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Essays on Finance and Entrepreneurship in a Global Venture Capital Landscape

Stefan J. Weik

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Vorsitz: Prof. Dr. Sebastian Schwenen
Prüfer*innen der Dissertation:
1. Prof. Dr. Dr. Ann-Kristin Achleitner
2. Prof. Dr. Christoph Kaserer

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Advisor: Ann-Kristin Achleitner Stefan J. Weik

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Abstract

This dissertation examines three research questions on finance and entrepreneurship in a global venture capital landscape. First, I seek to understand the main shortcomings of the startup ecosystem in Europe by studying how performance develops when European startups migrate to the U.S.[1] I find that the main difference between the U.S. and European startup ecosystems is a higher availability of venture capital funding and a higher risk tolerance in the U.S. Second, I provide a first view on international startup relocation from 17 advanced economies documenting that relocation is common, leads to most of the startup's workforce leaving the country, is mainly directed to the U.S., and is driven by foreign venture capital investment and fundraising issues. Last, I show that foreign venture capital investment may lead to emigration of startups and entrepreneurs out of host economies, suggesting that increased domestic funding should reduce this drain. These findings contribute to understanding the role of venture capital in promoting entrepreneurship and provide insights for policymakers, investors, and entrepreneurs seeking to enhance startup performance worldwide.

[1] In this dissertation, I use the term "I" in the introduction and conclusion. It does not necessarily refer to me directly as the second and third essay are based on joint work with my co-authors.

Betreuerin: Ann-Kristin Achleitner Stefan J. Weik

Aufsätze zu Finance und Entrepreneurship in einer globalen Venture Capital-Landschaft

Kurzfassung

In dieser Dissertation werden drei Forschungsfragen zu Finance und Entrepreneurship in einer globalen Venture Capital-Landschaft untersucht. Erstens wird untersucht, wie sich die Leistung europäischer Startups verändert, wenn sie in die USA ziehen, um zu verstehen welche die Hauptmängel im Startup-Ökosystem in Europa sind. Dabei zeigt sich, dass der Hauptunterschied zwischen den Startup-Ökosystemen in den USA und Europa in einer größeren Verfügbarkeit von Risikokapital und einer höheren Risikotoleranz in den USA besteht. Zweitens wird ein erster empirischer Einblick in die internationale Verlagerung von Startups aus 17 fortgeschrittenen Volkswirtschaften geboten, wobei dokumentiert wird, dass Verlagerungen regelmäßig vorkommen, dabei die Mehrheit der Arbeitskräfte der Startups das Herkunftsland verlässt, die USA das Hauptzielland sind und Verlagerungen insbesondere von ausländischen Venture Capital-Investitionen und Problemen bei der Kapitalbeschaffung getrieben sind. Schließlich wird gezeigt, dass ausländische Venture Capital-Investitionen zur Abwanderung von Startups und Unternehmern aus Gastländern führen können, was darauf hindeutet, dass eine erhöhte inländische Finanzierung diesen Abfluss reduzieren sollte. Diese Ergebnisse tragen dazu bei, die Rolle von Venture Capital bei der Förderung von Unternehmertum zu verstehen und bieten Einblicke für politische Entscheidungsträger, Investoren und Unternehmer, die die Leistung von Startups weltweit verbessern möchten.

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"We now come to the third of the elements with which our analysis works — the first being the creation of new combinations, and the second, depending on the social form: authority or credit. Although all three elements form a whole, the third — the entrepreneur — may be referred to as the actual fundamental phenomenon of economic development."

— Schumpeter (1934)

1

Introduction

Entrepreneurship is widely considered as a key factor for economic growth. However, the role of entrepreneurs has long been overlooked by economists, even though the issue of economic growth dates back at least to Adam Smith's "Wealth of Nations" in 1776. Earlier impactful work on economic growth highlighted the role of free markets (Smith, 1776), capital accumulation (Solow, 1956), and knowledge (Arrow, 1962; Romer, 1986; Lucas, 1988). It was not until the work of Schumpeter in 1934 that marked a turning point, as it recognized the importance of entrepreneurial activity in economic development. Accordingly, more recent models of "endogenous growth," such as the work of Aghion and Howitt (1992), emphasize the crucial role of entrepreneurial activity as a driver of innovation and economic development.

Venture capital (VC) has emerged as a crucial element in entrepreneurship, especially for the most innovative types. VC is a high-touch form of financing for innovative, high-growth, and high-risk companies, where most companies fail but some become overwhelming successes. For example, today (May 2023) eight of the top ten most valuable companies in the world all financed their early growth with venture capital: Alphabet, Apple, Amazon, Microsoft, Meta, Nvidia,

Tesla (in the United States), and TSMC (in Taiwan). Discerning the causal effect of venture capital in these outcomes is challenging; however, recent evidence suggests that the U.S. venture capital industry has played a significant role in fostering American leadership in entrepreneurship (Gornall and Strebulaev, 2021). Consistent with this view, there is mounting evidence on the positive effects of venture capital: promoting innovation (Kortum and Lerner, 2000; Bernstein et al., 2016), commercialization (Hellmann, 2002; Engel and Keilbach, 2007), productivity (Chemmanur et al., 2011), and growth (Hellmann and Puri, 2000; Bertoni et al., 2011; Puri and Zarutskie, 2012) at the company level; and increasing innovation, growth, and employment at the regional level (Samila and Sorenson, 2011; Popov and Roosenboom, 2012).[1]

The global faith in venture capital to drive economic growth is evident in the plethora of initiatives being undertaken by governments around the world to catch up with the leading paragons in the United States, particularly the iconic Silicon Valley. Consider, for example, that more than 100 regions around the world are trying to establish themselves as the next "Silicon Valley" by claiming to represent "Silicon Something".[2] Self-proclaimed places such as Silicon Sandbar, Savannah, Saxony, Shire, Shore, Sloboda, Slopes, Spa, Spuds, and Surf (to name a few starting with the letter S) highlight the global drive to cultivate thriving entrepreneurial ecosystems. With regard to venture capital, Bai et al. (2022) identified a staggering 755 national government-sponsored venture capital initiatives launched between 2010 and 2019. These collectively provided an annual budget of $156 billion during this period, which is about the same size as the $153 billion provided annually by the private VC industry. When counting in all regional programs, training initiatives, mentoring activities, grants, innovation prizes, and entrepreneurship centers, the scale of these efforts is staggering.

Despite the extensive and widespread initiatives globally, the majority of ven-

[1] Gompers and Lerner (2001); Da Rin et al. (2013); Lerner and Nanda (2020) provide comprehensive reviews of this literature.

[2] See, https://en.wikipedia.org/wiki/List_of_technology_centers, accessed on July 9, 2023.

ture capital and innovative entrepreneurship remains highly concentrated in a few places around the world. For instance, the U.S. venture capital industry continues to dominate the global landscape, accounting for more than half of all venture capital raised between 2012 and 2022 (Dealroom, 2023). And even within the U.S., venture capital is highly concentrated in a few regions, with the Silicon Valley area alone accounting for about 50% of all venture capital investments in the country (Kerr and Robert-Nicoud, 2020). This unequal distribution is also evident when looking at the companies backed by venture capital: In 2019, 78% of the world's startup value was concentrated in the top 11 metropolitan areas (Startup Genome, 2019).[3]

The divergent levels of success observed in venture capital and entrepreneurship globally raise questions that have received little academic scrutiny by economists so far. What are the reasons that startups in most advanced economies perform worse than in the U.S.? Do startups migrate internationally (e.g., to the top clusters), and if so, to what extent, and what are the main drivers? Does the dominance of the U.S. VC investors globally mean that the best startups in the world move to the U.S. sooner or later? These are important questions, yet their examination within academic circles remains limited. One reason for the lacking academic inquiry is that venture capital is relatively young: The venture capital industry proliferated in the U.S. in the 1970s (Gompers and Lerner, 2001; Kenney, 2011), and significant growth in other places like Europe and Asia occurred only after 2000 (Aizenman and Kendall, 2012). Another reason is the lack of available data of research quality due to the opaque nature of private markets.

This dissertation seeks to address these questions in finance and entrepreneurship in a global venture capital landscape. By utilizing novel datasets and

[3]It is crucial to emphasize that this pronounced geographical clustering contradicts prior expectations. In the 1990s, conventional wisdom suggested that globalization and the declining cost of information transfer would render geography irrelevant (Audretsch et al., 2007). In a 1995 article, "The Death of Distance", The Economist posited: "[Advances in telecommunications] will effectively eliminate distance as a perceptible concept from our lives." Yet it is still primarily in a few innovative regional clusters that high-tech entrepreneurship and venture capital continue to thrive.

employing quantitative empirical analysis, this research endeavors to shed light on the reasons behind the global disparities in startup performance, international migration patterns of startups, and the influence of the dominant U.S. VC investors on global startup ecosystems. Through a nuanced understanding of these phenomena, this dissertation seeks to provide valuable insights for policymakers, investors, and entrepreneurs seeking to boost the performance of their startups worldwide.

This dissertation consists of three essays that examine different aspects of finance and entrepreneurship in a global venture capital landscape. The first essay (Chapter 2) seeks to understand the main shortcomings of the startup ecosystem in Europe by studying the performance as European startups are migrating to the U.S. The second essay (Chapter 3) presents new evidence on the relocation of startups across international borders in 17 advanced economies, shedding light on the extent, dynamics, and drivers influencing entrepreneurs' choices of international destinations, with a specific focus on the role of venture capital. The last essay (Chapter 4) explores the influence exerted by U.S. venture capital firms on innovative enterprises worldwide, and in particular whether U.S. VC investment leads to the best startups and entrepreneurs moving to the U.S. sooner or later.

1.1 Research Questions and Main Findings

Each of the three essays in this dissertation utilizes a novel and proprietary data set and empirical strategy to examine the research questions. I outline the research questions, empirical & data collection strategies, and main findings in the following.

1.1.1 The Startup Performance Disadvantage(s) in Europe: Evidence from Startups Migrating to the U.S.

Europe is significantly lagging behind at producing venture-capital backed startups that grow into global technology giants, as evidenced by the absence of European companies among the most valuable tech companies in the world. Also, when looking at the next generation of companies that could rise to such heights – the unicorns, i.e. startups with a billion-dollar-valuation – Europe is lagging behind. As of 2021, the U.S. hosted about 4 times as many unicorns as Europe, despite the similarity in the size of their respective economies, both around 20 trillion USD in GDP. Observers have brought forward many hypotheses to explain the European startup disadvantage: a lack of (venture) capital (Bertoni et al., 2011; Puri and Zarutskie, 2012; Axelson and Martinovic, 2013), a lack of human capital, in particular entrepreneurs (Audretsch and Keilbach, 2004) and inventors (Chen et al., 2021), a lack of knowledge (Marshall, 1890; Romer, 1990; Arora et al., 2001), the fragmented product market, inadequate late-stage capital markets (Black and Gilson, 1998; Jeng and Wells, 2000), rigid labor laws, regulation, risk aversion etc. However, there is little systematic evidence on which of these factors explain the European startup performance disadvantage, let alone their relative importance.

To understand the startup performance disadvantage in Europe, I examine European startups that have migrated to the United States, referred to as "U.S. migrants". The objective is to examine how startup performance changes when migrants enter the thriving startup ecosystem in the U.S., with the aim of identifying the main disadvantages faced by European startups across various performance metrics.

The paper faces two main challenges. First, data on startup migration is not readily available. I overcome the data challenge by hand-collecting a novel dataset on the headquarter location history of approximately 11,000 European startups. This data is merged with other datasets to obtain performance measures in areas

such as financing, innovation, and commercial success outcomes. Second, the decision to migrate is endogenous, as it is determined by startup owners. To address the endogeneity challenge, I use the theoretical and empirical observation that a positive selection of startups moves to the U.S. Because there is positive selection, a simple cross-sectional comparison of movers and stayers identifies an *upper bound* of the effect of the U.S. ecosystem compared to Europe. Hence, if performance measures in specific areas do not differ, it suggests that Europe does not impede startups in those domains.

The empirical results demonstrate that the distinguishing feature of the U.S. ecosystem vs. Europe is that startups benefit from more venture capital funding and a higher tolerance for financial losses, allowing startups to achieve greater company scale. U.S. migrants also innovate slightly more after migration, but the scale, innovation, and loss tolerance differences can be mainly explained by the fundraising advantage, suggesting that the European venture capital market is likely the biggest hindrance to startup performance. Further results show that migrants do not increase their revenues after migration and that their probability to reach an IPO is not increased. Overall, these results suggest that the venture capital market is likely Europe's largest obstacle to startup growth, and that European product and IPO markets do not hinder startup performance much, if at all.

1.1.2 Venture Capital and the International Relocation of Startups

The dominance of U.S. venture capitalists in international markets is remarkable: In 2021, one out of five VC deals in Europe included U.S. VC, and even four out of five deals over 100m USD involved U.S. VC. While this foreign capital is certainly important to help international startups grow, it has raised concerns about startups leaving their home economies as a consequence. These concerns,

however, are so far based on anecdotes, which raises empirical questions. How common is startup relocation across international borders? Does relocation imply that the whole startup moves, or are relocations rather legal in nature? To what extent is foreign VC, and in particular U.S. VC, related to startup relocation? And if there is a relationship, why do foreign VCs relocate startups? These are some of the questions I address in my second essay.

To provide a first view on international startup relocation and the role of foreign VC, I use a novel dataset of startup headquarter (HQ) relocation histories, VC investment, and geographical startup footprints. To assemble this data set, I conducted a painstaking manual search of more than 11,000 startups from 17 advanced economies funded between 2000 and 2014. This novel data set is then used to unearth a number of key findings:

1) Startup Relocation in Europe: The study reveals that approximately 6% of European startups in the sample moved their HQ across borders, with the majority (86%) relocating to the United States. These relocations occurred relatively early in a startup's life, with the median company age at relocation being three years.

2) HQ Relocation as an Exodus: The relocation of HQs was found to be a reliable indicator of a startup's exodus or migration, as the majority of the relocated startups also moved a significant portion of their workforce abroad. On average, relocated startups employed 65% of their workforce outside their founding country at the time of their initial public offering (IPO).

3) Foreign VC and Startup Relocation: The study establishes a strong association between foreign VC investment, particularly from the United States, and startup relocation. Startups that received foreign (U.S.) VC investment were found to be 5 (10) percentage points more likely to relocate their HQ. Various empirical strategies, including matching, panel data, and instrumental variable analysis, were employed to address endogeneity concerns and confirm the relationship.

4) Destination of Relocated Startups: The data analysis indicates that relocated startups tend to move closer to their investors rather than to tax havens. Startups

moved to locations where their VC firms were located, suggesting that relocation is an activist strategy employed by VCs to create value and support their portfolio companies.

5) Fundraising as a Motivating Factor: The research explores the heterogeneity among startups and identifies fundraising as the most significant factor influencing relocation decisions. Startups in the sample without revenue and from less developed VC markets were more likely to relocate, indicating that relocation serves as a strategy to improve subsequent fundraising opportunities.

In summary, the study provides valuable insights into the international migration of startups, highlighting the role of foreign VC, particularly from the US, in driving relocations. The findings suggest that relocation is a value-adding exercise rather than solely driven by tax incentives, and VCs actively employ relocation as a strategy to enhance the fundraising conditions of their portfolio companies.

1.1.3 Follow the Money: How Venture Capital Facilitates Emigration of Firms and Entrepreneurs in Europe

The third essay addresses the research question whether foreign VC activity may have negative consequences for host economies in that it facilitates emigration of talents and companies. It explores whether foreign VC, particularly from the U.S., tends to back the best European ventures and whether this involvement is associated with an increased likelihood of foreign acquisitions or foreign initial public offerings (IPOs). The study also investigates whether foreign VC leads to a higher probability of entrepreneurs emigrating to the foreign country.

Understanding whether the foreign VC effect on foreign exits and entrepreneur emigration is *causal* is crucial and poses a significant challenge. This question matters very much considering the various public initiatives to promote the domestic VC supply. If foreign VC investors just matched with startups that would move abroad anyway, increased domestic capital supply would not alter the outflow of

talent and technology.

To isolate the causal effect, I use the capital inflow into foreign (U.S.) buyout funds as an instrumental variable (IV), similar to Gompers and Lerner (2000) and Nanda and Rhodes-Kropf (2013). Buyout funds buy controlling stakes in established businesses that have revenues and positive profits and cashflows. VC funds, however, do minority investments in startups that are high-risk bets on novel technologies which have little to no revenues and negative cash flows. Clearly, these markets have little to do with each other. However, institutional investors consider both markets together as "private equity" in their asset allocation decisions, without differentiating between buyout and VC funds. Therefore, by using foreign/U.S. buyout fundraising as an instrument, we capture the portion of foreign/U.S. VC investment that is the result of increased capital supply, independent of the investment opportunities among European startups at the time.

The findings show that foreign (U.S.) investors significantly increase the likelihood of foreign (U.S.) exits and foreign (U.S.) acquisitions beyond selection effects. Moreover, foreign (U.S.) VC investors have a long-lasting effect on entrepreneur emigration (to the U.S.). The results suggest that foreign VC firms have strong local networks at home, including relationships with local exit markets, such as public stock exchanges or potential strategic acquirers in M&A markets. This leads to an outflow of valuable talent from one ecosystem (Europe) and the accumulation of valuable talent in the VC-exporting ecosystem (e.g., U.S.). The findings should be of utmost interest to policymakers who might want to boost the competitiveness of their economies by increasing the domestic supply of venture capital.

1.2 Contributions and Policy Implications

This dissertation contributes to a better understanding of entrepreneurship and venture capital in a global landscape.

First, Chapter 2 shows that the main difference between the U.S. and European startup ecosystems is the better venture capital market and a higher tolerance for financial losses. This allows startups to reach a greater company scale, even for those that eventually fail. This contrasts with prior literature suggesting that migrating startups benefit in multiple ways, such as higher financing, acquisition and IPO likelihood, patents, trademarks, product launches, and sales growth (Guzman, 2019; Conti and Guzman, 2021). My findings imply that improving European startup clusters is more straightforward than previously thought. Policymakers may generate substantial benefits by focusing on venture capital markets instead of comprehensive efforts across multiple markets. Thus, governments should prioritize understanding the flaws in the venture capital market to improve European startup performance.

Second, Chapter 3 provides new empirical evidence on the international relocation of startups in a large sample of 17 advanced economies. Prior work on startup relocation had to rely on data from single countries, single VC portfolios, or within-country relocation (Cumming et al., 2009; Dahl and Sorenson, 2012; Guzman, 2019; Conti and Guzman, 2021). Relative to this prior work, I present the first systematic measurement of international startup relocation in 17 advanced economies, finding that cross-border relocation of headquarters is common, is directed to the US, and eventually leads to the migration of most of the company to the US. Additionally, I find that foreign VC investment is strongly associated with relocation, and this relationship is even more pronounced when financing conditions of the startup are poor. This finding suggests that VCs may help startups transition to other economies, particularly to assist with future fundraising, contributing to the literature on the active role of venture capital firms in portfolio companies.[4]

Finally, the last essay (in Chapter 4) contributes to the literature on the role of

[4]See, for example, Gorman and Sahlman (1989); Hellmann and Puri (2002); Bottazzi et al. (2008); Chemmanur et al. (2011); Bernstein et al. (2016); Ewens and Marx (2018); González-Uribe (2020).

VC in the economy. Prior work has focused on measuring the positive effects of VC on innovation and economic growth.[5] However, there is very little work on the limitations of venture capital in spurring innovation (Lerner and Nanda, 2020). One area of concern is that VC is concentrated in the hands of a few deep-pocketed investors, particularly in the most prominent U.S. VC funds. My findings show that this concentration indeed has consequences for non-U.S. innovative companies internationally. The findings in Chapter 4 show that U.S. VC funding in international startups *causally* leads to a higher likelihood of the startup doing an exit in the U.S., and leads to a higher likelihood that the startup's entrepreneurs emigrate to the U.S. These findings suggest that an increased domestic capital supply in advanced economies' startup ecosystems should reduce the outflow of startups and talent – which should be of utmost interest to policymakers.

[5]See Da Rin et al. (2013) and Lerner and Nanda (2020) for comprehensive overviews of this literature.

"There is no Silicon Valley and no Big Tech companies here [in Europe]. What do you think is the reason for that?"
"That is the one-trillion-dollar question."
— Peter Thiel; entrepreneur, in response to newspaper interviewer

2

The Startup Performance Disadvantage(s) in Europe: Evidence from Startups Migrating to the U.S.

Authors:	Stefan Weik
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Abstract

This paper uses novel data on the migration of European startups to the United States to understand Europe's main disadvantages in startup performance. I use positive sorting in migration as an identification strategy: because of positive sorting, the simple cross-sectional comparison gives an upper bound on the effect of the U.S. ecosystem compared to the European one. Results show that U.S. migrants receive much more venture capital (VC) funding, produce more innovation, and reach much bigger scale by exit than startups staying in Europe. More surprisingly, however, U.S. migrants do not increase revenue for many years after migration, incur higher losses for long time periods, and do not have a higher likelihood of successful exit than European stayers. Furthermore, a large part of the difference in innovation and scale can be explained by the U.S. funding advantage. These results are consistent with the view that technology, product, and exit markets hinder European startups little, if at all, but that Europe's VC funding market is its major obstacle to startup performance.

2.1 Introduction

The rapid growth of venture capital-backed startups into global technology companies is one of the defining economic trends of our time, and Europe is largely missing out. For example, eight out of the ten most valuable companies in the world are all young, innovative technology companies ("technology giants") that financed their early growth with venture capital, and none of them is from Europe (all eight are from the U.S.).[1] Europe is also far behind when it comes to the next generation of companies that may rise to these ranks - the so-called unicorns, i.e., startups with a valuation of greater than 1 billion USD: 51% of all unicorns existing in 2021 are from the U.S. and 13% from Europe, while both regions are of similar size in terms of GDP.[2][3]

There has been a great deal of speculation as to what are the reasons behind Europe's lower startup performance. Common hypotheses include: a lack of (experienced) venture capital (Bertoni et al., 2011; Puri and Zarutskie, 2012; Axelson and Martinovic, 2013), a lack of human capital, in particular entrepreneurs (Audretsch and Keilbach, 2004) and inventors (Chen et al., 2021), lacking technology (Marshall, 1890; Romer, 1990; Arora et al., 2001), as well as a host of other hypotheses such as, among others: the fragmented product market, inadequate markets for startup initial public offerings (IPOs) or acquisitions (Black and Gilson, 1998; Jeng and Wells, 2000), rigid labor laws, regulation, and risk aversion. However, there is little systematic evidence on which of these factors explain the startup disadvantage, let alone their relative importance.

[1] As of March 15, 2023, these companies are: Apple, Microsoft, Alphabet, Amazon, Tesla, Meta, NVIDIA, and Visa (see https://www.companiesmarketcap.com/).

[2] According to https://www.cbinsights.com/, there are 984 unicorns worldwide as of December 2021, of which 500 are from the U.S., 301 from Asia, and 130 from Europe.

[3] In this paper, I use "Europe" to refer to the geographical continent of Europe as defined in the United Nations Statistics Division's M49 standard, i.e., 51 countries (see https://unstats.un.org/unsd/methodology/m49/, accessed on February 7, 2022). The GDP in Europe and the U.S. was 22.9tn USD and 20.9tn USD in 2020, respectively (see https://data.worldbank.org/indicator/NY.GDP.MKTP.CD, accessed on February 7, 2022).

In this paper, I take one step to understand the European startup performance disadvantage by analyzing European startups migrating to the U.S. The idea is to observe how startups who move their headquarters to the U.S. (which I call "migrants") perform after migration - compared to startups staying in Europe - in various performance areas, e.g., fundraising, innovation, revenue, profitability, and exit success - to understand where Europe's biggest disadvantages are. Results show that U.S. migrants raise much more funding, produce more innovation, and reach much bigger scale by exit than startups staying in Europe. Surprisingly, however, U.S. migrants do not increase revenue for many years after migration, but instead incur higher losses for longer time periods, and do not have a higher likelihood of successful exit than European stayers. Moreover, main parts of the innovation and scale advantage can be explained by the U.S. funding advantage. I conclude that financing is likely the biggest obstacle to European startup growth, while markets for technology, products, and exits do not seem to hinder European startups very much, if at all.

The approach of this paper poses two main challenges. First, data on startup migration is not readily available. I overcome the data challenge by hand-collecting a novel data set on the headquarter location history of approximately 11,000 European startups. The data set is based on an industry-standard data set of VC-backed European startups first financed between 2000 and 2014 (to allow time to observe performance until 2021) from VentureSource. Then, I collected a timed history of headquarter locations using (historical) web footprints and national business registration records. Finally, I merged the data with several other data sets, such as Orbis, Preqin, SDC New Issues, SDC M&A, and PATSTAT, to acquire performance measures in various areas such as: innovation, commercial success, and exits.

Second, the decision to emigrate is determined by the startup owners, making it an endogenous choice. To overcome this endogeneity challenge, I use a combination of theory and empirical observation. Theoretically, as migration comes

with a cost, we should expect those startups to migrate which gain the most from moving to the world-leading startup ecosystem in the U.S. If those with the largest expected gains move, the performance difference between migrants and stayers will give an upper bound on the advantage treatment effect of the U.S. startup ecosystem compared to the European one. As a consequence, if we compare performance measures in different areas, and we do not find a difference in some of them, we can be quite confident that Europe does not hinder startups in these areas.

I begin the empirical analysis by showing that a positive selection of startups migrates to the U.S. I find that startup migrants, on average, are younger, have raised more financing, are backed by more (U.S.) investors, and have more patents at the first funding round, than European stayers. This observed positive selection is important, as it confirms the upper-bound argument. Additionally, U.S. migration tends to happen early in the startup life cycle: the average migrant moves 1 year after first funding, and 76% of migrants have moved by year 3 after first funding. By moving early, U.S. migrants spend a significant amount of time in their new environment, allowing for performances to be affected over long event windows.

Moving on to analyzing post-migration performance, the first set of findings is not surprising. I find that U.S. migrants raise much more venture capital (VC) funding, and innovate more, in terms of number of patents and citation-weighted patents, than European stayers. This is consistent with the idea that the U.S. startup ecosystem is a world leader in providing venture capital and developing novel technologies. However, it should be noted that the differences in fundraising and innovation may not be necessarily the result of the difference in the ecosystems, but could be simply caused by the positive selection of startups migrating to the U.S.

More importantly, and surprisingly, I find that startups migrating to the U.S. do not experience an increase in revenue and even incur higher net losses in the

years subsequent to their migration. From anywhere between 1 and 8 years after migration, migrants do not see any rise in revenues but, instead, experience significantly higher net losses than those startups that remain in Europe. Furthermore, U.S. migrants are not any more likely than European stayers to achieve a successful exit in the form of an initial public offering (IPO) or acquisition at a valuation of more than two times the amount of capital raised. This is contrary to what we would expect if the large U.S. markets for customers, acquirers, and IPOs were significant sources of the competitive advantage of the U.S. startup ecosystem compared to its European counterpart.

These previous findings are somewhat contradictory: Startups moving U.S. receive much more funding and produce more innovation, but they do not increase revenues or exit probabilities. Instead, U.S. migrants sustain long periods of financial losses, compared to European stayers. To understand this apparent contradiction I also look at another performance area: the scale that startups have at the moment of exit. I find that U.S. migrants, at the moment of an (equally likely) exit, are worth many times more, have more employees, more revenue, and are older than startups that exit in Europe. At the same time, they still have higher net losses at the moment of exit.

Thus, the analysis reveals a key difference between the U.S. and European ecosystems: a focus on achieving greater company scale, facilitated by a higher tolerance to financial losses and more venture capital funding. That is, long-term firm scale, as opposed to short-term sales, profit, or exit success seems to be an important criterion for U.S.-based firms to achieve after getting VC financed. The U.S. financing advantage plays a critical role in enabling this focus - without financing, the extended periods of losses to grow would not be sustainable. Consistent with the argument that financing is the key difference between the ecosystems, I find that the financing advantage can explain a large part of the performance difference in the areas of innovation and scale at exit. In other words, startups staying in Europe that have received comparable funding to U.S. migrants are much more

comparable to U.S. migrants in terms of innovation output and scale at exit.

Overall, my findings show that European startups moving to the U.S. mainly benefit from larger funding amounts, and a greater tolerance to financial losses, which allow reaching a larger firm scale before going public or being acquired. The finding that European stayers develop their revenues and successful exit frequencies at least as well as U.S. migrants indicates that local technology, product, and exit markets hinder European startups little, if at all.

My empirical results contrast with the small prior literature on the impact of startup migration on performance. Guzman (2019) examines U.S. startups migrating to the Silicon Valley between 1996 and 2005 and finds that moving benefits startups across the board, leading to increased financing, acquisitions or IPOs, patents, product launches, and sales growth. Moreover, the financial benefits disappear after 2001, while the non-financial benefits persist. Similarly, Conti and Guzman (2021) examine Israeli startups founded 1990 and 2014 and find benefits for U.S. movers in various performance dimensions, including larger funding amounts, trademark acquisition, and higher chances of being acquired. The implication of these studies is that the creation of a startup ecosystem requires comprehensive efforts on various fronts, including the markets for venture capital, IPOs, acquisitions, consumers, technology, and human capital. In contrast, my findings imply that improving European startup clusters is much more straightforward than previously thought: focus on improving venture capital markets.

What might explain these different findings? First, my study examines a more recent period when the European ecosystem has matured in many areas, potentially reducing the benefits of moving to the U.S. Second, markets for IPOs, acquisitions, technology, and human capital may be globally accessible from Europe, minimizing the impact on European startup performance. Consistent with this argument, there is considerable evidence that markets for technology, products, IPOs, and M&As, are highly globalized today (Erel et al., 2012; Doidge et al., 2013; Audretsch et al., 2014; De Marco et al., 2017). Only the venture capital market

persists to require local presence (Chen et al., 2010; Cumming and Dai, 2010; Lutz et al., 2013), explaining why European startups raise significantly more funding when relocating to the U.S. Last, European migrants may lack access to other benefits of the U.S. ecosystem besides venture capital financing, which is, albeit only partially, consistent with Michelacci and Silva (2007); Dahl and Sorenson (2012) who show that local entrepreneurs have better access to local resources.

This paper relates to a diverse set of prior literature. First, there is a large literature on the agglomerative clustering of entrepreneurship, starting with the seminal work of Saxenian (1994) and Glaeser et al. (2010), as well as Kerr and Robert-Nicoud (2020) who provide a more recent review. In this regard, my findings rhyme with recent evidence from Gornall and Strebulaev (2021) who underscore the causal role of the U.S. VC industry in today's U.S. tech dominance. Second, there is growing literature on the merits of entrepreneurship policies, such as Audretsch et al. (2007); Ferrary and Granovetter (2009); Lerner (2009); Hellmann and Thiele (2019). Many of these studies also underscore the importance of venture capitalists in the emergence of tech clusters, but often rely on anecdotal evidence or theoretical arguments. Finally, the results of this paper speak to the puzzle of the divergent productivity growth between Europe and the U.S. since 1995 (Van Ark et al., 2008). One explanation, put forward by Bloom et al. (2012), is that U.S. multinationals are better able to capitalize on the IT revolution. This paper indicates that the divergence in productivity may to some extent also be driven by the higher growth dynamics of U.S. startups, which benefit from the more more developed U.S. VC industry.

2.2 Model of Selection into Migration

It is unlikely that the selection of firms that migrate to the U.S. is random, and I have no source of exogenous variation in migration to exploit in this paper. Here, I present a simple model to clarify the equilibrium relationship between migration

and startup performance that we would expect if both can be determined endogenously. I use this simple consideration of which firms are likely to migrate to the U.S. to argue that cross-sectional data give a useful upper bound on the average causal effects of the U.S. startup ecosystem compared to the European one.

Let Π_i denote the performance of the startup i. The startup can choose to migrate to the U.S. or to remain in Europe, with the region choice being indexed by $R \in \{EU, US\}$. The U.S. ecosystem affects the performance of each startup individually by a certain factor, denoted as λ_i^{US}. Also, each startup faces a non-negative migration cost c_i. startup i can maximize its performance by migrating if $\left(1 + \lambda_i^{US} - c_i\right) \Pi_i > \Pi_i$, or if $\lambda_i^{US} > c_i$. That is, a startup will optimally migrate if the performance benefits of the U.S. ecosystem λ_i^{US} are higher than the cost c_i.

To assess the need for costly public interventions that improve local startup ecosystems, we are arguably most interested in estimating the quantity $\mathbb{E}_i\left[\lambda_i^{US} - c_i\right]$, that is, the average net effect the world-leading U.S. ecosystem has on startups compared to the local European ones. However, estimating this quantity requires that we have counterfactual startup performances if a startup stayed in Europe when it actually migrated to the U.S. Obviously, such counterfactual is not available.

If we used cross-sectional data instead to estimate the relative performance difference of startups moving to the U.S. and not moving, we would be measuring

$$\frac{\mathbb{E}_i\left[\left(1 + \lambda_i^{US} - c_i\right) \Pi_i | \lambda_i^{US} > c_i\right]}{\mathbb{E}_i\left[\Pi_i | \lambda_i^{US} < c_i\right]} - 1. \tag{2.1}$$

That is, we would observe performances of startups that optimally choose to migrate to the U.S. relative to performances of startups that optimally choose to stay in Europe. Assume now that $\mathbb{E}_i\left[\Pi_i\right]$ is equal across the migrants and stayers. That is, the average performance of migrants, if they stayed in Europe instead, is equal to those startup that stay in Europe anyway. Then, the the observable

cross-sectional difference of (2.1) becomes

$$\mathbb{E}_i \left[\left(\lambda_i^{US} - c_i \right) | \lambda_i^{US} > c_i \right] \geq \mathbb{E}_i \left[\lambda_i^{US} - c_i \right].$$

Thus, the difference between migrating and staying startups observable in the cross section would give us an *upper* bound on the average effect that the world-leading U.S. ecosystem has on European startups compared to the local ones.

However, contrary to the assumption made earlier, there are good reasons to believe that migrating startups are a positive selection. Reasons include that more capable startups may benefit more from greater resource agglomeration (Guzman, 2019) or be attracted to better pay for their (above-average) skills (Roy, 1951; Borjas, 1987). If positive selection is the case (and some evidence is provided later in the paper), the simple cross-section between migrants and stayers gives an upward biased upper limit–and hence still an informative upper bound of the true effect of the U.S. ecosystem compared to the European one.

The intuition is simple. Startups that will benefit most from relocating to an advanced ecosystem are the most likely to do so. Thus, comparing the performance of those that migrate and those that remain gives an overestimation of the effect of the advanced ecosystem, giving us an upper bound on the average effect of the advanced ecosystem. It is important to note that there are many ways to measure startup performance, all of which emphasize different aspects. For instance, common measures of startup performance include fundraising, innovation, business success (sales and net income), exits, and exit valuation. If the cross-sectional comparison does not show a difference in some performance areas, it is safe to assume the U.S. ecosystem does not have an advantage over the European ecosystem in these same areas. Applying this logic, we can identify the areas where the European ecosystem does not hinder startup performance, and so identify its main weaknesses.

2.3 Data

This paper's analysis of U.S. migration of European startups and performance consequences makes use of several datasets. The data collection strategy is to take a representative data set of VC-funded startups and augment it with migration and performance data from various data sources. This section describes the data collection process and resulting sample.

2.3.1 Startups and Migration Data

I start with an industry-standard dataset of VC-funded startups from Dow Jones' VentureSource. VentureSource, along with Refinitiv's VentureXpert, are the two primary venture capital databases used in academic research (Da Rin et al., 2013). We use VentureSource because with our filters it is more comprehensive than VentureXpert. To get a sample of VC-backed European startups, these filters are: 1) only financing rounds labeled "VC" (i.e., excluding buyout, angel, debt, grant, and exit financings), for which the financing date and amount are available; 2) the investee received its first VC between 2000 and 2014 and was no more than 10 years old at time of first VC; 3) the investee is from one of 17 European countries: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Russia, Spain, Sweden, Switzerland, and the United Kingdom. Using these filters, VentureSource lists 11.850 startups, which is about 30% more than the 8.961 obtained from VentureXpert (see Appendix Table A. 2).

Unlike VC funding data for startups, timed data on the headquarter locations of startups is not available in commercial datasets. Therefore, I manually collected the chronological history of each startup's headquarters as described in the following. First, I pulled all VC-backed startups from VentureSource that received their first VC investment between 2000 and 2014 and were funded from at least one European investor, regardless of the location of the startup's HQ.[4] Applying the

[4]I consider only financing rounds labeled as "VC", i.e., excluding buyout, angel, debt, grant, and

above filters yields 14,588 startups, of which 10,917 are headquartered in Europe and 3,671 are headquartered outside of Europe, according to VentureSource. I let the sample start in 2000, because VentureSource has only provided comprehensive data on Europe since then (Axelson and Martinovic, 2013; Retterath and Braun, 2020). Moreover, the upper bound of 2014 is chosen, because the dataset was assembled in July 2021 and so we give each startup at least 6.5 years to observe subsequent performance. This time span mirrors the choice in other venture capital analyses.[5]

Then, I manually researched HQ locations of each startup at the time of first VC and at end of the sample (i.e., the earliest of 2021, exit, or cease of operations). To identify each company's most recent HQ locations, I searched publicly available data sources such as the company's website, LinkedIn, and Crunchbase profiles. For historical HQ locations or if a webiste was defunct, we used the Internet Archive Wayback Machine and news articles from web searches.[6] The Internet Archive is a "digital library of Internet sites" which regularly stores billions of versions of public websites. Since these data are self-reported, we cross-checked HQ moves with official national trade registers. For example, if a company publicly announced a new HQ in the U.S., we verified this by checking publicly available U.S. business registration records. U.S. business registration regulations require companies to list at least two offices in a state: the office within the state and the principal executive office. Therefore, we only accepted a HQ migration if the web sources and business registration records indicated a move of HQ. When a HQ relocation was identified, I searched further to pinpoint the year it occurred. To do so, I searched Lexis/Nexis and the internet for news articles about the HQ move. If no news articles were found, I determined the year of the move by reviewing the Internet Archive to see when the HQ location was changed on the website.

exit financings; and only VC financings for which the date and financing amount are available.

[5](e.g., Hochberg et al. (2007); Nahata (2008); Ewens and Rhodes-Kropf (2015); Nanda et al. (2020) leave 4.5, 4, 6, and 8 years, respectively.)

[6]Website: https://archive.org, (last accessed July 22, 2021).

Finally, the sample was restricted to all startups headquartered in one of these 17 European countries when they started: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Russia, Spain, Sweden, Switzerland, and the United Kingdom. These countries account for more than 98% of all VC financing rounds on the European continent in the database.

The data collection process above resulted in a final sample of 11,066 startups initially headquartered in Europe. Creating a balanced panel of 17 years after first funding, we get 188,122 firm-year observations.

2.3.2 Startup Performance Data

I use a variety of measures of startup performance throughout the analysis, which may be categorized in four domains: fundraising, innovation, business success, and exit performance. These domains reflect the most relevant benefits the U.S. ecosystem may have to offer compared to the European ones: better VC market, better innovation inputs, better product market, and better exit markets.

While VentureSource already provides comprehensive data on fundraising, it provides incomplete data on financials and exits, and no data on innovation performance at all. In this section, I describe the datasets merged to VentureSource to improve or add these latter information.

2.3.2.1 Obtaining Information on Financials

I supplement the financial and employment data of VentureSouce with data from two other commercial data providers: Preqin and Orbis. Preqin focuses on private capital markets collecting data at the investor, fund, and asset (i.e., company) level. Preqin collects its data from surveys, voluntary reporting, or involuntary reporting using Freedom of Information Act (FOIA) requests from institutional investors (or limited partners (LPs)) and private markets fund managers (or general part-

ners (GPs))(Harris et al., 2014). On the other hand, Orbis provides harmonized financial data on more than 400 million firms from over 100 countries worldwide. The Orbis financial information comes directly from national business registers (Kalemli-Ozcan et al., 2015).

VentureSource is merged to the other databases by name and other identifying information with a procedure based on Bernstein et al. (2016) and described in detail in Section A.1. The merge to Preqin and Orbis increases firm-year observations with financial information from about 9,000 in VentureSource only to over 41,000 firm-years (an over 300% increase). Table A. 3 tabulates the number of observations with financials over time starting from the year of first funding. We observe revenue and net income for about 28% of the sample in the sixth year after first funding and at least one financial data point for about 62% of the sample.[7]

A disadvantage of Orbis in our context is that European coverage is better, because many national registries require annual financial reporting from private companies, but this does not apply to private companies in the U.S. Only when they go public via an IPO U.S.-based companies have to disclose their financial statements. Therefore, to the extent that financials are less available for U.S. companies when they are still private, the financials of U.S. migrant companies should be biased upward. However, again this is not critical in our context as we are measuring an upper bound. For example, if we find that revenues do not increase after U.S. migration, and they are upward biased, we can be very sure that increasing revenues are not the main benefit of the U.S. ecosystem.

[7] In few cases of the VenutureSource financial data (about 2% of observations), a range was given instead of exact data. I applied a consistent rule to transform these ranges into point estimates. For a specific range, I used the matching records from the other databases and use the average exact value for this range (e.g., 4.6m was assigned whenever the reported range was 1-10m).

2.3.2.2 Measuring Innovation

I also measure the innovation output of startups. If innovation inputs are a key difference between the U.S. and European startup ecosystems, startups migrating to the U.S. should improve their innovation performance.

An extensive innovation literature shows that patenting activity reflects firm innovation, so that patenting activity is a widely accepted measure of innovation (Hall, 2000). The first innovation measure is the stock of all (eventually granted) patents by company and year. To also capture the quality of patents, I use the number of citations that a patent receives from other patents (Hall et al., 2005). To account for differences in citing behaviour across countries and years, I scale the citations of a patent by the average citations that all patents receive that are filed in a patent office-times-year, similar to Bernstein (2015). The variable "Scaled citation-weighted patents" is then obtained by adding up all citation-scaled patents held by a company in a year.

To get startups' patents and their citations, VentureSource is merged with the European Patent Office's (EPO) PATSTAT database. PATSTAT aggregates patent data from national patent authorities in over 80 countries, including the U.S., Japan, and European countries (Block et al., 2014). Overall, 30% of all startups in the sample filed for at least one (eventually granted) patent.

2.3.2.3 Identifying Startup Exits

The most successful startups typically go public via an IPO. While there are examples of successful startups that exit through an acquisition rather than an IPO, on average, startups who IPO are worth more (Cochrane, 2005), grow more (Poulsen and Stegemoller, 2008), and generate the highest returns for their investors (Cumming and MacIntosh, 2003). All of the VC-funded companies that later became the most successful in the world (e.g., Microsoft, Facebook, Google, Amazon) exited via IPO. If the U.S. IPO market is a key building block behind this suc-

cess, then startups migrating to the U.S. should also benefit from a higher IPO probability. Nevertheless, large acquisitions may also be an important factor of the U.S. ecosystem, so I include successful acquisitions as a second performance indicator. In particular, I define "successful exit" as either IPO and acquisition with a reported value of more than two times VC invested. The third and fourth measures of exit performance are the company valuation in the event of an IPO or a successful exit.

