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Bank lending and small and medium-sized enterprises' access to finance – Effects of macroprudential policies



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ABSTRACT

This paper examines the impact of macroprudential policies on small and medium-sized firms' access to bank finance. To this end, we use data from a firm-level survey covering European Union (EU) countries between 2009 and 2017, as well as a recently published database on the use of macroprudential policies in EU countries, the Macroprudential Policies Evaluation Database (MaPPED), which allows us to separately consider the tightening and loosening macroprudential policy measures. We develop several macroprudential indices based on the target of the macroprudential instruments. The results reveal a significant relationship between macroprudential indices and firms' access to finance. The indices are mainly associated with limited access to bank credit for SMEs, taking different firm- and country-level characteristics into account. While use of macroprudential measures could lead to higher capitalisation and make the financial sector more resilient and reduce its risk exposure, this could also mean restricted lending to firms, especially smaller firms with fewer financing options and considerable reliance on bank credit.

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1. Introduction

This paper aims to fill a gap in the corporate finance literature by examining the impact of macroprudential regulatory changes in the banking sector on the credit access of small and medium-sized enterprises (SMEs). SMEs account for about 99% of all non-financial firms in the EU and create almost 55% of the sector's value added and over 65% of employment.¹ Given that access to and the price of financing plays the primary role in the business of SMEs, and given their overall dependence on bank-based financing, the literature on their financing obstacles and opportunities is an important component for both practitioners and academic debates.

The global financial crisis of 2008, followed by the eurozone debt crisis, has reduced firms' ability to obtain bank finance, on which the vast majority of SMEs in Europe are highly dependent (Acharya and Steffen, 2015; Aiyar et al., 2015; Campello et al., 2010; Chava and Purnanandam, 2011; European Banking Authority, 2016; Popov and Udell, 2012). Aiyar et al. (2015) highlight that SMEs account for the majority of employment and production in Europe, while they rely heavily on bank loans for financing. Most of these firms have experienced increased financing costs or had their options restricted in the aftermath of the 2008 global financial crisis (Santos, 2011). While many studies have examined the crisis' impact on bank lending to

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¹ Annual report on European SMEs 2018/2019 by European Commission.

firms (Jin et al., 2018; Santos, 2011; Tsuruta, 2015) and the determinants of constraints on bank lending to firms (Beck et al., 2006, 2011; Becker and Ivashina, 2014; Behr et al., 2017; Dell'Ariccia et al., 2012), limited research has analysed the impact of post-crisis regulatory reforms on bank lending to SMEs, although it is safe to say that most of these reforms were macroprudential in nature.

The focus of macroprudential policy is establishing a macro-protection framework whose key objective is to maintain the resilience of the financial sector and its agents, while smoothing banks' procyclical behaviour (Lim et al., 2011). The emphasis on macroprudential policy stems from the regulators' intention to strengthen the financial system's resilience and stabilise credit cycles (Claessens et al., 2013; ESRB, 2014). Yet, the consequences of regulatory changes may also translate into a decline in the credit supply and the erosion of economic activity, with undesirable effects like greater unemployment and a decline in investment (Cosimano and Hakura, 2011; Duygan-Bump et al., 2015; Francis and Osborne, 2012).

The severity of the 2008 financial crisis has led to the increased application of macroprudential instruments in European countries, with more policy measures aimed at tightening credit conditions. The desired effects of macroprudential policy are to stabilise credit cycles and prevent credit markets from overheating, thereby achieving financial stability objectives (Ayyagari et al., 2018). However, we are interested in examining the implications held by these policies for firms' access to bank credit, with a focus on smaller firms that have traditionally relied heavily on bank financing.

This paper investigates whether macroprudential measures implemented in 28 EU countries are associated with SMEs' access to bank credit, and explores this relationship empirically while controlling for various firm-level and macroeconomic determinants. We combine firm-level data from the Survey on the Access to Finance of Enterprises (SAFE), conducted by the European Central Bank, with the extensive macroprudential database, the Macroprudential Policies Evaluation Database (MaPPED), also collected and published by the European Central Bank. These datasets are complemented by macroeconomic data obtained from the ECB, the World Bank database and IMF's International Financial Statistics.

