, d_ln_team) Estimation Output; Region 5

Dependent Variable: ln_new_signups

	Coefficient	Std. Error	t-Statistic	p-value
Constant	5.181933	0.067320	76.97507	0.0000
d_ln_participation	0.060733	0.131931	0.460342	0.6487
d_ln_team	-0.654114	0.529461	-1.235435	0.2266

R-squared	0.050318	Mean dependent var	5.164356
Adjusted R-squared	-0.015177	S.D. dependent var	0.366488
S.E. of regression	0.369259	Akaike info criterion	0.934421
Sum squared resid	3.954205	Schwarz criterion	1.071833
Log likelihood	-11.95073	Hannan-Quinn criter.	0.979969
F-statistic	0.768271	Durbin-Watson stat	1.408310
Prob(F-statistic)	0.473024		

Sample (adjusted): 2009M09 - 2012M04
Included observations: 32 (after adj.)

Appendix 128 VAR (d_ln_posters) Lag Order Selection, SC; Region 5

Lag	SC
0	0.9859
1	0.7182
2	1.0880
3	1.4097
4	1.6371

Appendix 129 VAR (d_ln_posters) Normality, Autocorrelation, and Heteroskedasticity Tests; Region 5

		Statistic	p-value
Jarque-Bera		3.6175	0.4602
White[1)]		11.6445	0.7057
Autocorrelation LM			
	Lags		
	1	1.9842	0.7387
	2	3.1620	0.5311
	3	7.0517	0.1332
	4	1.0792	0.8976

1) Cross terms included

Appendix 130 VAR (d_ln_posters) Estimation Output; Region 5

	d_ln_posters	ln_new_signups
d_ln_posters_t-1	0.042144	0.000265
	(0.12532)	(0.21407)
	[0.33629]	[0.00124]
ln_new_signups_t-1	-0.380527	0.215915
	(0.11889)	(0.20309)
	[-3.20068]	[1.06314]
Constant	2.021569	4.048394
	(0.61354)	(1.04808)
	[3.29491]	[3.86269]
R-squared	0.280018	0.043718
Adj. R-squared	0.228591	-0.024588
Sum sq. resids	1.362167	3.974895
S.E. equation	0.220565	0.376777
F-statistic	5.444942	0.640027
Log likelihood	4.449019	-12.15027
Akaike AIC	-0.093485	0.977437
Schwarz SC	0.045288	1.116210
Mean dependent	0.053844	5.167032
S.D. dependent	0.251127	0.372228
Determinant resid covariance (dof adj.)		0.003757
Determinant resid covariance		0.003065
Log likelihood		1.734368
Akaike information criterion		0.275202
Schwarz criterion		0.552748

Sample (adjusted): 2009M10 - 2012M04
Included observations: 31 (after adj.)
Std. errors in ( ); t-statistics in [ ]

Appendix 131 VAR (d_ln_participation) Lag Order Selection, SC; Region 5

Lag	SC
0	2.7976
1	3.2036
2	3.5400
3	3.5400
4	3.9423

Appendix 132 Normality, Autocorrelation, and Heteroskedasticity Tests; Region 6

Model	Jarque-Bera		Breusch-Godfrey Serial Corr LM Test[1)]		White Heteroskedasticity Test[2)]	
	Statistic	p-value	Statistic	p-value	Statistic	p-value
Bass	1.5393	0.4632	1.5905	0.2066	1.7259	0.1723
ARMA	0.0778	0.9619	2.0507	0.1191	1.5211	0.2004
ADL (d_ln_posters)	0.9310	0.6278	1.5255	0.2279	6.6464	0.0002
ADL (d_ln_posters, d_ln_team)	1.2457	0.5364	0.2028	0.9334	1.7922[3)]	0.1355[3)]
ADL (d_ln_participation)	0.2985	0.8613	2.1481	0.1123	0.7151	0.7466

1) 4 lags included
2) White cross terms included
3) White-test cannot be performed; results of Breusch-Pagan-Godfrey test