While VentureSource's coverage of startup exits is better that that of other databases (Maats et al., 2011), is is not complete. I augment VentureSource exit data by a merge with Refinitiv's SDC New Issues and SDC Mergers & Acquisitions datasets, as well as a manual web search of all individual startups in the sample as part of our manual HQ-migration research (in particular, using company website & Crunchbase profiles). The two SDC databases are the industry standards for IPOs and M&As, respectively, and Cruncbhase is a popular wiki-site with detailed information on startups. Overall, 776 additional exits (a 25% increase) result from this search.

2.3.3 Summary Statistics

The final sample consists of 11,066 European startups, of which 555 (5% of the sample) moved their HQ to the U.S. during the sample period.[8] Table 2.1 and provides summary statistics for most variables used in this paper (variable descriptions can be found in Table A. 1). On average, U.S. relocations occur 1.6 years after first VC funding (median 1 year after), suggesting that U.S. relocations are generally an early step a company's life cycle.[9]

Table 2.2 presents descriptive statistics, separated by startups staying in Europe and "U.S. migrants", i.e. startups that moved their headquarters to the U.S. during

[8] Overall, 647 startups relocated their HQ across borders, with the vast majority, 555, or 86% of all migrants, moving to the U.S. and 92 moving within Europe.

[9] The average age at U.S. migration is 4.2 years (median 3); the average age at first VC funding is 2.6 years (median 2).

Table 2.1: Summary Statistics

This table presents summary statistics on the companies in the sample. The sample consists of 11,066 startups from 17 European countries that received first venture capital financing between 2000 and 2014 according to VentureSource. Panel A presents startup characteristics at first VC funding. Panel B summarizes headquarter (HQ) migration statistics that were hand-collected from several sources as described in the text. Startups are categorized as "Moves to US" if they moved their HQ location to the US during their VC funding period. Panel C contains measures of startups' final performance as of July 2021. The first VC funding year is defined as $t = 0$. $ values are in 2012 USD.

	Obs.	Mean	Median	SD	Min	Max
Panel A: Startup characteristics at first funding (t=0)						
VC raised ($ m)	11066	5.74	1.64	26.43	0.00	1178.00
Pre-money valuation ($ m)	3358	15.37	3.99	91.05	0.00	3208.00
Startup age	11066	2.59	1.80	2.53	0.00	20.39
Num. of VCs investing	11066	1.98	2.00	1.28	1.00	21.00
US VC involved	11066	0.09	0.00	0.29	0.00	1.00
Year of first funding	11066	2006.39	2006.00	4.96	2000.00	2014.00
Revenue ($ m)	3117	6.83	0.55	56.99	0.00	2200.13
Net income ($ m)	2860	- 0.66	- 0.23	4.23	- 64.05	151.20
Employees	3662	49.10	12.00	245.70	0.00	6554.00
Num. of Patents	11066	0.62	0.00	3.20	0.00	198.00
Stage						
Seed	11066	0.12	0.00	0.33	0.00	1.00
Product Development/Clinical Trial	11066	0.26	0.00	0.44	0.00	1.00
Generating Revenue	11066	0.61	1.00	0.49	0.00	1.00
Industry						
Software	11066	0.22	0.00	0.42	0.00	1.00
Hardware	11066	0.11	0.00	0.31	0.00	1.00
Medical/Biotechnology	11066	0.17	0.00	0.38	0.00	1.00
Consumer/Retail	11066	0.21	0.00	0.40	0.00	1.00
Other Industry	11066	0.30	0.00	0.46	0.00	1.00
Country						
France	11066	0.20	0.00	0.40	0.00	1.00
Germany	11066	0.12	0.00	0.33	0.00	1.00
Sweden	11066	0.07	0.00	0.25	0.00	1.00
United Kingdom	11066	0.29	0.00	0.45	0.00	1.00
Other Country	11066	0.32	0.00	0.47	0.00	1.00
Panel B: Migration variables						
Moves to US	11066	0.05	0.00	0.22	0.00	1.00
Age at migration to US	555	4.17	3.00	3.81	0.00	19.00
Panel C: Startup performance						
VC raised ($ m) by t+6	11066	12.55	3.10	44.46	0.00	1412.00
VC rounds by t+6	11066	1.68	1.00	0.98	1.00	7.00
Num. of patents by t+6	11066	1.66	0.00	5.70	0.00	231.00
Scaled citation-weighted patents by t+6	11066	1.44	0.00	8.11	0.00	532.94
Revenue ($ m) in t+6	1899	26.30	3.53	187.48	0.00	5487.07
Net income ($ m) in t+6	1597	- 1.95	- 0.26	22.82	-313.22	510.15
IPO	11066	0.05	0.00	0.21	0.00	1.00
Successful Exit (IPO or Acq.>2*VC raised)	11066	0.11	0.00	0.32	0.00	1.00

their lifetime. The paper's results are all foreshadowed in this table. U.S. migrants raise much more funding and innovate more than staying startups. However, revenues do not increase following migration and net income is even significantly lower for migrants. Moreover, migrants are not any more likely to reach an IPO, despite their fundraising advantage. These results already suggest that biggest challenges to European startup growth are the financing market and to a lesser extent innovation inputs, while product and exit markets do not seem to hinder European startups very much.

It is important to note, however, that U.S. migrants are different than stayers in several dimensions already at first funding. As shown in Panel A of Table 2.2, U.S. migrants are, among others, more often backed from U.S. VCs and more often software firms. The results that follow control for these differences in a variety of ways.

2.4 Selection into U.S. Migration

I start the empirical analysis by examining what kind of startups select into U.S. migration. Recall from section 2.2 that the upper bound argument only holds if there is no adverse selection of startups going to the U.S. If adverse selection were the case, the cross-section would give a downward biased upper bound–a bound that is not very useful. However, if the migration of startups is similar to the migration of individuals, a positive selection of startups can be expected to move from a less developed startup ecosystem (Europe) to a highly developed one (like the U.S.). For individuals, the phenomenon that in particular high-skilled individuals migrate from low to high development countries is referred to as "brain drain/gain". Reasons for the disproportionate migration of high-skilled individuals are that they are better paid for their skills abroad (an argument that dates back to at least Hicks (1932)), agglomeration effects, or productivity

Table 2.2: European Stayers vs. US Movers

This table reports the means of each variable, distinguishing between startups ever moving their headquarters (HQ) to the US and staying startups. Startups are categorized as "Moves to US" if they moved their HQ location to the US during their VC funding period and "Stays in Europe" otherwise. Panel A reports means of startup characteristics measured at first VC funding. Panel B reports startups' final performance measures as of July 2021. All variables are defined in Appendix A. 1. The last column reports t-statistics of two-sample t-tests for equality of means. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Stays in Europe	Moves to US	Difference	
	Mean	Mean	Mean	t-stat.
Panel A: Startup characteristics at first financing (t=0)				
VC raised ($ m)	5.73	5.93	0.21	0.18
Pre-money valuation ($ m)	15.45	13.39	−2.06	−0.25
Startup age	2.59	2.49	−0.10	−0.88
Num. of VCs investing	1.96	2.36	0.40	7.25***
US VC involved	0.08	0.29	0.21	16.76***
Revenue ($ m)	6.91	5.08	−1.83	−0.37
Net income ($ m)	−0.65	−1.00	−0.35	−0.90
Employees	50.02	30.99	−19.03	−1.01
Num. of Patents	0.62	0.67	0.06	0.42
Stage				
Seed	0.13	0.09	−0.03	−2.22**
Product Development/Clinical Trial	0.26	0.28	0.02	1.07
Generating Revenue	0.61	0.62	0.01	0.54
Industry				
Software	0.21	0.38	0.17	9.30***
Hardware	0.11	0.11	0.00	0.12
Medical/Biotechnology	0.18	0.12	−0.05	−3.32***
Consumer/Retail	0.21	0.14	−0.06	−3.63***
Other Industry	0.30	0.25	−0.05	−2.56**
Country				
France	0.20	0.17	−0.03	−1.67*
Germany	0.13	0.09	−0.04	−2.61***
Sweden	0.07	0.05	−0.02	−1.43
United Kingdom	0.29	0.31	0.02	0.81
Other Country	0.32	0.39	0.07	3.24***
Panel B: Startup performance variables				
VC raised ($ m) by t+6	11.93	24.25	12.32	6.37***
VC rounds by t+6	1.64	2.36	0.72	17.22***
Num. of patents by t+6	1.61	2.53	0.92	3.70***
Scaled citation-weighted patents by t+6	1.36	3.02	1.66	4.70***
Revenue ($ m) in t+6	23.50	18.04	−5.46	−0.41
Net income ($ m) in t+6	−1.35	−4.33	−2.98	−2.23**
IPO	0.05	0.04	−0.01	−0.76
Successful Exit (IPO or Acq.>2*VC raised)	0.11	0.15	0.04	2.60***
Observations	10511	555	11066	

spillovers (Kerr et al., 2016).[10]

To analyze selection into migration I estimate a regression model relating observable characteristics at the moment of first VC funding to an indicator of whether the startup moved headquarters to the U.S. The following characteristics, all observed at first VC funding, proxy for startup quality and should, all else equal, be indicative of a higher likelihood of success: the amount raised, the maturity (age and whether the startup already generates revenue), the number of VCs invested in the startup, the involvement of an U.S. VC, and the number of patents held. All continuous variables are included as the logarithm of one plus the variable. The model is estimated by ordinary-least-squares (OLS), meaning that coefficients are increases in the likelihood of migration per unit increase of the independent variables. Standard errors are clustered at the industry-year level to account for the clustering of U.S. migration in industries and years.

Table 2.3 presents the results. As expected, I find that measures of startup quality are, if anything, positively correlated with U.S. migration. In Column (1), I relate the log of the amount raised in the first VC round to the likelihood to migrate to the U.S. The model includes fixed effects (FE) for the industry sector, year of first funding, and country in which the startup was founded.[11] The coefficient is highly significant and indicates that U.S. migrants receive more funding already in their first funding. To the extent that the funding amount–within a certain industry, year, and country– is indicative of future performance, this means that

[10]Sports is a good example of how global outliers in terms of skill concentrate in few places, as outlined by Kerr et al. (2016). The U.S. NBA, the world's top-selling and most popular basketball league, attracts the best players from every country in the world. In the season 2021/2022 the NBA rosters feature 109 international players from 39 countries, which are typically among the best in their home countries (See https://www.nba.com/news/nba-rosters-feature-109-international-player (accessed on 09/03/2022)). The reason for their migration is likely a combination of higher pay for skills, educational opportunities, and productivity spillovers. For example, Dirk Novitzki is not only better paid at the Dallas Mavericks than at his hometown club, he likely developed his human capital better and is more productive when among other world-class players.

[11]Industry sectors are: "IT: Software", "IT: Hardware", "Biotechnology/Medical", "Consumer/Retail", and other. First funding year fixed are 15 dummy variables for the year of first funding from 2000-2104. Country fixed effects are dummy variables for the 17 countries in which the startup was initially located.

a positive selection of startups migrates to the U.S.

Table 2.3: Selection into US Migration

This table reports ordinary-least-squares (OLS) regressions of startups' US migration outcomes on variables measured at first VC funding. The unit of observation is a VC-backed startup. The dependent variable "Moves to US" is one if a startup moved its HQ location to the US during the VC funding period, and zero otherwise. The regressors of interest are measures for ex ante startup quality and US orientation measured in the moment of first VC funding. To build patent measures, only patents applied for by two months before the first VC financing round were considered. All variables are defined in Appendix A. 1. All models are estimated using ordinary-least-squares (OLS). Standard errors clustered at the industry x year level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable:	Startup moves to US?						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LN VC raised ($ m) in first round	0.011***						0.004***
	(0.002)						(0.002)
LN Startup age at first round		-0.006**					-0.007**
		(0.003)					(0.003)
LN Number of VCs investing in first round			0.047***				0.022***
			(0.008)				(0.008)
US VC in first round				0.117***			0.104***
				(0.014)			(0.014)
Stage: Generating Revenue					-0.005		-0.000
					(0.004)		(0.005)
LN Number of patents at first round						0.013**	0.008
						(0.005)	(0.005)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Funding year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11066	11066	11066	11066	11066	11066	11066
R-squared	0.023	0.018	0.023	0.041	0.018	0.018	0.044

In Columns (2) to (6), I test how other measures of startup quality are related to U.S. migration. I find that U.S. migrants are: younger, backed by more VCs, more often backed by U.S. VC, and have more patents at the moment of first funding. Only the variable indicating whether a startup already generates revenues at first funding is not significantly related to U.S. migration. Since no single startup quality measure is negatively related to migrations, I find no evidence of adverse selection into U.S. migration.

Overall, the results show that there is positive sorting, whereby startups with the greatest potential select to move to the U.S. Importantly, I find no evidence of adverse selection of startups into U.S. migration, which is important because it

confirms the upper bound argument from section 2.2.

2.5 Moving to the U.S. and Startup Performance

In this section, I compare the performance of startups moving to the U.S. with those staying in Europe. In particular, I compare the performance in five different areas: fundraising, innovation, commercial success, exit likelihood, and scale at exit. To compare the performances, I regress performance in a certain year (in most analyses, in year 6 after initial VC) on a dummy variable indicating whether the startup moved to the U.S. Since migration is concentrated around the year of first funding (the median migrant moves 1 year after first VC, and 76%, have moved by year three after initial VC), I compare migrants and stayers starting from initial funding. All continuous variables are log-transformed (after adding 1), to mitigate the impact of outliers. In all regressions, standard errors are clustered at the industry-times-year of first funding level, because performance of startups starting at the same time in the same industry may be correlated.

2.5.1 U.S. Migration and Fundraising

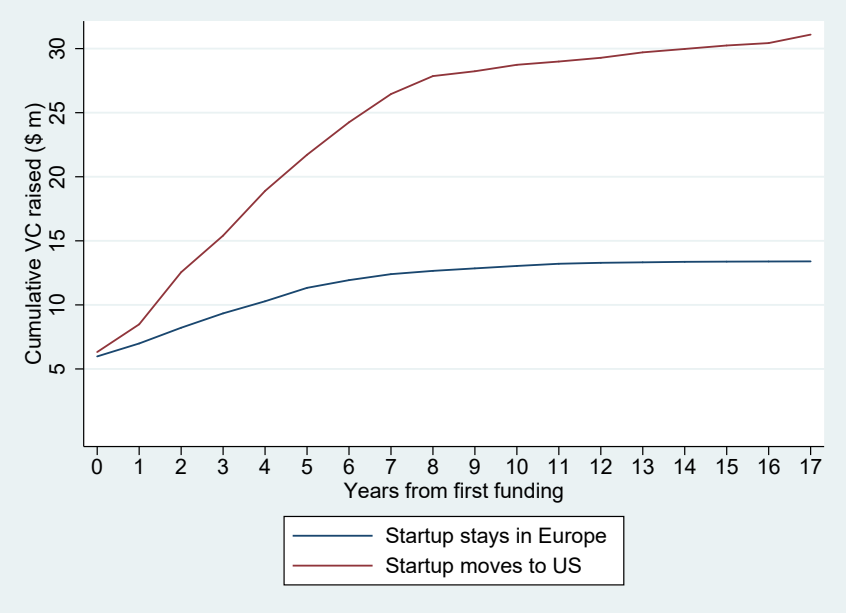
Figure 2.1 plots the fundraising performance, measured as average cumulative VC raised (in 2012 $ m) and average cumulative number of VC rounds received, over the years after first VC funding. The two lines each represent the sample of startups moving to the U.S. and those staying in Europe. It can be seen that U.S. migrants and stayers start at similar levels of funding at initial VC funding. The average initial difference in the funding amount is not statistically significant (see Panel A of Table 2.2).

After the initial funding/migration, U.S. migrants grow more in funding raised relative to staying startups. While U.S. movers and staying startups each raised an average of about $6 million at initial funding, U.S. movers had raised an average of $24 million six years later. By comparison, startups staying in Europe raised

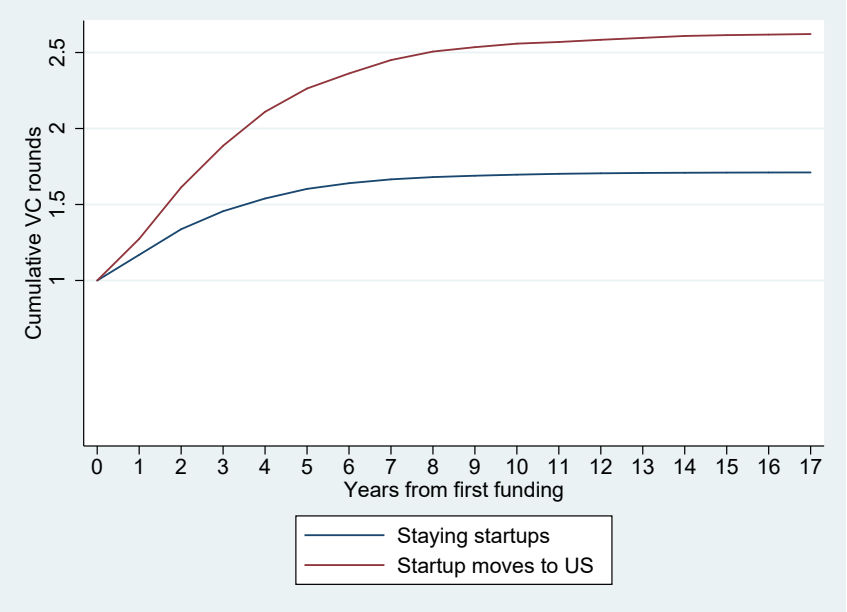
Figure 2.1: Moving to the US and Fundraising

The sample consists of 11,066 startups from 17 European countries that received venture capital financing between 2000 and 2014 according to VentureSource. The firms are tracked from the year of first VC funding up to 2021. All performance indicators are measured as average cumulative total up to year t.

Panel A: VC raised ($ m)



Panel B: VC rounds



$12 million by that time. Up to eight years after initial VC, we continue to see steeper funding growth among U.S. movers than startups in Europe. After that, both curves flatten and converge towards the final average funding amount of $31 million for U.S. movers and $13 million for startups staying in Europe.

Regression results in Table 2.4 quantify the fundraising difference between U.S. migrants and stayers formally. The dependent variable is (the natural logarithm of) cumulative funding raised by year $t + 6$, with t being the year of first funding. The variable of interest "Moves to U.S.", is an indicator of whether the startup migrated to the U.S. In Column (1), with no controls, the coefficient on the "Moves to U.S." dummy indicates that U.S. movers raise on average 183% more VC than European stayers ($= e^{1.04} - 1$). However, firms may fundamentally differ in their external funding needs depending on their industry sector, stage, and geography. If any of these factors also drives U.S. migration, the estimates in Columns (1) do not reflect an advantage of the U.S. ecosystem. To account for these differences, Column (2) adds fixed effects for the year, industry, stage, and source country, all at first funding. In addition, Column (3) controls for observable characteristics at first funding using all variables used in the most comprehensive selection model of Table 2.3. These controls, all measured at initial funding, include: the initial VC amount raised, startup age, number of VCs, U.S. VC involvement, stage, and number of patents.

In all three columns, the coefficient on "Moves to U.S." indicates that startups moving headquarters to the U.S. raise orders of magnitude more funding after migration than startups staying in Europe. The effect is large and statistically different from zero at the 1% level across all specifications. Depending on the controls, U.S. migrants raise between 86% and 210% more funding by year 6 after first funding.

To understand whether the fundraising advantage is driven by U.S. migrants receiving more more rounds or more funding per round, I also use the natural logarithm of the number of VC rounds by $t+6$ as a dependent variable in Columns

Table 2.4: Moving to the US and Fundraising

This table reports regression results of startup fundraising performance on an indicator of whether the startup moved to the US during the VC funding period. The unit of observation is a VC-backed startup. The dependent variable is the cumulative VC raised (in $ m) by year 6 after first funding in Columns (1)-(3), and cumulative number of VC rounds in Columns (4)-(6). $t = 0$ is the year of the first VC funding round. LN denotes the natural logarithm of a variable incremented by one. All models are estimated using ordinary-least-squares (OLS). Standard errors clustered at the industry x year level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable:	LN VC raised ($ m) by $t + 6$			LN VC rounds by $t + 6$		
	(1)	(2)	(3)	(4)	(5)	(6)
Moves to US	1.04***	1.13***	0.62***	0.22***	0.23***	0.20***
	(0.10)	(0.07)	(0.05)	(0.02)	(0.02)	(0.02)
LN VC raised ($ m) in first round			0.91***			0.01**
			(0.01)			(0.00)
LN Startup age at first round			-0.17***			-0.05***
			(0.02)			(0.01)
LN Number of VCs investing in first round			0.11***			0.09***
			(0.02)			(0.01)
US VC in first round			0.18***			0.03**
			(0.06)			(0.01)
LN Number of patents at first round			0.13***			0.04***
			(0.02)			(0.01)
Funding Year FE	No	Yes	Yes	No	Yes	Yes
Industry FE	No	Yes	Yes	No	Yes	Yes
Stage FE	No	Yes	Yes	No	Yes	Yes
Country FE	No	Yes	Yes	No	Yes	Yes
Observations	11066	11066	11066	11066	11066	11066
R-squared	0.019	0.070	0.677	0.025	0.075	0.103

(4) to (6). The estimated coefficient is 0.2 and highly statistically significant. This suggests that U.S. migrants receive approx. 22% more rounds than stayers. Hence, the overall fundraising advantage is driven by a mix of both factors: receiving more rounds and more funding per round in the U.S.

Overall, and not surprisingly, we find that startups migrating to the U.S. raise orders of magnitude more funding over time than startups staying in Europe.

2.5.2 U.S. Migration and Innovation

Figure 2.2 shows the average cumulative number of patents (eventually granted) over years after first funding, again broken down by U.S. migrants and European

stayers. We see that both groups start from about the same level in the first funding year, at approx. 0.6 patents. That is, migrants and stayers do not differ in in number of patents at first funding (see Panel A of Table 2.2). In the years after first funding, however, U.S. migrants grow their patent stock more than European stayers. The difference is such that 6 years after first funding, U.S. migrants hold on average about 0.9 patents more than European stayers.

Table 2.5 shows regression results that quantify the differential development in innovation performance. In Column (1), without controls, we find that U.S. migrants hold about 19% more patents by year 6 after first funding. This difference is significant at the 1% level and does not change much when controlling for year, country, industry, stage and observable characteristics at first funding (including the number of patents at first funding) in Columns (2) and (3).

A simple patent count may not account for the quality of patents. But even when weighting patents by their received citations, U.S. migrants innovate more than European stayers after first funding. In fact, the difference becomes even larger when considering patent quality. Columns (4) to (6) show the results when using the log number scaled citation-weighted patents, by year 6 after first funding, as dependent variable. Results show that U.S. migrants have between 26% and 35% more citation-weighted patents six years after first funding, compared to startups staying in Europe.

2.5.3 U.S. Migration and Commercial Success

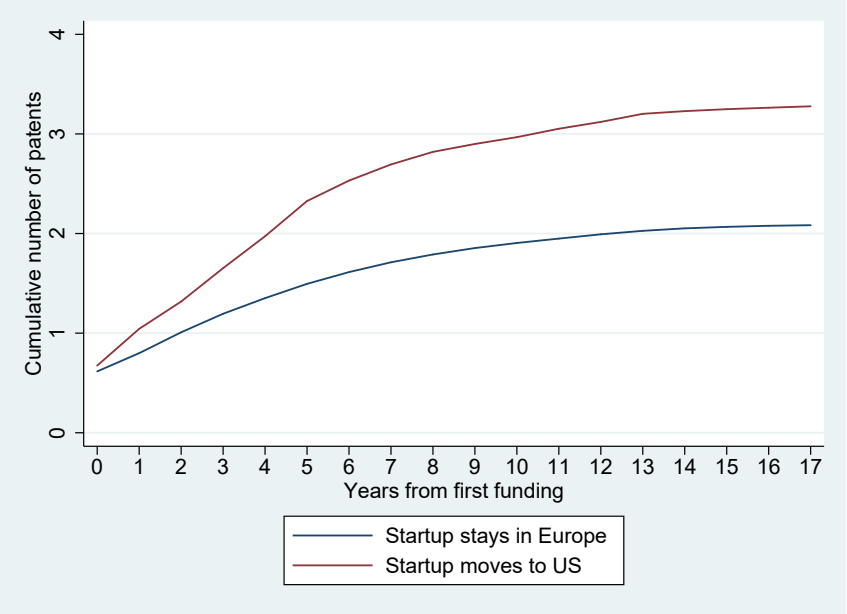
Next, I examine whether U.S. migration is related to higher commercial success. I use two measures of commercial success: revenue and net income (both in 2012 USD). Both measures emphasize a different type of commercial success: revenue reflects product market success, while net income reflects profitability of the business.

Figure 2.3 shows how revenue and net income evolve over time from initial funding, separated by U.S. migrants and stayers. We can see that U.S. migrants

Figure 2.2: Moving to the US and Innovation

The sample consists of 11,066 startups from 17 European countries that received venture capital financing between 2000 and 2014 according to VentureSource. The firms are tracked from the year of first VC funding up to 2021. All performance indicators are measured as average cumulative total up to year t.

Panel A: Patents



Panel B: Scaled citation-weighted patents

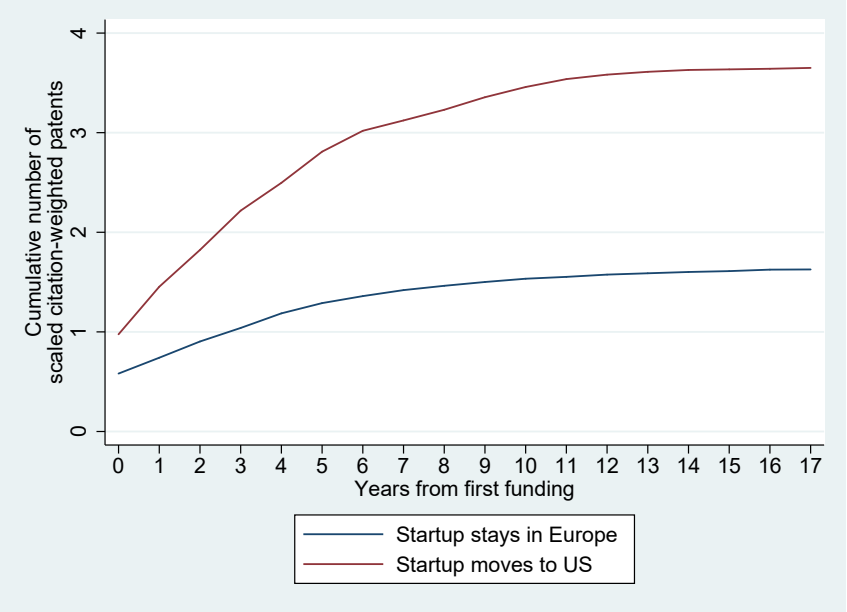


Table 2.5: Moving to the US and Innovation

This table reports regression results of startup innovation performance on an indicator of whether the startup moved to the US during the VC funding period. The unit of observation is a VC-backed startup. The dependent variable is the cumulative number of patents granted by year 6 after first funding in Columns (1)-(3), and cumulative scaled citation-weighted patents in Columns (4)-(6). $t = 0$ is the year of the first VC funding round. LN denotes the natural logarithm of a variable incremented by one. All models are estimated using ordinary-least-squares (OLS). Standard errors clustered at the industry x year level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable:	LN Num. of patents by $t+6$			LN Scaled citation-weighted patents by $t+6$		
	(1)	(2)	(3)	(4)	(5)	(6)
Moves to US	0.17***	0.22***	0.12***	0.27***	0.30***	0.23***
	(0.05)	(0.04)	(0.03)	(0.04)	(0.04)	(0.03)
LN VC raised ($ m) in first round			0.02***			0.02***
			(0.00)			(0.00)
LN Startup age at first round			-0.05***			-0.02***
			(0.01)			(0.01)
LN Number of VCs investing in first round			0.05***			0.03
			(0.02)			(0.02)
US VC in first round			0.03			0.03
			(0.02)			(0.02)
LN Number of patents at first round			1.09***			0.87***
			(0.02)			(0.02)
Funding Year FE	No	Yes	Yes	No	Yes	Yes
Industry FE	No	Yes	Yes	No	Yes	Yes
Stage FE	No	Yes	Yes	No	Yes	Yes
Country FE	No	Yes	Yes	No	Yes	Yes
Observations	11066	11066	11066	11066	11066	11066
R-squared	0.002	0.216	0.662	0.006	0.123	0.464

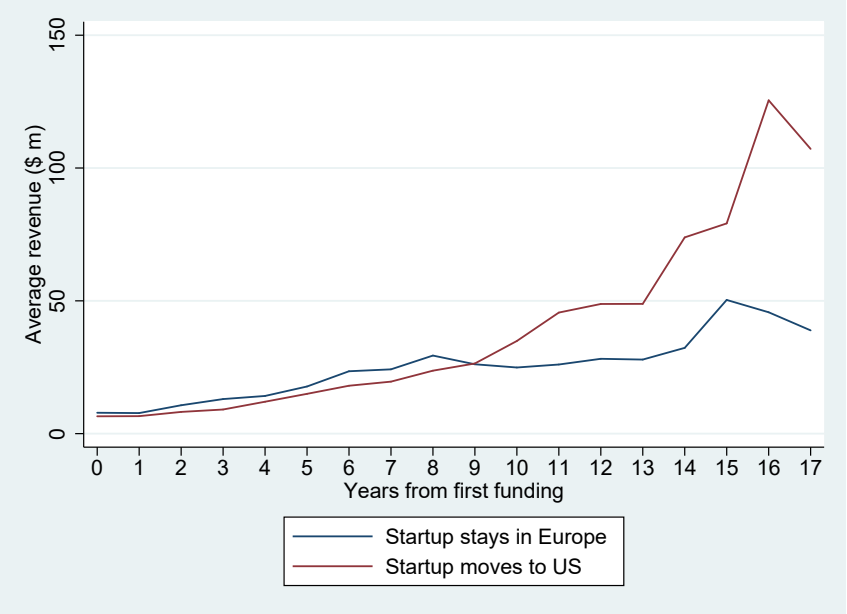
have, surprisingly, lower revenue than stayers in Europe over a long period after initial funding. It is not until year nine after initial financing that the revenue lines cross, and U.S. migrants show higher revenues from then on. In terms of net income, both groups show a "J-curve" (albeit a noisy one), meaning that startups first go through a period of net losses before they enter the path towards profitability. U.S. migrants, however, appear to ride a "deeper" J-curve, with higher financial losses over a longer period but higher profits at the end.

Table 2.6 shows that U.S. migration does not lead to higher revenues in many years after migration - also in a regression framework. Instead, U.S. migration is related with higher financial losses over a an extended period of time. The

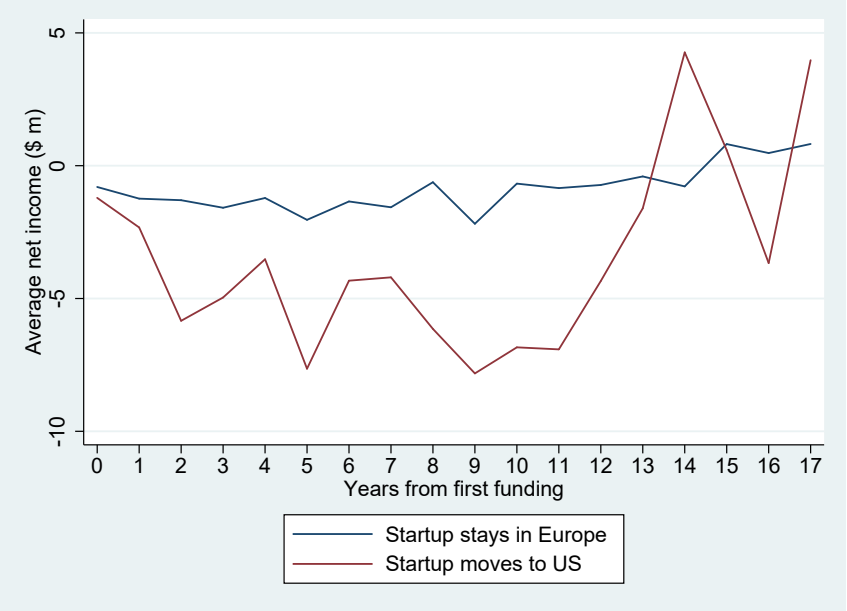
Figure 2.3: Moving to the US and Commercial Success

The sample consists of 11,066 startups from 17 European countries that received venture capital financing between 2000 and 2014 according to VentureSource. The firms are tracked from the year of first VC funding up to 2021. All performance indicators are measured as average in year t.

Panel A: Revenue ($ m)



Panel B: Net income ($ m)



dependent variables are now revenue and net income six years after first funding. As revenue and net profit can be negative, I cannot use the logarithm as before, and therefore winsorize both variables at the 1% and 99% ends to control for outliers in the regression estimates. The results in Columns (1)-(3) show that U.S. migrants, compared to staying startups, do not significantly increase their revenues by year 6 after initial funding.[12]

Table 2.6: Moving to the US and Commercial Success

This table reports regression results of startup commercial success on an indicator of whether the startup moved to the US during the VC funding period. The unit of observation is a VC-backed startup. The dependent variable is the revenue in year 6 after first funding in Columns (1)-(3), and net income in Columns (4)-(6). $t = 0$ is the year of the first VC funding round. Revenue and net income are winsorized at the 1% and 99% ends. LN denotes the natural logarithm of a variable incremented by one. All models are estimated using ordinary-least-squares (OLS). Standard errors clustered at the industry x year level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable:	Revenue ($ m) in $t+6$			Net income ($ m) in $t+6$		
	(1)	(2)	(3)	(4)	(5)	(6)
Moves to US	0.98	1.08	-2.62	-2.18***	-1.79***	-1.51**
	(3.10)	(2.90)	(2.85)	(0.70)	(0.67)	(0.70)
LN VC raised ($ m) in first round			9.08***			-0.42***
			(1.05)			(0.15)
LN Startup age at first round			-3.01**			0.40**
			(1.43)			(0.19)
LN Number of VCs investing in first round			-9.11***			-0.89**
			(2.52)			(0.45)
US VC in first round			8.56*			0.36
			(4.69)			(0.51)
LN Number of patents at first round			-6.00***			-1.00***
			(1.39)			(0.24)
Funding Year FE	No	Yes	Yes	No	Yes	Yes
Industry FE	No	Yes	Yes	No	Yes	Yes
Stage FE	No	Yes	Yes	No	Yes	Yes
Country FE	No	Yes	Yes	No	Yes	Yes
Observations	2802	2802	2802	2760	2760	2760
R-squared	0.000	0.073	0.168	0.009	0.094	0.120

Columns (4)-(6) show that, instead, U.S. migration is associated with higher losses after initial financing. The coefficients are absolute values and indicate that U.S. migrants sustain anywhere between 1.5-2.2 million higher losses in year 6

[12] U.S. migration is not associated with higher revenues anywhere between 1 and 8 years after initial funding (see Section 2.6).

after startup than startups staying in Europe. This difference is highly statistically significant across models.

Overall, the results in this subsection show that U.S. migration is not associated with higher immediate sales success but, on the contrary, with higher financial losses. This result is surprising and an important finding of this paper. With better startups going to the U.S. (see Section 2.2 and Section 2.4) but not increasing their sales, we can confidently conclude that the product market is not a disadvantage of the European startup ecosystem. If anything, the U.S. ecosystem seems better suited to withstand higher losses, consistent with the much better funding of U.S. migrants.

2.5.4 U.S. Migration and Exits

The most successful startups usually go public or exit through mergers and acquisitions (Cumming and MacIntosh, 2003; Puri and Zarutskie, 2012; Ewens and Marx, 2018; Chen et al., 2021; Yimfor and Garfinkel, 2023). As the U.S. hosts arguably the most developed market for IPOs and M&As in recent decades, European startups may mainly migrate to the U.S. to increase their chances of reaching a successful public offering or acquisition.

Surprisingly, however, I find that U.S. migrants do not benefit from a higher IPO probability. The average IPO rate of U.S. migrants is 4% and lower than the 4.7% of European stayers, as shown in Table 2.2. The regression results in Table 2.7 quantify the difference in a regression framework. In Column (1), with no controls, the coefficient on "Moves to U.S." reflects the cross-sectional difference of U.S. migrants of 0.7%. This difference is marginally significant at the 10% level. However, the difference in IPO rates loses its statistical significant when controlling for differences country, industry, and year (Column (2)), as well as when controlling fro observables at first funding in Column (3).

Figure 2.4 Panel A plots the cumulative IPO probability for U.S. movers and stayers over time. At any point after first VC, U.S. migrants have a lower IPO

Table 2.7: Moving to the US and Exits

This table reports regression results of startup exit outcomes on an indicator of whether the startup moved to the US during the VC funding period. The unit of observation is a VC-backed startup. The dependent variables are dummy variables indicating whether the startup had an exit via IPO in Columns (1)-(3)/IPO or successful acquisition (i.e., acquisition with valuation larger than $2 * VC_raised$) in Columns (4)-(6), by the end of the sample period (July 2021). $t = 0$ is the year of the first VC funding round. LN denotes the natural logarithm of a variable incremented by one. All models are estimated using ordinary-least-squares (OLS). Standard errors clustered at the industry x year level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable:	IPO			Successful Exit (IPO or Acq>2*VC raised)		
	(1)	(2)	(3)	(4)	(5)	(6)
Moves to US	-0.01*	0.00	-0.01	0.04*	0.04**	0.03
	(0.00)	(0.01)	(0.00)	(0.01)	(0.02)	(0.02)
LN VC raised ($ m) in first round			0.01**			0.02**
			(0.00)			(0.01)
LN Startup age at first round			0.01			0.00
			(0.01)			(0.00)
LN Number of VCs investing in first round			-0.01			-0.01
			(0.01)			(0.01)
US VC in first round			0.01			0.03**
			(0.01)			(0.01)
LN Number of patents at first round			0.02*			0.03
			(0.01)			(0.02)
Funding Year FE	No	Yes	Yes	No	Yes	Yes
Industry FE	No	Yes	Yes	No	Yes	Yes
Stage FE	No	Yes	Yes	No	Yes	Yes
Country FE	No	Yes	Yes	No	Yes	Yes
Observations	11066	11066	11066	11066	11066	11066
R-squared	0.000	0.037	0.050	0.001	0.029	0.046

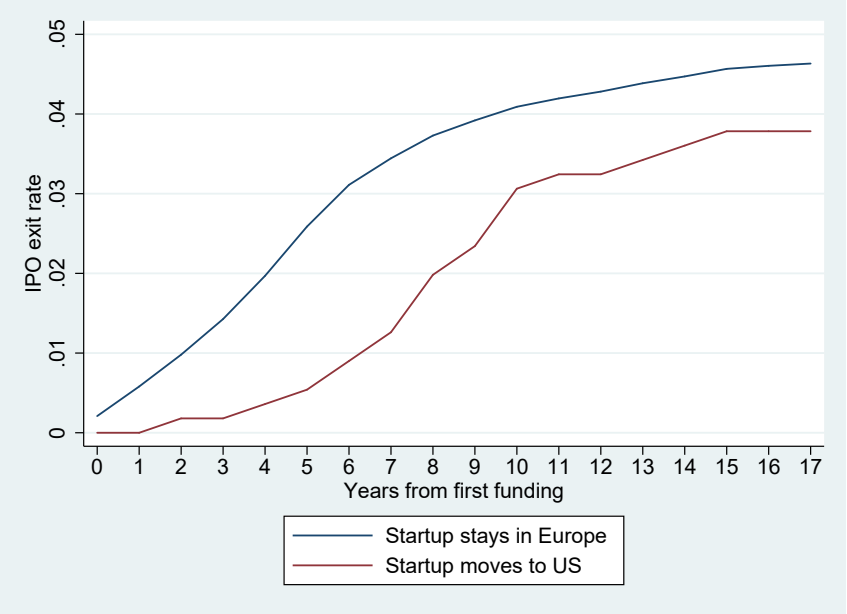
likelihood than startups staying in Europe. Also, the curve of U.S. migrants is shifted to the right in that U.S. migrants execute their IPO later on average. For example, the majority (approximately 2/3) of IPOs of startups staying in Europe takes place between 0 and 6 years after first VC funding. However, most U.S. movers' IPOs (approximately 2/3) occur between 6 and 10 years after first VC funding. Although U.S. movers catch up in IPOs between years 6 and 10, they can never close the gap, so startups staying in Europe are more likely to reach an IPO overall.

It may be that U.S. migrants substitute IPOs with successful acquisitions because

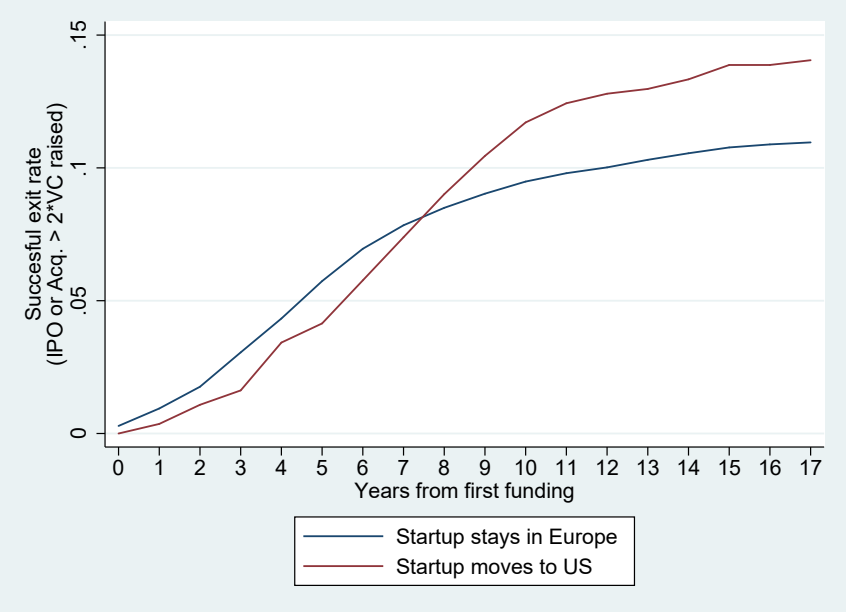
Figure 2.4: Moving to the US and Exits

The sample consists of 11,066 startups from 17 European countries that received venture capital financing between 2000 and 2014 according to VentureSource. The firms are tracked from the year of first VC funding up to 2021. All performance indicators are measured as average cumulative total up to year t.

Panel A: IPOs



Panel B: Successful Exits (IPO and Acq.>2*VC raised)



the U.S. M&A market offers large advantages for migrants. To understand whether this is the case, I test whether U.S. migrants are more likely to reach a "successful exit", which comprises both IPOs and acquisitions with a reported valuation of more than twice VC raised (Yimfor and Garfinkel, 2023). Columns (4) to (6) of Table 2.7 present the results. The coefficient is positive but loses its significance when controlling for observable differences at first funding. This indicates that conditional on having comparable funding, investors, stage, and patents at the outset, U.S. migrants are not any more likely to achieve a successful exit compared to stayers.

Overall, Table 2.7 highlights the fact that startups moving to the U.S. are not any more likely to reach an IPO or successful exit than comparable startups staying in Europe. This indicates that U.S. migrants do not benefit from better exit markets. This result is puzzling because U.S. movers raise significantly more funding and innovate more after moving. To resolve this apparent paradox, I now analyze the degree of success of companies that perform well.