Our contribution to corporate finance and the growing macroprudential literature is fourfold. First, to our knowledge, this is the first study to examine the impact of a comprehensive set of up to 53 macroprudential instruments activated over a long period of time in the European Union on SMEs' access to bank finance. We assess how macroprudential policies affect the loan application outcomes for SME borrowers and clarify which factors increase/decrease the availability of credit to these firms and how macroprudential regulation affects banks' willingness to provide financing to smaller firms. The comprehensive macroprudential policy dataset, the MaPPED, provides detailed information on the scope of instruments, policy actions, and the direction of policies. Second, we combine these data with the SAFE database on firms' financing conditions with extensive information on firm characteristics, with a focus on bank loan applications. The data on the rejection or approval of a loan application, together with the characteristics of each firm, are particularly informative and hold considerable predictive power. Third, given the limited micro evidence in the macroprudential policy literature, this paper also helps better understand the relationship between macroprudential instruments and firm financing with increased granularity, and at the same time limiting the endogeneity issues which may arise as a result of reverse causality, related to the decision to adopt macroprudential policies. Specifically, it is unlikely that the macroprudential regulator's decisions will depend on individual firms' business and financing conditions, but more on the macroeconomic state and risks pertaining to the financial system as a whole.² Fourth, we are able to identify the effects of different macroprudential policy cycles by separately testing macroprudential policy tightening and loosening actions, and contribute to a better understanding of their effects on real economic activity.

The remainder of this study is organised as follows. Section 2 presents an overview of the literature and the hypotheses development. Section 3 describes the data and the empirical framework for the study. Section 4 presents the main results and findings of the study, while Section 5 sets out further extensions and robustness checks. Section 6 presents the conclusion of the study.

2. Literature review and hypotheses development

This paper relates to several strands in the literature. First, there is evident growth in the literature on the financing and borrowing conditions of European SMEs but, to our knowledge, no studies have looked at the impact of macroprudential policy. Popov and Udell (2012) investigate how the decline in cross-border banking activity between 2010 and 2014 affected European firms' cost of financing following the financial crisis. The decline in cross-border banking activity had a significant impact on the likelihood of smaller firms facing higher financing costs. Mascia and Rossi (2017) examine the impact of the firm manager's gender on the cost of financing. The authors found that firms with female managers were more likely to have higher financing costs while controlling for different firm and country characteristics, suggesting that such firms thereby have worse credit conditions and a lower chance of obtaining bank credit. García-Posada Gómez (2018) showed that a firm's credit constraints have a significant negative impact on its investment and growth. Mayordomo and Rodríguez-Moreno (2018) suggest that the SME Supporting Factor introduced in January 2014 for all EU countries, which allows banks to reduce regulatory capital requirements associated with risk related with SME loans, reduces credit rationing for medium-sized enterprises, but not for micro enterprises.

² See Cerutti et al. (2017), Claessens et al. (2013), and Kang et al. (2021).

In terms of the availability of bank credit to firms [Casey and O'Toole \(2014\)](#) show that credit-rationed firms are likely to turn to the informal market for financing. More leveraged firms and those with poor credit histories have a greater need to resort to borrowing from other firms or informal credit because they cannot easily obtain bank financing. In a recent paper by [Wang et al. \(2020\)](#), the authors emphasise that SMEs may deviate from sound behaviour after the loan has been granted, resulting in a moral hazard problem and increasing the credit risk for the lender. All of these imperfections mean the SME lending market struggles to obtain the funds needed. The importance of this sector for the economy as a whole ensures that it is an important part of academic and institutional discussions.