Appendix 133 ARMA Model Selection, SC; Region 6

	MA(0)	MA(1)	MA(2)
AR(0)	2.784613	2.566941	2.063918
AR(1)	2.035357	1.075621	1.754965
AR(2)	1.716624	1.813316	1.858354

Appendix 134 ADL (d_ln_posters) Model Selection, SC; Region 6

	d_ln_posters	d_ln_posters_t-1	d_ln_posters_t-2
-------	2.637610	2.660286	2.614741
ln_new_signups_t-1	1.401408	1.177679	1.232737
ln_new_signups_t-2	1.182218	1.217586	1.182440

Appendix 135 ADL (d_ln_posters, d_ln_team) Model Selection, SC; Region 6

	d_ln_posters d_ln_team	d_ln_posters_t-1 d_ln_team_t-1	d_ln_posters_t-2 d_ln_team_t-2
-------	2.719240	2.803362	2.765944
ln_new_signups_t-1	1.502560	1.323266	1.366446
ln_new_signups_t-2	1.252109	1.375072	1.197374

Appendix 136 ADL (d_ln_participation) Model Selection, SC; Region 6

	d_ln_participation	d_ln_participation_t-1	d_ln_participation_t-2
-------	2.695698	2.668959	2.541864
ln_new_signups_t-1	1.774498	1.645698	1.652759
ln_new_signups_t-2	1.572423	1.616242	1.555972

Appendix 137 ADL (d_ln_participation, d_ln_team) Estimation Output; Region 6

Dependent Variable: ln_new_signups				
	Coefficient	**Std. Error**	**t-Statistic**	**p-value**
Constant	0.923578	0.486269	1.899317	0.0687
ln_new_signups_t-1	0.395617	0.139732	2.831260	0.0088
ln_new_signups_t-2	0.423253	0.123972	3.414098	0.0021
d_ln_participation	0.459654	0.143563	3.201761	0.0036
d_ln_team	1.764655	0.917797	1.922707	0.0655

R-squared	0.773052	Mean dependent var	5.041192
Adjusted R-squared	0.738137	S.D. dependent var	0.849732
S.E. of regression	0.434830	Akaike info criterion	1.318966
Sum squared resid	4.916001	Schwarz criterion	1.550254
Log likelihood	-15.44397	Hannan-Quinn criter.	1.394360
F-statistic	22.14092	Durbin-Watson stat	1.970038
Prob(F-statistic)	0.000000		

Sample (adjusted): 2009M10 - 2012M04
Included observations: 31 (after adj.)

Appendix 138 VAR (d_ln_posters) Lag Order Selection, SC; Region 6

Lag	SC
0	3.0855
1	2.2807
2	2.2895
3	2.7248
4	2.7770

Appendix 139 VAR (d_ln_posters) Normality, Autocorrelation, and Heteroskedasticity Tests; Region 6

		Statistic	p-value
Jarque-Bera		8.1027	0.0879
White[1)]		24.8211	0.1299
Autocorrelation LM			
	Lags		
	1	2.5524	0.6353
	2	0.3826	0.9839
	3	2.1632	0.7058
	4	1.9310	0.7484

1) Cross terms included

Appendix 140 VAR (d_ln_posters) Estimation Output; Region 6

	d_ln_posters	ln_new_signups
d_ln_posters_t-1	-0.186485	-0.676754
	(0.18027)	(0.20532)
	[-1.03446]	[-3.29611]
ln_new_signups_t-1	-0.099823	0.723072
	(0.10322)	(0.11756)
	[-0.96707]	[6.15046]
Constant	0.625907	1.554256
	(0.51964)	(0.59183)
	[1.20451]	[2.62618]
DUM2010M01	-0.307630	-1.099859
	(0.47505)	(0.54105)
	[-0.64757]	[-2.03282]
R-squared	0.097252	0.673515
Adj. R-squared	-0.003054	0.637239
Sum sq. resids	5.451945	7.072109
S.E. equation	0.449359	0.511791
F-statistic	0.969556	18.56634
Log likelihood	-17.04787	-21.08075
Akaike AIC	1.357927	1.618113
Schwarz SC	1.542957	1.803144
Mean dependent	0.096566	5.041192
S.D. dependent	0.448675	0.849732
Determinant resid covariance (dof adj.)		0.023654
Determinant resid covariance		0.017944
Log likelihood		-25.65634
Akaike information criterion		2.171377
Schwarz criterion		2.541438