2.5.5 U.S. Migration and Firm Scale at Exit

We have seen that companies that relocate their headquarters to the U.S. experience a greater increase in funding and innovation than companies that remain in Europe. However, it is unclear why this advantage does not translate into a significantly higher probability of a successful exit. One explanation could be that the degree of success of companies that relocate to the U.S. and succeed is greater than that of European startups. To analyze this possibility, I now compare the value and scale of firms that achieve an exit.

Table 2.8 reports estimates from company-level regressions where the dependent variables are either the (1) valuation, (2) employees, (3) revenue, (4) net income, or (5) company age, in the moment of achieving a successful exit. I use the natural logarithm of one plus these variables–except for net income, since it can be negative. As in the most restrictive models in Table 2.4 to Table 2.7, all

regressions include company industry, year, and country fixed effects, as well as observable characteristics at first funding (i.e., VC amount raised, startup age, number of VCs, U.S. VC involvement, stage, and number of patents at first VC funding).

Column (1) reports the difference in company valuation between U.S. migrants and European stayers in the moment of IPO or successful exit (in Panel A or B, respectively).[13] I find that U.S. migrants have higher company valuations on the day of IPO or successful exit. This difference is statistically significant at the 1% level. The coefficient implies that startups moving headquarters to the U.S. are worth 4.4 *times* times the value of startups reaching an IPO in Europe (= $e^{1.48}$). This difference remains huge when considering both IPOs and successful acquisitions together as successful exits. The company value of U.S. migrants is 2.4 times that of European stayers at a successful exit, as implied by Column (1) of Panel B.

Columns (2) and (3) show that U.S. migrants are also of much bigger scale at exit, compared to European stayers. Firme scale is measured as number of employees and revenue in Columns (2) and (3), respectively. The results show that firms moving to the U.S. have 3.8 times more employees and 4.1 times more revenue at IPO compared to startups reaching an IPO in Europe. Similarly, U.S. migrants have 2.2 times more employees and 2.4 times more revenues than their European counterparts in case of a successful exit.

Columns (4) shows that U.S. migrants are less profitable at IPO and successful exit than European startups reaching such exits. The differences are highly statistically significant and indicate that U.S. migrants have on average 21 U.S. dollar millions lower net income at IPO, and 18 millions lower net income at successful exit. Since the average net income at exit in the sample is negative (mean: -3.1 USDm, median: -0.5 USDm), this means that U.S. migrants have much higher net losses than the average startup.

[13] For IPOs, company valuation is calculated as shares outstanding after offer times offer price. For acquisitions, the transaction value is used.

Table 2.8: Moving to the US and Scale at Exit

This table reports regression results of startup exit outcomes on an indicator of whether the startup moved to the US during the VC funding period. The unit of observation is a VC-backed startup. Conditional on IPO (Columns (1)-(3)) or conditional on successful exit ((4)-(6)), the dependent variables are measures of firm scale at exit. Firm scale measures include valuation (market cap at IPO or deal value at acquisition), number of employees, revenue, and net income, as well as firm age. LN denotes the natural logarithm of a variable incremented by one. All models are estimated using ordinary-least-squares (OLS). Standard errors clustered at the industry x year level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
Panel A: IPOs					
Dependent variable:	LN Valuation at IPO	LN Employees at IPO	LN Revenue at IPO	Net income ($m) at IPO	LN Age at IPO
Moves to US	1.48***	1.34***	1.18***	-20.93***	0.41***
	(0.27)	(0.39)	(0.39)	(5.70)	(0.07)
First funding controls	Yes	Yes	Yes	Yes	Yes
Funding Year FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Stage FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Observations	495	422	414	402	512
R-squared	0.461	0.476	0.547	0.089	0.368
*Panel B: Successful Exits (IPO or Acq. >2*VC raised)*					
Dependent variable:	LN Valuation at Succ. Exit	LN Employees at Succ. Exit	LN Revenue at Succ. Exit	Net income ($m) at Succ. Exit	LN Age at Succ. Exit
Moves to US	0.89***	0.77***	0.75***	-17.72**	0.20***
	(0.15)	(0.19)	(0.18)	(7.75)	(0.05)
First funding controls	Yes	Yes	Yes	Yes	Yes
Funding Year FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Stage FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Observations	1223	956	801	741	1240
R-squared	0.380	0.342	0.427	0.057	0.278

Finally, the question remains whether U.S. migrants reach their enormous scale in the same time frame as European startups or whether higher VC funding leaves them more time to scale before an exit. Therefore, Columns (5) reports the same regressions as before, with the only difference that the (natural logarithm of) age at IPO/successful exit is the dependent variable. The coefficients imply that U.S. migrants are 42% older at IPO and 16% older at successful exit than their European equivalents. These differences are similar in the descriptive statistics. While European startups are on average 8.6 years old at IPO, U.S. migrants are 11.2 years old at IPO (i.e., 30% older).

2.5.6 Fundraising Advantage as Main Mechanism?

How much of the relationship between U.S. migration and company outcomes can be explained by the fundraising advantage? To answer this question, I re-estimate the same regression models of startup performance as in Table 2.5 to Table 2.8, but now add the amount of cumulative funding raised by the time of the dependent variable as an explanatory variable. The change in the "Moves to U.S."-coefficient should give us an indication of how much of the performance difference can be explained by the financing advantage.

The results in Table 2.9 show that, depending on the area of performance, much of the higher performance of U.S. migrants can be explained by their financing advantage. For example, the coefficient on the number of patents drops by 50% from 0.12 (in Column (3) of Table 2.5) to 0.06 in Column (1). Similarly, the effect on net income becomes insignificant (Column (4)), meaning that the relationship between U.S. migration and higher net losses can be entirely explained by the financing advantage. Also the relationship between U.S. migration and successful exits is explained away by the financing advantage. Last, the valuation at exit coefficients in Columns(7)-(8) drop by approx. 50% after controlling for the financing advantage. Taken together, these results suggest the fundraising disadvantage explains a major part of the overall European disadvantage at startup

performance.

2.6 Robustness

Overall, we found that the main performance differences of startups moving to the U.S. is more financing, that allows to reach a larger scale under the accumulation of higher losses over longer time periods. However, these factors are not necessarily due to the ecosystem in the U.S., but could be the result of a selection of startups moving to the U.S. If true, this implies that the U.S. startup ecosystem has no advantages over the European ecosystem in terms of facilitating startup success. Given the overwhelming startup success in the U.S., it seems unlikely that the U.S. ecosystem does not offer any advantages.

However, I conduct several robustness checks to examine the extent to which the main differences are due to selection. In the main analysis, I use all U.S. migrants regardless of when they migrate (e.g., before, after first funding, or even just before exit). This is justified by the fact that migration happens on average very early, so that startups spend enough time in the respective ecosystem. For example, remember that 420 of the 555 migrants (or 76%) have already migrated by year 3 after first funding. However, results are qualitatively and quantitatively similar when only considering the 420 early migrants who moved up to three years after first funding (Table A. 4). That is, results are not driven by late migrants moving shortly before an impending exit.

The decision to investigate performance in year 6 after first funding is admittedly ad-hoc. However, consistent with the graphical evidence, the results are qualitatively and quantitatively similar when looking at performance in year 4 or 8 after first funding (see Table A. 5 and Table A. 6, respectively).

Table 2.9: Funding Advantage as Main Mechanism?

This table reports regression results of different startup performance measures on an indicator of whether the startup moved to the US during the VC funding period. The unit of observation is a VC-backed startup. The models are the same as in the Column (3)/(6) of Table 2.4 to Table 2.8, with the only difference that I the cumulative VC raised ($m) during the measurement period of the dependent variable is included. All variables are defined in Appendix A. 1. LN denotes the natural logarithm of a variable incremented by one. All models are estimated using ordinary-least-squares (OLS). Standard errors clustered at the industry x year level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Innovation		Commercial success		Exit		Valuation at exit	
Dependent variable:	LN Num. of patents by t+6	LN Scaled citation-weighted patents by t+6	Revenue ($ m) in t+6	Net income ($ m) in t+6	IPO	Successful Exit	LN Valuation at IPO	LN Valuation at Succ. Exit
Moves to US	0.06**	0.18***	-7.37**	-0.44	-0.06***	-0.01	0.75***	0.35***
	(0.02)	(0.03)	(3.01)	(0.61)	(0.02)	(0.03)	(0.22)	(0.12)
LN VC raised ($ m) by t+6	0.10***	0.08***	6.84***	-1.60***				
	(0.01)	(0.01)	(1.12)	(0.17)				
LN VC raised ($ m) by exit					0.04***	0.04***	0.58***	0.67***
					(0.01)	(0.01)	(0.05)	(0.03)
First funding controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Funding Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Stage FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11066	11066	2802	2760	3812	3812	495	1223
R-squared	0.677	0.476	0.198	0.203	0.126	0.073	0.663	0.613

2.6.1 Matched Sample

Another way to disentangle selection and treatment effects would be use a closely-matched control group of similar firms at migration. Such matching approach exploits the fact that the sample of non-migrants is many times larger (about 20x) than the migrant sample, allowing to identify highly similar control firms as counterfactual sample. However, while matching results might be closer to the actual treatment effect of the different ecosystems, I refrain from denoting these effects as causal.

The idea is to form a control group that is as similar to migrants as possible, with the only difference that they do not migrate to the U.S. To form such a control group, I choose the nearest neighbor - among all non-migrants that are active in the same industry and are in the same stage in the migration year - on cumulative VC raised, cumulative number of rounds, age, number of VCs invested, an indicator of whether the startup is backed by U.S. VC, and an indicator of whether the startup has at least one patent, based on Mahalanobis distance (Rubin, 1980).[14] All startups that are active, that is, all that have started but not yet exited, are considered as a potential match for one migrant in its migration year. The approach can identify a matching control firm for all 555 migrants. Table A. 7 reports the means of startup characteristics in the match(=migration) year, together with a test for differences. After matching, treatment and control samples are indistinguishable along observables.

Figure A. 1, Figure A. 2, Figure A. 3 Figure A. 4 provide a graphical impression how U.S. migrants perform compared to matched control firms in terms of fundraising, innovation, commercial success, and exit success, respectively. The development paths before the migration year are largely parallel, but after migration, development paths deviate in a similar fashion as in the overall sample:

[14] I use a multivariate distance measure instead of a univariate distance measure based on a prediction model (like propensity score (Rosenbaum and Rubin, 1983)), because many industry-stage-year cells contain only few migrants, and these would all have to be dropped from the sample because of perfect prediction.

After migration, migrants perform much better in fundraising, slightly better in innovation, revenues do not increase much for at least 7 years after migration, and net income becomes more negative. Regression results only change slightly compared to the overall sample. Table A. 8 to Table A. 11 repeat the same analysis from Table 2.4 to Table 2.7, except for now using the matched control sample. U.S. migrants still raise between 72-112% higher funding in the years after migration compared to the closely matched control sample. This effect is again highly statistically significant. However, the U.S. migration effects on commercial and exit success become generally insignificant when using a closely matched control group. Overall, these results corroborate the interpretation that the financing advantage in the U.S. is the key difference versus the European startup ecosystem.

2.7 Conclusion

This paper explores the main drawbacks of the European startup ecosystem using a new dataset on European startups moving to the U.S. I argue that since the more promising startups migrate to the U.S., the difference between migrants and stayers provides an upper bound on the advantage of the U.S. startup ecosystem relative to Europe - allowing to identify the main European disadvantage at startup performance.

Empirical evidence shows that startups moving to the U.S. receive much more capital, produce slightly more innovation, and are grow much bigger before exit than startups staying in Europe. More surprisingly, I find that U.S. migrants do not increase their revenues for many years after migration, instead incur higher financial losses throughout, and do not significantly improve their likelihood of achieving an IPO or successful exit. Additional evidence shows that large parts of the innovation, net income loss, and growth difference can be explained by U.S. migrants' funding advantage.

I view these results as contributing to our understanding of the main European

disadvantage at startup performance in showing that European startups are only marginally, if at all, hindered by technology, product, and exit markets, but that the main disadvantage is the VC financing market. This is consistent with the perception that markets for technology, consumer product, IPOs and M&As are highly globalized (Erel et al., 2012; Doidge et al., 2013; Audretsch et al., 2014; De Marco et al., 2017), but the VC market requires a certain degree of locality (Chen et al., 2010; Cumming and Dai, 2010; Lutz et al., 2013).

The findings of this paper have important implications for entrepreneurs and policymakers seeking to enhance the performance of their startups. Encouragingly, the results suggest that improving the European startup ecosystem is much more straightforward than previously thought. Instead of orchestrating comprehensive efforts across multiple markets, such as product, technology, IPO, and acquisition markets, policymakers can derive significant benefits by strategically concentrating their efforts on the venture capital market. These findings contribute valuable insights to the ongoing discourse on fostering entrepreneurial ecosystems and hold a promise for effectively fostering startup development and innovation in Europe.

3

Venture Capital and the International Relocation of Startups

Authors:	Stefan Weik, Ann-Kristin Achleitner, Reiner Braun
First Author:	Stefan Weik
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Abstract

Venture capital (VC) in Europe is still developing and relies heavily on foreign investment. This raises concerns that startups are migrating out of Europe as a consequence. Using a novel large-scale data set of startup headquarter (HQ) location histories, we document that cross-border startup relocation is common in Europe: About 6% of startups move across borders, which account for a disproportionate 14% of total startup value. We also document that most relocation is towards the US, and that relocation leads to most of the startup's workforce ending up in the foreign country. Moreover, our results show that foreign VC investment, particularly from the US, is strongly associated with relocation, with the effect implying that one in ten US investments leads to relocation. This foreign VC effect is robust to matching, panel data, and instrumental variable analyses, and is more pronounced when startup financing conditions are poor. These findings provide new insights into the international migration of European startups, and suggest that the outflow can be addressed by improving startups' local financing conditions.

3.1 Introduction

The growing importance of venture capital-backed companies in the global economy is difficult to overstate. For example, eight of the world's ten most valuable companies are all relatively young technology companies from the US or Asia that relied on venture capital (VC) to finance their early growth.[1] Gornall and Strebulaev (2021) argue that the US VC industry, which emerged in the second half of the 20th century,[2] has played an important and causal role in the current dominance of US technology companies. But even beyond these extraordinary success stories, VC has been shown to contribute to innovation (Kortum and Lerner, 2000; Samila and Sorenson, 2010; Colombo et al., 2016), employment growth (Engel and Keilbach, 2007), and higher incomes to society (Samila and Sorenson, 2011).

Europe has a relatively young VC industry that has only recently taken off under a large influx of foreign investment, especially from the US (Aizenman and Kendall, 2012). In 2021, for example, a US VC was involved in 1 in 5 of all VC financings to European startups, and even in 4 in 5 financings over USD 100m (Pitchbook, 2021; Atomico, 2021). While this foreign capital is certainly helpful in helping European startups grow, it has raised concerns about migration of startups abroad. Consider, for example, the following statements by European Commissioner for Innovation Mariya Gabriel and the CEO of startup Zendesk, which is also a data point in our analysis:

> *"[...]in too many cases in the past, high potential European innovators have left Europe to pursue their ambitions on other continents. This movement is usually requested by the investor who is usually not European."*[3]

[1] As of 7 February 2022, these companies are: Apple, Microsoft, Alphabet, Amazon, Tesla, Meta, Nvidia (all US) and TSMC (Taiwan).

[2] Gompers and Lerner (2001) and Kenney (2011) provide detailed descriptions of the history of the US VC industry.

[3] This statement is from European Commissioner Mariya Gabriel, see https://ec.europa.eu/commission/commissioners/2019-2024/gabriel/announcements/keynote-speech-commissioner-mariya-gabriel-tackling-scale-gap-expert-webinar_en (accessed on November 10, 2021).

"With all the [US] VCs we talked to, the money and the move [to the US] had to go hand-in-hand."[4]

The anecdotal evidence on the relocation of European startups and the role of foreign VCs raises several empirical questions. How many European startups relocate to other continents? When they relocate their headquarters, does this mean that a large part of the company goes with it, or are headquarters relocations merely legal formalities? To what extent is foreign VC related to the relocation of startups? And if there is a relationship, what motivates foreign VCs to relocate startups? These are some of the questions this paper addresses.

Our study of European startup relocation and the role of foreign VC uses a novel large-scale data set of startup headquarter (HQ) location histories. To assemble the data set, we conducted a painstaking manual archival investigation of HQ location histories of more than 11,000 VC-backed European startups first funded between 2000 and 2014. Using this novel data set as a starting point, we are able to derive a number of key findings:

First, we provide a first systematic description of startup relocation in Europe, documenting novel facts. First, cross-border startup relocation is common in Europe: About 6% (555 of 11,066) of the sample startups moved across borders, which is very similar to the emigration rate of high skilled individuals in Europe (Arslan et al., 2014) and multinational companies (Voget, 2011).[5] Based on the company valuations at the time of their initial public offering (IPO), relocating startups account for a disproportionate 14% of total startup value. Not surprisingly, 86% of all migrating startups moved to the US, which is arguably the most

[4]This statement is from Zendesk's CEO, see https://www.entrepreneur.com/article/220076 (accessed on September 9, 2021). Founded in Copenhagen in 2007, Zendesk considered raising VC in 2009. Several US VCs were willing to invest, but only on the condition that the three co-founders move to the US. Zendesk accepted, relocated its headquarters (HQ), and most of the company followed. When Zendesk went public in 2014, 72% of its workforce (339 of 473 employees) was based in the US (See Zendesk's April 10, 2014, S-1 filing in the SEC EDGAR system).

[5]Both the emigration rate of high skilled individuals in Europe (Arslan et al., 2014) and the relocation rate of multinational companies (Voget, 2011) is about 6% between 2000 and 2010.

developed startup ecosystem in the world. Thus, the international migration of startups essentially paints a one-way picture, and one disproportionately towards the US. This is very similar to the migration patterns of exceptionally talented individuals, such as Nobel Prize winners, inventors, and international mathematical olympiade medalists, for whom the US is also the largest importer (Hunter et al., 2009; Miguelez and Fink, 2017; Agarwal et al., 2023). Finally, contrary to popular perception, we find that relocations occur early in a startup's life. The median company age at relocation is 3 years, while the median age at first funding is 2 years and 11 years at the time of IPO.

Second, our results confirm that HQ relocation is a good proxy for exodus/ drain/ migration. To find this out, for all startups in our sample that achieved an initial public offering, we searched the IPO documents for the geographical distribution of the workforce. We focus on startups that have gone public because they represent the major share of the value created in venture capital (Cumming and MacIntosh, 2003; Phalippou and Gottschalg, 2009) and because the geographical distribution at the time of the IPO is available. We find that relocated startups employ, on average, 65% of their workforce outside their founding country at the time of the IPO. Specifically, 56% of the employees are located in the US, 35% in the founding country and 9% in other countries. In comparison, for companies that have not relocated their headquarters, 92% of employees are in the founding country, 4% in the US and 4% in other countries. Given that relocating startups move both their headquarters and the majority of their workforce abroad, it is fair to say that relocating startups mostly leave their home country.

Third, we document that startup relocation is strongly associated with foreign VC investment, particularly from the US. Cross-sectional regressions suggest that a European startup is 5 percentage points (10 percentage points) more likely to relocate its HQ if a foreign (US) VC invests in the first VC round. This coefficient implies that about one in ten additional US VC deals results in a startup relocating its HQ to the US. However, this number ignores that the estimate is likely to be

positively biased due to at least two major endogeneity concerns: First, startups may relocate first and then attract US VC (i.e., reverse causality). Second, both may be driven by other factors (i.e., omitted variables). For example, it may be that startups that are more US-focused, e.g. because this is the main product market, are both more likely to attract US VC and to move their headquarters to the US.

To understand the extent to which the simple regressions are positively biased, we use three empirical strategies to separate selection from treatment: matching, panel data, and instrumental variable analysis. First, we collect a rich set of variables and apply coarsened exact matching (CEM). This creates a control group of startups with similar business traction, intellectual property, US focus, and fundraising success as the foreign-backed startups, with the sole exception of having *no* foreign VC. The resulting control sample is indistinguishable from the treated sample on observable variables, including those not used in the matching procedure. The resulting CEM-based regressions suggest that a European startup is again 5 percentage points (11 percentage points) more likely to relocate its headquarters if a foreign (US) VC invests in the first round of financing. We obtain similar results using an instrumental variable (IV) previously used by Humphery-Jenner and Suchard (2013a,b) in the same context, where the likelihood of receiving foreign VC is instrumented by the presence of foreign VC in a startup's local market. Finally, we use panel data, which allows us to understand the dynamic relationship between relocation and foreign VC. The dynamic pattern is such that we see no relocation trend in the years before foreign VC investment, a robust relocation peak in the year of foreign investment, and gradually diminishing effects in the years after investment. This pattern is inconsistent with a reverse causality story, where we would expect the opposite. Overall, while these analyses are not sufficient to establish causality with certainty, they at least provide no evidence that simple regression estimates are seriously biased by omitted variables or reverse causality.

Fourth, we provide additional empirical patterns on the geographical destina-

tion of European companies that relocate to the US, which indicate that relocation is a value-adding rather than a tax-saving exercise. To this end, we manually collect data on the location of the headquarters of the relocated firms within the US and compare this with the location of the US VC firms that invested in them prior to relocation. We find that startups tend to move closer to their investors rather than to a tax haven, such as the US state of Delaware. For example, a Californian VC-backed startup is more likely to move to California, but not more likely to move to other US states. Similarly, non-US foreign investment predicts relocation to non-US foreign countries, but is not associated with relocation to the US. Thus, our data do not suggest that legal and tax reasons are the drivers of relocation; otherwise, VC firms would relocate startups mainly to the same tax havens and business-friendly states. Instead, the "get closer" pattern suggests that relocating may be an activist strategy used by VCs to create value.[6] If so, the immediate question is: how do VC firms hope to help the (now local) relocated startups succeed?

Therefore, and *fifth*, we explore the heterogeneity of the startups and find that fundraising is the most important factor out of three possible explanations for moving closer to venture capitalists: reduction of information asymmetries, access to a larger product market, and help with additional fundraising. We exploit the fact that the firms in our sample have different levels of financing constraints, home market size, and information asymmetry at the time of initial financing. We find that fundraising conditions significantly affect the foreign VC effect, suggesting that relocation is a VC strategy to support subsequent fundraising. For example, for startups without revenues (an additional source of funding), US VC increases the probability of relocation by 17 percentage points. However, for startups with revenues, the effect is only 7 percentage points. Similarly, foreign/US VC firms are significantly more likely to relocate portfolio companies from countries with

[6]See Da Rin et al. (2013) and Lerner and Nanda (2020) for excellent overwiews of the activist roles VCs play, above and beyond providing financial capital.

less developed VC markets. However, the size of a startup's home market or information asymmetries do not seem to play a role. Overall, the results suggest that VCs use the relocation of their portfolio companies as an active strategy to improve the fundraising conditions of their startups.

In summary, this paper provides a systematic analysis of the international migration of European startups, the role of foreign VC, and the motivations for VCs to relocate startups. Our results confirm that HQ relocation is a good proxy for exodus/drain/migration and that it is strongly associated with foreign VC investment, particularly from the US. Moreover, we find that relocation is a value-adding rather than a tax-saving exercise, and that VCs use the relocation of their portfolio companies as an active strategy to improve the fundraising conditions of their startups.

3.2 Relation to Existing Literature

This paper builds on the literature in both entrepreneurship and venture capital.

First, it provides new empirical evidence on the migration of startups in an international and representative sample. Although there is a large literature on the clustering of entrepreneurship and innovation (Florida and Kenney, 1988; Feldman and Florida, 1994; Saxenian, 1994; Audretsch and Feldman, 1996; Feldman et al., 2005; Glaeser et al., 2010; Chatterji et al., 2014; Kerr and Kominers, 2015; Kerr and Robert-Nicoud, 2020; Chattergoon and Kerr, 2022), there has not been much research on the migration of startups. Only recently have a small number of papers begun to consider startup migration (Cumming et al., 2009; Dahl and Sorenson, 2012; Guzman, 2019; Conti and Guzman, 2021), but this work has remained focused on within-country migration, or has had only small samples from single countries or single VC portfolios. Relative to this prior work, we present the first systematic measurement of startup migration rates in Europe, finding that cross-border relocation of headquarters is common, is directed to the US, and

leads to migration of most of the company to the US.

Second, this paper relates to the literature on cross-border VC. While most studies of cross-border VC have focused on investment performance (Dai et al., 2012; Humphery-Jenner and Suchard, 2013a; Nahata et al., 2014; Chemmanur et al., 2016; Cumming et al., 2016; Devigne et al., 2016; Buchner et al., 2018), our findings contribute to more recent work on the broader effects of foreign VC on local economies (e.g., Bradley et al. (2019); Braun et al. (2019); Hellmann et al. (2019); Hellmann and Thiele (2019); Khurshed et al. (2020); Hellmann and Thiele (2022); Akcigit et al. (2020)). Given the overarching question of whether foreign VC benefits or harms local economies, our study focuses on only one key relationship and should not be misinterpreted as a conclusive assessment against foreign VC. We do find a positive correlation between early foreign VC investment and later headquarters relocation. However, the size of the "effect" implies that only one out of ten US VC investments in early rounds of European startups leads to relocation. Due to endogeneity concerns, this "effect" is most likely an upper bound on the true causal effect of foreign VC. Thus, in at least nine out of ten cases, US VC contributes to the financing of a European startup without the main parts of the startup being relocated abroad. Overall, we believe that our results point to a potentially effective policy alternative that could reduce startup outflows without driving away otherwise valuable foreign capital: improving local financing conditions.

Finally, this study contributes to the literature on the active role venture capital firms play in portfolio companies, above and beyond providing financial capital. Previous studies have shown that VCs help to professionalize startups (Hellmann and Puri, 2002; Chemmanur et al., 2011), recruit key personnel (Bottazzi et al., 2008; Ewens and Marx, 2018; Amornsiripanitch et al., 2019; Conti and Graham, 2020), raise subsequent funding (Gorman and Sahlman, 1989), and acquire innovation resources (González-Uribe, 2020). Our study suggests that VCs can help startups transition to other ecosystems, particularly that of the VC, which represents an

additional activist role not often seen in traditional financial intermediaries.

3.3 Data

The objective of the data collection discussed here, and in more detail in the Appendix B, is to obtain a representative sample of European VC-backed startups, their investors, and a chronological history of their headquarters locations.

Representative samples of VC-backed startups are readily available in commercial datasets. We use startups, their rounds and their investors from DowJones VentureSource (VS). VentureSource (formerly VentureOne) is one of two databases primarily used in venture capital research and is recognised for providing a comprehensive picture of the venture capital market (e.g. Da Rin et al. (2013); Ewens and Rhodes-Kropf (2015)). Although VS was launched in 1987, it was not until 2000 that it began to systematically collect data on European startups. Since 2000, a variety of methods have been used to validate the comprehensiveness of VS for the European market. For example, Axelson and Martinovic (2013) compares VS with investment data from the European Venture Capital Association (EVCA) and concludes that VS has good coverage since 2000. Retterath and Braun (2020) reach the same conclusion when comparing VS with a complete list of all investments made by a major European VC between 1999 and 2019.[7] Therefore, we consider all startups listed in VentureSource that received their first round of funding between 2000 and 2014. Stopping after 2014 gives us at least six years to observe headquarters relocations and startup performance, which is the range used in previous venture capital exit analyses.[8] We apply additional filters to restrict our analysis to young, high-growth, and VC-backed companies. Our sample only

[7] Retterath and Braun (2020) compare the most commonly used commercial VC databases with a complete set of original financing documents from a major European VC, based on 339 rounds of financing provided to 108 predominantly European companies between 1999 and 2019. Among the databases considered, VentureSource was the only one with full company coverage.

[8] E.g., Hochberg et al. (2007); Nahata (2008); Nanda et al. (2020) leave 4.5, 4, and 8 years between investment and observed exit, respectively.

includes financing rounds labeled 'VC' and excludes buyout, angel, debt, and grants. Furthermore, we omit companies older than ten years at the time of their first VC round. Finally, we exclude all financing rounds for which the invested amount is not available.

3.3.1 Identifying Headquarter Relocations

Data on HQ movements, however, is not readily available. The problem is that data providers commonly treat HQ location as static, even though it is not. Static means that the attribute is fixed and does not change once recorded. As a result, databases like VentureSource cannot create an HQ location history that we could use to identify changes. Specifically, VentureSource officials informed us that they treat HQ locations as static and overwrite them when they learn of changes, but do not actively seek updates to the attribute. We believe that other providers follow the same or similar procedures. As a result, researchers are unable to use commercial data providers to identify HQ relocations.

To overcome this problem, we manually collected data on HQ relocations as described below. First, we look only for startups that received funding from at least one European investor according to VentureSource, irrespective of the listed HQ location. Specifically, we included all startups that received at least one financing from an investor headquartered in one of the 51 countries of geographical Europe.[9] Then, we searched commercial databases and the internet to hand-collect chronological data on the HQ locations of these startups. The upside of this strategy is that we narrowed the sample down to a more manageable size. The downside is that we miss all European startups that migrated pre-funding and never received any European funding.

After applying the above filters, we are left with 14,588 startups, of which 10,917 are headquartered in Europe and 3,671 outside Europe, according to Ven-

[9] The United Nations Statistics Division's M49 standard reports 51 countries belonging to the region of Europe as of 2020, see https://unstats.un.org/unsd/methodology/m49/ (accessed on July 22, 2020).

tureSource. In order to manually investigate the location of headquarters over time, we used the headquarters location reported in VentureSource. We split the sample into startups headquartered in Europe and those headquartered outside Europe according to VentureSource. For the 'In-Europe' sample, the HQ locations may not be up to date, so we focused on the location of the company's HQ at the time of exit, cessation of operations or 2021, whichever came first. For the 'Outside Europe' sample, we wanted to know if these companies had ever been headquartered in Europe, so we focused on identifying the location of the company's headquarters at the time of first funding. To identify each company's HQ location, we searched publicly available data sources such as the company's website, LinkedIn, Crunchbase profiles and news articles from web searches. If a website was no longer available, or if we were interested in headquarters locations at specific dates, we used the Internet Archive's Wayback Machine,[10], which regularly stores versions of public websites. As this data is self-reported, we cross-checked relocations with official national business registers. For example, if a company publicly announced a new headquarters in the US, we verified this by checking publicly available US business registration records. US business registration rules require companies to list at least two offices in a state: the in-state office and the principal executive office. Therefore, we only accepted a relocation if the web sources and business registration records indicated a change of headquarters. Similarly, we only consider relocations across national borders. When we identified a headquarters relocation, we searched further to determine the year in which it took place. Specifically, we searched Lexis/Nexis and the Internet for news articles about the headquarters relocation. If none were found, we determined the year of the move by checking the Internet Archive to see when the HQ location was changed on the website.

Finally, we restricted the sample to all startups headquartered in one of these 17 European countries when they started: Austria, Belgium, Denmark, Finland,

[10]Website: https://archive.org, (last accessed 22 July 2021).

France, Germany, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Russia, Spain, Sweden, Switzerland, and the United Kingdom. These countries account for more than 98% of all VC financing rounds on the European continent in the database.

The data collection process above resulted in a final sample of 11,074 startups initially headquartered in Europe. Note that our sample likely omits some relocated startups (i.e., false negatives) due to missing or non-updated public information. However, the approach yields a clean sample of HQ relocations (i.e., false positives are unlikely).[11]

3.3.2 Identifying Foreign VC and US VC

To examine whether foreign VC facilitates the relocation of startups, we need to identify foreign investments in local startups. We use VCs' HQ data in VentureSource to determine whether a foreign or US VC invested in a startup. We define an investment as *foreign* if at least one investor is headquartered in a different country than the startup at the time of funding. Similarly, we categorise a startup as *US* VC if at least one US investor participated in the first round of funding.

While using the VC HQ location provided by a data provider to determine the VC's home is commonly used in the cross-border VC literature, this approach ignores possible issues (Devigne et al., 2018). For example, a local subsidiary of a foreign VC firm would be considered local. However, there are empirical and conceptual reasons why the simple approach is valid in our setting. Empirically, VC firms are typically small organizations with a handful of employees that rarely open branches.[12] For example, even the most prominent US VCs, such as

[11] One might worry about false negatives. However, false negatives are only an issue if our objective was to demonstrate the absence of an effect because false negatives diminish statistical power. Therefore, to the extent that false negatives reduce statistical power, our test should be biased against finding significant results.

[12] Using a broad VentureXpert sample, Chen et al. (2010) report the average VC firm to have 5.4 employees while Gompers et al. (2020) report 11 employees based on a survey of VCs. Chen et al. (2010) also document that branch office expansions are rare and, somewhat surprisingly, negatively correlated with investment experience.

Sequoia Capital and Bessemer Venture Partners, have been investing in Europe for decades but only announced plans to open dedicated European offices in 2020.[13] Conceptually, if foreign-owned subsidiaries behaved like local funds, we would not find any differences in our empirical analyses. In other words, our design explicitly tests whether it makes a difference if the ultimate owner of a VC fund is located outside the country of origin of the firm.

3.3.3 Other Data

We further enrich the VentureSource and HQ data with patent data from the European Patent Office (EPO) PATSTAT, patent and trademark applications from the US Patent and Trademark Office (USPTO) and IPO information from Refinitiv's SDC New Issues database. To merge these databases, we follow the procedure outlined in Bernstein et al. (2016), as explained in more detail in the Appendix B.

3.4 Stylized Facts on HQ Relocation in Startups

We have gathered a hand-collected data set on relocation among VC-backed startups all over Europe. As this data is new and there is little information in the literature on startup relocation in Europe, we will present some basic facts in this section.

Stylized Fact 1: Startup relocation is common across Europe and has become more, not less, prevalent over the years.

As Table 3.1 shows, our data cover 11,074 European startups first funded between 2000 and 2014 and 647 of them, or 6% of the sample, moved their headquarters across borders. This rate is very similar to the emigration rate of highly skilled individuals in Europe: Arslan et al. (2014) report an emigration rate of

[13] See https://sifted.eu/articles/us-vcs-europe/ and https://www.businessinsider.com/venture-capital-bessemer-venture-partners-boost-europe-presence-2020-8?r=DE&IR=T (accessed on June 12, 2021).

5.8% among European high-skilled individuals, which is virtually identical to the startup emigration rate in our sample.

Figure 3.1 shows that HQ relocations have become more prevalent over the years: from around 4% of all startups relocating in 2000, to more than 8% in 2013. Note that due to our sampling strategy, we miss all startups that only received US funding (remember, we only include startups that received at least one funding by a European VC). Therefore, the overall migration statistics reported here can only be seen as a lower bound of the larger phenomenon of HQ relocation among European startups. Panel A of Table 3.1 also shows that European countries differ in their startup migration rates. The highest migration rates occur in countries with the fewest startups in the sample and therefore the smallest ecosystems: for instance, in Russia (14.0%), Portugal (10.7%), and Poland (9.0%). In contrast, the three largest ecosystems in our sample, the UK, France, and Germany, have below-average migration with 5.8%, 4.8%, and 4.3%, respectively. Aside from these differences, there is one thing that all ecosystems have in common: while some countries experience inflows and outflows (e.g., the UK gains 18 new HQs), all countries experience a net outflow of startups.

Since the few outlier successes that reach an IPO account for a large part of the value created in VC (Cumming and MacIntosh, 2003; Phalippou and Gottschalg, 2009), we can estimate how much company value moves across borders. The 28 relocating startups that reach an IPO have an average IPO valuation of USD 978 million (in 2012 US dollars, see Table 3.2, Panel B) and thus a total company value of USD 27 billion. The 485 staying startups that reach an IPO have an average IPO valuation of USD 361 million, for a total company value of USD 202 billion. In other words, although only 6% in number, relocating startups account for about 14% of the firm value created in the sample.

Stylized Fact 2: The vast majority of all relocating startups move to the US

The relocation of European startups has a clear direction: 558 startups, representing 5% of the sample and 86% of all migrants, move their headquarters to the

Table 3.1: Startup Headquarter Relocation Patterns

This table presents country and timing patterns of headquarter (HQ) relocations among European startups. The sample consists of 11,074 startups from 17 European countries that received venture capital financing from a European VC between 2000 and 2014 according to VentureSource. Startups' HQ relocations were hand-collected from several sources as described in the text. Startups were categorized as 'Relocating' if they moved their HQ location to another country during the VC funding period, and 'Staying' if otherwise. In Panel A, each column represents the HQ location at the time of first VC investment, while each row represents the HQ location at exit, cease of operations, or 2021, whichever is earlier. Panel B splits the 647 relocating startups according to the timing of their HQ move compared to their first VC year.

Panel A: Distribution of startups by country

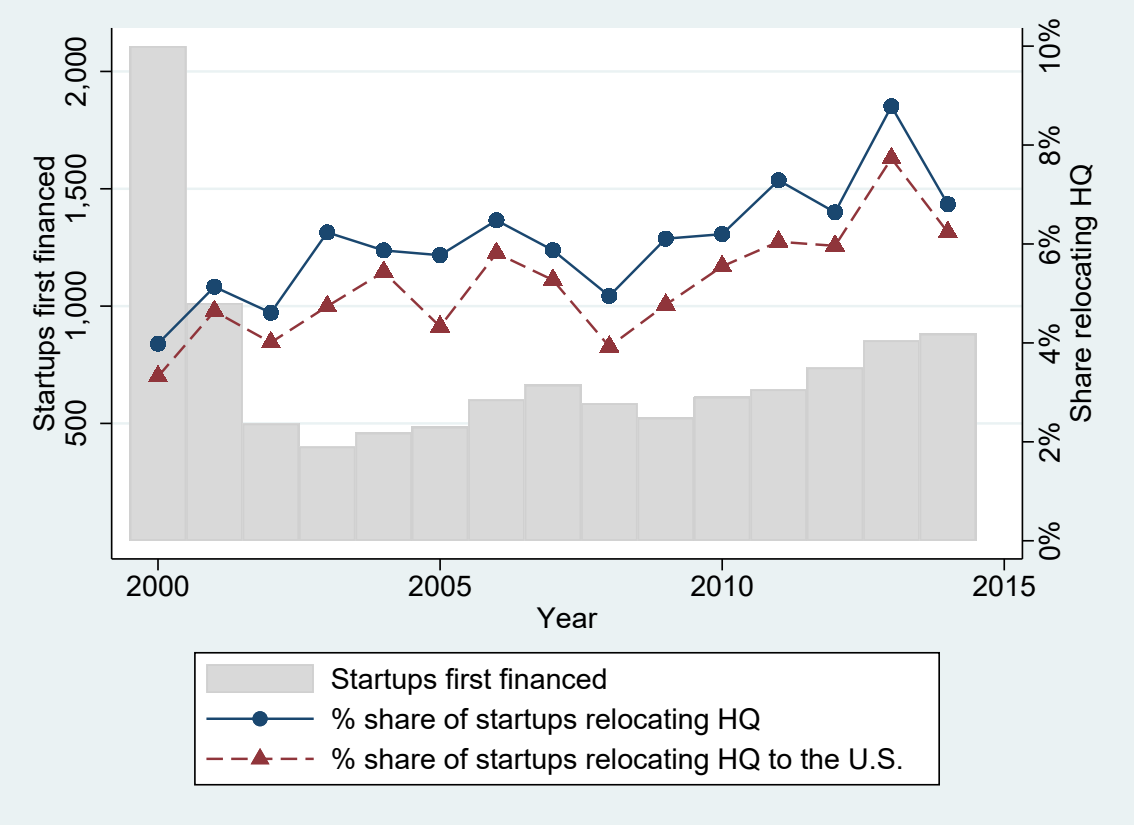
	Startup HQ location at start																	
	AT	BE	CH	DE	DK	ES	FI	FR	GB	IE	IT	NL	NO	PL	PT	RU	SE	Total
Final startup HQ location																		
AT	117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	121
BE	0	218	0	2	0	0	0	0	1	0	0	1	0	0	0	0	0	222
CH	0	0	282	1	0	0	1	1	2	0	1	0	0	0	0	0	1	289
DE	1	0	1	1,313	0	1	1	2	0	0	0	0	1	0	0	0	0	1,320
DK	0	0	1	0	333	0	0	0	0	0	0	0	0	0	0	0	0	334
ES	0	0	0	0	0	579	0	1	2	0	0	0	0	0	0	0	0	582
FI	0	0	0	0	0	0	366	0	0	0	0	0	1	0	0	0	1	368
FR	0	0	0	0	0	0	0	2,072	0	0	0	0	0	0	0	0	0	2,072
GB	1	1	2	0	2	1	3	2	3,037	2	0	0	0	0	0	1	3	3,055
IE	0	0	0	1	0	0	0	1	0	299	0	0	0	0	0	0	0	301
IT	0	0	0	0	0	0	0	0	0	0	277	0	0	0	0	0	0	277
NL	0	1	0	0	0	1	0	0	1	0	0	332	1	0	0	1	0	337
NO	0	0	0	0	0	0	0	0	1	0	0	0	205	0	0	0	2	208
Other	1	2	2	4	2	0	4	3	8	0	3	2	0	0	0	1	1	33
PL	0	0	0	0	0	0	0	0	0	0	0	0	0	61	0	0	0	61
PT	0	0	0	0	0	0	0	0	1	0	0	0	0	0	67	0	0	68
RU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	184	0	184
SE	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	685	688
US	7	13	11	50	24	24	23	95	170	31	10	20	11	6	8	27	28	558
Total	127	235	299	1,372	361	606	399	2,177	3,223	332	291	355	220	67	75	214	721	11,074
Relocating (%)	7.9	7.2	5.7	4.3	7.8	4.5	8.3	4.8	5.8	9.9	4.8	6.5	6.8	9.0	10.7	14.0	5.0	5.8
Relocating to US (%)	5.5	5.5	3.7	3.6	6.6	4.0	5.8	4.4	5.3	9.3	3.4	5.6	5.0	9.0	10.7	12.6	3.9	5.0

Panel B: Distribution of HQ relocations relative to first VC year

HQ relocation t years after first VC year	t=								
	<3	-3	-2	-1	0	1	2	3	>3
Relocating startup	8	10	20	72	142	93	65	64	173
%	1.2%	1.5%	3.1%	11.1%	21.9%	14.4%	10.0%	9.9%	26.7%
Cum.	8	18	38	110	252	345	410	474	647
Cum. %	1.2%	2.8%	5.9%	17.0%	38.9%	53.3%	63.4%	73.3%	100.0%

Figure 3.1: Headquarter Relocations over Time

This figure shows headquarter (HQ) relocations among European startups over time. The sample consists of 11,074 startups from 17 European countries that received venture capital financing from a European VC between 2000 and 2014 according to VentureSource. Startups' HQ relocations were hand-collected from several sources as described in the text. Startups were categorized as 'relocating' ('relocating to US') if they moved their HQ location to another country (the US) during the VC fundraising period and 'staying' if otherwise.