[Ferrando et al. \(2017\)](#) find that government stress has a significant negative impact on the availability of finance for SMEs and that firms in stressed economies are likely to use government subsidies as another form of finance. [Adelino and Ferreira \(2016\)](#) suggest that lending to firms may be affected when banks face more stringent liquidity requirements, even if firms' characteristics remain the same. Banks facing a credit downgrade reduce their supply of credit. This reduction in lending may be related to difficulties in accessing different sources of financing and hence to higher financing costs.³

[Ferrando et al. \(2019\)](#) investigate whether the unconventional monetary policy measures introduced by the ECB make it easier for SMEs to obtain financing. The authors establish that the announcement of the unconventional monetary policy measures increased the probability of firms obtaining loans, which added to firm profitability. Similar results concerning the effects of expansionary monetary policy were found by [Jin et al. \(2018\)](#). [Albertazzi and Marchetti \(2010\)](#) and [Berger and Udell \(1994\)](#) showed that larger banks with lower capitalisation ratios restricted their lending to riskier corporate borrowers, while the same effect was not observed for smaller banks with lower capital ratios. Similarly, [Barth et al. \(2013\)](#) found that higher regulatory capital requirements are associated with a smaller share of nonperforming loans in bank assets, making a bank's loan portfolio less risky and improving its asset quality. However, to meet regulatory requirements, financial institutions might restrict their lending or charge borrowers higher lending rates ([Ebrahimi Kahou and Lehar, 2017](#)). Using data on banks in the United Kingdom, [Aiyar et al. \(2016\)](#) find that higher capital requirements combined with monetary policy instruments affect bank lending. Depending on the size of a bank, credit growth is negatively associated with higher capital requirements. In a study of Slovenian firms by [Bole et al. \(2014\)](#), the authors show that post-crisis regulatory interventions in the form of increased capital requirements led to a decline in bank lending to firms within a short period of time, triggering a sharp rise in the number of firm failures. [Carlson et al. \(2013\)](#) show that during downturns higher capital requirements substantially affect the volume of lending by causing banks to cut their lending to borrowers, whereas in normal times these requirements are unlikely to bring such effects. On the other hand, [Bridges et al. \(2014\)](#) describe how higher capital requirements lead to reduced lending to firms and households and that loan growth only normalises after 3 years. The authors also point to the need to investigate possible similarities to these effects arising from macroprudential policies and how they might affect lending. These contributions to the literature are insightful and highlight the need to examine the potential trade-off between financial stability and economic development.

Our study also touches considerably on the growing literature on the effectiveness and impact of macroprudential regulation. The literature shows that macroprudential regulation has significantly affected banking and its activities ([Cerutti et al., 2017](#); [Claessens et al., 2013](#); [Lim et al., 2011](#); [Morgan et al., 2018](#); [Olszak et al., 2018](#)). Macroprudential policy is designed and implemented by introducing different macroprudential measures that target both the asset and liability sides of banks' balance sheets, thereby affecting banks' exposure to particular risks. In a cross-country study, [Borio and Shim \(2007\)](#) find that macroprudential policies are efficient for reducing credit growth in years following introduction of the instruments. Similarly, [Crowe et al. \(2013\)](#) find that loan-to-value limits can help control credit growth in periods of upswing, while dynamic provisioning can moderate loan cycles. Other extensive cross-country studies on the effects of macroprudential policy suggest that macroprudential measures are successful in restraining credit growth and reducing bank risk-taking. The literature suggests that macroprudential instruments can reduce the incidence of loan booms and lower the likelihood of financial instability and financial crises ([Akinci and Olmstead-Rumsey, 2018](#); [Cerutti et al., 2017](#); [Crowe et al., 2013](#); [Lim et al., 2011](#)). In a recent study by [Nakatani \(2020\)](#) that empirically examined the effectiveness of LTV limits, macroprudential policies are shown to be associated with changes in the likelihood of a financial crisis. Similar results were presented by [Franta and Gambacorta \(2020\)](#) while investigating the impact of macroprudential policies on growth-at-risk (GaR), a measure of financial stability developed by the [IMF \(2017\)](#). Other studies also found substantial evidence of macroprudential policy's impact on bank risk by amplifying the effects of corporate governance ([Gaganis et al., 2020](#)), by analysing the Z-score and expected default frequency of over 3,000 banks in 61 advanced and emerging countries ([Altunbas et al., 2018](#)) or by analysing the effects on listed banks in EU countries with recent macroprudential data ([Meuleman and Vander Vennet, 2020](#)). The study by [Ely et al. \(2020\)](#) shows the impact of macroprudential policy on bank risk depends on the particular mix of measures used, the determinants of bank risk and the concentration of the banking market being considered. [Suhail Rizwan \(2021\)](#) states that macroprudential policies are efficient for enabling systemic stability, yet the study also warns about differences in macroprudential instruments' effectiveness based on country heterogeneity in terms of institutional settings, market characteristics and business environment.