Sample (adjusted): 2009M10 - 2012M04
Included observations: 31 (after adj.)
Std. errors in ( ); t-statistics in [ ]

Appendix 141 VAR (d_ln_participation) Lag Order Selection, SC; Region 6

Lag	SC
0	3.6955
1	3.2193
2	3.2457
3	3.6756
4	3.8869

Appendix 142 VAR (d_ln_participation) Normality, Autocorrelation, and Heteroskedasticity Tests; Region 6

		Statistic	p-value
Jarque-Bera		1.3832	0.8471
White[1)]		26.2659	0.0938
Autocorrelation LM			
	Lags		
	1	6.9848	0.1367
	2	1.8116	0.7704
	3	0.6992	0.9514
	4	0.9086	0.9233

1) Cross terms included

Appendix 143 VAR (d_ln_participation) Estimation Output; Region 6

	d_ln_participation	ln_new_signups
d_ln_participation_t-1	-0.312603	-0.519080
	(0.15418)	(0.12928)
	[-2.02754]	[-4.01521]
ln_new_signups_t-1	-0.121595	0.668948
	(0.12737)	(0.10680)
	[-0.95467]	[6.26364]
Constant	0.726068	1.809696
	(0.64629)	(0.54192)
	[1.12343]	[3.33943]
DUM2010M01	-0.470225	-1.204600
	(0.60297)	(0.50559)
	[-0.77985]	[-2.38256]
R-squared	0.177327	0.713321
Adj. R-squared	0.085919	0.681468
Sum sq. resids	8.832331	6.209860
S.E. equation	0.571947	0.479578
F-statistic	1.939946	22.39397
Log likelihood	-24.52579	-19.06544
Akaike AIC	1.840373	1.488093
Schwarz SC	2.025404	1.673123
Mean dependent	0.067440	5.041192
S.D. dependent	0.598223	0.849732
Determinant resid covariance (dof adj.)		0.061726
Determinant resid covariance		0.046824
Log likelihood		-40.52315
Akaike information criterion		3.130526
Schwarz criterion		3.500587

Sample (adjusted): 2009M10 - 2012M04
Included observations: 31 (after adj.)
Std. errors in ( ); t-statistics in [ ]

Appendix 144 Normality, Autocorrelation, and Heteroskedasticity Tests; Region 2

Model	Jarque-Bera		Breusch-Godfrey Serial Corr LM Test[1)]		White Heteroskedasticity Test[2)]	
	Statistic	p-value	Statistic	p-value	Statistic	p-value
ADL (ln_posters)	0.2326	0.8902	0.8700	0.4969	1.5625	0.1909
ADL (ln_participation)	0.8323	0.6596	0.3125	0.8668	0.4982	0.7747

1) 4 lags included
2) White cross terms included

Appendix 145 ADL (ln_posters) Model Selection, SC; Region 2

	ln_posters	ln_posters_t-1	ln_posters_t-2
-------	0.877494	0.552876	0.508251
ln_new_signups_t-1	0.672232	0.540714	0.579620
ln_new_signups_t-2	0.673011	0.586247	0.690336

Appendix 146 ADL (ln_participation) Model Selection, SC; Region 2

	ln_participation	ln_participation_t-1	ln_participation_t-2
-------	1.231156	1.035221	1.156715
ln_new_signups_t-1	1.034700	1.142054	1.267413
ln_new_signups_t-2	1.103198	1.208404	1.312589

Appendix 147 VAR (ln_posters) Lag Order Selection, SC; Region 2

Lag	SC
0	1.9917
1	1.2665
2	1.5649
3	1.9105
4	2.3430

Appendix 148 VAR (ln_posters) Normality, Autocorrelation, and Heteroskedasticity Tests; Region 2