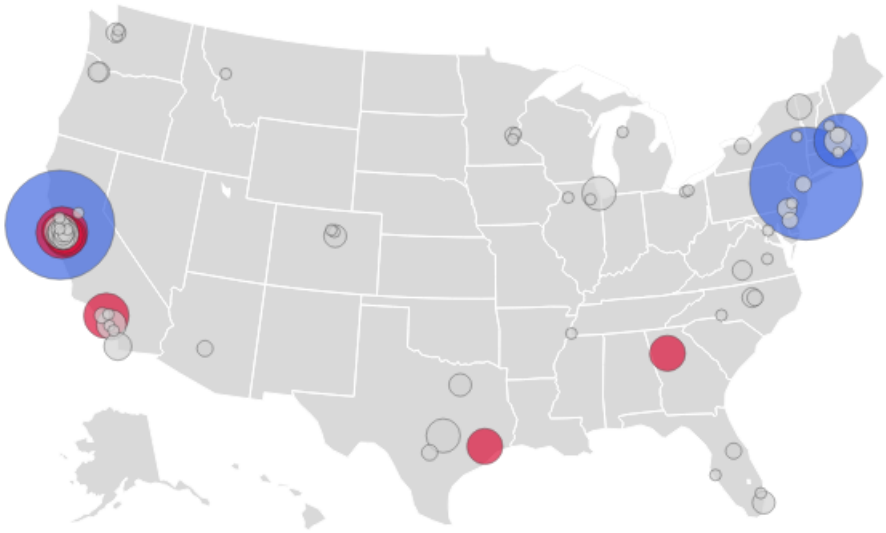
US. Of these, 47% move to California, 19% to New York, 9% to Massachusetts, and 25% to other US states. Figure 3.2 shows the geographic distribution of European US migrants (Panel A) compared to the general population of native US startups (Panel B). It can be seen that the geographic distribution of European startups is very similar to that of native-born US startups, albeit with a slightly stronger focus on the East Coast (e.g. Boston and Atlanta are relatively more popular for European migrants than for native-born US startups).

Stylized Fact 3: Startup relocation happens at a young age.

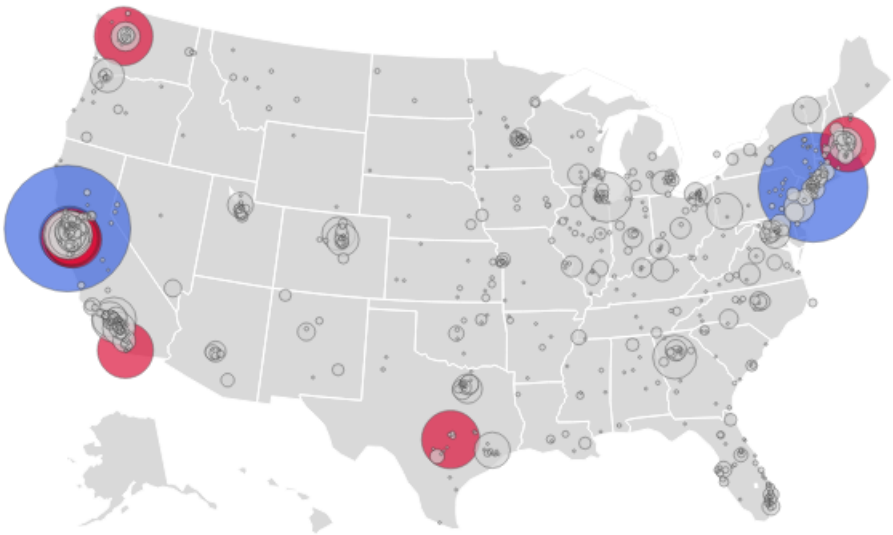
Figure 3.2: Headquarters of European Startups Relocating to the US

This figure shows the US locations of European startups moving their headquarters (HQ) to the US. Blue points indicate top 3 cities; red points indicate top 4-10 cities. Panel A represents the HQ locations of 558 startups from 17 European countries that moved their HQ to the US during the sample period. Panel B represents the HQ locations of all native US startups first funded between 2000 and 2014 in the VentureSource database ($N = 18,821$).

Panel A: European Startups Relocating to the US



Panel B: Native US Startups



Panel B of Table 3.1 shows the average timing of HQ moves relative to the time of the first VC round. Overall, 73% of all HQ moves (474 of 555) occurred within three years of the first VC round. The median age at which a relocating company moves is 3 years, while the median age at first funding and IPO is 2 and 11 years respectively. This suggests that HQ relocation tends to be a strategic move in the early stages of a company's life, rather than shortly before an imminent exit. Moreover, most HQ moves (47%) take place in the three-year window between one year before and after the first VC round, suggesting that VC funding plays a significant role in the decision to move.

Stylized Fact 4: Relocating startups end up with the majority of the company in the target country.

Is the relocation of a startup's headquarters a legal formality or does it lead to the migration of most of the company? To answer this question, we take an ex-post look at the geographic footprint of the companies in the sample that went public through an IPO (513 companies, or 5% of the sample achieve an IPO). We focus on startups that achieve an IPO for two reasons: First, companies typically disclose their geographic footprint in the public IPO filing called the IPO prospectus. Second, the most successful companies in VC portfolios go public, reflecting much of the value created by venture capital (Cumming and MacIntosh, 2003; Phalippou and Gottschalg, 2009). In total, 28 relocating startups and 485 remaining startups in the sample achieve an IPO. We search the IPO prospectuses of these companies for the geographic distribution of their employees.[14] Table 3.2, Panel B, shows that on average 65% of the employees of relocating startups are located outside their founding country at the time of the IPO. Specifically, 56% of employees are located in the US, 35% in the founding country and 9% in other countries. By comparison, for companies that have not relocated their headquarters, 92% of employees are

[14]When going public, most firms report the geographic distribution of their employees and primary locations in a public filing called an IPO prospectus, which we collected manually. We obtained the IPO prospectuses from the Internet, mainly from national stock exchanges and regulators, e.g. SEC, Euronext, London Stock Exchange. The Appendix B.2 describes each step in detail.

in the country of founding, 4% in the US and 4% in other countries. These results suggest that the relocation of the headquarters of startups generally involves the relocation of the majority of the enterprise, and not just the legal seat.

Table 3.2: Summary Statistics: Relocating vs. Staying Startups

This table reports the means of each variable, distinguishing between startups relocating their HQ during the sample period and staying startups. Startups are categorized "Relocating HQ" if they moved their HQ across borders during the VC funding period and "Staying" otherwise. Panel A reports means of startup characteristics measured at first funding for the full sample of 11,074 startups. Panel B reports startup outcomes as of 06/2021. All variables are defined in Appendix B. 1. The last column reports t-statistics of two-sample t-tests for equality of means. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Relocating startups		Staying startups		Test for diff.
	Obs.	Mean	Obs.	Mean	(t-stat)
Panel A: Startup characteristics at first funding					
Financing					
First round: Amount raised ($ m)	647	5.94	10427	5.74	0.18
First round: Pre-money valuation ($ m)	153	12.23	3206	15.62	–0.45
First round: Foreign VC involved	647	0.47	10427	0.24	13.00***
First round: US VC involved	647	0.27	10427	0.08	15.92***
First round: Number of VCs investing	644	2.34	10364	1.96	7.30***
Business traction					
Generating revenue	647	0.62	10427	0.61	0.30
Revenue ($ m)	76	7.73	1434	14.08	–0.55
Employees	208	30.41	3458	50.25	–1.13
Startup age	647	2.52	10427	2.59	–0.67
Intellectual capital & US orientation					
Serial entrepreneur	647	0.10	10427	0.05	6.29***
Has Patent	647	0.29	10427	0.25	2.34**
Has US Patent	647	0.16	10427	0.11	3.80***
Has US Trademark	647	0.22	10427	0.10	9.77***
Panel B: Startup outcomes					
IPO	647	0.04	10427	0.05	–0.38
# Startups with IPO	28		485		
Valuation at IPO ($ m)	28	977.70	468	360.90	1.93*
Total employees at IPO	28	366.75	407	217.38	1.13
Share employees abroad at IPO	26	0.65	384	0.09	13.94***
Share employees in US at IPO	26	0.56	384	0.04	15.79***

Stylized Fact 5: US VCs are disproportionately involved in relocating startups.

Table 3.2 compares companies that relocate with those that stay. Panel A reveals no significant differences between relocators and stayers in the average amount raised and company valuation at first funding. To the extent that amount and

valuation at first funding are indicative of future performance, this result suggests that relocating firms are not a strict positive selection of firms at first funding. However, relocating startups are significantly different from stayers in at least three other dimensions: relocating startups are more likely to be backed by foreign and US VCs, more likely to be founded by serial entrepreneurs, and more likely to hold patents and trademarks, especially in the US.

Our data also allows us to see which individual VCs are most often involved in relocating startups. Table 3.3 lists all VCs who invested in at least eight relocating startups in our sample. The importance of well-known US VC firms in relocating startups is evident. For example, 11 of the 38 VCs most actively involved in relocating startups are from the US. While 5.8% of all startups relocate, in most US VC portfolios more than 20% of the companies move across borders. For some US VC firms on the list, the relocation rate even exceeds 70%.

3.5 Foreign VC and the Relocation of Startups

We now examine whether and to what extent foreign VC is associated with the relocation of startups. To do so, this chapter first assesses the relationship between foreign capital and relocation, whether the relationship is likely to be driven by selection or treatment, and which conditions affect the relationship. Since the vast majority of startups relocate to the US and the vast majority of non-European capital comes from the US (Braun et al., 2019), we analyze US VC separately as part of foreign VC.[15]

3.5.1 Univariate Relationship

Table 3.4 shows the time pattern of HQ relocations relative to US VC investments. HQ moves are broken down by their timing relative to the first round of financing

[15] After the IT boom in 2000, the US became as the world's largest exporter of VC by a wide margin (Aizenman and Kendall, 2012).

Table 3.3: Venture Capitalists Involved in Relocating Startups

This table reports the venture capitalists (VCs) which are most frequently involved in startups relocating across borders. The sample consists of 11,074 startups from 17 European countries that received venture capital financing from a European fund between 2000 and 2014 according to VentureSource. The table lists all VCs that invested in at least eight startups relocating HQ across borders in the sample as well as the total startups they backed.

VC investor	Country	Relocating startups backed	Total startups backed	Relocating startups as share of Total [in %]
Index Ventures	United Kingdom	36	142	25.4
Intel Capital	United States	25	84	29.8
3i Group PLC	United Kingdom	19	321	5.9
Accel Partners	United States	19	79	24.1
Enterprise Ireland	Ireland	19	202	9.4
Wellington Partners	Germany	17	88	19.3
Balderton Capital Management LLP	United Kingdom	16	73	21.9
Amadeus Capital Partners Ltd.	United Kingdom	14	58	24.1
Draper Esprit LLP	United Kingdom	14	58	24.1
Bpifrance Investissement SAS	France	13	201	6.5
Atlas Venture	United States	12	72	16.7
Octopus Ventures	United Kingdom	12	76	15.8
Scottish Enterprise	United Kingdom	12	177	6.8
Sunstone Capital A/S	Denmark	12	73	16.4
Benchmark Capital	United States	11	41	26.8
Dawn Capital LLP	United Kingdom	11	24	45.8
Earlybird Venture Capital GmbH & Co. KG	Germany	11	49	22.4
Idinvest Partners	France	11	119	9.2
Kima Ventures	France	11	58	19.0
Y Combinator	United States	11	14	78.6
Business Finland	Finland	10	64	15.6
Draper Fisher Jurvetson	United States	10	23	43.5
Kreos Capital	United Kingdom	10	60	16.7
Oseo	France	10	129	7.8
Finnish Industry Investment Ltd.	Finland	9	74	12.2
High-Tech Gruenderfonds Management GmbH	Germany	9	218	4.1
Northzone Ventures AS	Norway	9	78	11.5
Venture Capital Investment Management Ltd.	United Kingdom	9	33	27.3
XAnge	France	9	81	11.1
AIB Seed Capital Fund	Ireland	8	48	16.7
Bessemer Venture Partners	United States	8	22	36.4
Cisco Systems	United States	8	21	38.1
Deutsche Telekom Strategic Investments	Germany	8	51	15.7
Greylock Management Corporation	United States	8	19	42.1
Omnes Capital	France	8	134	6.0
Runa Capital	United States	8	30	26.7
Silicon Valley Bank	United States	8	39	20.5
Target Partners GmbH	Germany	8	35	22.9

in which at least one US VC participated. The sample is reduced to 340 startups because only 340 of the 647 relocating startups were funded at least once by a US VC.

Table 3.4: The Timing of HQ Relocations Relative to US VC Investment

The sample consists of 340 European startups that relocated their headquarters (HQ) during the sample period and received at least one VC round from a US VC. If a startup received multiple rounds involving US VC, only the first round with at least one US VC is considered.

Timing of HQ relocation relative to first US VC investment	No.	%
12 years prior	1	0.3%
11 years prior	2	0.6%
10 years prior	2	0.6%
9 years prior	1	0.3%
8 years prior	3	0.9%
7 years prior	4	1.2%
6 years prior	9	2.6%
5 years prior	10	2.9%
4 years prior	10	2.9%
3 years prior	25	7.4%
2 years prior	29	8.5%
1 years prior	49	14.4 %
Both occur in same year	98	28.8 %
1 year after	35	10.3 %
2 years after	19	5.6%
3 years after	12	3.5%
4 years after	10	2.9%
5 years after	9	2.6%
6 years after	8	2.4%
7 years after	3	0.9%
11 years after	1	0.3%
Total	340	100.0 %

The second Column of Table 3.4 documents the relationship between US VC investment and headquarters relocations in European startups. This column shows that there is a large peak in relocation activity in the year in which the first US VC joins the cap table of a European startup. There are 98 relocations in the year of the US investment and a further 49 and 35 in the year before and after a

US VC investment, respectively. Overall, 53% of all HQ moves by US VC-backed startups take place in the 3 years around the arrival of the US VC. The remaining moves are spread over many years during the life of the venture. These results suggest that there is a high level of relocation activity around the time of US investment.

Cross-sectional comparisons of startups with and without foreign VC show a similar picture of the univarariate relationship between foreign VC and HQ relocation. Since most HQ moves occur around the first VC financing, we focus only on the first VC financing and divide startups into two groups according to whether the first financing involves a foreign (or US) VC or not. In our dataset, 26% of startups have at least one foreign VC involved in their first financing and 9% have a US VC involved. In the foreign VC group, 11% of startups move their headquarters, while only 4% of startups without foreign VC do so (Panel A of Table B. 3). For startups with US VC involvement in the first round, the relocation rate is 17%, while only 5% without US VC relocate their headquarters. Chi-squared tests indicate that the association between foreign VC and HQ relocation is statistically significant at the 1% level.

3.5.2 Baseline Results

To examine the relationship between foreign VC and HQ relocation in the cross-section of startups, we focus on the first VC financing round and use the following Equation (3.1):

$$Pr(HQRelocation_i) = f(ForeignVC_i, \Gamma_i, \varepsilon_1 i) \tag{3.1}$$

Where $HQRelocation_i$ is an indicator variable equal to 1 if startup i relocated its HQ during or after its first funding, and zero otherwise. $ForeignVC_i$ is the main variable of interest, indicating whether startup i received funding from at least one foreign/US VC in its first VC funding round or not. Γ_i is a vector of startup

characteristics measured at the first VC round, such as measures of fundraising success, business traction, and intellectual capital. In addition, all regressions include fixed effects for time, industry, and country. All variables are defined in Appendix B. 1.[16] Standard errors are clustered at the country level.[17]

Table 3.5 shows the results of the baseline regression. The baseline specification is a linear probability model that relates the incidence of foreign VCs in the first round of funding to the probability of HQ relocation during or after the round. In Columns (1) and (2), without controls, we calculate the mean differences in relocation rates between domestic and foreign VC-backed startups within the same industry, country and year. At 6.6 percentage points and 12.1 percentage points for foreign and US VC, respectively, the conditional means are almost identical to the differences in the overall sample means (6.6 and 12.1), indicating that the overall difference is not due to industry, country and year effects.

When we control for the set of startup observables measured at the first VC round reported in Table 3.2, the effects are slightly but not significantly reduced. In particular, in Columns (3) and (4) of Table 3.5 we include the following proxies for startup quality, all of which are expected to be indicative of future performance: the amount of funding raised, whether at least one serial entrepreneur is involved, the number of VCs involved, the startup stage (seed, early, later), the age of the startup, whether the startup has generated revenue, whether the startup holds patents.

In Columns (5) and (6) Table 3.5, we also add proxies for ex-ante US orientation at the time of first funding, namely indicators for whether the startup had already filed patents or trademarks in the US three months before the funding. The proxies for US orientation do little to change the positive and significant relationship between foreign VC funding and headquarters relocation.

The magnitude is economically significant: startups with foreign VC backing

[16] Summary statistics for all variables are provided in Appendix B. 2.
[17] All results being robust to other clustering choices (e.g., year or industry-times-year levels).

Table 3.5: Foreign VC and Headquarter Relocation: Naïve Regression

This table presents unweighted linear regression results. *Headquarter relocation* is an indicator of whether the startup relocated its headquarters (HQ) during or after the first VC funding. *Foreign/US VC in first round* is an indicator variable that takes the value of one if a startup received funding from at least one Foreign/US VC in its first VC funding and zero otherwise. All variables are defined in Appendix B. 1. LN denotes the natural logarithm of a variable incremented by one. Fixed effects for the initial home country, industry, and year of the first investment of the startup are included. Constants are included in all regressions. Robust standard errors clustered at the country level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Headquarter relocation					
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign VC in first round	0.066***		0.053***		0.051***	
	(0.009)		(0.005)		(0.005)	
US VC in first round		0.121***		0.105***		0.101***
		(0.015)		(0.008)		(0.007)
LN Amount raised (USD m) in first round			0.006	0.005	0.004	0.004
			(0.003)	(0.003)	(0.003)	(0.003)
LN Number of VCs investing in first round			0.024	0.021	0.022	0.020
			(0.017)	(0.015)	(0.017)	(0.015)
Generating revenue			-0.002	-0.002	-0.003	-0.003
			(0.009)	(0.009)	(0.008)	(0.008)
LN Startup age in first round			-0.006	-0.005	-0.009	-0.008
			(0.006)	(0.006)	(0.006)	(0.005)
Serial entrepreneur			0.047**	0.044*	0.046**	0.043*
			(0.017)	(0.017)	(0.016)	(0.016)
Has Patent			0.013	0.014	0.002	0.002
			(0.013)	(0.012)	(0.013)	(0.012)
Has US Patent					0.012*	0.012*
					(0.006)	(0.005)
Has US Trademark					0.058***	0.057***
					(0.005)	(0.005)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Funding Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11074	11074	11008	11008	11008	11008
R-squared	0.031	0.038	0.037	0.043	0.042	0.049

in their first funding are 5.1 percentage points more likely to relocate their headquarters. When US VCs are involved, the probability of HQ relocation increases by 10.1 percentage points.

3.5.3 Selection vs. Treatment

The question remains whether the apparent association between foreign VC and startup relocation is due to foreign VCs selecting such startups (selection) or actively inducing a relocation (treatment). To measure the incremental effect of foreign VC on HQ relocation activity, we use three different approaches: Matching, panel data and instrumental variable analysis.

3.5.3.1 Matching Analysis

It is unlikely that a startup receives foreign or US VC at random. One strategy to disentangle the selection and treatment effects of foreign VC funding is to construct a control group that is identical to the foreign VC-funded group, except that it did not receive foreign VC. We collect a rich set of observed characteristics and use a coarsened exact matching (CEM) algorithm to construct such a control group.[18]

To implement CEM, the researcher chooses the variables to be matched on, discretizes all continuous variables in the set ('coarsening'), and creates 'cells' representing all possible combinations of values of the coarsened variables. Then, each cell containing both treatment and control observations is assigned a weight, and other cells are discarded.[19] By choosing more variables and more cut points within each variable, the researcher creates closer matches but also discards more data, implying a trade-off between balance and variance. Finally, a weighted least

[18] Our approach is based on Conti and Graham (2020), who investigate the effect of prominent VCs on CEO replacement.

[19] Assuming that T_c and C_c are the number of treatment and control observations in each cell c, each treatment observation receives a weight of 1, and each control observation has the weight T_c / C_c.

squares estimation estimates the treatment effect for treated startups remaining in the matched sample.

We chose CEM because it has distinct advantages over propensity score matching and other matching methods (Iacus et al., 2012). In our setting, the main advantages are: First, CEM is a non-parametric method, which means that it is impossible for a misspecified matching model to increase imbalance, which can happen with propensity score matching. Second, CEM bounds the model dependence, bias, and estimation error of the causal effect, which is not necessarily the case with other matching methods. Last, CEM balances not only the means but also all the other distribution moments, which is particularly advantageous when dealing with the highly skewed distributions in venture capital.

To implement the CEM algorithm, we match each treated observation with control observations based on data available in the first round of VC funding. We match on country of founding, industry, and year of first funding[20] as well as on discrete buckets of the following variables: We start with the amount of funding received in the startup's first round. We create seven buckets using cutoff values at the 25th, 50th, 75th, 90th, 95th, and 99th percentile of the funding amount distribution within each industry.[21] The many buckets aim to find close matches in terms of funding amounts because, all else equal, higher amounts should reflect better startup quality. However, the tight grid reduces dimensionality when we use a similarly tight grid with other continuous variables. Thus, we match on a coarser grid for the total number of investors participating in the first round ("syndicate size") and for startup age, creating six and three buckets per variable, respectively.[22] Finally, we match on additional binary indicators for

[20] Locations are the 17 countries in our sample. Industries are the five clusters "IT: Software", "IT: Hardware", "Healthcare/Biotech", "Consumer/Retail", and "Others". The three year clusters according to the year in which a startup received its first funding are: 2000-2004, 2005-2009, 2010-2013.

[21] Conti and Graham (2020) use similar buckets.

[22] The cutoff points for syndicate size are at the 25th, 50th, 75th , 90th, and 95th percentiles and for startup age are at the 25th and 75th percentile of their distributions within each industry.

startup quality and US orientation including: development stage[23], the presence of at least one serial entrepreneur (Gompers et al., 2010)[24], revenue generation, patent applications (eventually granted), US patent applications, and US trademark applications. We identify a match for 1,610 (or 57%) of the 2,826 startups treated with foreign VC, and for 568 of the 1,030 startups treated with US VC.

Panel B of Table B. 3 reports the means of matching variables in the treated and control samples, along with a test for differences. After matching, firms treated with foreign/US VC and control firms are indistinguishable based on observable characteristics.

We did not use some observable variables in the matching procedure, which we use as a falsification test: if the treatment remains correlated with observable variables not used in the matching, we should be sceptical about our assumption that the treatment is uncorrelated with unobserved firm characteristics. Reassuringly, this test also shows no statistically significant differences between the treated and control samples for the following observables excluded from the matching procedure: pre-money valuation, revenues and number of employees at first funding (see Panel B of in Table B. 3). Overall, these results show that CEM removes all observable differences, suggesting that we have removed much of the potential bias in the data.

Table 3.6 shows the results when estimating Equation (3.1) using the CEM-matched sample. We find that even when using a closely matched control group, foreign VC increases the likelihood of HQ relocation. In particular, we re-estimate the most comprehensive models of Columns (5) and (6) of Table 3.5, except that we apply the CEM weights from our CEM procedure. We find that foreign VC and US VC increase the probability of HQ relocation after investment by 5.0 percentage points and 11.0 percentage points, respectively. Both coefficients are significant

[23]Development stages are "Seed/Startup", "Product development/clinical trial", and "Later stage".

[24]Following Gompers et al. (2016), we identify serial entrepreneurs by tracking the careers of founders and CEOs in the VentureSource database and identify those who were previously founders in another startup as serial entrepreneurs.

at the 1% level. The finding that the CEM-weighted effects are close to the simple mean differences and OLS estimates suggests that relocation is relatively unaffected by selection problems. This is consistent with the earlier finding that relocators and stayers do not differ in terms of firm value at first funding (see Table 3.2).

Table 3.6: Foreign VC and Headquarter Relocation: CEM-Weighted Regression

This table presents CEM-weighted linear regression results. *Headquarter relocation* is an indicator of whether the startup relocated its headquarters (HQ) during or after the first VC funding. *Foreign/US VC in first round* is an indicator variable that takes the value of one if a startup received funding from at least one Foreign/US VC in its first VC funding and zero otherwise. Controls include the same startup characteristics as those listed in Table 3.5. Fixed effects for the initial home country, industry, and year of the first investment of the startup are included. Constants are included in all regressions. Robust standard errors clustered at the country level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Headquarter relocation	
	(1)	(2)
Foreign VC in first round	0.050***	
	(0.007)	
US VC in first round		0.110***
		(0.005)
Controls	Yes	Yes
Country FE	Yes	Yes
Industry FE	Yes	Yes
Funding Year FE	Yes	Yes
Observations	5776	3100
R-squared	0.042	0.086

3.5.3.2 Panel Data Analysis

Despite the aforementioned advantages, CEM, like any other matching method, assumes selection on observable variables, so omitted variable bias may still affect the CEM estimates. Being aware of this concern, we exploit the panel nature of our VC investment and HQ data to conduct a panel data analysis. The use of panel data allows us to describe the dynamic relationship between foreign

VC investment and HQ relocation. In addition, the use of startup-fixed effects allows us to rule out the possibility that the relationship between foreign VC and relocation is due to unobserved time-stable differences, such as US orientation of the product.

To measure the effect of foreign VC on headquarter relocation, we estimate a model that predicts the probability of HQ relocation in a given year. Each startup enters the sample in its founding year and leaves the sample in the year of relocation, exit (IPO or acquisition), or 2021, whichever comes first. The unit of observation is the startup-times-year.

The dependent variable $HQRelocation_{it}$ is an indicator variable equal to 1 if startup i relocated its HQ in year t, and zero otherwise. $ForeignVC_{i,t-k}$ is a set of indicator variables indicating whether a financing with at least one foreign VC took place in year $k = \{-3, -1, ..., 4\}$ relative to t. The year prior to foreign VC funding (i.e., $k = -1$) is omitted as the reference group. θ_t are startup age fixed effects which control for general relocation patterns over the startup lifecycle. More importantly, δ_i is the startup fixed effect, which controls for time-invariant characteristics of the startup such as overall quality or US orientation. ε_{2i} is random noise. The following specification then captures the dynamic relationship between foreign VC funding and HQ relocation:

$$HQRelocation_{it} = \alpha_2 + \sum_{k=-3}^{4} \beta_k ForeignVC_{i,t-k} + \delta_i + \theta_t + \varepsilon_{2i} \tag{3.2}$$

Here $\{\beta_k\}$ for $k < 0$ corresponds to pre-trends, and for $k >= 0$ to dynamic effects k years relative to the foreign VC treatment. Intuitively, we measure the difference between a startup's probability of relocation in any year k around the foreign VC treatment, relative to the average probability of relocation in the year before foreign VC.

Figure 3.3 and Table 3.7 present the estimated Equation (3.2). The overall dynamic pattern is that there is no pre-trend before the foreign/US VC investment,

a robust relocation peak in the year of foreign/US VC investment, and gradually fading effects in the years after the investment. The coefficient on foreign VC in Column (1) in each year before the foreign VC treatment is small and insignificant, suggesting that there is no pre-existing trend in the data. If reverse causality were driving the relationship, i.e. startups first move abroad and then attract foreign VC, we would expect significant relocation effects prior to the year of foreign VC investment. However, this is not what we find. Instead, there is a large and significant peak in relocation activity in the year of foreign VC investment. Finally, the effect persists in the long run (at least four years after the treatment). We observe the same pattern for the US VC treatment, shown in Column (2).

In Columns (3) and (4), we restrict the analysis to startups that ever received foreign VC. In doing so, we compare the relocation rates of foreign VC-backed startups with those of startups that have not yet received foreign VC. The idea is that we now have a much more homogeneous sample of startups that are all foreign VC-backed, but at different points in time. The results in this sample are qualitatively similar: we find no pre-trends, a highly significant peak in the year of foreign/US VC investment, and diminishing effects after treatment.

Overall, the dynamic pattern suggests that foreign/US VC affects headquarters relocations immediately in the year of investment and continues for an extended period after the investment.

3.5.3.3 Instrumental Variable and Other Robustness Tests

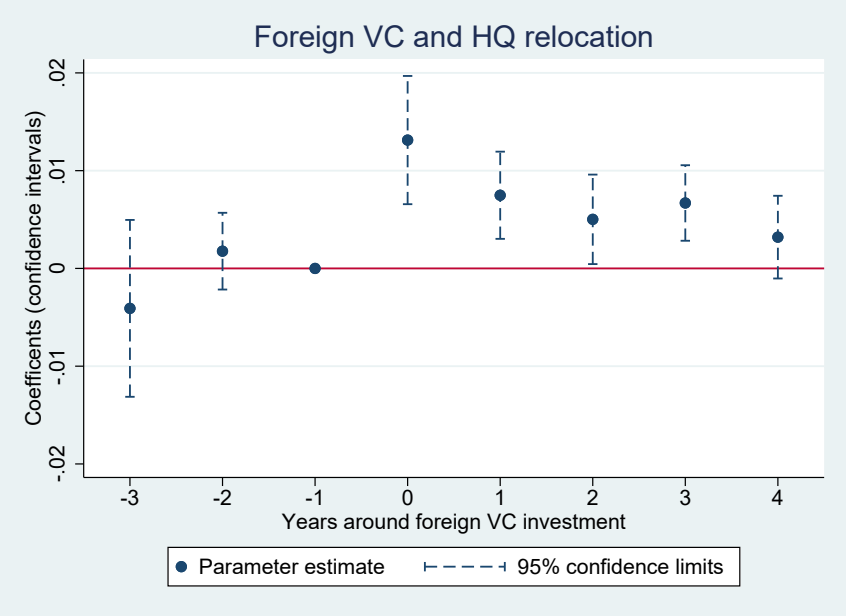
We provide additional robustness tests for our finding that foreign VC increases the likelihood of HQ relocation abroad. In particular, we analyzse the extent to which reverse causality and omitted variables are likely to bias our estimates using an instrumental variable strategy and the Oster (2019) bounding method.

It is possible that the relationship between foreign VC and relocation shown above is simply due to the fact that startups that relocate abroad (for whatever reason) increase the likelihood that they will subsequently receive foreign funding.

Figure 3.3: Time Dynamics of Foreign VC and Headquarter Relocation

The figure shows the dynamic relationship between HQ relocations and and foreign VC investment from a panel data regression. The coefficient estimate represents the relative rate of HQ relocations around a foreign VC (Panel A) and US VC (Panel B) investment event. See Table 3.7 for the full regression results.

Panel A: Foreign VC



Panel B: US VC

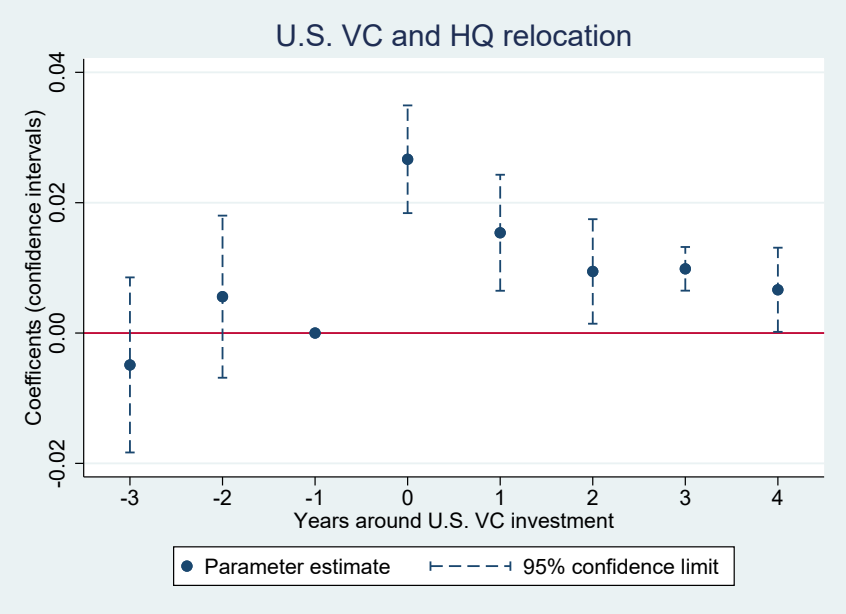


Table 3.7: Foreign VC and Headquarter Relocation: Panel Data Analysis

This table shows the results of panel data regressions with startup fixed effects. The observation level is the startup-year. Each startup enters the sample in its start year and drops from the sample if it relocates, exits (IPO or acq.), or 2021, whichever comes first. The dependent variable is an indicator of whether a startup relocated HQ in that year. The variables of interest are indicator variables that take the value of one if a startup received funding from at least one *Foreign/US VC*, relative to year t and zero otherwise. Fixed effects for the startup and startup age are included. Constants are included in all regressions. Robust standard errors clustered at the startup level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable:	Headquarter relocation this year?			
Sample:	All		Ever treated	
Treatment:	Foreign VC	US VC	Foreign VC	US VC
	(1)	(2)	(3)	(4)
Treatment(-3)	-0.004	-0.005	-0.001	0.000
	(0.003)	(0.005)	(0.003)	(0.005)
Treatment(-2)	0.002	0.006	0.004*	0.009
	(0.001)	(0.004)	(0.002)	(0.005)
Treatment(-1)	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
Treatment(0)	0.013***	0.027***	0.014***	0.027***
	(0.002)	(0.003)	(0.003)	(0.003)
Treatment(1)	0.007***	0.015***	0.006**	0.012**
	(0.002)	(0.003)	(0.002)	(0.003)
Treatment(2)	0.005**	0.009**	0.004*	0.006
	(0.002)	(0.003)	(0.002)	(0.003)
Treatment(3)	0.007***	0.010***	0.005**	0.005**
	(0.001)	(0.001)	(0.001)	(0.001)
Treatment(4)	0.003	0.007**	0.002	0.001
	(0.002)	(0.002)	(0.002)	(0.003)
Observations	145374	145374	45542	18351
R-squared	0.246	0.247	0.268	0.281
Startup FE	Yes	Yes	Yes	Yes
Startup Age FE	Yes	Yes	Yes	Yes

Before moving on to further analysis that formally tests this possibility, we note that if this were the driving force behind the relationship, relocation should occur first, followed by an increase in the likelihood of foreign funding. However, the panel data analyses above show that the temporal relationship is exactly the opposite: foreign investment occurs first, and the probability of relocation increases in the same year and thereafter. Overall, therefore, the results of the panel data analysis are inconsistent with a reverse causality argument, whereby relocation leads to a subsequent increase in the probability of receiving foreign VC.

In the absence of a natural experiment, we use an instrumental variable to capture some exogenous variation in foreign VC investment and thus control for endogenous allocation to foreign VC. Analogous to previous studies on VC characteristics (e.g., Bottazzi et al. (2008); Hellmann et al. (2008); Humphery-Jenner and Suchard (2013a)), we use variation in the local availability of certain VCs - in our case foreign ones - as an instrumental variable. The intuition is that the local presence of foreign VCs should be exogenous to the individual startup born in that local market. At the same time, the local presence of foreign VCs should increase the likelihood of receiving foreign funding (i.e., relevance), but should not influence relocation in any other way than by investing in a startup (i.e., exclusion restriction). Regarding exclusion restriction, we are not aware of any theory or evidence that the local availability of foreign VC leads to the relocation of startups other than through direct influence as an investor. In fact, to the extent that foreign VC is seen as a valuable resource (which is likely), the local availability of foreign VC should be negatively correlated with relocation. This is because the more of the valuable resource is available locally, the lower the incentives for startups to relocate.

The instrumental variable measuring the local availability of foreign VC is calculated as follows. First, we define the local market for each startup as the combination of its country of origin and the year in which it received its first VC

funding. Then, we count all rounds in which at least one foreign VC participated in this local market (excluding the respective startup) and divide this number by all rounds that took place in the local market (again excluding the respective startup).

An obvious concern with local market share IV is that it may capture endogenous features of the local ecosystem. We address this concern in two ways. First, all such features that are stable over time within a country (such as, e.g., the general openness to foreign countries) are filtered out in the regression model by country-fixed effects. Second, it could also be that foreign VCs invest within a country at times when particularly attractive startups emerge that are simultaneously competitive on a global level–and thus more likely to relocate globally. If foreign VC coincides with attractive markets, the instrument should be positively correlated with startup performance. We test this using a measure of startup performance that is widely used in the VC literature: a dummy variable indicating whether a startup achieved an IPO exit.[25] Column (1) of Table 3.8, shows the result of a regression model that relates a startup's IPO probability to the local market share of foreign VC at the time of its first funding. The coefficients for market share of foreign VC/US VC are -5.5/-8.9 percentage points and marginally significant. That is, Column (1) shows a negative correlation, if any, between foreign VC intensity and startup success. The negative correlation is consistent with previous findings that foreign VC intensity coincides with hot VC markets (Aizenman and Kendall, 2012) and that hot markets are associated with lower success rates (Nanda and Rhodes-Kropf, 2013). Although the exclusion restriction cannot be directly tested, the non-existent/negative correlation between startup success and the instrument is reassuring with respect to the validity of the instrument.

Finally, Table 3.8 shows the effect of foreign VC on relocation using the instrumental variable. Columns (2), (3), and (4) of show the reduced form, first stage, and second stage, respectively. To implement the IV model, we re-estimate the

[25]We measure whether the startup eventually goes public in an IPO as of June 2021.

baseline model of Table 3.5, except that we instrument the endogenous foreign/US VC variable with the local market share of foreign/US VC.[26] Column (3) shows that the instrument is a highly relevant predictor of the likelihood that a foreign (Panel A) or US VC (Panel B) participates in a startup's first round. Consistent with the earlier findings, the second stage estimates in Column (4) suggest a statistically significant effect of foreign VC on HQ relocation. At 11.9 percentage points and 20.3 percentage points for foreign VC and US VC, respectively, the point estimates for US VC are higher than in the baseline and matching-based models. A likely reason for the higher effects is that some of the observable variables we use in the matching models capture some of the effect attributable to US VCs. For example, in models where we use both the funding amount and the US VC dummy, the coefficient on US VC only captures the effect of the non-financial capital of US VCs. Suppose, however, that US VCs also provide more financial capital than domestic VCs. In this case, the coefficient on the amount of funding captures part of the effect attributable to US VC and the effect of US VC is biased downward.

As a further robustness check, we apply the bounding method of Oster (2019) to assess the extent to which our estimates may be affected by omitted variable bias. Assuming that the relationship between treatment and unobservables is proportional to the relationship between treatment and observables, Oster (2019) provides a simple method for assessing robustness to omitted variable bias. The method requires only the changes in the treatment coefficient and R-squared when observable controls are added to the regression. The results in Appendix B. 4 show that the influence of unobservables (expressed as δ^*) must be more than three times greater than that of observables to achieve a treatment effect of zero on HQ relocations. Given that Oster (2019) estimates a δ^* of one as a reasonable bound, or, in other words, assuming that unobservables have roughly the same impact on the treatment coefficient as observables, this result suggests

[26] We do not include the startup level control variables in the IV models because they may be endogenously affected by the instrument. If they are affected, the startup controls could pick up effects that are actually due to the treatment.

Table 3.8: Foreign VC and Headquarter Relocation: Instrumental Variable

This table presents reduced form and instrumental variable regression results. Headquarter relocation is an indicator of whether the startup relocated its headquarters (HQ) during or after the first VC funding. *Foreign/US VC in first round* is an indicator variable that takes the value of one if a startup received funding from at least one Foreign/US VC in its first VC funding and zero otherwise. Foreign/US VC in first round are instrumented by the market share of foreign/US VCs, defined as the number of deals with at least one foreign/US VC divided by all deals in the same country-year combination in which the startup was first funded (except the focal startup). Columns (1), (3), and (4) present the reduced form, first stage, and second stage results, respectively. Column (2) regresses IPO outcomes on the instruments. Fixed effects for the initial home country, industry, and year of the first investment of the startup are included. Constants are included in all regressions. Robust standard errors clustered at the country level are shown in parentheses. 'IV F-Stat' refers to the F-statistic on excluded instruments. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
Panel A: Foreign VC				
	IPO	HQ relocation	Foreign VC in first round	HQ relocation
	(OLS)	(OLS)	(IV: 1st)	(IV: 2SLS)
Market share of foreign VCs among other startups funded in same country-year	-0.055*	0.107***	0.901***	
	(0.030)	(0.027)	(0.088)	
Foreign VC in first round	0.025***			0.119***
	(0.004)			(0.033)
Observations	11,074	11,074	11,074	11,074
R-squared	0.026	0.014	0.050	0.018
IV F-stat			104.648	
Controls	No	No	No	No
Funding Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Panel B: US VC				
	IPO	HQ relocation	US VC in first round	HQ relocation
	(OLS)	(OLS)	(IV: 1st)	(IV: 2SLS)
Market share of US VCs among other startups funded in same country-year	-0.089	0.131*	0.645***	
	(0.054)	(0.062)	(0.063)	
US VC in first round	0.027***			0.203**
	(0.008)			(0.098)
Observations	11,074	11,074	11,074	11,074
R-squared	0.025	0.013	0.028	0.024
IV F-stat			104.398	
Controls	No	No	No	No
Funding Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes

that unobserved confounders are unlikely to bias our estimates severely.

3.5.4 Where Do Foreign VCs Relocate Startups?

Having shown that VCs are likely to trigger the relocation of portfolio companies when they invest across borders, the question remains as to why. To answer this question, we analyse the geographical directions in more detail. Our hypothesis is that relocation may have two main objectives: 1) to comply with the legal, regulatory, or tax requirements of the VC investor (i.e., *the legal/regulatory/tax hypothesis*)[27], or 2) to add value to the portfolio company (i.e., *the value-add hypothesis*). Under the legal/regulatory/tax hypothesis, we would expect headquarters to be relocated either to tax havens or to countries with business-friendly laws. Under the value-add hypothesis, VCs may want to add value either by themselves or by introducing startups to critical resources (e.g., financiers, customers, employees, or information) in their own or another ecosystem. In this case, we should see VCs mainly moving startups closer to themselves or to another attractive startup ecosystem. On the other hand, if a legal/regulatory/tax motive drives the relocation, we should observe that most startups move to a common destination (a corporate law or tax haven).

To test these two hypotheses, we examine the association between VC origin and startup destination at a more granular level. We re-estimate the model from Table 3.5 and separate the variable of interest, foreign VCs, into non-US foreign VCs and US VCs and test whether these VCs mainly influence relocation to non-US foreign countries or the US, respectively. Because we cannot use the CEM procedure described above, these results are correlations. Table 3.9, Panel A, does not show a common direction, but that startups move towards their VCs. Invest-

[27] While corporate law or tax motives are obvious, the regulatory motive means that some VCs may require startups to relocate because they are mandated to invest in certain geographies. A well-known example is Y Combinator, which invites startups from around the world to participate in its programme, but requires foreign participants to establish a parent company in either the US, Canada, Singapore or the Cayman Islands.

ment by non-US foreign VCs is only correlated with the likelihood of relocation to non-US foreign countries (not to the US). On the other hand, investment by US VCs only increases the probability of relocation to the US (not to other countries). Both associations are statistically significant at the 1% level.