Regarding recent evidence on the effects of macroprudential policy on lending, [Kinghan et al. \(2019\)](#) show in the context of first-time homebuyers that macroprudential policy has significant effects on property selection, down-payment value and debt, with mixed effects among groups of borrowers. The authors also emphasise the importance of using granular micro

³ See also [Correa et al. \(2013\)](#).

data while analysing the effects of macroprudential instruments. Considering extensive data on macroprudential measures in the EU that target credit growth, Poghosyan (2020) finds for tightening policy actions only a limited effect on credit growth, in contrast with a strong and positive relationship found for loosening measures. A recent study by Mirzaei et al. (2021) suggests that macroprudential policies are successful with curbing lending, although it is stressed that bank state ownership attenuates this effect.

There is an apparent gap in the literature regarding a more granular approach to measuring macroprudential policies' impact on the non-financial sector, especially when using firm-level data. Yarba and Güner (2020) examined the impact of macroprudential policies on Turkish firms and their leverage and find that leverage is reduced in the presence of enforced and tightened macroprudential instruments, particularly for SMEs. Our study extends the paper by Ayyagari et al. (2018), namely, one of the first attempts to measure the extent of macroprudential regulation's impact on firms' loan accessibility. Using firm-level data for 59 countries for the period 2002–2011, the authors investigate the impact of a limited set of 11 macroprudential instruments on firms' credit access. The findings show that younger and smaller firms are substantially affected by the use of macroprudential instruments. Moreover, the authors stress the importance of understanding the trade-off between the use and deepening of financial regulation on one hand and the impact on the real economy and economic development on the other. In their study on the interaction of macroprudential and monetary policy as well as the role played by the central bank in achieving financial stability goals, Klingelhöfer and Sun (2019) state macroprudential regulations should be carefully designed based on a country's specific characteristics due to the possible costs of overregulation, which could also bring undesired consequences with regard to regulatory leakages or capital misallocation.

In the contrast to Ayyagari et al. (2018) we use firm-level, survey-based data focused on EU countries and macroprudential data published by the ECB, which contain extensive information on the use of up to 53 macroprudential instruments in EU countries, with data available for a longer time horizon. We merge these two datasets while controlling for various macroeconomic characteristics for the period 2009–2017, during which macroprudential policies were most actively used (Cerutti et al., 2017). We divide the available macroprudential tools into *borrower-related tools*, such as limits on credit growth, limits on loan-to-value ratios, limits on debt-to-income ratios, limits on foreign currency lending, or reserve requirements; *liquidity-related measures*, such as different liquidity requirements and limits on maturity and currency mismatches, and *capital tools*, which include profit distribution limits, dynamic provisioning, or countercyclical capital requirements. We group the remaining macroprudential instruments included in the database in the *Other* category.

We develop four hypotheses that are then examined in this paper. First, we test whether macroprudential policies affect the availability of credit for SMEs. Since macroprudential instruments have a negative impact on bank lending (Cerutti et al., 2017; Claessens et al., 2013; Lim et al., 2011; Morgan et al., 2018; Poghosyan, 2020), we expect a negative relationship between macroprudential measures and SMEs' access to bank financing. Further, a recent study by Kang et al. (2021) on macroprudential policy's impact on bank financing for firms in China confirms that macroprudential policy tightening actions are negatively associated with the bank firm financing level.

H1. The activation of macroprudential policies is associated with reduced bank lending to SMEs.

The way banks respond to the tightening of macroprudential policy may be seen in their borrower selection. In Kang et al. (2021), the authors find that macroprudential policy tightening is associated with the change in bank borrowing policies that leads to favouritism being shown to larger firms and those owned by state, even those with the same amount of leverage as in smaller and privately-owned firms. Second, we test whether the impact of macroprudential policies on the availability of credit to SMEs depends on these policies' direction and their effect through the credit channel. Therefore, we posit the following hypotheses:

H2a. The tightening of macroprudential measures is negatively associated with banks' propensity to lend to SMEs.