	Statistic	p-value
Jarque-Bera	2.4169	0.6596
White[1)]	16.2124	0.3681
Autocorrelation LM		
Lags		
1	7.9877	0.0920
2	5.8530	0.2104
3	0.2454	0.9931
4	2.7915	0.5933

1) Cross terms included

Appendix 149 VAR (ln_posters) Estimation Output; Region 2

	ln_posters	ln_new_signups
ln_posters_t-1	0.949679	0.221438
	(0.14029)	(0.13845)
	[6.76964]	[1.59943]
ln_new_signups_t-1	-0.818071	-0.223234
	(0.20889)	(0.20615)
	[-3.91630]	[-1.08286]
Constant	4.927735	5.775340
	(0.64042)	(0.63203)
	[7.69457]	[9.13777]
R-squared	0.694465	0.095890
Adj. R-squared	0.673394	0.033538
Sum sq. resids	4.280613	4.169228
S.E. equation	0.384197	0.379166
F-statistic	32.95781	1.537870
Log likelihood	-13.21980	-12.79795
Akaike AIC	1.013737	0.987372
Schwarz SC	1.151150	1.124785
Mean dependent	4.940014	5.600013
S.D. dependent	0.672267	0.385688
Determinant resid covariance (dof adj.)		0.010619
Determinant resid covariance		0.008721
Log likelihood		-14.93975
Akaike information criterion		1.308734
Schwarz criterion		1.583560

Sample (adjusted): 2009M09 - 2012M04
Included observations: 32 (after adj.)
Std. errors in ( ); t-statistics in [ ]

Appendix 150 VAR (ln_participation) Lag Order Selection, SC; Region 2

Lag	SC
0	2.5205
1	2.7574
2	3.1221
3	3.5557
4	3.8828

Appendix 151 Normality, Autocorrelation, and Heteroskedasticity Tests; Region 4

Model	Jarque-Bera		Breusch-Godfrey Serial Corr LM Test[1)]		White Heteroskedasticity Test[2)]	
	Statistic	p-value	Statistic	p-value	Statistic	p-value
ADL (ln_posters)	3.7335	0.1546	0.5244	0.7187	7.7912	0.0001
ADL (ln_participation)	1.0748	0.5843	0.7863	0.5449	1.2024	0.3356

1) 4 lags included
2) White cross terms included

Appendix 152 ADL (ln_posters) Model Selection, SC; Region 4

	ln_posters	ln_posters_t-1	ln_posters_t-2
-------	1.422579	1.072701	1.151360
ln_new_signups_t-1	1.325504	1.086479	1.224780
ln_new_signups_t-2	1.344902	1.219923	1.328218

Appendix 153 ADL (ln_participation) Model Selection, SC; Region 4

	ln_participation	ln_participation_t-1	ln_participation_t-2
-------	1.464579	1.063595	1.130465
ln_new_signups_t-1	1.342575	1.140860	1.241161
ln_new_signups_t-2	1.301523	1.255425	1.350416

Appendix 154 VAR (ln_posters) Lag Order Selection, SC; Region 4

Lag	SC
0	3.0503
1	2.5049
2	2.9018
3	3.3048
4	3.6790

Appendix 155 VAR (ln_posters) Normality, Autocorrelation, and Heteroskedasticity Tests; Region 4

	Statistic	p-value
Jarque-Bera	0.8861	0.9265
White[1)]	27.3742	0.1588
Autocorrelation LM		
Lags		
1	7.4963	0.1119
2	0.8039	0.9379
3	0.4769	0.9757
4	1.9080	0.7527