We perform a similar analysis within the US. If US VCs move companies to the US mainly for legal/regulatory/tax reasons, we should expect startups to move mainly to business- and tax-friendly states, such as Delaware.[28] To test this proposition, we separate US VCs into California (CA), New York (NY), Massachusetts (MA) and 'US (Other)', depending on the HQ listed in VentureSource. Similarly, we separate HQ moves to CA, NY, MA and "US (Other)". Table 3.9, Panel B, shows that US VC investment from a particular state is mainly associated with relocation to that state. For example, investment from a California VC predicts a substantial 21.0 percentage point increase in the probability of relocating to California. However, Californian VC investments are not correlated with relocations to New York or Massachusetts and to 'other' US states. Similarly, investments from New York, Massachusetts and 'Other US' VCs are only significantly related to relocations. VCs are only significantly related to relocations to New York, Massachusetts and 'other US states', respectively, and not to other destinations.

Overall, we find that startups mainly move to the country or state of the investing foreign VC. While we cannot determine whether VCs' motivation behind this pattern is to move startups closer to themselves or to a better ecosystem, the pattern is inconsistent with the legal/regulatory/tax regime hypothesis and suggests that relocations are aimed at adding value to portfolio companies.

[28] The state of Delaware is the legal home of more than 66% of the Fortune 500 companies because, in the state administration's own words, the state offers a "complete package of corporation services" (https://corp.delaware.gov/aboutagency/, accessed 28 June 2021). This approach appears to have consequences, as Delaware law has been shown to increase firm value (Daines, 2001) and help corporations reduce taxes (Dyreng et al., 2013).

Table 3.9: Foreign VC and Headquarter Relocation: Decomposing Destinations

This table presents unweighted linear regressions when decomposing HQ relocations and foreign/US VCs in different geographies. Panel A regresses relocations to *Non-US foreign countries/US* on the incidence of *Non-US foreign/US VCs* in the first funding round. Panel B regresses relocations to different US states (i.e., California (CA), New York (NY), Massachusetts (MA), and others) on the incidence VCs from different US states in the first funding round. Controls include the same variables as in Table 3.5. Fixed effects for the initial home country, industry, and year of the first investment of the startup are included. Constants are included in all regressions. Robust standard errors clustered at the country level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Non-US vs. US

	Headquarter relocated to:			
	Non-US foreign country		US	
	(1)	(2)	(3)	(4)
Non-US foreign VC in first round	0.014***		-0.009**	
	(0.003)		(0.003)	
US VC in first round		0.002		0.100***
		(0.003)		(0.008)
Controls	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Funding Year FE	Yes	Yes	Yes	Yes
Observations	11008	11008	11008	11008
R-squared	0.010	0.007	0.036	0.051

Panel B: Within US

	Headquarter relocated to:			
	US (CA) (1)	US (NY) (2)	US (MA) (3)	US (Other) (4)
US (CA) VC in first round	0.210***	0.003	0.001	0.014
	(0.026)	(0.010)	(0.006)	(0.011)
US (NY) VC in first round	0.004	0.092***	0.001	-0.002
	(0.020)	(0.025)	(0.009)	(0.012)
US (MA) VC in first round	0.022	-0.010	0.059**	0.039
	(0.025)	(0.012)	(0.027)	(0.024)
US (Other) VC in first round	0.010	-0.005	0.005	0.020**
	(0.007)	(0.003)	(0.004)	(0.008)
Controls	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Funding Year FE	Yes	Yes	Yes	Yes
Observations	11008	11008	11008	11008
R-squared	0.074	0.025	0.013	0.013

3.5.5 Why Do Foreign VCs Relocate Startups?

Having established that relocating startups mainly move closer to their foreign investor, we now want to understand what drives this motivation. We hypothesize two ways of how VCs might want to add value by moving the portfolio company closer: 1) to *improve control* over the startup, or 2) to *improve value-adding* in a narrow sense, such as by giving access to local ressources of the VC (e.g., financiers, customers, or information). The main difference between the two is that control actions may benefit the startup potentially may harm the founder(s), e.g., by replacing them, while value-adding services typically benefit both the startup and the founder(s) (Da Rin et al., 2013). If motivated by control, the relocation effect should be heterogeneous across different levels of information asymmetry. However, if motivated by value-adding services, the relocation effect should vary depending on the resource constraints of the startup (e.g., lack of finance, customers, knowledge). In the following, we provide suggestive evidence that the main purpose of relocation is to add value by facilitating subsequent fundraising.

3.5.5.1 Financial Capital

In their seminal paper, Gorman and Sahlman (1989) document that VCs consider the most important service they provide to portfolio companies is to help them raise additional funds. If relocation is a VC strategy to help with subsequent fundraising, the effect should be heterogeneous across startups with different fundraising constraints. For example, the effect should differ depending on whether startups 1) have alternative sources of funding (e.g. revenues) and 2) come from more or less developed VC markets. We test both hypotheses in turn.

In Panel A of Table 3.10, we re-estimate the CEM-weighted model of Table 3.6 but interact the foreign VC dummy with a dummy variable indicating whether a startup was generating revenues at the time of the funding or not. Consistent with relocation as a fundraising support strategy, the interaction is statistically

significant at conventional levels. The most rigorous model (Column (4)) implies that US VC increases the probability of relocation for startups without revenues by 17.2 percentage points, but only by 7.0 percentage points for startups with revenues (= 17.2 − 10.2). This result is qualitatively similar for foreign VC in general.

Panel B of Table 3.10 examines whether the foreign VC effect is heterogeneous for startups from differently developed VC markets. Similar to Rajan and Zingales (1998), we measure the development of the VC market[29] as the ratio of total VC investment to GDP in a startup's country and first year of funding.[30] The interaction between the foreign/US VC dummy and VC market development is statistically significant at the 1% level. The magnitude of the effect is such that a one standard deviation increase in VC market development (being 1.1‰ of GDP, which is comparable to a change in development from, say, Ireland (0.7‰, or 4th out of the 17 sample countries in 2013) to the UK (1.8‰, or 1st out of the 17 countries)) reduces the probability of relocation after US VC investment by 3.8 percentage points $\left(= 34.809 \cdot \frac{1.1}{1000}\right)$.

3.5.5.2 Home Market Size

Foreign VCs may relocate European startups to introduce them to larger product markets (such as the US). If market size considerations play a role, the foreign VC effect should be larger for startups from smaller markets.

Panel C of Table 3.10 examines the foreign VC effect at different sizes of the startup's home market. We proxy the size of the home market by the GDP

[29] Traditionally, the financial development of a country is measured as the ratio of stock market capitalisation plus credit market to GDP (Rajan and Zingales, 1998). Similarly, we measure the development of a country's VC market as the ratio of VC investment to GDP. The measure of VC investment to GDP also reflects how practitioners and policy makers compare the development of VC markets (see, for example, https://ec.europa.eu/programmes/horizon2020/en/news/assessing-potential-eu-investment-venture-capital-and-other-risk-capital-fund-funds, accessed on 28 June 2021).

[30] Total VC investment is calculated as the sum of all deal amounts in a country and year based on all deals reported by VentureSource. GDP data are from Refinitiv Datastream.

Table 3.10: Heterogeneity of the Foreign VC Effect

This table presents results of the baseline CEM-weighted estimates as per Table 3.6 when interacting the Foreign/US VC treatment with different variables. Panel A interacts the treatment with an indicator of whether the startup generated revenues as of the financing. Panel B interacts the treatment with a proxy for VC market development. VC market development is proxied by the ratio of total VC investment (according to VentureSource) to GDP (according to Datastream) in the country and year of first financing. Panel C interacts the treatment with a proxy for home market size (i.e., GDP). Panel D interacts the treatment with an indicator of whether a domestic VC participated in the funding. Robust standard errors clustered at the country level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable:	Headquarter relocation			
Treatment:	Foreign VC		US VC	
	(1)	(2)	(3)	(4)
Panel A: Generating revenue				
Treatment	0.082***	0.083***	0.168***	0.172***
	(0.016)	(0.016)	(0.027)	(0.024)
Treatment x Generating revenue	-0.050*	-0.052**	-0.096**	-0.102**
	(0.019)	(0.016)	(0.028)	(0.025)
Generating revenue	0.004	0.005	0.003	0.008
	(0.002)	(0.003)	(0.019)	(0.014)
Panel B: VC market development (VC investment / GDP)				
Treatment	0.065***	0.066***	0.159***	0.159***
	(0.007)	(0.006)	(0.013)	(0.009)
Treatment x (VC investment / GDP)	-11.924	-12.102*	-35.968***	-34.809***
	(5.839)	(4.531)	(6.461)	(6.960)
VC investment / GDP	3.745	7.966**	7.858	21.400*
	(2.944)	(2.644)	(8.451)	(7.909)
Panel C: Home market size (GDP)				
Treatment	0.051	0.055	0.154	0.149*
	(0.026)	(0.029)	(0.074)	(0.061)
Treatment x GDP	-0.001	-0.003	-0.023	-0.020
	(0.014)	(0.014)	(0.034)	(0.029)
GDP	-0.009*	-0.080**	-0.009	-0.081
	(0.004)	(0.021)	(0.007)	(0.071)
Panel D: Domestic VC involved				
Treatment	0.044***	0.047***	0.086***	0.091***
	(0.002)	(0.006)	(0.013)	(0.010)
Treatment x Domestic VC	0.016	0.008	0.055	0.046
	(0.010)	(0.010)	(0.030)	(0.026)
Observations	5,783	5,776	3,105	3,100
Controls	No	Yes	No	Yes
Funding year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Country FE	No	Yes	No	Yes

of a startup's country and the year of first funding. The interaction between the foreign/US VC dummy and home market GDP is not statistically significant, meaning that the effect does not depend on the size of the home market. This could be because either the product market has little to do with relocation decisions, or all European markets are small compared to the US. In addition, we note that the proxy for local market size for all startups with GDP is coarse. For both reasons, we can't rule out that access to larger product markets is important, but we conclude that the fundraising motive is clearly more evident.

3.5.5.3 Information Asymmetry

Finally, we have seen in the previous section that relocation tends to reduce the geographical distance between the foreign VC and the startup. Therefore, relocation may simply reduce information asymmetry to allow for better control over the portfolio company. If reducing information asymmetry is a motivation, having a domestic VC in the syndicate should lead to a heterogeneous relocation effect. The reason is that a domestic VC should reduce the information asymmetry between the foreign VC and the startup due to its geographical and cultural proximity (Dai et al., 2012), making relocation a less effective lever for value creation.

In Panel A of Table 3.10, we re-estimate the CEM-weighted model of Table 3.6, but interact the foreign VC dummy with a dummy variable indicating whether a domestic VC participates in the financing syndicate or not. The interaction term is not significantly different from zero, implying that the effect is the same whether a domestic VC is involved or not. This result suggests that relocation does not primarily serve to reduce information asymmetry between the foreign VC and the startup.

Overall, the results in this subsection are consistent with the hypothesis that relocation is a VC strategy to add value to startups, in particular by helping with fundraising, but not to monitor startups more closely.

3.5.6 Foreign VC Effect Over Time

Our hypothesis that VCs relocate startups mainly to help with fundraising has interesting predictions for ecosystems as a whole. From the perspective of the European ecosystem, this means that relocations out of Europe would decrease as funding conditions improve. To test whether such a shift occurred during our study period, we divided the startups in our sample according to the receipt of first funding (i.e. 2000-2005, 2006-2010 and 2011-2014) and estimated the CEM-weighted effect of Table 3.6 for each sample.

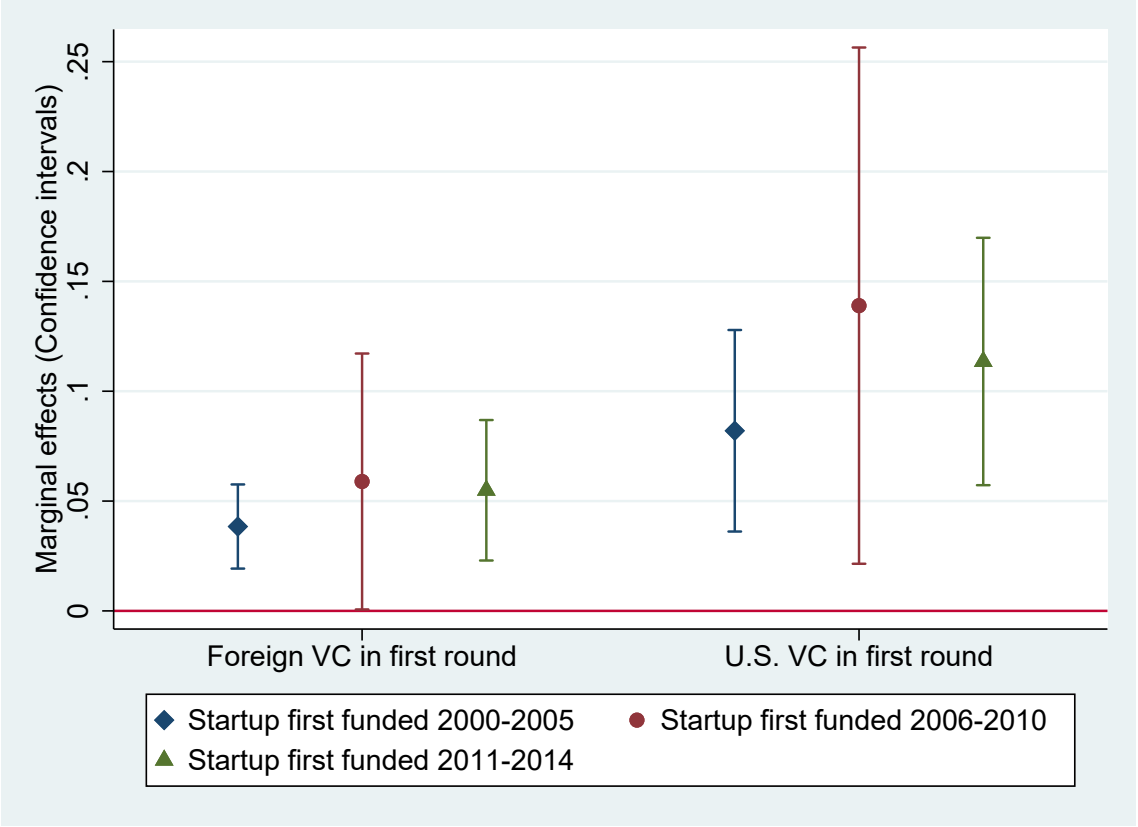
Figure 3.4 presents the results (see also Appendix B. 5). We do not find any significant changes over time, as the confidence intervals of the effect are highly overlapping in all three periods. The only indication of a downward trend is that the point estimate of the US VC effect is lower in the last period (11.4 percentage points) than in the previous period (14.1 percentage points). However, this is more likely due to a "crisis effect" than to a declining trend, as an estimate of the effect for startups funded for the first time during the financial crisis, i.e. in 2009-2010, gives an even higher effect of 17.5 percentage points (see Appendix B. 5). Note that the peak effect during the financial crisis is again consistent with the fundraising hypothesis.

3.5.7 Is Foreign VC Bad for Local Economies?

Finally, we discuss whether, on the basis of our findings, policymakers should consider imposing restrictions on foreign financing, whether through regulatory barriers or taxes. For this exercise, we take a European rather than a national perspective. Since all relocations from Europe are to the US, we can simplify the problem as a Europe vs. US one. Our coefficient for US VC (as the main part of non-European VC) of around 10 percentage points suggests that, on average, one out of ten additional US VC investments leads to the relocation of a startup. Thus, in nine out of ten cases, US capital helps to finance a company without the main

Figure 3.4: Foreign VC Effect over Time

The figure shows CEM-weighted effects and 95% confidence intervals as per Table 3.6 in different subsamples (see also Table B. 5). Startups are split into subsamples according to their year of first funding, i.e. 2000-2005, 2006-2010, and 2011-2014.



parts of the startup being relocated to the US.

The overall relocation statistics provide a similar conclusion: According to Invest Europe (2020), 14% of all capital invested in European startups comes from non-European VCs. Based on our sample, 5.0% of startups leave Europe. Of these 5%, 43% never raise US VC, so they cannot be driven out by it. Therefore, 2.9% is the maximum number of startups that can be relocated due to non-European VC ($= 5.0\% \cdot (1 - 43\%)$). From this 2.9% we would have to subtract all the startups that moved to the US for any other reasons than VC. Assuming that foreign VC supply is additional to (rather than a substitute for) domestic supply,[31] gaining

[31]It is an open question to what extent foreign VC supply is additional to or a substitute for

14% of additional capital by losing a maximum of 2.9% of startups again speaks against raising barriers to foreign VC.

The cost-benefit illustrations above assume that home economies lose companies that relocate. This assumption is based on the fact, documented above, that the main parts of relocated companies were abroad at the IPO. Note, however, that while about 6% of all startups relocate, they account for 14% of the value created by all startups that reach an IPO (= $\frac{28 \cdot 978[\$m]}{28 \cdot 978[\$m]+485 \cdot 361[\$m]}$, see Table 3.2, Panel B). Since relocators and stayers have similar company valuations at first funding, this disproportionate growth occurs after relocation, and it is not unlikely that it occurs only *because* these firms relocate abroad (Conti and Guzman, 2021). By becoming disproportionately successful abroad, they may have created more value in their original host economies (e.g., by growing remaining home locations, remittances, spillovers, return migration) than if they had never left.

Overall, the back-of-the-envelope calculations above show that imposing investment barriers on foreign VCs is not a reasonable response to fears of a startup exodus.

3.6 Conclusion

This paper contributes to the long-standing policy debate on whether foreign VC is beneficial or detrimental to local economies. We empirically investigate a key concern often reported in anecdotes: the startup drain and the role of foreign VC. We assemble a unique dataset that systematically tracks the HQ location history of European startups to provide a novel set of previously unreported facts, including that international HQ relocation in startups: 1) is common (6% of all startups relocate, accounting for 14% of all firm value created), 2) occurs at an early stage, and 3) is a valid measure of startup drain/exodus/migration because

('crowding out') domestic VC. However, the empirical correlation between foreign VC activity and startup activity (e.g.Aizenman and Kendall (2012); Akcigit et al. (2020)) suggests that foreign VC is, at least in part, additional.

it results in the majority of the firm moving abroad.

Consistent with the anecdotal evidence, our results suggest that foreign and US VC increase the probability of HQ relocation by about 5 and 10 percentage points, respectively. This effect is robust to matching, panel data, and instrumental variable analyses. The estimate of about 10 percentage points implies that one out of ten early US VC investments leads to relocation, while the other nine help finance a European startup without relocating it abroad. Given this imbalance in favour of host economies, we conclude that the fear of a startup exodus hardly justifies raising barriers to foreign VC. Rather, our finding that the foreign VC effect becomes more pronounced as financing conditions become more difficult for startups provides a compelling policy alternative to reduce startup exodus: improving local financing conditions.

While we find that foreign VC likely leads to an outflow of meaningful economic activity, the effect is unlikely to be large enough to outweigh the benefits of foreign capital. As such, our results lend support to Hellmann and Thiele (2019)'s theory that the supply of foreign VC can help to lift startup ecosystems to a higher equilibrium with more (ultimately domestic) entrepreneurial activity. However, our results also show that fears of foreign VCs harming local economies are based on more than a few anecdotes. In particular, when all other effects of foreign VC are taken into account (e.g., on foreign IPOs (Humphery-Jenner and Suchard, 2013b), talent outflow (Braun et al., 2019), national security (Akcigit et al., 2020), the overall balance could become negative. Future work is therefore needed to determine the overall welfare effect for (heterogeneous) host economies.

4

Follow the Money: How Venture Capital Facilitates Emigration of Firms and Entrepreneurs in Europe

Authors:	Reiner Braun, Stefan Weik, Ann-Kristin Achleitner
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Abstract

The increasingly global venture capital (VC) business raises the question of whether foreign VC investments pull economic activity away from domestic economies. This paper analyzes whether foreign VC influences the emigration patterns of European venture-backed firms and entrepreneurs. To address endogeneity issues, we instrument foreign VC activity with U.S. buyout fund fundraising (Nanda and Rhodes-Kropf, 2013). Results show that foreign investors, particularly from the U.S., back better European ventures and facilitate foreign exits and entrepreneur emigration. These findings suggest that VC firms are a funnel through which countries with international venture capitalists absorb high-impact economic actors.

4.1 Introduction

Four of the five most valuable companies in the world today are relatively young U.S. organizations that had substantial backing from venture capital (VC).[1] Even beyond these bright and extraordinary examples, VC has been shown to be a successful model in the U.S., as VC tends to be about three times more effective in promoting innovation than conventional R&D (Kortum and Lerner, 2000).

Following the U.S. blueprint, other economies around the globe have long tried to establish active venture capital ecosystems to strengthen competitiveness. Europe is no exception and has taken several measures to foster venture capital activity (Da Rin et al., 2006). Compared to the U.S., however, European VC remains small in absolute terms and relative to GDP (Tykvová et al., 2012) because, among other things, the domestic product as well as exit (IPO and M&A) markets are substantially smaller in Europe (Black and Gilson, 1998; Gompers and Lerner, 2001; Jeng and Wells, 2000). Both factors impede the key ingredients for success in the VC model: rapid company growth and share sell-off within a few years. Accordingly, there are barely any European VC-backed companies of global relevance comparable to the U.S. paragons.

What is more, this paper shows that foreign venture capital activity facilitates the emigration of European talents and companies. Foreign VC firms, particularly those from the U.S., tend to back the best European ventures. Our analysis suggests that foreign VC involvement is associated with a significantly higher likelihood of ventures being acquired by a foreign firm or initial public offering (IPO) in a foreign market. This pattern seems to go beyond a mere selection effect. The implications for Europe are profound: In our sample, more than USD 130 billion in European firm value ended up in U.S. exits, i.e., acquisitions by U.S. buyers or U.S. IPOs, alone. This represents a striking 35% of all company value

[1] See also https://www.statista.com/statistics/263264/top-companies-in-the-world-by-market-capitalization/ (accessed on January 7, 2021).

generated by VC-backed European firms in our sampling period. Also, our study is the first to document another potentially harmful effect on European economies: our data suggest that foreign VC also results in a much higher probability of a firm's entrepreneurs emigrating to that foreign country. It is worth noting that entrepreneurs who emigrate have higher human capital and are more often serial entrepreneurs than their remaining counterparts.

To be clear, the effects we establish are not necessarily net negative for host countries. For example, there may be spillover effects outweighing the cost of leaving firms and entrepreneurs, or, the prospect of a foreign exit may motivate much more entrepreneurs to start than actually leave.[2] Therefore, we interpret our empirical findings as evidence that global VC firms induce a 'gravitational pull' towards VC-exporting countries (like the U.S.) and that this represents another channel of how the development of financial markets contributes to economic growth.[3]

To derive our empirical findings, we collect and merge several large commercial and new proprietary data sets. The details of our sample and the variables are presented in Section 4.2 of this paper. We start with a comprehensive sample drawn from the Dow Jones VentureSource database: more than 19,000 VC financing rounds between years 2000 and 2019 to over 11,000 ventures from 17 of Europe's largest economies. For each financing round, we classify investors by their country of origin. First, we classify financing rounds as domestic rounds if they only involve investors from the venture's home country. Second, if at least one investor is from another country, we classify these as foreign rounds. Third, we identify those foreign rounds involving at least one U.S. VC firm to build a U.S. subgroup of foreign rounds. Because some European economies are highly

[2]Establishing the theory of 'beneficial brain drain', Beine et al. (2001) show that there may be an equilibrium in which more people acquire education in the hope of emigration than actually leave the country. Similarly, the prospect of emigration may motivate more entrepreneurs to found than actually leave.

[3]See Levine (2005) for an excellent overview on the theory and evidence regarding the connection between the development of financial systems and economic growth.

integrated, it is difficult to argue that exits and entrepreneur emigration to nearby economies are significant economic issues. However, in the case of investments from the U.S., i.e., from outside Europe, we argue that they represent real foreign investments in the narrow sense that are potentially associated with harmful effects, such as emigration to the U.S.

In Section 4.3, we provide persuasive empirical evidence that foreign VC firms (particularly U.S.) provide capital to the best European ventures. We show that foreign investors are indeed involved in a positive selection of VC rounds based on standard measures of venture quality and innovativeness. Accordingly, foreign VC investments in higher-performing and more innovative European ventures are also associated with higher financing amounts and company valuations. The differences compared to domestic rounds are statistically and economically significant and even higher when U.S. VC firms are involved. Compared to entirely domestic VC syndicates, syndicates with foreign investors invest approx. four times larger financing amounts to companies with approx. three times higher valuation. These foreign-backed companies also tend to be two to three times more innovative (based on patents and received patent citations) and raise about five times more VC throughout their lifetime.

In Section 4.4, we analyze whether foreign VC also increases the likelihood of a foreign exit. To do so, we change the unit of analysis to the company level and collect data on exit location countries for the approx. 11,000 European VC-backed ventures in our sample. In particular, we identify where a company goes public (stock market country) and where the buyer is headquartered if a third party acquires a controlling stake (trade sale). We focus on IPOs and trade sales not because these are common indicators of startup success but because they imply a change of ownership.[4] While foreign IPOs are likely to result in higher foreign

[4]IPOs and trade sales have become commonly used measures of startup success (e.g., Cochrane (2005); Hochberg et al. (2007); Sorensen (2007); Nahata (2008); Cumming et al. (2016); Nanda et al. (2020)), even though they are arguably crude measures. However, this imprecision does not impact our analysis, since we are interested in ownership transferring to foreign hands rather than success per se. For example, an acquisition (trade sale) by a foreign buyer results

ownership than domestic exits, foreign acquisitions by definition result in foreign control of the venture.

In Sections 4.4.1 and 4.4.2, we provide empirical evidence that foreign and U.S. investments in any financing round significantly increase the probability of a foreign and U.S. exit, but not domestic exit. In other words, exit routes are contingent on capital origin. This in itself is relevant because foreign VC firms (particularly U.S.) invest in higher quality companies and, as a result, the better European ventures experience a foreign exit. For example, the rate of foreign exits is 11.5% for domestically backed ventures, but 24.6% when at least one foreign investor is involved (27.8% with at least one U.S. investor). Even if we account for observable venture quality differences in a regression framework, foreign investors seem to increase the likelihood of foreign exits and foreign acquisitions by 6.8 and 6.2 percentage points, respectively.

At the same time, it remains unclear whether the higher likelihood of a foreign exit contingent on foreign VC stems from a selection and/or treatment effect. This question matters very much considering the various public initiatives to promote the domestic supply of VC in Europe. If foreign investors just matched with those European ventures seeking a foreign exit irrespective of their investors' origin, we would observe the same empirical patterns laid out in Sections 4.4.1 and 4.4.2. In fact, we could very well reverse the causal direction: ventures, and their early-stage investors, might actively seek U.S. investors to facilitate entry into the huge U.S. product and exit markets. In this case, increased domestic capital levels would neither alter this intention nor reduce the likelihood of an ultimate foreign exit.

To shed more light on this aspect, in Section Subsection 4.4.3, we show that there is a treatment effect of foreign capital on exits to foreign countries beyond the selection effect already established. To isolate the treatment effect, we use the

in an asset moving to a foreign owner regardless of whether the sale itself is a success for previous owners or not.

capital inflow into foreign (U.S.) buyout funds as an instrumental variable (IV), following Gompers and Lerner (2000) and Nanda and Rhodes-Kropf (2013). In general, buyout funds buy controlling stakes in established businesses that generate revenues and profits. In contrast, VC funds invest in high-risk, high-growth startups that create and commercialize novel technologies. Our approach exploits the fact that the amount of capital flowing into venture capital is greatly influenced by asset allocation of limited partners who invest in private equity more broadly without making distinctions between venture capital and buyout funds. Using foreign/U.S. buyout fundraising as instrument, we aim to capture that portion of foreign/U.S. VC investment that is the result of increases in capital supply, independent of the investment opportunities available in European startups at the time.

Our results are robust to this IV strategy and show that foreign (U.S.) investors significantly increase the likelihood of foreign (U.S.) exits and foreign (U.S.) acquisitions beyond selection effects. A likely explanation for these findings is that VC firms have strong local networks at home (Sorenson and Stuart, 2001), including relationships with local exit markets, such as public stock exchanges (including the necessary advisors like investment bankers or lawyers) or potential strategic acquirers in M&A markets (Sahlman, 1990). Hence, it seems plausible that U.S. VC firms investing in a given European venture will increase the likelihood of a U.S. IPO or sale to a U.S. buyer, particularly considering that these exit markets are much smaller in Europe anyway.

Although we cannot observe what ultimately happens to jobs and tax payments after a foreign exit, we argue that such exits likely to lead to an outflow of relevant technologies and human capital from European economies. To support this argument, we go one step further in Section 4.5 and examine the migration behavior of startup founders, which arguably represent the most important human capital of a startup. The question we analyze is whether foreign VC also encourages entrepreneurs to emigrate. To analyze this question, we collect an-

other comprehensive proprietary data set on the positions held by founders and CEOs (hereafter referred to as 'entrepreneurs') after their venture's final financing event. For the approx. 11,000 European ventures in our sample, we were able to manually collect data on the jobs held by approx. 10,000 entrepreneurs one, three, and six years after the exit of their previous venture from commercial databases and the internet. To the best of our knowledge, we are the first to gather a comprehensive and rich data set on the job history of European venture founders and CEOs at multiple points in time after their initial venture.

In Sections 4.5.1 and4.5.2, we provide empirical evidence of a critical entrepreneurial human capital drain related to foreign VC investments in Europe. First, we document an arguably large share of 13% (6%) of all entrepreneurs from European ventures is mainly professionally occupied in a foreign country (U.S.) six years after their venture's last financing event. The entrepreneurs who emigrated have raised more VC, are more experienced, and are more likely to start another VC-backed venture than entrepreneurs who stayed in their venture's initial country. Second, bivariate tests show significant differences in the primary work location contingent on the VC backer's origin. While the share of domestically financed entrepreneurs working abroad one year after their initial venture's last financing event is only 7%, it is 16% (17%) for ventures with at least one foreign (U.S.) VC investment. Notably, we do not see a decrease in these emigration rates within six years after the venture, indicating that entrepreneurs stay for the medium to long term once they leave. Moreover, even if we control for venture quality and foreign (U.S.) exits in a regression framework, results suggest foreign (U.S.) VC investors have a long-lasting effect on entrepreneur emigration (to the U.S.).

Lastly, Sections 4.5.3 confirms that the association of foreign VC and entrepreneur emigration is at least partially due to a treatment effect, meaning that entrepreneurs of a given quality are more likely to go abroad if foreign investors backed their ventures. Further analyses suggest that foreign exits, which as established earlier

are partially caused by foreign VC backing, represent one mechanism of how the correlation between foreign VC and emigration abroad comes into place.

In our view, the findings showing the increased odds of entrepreneur emigration represent another implication of the 'gravitational pull' of active entrepreneurial ecosystems facilitated by internationally active VCs. It seems that some of the most talented entrepreneurs leave weaker entrepreneurial ecosystems (like Europe) because they get access to new networks through collaboration with an international VC investor. This mechanism leads to an outflow of valuable talent from one ecosystem (Europe) and the accumulation of valuable talent in the VC-exporting ecosystem (e.g., U.S.).

This paper contributes to the literature on the role of VC in the economy. First, we underline the importance of the literature on cross-border VC (notable contributions include, but are not limited to: Dai et al. (2012); Humphery-Jenner and Suchard (2013a,b); Nahata et al. (2014); Cumming et al. (2016); Devigne et al. (2016); Buchner et al. (2018))[5] by showing the rise of internationalization in European VC markets, arguably covering the entire market over 20 years. We add to the literature by demonstrating that foreign VC firms (particularly U.S.) invest in the best companies. Second, by using a suitable instrument, we are the first to provide evidence that VC origin has a general causal effect on the geographical exit route.[6] By showing a causal relationship between foreign VC investors and foreign exits and acquisitions, we add to the literature on how VC firms play an active role in adding value (e.g., Hellmann and Puri (2002); Bottazzi et al. (2008); Chemmanur et al. (2011); Bernstein et al. (2016); Ewens and Marx (2018); González-Uribe (2020)). Finding a treatment effect indicates that foreign VC firms actively drive what happens to ventures in their portfolio. Third, we extend this 'drain' analysis

[5] See Devigne et al. (2018) for an excellent overview.

[6] Hursti and Maula (2007) and Humphery-Jenner and Suchard (2013b) already suggest that foreign VCs increase the likelihood that ventures list abroad. However, it remains unclear whether their finding is causal and extends to foreign takeovers and beyond China. Hursti and Maula (2007) ignore the endogeneity problem. Humphery-Jenner and Suchard (2013b), analyzing Chinese ventures, note that the relationship could be driven by Chinese listing rules or foreign VCs' difficulty to repatriate profits back into their home country.

by assessing the emigration of top entrepreneurs within and from Europe. Our study reveals that foreign VC increases the likelihood that entrepreneurs emigrate to those foreign countries. Given the outsized role U.S. immigrants play in innovation (Bernstein et al., 2018), job creation (Azoulay et al., 2020), science (Agarwal et al., 2023), and startup success (Dimmock et al., 2019), our findings that the foreign activity of U.S. VCs generates such immigration is an important one.

Altogether, our findings should be of utmost interest to policymakers who might want to boost the competitiveness of their economies. We show that they can decrease venture and talent drain or even create an inflow of both by increasing the domestic supply of venture capital. This will highly likely boost domestic innovation and economic growth.

4.2 Data

Our data collection aimed at obtaining a representative sample of European VC-backed ventures, their exit locations, and the emigration patterns of their entrepreneurs.

4.2.1 Ventures

We sourced our primary data set on VC investments from the Dow Jones VentureSource database. VentureSource and Refinitiv VentureXpert (formerly Thomson Reuters Venture Economics) are the two primarily used databases in venture capital research and recognized for providing a comprehensive picture of the venture capital market (Da Rin et al., 2013; Ewens and Rhodes-Kropf, 2015). We choose VentureSource because, in addition to company and funding data, it also provides data on founders that we need in our later analysis of founder migration. We include all investments to ventures headquartered in 17 European countries (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Russia, Spain, Sweden, Switzerland, and the

United Kingdom). The financing rounds in these countries account for more than 98% of all VC financing rounds on the European continent in the database.

We apply additional filters to restrict our analysis to young, high-growth, VC-backed companies. Our sample only includes financing rounds labeled as 'VC' and excludes buyouts, angels, venture debt investments, and grants. We also exclude VC-backed companies older than ten years at the time of their first VC round. Lastly, we filter out all financing rounds for which the invested amount is not available. After applying these filters, our primary sample contains all European ventures from the countries mentioned above that received at least one round of VC funding with a known amount between the years 2000 and 2013. We include financing rounds after 2013, but only for ventures that received initial financing by 2013. The upper time limit is a trade-off between sample size and leaving sufficient time to observe venture exits. We collected our data in 2019, which means we leave a minimum of six years to observe eventual exits, which is in the same range as previous analyses of venture capital exits.[7] The lower time limit is constrained by the availability of verified data. VentureSource started in 1987 in the U.S., but its coverage of the European market is only considered comprehensive from around 2000.[8] Following these steps, our main sample consists of European ventures, initially financed between 2000 and 2013, which obtained rounds of financing during their lifetime.

[7] E.g., Hochberg et al. (2007); Nahata (2008); Ewens and Rhodes-Kropf (2015); Nanda et al. (2020) leave 5, 4, 6, and 8 years of time between investment and observed exit, respectively.

[8] Axelson and Martinovic (2013) compare VentureSource with data from the European Venture Capital Association (EVCA) and find comprehensive coverage from about 2000. Retterath and Braun (2020) find similar results when they match VentureSource with original financing documents from 339 financing rounds on 108 mostly European ventures between 1999 and 2019. Among the eight databases examined, VentureSource was the only database covering all 108 startups.

4.2.2 Venture Exit Locations

IPO and especially trade sale (acquisition) exits are the first subject of our analysis because they imply a transition of ownership, potentially into foreign hands.[9] To analyze exit locations, we need to know where the venture exited, i.e., the IPO country or buyer's headquarters. VentureSource provides our starting point to determine exits. Although VentureSource is superior to other VC databases in terms of exit coverage, its exit data is incomplete. To improve the exit coverage, we match the data manually with the Refinitiv SDC M&A and New Issues databases.[10] As a result, 34% of the companies in our sample reach an exit, with 5% reaching IPO and 29% an acquisition. These success rates are similar to U.S. startups post 2000, as reported by Ewens and Farre-Mensa (2020) (based on VentureSource), according to which about 25% of startups achieve an acquisition and around 2% an IPO.[11]

Exit locations include the acquirer's home country (headquarters) or the IPO host country. This data is readily available from VentureSource and SDC. If we cannot locate the buyer's home country, we obtain it by matching their ticker to all listed companies in Refinitiv's Datastream database. In the few cases where this does not reveal the IPO or acquirer countries, we search the internet for this information. Ultimately, we identify all IPO locations and treat unknown buyer headquarters as domestic acquisitions.

[9] Acquisition exits, especially those without reported values, may be disguised failures (e.g., Puri and Zarutskie (2012); Korteweg (2018); Gompers et al. (2020)). However, note that we are not interested in success per se but rather in the change of ownership (e.g., into foreign hands). As any acquisition entails a change of ownership, its degree of success is irrelevant in our context. If anything, it is possible that low-value acquisitions are under-reported in the data, but this does not appear to affect our analysis.

[10] An additional 776 exits result from this search (a 25% increase). See the Appendix Section C.1 for a detailed description of the database construction.

[11] Note that we disregard startups without any reported financing amount. As these startups tend to be less successful, success rates would be lower if we considered them too. However, the main results are qualitatively and quantitatively similar if we include ventures without any financing amount documented.

4.2.3 Entrepreneur Emigration

In addition to venture exit locations, our second main object of analysis is the emigration patterns of the entrepreneurs who launched these startups. We define entrepreneurs as the founders and CEOs who, according to VentureSource, were with the startup since the first funding. We include initial CEOs because many founders are incorrectly labeled as 'non-founder CEOs' in VentureSource and would otherwise be excluded from our sample.[12] Moreover, early CEOs, even if not founders, likely have similarly valuable skill-sets and stakes in the ventures (Sahlman, 1988) and therefore are equally important for the underlying ecosystem in which they work.

We retrieve the names of 14,105 founders and initial CEOs in our sample from VentureSource. We then manually search the public LinkedIn profiles of these founders and collect from there their primary work locations one, three, and six years after their last funding event, i.e., exit or last VC round, respectively. This choice is motivated by three considerations: First, we start with the last funding event because we are interested in the long-term impact of VC funding on emigration. Second, we measure at different points in time after the last funding event because this allows us to delineate whether emigration (if any) is generally short-term or whether it persists over time. Third, we use primary places of work as a proxy for where entrepreneurs primarily contribute to the ecosystem, e.g., by starting or investing in new businesses and paying taxes. To define primary work locations, we only consider executive positions and disregard all non-executive, board, and advisory roles, which are common in our sample. Using the above steps, we were able to identify the primary work locations of 10,015 entrepreneurs one year after their startup's last financing event.[13] Because we collected the data in 2020, we are not able to observe the work location 3 and 6 years after last

[12] Ewens and Marx (2018) document this pattern for VentureSource, namely, that actual founders are incorrectly labeled as non-founders.

[13] For the 14,105 initial names, we found 10,736 LinkedIn profiles, but only 10,015 profiles allowed to identify the location of the founder.

financing if that financing was shortly before 2020. Accordingly, the sample is reduced to 9,659 and 7,770 observations when looking at primary work locations 3 and 6 years after last financing, respectively.

4.2.4 Key Variables

Here we describe the key variables used in our analysis. All variables are defined in the Appendix.

4.2.4.1 Foreign/U.S. Exits

The first part of our analysis is at the venture level. For each venture, we measure whether it exited in a country other than its origin (foreign exit), in the U.S. (U.S. exit), or whether the opposite was true (domestic exit or non-U.S. exit). To determine foreign and U.S. exits, we refer to both listings on exchanges outside the venture's home country and in the U.S., as well as acquisitions by buyers headquartered outside the home country and in the U.S. To define the venture's home country, we use the headquarters location listed in VentureSource.[14]

4.2.4.2 Emigration Abroad/to the U.S.

The second part of our analysis is at the entrepreneur level. Based on their primary work locations one, three, and six years after the final financing event (i.e., exit or last VC round), we define dummy variables indicating whether entrepreneurs work abroad (*Abroad X years after the last financing*) or in the U.S. (*U.S. X years after the last financing*).

[14]While seemingly straightforward, simply taking over the headquarters from a data provider might be problematic because they commonly treat the headquarters as static while in reality it is not. VentureSource officials informed us that their policy is to overwrite the location when they learn about headquarter changes occasionally, but they do not actively seek updates for this attribute. In our context, the sloppy treatment is an advantage because the 'stickier' the location, the closer it is to our optimal measure, the origin of the venture. Moreover, headquarter moves are very rare events (Laamanen et al., 2012) which are unlikely to affect our results.

4.2.4.3 Foreign/U.S. Investor

Our main question is whether foreign capital leads to foreign exits and entrepreneur emigration. Therefore, in line with previous literature on foreign VC, we assign dummy variables being 1 if foreign/U.S. VC investors are involved in a financing round or company and 0 otherwise. We obtain data on VC headquarters from VentureSource. We consider investments foreign if at least one investor in the round/company is located in a country other than the venture. While we use this conventional and straightforward formula to define the VC's home country, we note that it ignores potential issues. In particular, a U.S. group could invest through a separate European fund based in the venture's home country. However, there are at least two reasons why the approach is appropriate in our context. First, VC companies are small organizations and rarely open any branch offices at all.[15] For example, even though U.S. VCs have invested in Europe at least since the beginning the database in 1987, even the largest and most successful VCs in the industry, Sequoia Capital and Bessemer Venture Partners, did not announce plans to hire dedicated European partners and open a European office until 2020.[16] Second, and more importantly, if European funds under the umbrella of U.S. groups behaved in the same way as other European funds, we would not find any differences in our empirical analyses. In other words, our design explicitly tests whether it makes a difference if the ultimate owner of a VC fund is located outside the venture's home country.

[15] Using a broad VentureXpert sample, Chen et al. (2010) report the average VC firm to have 5.4 employees while Gompers et al. (2020) report 11 employees based on a survey of VCs. Chen et al. (2010) also document that branch office expansions are rare and, somewhat surprisingly, negatively correlated with investment experience.

[16] See also https://sifted.eu/articles/us-vcs-europe/ and https://www.businessinsider.com/venture-capital-bessemer-venture-partners-boost-europe-presence-2020-8?r=DE&IR=T (accessed on December 12, 2020).

4.2.4.4 VC Characteristics

To isolate the marginal effect of foreign capital, one 'naïve regression' strategy would be to control for alternative explanations in a regression framework. One such concern is that more experienced VCs invest across borders, which gives them access to top-quality ventures (Sorensen, 2007) that are more likely to attract international interest ex ante. To proxy VC experience, we construct two measures based on VC investment data from VentureSource. We start with the VC's age, which is consistent with prior literature (e.g., Hochberg et al. (2007); Sorensen (2007); Nahata (2008)). We calculate the average age of all VCs engaged in the round/company to measure industry experience. The second measure involves the cumulative number of unique portfolio companies a VC has invested in before investing in the round/company. To subsequently aggregate by round/company when more than one VC is involved in a round/company, we take the sum of the portfolio companies divided by all VCs co-investing together. To illustrate this point, if Intel Capital (889 unique portfolio companies and 33 years of experience as of 2016) and 'SuperVentures' (1 portfolio company and 1 year of experience) invest in a deal together in 2016, our experience measures for this syndicate would be 17 years ((33+1)/2) and 890 (889+1) portfolio companies. Previous research has also provided evidence that syndicated investments are associated with higher returns (Brander et al., 2002). Therefore, in addition to experience, we measure the syndicate's size by counting the number of VCs involved in a round/company.