H2b. Loosening actions of macroprudential policy are associated with a higher likelihood of a successful bank loan application outcome for SMEs.

Following previous studies that showed the importance of firm size while applying for a bank loan (Beck et al., 2005; Beck and Demircug-Kunt, 2006; Petersen and Rajan, 1994) and in order to test if the effect of macroprudential policy on bank-based firm financing differs among various firm size groups, we form the last hypothesis:

H3. Macroprudential measures exert a smaller influence on firms' access to bank finance as firm size increases.

To test these hypotheses, we use data from SAFE that allow us to control for several firm characteristics like firm size, age, use of debt, turnover level, credit history, and ownership, along with bank-related variables concerning maturity and collateral conditions. The choice of these variables is supported by the literature (Berger and Udell, 2006; Mascia and Rossi, 2017). The Macroprudential Policies Evaluation Database (MaPPED) by Budnik and Kleibl (2018) gives the possibility of constructing different macroprudential indices based on the policy measures captured in the database. First, we measure the impact of macroprudential policy through an aggregate macroprudential index by summing all policy measures across survey waves. Second, this index is subdivided by the particular target of the macroprudential instruments, i.e., for instruments targeting borrowers, we construct the *Borrower* index; when instruments target the liquidity positions of financial institutions, we

construct the *Liquidity* index. For macroprudential measures targeting banks' capital positions, we construct the *Capital* index while for the other macroprudential measures we construct the *Other* index.⁴ In this way, we are able to evaluate the channels through which macroprudential measures can affect the probability of SMEs gaining access to bank credit.

Our results support the hypothesis that macroprudential policies are associated with a lower likelihood of a successful loan application outcome for SMEs. We find the strongest relationship for the aggregate macroprudential index and the capital index, grouping capital-based macroprudential policies. When testing the direction of macroprudential measures, the results show that a tightening of macroprudential instruments is associated with a lower likelihood of SMEs gaining access to bank financing. On the contrary, the relaxation of macroprudential measures is associated with a higher likelihood of SMEs obtaining bank financing, as revealed in empirical results. Overall, our results hold after running various robustness tests.

3. Data and methodology

Firm-level data come from the restricted Survey on the Access to Finance of Enterprises (SAFE), obtained with permission of the European Central Bank. SAFE was initiated in 2009 in the wake of the financial crisis, and is conducted every 6 months for a number of euro area countries, known as *ECB round* waves. A bigger survey is conducted once a year in collaboration with the European Commission, the *common round* covering all EU countries and certain other European countries. Firms in the database are randomly selected from the Dun and Bradstreet database and stratified by country, sector and firm size. The survey provides a large amount of qualitative data on the financial access of firms in the eurozone and also in the EU. In this analysis, we are only focusing on countries that form part of the EU and for which we possess the necessary information.⁵ Apart from SAFE, to collect information on the implementation and changes made to macroprudential regulations we use the recently collected and publicly available database on macroprudential policy implementation that focuses on EU countries and contains data for a long period of time as well as the information on the scope and direction of the instruments. In addition, we control for various macroeconomic determinants using data available from the World Bank, the ECB and the IMF's International Financial Statistics.

3.1. Firm-level data

SAFE was launched in 2009, with two waves being conducted: Wave 1 of 2009 for the period January 2009 to June 2009, while wave 2 is for July 2009 to December 2009. Wave 3 has the reference period from March 2010 to September 2010 and wave 4 from September 2010 to February 2011. For all other waves (wave 5–wave 17), the first wave of each survey covers the second and third quarters of the current year, while the second wave of each survey covers the fourth quarter of the current year and the first quarter of the following year.⁶ We adjust our macroeconomic variables to these reference periods to accurately measure their impact. We use all waves available, both the ECB and the common rounds, and since we want to measure access to bank financing, we only include firms that applied for a bank loan or line of credit according to their responses to the questionnaire. In the end, we have 52,189 observations for 36,466 firms, and most firms in our dataset were interviewed only once. SAFE provides data stratified by country and firm size, as measured by the number of employees, using the following categorisations: a) micro (from 1 to 9 employees); b) small (from 10 to 49 employees); c) medium (from 50 to 249 employees); and d) large (250 employees or more).⁷ The sample is further stratified by main activity, age, and ownership. In addition, SAFE provides weights based on firm size, measured by the number of employees across firm size, activity, and country, which we include in all regressions.