1) Cross terms included

Appendix 156 VAR (ln_posters) Estimation Output; Region 4

	ln_posters	ln_new_signups
ln_posters_t-1	0.987132	0.240582
	(0.13620)	(0.16109)
	[7.24746]	[1.49349]
ln_new_signups_t-1	-0.227330	0.108554
	(0.18873)	(0.22321)
	[-1.20450]	[0.48632]
Constant	1.180175	3.316628
	(0.57577)	(0.68095)
	[2.04974]	[4.87055]
DUM2009M10	2.408338	1.406254
	(0.56668)	(0.67021)
	[4.24988]	[2.09822]
DUM2012M03	1.368856	-0.199969
	(0.46083)	(0.54501)
	[2.97045]	[-0.36691]
R-squared	0.834741	0.271330
Adj. R-squared	0.810258	0.163379
Sum sq. resids	5.426039	7.589732
S.E. equation	0.448291	0.530190
F-statistic	34.09495	2.513456
Log likelihood	-17.01361	-22.38300
Akaike AIC	1.375851	1.711437
Schwarz SC	1.604872	1.940459
Mean dependent	4.069405	4.801734
S.D. dependent	1.029148	0.579652
Determinant resid covariance (dof adj.)		0.011711
Determinant resid covariance		0.008337
Log likelihood		-14.21903
Akaike information criterion		1.513690
Schwarz criterion		1.971732

Sample (adjusted): 2009M09 - 2012M04
Included observations: 32 (after adj.)
Std. errors in ( ); t-statistics in [ ]

Appendix 157 VAR (ln_participation) Lag Order Selection, SC; Region 4

Lag	SC
0	3.3723
1	2.9222
2	3.2745
3	3.5803
4	3.8981

Appendix 158 VAR (ln_participation) Normality, Autocorrelation, and Heteroskedasticity Tests; Region 4

		Statistic	p-value
Jarque-Bera		2.4292	0.6574
White[1)]		20.7119	0.2942
Autocorrelation LM			
	Lags		
	1	3.8773	0.4229
	2	1.5128	0.8244
	3	1.4465	0.8361
	4	2.1201	0.7137

1) Cross terms included

Appendix 159 VAR (ln_participation) Estimation Output; Region 4

	ln_participation	ln_new_signups
ln_participation_t-1	0.919175	0.199294
	(0.13962)	(0.11958)
	[6.58343]	[1.66661]
ln_new_signups_t-1	-0.073168	0.099380
	(0.24359)	(0.20863)
	[-0.30037]	[0.47635]
Constant	0.862223	3.334641
	(0.76809)	(0.65785)
	[1.12255]	[5.06897]
DUM2009M10	2.603174	1.414231
	(0.75430)	(0.64604)
	[3.45112]	[2.18909]
R-squared	0.798348	0.280985
Adj. R-squared	0.776742	0.203948
Sum sq. resids	10.20948	7.489167
S.E. equation	0.603841	0.517175
F-statistic	36.95093	3.647394
Log likelihood	-27.12733	-22.16958
Akaike AIC	1.945458	1.635599
Schwarz SC	2.128675	1.818816
Mean dependent	5.003434	4.801734
S.D. dependent	1.277966	0.579652
Determinant resid covariance (dof adj.)		0.049374
Determinant resid covariance		0.037802
Log likelihood		-38.40561
Akaike information criterion		2.900351
Schwarz criterion		3.266785

Sample (adjusted): 2009M09 - 2012M04
Included observations: 32 (after adj.)
Std. errors in ( ); t-statistics in [ ]

Appendix 160 Normality, Autocorrelation, and Heteroskedasticity Tests; Region 5

	Jarque-Bera		Breusch-Godfrey Serial Corr LM Test[1)]		White Heteroskedasticity Test[2)]	
Model	Statistic	p-value	Statistic	p-value	Statistic	p-value
ADL (ln_posters)	1.9744	0.3726	0.3161	0.8644	0.7994	0.6209
ADL (ln_participation)	1.0764	0.5838	1.0071	0.4211	1.5780	0.2230

1) 4 lags included
2) White cross terms included

Appendix 161 ADL (ln_posters) Model Selection, SC; Region 5

	ln_posters	ln_posters_t-1	ln_posters_t-2
-------	0.869812	0.788170	0.774576
ln_new_signups_t-1	0.988078	0.551131	0.628780
ln_new_signups_t-2	1.003844	0.594755	0.702422

Appendix 162 ADL (ln_participation) Model Selection, SC; Region 5

	ln_participation	ln_participation_t-1	ln_participation_t-2
-------	1.041852	1.075599	1.212673
ln_new_signups_t-1	1.059975	1.168069	1.294860
ln_new_signups_t-2	1.117900	1.225893	1.336622