4.2.4.5 Venture Characteristics

A second main concern is that foreign VCs might invest in a select sample of higher quality ventures, meaning quality differences might drive our results instead of VC origin. To separate the potential quality effect from the foreign capital effect in a naïve regression framework, we construct four venture characteristics to proxy for underlying venture quality. First, we create a variable that measures

the total amount of VC investment across all rounds according to VentureSource. The higher the amount of total funding, the higher the venture's potential and the more diverse – including foreign – exit opportunities might emerge. Second, serial entrepreneurs tend to be associated with more successful companies (Gompers et al., 2010). We assign indicator equal to 1 if one of the venture's founders or initial CXOs was previously on the management team of another VC-backed company, according to VentureSource. Third, patents are important assets and signals for startups in that they are associated with higher valuations and attract prominent VCs (Hsu and Ziedonis, 2013). At the round level, we calculate the number of patent applications in stock at the moment of financing. At the company level, we take the company's patent stock at the moment of the last VC financing. Moreover, VCs can effectively distinguish higher impact patents from lower impact patents in terms of subsequently received citations (Häussler et al., 2009). Therefore, we measure the total citations received by those patents in stock at the moment of financing (at round level) or last observed VC financing (at company level). To get patent data, we manually match startups in the sample with PATSTAT, a comprehensive database by the European Patent Office that aggregates patent application data across more than 80 countries (Block et al., 2014).[17]

4.3 Patterns of Foreign VC Activity in Europe

Before analyzing exit routes and entrepreneur emigration, we characterize patterns of foreign VC investment in our data. Panel A in Figure 4.1 plots time trends for invested amounts and foreign investor round participation in our overall sample. Our sample shows expected cycles of investment activity in European venture capital, peaking at approx. USD 25 billion (indexed at 2012 values) in 2000. Overall, there is a steady increase in the share of rounds involving at least

[17] We match ventures based on company name and geographic location. In case company names were similar but not identical, we conduct web searches to verify matches.

one foreign investor, which provides evidence for an internationalization of the supply in European venture capital markets over time. While foreign investors participated in approx. 25% of all rounds from 1995 to 1998, more than 45% of all rounds in 2019 included foreign investors, marking a record high in Europe. By far, most non-European venture capital comes from the United States.

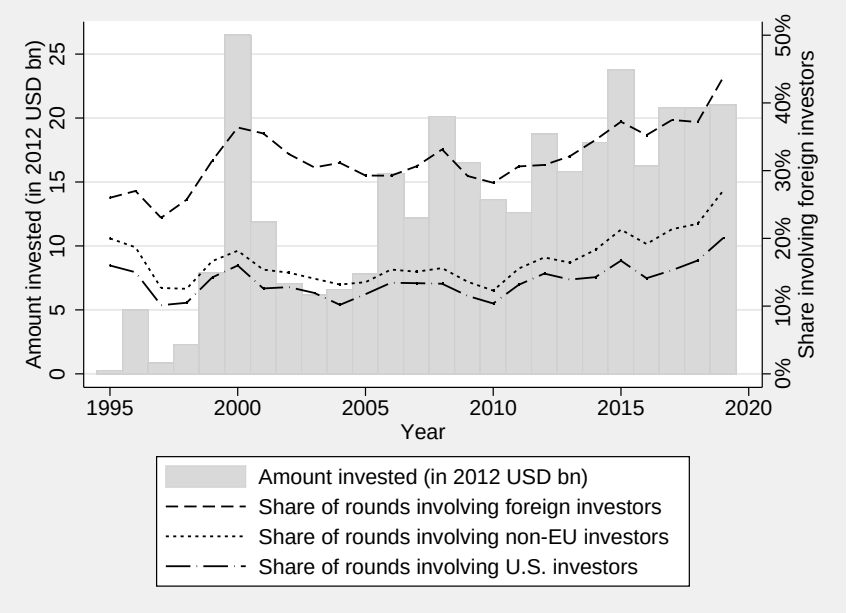
The trend of increasingly international VC markets is also apparent in the two largest markets in our sample (Figure 1, Panel B). In Germany and the United Kingdom, foreign investor involvement increased over time to more than 40% of all rounds as of 2014. However, there are exceptions to this overall trend. For example, in France, foreign investor participation has been mostly below 30%, increasing only more recently.

Next, we look at whether and to what extent foreign investments structurally differ from domestic investments. Table 4.1 reports descriptive statistics on investment characteristics at the round level (Panel A) and company level (Panel B). We split the sample by financing rounds involving domestic investors only (13,451 rounds, or 68% of the sample), those involving at least one foreign investor (6,334 rounds, or 32%), and, as a subsample of foreign, those involving at least one U.S. investor (2,606 rounds, or 13%). We find astonishing differences: Foreign investments differ substantially from domestic investments in all the dimensions we collected and deemed relevant, i.e., all mean/median tests indicate statistically significant differences at the 1% level. Panel A shows that financing rounds with at least one foreign investor differ significantly from entirely domestic ones. Compared to wholly domestic VC syndicates, foreign VCs provide capital to a select sample of higher valued companies (median pre-money valuation of USD 12.7 million vs. 4.2 million), which require more financing (median USD 6.1 million vs. 1.6 million). In terms of venture quality characteristics, the companies funded by foreign VCs are more often managed by serial entrepreneurs (mean 8% vs. 4%), backed by larger syndicates (median 3.0 vs. 2.0), more mature at the time of investment (median financing round number 2.0 vs. 1.0), and hold more patent

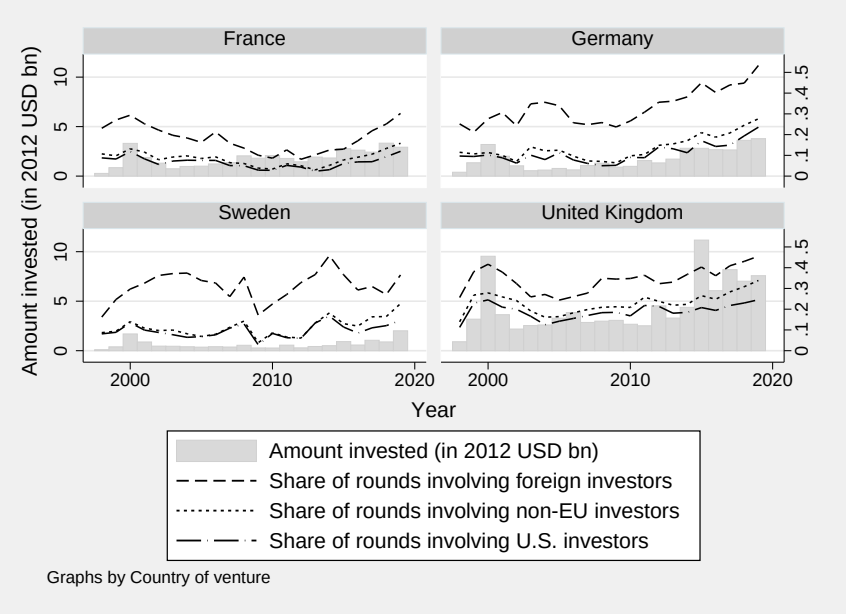
Figure 4.1: Time Trend of Foreign VC Investment

The graphs plot VC investment activity in Europe between 1990 and 2019 based on data from VentureSource. The sample includes all VC financing rounds between January 1990 and August 2019 to companies headquartered in Europe, i.e. for this plot, we do not restrict to companies funded between 2000 and 2013 as in the major sample of the paper. The amount invested is the total amount of venture capital (VC) financing, in 2012 U.S. dollars (USD). *Share of rounds involving foreign/non-EU/US investors* is the percentage share of venture financing rounds that involved at least one foreign (i.e. different country of origin than the financed company)/non-EU (i.e. different continent of origin than the financed company)/U.S. investor.

Panel A: Europe



Panel B: Selected European Countries



applications (mean 1.1 vs. 0.6) that receive more patent citations (mean 13.9 vs. 5.0). Qualitatively, we observe the same pattern in the sample at the company level (Table 4.1, Panel B) and split the sample into companies backed by domestic VCs only (7,652 companies, or 67% of the sample), financed by a foreign VC at least once (3,734 companies, or 33%), and backed by a U.S. VC at least once (1,599 companies, or 14%). Compared to domestic investors, foreign investors generally invest in higher quality, more innovative, and higher valued companies. The difference is even more pronounced if U.S. investors are involved.

The positive selection by foreign investors might stem from a selection of better market segments, that is, venture stage, industry, country, or year preferences, or from selection within market segments, or both. To analyze this question, we test to what extent differences remain in round level regressions when we add country x industry x year x round number fixed effects. Table 4.2 presents regression results of at the round level with venture characteristics as dependent variables and foreign (U.S.) investor dummies as independent variables. Still, within the same country-industry-year-stage, foreign (U.S.) investors are involved in significantly higher quality (Models 1 and 2), more innovative (Models 3 and 4), and higher valued companies (Models 6 and 7) with larger financing needs (Model 5). However, accounting for market segment preferences reduces the differences compared to the simple mean/median comparisons. For example, within the same market segment, foreign investors participate in 2.3 times (exp(0.838)) higher valued companies (Model 6a), while the simple median difference was 3.0 times domestic rounds (12.7/4.2). Therefore, foreign investors appear selective on both levels: they pick market segments with higher quality companies and, within market segments, make individual investments in the highest quality companies. Qualitatively, the same pattern is true for U.S. VCs (Panel B).

Overall, we present conclusive evidence that foreign, and particularly U.S., investors invest in a positive selection of European ventures. We note that it is important to account for this positive selection when identifying any marginal

Table 4.1: Descriptive Statistics

The sample consists of 11,066 ventures from 17 European countries that received VC financing between 2000 and 2013, and for which at least one actual VC investment amount is available. Rounds/companies are classified as Foreign/U.S. if at least one foreign/U.S. investor was engaged in the round/company. Domestic refers to rounds/companies that did not include foreign VC funding. Panel A reports summary statistics on 19,785 venture capital financing rounds received by the ventures in the sample between 2000 and 2019. Panel B presents the respective statistics at the portfolio company (i.e. venture) level. Definitions of all variables are given in the Appendix. Test for difference reports z-statistics of Wilcoxon rank-sum tests for equality of medians. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided), respectively.

	VC investor origin									Test for difference (z-statistic)	
	Domestic			Foreign			U.S.				
	Obs.	Mean	Median	Obs.	Mean	Median	Obs.	Mean	Median	Domestic vs. foreign	Domestic vs. U.S.
Panel A: Round level											
Venture characteristics											
VC amount raised (USD m)	13,451	5.14	1.61	6,334	21.05	6.12	2,606	29.55	9.65	-57.42***	-50.99***
Pre-money valuation (USD m)	3,862	19.59	4.21	1,712	92.72	12.71	615	147.90	20.52	-26.99***	-24.55***
Serial entrepreneur	13,451	0.04	0.00	6,334	0.08	0.00	2,606	0.10	0.00	-12.39***	-14.87***
Round	13,451	1.66	1.00	6,334	2.30	2.00	2,606	2.48	2.00	-33.47***	-30.22***
Patent applications	13,451	0.58	0.00	6,334	1.08	0.00	2,606	1.21	0.00	-8.45***	-6.92***
Patent citations received	13,451	4.97	0.00	6,334	13.92	0.00	2,606	16.48	0.00	-9.68***	-7.54***
VC characteristics											
VCs' cumulative number of portfolio companies	13,078	64.71	28.00	6,334	218.47	95.00	2,606	299.02	168.00	-44.72***	-45.29***
VCs' age	13,078	6.93	6.00	6,334	9.43	8.50	2,606	11.34	10.67	-27.29***	-32.05***
Syndicate size	13,284	1.94	2.00	6,334	3.09	3.00	2,606	3.52	3.00	-42.92***	-38.45***
Panel B: Company level											
Venture characteristics											
Total VC amount raised (USD m)	7,652	6.83	2.10	3,734	40.23	10.42	1,599	61.58	19.99	-47.79***	-43.35***
Serial entrepreneur	7,652	0.03	0.00	3,734	0.06	0.00	1,599	0.08	0.00	-7.99***	-10.42***
Patent applications at last VC financing	7,652	0.44	0.00	3,734	0.99	0.00	1,599	1.13	0.00	-7.88***	-5.43***
Patent citations received at last VC financing	7,652	3.07	0.00	3,734	10.76	0.00	1,599	13.09	0.00	-9.12***	-6.89***
VC characteristics											
VCs' cumulative number of portfolio companies	7,652	63.01	27.00	3,734	225.45	101.00	1,599	304.00	173.00	-36.59***	-37.20***
VCs' age	7,652	6.48	5.00	3,734	7.86	7.00	1,599	9.27	8.50	-15.15***	-20.18***
Syndicate size	7,652	1.93	1.00	3,734	3.89	3.00	1,599	4.73	4.00	-43.34***	-39.49***

Table 4.2: Venture Characteristics Associated With Foreign VC Rounds

The table shows 12 ordinary least squares (OLS) regressions of venture quality characteristics on indicators for whether foreign (U.S.) investors were involved in the VC financing syndicate. The unit of observation is the financing round. The main variable of interest, Foreign (U.S.) investor, is an indicator variable equal to one if at least one foreign (U.S.) investor is involved in the round. Definitions of all other variables are given the Appendix. LN denotes the natural logarithm of a variable incremented by one. All regressions include country x industry x financing year x round number fixed effects. Constants are included in all regressions. Robust standard errors clustered at the venture level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided), respectively.

	General quality		Innovativeness		Amount & valuation	
Dependent variable:	Serial entre-preneur	LN Syndicate size	LN Patent appli-cations	LN Patent citations received	LN Amount raised ($m)	LN Pre-money valuation ($m)
Panel A: Foreign	(1a)	(2a)	(3a)	(4a)	(5a)	(6a)
Foreign investor	0.032***	0.231***	0.049***	0.131***	1.133***	0.838***
	(0.005)	(0.008)	(0.012)	(0.027)	(0.028)	(0.082)
Observations	18,699	18,535	18,699	18,699	18,699	4,754
R-squared	0.165	0.320	0.349	0.331	0.342	0.288
Country x Industry x Year x Round FE	Yes	Yes	Yes	Yes	Yes	Yes
Panel B: U.S.	(1b)	(2b)	(3b)	(4b)	(5b)	(6b)
U.S. investor	0.050***	0.267***	0.072***	0.143***	1.266***	0.891***
	(0.009)	(0.012)	(0.018)	(0.041)	(0.040)	(0.132)
Observations	18,699	18,535	18,699	18,699	18,699	4,754
R-squared	0.166	0.305	0.349	0.330	0.312	0.275
Country x Industry x Year x Round FE	Yes	Yes	Yes	Yes	Yes	Yes

effects of foreign financing.

4.4 Foreign VC Activity and Implications for Exit Routes

To study the effect of foreign ownership on venture outcomes, we continue our analysis at the venture level. We start with descriptive evidence of the bivariate

relationship between foreign funding and foreign exits. Next, we proceed to a multivariate regression framework to control for the observable selection involved in foreign investments. Finally, we apply an instrumental variable approach to analyze whether, apart from selection, a foreign investor treatment effect exists.

4.4.1 Bivariate Association

We start with descriptive evidence of the relationship between domestic, foreign, and U.S. investors and domestic, foreign, and U.S. exits.

Panel A in Table 4.3 shows frequencies of different exit types if we split the sample by investor origin. Foreign VCs are invested in companies with a higher frequency of exits, which is not surprising given that we have established that they invest in higher quality ventures. While the percentage of exits (IPO or acquisition) for domestically financed ventures is 29.4% in our sample, the frequencies are 43.9% for foreign-backed and even 47.5% for U.S.-backed European ventures. The differences in domestic exit rates are marginally significant: the percentage of domestic exits is 17.9% for domestically financed ventures, whereas it is 19.4% (19.7%) for foreign (U.S.)-backed ventures. Notably, this difference is driven by differences in domestic IPOs but not domestic acquisitions: while there is no significant difference in domestic acquisition frequency between domestic and foreign-backed ventures (14.7% vs. 13.9%, respectively), the percentage of domestic IPOs is significantly higher when foreign investors are involved (3.2% vs. 5.6%, respectively). With regard to foreign exits, descriptive statistics suggest that the foreign exit frequency is significantly higher among foreign-backed ventures. The share of foreign exits is 11.5% when domestically financed but 24.6% (27.8%) with at least one foreign (U.S.) investor. Furthermore, in contrast to domestic exits, the difference in foreign exits is both driven by differences in foreign acquisition rates (domestic-backed 11.3% vs. foreign-backed 22.6%) and foreign IPO rates (0.3% vs. 2.0%, respectively).

Reported equity valuations at acquisition or IPO exit also allow us to understand

Table 4.3: Investor Origin and Exit Locations – Bivariate

The table reports bivariate comparisons of different exit locations by investors' origin. Domestic, foreign, and U.S. exit indicate whether the venture was exited through either domestic, foreign, or U.S. IPO or through acquisition by a domestic, foreign, or U.S. buyer, respectively. The sample consists of 11,066 privately held European entrepreneurial companies that received VC funding between 2000 and 2013. Exits were followed up until end of 2019. The sample is split by VC investors' origin: Domestic refers to companies that did not involve any foreign investor, while Foreign and U.S. refer to companies that did involve at least one foreign investor/U.S. investor in their financing. The columns Test for difference show the Pearson's chi-square test results. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided), respectively.

Panel A: Exit rate

	Full sample		VC investor origin						Test for difference	
			Domestic		Foreign		U.S.			
	N	Mean	N	Mean	N	Mean	N	Mean	Domestic vs. foreign	Domestic vs. U.S.
Exit (IPO or acquisition)	3,890	34.2%	2,249	29.4%	1,641	43.9%	760	47.5%	236.40***	198.28***
Domestic exit	2,092	18.4%	1,368	17.9%	724	19.4%	315	19.7%	3.82***	2.95***
Domestic aquisition	1,644	14.4%	1,126	14.7%	518	13.9%	214	13.4%	1.44	1.89*
Domestic IPO	455	4.0%	247	3.2%	208	5.6%	101	6.3%	35.89***	34.85***
Foreign exit	1,800	15.8%	883	11.5%	917	24.6%	445	27.8%	319.55***	285.49***
Foreign acquisition	1,708	15.0%	863	11.3%	845	22.6%	398	24.9%	253.62***	208.17***
Foreign IPO	94	0.8%	20	0.3%	74	2.0%	48	3.0%	90.72***	136.14***
Therof: U.S. exit	810	7.1%	393	5.1%	417	11.2%	239	14.9%	138.17***	200.01***
U.S. acqusition	765	6.7%	386	5.0%	379	10.1%	207	12.9%	104.37***	137.63***
U.S. IPO	46	0.4%	7	0.1%	39	1.0%	33	2.1%	56.64***	119.51***
Obs.	11,386		7,652		3,734		1,599			

Panel B: Exit valuation

	N	Mean
Valuation at exit ($m)	1,535	244.0
Valuation at domestic exit ($m)	778	219.5
Valuation at foreign exit ($m)	748	270.9
Valuation at U.S. exit ($m)	345	381.6
Obs.	11,386	

the economic value that moves across borders. As shown in Panel B of Table 4.3, the total economic value of the subset of exited firms for which our database reports such valuations is USD 374 billion (1,535 exits * 244.0 mUSD average valuation / exit). The total value that undergoes a foreign exit is USD 203 billion, or 54%, with U.S. exits making up the largest share. Of all European startups first funded between 2000 and 2013, an economic value of USD 132 billion (or 35%) exited through U.S. acquisitions or U.S. IPOs. In our view, these numbers underscore that the role of VC as a facilitator of such mobility is a very relevant economic phenomenon to study.

4.4.2 Naïve Regression

The bivariate comparisons above suggest a relationship between foreign investors and foreign exits. However, these comparisons do not allow us to draw conclusions about what is actually driving the relationship. Is it the supply of foreign capital or other factors? For example, foreign investor preferences (e.g., industry, country, time) or the ex-ante venture quality differences established earlier could drive the bivariate link to foreign exits. Therefore, we turn to a more comprehensive regression setting to control for observable correlates of foreign investment.

The regression model ties the incidence of foreign/U.S. investors to venture exit outcomes Y_i:

$$Y_i = \alpha_1 + \beta_i ForInv_i + \gamma_1' \boldsymbol{X_i} + \rho_{C(i)} + \rho_{I(i)} + \rho_{t(i)} + \epsilon_{1i} \tag{4.1}$$

where unit of observation is the VC-backed company i. The variable $ForInv_i$ is the main variable of interest, namely the dummy variables indicating whether the venture is backed by foreign or U.S. investors. $\boldsymbol{X_i}$ is the vector of control variables, which includes total VC funding raised, serial entrepreneur, patent application stock, patent citations received, VC investment experience, VC firm age, and syndicate size. The model includes industry ($\rho_{I(i)}$), country ($\rho_{C(i)}$), and

year of first venture funding ($\rho_{t(i)}$) fixed effects. If any of the explanatory variables are of interval or ordinal scale, we use logarithms to minimize the effect of outliers.

Table 4.4 presents the estimation results of Equation (4.1) for the different types of company exits.[18] We find that foreign investor involvement correlates with a higher probability of foreign exit (Model 3) and a lower probability of domestic exit (Model 1), even if we control for observable venture and VC quality in a regression framework. The relationship between foreign investors and foreign exits is mainly driven by the significant relationship between foreign investors and foreign acquisitions (Model 4). In terms of economic size, foreign funding increases the likelihood of foreign acquisition by 6.2 percentage points (compared to other exit types, including non-exits). We detect the same pattern for European ventures backed by at least one investor from the U.S. The participation of U.S. investors in a venture's funding significantly increases the likelihood of all types of U.S. exits (Model 7), namely U.S. acquisition and U.S. IPO. Like foreign investors in general (Models 1-2), U.S. investors do not seem to increase the likelihood of non-U.S. exits (Models 5-6).

While the more comprehensive multivariate analysis confirms a correlation between foreign investors and foreign exits, we still cannot draw causal conclusions from Table 4.4. To identify whether foreign capital supply has a causal effect, we apply the instrumental variable (IV) approach described below.

4.4.3 Instrumental Variable

The question remains whether the observed relationship between foreign VC and foreign exits is causal. For example, would it be the same if foreign VC was randomly assigned to ventures? Considering the many public initiatives to promote the domestic supply of VC across the world, we find this to be a

[18] We obtain qualitatively and quantitatively similar results when we estimate logit, multinomial logit, or hazard models. However, we present linear probability models to allow for comparability with the later instrumental variable regressions.

Table 4.4: Investor Origin and Exit Locations – Naïve Regressions

The table shows ordinary least squares (OLS) regressions of exit locations on indicators of whether foreign (U.S.) investors were involved in the funding of the venture. The dependent variables are dummies indicating whether the venture exit happened through either domestic, foreign, U.S., or non-U.S. exit IPO and/or acquisition. The main variable of interest, Foreign (U.S.) investor, is an indicator variable equal to one if at least one foreign (U.S.) investor is involved in the venture. Venture controls include: Total VC amount raised ($m), serial entrepreneur, patent applications, and patent citations received. VC controls are: VCs' age, VCs' total cumulative number of portfolio companies, and number of VCs in the syndicate. All VC controls and Venture controls are measured as of the last observed VC funding round. All variables are defined in the Appendix. LN denotes the natural logarithm of a variable incremented by one. Fixed effects include the headquarters country of the venture, the industry, and the year of the first VC investment in the venture. Constants are included in all regressions. Robust standard errors clustered at the country level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided), respectively.

	Domestic		Foreign		Non-U.S.		U.S.	
	exit (IPO or acq.)	acq.	exit (IPO or acq.)	acq.	exit (IPO or acq.)	acq.	exit (IPO or acq.)	acq.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VC Investor Origin								
Foreign Investor	-0.007*	-0.011**	0.068***	0.062***				
	(0.004)	(0.004)	(0.009)	(0.010)				
U.S. Investor					0.000	-0.009	0.052***	0.040***
					(0.009)	(0.009)	(0.008)	(0.007)
VC Controls								
LN VCs' age	-0.005	-0.000	0.013**	0.012**	0.000	0.006	0.005	0.004
	(0.010)	(0.008)	(0.005)	(0.004)	(0.011)	(0.009)	(0.004)	(0.004)
LN VCs' total num. of portfolio companies	0.005	0.003	-0.005	-0.004	0.003	0.001	0.000	0.001
	(0.005)	(0.004)	(0.003)	(0.003)	(0.006)	(0.006)	(0.003)	(0.003)
Venture Controls								
LN Total VC amount raised	0.026***	0.014***	0.033***	0.028***	0.046***	0.032***	0.015***	0.012***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.003)	(0.003)
Serial entrepreneur	0.003	-0.022	0.029*	0.020	0.032	0.011	0.000	-0.011
	(0.026)	(0.015)	(0.014)	(0.013)	(0.029)	(0.019)	(0.013)	(0.009)
LN Syndicate size	-0.023**	-0.028***	-0.003	-0.008	-0.029**	-0.034***	0.007	0.003
	(0.010)	(0.010)	(0.009)	(0.009)	(0.011)	(0.007)	(0.007)	(0.007)
LN Patent applications	-0.010	-0.019	-0.008	-0.009	-0.001	-0.013	-0.018	-0.016
	(0.019)	(0.014)	(0.018)	(0.017)	(0.019)	(0.012)	(0.013)	(0.012)
LN Patent citations received	0.004	0.003	0.022**	0.024***	0.013	0.013	0.013**	0.015***
	(0.010)	(0.009)	(0.008)	(0.008)	(0.009)	(0.007)	(0.006)	(0.005)
Year, country & industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,386	11,386	11,386	11,386	11,386	11,386	11,386	11,386
R-squared	0.052	0.039	0.075	0.065	0.061	0.041	0.049	0.042

fundamental question. If foreign VCs just matched with ventures seeking a foreign exit irrespective of their investors' origin, we would observe the same empirical patterns laid out in Sections 4.4.1 and 4.4.2. In this case, governments' initiatives to increase domestic VC would not affect this relationship, and they would not affect the ultimate ownership of domestic ventures. However, suppose a causal effect exists between foreign VC backing and foreign exits. In that case, governments could influence the fate of startups without scaring away otherwise valuable foreign investors by increasing domestic VC supply.

4.4.3.1 Empirical Design

The ideal framework for identifying the causal effect of foreign VC would be a controlled experiment in which foreign VC is randomly assigned to startups. Since such an experiment is not feasible, the best available alternative to identify causal effects are exogenous shocks to the availability of foreign VC (i.e., relevance), but which themselves have no effect on startups (i.e., exclusion restriction). We argue that the inflow of capital into U.S. buyout funds during the financing phase of a European startup is one such exogenous shock, following Gompers and Lerner (2000), Nanda and Rhodes-Kropf (2013), and Schnitzer and Watzinger (2022). The approach exploits the fact that institutional investors who invest in VC typically allocate capital to "private equity" as a whole, which includes both leveraged buyouts and VC. This leads to a strong correlation between the fundraising of the two sub-asset classes buyout and VC, even though the two invest in fundamentally different assets.

The supply shocks to U.S. buyout funds are exogenous to the development of European startups for two main reasons. First, an institutional investor who has private information about the European startup market will invest directly in European VC and not in U.S. buyout funds. Second, the demand for U.S. buyout capital and venture capital for European startups will most likely not be correlated. Buyout firms acquire majority stakes in established companies

that generate revenues and cash flows. In contrast, VC firms make minority investments in young startups that develop and commercialize new technologies. In addition, there is the high geographical distance. Taken together, therefore, it is highly unlikely that the capital demand of target companies of U.S. buyout funds is correlated with that of European startup companies.

To be a relevant instrument in our setting, fundraising by U.S. buyout funds must not only be correlated with fundraising by U.S. VCs, but also lead to increased U.S. VC activity in Europe. Figure 4.2 graphically illustrates the relationship between U.S. VC activity in Europe and capital inflows into U.S. buyout funds. The solid line shows total capital inflows into U.S. buyout funds each year, by vintage, from the Refinitiv VentureXpert database.[19] The dashed line represents the percentage of companies that received funding from at least one U.S. VC, plotted over the time of their first VC funding. The correlation between the two charts is 0.44.

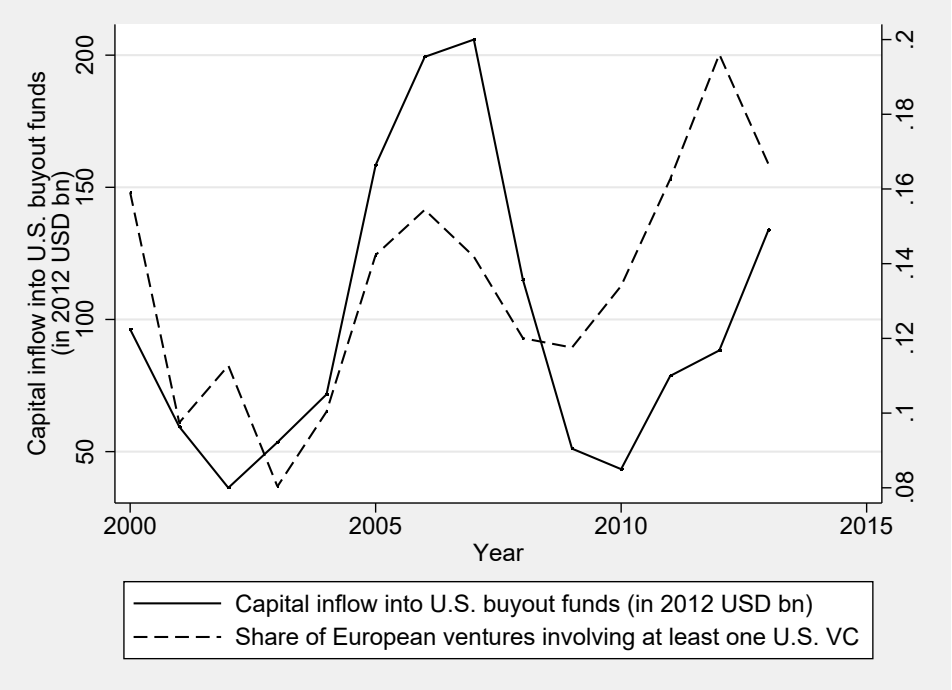
The question remains how to measure the capital inflow into foreign/U.S. buyout funds to which a venture in our sample was exposed. We construct this variable (i.e., instrument) as follows. We first define the time window in which a venture raised VC funding as the period between the first and last VC funding. We cap this period at a maximum of five years since there is a correlation between the length of the fundraising period and eventual success.[20] Then, we calculate the average annual inflow into foreign/U.S. buyout during this period. We define foreign as all countries except the home country of the venture. Using a flexible window capped at five years is somewhat arbitrary. One could use a fixed window of three years, for example. However, since most ventures raise only one round of funding, a flexible window with a cap provides the most accurate

[19] VentureXpert (formerly Thomson Reuters Venture Economics), along with Cambridge Associates and Preqin, is one of three commercial data sources on buyout funds, which are frequently used by practitioners and researchers alike. While none of them are complete, data from Harris et al. (2012) suggest that VentureXpert has the largest coverage in terms of fundraising data.

[20] Results are qualitatively and quantitatively similar if we do not cap and use the entire fundraising period.

Figure 4.2: Inflow into U.S. Buyout Funds and U.S. VC in Europe

The figure illustrates the sensitivity of the market share of U.S. VCs in Europe to capital inflows into U.S. buyout funds. The sample consists of 11,066 ventures from 17 European countries that received VC financing between 2000 and 2013, and for which at least one actual VC investment amount is available. Of the 11,066 ventures, 1,599 received financing by at least one U.S. VC. The dashed line is the fraction of ventures that received financing by at least one U.S. VC, plotted over the time of their first VC funding. The solid line is the total capital inflow into U.S. buyout funds in each year, by vintage years, drawn from the Thomson Venture Economics database. The correlation of the two plots is 0.44.



estimate of actual exposure to fundraising conditions while limiting the impact of fundraising length.

To implement our instrumental variable approach, we estimate the following first-stage regression:

$$ForInv_i = \alpha_2 + \beta_2 ForeignBuyoutInflow_i + \gamma_2' \boldsymbol{X_i^{First}} + \rho_{C(i)} + \rho_{I(i)} + P_{t(i)} + \epsilon_{2i} \quad (4.2)$$

where $ForeignBuyoutInflow_i$ is the instrumental variable. The other variables

are defined as before in the naïve regression model (Equation (4.1)), with two exceptions. First, we use non-overlapping period fixed effects P_i to control for time because our instrument does not allow year fixed effects.[21] Second, we use the same VC controls and venture controls as before (i.e., VC funding raised, serial entrepreneur, patent application stock, patent citations received, VC investment experience, VC firm age, and syndicate size), albeit measured at the moment of first funding. The reason is that all time-varying VC and venture controls may be endogenously affected by foreign/U.S. VC, so that, if included, they would capture effects that should be attributed to the instrument.

The second stage estimates the effect of foreign (U.S.) investors on venture exit outcomes Y_i:

$$Y_i = \alpha_3 + \beta_3 \widehat{ForInv_i} + + \gamma_3' \boldsymbol{X_i^{First}} + \rho_{C(i)} + \rho_{I(i)} + P_{t(i)} + \epsilon_{3i} \tag{4.3}$$

where $\widehat{ForInv_i}$ are predicted values from Equation (4.2) using two-stage least squares (2SLS). If the conditions for a valid instrument are met, β_3 measures the causal effect of foreign/U.S. investors on venture exit outcomes.

4.4.3.2 Instrument Relevance

To be valid, our instrument must strongly affect foreign/U.S. VC involvement in Europe. This is likely because there is an empirical correlation between capital inflows into buyout and venture funds (Schnitzer and Watzinger, 2022). As a consequence, more available capital to foreign/U.S. VC funds should (also) affect their investment activity in Europe.

The first-stage results, presented in Table 4.5, estimate the effect of capital inflows into foreign/U.S. buyout funds during the VC fundraising period of the venture on foreign/U.S. VC involvement in European ventures. The dependent variable is a dummy indicating whether a foreign/U.S. VC invested in the ven-

[21] The three periods are 2000-2004, 2005-2008, and 2009-2013. Results are robust to splitting the sample years into between one and five periods and using different period limits.

ture. In column (1)/(5), we find that the coefficient for capital inflows into foreign/U.S. buyout funds is 0.107/0.062 and significant at the 1% level. In other words, 2.7 times (exp(1)) higher capital inflow into U.S. buyout translates into a 6-percentage-point higher likelihood of receiving U.S. VC for European ventures. This is consistent with the graphical evidence of Figure 4.2: from 2003 to 2006, capital inflow to U.S. buyout increased from approx. USD 60 to 200 billion (3.3 times), while U.S VC participation in European ventures increased from approx. 8% to 15% (7% increase). Moreover, the F-statistic on excluding instruments is well above the conventional threshold of 10, suggesting no signs of weak instruments (e.g., Stock and Yogo (2005)).

One might be concerned that the instrument captures general booms in private equity, including domestic VC fundraising. In columns (2) and (6), we add a control variable for the capital inflow into domestic VC funds during the venture's fundraising period (hereafter 'Domestic VC inflow'). The foreign/U.S. buyout coefficient hardly changes and remains highly statistically significant, suggesting that the instrument is almost orthogonal to domestic VC inflows. In columns (3) and (7), we use a fixed three-year window to measure the capital inflow exposure. The coefficient remains significant at the 1% level, but the magnitude is somewhat lower. In columns (4) and (8), we use the inflow in the venture's first VC year only. Coefficients remain qualitatively similar but lose their significance in column (8).

Overall, the first-stage results show that capital inflows into foreign/U.S. buyout funds substantially affect foreign/U.S. VC investment activity in Europe. Moreover, the effect seems to be orthogonal to domestic VC fundraising.

4.4.3.3 The Exclusion Restriction

The exclusion restriction requires that foreign/U.S. buyout fundraising does not affect European venture outcomes through any channel other than foreign/U.S. VC investment. Gompers and Lerner (2000) and Nanda and Rhodes-Kropf (2013) have previously used the inflow into U.S. buyout funds as instrument for inflow

Table 4.5: First Stage

The table presents the first-stage estimates of the instrumental variable analysis. The dependent variable is a dummy variable equal to one if a foreign VC (Models 1-4) or U.S. VC (models 5-8) invested in the venture, and zero otherwise. In columns (1) to (2) and (5) and (6), the instrument is the average annual capital inflow into foreign/U.S. buyout funds during the VC funding period of the venture. The 'VC funding period' is the period between the first and last VC funding of the venture. 'Foreign' includes all countries except the headquarters country of the venture. In columns (3) and (7), average capital inflows in foreign/U.S. buyout funds are averages during the first 3 years starting from the year of the first VC funding of the venture. Columns (4) and (8) use the capital inflow into foreign/U.S. buyout funds in the year of the first VC funding of the venture only. Venture controls include: VC amount raised ($m), serial entrepreneur, patent applications, and patent citations received. VC controls are: VCs' age, VCs' total cumulative number of portfolio companies, and number of VCs in the syndicate. All VC controls and Venture controls are measured as of the *first* VC funding round. Control variables of ordinal and interval scale are included in logs. All variables are defined in the Appendix. LN denotes the natural logarithm of a variable incremented by one. Fixed effects include dummies for the headquarters country of the venture, the industry, and non-overlapping 4-year periods for the year of first VC investment in the venture. The model is estimated using OLS, and robust standard errors clustered at the country level are shown in parentheses. IV F-Stat refers to the F-statistic on excluded instruments. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided), respectively.

Dependent variable	Foreign VC invested in venture				U.S. VC invested in venture			
Instrument	During VC funding period	During VC funding period	During first 3 years	In first VC year	During VC funding period	During VC funding period	During first 3 years	In first VC year
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LN Average capital inflow into foreign buyout funds	0.101***	0.113***	0.053***	0.042**				
	(0.020)	(0.018)	(0.017)	(0.015)				
LN Average capital inflow into U.S. buyout funds					0.058***	0.059***	0.027**	0.020
					(0.007)	(0.007)	(0.010)	(0.013)
LN Average capital inflow into domestic VC funds		-0.036*	-0.041**	-0.030**		-0.003	-0.009	-0.007
		(0.020)	(0.018)	(0.014)		(0.009)	(0.008)	(0.006)
Observations	11,386	11,386	11,386	11,386	11,386	11,386	11,386	11,386
R-squared	0.153	0.154	0.149	0.149	0.115	0.115	0.111	0.111
VC controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Venture controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period, country & industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IV F-stat	25.13	39.57	9.359	7.656	66.63	82.37	6.855	2.328

into U.S. VC. In that sense, our exclusion restriction is even stronger because it only requires U.S. buyout fundraising to be independent of investment opportunities among European startups. However, to alleviate remaining concerns about the exclusion restriction, we take additional steps:

(1) *Comparison of observables:* We investigate whether there are significant differences between ventures experiencing periods of high inflows in U.S. buyout relative to low inflows. We split the entire sample into the bottom 50% (25%) in terms of their assigned instrument. Table 4.6 presents the differences in venture and VC characteristics as of the first VC round. Both groups are not systematically different in terms of amount raised, pre-money valuation, number of patents, and equipment with serial entrepreneurs. However, two differences emerge. First, ventures vary considerably in the likelihood of receiving U.S. VC, which is precisely our first-stage hypothesis. Second, and not surprisingly given that U.S. VCs are among the most experienced, the average VC experience increases in Europe during in periods of high U.S. fundraising.

(2) *Placebo test:* Panel A of Table 4.7 presents the reduced form result showing that capital inflow to foreign/U.S. buyout funds during VC fundraising correlate with foreign exit types but not domestic ones. If the exclusion restriction were violated, capital inflow to foreign/U.S. buyout funds would affect European ventures other than through investment by foreign/U.S. VCs. If such a channel exists, it should also be at work after the fundraising phase, when venture ownership is fixed. To test this possibility, we regress venture exit locations on the capital inflow into foreign/U.S. buyout funds in the two years after the venture's last fundraising. Using this as a placebo test, Panel B shows that capital inflow to foreign/U.S. buyout funds after fundraising does not correlate with any exit location type. These findings are consistent with the idea that capital inflow to foreign/U.S. buyout funds

only affects European ventures through foreign/U.S. VC investment in those ventures.

Table 4.6: Capital Inflow into U.S. Buyout Funds and Venture Characteristics

The table presents mean characteristics of ventures that raise VC funding during periods of high average annual capital inflow into U.S. buyout funds and ventures during times of low inflow. Bottom 50%/25% refers to all ventures that experience the 50%/25% lowest capital inflows into U.S. buyout funds during their VC funding period, and Top 50%/75% refers to the remaining firms. All variables are defined in the Appendix. All columns present means except for the column "Difference test" showing t-stats of a t-test for equality of means. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided), respectively.

	Capital inflow into U.S. buyout funds					
	Bottom 50%	Top 50%	Difference test	Bottom 25%	Top 75%	Difference test
	Mean	Mean	(t stat)	Mean	Mean	(t stat)
Venture characteristics						
First round: Amount raised (USD m)	9.97	10.09	-0.07	9.30	10.27	-0.46
First round: Pre-money valuation (USD m)	24.69	24.88	-0.02	15.98	28.81	-1.33
First round: Serial entrepreneur	0.03	0.05	-1.70*	0.02	0.04	-1.51
First round: Syndicate size	1.82	1.86	-1.41	1.76	1.86	-2.82***
First round: Patent applications	0.32	0.36	-0.99	0.31	0.35	-0.98
First round: Patent citations	3.14	4.31	-1.88*	3.59	3.82	-0.31
VC characteristics						
First round: VCs' Age	6.44	6.90	-3.93***	6.17	6.85	-4.90***
First round: VCs' cumulative number of portfolio companies	65.81	73.63	-2.99***	66.51	71.06	-1.47
First round: Foreign investor	0.22	0.24	-2.64***	0.19	0.24	-5.10***
First round: U.S. investor	0.07	0.09	-3.75***	0.06	0.09	-5.29***
Average annual capital inflows, during VC funding period, into:						
U.S. buyout funds	65.62	130.70	-126.74***	51.75	115.20	-86.84***
Foreign buyout funds	103.10	193.20	-112.25***	82.39	172.30	-82.40***
Domestic VC funds	1.81	2.47	-18.43***	1.60	2.33	-17.09***
Obs.	5,274	6,112		2,634	8,752	

4.4.3.4 Results

Table 4.8 presents our IV regression results with domestic, foreign, U.S., and non-U.S. exits as dependent variables.[22] We note that accounting for potential

[22]We present simple 2SLS results for a linear probability model in both stages, since such an approach generally provides good approximations of the average partial effect (Wooldridge, 2010). However, results are robust to applying bivariate probit models which may, on the one hand, account for binary responses, but on the other hand introduce nonlinearity that could identify parameter estimates rather than actual data (e.g., Altonji et al. (2005)).