Table 1 provides more information on firm characteristics and shows the frequency of firm observations by size, age, main activity, and ownership. The biggest share of the sample is accounted for by small (31%) and medium-sized firms (31%) with 10 to 49 employees and 50 to 249 employees, while a smaller yet significant share is held by micro firms (27%) with up to 9 employees. A much smaller proportion (11%) of firms is represented by large enterprises with over 250 employees. We include this set of observations in the analysis to better compare the impact of size on financing conditions. The largest share of firms in our sample belongs to the services sector (29%), while industry (26%) and trade (24%) follow. The smallest part of the sample belongs to the construction sector (10%) while for the remaining firms their main activity is not indicated. In terms of age, the majority of firms in the sample (up to 80%) had been operating for 10 years or more, suggesting that many firms in the sample have established business and banking connections (Casey and O'Toole, 2014). Firms aged between 5 and 10 years old make up 12% of the sample, while firms less than 5 years old but established for more than 2 years, account for 5% of the sample. Only about 1% of the sample are start-ups established for less than 2 years. We do not have complete data for the remaining 2% of the sample. When it comes to ownership, most of the sample belongs to firms owned by families or entrepreneurs (52%), while private owners follow (26%); 13% are owned by other firms or business partners, about 4% are publicly listed, and 1% of firms are venture capital or business angel firms.

⁴ For more information on the construction of the indices, see Section 3.2, and for more information on the macroprudential measures included in the MaPPED database, see Appendix, Table A3.

⁵ For more information on the survey, see: https://www.ecb.europa.eu/stats/ecb_surveys/safe/html/index.en.html

⁶ For more information on the reference period of the data, see Appendix, Table A1.

⁷ The number of large firms in SAFE is limited, and these firms were included in our sample to allow for a comparison of conditions for large and small firms.

Table 1
Firm frequency and share of observations based on firm characteristics.

	Frequency	Share (%)
<i>Size</i>		
Micro (from 1 to 9 employees)	13,818	26.48
Small (from 10 to 49 employees)	16,326	31.28
Medium (from 50 to 249 employees)	16,158	30.96
Large (250 employees or more)	5,887	11.28
<i>Sector</i>		
Industry	13,507	25.88
Construction	5,423	10.39
Trade	12,302	23.57
Services	15,070	28.88
Other or unstated	5,887	11.28
<i>Age</i>		
10 years or more	41,762	80.02
5 years or more but less than 10 years	6,300	12.07
2 years or more but less than 5 years	2,622	5.02
Less than 2 years	658	1.26
Other or unstated	847	1.62
<i>Ownership</i>		
Public shareholders	1,901	3.64
Family or entrepreneurs	26,904	51.55
Other firms or business associates	6,667	12.77
Venture capital firms or business angel	439	0.84
A natural person, one owner only	13,648	26.15
Other or unstated	2,630	5.04

Note: The table shows the frequency and percentage of observations for different firm characteristics.

3.2. Macroeconomic and macroprudential data

In addition to macroeconomic data obtained from the IMF's data warehouse International Financial Statistics, the ECB and partly from the World Bank and national sources, we use the dataset based on a detailed survey of macroprudential policies in EU countries provided by the ECB (Budnik and Kleibl, 2018). Entitled the Macroprudential Policies Evaluation Database (MaPPED)⁸, the database is based on a survey conducted by the ECB with the data being collected with the support of national central banks and regulators in EU countries. It contains information on prudential measures and instruments of a macroprudential nature in all EU member states between 1995 and 2017. The dataset includes information on 1,700 prudential actions, divided by their objective and purpose into 11 instrument categories, in turn subdivided into 53 subcategories of policy instruments.⁹ The introduction of an instrument, changes in its intensity during the observed period and the repeal of an instrument are covered. These policy measures are recorded as loosening, tightening or ambiguous. We are able to measure these changes in policy measures over time, which allows indices to be constructed that measure the direction of macroprudential policy in terms of its tightening or loosening nature. We follow several approaches from the literature (see Akinci and Olmstead-Rumsey 2018; Altunbas et al., 2018; Kuttner and Shim, 2016; Lim et al., 2011).