Appendix 163 VAR (ln_posters) Lag Order Selection, SC; Region 5

Lag	SC
0	1.0579
1	0.3929
2	0.8007
3	1.1617
4	1.4758

Appendix 164 VAR (ln_posters) Normality, Autocorrelation, and Heteroskedasticity Tests; Region 5

	Statistic	p-value
Jarque-Bera	3.5143	0.4757
White[1)]	17.2703	0.3030
Autocorrelation LM		
Lags		
1	2.3786	0.6665
2	3.9492	0.4129
3	4.6646	0.3235
4	1.8267	0.7676

1) Cross terms included

Appendix 165 VAR (ln_posters) Estimation Output; Region 5

	ln_posters	ln_new_signups
ln_posters_t-1	0.705449	-0.048825
	(0.07957)	(0.13797)
	[8.86545]	[-0.35389]
ln_new_signups_t-1	-0.288627	0.226265
	(0.11886)	(0.20609)
	[-2.42822]	[1.09788]
Constant	2.978649	4.232046
	(0.48576)	(0.84224)
	[6.13192]	[5.02473]
R-squared	0.761942	0.044960
Adj. R-squared	0.745524	-0.020904
Sum sq. resids	1.322739	3.976513
S.E. equation	0.213569	0.370299
F-statistic	46.40954	0.682616
Log likelihood	5.570472	-12.04074
Akaike AIC	-0.160655	0.940047
Schwarz SC	-0.023242	1.077459
Mean dependent	4.843929	5.164356
S.D. dependent	0.423365	0.366488
Determinant resid covariance (dof adj.)		0.003316
Determinant resid covariance		0.002723
Log likelihood		3.683850
Akaike information criterion		0.144759
Schwarz criterion		0.419585

Sample (adjusted): 2009M09 - 2012M04
Included observations: 32 (after adj.)
Std. errors in ( ); t-statistics in [ ]

Appendix 166 VAR (ln_participation) Lag Order Selection, SC; Region 5

Lag	SC
0	2.7878
1	2.8072
2	2.7983
3	3.1023
4	3.3118

Appendix 167 Model Selection and Forecasting Performance (Bass, ARMA, ADL and VAR incl. d_ln_posters/d_ln_participation)