Table 4.7: Placebo Test

The table presents a placebo test to evaluate the validity of the exclusion restriction of the instrumental variable. The dependent variables are dummies indicating whether the venture exit happened through either domestic, foreign, U.S., or non-U.S. exit IPO and/or acquisition. Panel A presents the results of the reduced form, i.e. regressing the venture outcomes on the instrumental variable directly. The instrument is the average annual capital inflow into foreign (models 1-4) or U.S. (models 5-8) buyout funds during the VC funding period of the venture. The 'VC funding period' is the period between the first and last VC funding of the venture. 'Foreign' includes all countries except the headquarters country of the venture. Panel B presents the results of the placebo test, in which the instrument is the average annual capital inflow into foreign/U.S. buyout funds in the two years after the VC funding period of the venture. Control variables and fixed effects are the same as in Table 4.5. The model is estimated using OLS, and robust standard errors clustered at the country level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided), respectively.

	Domestic		Foreign		Non-U.S.		U.S.	
	exit (IPO or acq.)	acq.	exit (IPO or acq.)	acq.	exit (IPO or acq.)	acq.	exit (IPO or acq.)	acq.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Reduced from								
LN Average capital inflow into foreign buyout funds	-0.014	-0.010	0.030***	0.029***				
	(0.011)	(0.010)	(0.010)	(0.010)				
LN Average capital inflow into U.S. buyout funds					-0.001	0.001	0.017***	0.014**
					(0.011)	(0.011)	(0.006)	(0.006)
LN Average capital inflow into domestic VC funds	-0.030***	-0.017**	-0.052***	-0.048***	-0.059***	-0.043***	-0.024***	-0.022***
	(0.009)	(0.008)	(0.008)	(0.008)	(0.010)	(0.009)	(0.005)	(0.005)
VC Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Venture controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period, country & industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11386	11386	11386	11386	11386	11386	11386	11386
R-squared	0.050	0.037	0.055	0.049	0.057	0.040	0.035	0.032
Panel B: Placebo test								
LN Average capital inflow into foreign buyout funds 2 years after last funding	-0.024	-0.011	-0.006	-0.006				
	(0.031)	(0.028)	(0.030)	(0.030)				
LN Average capital inflow into U.S. buyout funds 2 years after last funding					-0.043	-0.028	0.000	0.001
					(0.031)	(0.029)	(0.020)	(0.019)
LN Average capital inflow into domestic VC funds	-0.033***	-0.019**	-0.046***	-0.042***	-0.058***	-0.042***	-0.020***	-0.019***
	(0.008)	(0.008)	(0.008)	(0.007)	(0.010)	(0.009)	(0.005)	(0.005)
VC Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Venture controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period, country & industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11386	11386	11386	11386	11386	11386	11386	11386
R-squared	0.050	0.037	0.055	0.048	0.057	0.040	0.034	0.032

endogeneity does not change our previously established results much. The second stage results reveal a highly significant causal effect of foreign investors on foreign exits (Model 3). This effect is mainly driven by the causal relationship between foreign VCs and foreign acquisitions (Model 4).[23] The coefficient suggests that foreign VC involvement increases the likelihood of foreign acquisition by 25.3 percentage points. As with foreign investors, there is a causal relationship between U.S. VCs and U.S. exits (Model 7). Again, the relationship is mainly driven by an 24.2 percentage-point increase in the venture's likelihood to be sold to a U.S. buyer if a U.S. VC is involved (Model 8). The coefficients increase compared to the naïve regressions, indicating a downward bias in the OLS estimates. The negative bias is probably because foreign VC involvement in itself likely affects our startup quality proxies (e.g., total funding). If so, the OLS coefficients of these affected control variables assume effects that are actually attributable to foreign investors – which is then reversed in the IV estimates.

Our results suggest that foreign and U.S. VCs do causally increase the likelihood of foreign and U.S. exits but not domestic exits. From a business perspective, this finding details one mechanism of how foreign VCs achieve the higher likelihood of exit, which prior studies have documented (e.g., Dai et al. (2012); Humphery-Jenner and Suchard (2013a); Cumming et al. (2016)). From a policy perspective, this result indicates that increased domestic VC should decrease venture sales to foreign owners.

In conclusion, the estimates suggest a positive causal effect of foreign VC funding on foreign exits, mainly driven by the causal effect on foreign acquisitions.

4.4.3.5 Robustness

Humphery-Jenner and Suchard (2013b) suggest another instrument to deal with the endogeneity of foreign VC. They use the local market share of foreign VCs

[23] We do not report the effect of foreign (U.S.) VC on foreign (U.S.) IPOs (they are also significantly positive), because foreign IPOs do not imply the sale of the venture to a single foreign owner like foreign acquisitions.

Table 4.8: Investor Origin and Exit Locations - Instrumental Variable

The table reports the effect of foreign (U.S.) VC investors on venture exit locations. The dependent variables are dummies indicating whether the venture exit happened through either domestic, foreign, U.S., or non-U.S. exit IPO and/or acquisition. The main variable of interest, Foreign (U.S.) investor, is an indicator variable equal to one if at least one foreign (U.S.) investor is involved in the venture. The involvement of foreign (U.S.) investors is instrumented by the average annual capital inflow into foreign/U.S. buyout funds during the VC funding period of the venture. The 'VC funding period' is the period between the first and last VC funding of the venture. Control variables and fixed effects are the same as in Table 4.5. The model is estimated using 2SLS, and roubst standard errors clustered at the country level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided), respectively.

	Domestic		Foreign		Non-U.S.		U.S.	
	exit (IPO or acq.)	acq.	exit (IPO or acq.)	acq.	exit (IPO or acq.)	acq.	exit (IPO or acq.)	acq.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Foreign investor [instrumented]	-0.126	-0.089	0.269***	0.253***				
	(0.097)	(0.090)	(0.089)	(0.088)				
U.S. investor [instrumented]					-0.018	0.020	0.283***	0.242***
					(0.429)	(0.338)	(0.093)	(0.080)
VC Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Venture controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Domestic VC inflow	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period, country & industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11386	11386	11386	11386	11386	11386	11386	11386
R-squared	0.027	0.028	0.026	0.017	0.056	0.040	.	.

as instrumental variable for the foreign VC dummy variable. The key intuition is that investors' actual selection may be endogenous, but the local availability of foreign investors is exogenous to the individual venture. Theoretically, once the matching took place, the local availability of foreign VC should no longer affect the individual venture's exit outcome.

We use this 'local market share' approach as a robustness check. To proxy the local market share of foreign investors that one venture was exposed to, we first define the time window in which each venture was active on the venture capital market as all years between its first and last VC financing. Then, we calculate the average market share of foreign (U.S.) investors, defined as the number of deals with at least one foreign (U.S.) investor divided by all deals (excluding all rounds to the focal venture) over all country-industry-year combinations during which a venture was active. Finally, we estimate the same instrumental variable models as

before, except that we use the market share of foreign (U.S.) VCs' as an instrument. The results remain qualitatively similar: foreign VCs appear to facilitate foreign exits, while domestic exits remain unaffected (see Table C. 4 in the Appendix).

However, we note that the 'market share approach' is not our preferred one. If foreign VCs select the most attractive markets, that is, markets with the highest quality ventures and entrepreneurs (which is likely, see Section 4.3), it is possible that the unobserved quality of ventures in a location is correlated with foreign VC presence. Hence, unless we can fully control for venture quality, regressions using the local market share as instrument will not establish a causal relationship between foreign VC and foreign exits.

4.5 Foreign VC Activity and Implications for Entrepreneur Emigration

Another central question of this paper is whether foreign VC involvement leads to a consistent and long-lasting emigration of entrepreneurs out of their home countries. To assess the effect of foreign funding on entrepreneur emigration, we apply the same set of tests as before, which we describe in this section. The only difference is that instead of venture exits, we use entrepreneur emigration variables as dependent variables and switch the observation level to the entrepreneur.

To the best of our knowledge, we are the first to document the international emigration of VC-backed entrepreneurs. Therefore, we first provide descriptive statistics on the phenomenon. To quantify the magnitude of the emigration, we count the number of entrepreneurs moving to foreign countries (the U.S.) in the long run, i.e., working primarily abroad (in the U.S.) six years after the last financing event of their initial venture. Results suggest that 13.1% (1,014 of 7,770) of entrepreneurs work abroad six years after their initial venture, and 5.6% (433 of 7,770) work in the U.S. (Table 4.9). From a European perspective, the former might be a measure of European integration, while emigration to the U.S.

gives an indication of the actual size of the drain out of Europe. In any case, the U.S. are the entrepreneurs' major target country hosting 43% (433 of 1,014) of all long-term emigrating European entrepreneurs. The advantage of this long-run perspective is that we may compare these numbers with general emigration patterns of people with tertiary education, a phenomenon commonly referred to as 'brain drain'. Worldwide, about 5.3% of people with tertiary education, i.e., those with a degree above high school, worked outside their birth country in 2010, according to Brücker et al. (2013). Also, general brain drain rates differ greatly across the 17 countries in our sample: while only 0.4% of all Russian citizens with tertiary education worked abroad in 2010, a notable 16.7% of UK citizens did so (Brücker et al., 2013). Overall, even if the emigration rates that we document among VC-backed entrepreneurs seem relatively high (~13% in the long run), they are in the ballpark of emigration rates of people with tertiary education.

Furthermore, our data allow us to compare emigrating entrepreneurs with those remaining in their initial ecosystem (Table 4.10). The comparison reveals that European entrepreneurs emigrating in the long term are a positive selection of entrepreneurs: have gained more experience pre-venture, and they founded ventures that raise more total VC. Moreover, emigrating entrepreneurs are more likely to become VC-backed founders again after-venture. These differences are all statistically significant and, by and large, similar when comparing entrepreneurs leaving for the U.S. with those staying home.

In the following, we analyze whether foreign funding has an impact on the documented entrepreneur emigration. To do so, we apply the same set of tests as in Section 4.4 with the main difference that we use entrepreneur emigration dummies as dependent variables.

4.5.1 Bivariate Association

Table 4.9 presents the results of bivariate comparisons of emigration variables by investor origin. At all points in time after the last financing, a statistically

Table 4.9: Investor Origin and Entrepreneurial Migration - Bivariate

The table reports summary statistics for 10,015 VC-backed entrepreneurs (founders & CEOs) of European ventures receiving first VC between 2000 and 2013, and for which the primary work location could be identified 1 year after the last financing event. The sample is split by the location where an entrepreneur primarily worked one years after the last financing event: *Home* refers to entrepreneurs who still worked in the country of their initial venture; *Abroad* refers to entrepreneurs who primarily worked outside the country in which their initial venture was located; *U.S.* includes entrepreneurs who primarily worked in the U.S. An entrepreneur is defined to work primarily abroad (in the U.S.) only if all executive positions are located abroad (in the U.S.), i.e. disregarding all non-executive, board, and advisory roles. All variables are defined in the Appendix. The Test for difference columns show the t-statistics of t-tests for equality of means. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided), respectively.

		All	VC investor origin			Test for difference	
			Domestic	Foreign	U.S.	Domestic vs. foreign	Domestic vs. U.S.
Primary work location 1 year after last financing	N	10,015	5,691	4,324	2,054		
Abroad	Mean	10.6 %	6.6%	15.9 %	17.3 %	221.14***	200.36***
Therof: U.S.	Mean	5.1%	3.3%	7.5%	9.2%	91.57***	115.32***
Primary work location 3 years after last financing	N	9,659	5,523	4,136	1,943		
Abroad	Mean	12.6 %	8.2%	18.5 %	20.4 %	227.36***	210.69***
Therof: U.S.	Mean	5.7%	3.8%	8.2%	10.1 %	86.82***	112.88***
Primary work location 6 years after last financing	N	7,770	4,700	3,070	1,368		
Abroad	Mean	13.1 %	8.7%	19.7 %	21.0 %	198.19***	157.29***
Therof: U.S.	Mean	5.6%	3.8%	8.3%	10.2 %	72.07***	88.68***

significant higher proportion of entrepreneurs works outside the country of the initial venture if that venture had at least one foreign investor. One year after the venture, 6.6% of domestic VC-backed entrepreneurs work primarily abroad, while 15.9% of entrepreneurs backed by at least one foreign VC move abroad. Notably, emigration rates do not decline but persist over time: 8.7% of domestic VC-backed entrepreneurs work abroad six years after venture, with the rate among foreign VC-backed entrepreneurs increasing to 19.7%. Therefore, once left, entrepreneurs remain for longer terms. The same patterns hold for U.S. VC-backing and entrepreneur emigration to the U.S.: Only 3.3% (3.8%) of entrepreneurs with domestic backing work primarily in the U.S. one (six) years after

Table 4.10: Entrepreneurial Migration - Descriptive Statistics

The table reports summary statistics for 10,015 VC-backed entrepreneurs (founders & CEOs) of European ventures receiving first VC between 2000 and 2013, and for which the primary work location could be identified 1 year after the last financing event. The sample is split by the location where an entrepreneur primarily worked one years after the last financing event: *Home* refers to entrepreneurs who still worked in the country of their initial venture; *Abroad* refers to entrepreneurs who primarily worked outside the country in which their initial venture was located; *U.S.* includes entrepreneurs who primarily worked in the U.S. An entrepreneur is defined to work primarily abroad (in the U.S.) only if all executive positions are located abroad (in the U.S.), i.e. disregarding all non-executive, board, and advisory roles. All variables are defined in the Appendix. The Test for difference columns show the t-statistics of t-tests for equality of means. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided), respectively.

	Entrepreneur's primary work location 1 year after last funding			Test for difference (t stat)	
	Home	Abroad	U.S.	Home vs.	Home vs.
	Mean	Mean	Mean	Abroad	U.S.
Venture characteristics					
Total VC amount raised (USD m)	16.21	34.00	30.11	-5.64***	-4.07***
Serial entrepreneur	0.05	0.06	0.07	-1.70*	-1.41
Patent applications	1.01	1.31	1.25	-1.90*	-1.01
Patent citations received	10.34	19.44	18.06	-2.54**	-1.46
Foreign investor	0.41	0.65	0.64	-15.35***	-10.47***
U.S. investor	0.19	0.33	0.37	-9.58***	-8.27***
Exit characteristics					
Foreign exit	0.27	0.51	0.57	-15.41***	-13.32***
U.S. exit	0.12	0.27	0.37	-10.46***	-11.29***
Valuation at exit (USD m)	199.10	378.50	361.20	-1.93*	-1.12
Entrepreneur characteristics					
Number jobs pre-venture	2.96	3.38	3.31	-4.73***	-3.06***
Years experience pre-venture	10.19	10.79	10.32	-2.13**	-0.35
Past VC-backed founder	0.02	0.03	0.04	-1.02	-1.70*
PhD	0.15	0.13	0.14	1.91*	0.74
MBA	0.14	0.20	0.22	-4.28***	-3.95***
Entrepreneurs' occupation after focal venture					
Founder at another VC-backed startup	0.11	0.18	0.21	-5.81***	-5.32***
Founder at foreign startup	0.03	0.15	0.17	-10.76***	-8.35***
Founder at U.S. startup	0.02	0.08	0.15	-7.72***	-8.31***
Obs.	8,952	1,063	511		

venture. In contrast, when at least one U.S. investor is involved in the financing, 9.2% of entrepreneurs backed by U.S. VCs work in the U.S. one year after venture and 10.2% six years after.

4.5.2 Naïve Regression

To test whether the positive association between foreign (U.S.) funding and emigration abroad (to the U.S.) holds when we control for other observable factors that might drive the relationship, we move on to a more comprehensive regression setting.

Table 4.11 presents naïve regression results. Even when controlling for the observable quality of the venture, including total funding received, foreign VC funding appears to significantly drive entrepreneur emigration to foreign countries (Model 1). The effect is also long-term, as foreign investor involvement correlates with emigration to foreign countries both immediately after the last financing event and up to six years after (Models 2-3). Looking at U.S. VC (Panel B), the relationship also persists over time: U.S. VC correlates with entrepreneur emigration to the U.S. across all measured periods (Models 7-9). In terms of magnitude, foreign (U.S.) VC investors in European ventures appear to increase the likelihood of entrepreneur emigration abroad (to the U.S.) by about 7.0 percentage points (3.6 percentage points) one year after the last financing. The effects of foreign (U.S.) VC persist at about the same level six years after (8.0 percentage points and 3.3 percentage points, respectively).

Next, we ask whether the correlation between foreign VC and emigration abroad is driven by the effect on foreign exits that we established earlier. We find that the effects decrease but remain statistically significant when controlling for foreign (U.S.) exits, which, as we established earlier, is in part caused by foreign VCs (Models 4-6 and 10-12). The effect of foreign/U.S. exits is interesting in its own right. The coefficients suggests that foreign/U.S. exits increase the likelihood of entrepreneurs emigrating by about eight percentage points in one and three

Table 4.11: Investor Origin and Entrepreneurial Migration - Naïve Regressions

The table shows OLS regressions where the dependent variables are dummy variables indicating whether an entrepreneur primarily worked abroad (Panel A) or in the U.S. (Panel B) one, three, and six years after the last financing event. The sample consists of 10,015 VC-backed entrepreneurs (founders & CEOs) of European ventures receiving first VC between 2000 and 2013. The unit of observation is the entrepreneur. The main variable of interest, Foreign (U.S.) investor, is an indicator variable equal to one if at least one foreign (U.S.) investor is involved in the venture. Control variables and fixed effects are the same as in Table 4.4. Robust standard errors clustered at the country level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided), respectively.

Panel A: Migration abroad

Dependent variable:	Entrepreneur abroad t years after last financing					
	t = 1	t = 3	t = 6	t = 1	t = 3	t = 6
	(1)	(2)	(3)	(4)	(5)	(6)
Foreign Investor	0.070***	0.075***	0.080***	0.064***	0.069***	0.077***
	(0.012)	(0.011)	(0.008)	(0.012)	(0.011)	(0.008)
Foreign exit				0.083***	0.076***	0.051***
				(0.008)	(0.008)	(0.009)
VC Controls	Yes	Yes	Yes	Yes	Yes	Yes
Venture controls	Yes	Yes	Yes	Yes	Yes	Yes
Year, country & industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10015	9659	7770	10015	9659	7770
R-squared	0.046	0.047	0.043	0.060	0.056	0.047

Panel B: Migration to the U.S.

Dependent variable:	Entrepreneur in U.S. t years after last financing					
	t = 1	t = 3	t = 6	t = 1	t = 3	t = 6
	(7)	(8)	(9)	(10)	(11)	(12)
U.S. Investor	0.036***	0.037***	0.033***	0.031***	0.034***	0.030***
	(0.010)	(0.009)	(0.008)	(0.009)	(0.008)	(0.008)
U.S. exit				0.081***	0.077***	0.061***
				(0.011)	(0.008)	(0.009)
VC Controls	Yes	Yes	Yes	Yes	Yes	Yes
Venture controls	Yes	Yes	Yes	Yes	Yes	Yes
Year, country & industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10015	9659	7770	10015	9659	7770
R-squared	0.025	0.026	0.025	0.040	0.038	0.032

years after venture. After six years, the effect of foreign (U.S.) exits persists, albeit smaller in magnitude at 5.1% (6.1%). This pattern is consistent with earn-out provisions often included in acquisitions, which might encourage entrepreneurs to move to the mother company up to the first three years after exit. However, foreign and U.S. exits seem to have a long-lasting impact on individual emigration decisions even six years after exit, which is the longest period we measured.

Overall, naïve regressions suggest that foreign (U.S.) VC investors have a long-term effect on entrepreneur emigration (to the U.S.) even if we control for foreign (U.S.) exits and venture quality. Early emigration is easier to explain because transitioning the startup (or parts thereof) might be a condition of the VC or exit deal; later emigration as measured long after the venture exits is less obvious. We note that the longevity of the effect is consistent with the importance of network ties in venture capital financing (e.g., Hochberg et al. (2007); Hsu (2007)). It is plausible that entrepreneurs stay abroad to remain close to their (new) network, e.g., to increase odds of future funding (Hsu, 2007)). In fact, one in five emigrants to the U.S. in our sample founded another VC-backed startup in the U.S., which explains their motivation to stay in there (Table 4.10). However, four in five emigrants seem to follow a different path, e.g., becoming employees or investors or starting a new project that had not (yet) raised VC. Therefore, further research is required to gain more insights into the motivation behind entrepreneur emigration.

4.5.3 Instrumental Variable

As with foreign exits, we cannot draw causal conclusions from Table 4.11 as there might be unobserved factors driving the established relationships. To identify whether foreign and U.S. investors cause European entrepreneurs to emigrate abroad and to the U.S., we apply the same instrumental variable approach as presented in Section 4.4.3.

Table 4.12 presents the relationship between foreign investors and entrepreneur emigration when the presence of foreign investors is instrumented by shocks to

foreign capital supply. Like with foreign exits, first-stage results suggest that capital inflow into foreign buyout funds increases the likelihood of foreign VC investors participating in ventures (Model 1). At 46, the F-statistic on excluded instruments is well above the conventional threshold of 10, indicating no concerns with weak instruments. Finally, when correcting for the endogenous selection involved in foreign investment, we find a positive effects of foreign investors on entrepreneur emigration (Models 2-7).

As in the naïve regressions, the coefficient again persists from the first to the sixth year after the venture, suggesting that foreign capital has a lasting effect on entrepreneur emigration. However, for longer time periods after venture and U.S. VC, the coefficients are also positive but lose their statistical significance. We deem this a matter of statistical power given the comparably lower observations and incidence rates. Lastly, including foreign (U.S.) exits (Models 5-7 and 12-14) explains away a sizable part of the effect, giving hints about the mechanism at play. This results suggests that foreign exits are one major, mechanism of how foreign VC induces entrepreneur emigration.

In conclusion, we find a causal relationship between foreign (U.S.) VC capital supply and the emigration patterns of VC-backed entrepreneurs. Specifically, we find that foreign VC supply causally increases the likelihood of entrepreneurs leaving their home countries. Notably, this result implies that higher availability of domestic VC would decrease the drain of successful entrepreneurs out of their home countries, which is an important finding for policymakers.

4.6 Conclusion

Although the venture capital model originates in the U.S., it has become a relevant yet comparably small element of European innovation. No one doubts the potential of VC to promote economic growth. Still, many in Europe have argued that foreign VC firms fund the best ventures and that, as a consequence, many

Table 4.12: Investor Origin and Entrepreneurial Migration - Instrumental Variable

The table shows two-stage least squares (2SLS) regressions where the dependent variables are dummy variables indicating whether an entrepreneur primarily worked abroad (Panel A) or in the U.S. (Panel B) one, three, and six years after the last financing event. The main variable of interest, Foreign (U.S.) investor, is an indicator variable equal to one if at least one foreign (U.S.) investor is involved in the venture. The involvement of foreign (U.S.) investors is instrumented by the average annual capital inflow into foreign/U.S. buyout funds during the VC funding period of the venture. Control variables and fixed effects are the same as in Table 4.5. Robust standard errors clustered at the country level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided), respectively.

Panel A: Migration abroad

Dependent variable:	Foreign investor	Entrepreneur abroad t years after last financing					
	1st stage	t = 1 2SLS	t = 3 2SLS	t = 6 2SLS	t = 1 2SLS	t = 3 2SLS	t = 6 2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LN Average capital inflow into foreign buyout funds	0.127***						
	(0.019)						
Foreign Investor		0.162***	0.089	0.104	0.105**	0.037	0.067
		(0.043)	(0.058)	(0.097)	(0.048)	(0.070)	(0.109)
Foreign exit					0.082***	0.092***	0.065***
					(0.013)	(0.014)	(0.020)
VC Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Venture controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Domestic VC inflow	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period, country & industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10015	10015	9659	7770	10015	9659	7770
R-squared	0.044	0.027	0.039	0.034	0.053	0.046	0.037
IV F-stat	46.27						

Panel B: Migration to the U.S.

Dependent variable:	US investor	Entrepreneur in U.S. t years after last financing					
	1st stage	t = 1 2SLS	t = 3 2SLS	t = 6 2SLS	t = 1 2SLS	t = 3 2SLS	t = 6 2SLS
	(8)	(9)	(10)	(11)	(12)	(13)	(14)
LN Average capital inflow into U.S. buyout funds	0.067***						
	(0.010)						
U.S. Investor		0.085	0.000	0.080	0.042	-0.040	0.049
		(0.080)	(0.109)	(0.066)	(0.097)	(0.127)	(0.064)
U.S. exit					0.084***	0.092***	0.066***
					(0.021)	(0.022)	(0.011)
VC Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Venture controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Domestic VC inflow	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period, country & industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10015	10015	9659	7770	10015	9659	7770
R-squared	0.041	0.017	0.013	0.016	0.037	0.014	0.026
IV F-stat	41.51						

ventures leave along with their entrepreneurial talent. If true, the lack of adequate domestic capital represents a major concern for European economies as foreign VC activity can have, at least partially, harmful economic effects.

We generate and merge several large novel data sets to test the effects of venture capital origin on approximately 11,000 ventures that received VC funding between the years 2000 and 2013 in 17 European countries and their entrepreneurs. From a European perspective, we find our results alarming, while they might be reassuring from a U.S. perspective. The findings indicate that economies with advanced VC markets (like the U.S.) are likely benefiting from the global activity of their venture capital firms.

In line with the currently prevailing perception in Europe, the likelihood of a foreign exit is correlated with the origin of capital. In our sample, 25% (28%) of the European ventures resulted in a foreign exit when a foreign (U.S.) investor was involved, while this rate is only 11% among entirely domestically backed ventures. All these differences remain statistically and economically significant in multivariate regressions. While there is a clear pattern in our data, it does not tell us whether this results from a potentially endogenous selection of ventures only or if there is also a treatment effect in that, ceteris paribus, a foreign investor actively influences the exit route (geographically). We use capital inflow into foreign (U.S.) buyout funds during a venture's fundraising period as an instrument for foreign (U.S.) VC investment. Our instrumental variable regressions indicated that foreign (U.S.) investors significantly increase the likelihood of foreign (U.S.) exits and foreign (U.S.) acquisitions beyond selection effects.

Besides exit routes, we scrutinize whether the supply of foreign VC impacts entrepreneur emigration patterns. First, we find that a substantial share of 13% (6%) of all entrepreneurs from European ventures works primarily in a foreign country (the U.S.) six years after the corresponding venture's last financing event. Notably, the entrepreneurs who leave long-term are superior to those who stay because they generally raise more VC funding, gain more entrepreneurial experi-

ence, and are more likely to start another VC-backed venture afterward. We also detect a correlation between foreign VC investors and emigration abroad after the last financing: While only 7% of the domestically financed entrepreneurs emigrate to another country one year after their initial venture, the share is 16% (17%) for ventures with at least one foreign (U.S.) VC round. This significant difference persists even six years after the venture. Moreover, employing our instrumental variable strategy, we show that the positive relationship at least partially stems from a causal treatment effect in the sense that entrepreneurs of a given quality are more likely to go abroad if foreign investors back their ventures.

In sum, we show empirical evidence of a causal relationship between the lack of domestic VC supply in Europe and foreign exits and entrepreneur emigration. Adequate initiatives to address this issue should reduce the drain. Policymakers in Europe may want to take note of this potential lever to improve the global competitiveness of their economies.

5

Conclusion

This dissertation consists of three essays that empirically analyze different aspects of finance and entrepreneurship in a global venture capital world. The first seeks to understand the main startup performance disadvantage(s) in Europe, by analyzing the performance implications for startups that migrate to the U.S. The second and third focus on to what extent and why startups and entrepreneurs "follow the money" to the few places where venture capital is highly concentrated.

Chapter 2 studies the main disadvantage(s) at startup performance in Europe, by analyzing startups that migrate to the world-leading startup ecosystem in the U.S. I use the positive selection into migration as an identification strategy: because of the positive selection, the simple cross-sectional difference gives an *upper bound* of the effect of the U.S. ecosystem compared to Europe. Hence, if performance measures in specific areas do not differ, it suggests that Europe does not impede startups in those domains. I find that the main difference at startup performance of the U.S. ecosystem vs. Europe is more venture capital funding and a higher tolerance for losses. This allows startups, even for those that eventually fail, to reach greater company scale. I also find that migrants do not increase their revenues for many years after migration and do not increase their likelihood of

reaching an IPO. These results suggest that European product, technology, and IPO markets do hinder startups little, if at all, but that the (VC) funding market is likely Europe's major obstacle to startup performance.

Chapter 3 provides new evidence on the international relocation of startups in 17 advanced economies to answer the following questions: To what extent do startups relocate across borders? Where do they go? Does relocation imply that most of the startup's workforce moves? What are the drivers of relocation? I document that international relocation is common, with 6% of startups and 14% of startup value moving across boders, is mainly directed to the U.S., and leads to most of the company's workforce ending up in that foreign country. I also find that foreign VC investment, in particular from U.S. VCs, is a strong predictor of relocation. The effect implies that one in ten U.S. VC deals leads to relocation, meaning that nine out of ten U.S. VC deals provide additional startup capital *without* driving the startup away. Moreover, the effect of foreign VC becomes larger the tougher the financing conditions are for the startup. These results suggest that the outflow of startups is to be taken seriously, and that it be addressed by improving startups' local funding conditions.

The last essay, in Chapter 4, investigates the effect of foreign (and U.S.) VC investment on foreign startup exits and emigration of entrepreneurs abroad (and to the U.S.). To identify the effect of foreign/U.S. VC, I borrow from Gompers and Lerner (2000); Nanda and Rhodes-Kropf (2013) and use foreign/U.S. buyout fundraising as an instrumental variable. This instrument should capture the part of U.S. capital that is due to fundraising in the U.S. buyout market, which should be independent of investment opportunities in European startups. I present evidence that foreign investors, in particular from the U.S., back better European ventures and increase the likelihood of foreign exits and entrepreneur emigration. These findings suggest that international VC firms are a funnel though which VC-exporting countries absorb high-impact economic actors.

In conclusion, this dissertation provides important new insights about the rea-

sons for the lower startup performance in most advanced economies compared to the U.S., startup relocation, and consequences of foreign venture capital investment on local economies. Many open questions remain and there is a wide range of opportunities for future research. For example, understanding venture capital's limitations in driving innovation, in particular considering the boom of venture capital in the 2010s is an important challenge going forward. I hope that with the data and findings presented in this dissertation, new avenues for research and better policies for venture capital and entrepreneurship will be possible.

A

Chapter 1

A.1 Merging Data Sets

A.1.1 Standardization Procedure

VentureSource is merged with several "other databases", among others, with Preqin, Orbis, SDC New Issues, SDC Mergers & Acquisitions, and the European Patent Offices' PATSTAT database. Unfortunatly, no bridge files or identifiers between these databases are available. Therefore, I match VentureSource to each of the three databases to using the following procedure, which is based on the procedure outlined in Bernstein et al. (2016). I begin by standardizing the company names in each, using the standardization routines developed by the NBER Patent Data Project[1]. These routines standardize company prefixes and suffixes (e.g., PHARMACEUTICAL(S), PHARMACEUTICA, PHARMACEUTIQUE(S), PHARMAZEUTIKA, PHARMAZEUTISCH(E)(N), and PHARMAZIE become PHARM), generating a company's "standard name" and "stem name". While the standard name does not strip any information, the "stem name" is a "core" of the company name stripping organizational form suffixes, prefixes, capital letters, punctuation, and spaces.

[1]See https://sites.google.com/site/patentdataproject/.

A.1.2 Matching Procedure

Using standard names, stem names, and countries, I employ the following matching procedure between VentureSource and each of the "other databases":

1. Each standardized company name in VentureSource (including previous ones) is matched with standardized names from the other database. If an exact match is found, this is taken to be the same company.

2. Each stem name in VentureSource is matched with stem names from the other databases. If an exact match is found and enough other identifying information matches as well, this is taken to be the same company. In particular, I consider a stem name match definite if the country and time period matches (i.e., IPO/Acquisition/first patent application was after company founding year). If an exact stem name match is found but not enough other identifying information matches as well, the match is added to a list of borderline matches to be checked manually.

3. The borderline matches, i.e. stem name matches where the country or time periods do not match or are not known, are reviewed manually using other qualitative information from both data sources, including full company descriptions, deal summaries, and patent abstracts.

Table A. 1: Variable Definitions

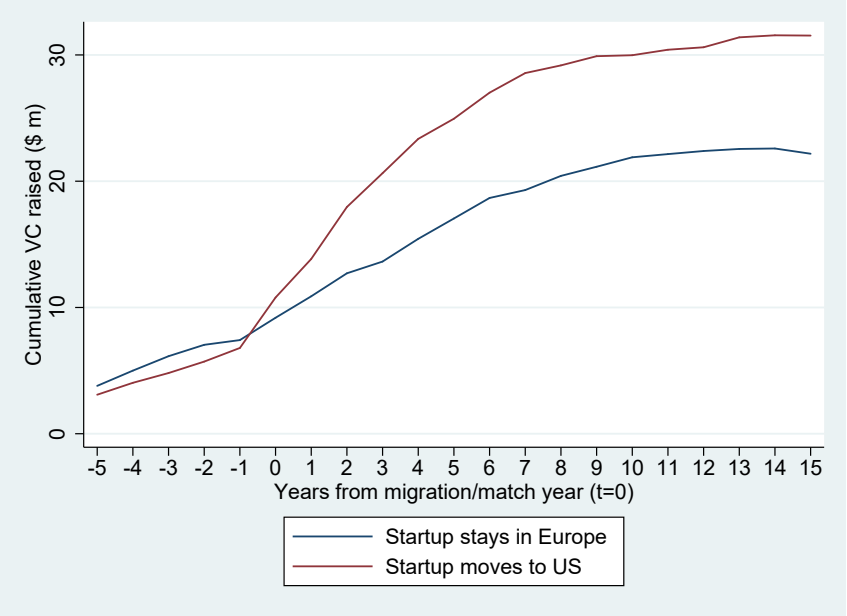
This table contains descriptions of the variables used in the analysis.

Variable	Description
Moves to US	A dummy variable that equals one if the startup relocated ist headquarters (HQ) to the U.S.
Age at migration to US	Age of the startup at migration to the U.S.
VC raised ($ m)	VC amount raised in 2012 U.S. dollars
VC rounds	Number of (cumulative) VC rounds raised
Pre-money valuation ($ m)	Pre-money valuation at the financing in 2012 U.S. dollars
Startup age	Age of the startup
Number of VCs investing	The number of unique investors invested in the startup
US VC involved	A dummy variable that equals one if at least oneU.S. VC is invested in the startup
Revenue ($ m)	A startup's revenue in 2012 U.S. dollars
Net income ($ m)	A startup's net profit or loss in 2012 U.S. dollars
Employees	A startup's number of employees
Num. of patents	The number of (eventually granted) patents a startup has applied for
Scaled citation-weighted patents	The number of lifetime citations to patents, scaled by the average citations of all patents filed in the same country and year
Stage: Generating revenue	A dummy variable that equals one if startup already generates revenue (other stages: "Seed", "Product Development/Clinical Trial")
IPO	A dummy variable that equals one if startup goes public via initial public offering (IPO)
Valuation at IPO ($ m)	Startup valuation at IPO, i.e. first day closing price times shares outstanding, in 2012 U.S. dollars
Successful exit	A dummy variable that equals one if startup goes public via IPO or gets acquired with transaction value of > 2 times total VC raised
Valuation at Successful Exit ($ m)	Startup valuation at IPO (i.e., first day closing price times shares outstanding), or deal value at succesful acquisition, i.e. acquisition with deal value of > 2 times total VC raised, in 2012 U.S. dollars
Fixed effects	
Funding year FE	Year of first VC financing fixed effects (15 in total)
Industry FE	Startup industry fixed effects: "Software", "Hardware", "Healthcare/Biotech", "Consumer/Retail", "Other"
Stage FE	Startup stage fixed effects: "Seed", "Product Development/Clinical Trial", "Generating revenue"
Country FE	Country fixed effects for the initial headquarter location country of the startup (17 in total)

Figure A. 1: Moving to the U.S. and Fundraising - Matched Sample

The sample consists of the treatment and control samples resulting from the matching procedure described in the body of the text. The firms are tracked up to 2021. $t = 0$ is the migration year (=match year). All performance indicators are measured as average cumulative total up to year t.

Panel A: VC raised ($ m)



Panel B: VC rounds

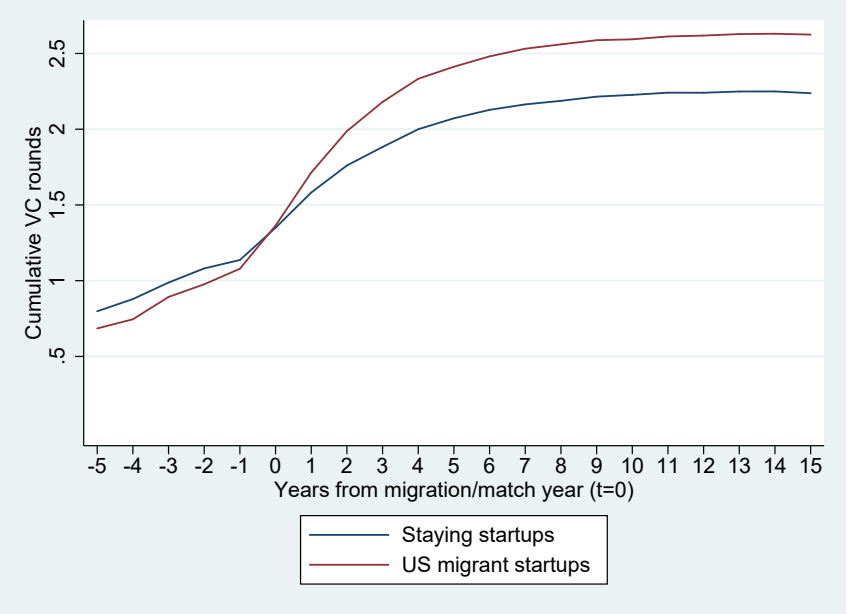
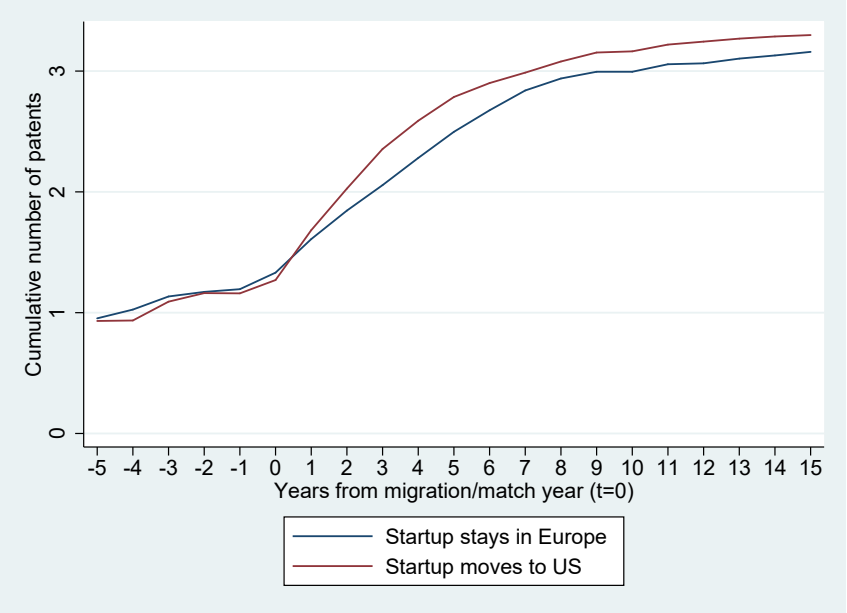


Figure A. 2: Moving to the U.S. and Innovation - Matched Sample

The sample consists of the treatment and control samples resulting from the matching procedure described in the body of the text. The firms are tracked up to 2021. $t = 0$ is the migration year (=match year). All performance indicators are measured as average cumulative total up to year t.

Panel A: Patents



Panel B: Scaled citation-weighted patents

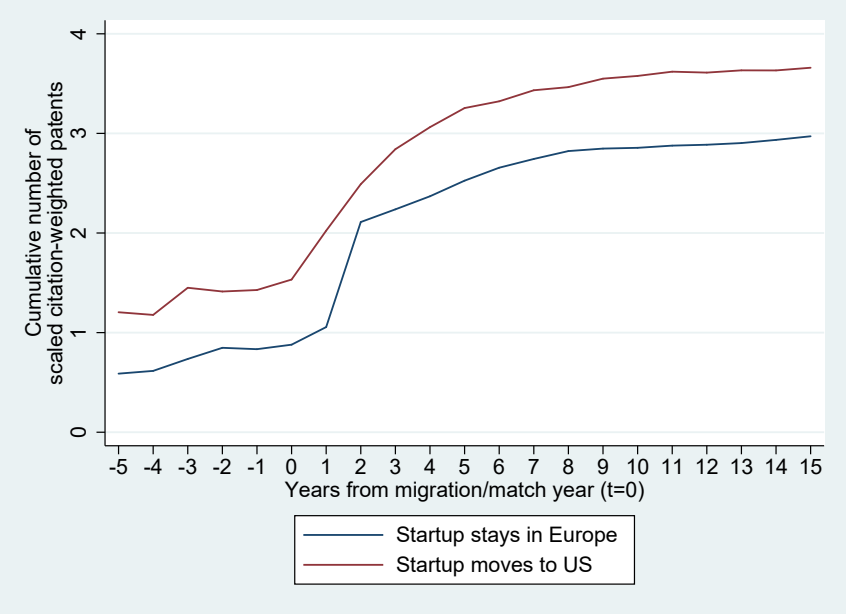
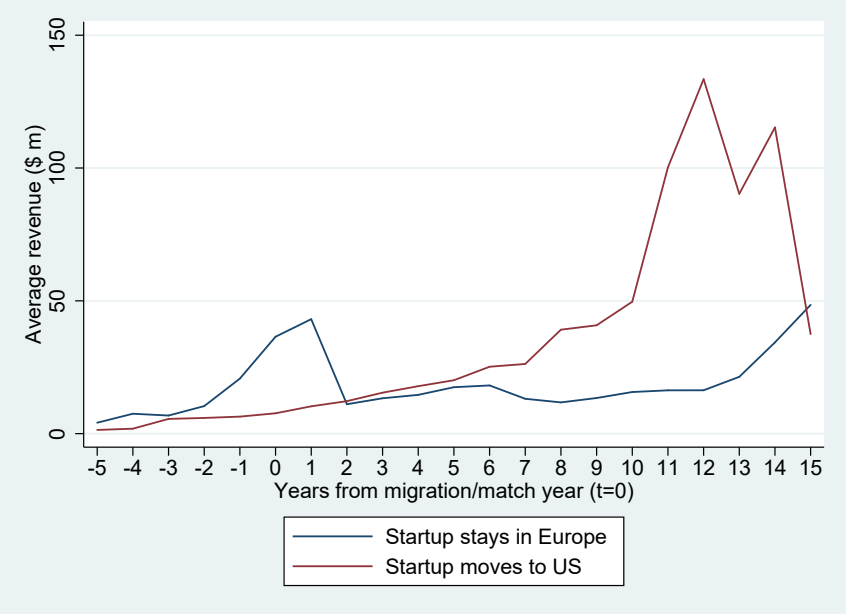


Figure A. 3: Moving to the U.S. and Business Success - Matched Sample

The sample consists of the treatment and control samples resulting from the matching procedure described in the body of the text. The firms are tracked up to 2021. $t = 0$ is the migration year (=match year). All performance indicators are measured as average in year t.