Given that the MaPPED dataset contains information about the legal nature of a measure: whether a policy action is installed as a legally binding measure or as a recommendation by the regulator, we choose to exclude recommended policy measures and to only include binding measures in our analysis to ensure accurate and reliable estimates.¹⁰ We are able to capture information on the direction of macroprudential instruments with three possible responses to the nature of a policy action: 1) policy tightening; 2) policy loosening; or 3) other and with an ambiguous impact. Since the database contains quarterly information on changes in a policy instrument, we first denote the policy actions with indicator variables: -1 for easing measures, 1 for tightening measures, and 0 for no change (Budnik and Kleibl, 2018; Altunbas et al., 2018). We also denote "other and ambiguous" as 0 because we do not have enough information on the magnitude and direction of a change. Since these action changes are captured on the quarterly level, we start by coding quarterly policy changes in our sample period 2009–2017.

Since the firm-level data used in our study are semi-annual, in order to capture accurate information and be able to merge the data, the data taken from the macroprudential database are adjusted semi-annually to capture changes in the period corresponding to each wave. We do this by summing policy actions across quarters. This means that policy actions with different signs can sum to zero and cancel each other out (Altunbas et al., 2018). We do the same for macroeconomic variables, for which we take averages of quarterly data and transform them to correspond to each survey round (see Appendix, Table A1),

⁸ Database available at: <https://www.ecb.europa.eu/pub/research/working-papers/html/mapped.en.html>

⁹ For a list of instruments included in the MaPPED database, see Appendix, Table A3.

¹⁰ We perform additional analysis in Section 5.2, where we conduct a robustness test by including measures which were recommended by the regulator.

like in Mascia and Rossi (2017) and Bremus and Neugebauer (2018). First, we distinguish macroprudential instruments with the same objective and divide them into categories: a) capital-related instruments (minimum capital requirements, capital buffers, risk weights, provisioning); b) borrower-related instruments (lending ceilings, reserve requirements); c) liquidity-related instruments (loan/deposit ratios, funding requirements, liquidity coverage ratios); and d) other measures (taxes, exposures, other). Second, based on these subdivisions, we construct 4 indices that equal the sum of all related policy actions across all waves and countries in the sample. This means the index can theoretically take a value of $-1, 0, 1, -2, 2$ or up to -6 or 6 or more. We also construct an index that captures all macroprudential instruments: MPP, which can take a value of -3 to 6 in our database. A higher index value indicates a restrictive macroprudential policy stance, while lower values indicate looser policies and a more relaxed macroprudential stance. Finally, we construct two indicators based on the direction of the measures. We measure tightening and loosening separately by constructing indices that take the value of the sum of either tightening or loosening policy actions separately, attributing zero elsewhere.¹¹

3.3. Empirical model

To investigate the impact of macroprudential policy on the financing of SMEs, we specify the following probability model:

$$\Pr(y_{i,k,t}^* = 1) = F(\alpha + \beta MPI_{k,t} + \gamma CRISIS_{k,t} + \delta MACRO_{k,t} + \theta FIRM_{i,k,t} + \lambda_k + v_t + \mu_s + \varepsilon_{i,k,t}) \quad (1)$$