	Bass		ARMA		ADL				VAR			
					d_ln_posters		d_ln_participation		d_ln_posters		d_ln_participation	
	SC	RMSE	SC	RMSE	SC	RMSE	SC	RMSE	SC	RMSE	SC	RMSE
	AIC	MAE	AIC	MAE	AIC	MAE	AIC	MAE	AIC	MAE	AIC	MAE
Region 1	0.804309 *3*	0.569461 *4*	0.865810 *4*	0.682572 *5*	0.507668 *1*	0.559356 *3*	0.775356 *2*	0.512529 *2*	1.092977 *5*	0.448382 *1*	*VAR(0)* *6*	*6*
	0.624738 *2*	0.456720 *2*	0.684415 *4*	0.491148 *4*	0.326274 *1*	0.489940 *3*	0.684659 *5*	0.501042 *5*	0.630401 *3*	0.337662 *1*	*6*	*6*
Region 2	1.224260 *4*	0.911829 *5*	1.101018 *2*	0.891237 *4*	0.482513 *1*	0.746861 *1*	1.116894 *3*	0.872336 *2*	1.540703 *5*	0.886907 *3*	*VAR(0)* *6*	*6*
	1.042865 *4*	0.631596 *5*	1.009409 *2*	0.611291 *4*	0.202273 *1*	0.543002 *1*	1.025285 *3*	0.600538 *3*	1.263157 *5*	0.568453 *2*	*6*	*6*
Region 3	2.211019 *4*	0.303772 *3*	1.714515 *2*	0.259265 *1*	1.279547 *1*	0.329818 *5*	1.809798 *3*	0.260706 *2*	2.750804 *5*	0.310970 *4*	*VAR(0)* *6*	*6*
	2.074973 *4*	0.249843 *3*	1.622907 *2*	0.198933 *2*	0.999308 *1*	0.288227 *5*	1.672385 *3*	0.195050 *1*	2.473258 *5*	0.252235 *4*	*6*	*6*
Region 4	2.280116 *4*	0.645011 *4*	1.569605 *3*	0.599637 *3*	1.184270 *1*	0.364028 *2*	1.301809 *2*	0.222048 *1*	*VAR(0)* *5.5*	*5.5*	*VAR(0)* *5.5*	*5.5*
	2.144070 *4*	0.506322 *4*	1.430832 *3*	0.499543 *3*	1.046857 *1*	0.299059 *2*	1.116778 *2*	0.180803 *1*	*5.5*	*5.5*	*5.5*	*5.5*
Region 5	1.201222 *5*	0.588346 *5*	0.910860 *3*	0.410786 *1*	0.615635 *2*	0.435657 *2*	1.014822 *4*	0.495176 *4*	0.552748 *1*	0.443818 *3*	*VAR(0)* *6*	*6*
	1.065176 *5*	0.535764 *5*	0.587056 *3*	0.346638 *1*	0.430604 *2*	0.347253 *2*	0.923213 *4*	0.407219 *4*	0.275202 *1*	0.387960 *3*	*6*	*6*
Region 6	1.731827 *4*	0.651676 *6*	1.324878 *2*	0.095207 *1*	1.177679 *1*	0.381549 *5*	1.555972 *3*	0.261179 *3*	2.541438 *5*	0.304962 *4*	3.500587 *6*	0.210604 2
	1.595781 *4*	0.634025 *6*	1.141661 *2*	0.079101 *1*	0.992649 *1*	0.361416 *5*	1.275732 *3*	0.225563 *4*	2.171377 *5*	0.222500 *3*	3.130526 *6*	0.186739 2
Σ	*47*	*52*	*32*	*30*	*14*	*36*	*37*	*32*	*51*	*39*	*71*	63
Overall Rank	*4*	*5*	*2*	*1*	*1*	*3*	*3*	*2*	*5*	*4*	*6*	6

Appendix 168 Model Selection and Forecasting Performance (Bass, ARMA, ADL and VAR incl. ln_posters/ln_participation)

	Bass		ARMA		ADL				VAR			
					ln_posters		ln_participation		ln_posters		ln_participation	
	SC	RMSE	SC	RMSE	SC	RMSE	SC	RMSE	SC	RMSE	SC	RMSE
	AIC	MAE	AIC	MAE	AIC	MAE	AIC	MAE	AIC	MAE	AIC	MAE
Region 2	1.224260 *4*	0.911829 *3*	1.101018 *3*	0.891237 *2*	0.508251 *1*	1.054225 *4*	1.034700 *2*	0.876823 *1*	1.583560 *5*	1.155746 *5*	*VAR(0)* *6*	6
	1.042865 *4*	0.631596 *2*	1.009409 *3*	0.611291 *1*	0.323220 *1*	0.940555 *4*	0.897287 *2*	0.666234 *3*	1.308734 *5*	0.983532 *5*	*6*	6
Region 4	2.280116 *5*	0.645011 *3*	1.569605 *3*	0.599637 *2*	1.072701 *2*	0.702416 *4*	1.063595 *1*	0.495923 *1*	1.971732 *4*	0.766993 *6*	3.266785 *6*	0.721041 5
	2.144070 *5*	0.506322 *3*	1.430832 *3*	0.499543 *2*	0.935288 *2*	0.640264 *4*	0.926182 *1*	0.477706 *1*	1.513690 *4*	0.707702 *6*	2.900351 *6*	0.674794 5
Region 5	1.201222 *5*	0.588346 *4*	0.910860 *3*	0.410786 *1*	0.551131 *2*	0.682844 *5*	1.041852 *4*	0.435531 *2*	0.419585 *1*	0.450178 *3*	*VAR(0)* *6*	6
	1.065176 *5*	0.535764 *4*	0.587056 *3*	0.346638 *2*	0.367914 *2*	0.661482 *5*	0.951154 *4*	0.307779 *1*	0.144759 *1*	0.408871 *3*	*6*	6
Σ	*28*	*19*	*18*	*10*	*10*	*26*	*14*	*9*	*20*	*28*	*36*	34
Overall Rank	*5*	*3*	*3*	*2*	*1*	*4*	*2*	*1*	*4*	*5*	*6*	6