Panel A: Revenue ($ m)



Panel B: Net income ($ m)

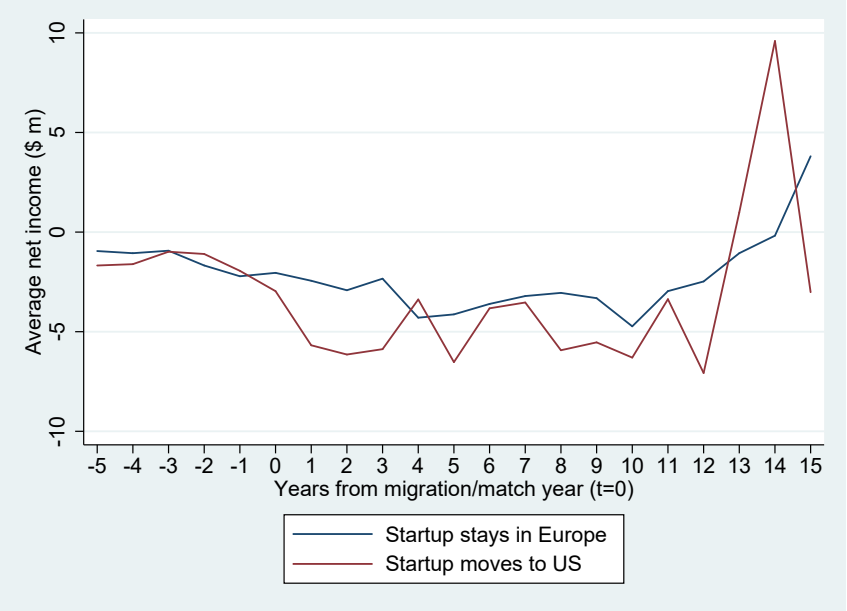
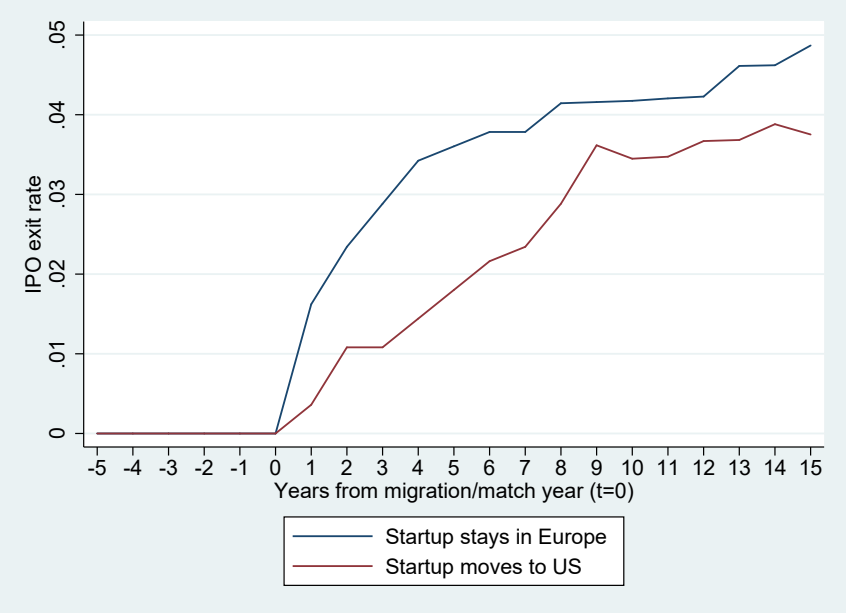


Figure A. 4: Moving to the U.S. and Exits - Matched Sample

The sample consists of the treatment and control samples resulting from the matching procedure described in the body of the text. The firms are tracked up to 2021. $t = 0$ is the migration year (=match year). All performance indicators are measured as average cumulative total up to year t.

Panel A: IPOs



Panel B: Successful Exits (IPO and Acq.>2*VC raised)

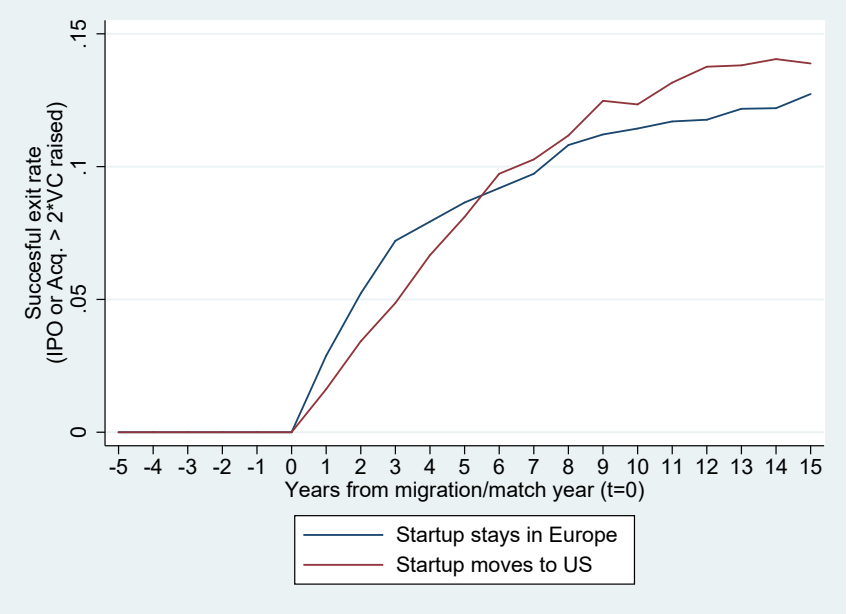


Table A. 2: European Coverage in Commercial VC Databases

This table shows the number of startups first funded in a given year, as captured by Refinitiv's VentureXpert (also known as Thomson One, Thomson Eikon, or Venture Economics) and Dow Jones' VentureSource (also known as VentureOne). The following filters were applied in both databases: 1) only financing rounds labeled as "VC"–excluding buyout, angel, debt, grant, and exit financings; 2) only financing rounds with round date and financing amount available; 3) Investee must not be older than 10 years in the year of the first VC financing; 4) Include companies from 17 European countries: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Russia, Spain, Sweden, Switzerland, and the United Kingdom.

	Number of startups first funded	
Year	VentureXpert	VentureSource
2000	1245	2236
2001	870	1074
2002	405	528
2003	349	441
2004	299	493
2005	628	528
2006	699	667
2007	511	757
2008	480	643
2009	421	569
2010	620	644
2011	648	688
2012	590	777
2013	591	898
2014	605	907
Total	8961	11850

Table A. 3: Firm Financials Coverage

This table shows the number of startups for which firm financials, in particular, revenue and net income, are available in the sample. Coverage is tabulated over years, starting from the year of first funding.

Years after first funding	# Startups with financial information	% of sample
0	3878	35%
1	4323	39%
2	4251	38%
3	4044	37%
4	3755	34%
5	3394	31%
6	3099	28%
7	2587	23%
8	2197	20%
9	1905	17%
10	1647	15%
11	1423	13%
12	1245	11%
13	1078	10%
14	908	8%
15	738	7%
16	622	6%
17	526	5%
Total Firm-Year Obs.	41620	

Table A. 4: Robustness - Early Migrants Only

This table reports regression results of different startup performance measures on an indicator of whether the startup moved to the U.S. during the VC funding period. The unit of observation is a VC-backed startup. The models are the same as in the Column (3)/(6) of Table 2.4 to Table 2.8, with the only difference that migrants that moved later than three years after first funding are dropped from the sample. All variables are defined in Appendix A. 1. LN denotes the natural logarithm of a variable incremented by one. All models are estimated using ordinary-least-squares (OLS). Standard errors clustered at the industry x year level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Fundraising		Innovation		Commercial success		Exit		Valuation at exit	
Dependent variable:	LN VC raised ($m) by t+6	LN VC rounds by t+6	LN Num. of patents by t+6	LN Scaled citation-weighted patents by t+6	Revenue ($ m) in t+6	Net income ($ m) in t+6	IPO	Successful Exit	LN Valuation at IPO ($)	LN Valuation at Successful Exit ($)
Moves to US	0.58***	0.18***	0.11***	0.22***	-3.33	-1.43*	-0.02**	0.02	1.32***	0.76***
	(0.07)	(0.02)	(0.03)	(0.04)	(3.67)	(0.84)	(0.01)	(0.02)	(0.33)	(0.20)
First funding controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Funding Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Stage FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10931	10931	10931	10931	2744	2704	10931	10931	485	1202
R-squared	0.677	0.094	0.662	0.462	0.169	0.115	0.049	0.045	0.458	0.378

Table A. 5: Robustness - Four Years After

This table reports regression results of different startup performance measures on an indicator of whether the startup moved to the U.S. during the VC funding period. The unit of observation is a VC-backed startup. The models are the same as in the Column (3)/(6) of Table 2.4 to Table 2.8, with the only difference that time-sensitive dependent variables are measured in year 4 after first funding. All variables are defined in Appendix A. 1. LN denotes the natural logarithm of a variable incremented by one. All models are estimated using ordinary-least-squares (OLS). Standard errors clustered at the industry x year level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Fundraising		Innovation		Commercial success		Exit		Valuation at exit	
Dependent variable:	LN VC raised ($m) by t+4	LN VC rounds by t+4	LN Num. of patents by t+4	LN Scaled citation-weighted patents by t+6	Revenue ($ m) in t+4	Net income ($ m) in t+4	IPO	Successful Exit	LN Valuation at IPO ($)	LN Valuation at Successful Exit ($)
Moves to US	0.52***	0.17***	0.09***	0.19***	-3.01	-1.01*	-0.01	0.03*	1.48***	0.89***
	(0.05)	(0.01)	(0.02)	(0.03)	(2.30)	(0.52)	(0.01)	(0.01)	(0.27)	(0.15)
First funding controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Funding Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Stage FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11066	11066	11066	11066	3402	3250	11066	11066	495	1223
R-squared	0.720	0.095	0.704	0.483	0.166	0.138	0.050	0.046	0.461	0.380

Table A. 6: Robustness - Eight Years After

This table reports regression results of different startup performance measures on an indicator of whether the startup moved to the U.S. during the VC funding period. The unit of observation is a VC-backed startup. The models are the same as in the Column (3)/(6) of Table 2.4 to Table 2.8, with the only difference that time-sensitive dependent variables are measured in year 8 after first funding. All variables are defined in Appendix A. 1. LN denotes the natural logarithm of a variable incremented by one. All models are estimated using ordinary-least-squares (OLS). Standard errors clustered at the industry x year level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Fundraising		Innovation		Commercial success		Exit		Valuation at exit	
Dependent variable:	LN VC raised ($m) by t+8	LN VC rounds by t+8	LN Num. of patents by t+8	LN Scaled citation-weighted patents by t+8	Revenue ($ m) in t+8	Net income ($ m) in t+8	IPO	Successful Exit	LN Valuation at IPO ($)	LN Valuation at Successful Exit ($)
Moves to US	0.68***	0.22***	0.15***	0.24***	0.95	-2.46***	-0.01	0.03*	1.48***	0.89***
	(0.06)	(0.02)	(0.03)	(0.03)	(4.49)	(0.86)	(0.01)	(0.01)	(0.27)	(0.15)
First funding controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Funding Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Stage FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11066	11066	11066	11066	1982	2017	11066	11066	495	1223
R-squared	0.660	0.108	0.641	0.457	0.173	0.139	0.050	0.046	0.461	0.380

Table A. 7: Matching - Characteristics of Treatment and Control Firms

This table provides mean comparisons between startups moving their headquarters (HQ) to the U.S. and a matched sample of staying startups. Startup characteristics are measured in the match year (=migration year). The control group is identified based on exact matching on industry, migration year, and stage, and then using the nearest neighbor based Mahalanobis distance matching. Distance is calculated based on the cumulative VC amount raised, cumulative number of rounds, age, number of VCs invested, an indicator of whether a U.S. VC is invested, and an indicator of whether the startup has at least one patent. All variables are defined in Appendix A. 1. The last column reports t-statistics of two-sample t-tests for equality of means. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Stays in Europe	Moves to US	Difference	
	Mean	Mean	Mean	t-stat.
Panel A: Startup characteristics in match/migration year (t=0)				
VC raised ($ m)	9.19	10.79	1.60	1.33
VC rounds	1.35	1.36	0.01	0.21
Startup age	4.19	4.17	−0.02	−0.08
Num. of unique VCs invested	2.46	2.53	0.07	0.48
US VC involved	0.32	0.32	0.00	0.00
Revenue ($ m)	36.50	7.67	−28.83	−1.08
Net income ($ m)	−2.05	−2.96	−0.92	−1.33
Num. of patents	1.33	1.27	−0.06	−0.26
Stage				
Pre-funding	0.21	0.21	0.00	0.00
Seed	0.05	0.05	0.00	0.00
Product Development/Clinical Trial	0.17	0.17	0.00	0.00
Generating Revenue	0.58	0.58	0.00	0.00
Industry				
Software	0.38	0.38	0.00	0.00
Hardware	0.11	0.11	0.00	0.00
Medical/Biotechnology	0.12	0.12	0.00	0.00
Consumer/Retail	0.14	0.14	0.00	0.00
Other Industry	0.25	0.25	0.00	0.00
Country				
France	0.17	0.17	0.00	−0.16
Germany	0.11	0.09	−0.02	−1.21
Sweden	0.05	0.05	0.00	−0.27
United Kingdom	0.33	0.31	−0.02	−0.77
Other Country	0.34	0.39	0.05	1.75*
Panel B: Startup performance variables				
VC raised ($ m) by t+6	18.68	27.01	8.34	3.19***
VC rounds by t+6	2.13	2.48	0.35	4.10***
Num. of patents by t+6	2.68	2.90	0.23	0.50
Scaled citation-weighted patents by t+6	2.66	3.32	0.67	0.62
Revenue ($ m) in t+6	18.15	25.19	7.05	0.85
Net income ($ m) in t+6	−3.61	−3.83	−0.22	−0.12
IPO	0.05	0.04	−0.01	−0.73
Successful Exit (IPO or Acq.>2*VC raised)	0.13	0.15	0.02	0.87
Observations	555	555	1110	

Table A. 8: Moving to the U.S. and Fundraising - Matched Sample

This table reports regression results of startup fundraising performance on an indicator of whether the startup moved to the U.S. during the VC funding period. The unit of observation is a VC-backed startup. The sample consists of the treatment and control samples resulting from the matching procedure described in the body of the text. The dependent variable is the cumulative VC raised (in $ m) by year 6 after migration/match in Columns (1)-(3), and cumulative number of VC rounds in Columns (4)-(6). $t = 0$ is the migration/match year. LN denotes the natural logarithm of a variable incremented by one. All models are estimated using ordinary-least-squares (OLS). Standard errors clustered at the industry x year level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable:	LN VC raised ($ m) by $t + 6$			LN VC rounds by $t + 6$		
	(1)	(2)	(3)	(4)	(5)	(6)
Moves to US	0.70***	0.75***	0.54***	0.11***	0.11***	0.10***
	(0.12)	(0.12)	(0.07)	(0.02)	(0.02)	(0.02)
LN VC raised ($ m) by t=0			0.00			-0.01***
			(0.01)			(0.00)
LN Startup age in t=0			-0.26***			-0.01
			(0.09)			(0.01)
LN Num. of unique VCs invested by t=0			0.59***			0.31***
			(0.11)			(0.03)
US VC involved by t=0			0.83***			0.11***
			(0.11)			(0.03)
LN Num. of patents granted by t=0			0.28***			0.04**
			(0.06)			(0.02)
Funding Year FE	No	Yes	Yes	No	Yes	Yes
Industry FE	No	Yes	Yes	No	Yes	Yes
Stage FE	No	No	Yes	No	No	Yes
Country FE	No	Yes	Yes	No	Yes	Yes
Observations	1110	1110	1110	1110	1110	1110
R-squared	0.025	0.098	0.624	0.019	0.114	0.441

Table A. 9: Moving to the U.S. and Innovation - Matched Sample

This table reports regression results of startup innovation performance on an indicator of whether the startup moved to the U.S. during the VC funding period. The unit of observation is a VC-backed startup. The sample consists of the treatment and control samples resulting from the matching procedure described in the body of the text. The dependent variable is the cumulative number of patents granted by year 6 after migration/match in Columns (1)-(3), and cumulative scaled citation-weighted patents in Columns (4)-(6). $t = 0$ is the migration/match year. LN denotes the natural logarithm of a variable incremented by one. All models are estimated using ordinary-least-squares (OLS). Standard errors clustered at the industry x year level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable:	LN Num. of patents by $t + 6$			LN Scaled citation-weighted patents by $t + 6$		
	(1)	(2)	(3)	(4)	(5)	(6)
Moves to US	0.07	0.07	0.09***	0.19***	0.18***	0.20***
	(0.06)	(0.05)	(0.03)	(0.05)	(0.05)	(0.04)
LN VC raised ($ m) by t=0			-0.00			-0.01
			(0.00)			(0.01)
LN Startup age in t=0			-0.14***			-0.10***
			(0.03)			(0.03)
LN Num. of unique VCs invested by t=0			0.04			0.08
			(0.05)			(0.06)
US VC involved by t=0			0.06			0.04
			(0.04)			(0.06)
LN Num. of patents granted by t=0			1.05***			0.91***
			(0.03)			(0.04)
Funding Year FE	No	Yes	Yes	No	Yes	Yes
Industry FE	No	Yes	Yes	No	Yes	Yes
Stage FE	No	No	Yes	No	No	Yes
Country FE	No	Yes	Yes	No	Yes	Yes
Observations	1110	1110	1110	1110	1110	1110
R-squared	0.001	0.221	0.743	0.010	0.157	0.574

Table A. 10: Moving to the U.S. and Commercial Success - Matched Sample

This table reports regression results of startup commercial success on an indicator of whether the startup moved to the U.S. during the VC funding period. The unit of observation is a VC-backed startup. The sample consists of the treatment and control samples resulting from the matching procedure described in the body of the text. The dependent variable is the revenue in year 6 after migration/match in Columns (1)-(3), and net income in Columns (4)-(6). $t = 0$ is the migration/match year. Revenue and net income are winsorized at the 1% and 99% ends. LN denotes the natural logarithm of a variable incremented by one. All models are estimated using ordinary-least-squares (OLS). Standard errors clustered at the industry x year level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable:	Revenue ($ m) in $t + 6$			Net income ($ m) in $t + 6$		
	(1)	(2)	(3)	(4)	(5)	(6)
Moves to US	6.31	3.44	2.11	-0.42	1.29	1.36
	(5.89)	(6.85)	(6.84)	(1.80)	(2.01)	(2.11)
LN VC raised ($ m) by t=0			2.52**			0.22
			(1.23)			(0.19)
LN Startup age in t=0			7.00			0.21
			(5.44)			(0.91)
LN Num. of unique VCs invested by t=0			-25.72*			-4.62**
			(13.35)			(2.28)
US VC involved by t=0			24.35**			1.18
			(11.83)			(2.81)
LN Num. of patents granted by t=0			-2.44			-0.24
			(3.22)			(0.83)
Funding Year FE	No	Yes	Yes	No	Yes	Yes
Industry FE	No	Yes	Yes	No	Yes	Yes
Stage FE	No	No	Yes	No	No	Yes
Country FE	No	Yes	Yes	No	Yes	Yes
Observations	265	265	265	258	258	258
R-squared	0.005	0.145	0.237	0.000	0.235	0.263

Table A. 11: Moving to the U.S. and Exits - Matched Sample

This table reports regression results of startup exit outcomes on an indicator of whether the startup moved to the U.S. during the VC funding period. The unit of observation is a VC-backed startup. The sample consists of the treatment and control samples resulting from the matching procedure described in the body of the text. The dependent variables are dummy variables indicating whether the startup had an exit via IPO in Columns (1)-(3)/IPO or successful acquisition (i.e., acquisition with valuation larger than $2 * VC_raised$) in Columns (4)-(6), by the end of the sample period (July 2021). $t = 0$ is the migration/match year. LN denotes the natural logarithm of a variable incremented by one. All models are estimated using ordinary-least-squares (OLS). Standard errors clustered at the industry x year level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable:	IPO			Successful Exit (IPO or Acq>2*VC raised)		
	(1)	(2)	(3)	(4)	(5)	(6)
Moves to US	-0.01	-0.01	-0.01	0.02	0.02	0.02
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)
LN VC raised ($ m) by t=0			-0.00			0.00
			(0.00)			(0.00)
LN Startup age in t=0			-0.00			-0.03*
			(0.01)			(0.02)
LN Num. of unique VCs invested by t=0			0.02			0.03
			(0.02)			(0.03)
US VC involved by t=0			0.06***			0.06**
			(0.02)			(0.03)
LN Num. of patents granted by t=0			-0.00			0.00
			(0.01)			(0.02)
Funding Year FE	No	Yes	Yes	No	Yes	Yes
Industry FE	No	Yes	Yes	No	Yes	Yes
Stage FE	No	No	Yes	No	No	Yes
Country FE	No	Yes	Yes	No	Yes	Yes
Observations	1110	1110	1110	1110	1110	1110
R-squared	0.000	0.076	0.098	0.001	0.058	0.077

B

Chapter 2

B.1 Tracing IPO outcomes

Using quarterly surveys with startups, press releases, and regulatory filings, VentureSource traces the outcomes of startups in terms of whether they achieved an IPO or trade sale. While VentureSource is more accurate in tracing startup outcomes compared to other widely used databases in VC research (Kaplan and Lerner, 2017), coverage is not complete.

We augment the IPO exit coverage by two measures. First, we match VentureSource with Revinitiv's Securities Data Company (SDC) New Issues database, which is the industry standard in IPO research. Second, during the manual collection of HQ relocations from the Crunchbase, LinkedIn, and company websites of all companies in our sample, we also check these sources for updates in the public listing status.

To match VentureSource to SDC, we begin by standardizing the company names in both databases, using the standardization routines developed by the NBER Patent Data Project[1]. These routines standardize company prefixes and suffixes (e.g., PHARMACEUTICAL(S), PHARMACEUTICA, PHARMACEUTIQUE(S), PHARMAZEUTIKA, PHARMAZEUTISCH(E)(N), and PHARMAZIE become PHARM), generating a company's

[1]See https://sites.google.com/site/patentdataproject/.

"standard name" and "stem name". We match on the stem name, which is a "core" of the company name stripping organizational form suffixes, prefixes, capital letters, punctuation, and spaces. We consider all exact matches and the 5 closest matches based on a fuzzy match score if this score is above a similarity threshold of 0.95. We also perform this matching on former company names listed in VentureSource. The results of this procedure are then carefully checked by hand verifying each match with identifying information such as country, industry, and business description in both data sets.

Overall, an additional 53 IPOs (a 12% increase over the initial 460 IPOs) results from this search.

B.2 Geographical footprint of companies that went public

To determine the extent to which startups that relocate their headquarters also relocate overall, we look at the geographic footprint of startups that achieve an IPO.

To do this, we take advantage of the fact that companies applying for a public listing provide information about their geographic footprint. For example, companies seeking to go public in the US must file a public S-1 filing with the US Securities and Exchange Commission (SEC). The SEC provides web access to all S-1 filings since 1996 through the EDGAR database (see https://www.sec.gov/edgar/searchedgar/companysearch.html, last accessed on August 23, 2021). The content of this filing, called the IPO prospectus, is largely standardized and includes, among other things, a section tabulating the company's employees and facilities by geography. The IPO prospectuses on European stock exchanges are very similar to those in the US and are also mostly publicly available on stock exchange and company websites (e.g. for listings in France, Holland, Belgium and Italy from the pan-European stock exchange group Euronext at https://www.euronext.com/en, last accessed on August 23, 2021).

Of the 513 startups that achieve an IPO in our data set, 28 are among those that relocate and 485 are among those that stay. We search the public databases of the stock exchanges and the internet for the IPO prospectuses of all 28 relocating companies and

of 100 randomly selected staying companies. We find the IPO prospectus (in the UK also "Admission Document", in France "Document di Base") for 23 and 90 of them, respectively (i.e., 88% match rate in total).

In the IPO prospectus, the majority of companies explicitly state the geographic distribution of their employees. If the employees are not explicitly indicated by geography, we distribute the employees according to the indicated area of the company's facilities.

Table B. 1: Variable Definitions

This table reports descriptions of the variables used in the analysis.

Variable	Description
First round variables	
Foreign VC in first round	At least one foreign VC participated in the financing
US VC in first round	At least one US VC participated in the financing
First round: Amount raised ($ m)	Amount raised in the financing in 2012 US dollars
First round: Pre-money valuation ($ m)	Pre-money valuation at the financing in 2012 US dollars
First round: Number of VCs investing	The number of investors involved in the financing
Generating revenue	Startup reported revenues at financing
Revenue ($ m)	Revenue reported by startup at financing in 2012 US dollars
Employees	Number of employees at startup at financing
Startup age	Age of the startup at financing
Serial entrepreneur	At least one serial entrepreneur is involved in the startup
Has patent	Startup applied for at least one patent by financing
Has US patent	Startup applied for at least one US patent by financing
Has US trademark	Startup applied for at least one US trademark by financing
Market share of foreign VCs among other startups funded in same country-year	Ratio of deals with at least one foreign VC to all deals (excl. the focal startup), in the same country and year as of the startup's first funding
Market share of US VCs among other startups funded in same country-year	Ratio of deals with at least one US VC to all deals (excl. the focal startup), in the same country and year as of the startup's first funding
GDP	Gross Domesic Product in 2012 US dollars
VC investment / GDP	The ratio of total VC investment (according to VentureSource) to GDP (according to Datastream) in the country and year of the startup's first funding
Startup outcomes	
Headquarter relocation	Startup relocated ist headquarters (HQ) during the VC fundraising period, i.e., after start and before exit, or 2021 if no exit occured.
IPO	Startup exited via IPO (by June 2021)
Valuation at IPO ($ m)	Startup valuation at IPO, i.e. first day closing price times shares outstanding, in 2012 US dollars
Fixed effects	
Funding year FE	First VC financing year fixed effects
Industry FE	Startup industry fixed effects: "Software", "Hardware", "Healthcare/Biotech", "Consumer/Retail", "Other"
Country FE	Country fixed effects for the initial HQ-country of the startup

Table B. 2: Summary Statistics

This table reports summary statistics about startup characteristics measured at first funding (Panel A), startup outcomes as of 06/2021 (Panel B). All variables are defined in the Appendix.

	Obs.	Mean	Median	SD	Min	Max
Panel A: Startup characteristics at first funding						
First round: Foreign VC involved	11074	0.26	0.00	0.44	0.00	1.00
First round: US VC involved	11074	0.09	0.00	0.29	0.00	1.00
First round: Amount raised ($ m)	11074	5.75	1.64	26.45	0.00	1178.00
First round: Pre-money valuation ($ m)	3359	15.47	3.99	91.19	0.00	3208.00
First round: Number of VCs investing	11008	1.99	2.00	1.28	1.00	21.00
Generating revenue	11074	0.61	1.00	0.49	0.00	1.00
Revenue ($ m)	1510	13.76	1.29	97.97	0.00	2289.00
Employees	3666	49.13	12.00	245.58	0.00	6554.00
Startup age	11074	2.59	1.80	2.53	0.00	20.39
Serial entrepreneur	11074	0.05	0.00	0.22	0.00	1.00
Has Patent	11074	0.25	0.00	0.43	0.00	1.00
Has US Patent	11074	0.11	0.00	0.32	0.00	1.00
Has US Trademark	11074	0.11	0.00	0.31	0.00	1.00
Industry: IT-Software	11074	0.22	0.00	0.42	0.00	1.00
Industry: IT-Hardware	11074	0.11	0.00	0.31	0.00	1.00
Industry: Medical/Healthcare	11074	0.17	0.00	0.38	0.00	1.00
Industry: Consumer/Retail	11074	0.21	0.00	0.40	0.00	1.00
Industry: Other	11074	0.30	0.00	0.46	0.00	1.00
Year of first funding	11074	2006.38	2006.00	4.96	2000.00	2014.00
Panel B: Startup outcomes						
Headquarter relocation	11074	0.06	0.00	0.24	0.00	1.00
Age at HQ relocation	647	4.38	3.00	3.95	0.00	19.00
IPO	11074	0.05	0.00	0.21	0.00	1.00
Valuation at IPO ($ m)	496	395.70	76.49	1647.00	3.11	30030.00
Age at IPO	513	8.70	8.00	4.46	0.00	26.00
# Startups with IPO	513					
# Startups w. employee data at IPO	113					
Total employees at IPO	113	233.08	47.00	502.75	1.00	3200.00
Share employees abroad at IPO	113	0.20	0.00	0.32	0.00	1.00
Share employees in US at IPO	113	0.15	0.00	0.29	0.00	1.00

Table B. 3: Foreign VC Involvement: Covariate Balance in Full and Matched Samples

This table compares the characteristics of startups receiving (treatment) and not receiving (control) foreign VC or US VC backing in their first VC round. A startup is classified as *Foreign/US VC*-backed if at least one VC headquartered in a foreign country/the US participated in the first VC funding. Panel A reports means for the full sample of 11,066 startups. Panel B reports CEM-weighted means for the matched sample. All variables are defined in Appendix B. 1. The last column reports t-statistics of two-sample t-tests for equality of means. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Foreign VC in first round?					US VC in first round?				
	Startups with foreign VC		Startups without foreign VC		Test for diff. (t-stat)	Startups with US VC		Startups without US VC		Test for diff. (t-stat)
	Obs.	Mean	Obs.	Mean		Obs.	Mean	Obs.	Mean	
Panel A: Full Sample										
Variables used in the CEM procedure (all measured at first financing)										
First round: Amount raised ($ m)	2,826	12.81	8,248	3.34	16.64***	1,030	21.14	10,044	4.18	19.95***
First round: Number of VCs investing	2,826	2.53	8,182	1.80	26.98***	1,030	2.88	9,978	1.89	24.31***
Serial entrepreneur	2,826	0.07	8,248	0.04	6.58***	1,030	0.10	10,044	0.04	7.87***
Startup age	2,826	2.48	8,248	2.63	-2.72***	1,030	2.33	10,044	2.62	-3.48***
Generating revenue	2,826	0.59	8,248	0.62	-3.19***	1,030	0.57	10,044	0.62	-3.16***
Has Patent	2,826	0.26	8,248	0.24	1.66*	1,030	0.25	10,044	0.25	0.54
Has US Patent	2,826	0.13	8,248	0.11	4.26***	1,030	0.14	10,044	0.11	2.98***
Has US Trademark	2,826	0.16	8,248	0.09	10.12***	1,030	0.18	10,044	0.10	8.70***
Variables not used in the CEM procedure (all measured at first financing)										
First round: Pre-money valuation ($ m)	828	29.54	2,531	10.86	5.14***	255	48.42	3,104	12.76	6.03***
Revenue ($ m)	343	24.19	1,167	10.69	2.25**	113	29.34	1,397	12.50	1.76*
Employees	955	71.57	2,711	41.22	3.29***	341	75.18	3,325	46.45	2.06**
Startup outcomes										
Headquarter relocation	2,826	0.11	8,248	0.04	13.00***	1,030	0.17	10,044	0.05	15.92***
IPO	2,826	0.06	8,248	0.04	4.58***	1,030	0.07	10,044	0.04	3.16***
Panel B: Matched Sample										
Variables used in the CEM procedure (all measured at first financing)										
First round: Amount raised ($ m)	1,610	5.84	4,173	6.26	-0.40	568	9.87	2,537	9.57	0.18
First round: Number of VCs investing	1,610	2.02	4,166	1.99	0.98	568	2.35	2,532	2.30	0.79
Serial entrepreneur	1,610	0.02	4,173	0.02	0.00	568	0.03	2,537	0.03	0.00
Startup age	1,610	2.31	4,173	2.36	-0.61	568	2.34	2,537	2.37	-0.25
Generating revenue	1,610	0.63	4,173	0.63	0.00	568	0.62	2,537	0.62	0.00
Has Patent	1,610	0.12	4,173	0.12	0.00	568	0.12	2,537	0.12	0.00
Has US Patent	1,610	0.05	4,173	0.05	0.00	568	0.06	2,537	0.06	0.00
Has US Trademark	1,610	0.05	4,173	0.05	0.00	568	0.08	2,537	0.08	0.00
Variables not used in the CEM procedure (all measured at first financing)										
First round: Pre-money valuation ($ m)	503	16.16	1,367	20.31	-0.69	139	23.30	785	25.31	-0.20
Revenue ($ m)	168	9.80	549	10.16	-0.11	49	9.52	313	17.22	-0.86
Employees	556	51.25	1,433	80.94	-1.57	188	50.63	947	101.5	-1.69*
Startup outcomes										
Headquarter relocation	1,610	0.09	4,173	0.04	7.75***	568	0.16	2,537	0.05	9.65***
IPO	1,610	0.04	4,173	0.04	-0.06	568	0.05	2,537	0.05	0.26

Table B. 4: Oster (2019)-Test for Size of Unobservables to Set Effect to Zero

This table shows the results of the bounding method according to Oster (2019). Under the assumption that 1) the relationship between treatment and observables is proportional to the relationship between treatment and unobservables, and 2) the upper bound of the variation R^2_{max} is $1.3R^2$, which Oster empirically derives from comparing experimental vs. observational studies, then it is possible to provide the required size of unobservables to make the effect be of a certain value, e.g., zero.

	Foreign VC	US VC
Baseline regressions		
Baseline effect, (Std. err.), [R^2]	0.066 (0.009) [0.031]	0.121 (0.015) [0.038]
Controlled effect, (Std. err.), [R^2]	0.051 (0.005) [0.042]	0.101 (0.007) [0.049]
Oster (2019)-bounds		
Bias-adjusted β	0.042	0.088
Degree of selection on unobservables relative to observables to set effect to zero (i.e., δ^*)	2.996	3.270
Max R^2 to set effect to zero	0.096	0.128

Table B. 5: Foreign VC Effect over Time

The table reports CEM-weighted effects as per Table 3.6 in different subsamples. Startups are split into subsamples according to their year of first funding, i.e. 2000-2005, 2006-2008, 2009-2010, and 2011-2014.

Dependent variable:	Headquarter relocation							
	Startup first funded				Startup first funded			
	2000-2005 (1)	2006-2008 (2)	2009-2010 (3)	2011-2014 (4)	2000-2005 (5)	2006-2008 (6)	2009-2010 (7)	2011-2014 (8)
Foreign VC in first round	0.038***	0.079***	0.059**	0.055***				
	(0.010)	(0.030)	(0.025)	(0.016)				
US VC in first round					0.082***	0.139**	0.175***	0.114***
					(0.023)	(0.060)	(0.052)	(0.029)
Observations	2,697	760	508	1,811	1,238	399	286	1,177
R-squared	0.031	0.082	0.144	0.058	0.072	0.271	0.334	0.092
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Funding year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

C

Chapter 3

C.1 Merging VentureSource With Other Data Sets

We augment VentureSource data on three fronts. First, we improve startup exit coverage by matching VentureSource with the industry standard databases in IPO and M&A research: Revinitiv's Securities Data Company (SDC) Mergers and Acquisitions and SDC's New Issues databases. Although VentureSource is more accurate in tracking startup exits compared to other databases used in VC research, its coverage is not complete (Kaplan and Lerner (2017)). This search resulted in 776 additional exits (a 25% increase). Second, we match VentureSource with the European Patent Office (EPO) PATSTAT database to measure a company's level of innovation using patent data. PATSTAT is a comprehensive database of patent documents from more than 40 national and international patent offices, including, for example, the national patent offices of the US, UK, Germany, and Japan. Third, we manually search the LinkedIn profiles for the founders and initial CEOs contained in the VentureSource data. From these public LinkedIn profiles of the founders, we extract the full career history including locations.

To match VentureSource to the three commerical databases SDC Mergers and Acquisitions, SDC New Issues, and PATSTAT, we follow the same procedure three times: We begin by standardizing the company names in both databases, using the standardization rou-

tines developed by the NBER Patent Data Project[1]. These routines standardize company prefixes and suffixes (e.g., PHARMACEUTICAL(S), PHARMACEUTICA, PHARMACEUTIQUE(S), PHARMAZEUTIKA, PHARMAZEUTISCH(E)(N), and PHARMAZIE become PHARM), generating a company's "standard name" and "stem name". We match on the stem name, which is a "core" of the company name stripping organizational form suffixes, prefixes, capital letters, punctuation, and spaces. We consider all exact matches and the 5 closest matches based on a fuzzy match score if this score is above a similarity threshold of 0.95. We also perform this matching on former company names listed in VentureSource. All positive matches resulting from this procedure are then carefully checked by hand verifying each match with identifying information such as country, industry, and business description in both data sets.

[1]See https://sites.google.com/site/patentdataproject/.

Table C. 1: Variable Definitions - Round Level

This table contains descriptions of the variables used in the round-level analysis.

Variable	Description
VC Origin	
Foreign investor	At least one foreign investor is involved in the round
U.S. investor	At least one U.S. investor is involved in the round
Venture characteristics	
VC amount raised ($m)	Amount of VC invested in the venture in the round in 2012 U.S. dollars
Pre-money valuation ($m)	Pre-money valuation the venture received in the round in 2012 U.S. dollars
Sales multiple	Pre-money valuation divided by sales generated in the year of the financing round, in the year after the round or in the year before the financing, depending on availability
Serial entrepreneur	At least one serial entrepreneur is involved in the venture
Round	Consecutive VC financing round number
Patent applications	The total number of patents the venture has applied for as of the date of the round
Patent citations received	The total number of forward citations all patents received that were in stock in the moment of financing
VC characteristics	
VCs' cumulative number of portfolio companies	The total cumulative number of unique portfolio companies all VCs in the syndicate have invested in up to the round date
VCs' age	Average age of all VCs in the syndicate at time of the round
Syndicate size	The number of investors involved in the round
Fixed effects	
Round FE	Financing round # fixed effects
Year FE	Financing year fixed effects
Industry FE	Startup industry fixed effects: "Communication & Media", "Information Technology", "Medical/Biotech", "Consumer/Retail", "Business support services", "Other"
Country FE	Country fixed effects for the headquarters of the venture
Miscellaneous	
First round:	If used as a prefix before a variable, "First round:" indicates that the variable is measured as of the first VC round

Table C. 2: Variable Definitions - Company Level

This table contains descriptions of the variables used in the company-level analysis. Only variables which are different than at the round-level are listed.

Variable	Description
VC Origin and instrumental variable	
Foreign investor	At least one foreign investor is involved in the venture
U.S. investor	At least one U.S. investor is involved in the venture
Average capital inflow into foreign buyout funds	Average annual capital inflow, i.e. funds raised, by foreign buyout funds during the years of VC funding of the venture, i.e. between first and last observed VC round, in 2012 U.S. dollars
Average capital inflow into U.S. buyout funds	Average annual capital inflow, i.e. funds raised, by U.S. buyout funds during the years of VC funding of the venture, i.e. between first and last observed VC round, in 2012 U.S. dollars
Average capital inflow into domestic VC funds / "Domestic VC inflow"	Average annual cpital inflow, i.e. funds raised, by domestic venture capital funds during the years of VC funding of the venture, i.e. between first and last observed VC round, in 2012 U.S. dollars
Venture characteristics	
Total VC amount raised ($m)	The total VC amount invested in the venture, across all rounds, in 2012 U.S. dollars
Patent applications	The total number of patents the venture has applied for by the last financing event of the venture
Patent citations received	The total number of forward citations all patents received that were in stock in the moment of the last financing event of the venture
VC characteristics	
VCs' cumulative number of portfolio companies	The total cumulative number of unique portfolio companies all VCs in the syndicate have invested in up to the first investment in the venture
VCs' age	Average age of all VCs in the syndicate at time of the first investment in the venture
Syndicate size	The number of investors involved in the venture
Fixed effects	
Period FE	Fixed effects for non-overlapping four to five year periods, i.e. 2000-2004, 2005-2008, 2009-2013
Exit locations	
Exit (IPO or acquisition)	Venture exited through either IPO or acquisition
Domestic exit	Venture exited through either domestic IPO or acquisition by a domestic buyer
Foreign exit	Venture exited through either foreign IPO or acquisition by a foreign buyer
U.S. exit	Venture exited through either U.S. IPO or acquisition by an U.S. buyer
Non-U.S. exit	Venture exited through either non-U.S. IPO or acquisition by a non-U.S. buyer

Table C. 3: Variable Definitions - Entrepreneur Level

This table contains descriptions of the variables used in the entrepreneur-level analysis. Only variables which are different than at the company-level are listed.

Variable	Description
Entrepreneurial migration	
Abroad 1 year after last financing	Founder/CEO had her primary work location abroad 1 year after last financing event (i.e. all executive positions were located in a different country than the country of the venture)
Abroad 3 years after last financing	Founder/CEO had her primary work location abroad 3 years after last financing event (i.e. all executive positions were located in a different country than the country of the venture)
Abroad 6 years after last financing	Founder/CEO had her primary work location abroad 6 years after last financing event (i.e. all executive positions were located in a different country than the country of the venture)
U.S. 1 year after last financing	Founder/CEO had her primary work location in the U.S. 1 year after last financing event
U.S. 3 years after last financing	Founder/CEO had her primary work location in the U.S. 3 years after last financing event
U.S. 6 years after last financing	Founder/CEO had her primary work location in the U.S. 6 years after last financing event

Table C. 4: Investor Origin and Exit Locations - Alternative Instrument

The table shows two-stage least squares (2SLS) regressions of exit location types on incidence of foreign (U.S.) investors. The unit of observation is the VC-backed company. The main variable of interest, Foreign (U.S.) investor, is an indicator variable equal to one if at least one foreign (U.S.) investor is involved in the venture. The involvement of foreign (U.S.) investors is instrumented by the average 'Market share of foreign (U.S.) investors', defined as the number deals with at least one foreign (U.S.) investor divided by all deals (excluding all rounds to the focal venture), over all country-industry-year combinations during which the venture was active on the VC market. Columns (1) and (6) report first stage results where foreign (U.S.) investor dummies are instrumented by the 'Market share of foreign (U.S.) investors'. Columns (2)-(5), and (7)-(10) show the 2SLS estimates of the second stage. Control variables and fixed effects are the same as in Table 4.5. The model is estimated using 2SLS, and robust standard errors clustered at the country level are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided), respectively.

	Foreign investor	Domestic		Foreign		U.S. investor	Non-U.S.		U.S.	
		exit (IPO or acq.)	acq.	exit (IPO or acq.)	acq.		exit (IPO or acq.)	acq.	exit (IPO or acq.)	acq.
	1st stage	2SLS	2SLS	2SLS	2SLS	1st stage	2SLS	2SLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Market share of foreign investors in local market (excl. focal venture)	0.325***									
	(0.102)									
Foreign Investor		-0.005	-0.096	0.138*	0.125					
		(0.094)	(0.096)	(0.080)	(0.081)					
Market share of U.S. investors in local market (excl. focal venture)						0.174***				
						(0.052)				
U.S. Investor							-0.006	-0.168	0.254***	0.222**
							(0.211)	(0.183)	(0.087)	(0.096)
VC Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Venture controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period, country & industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11386	11386	11386	11386	11386	11386	11386	11386	11386	11386
R-squared	0.155	0.051	0.028	0.065	0.056	0.116	0.056	0.021	-0.009	-0.008
IV F-stat	10.18					11.05				

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