Appendix 169 Model Selection and Forecasting Performance (All Models)

	Bass		ARMA		ADL								VAR							
					ln_posters		d_ln_posters		ln_participation		d_ln_participation		ln_posters		d_ln_posters		ln_participation		d_ln_participation	
	SC	RMSE	SC	RMSE	SC	RMSE	SC	RMSE	SC	RMSE	SC	RMSE	SC	RMSE	SC	RMSE	SC	RMSE	SC	RMSE
	AIC	MAE	AIC	MAE	AIC	MAE	AIC	MAE	AIC	MAE	AIC	MAE	AIC	MAE	AIC	MAE	AIC	MAE	AIC	MAE
Region 2	1.224260 *6*	0.911829 *6*	1.101018 *4*	0.891237 *5*	0.508251 *2*	1.054225 *7*	0.482513 *1*	0.746861 *1*	1.034700 *3*	0.876823 *3*	1.116894 *5*	0.872336 *2*	1.583560 *8*	1.155746 *8*	1.540703 *7*	0.886907 *4*	*VAR(0)* *9.5*	*9.5*	*VAR(0)* *9.5*	*9.5*
	1.042865 *6*	0.631596 *5*	1.009409 *4*	0.611291 *4*	0.323220 *2*	0.940555 *7*	0.202273 *1*	0.543002 *1*	0.897287 *3*	0.666234 *6*	1.025285 *5*	0.600538 *3*	1.308734 *8*	0.983532 *8*	1.263157 *7*	0.568453 *2*	*9.5*	*9.5*	*9.5*	*9.5*
Region 4	2.280116 *7*	0.645011 *5*	1.569605 *5*	0.599637 *4*	1.072701 *2*	0.702416 *6*	1.184270 *3*	0.364028 *2*	1.063595 *1*	0.495923 *3*	1.301809 *4*	0.222048 *1*	1.971732 *6*	0.766993 *8*	*VAR(0)* *9.5*	*9.5*	3.266785 *8*	0.721041 *7*	*VAR(0)* *9.5*	*9.5*
	2.144070 *7*	0.506322 *5*	1.430832 *5*	0.499543 *4*	0.935288 *2*	0.640264 *6*	1.046857 *3*	0.299059 *2*	0.926182 *1*	0.477706 *3*	1.116778 *4*	0.180803 *1*	1.513690 *6*	0.707702 *8*	*9.5*	*9.5*	2.900351 *8*	0.674794 *7*	*9.5*	*9.5*
Region 5	1.201222 *8*	0.588346 *7*	0.910860 *5*	0.410786 *1*	0.551131 *2*	0.682844 *8*	0.615635 *4*	0.435657 *3*	1.041852 *7*	0.435531 *2*	1.014822 *6*	0.495176 *6*	0.419585 *1*	0.450178 *5*	0.552748 *3*	0.443818 *4*	*VAR(0)* *9.5*	*9.5*	*VAR(0)* *9.5*	*9.5*
	1.065176 *8*	0.535764 *7*	0.587056 *5*	0.346638 *2*	0.367914 *3*	0.661482 *8*	0.430604 *4*	0.347253 *3*	0.951154 *7*	0.307779 *1*	0.923213 *6*	0.407219 *5*	0.144759 *1*	0.408871 *6*	0.275202 *2*	0.387960 *4*	*9.5*	*9.5*	*9.5*	*9.5*
Σ	*42*	*35*	*28*	*20*	*13*	*42*	*16*	*12*	*22*	*18*	*30*	*18*	*30*	*43*	*38*	*33*	*54*	*52*	*57*	*57*
Overall Rank	*8*	*6*	*4*	*4*	*1*	*7*	*2*	*1*	*3*	*2.5*	*5.5*	*2.5*	*5.5*	*8*	*7*	*5*	*9*	*9*	*10*	*10*