where index i refers to the firm, k refers to the country and t refers to the time period. $y_{i,k,t}$ is the loan application outcome, a dichotomous variable that takes the value of 1 if a firm applied for a loan and the loan application was successful, and 0 otherwise. $MPI_{k,t}$ is the macroprudential policy index, which can be represented by different policy indices based on their target or direction; $MACRO_{k,t}$ is a vector of macroeconomic variables that includes the real GDP growth rate and the unemployment rate, while $CRISIS_{k,t}$ denotes a dummy variable that captures the impact of the sovereign debt crisis and takes the value of 1 for waves 4–7 (from September 2010 until September 2012); $FIRM_{i,k,t}$ is a set of firm-level characteristics representing size, age, leverage, profit, credit history, maturity, collateral, autonomy and ownership; $\varepsilon_{i,k,t}$ represents the error term. We use pooled probit with robust standard errors, clustered at the country level as the estimation method, and in all our regressions we include weights¹² as well as country (λ_k), time (v_t), and sector (μ_s) dummies to capture unobserved heterogeneity and time effects in our data.¹³

3.4. Definition of the variables

Access to finance (y^*) is the dependent variable. As a measure of access to finance, we use a dummy variable equal to 1 if a firm applied for a bank loan or line of credit that resulted in a successful outcome and 0 otherwise, similar to Wang et al. (2020) and Moro et al. (2017). Firm-level determinants include firm-size information captured by three variables: *Micro*, which takes the value of 1 if the firm has 1 to 9 employees, and zero otherwise; *Small*, which takes the value of 1 if the firm has 10 to 49 employees, and zero otherwise.¹⁴ Since smaller firms are traditionally more financially constrained than large ones (Petersen and Rajan, 1994; Beck et al., 2005; Beck and Demirgüç-Kunt, 2006), to capture this effect we also include the dummy *Large*, which takes the value of 1 if the firm has more than 250 employees. We measure the effects of firm age by including the variable *Age*, which takes the value of 1 if the firm is older than 10 years, and 0 otherwise. Beck et al. (2006) find that financing constraints are inversely related to firm age, i.e., financing constraints decrease with increasing age.

To control for a firm's riskiness and credit history (Petersen and Rajan, 1994; Petersen and Rajan, 1995; Casey and O'Toole, 2014), we also control for several other firm characteristics. To capture a firm's level of leverage, we include the *Leverage* dummy variable, which equals 1 if the firm had increased its use of debt in the last 6 months. The survey provides information about the firms' credit history by including a question about the recent outlook of a firm's credit history and whether it has improved or deteriorated in the last 6 months. We capture this information by including the dummy variable *Credit history* that equals 1 if a firm's credit history had improved in the last 6 months, and 0 otherwise. To control for firm profitability and economic outlook, we also include the variable *Profit*, which provides information on firms' profits and whether they have increased in the last 6 months. The variable equals 1 if a firm's profit has increased and is 0 otherwise. In line with Beck et al. (2006) and Mayordomo and Rodríguez-Moreno (2018), to assess the effect of firm ownership on the availability of bank financing, we include two variables, *Autonomous*, which equals 1 if the firm is an autonomous, profit-oriented firm, and 0 if the firm is a subsidiary, branch, or part of another firm, and *Ownership*, whose value of 1 indicates that a firm is owned by an individual, family, or entrepreneur, and 0 otherwise, denoting that it is owned by shareholders or other firms. In addition, we include two variables that only apply to firms that had applied for bank credit: *Collateral*, a dummy variable

¹¹ For similar application see Altunbas et al. (2018).

¹² The weight variable, which restores the economic weight, is given in SAFE and is constructed by the economic activity of the firm, the country to which the firm belongs, and its size. The number of employees is used as a measure of economic weight. For more information on the weighting variable, see the Methodological information on the survey and User's guide for the anonymized microdata set, available at: https://www.ecb.europa.eu/stats/pdf/surveys/sme/methodological_information_survey_and_user_guide.pdf?52b8c258739e26506dfb36e24899f5c0

¹³ We follow the approach in Beck et al. (2011), Mascia and Rossi (2017), and Bremus and Neugebauer (2018).

¹⁴ The SAFE provides the size decomposition in the following way: 1–9 employees - micro enterprises, 10–49 employees - small enterprises, 50–249 employees - medium enterprises and over 250 employees - large enterprises.

which has a value of 1 if a bank decreased the amount of collateral required from firms when applying for bank credit, and 0 otherwise, and *Maturity*, an indicator that has a value of 1 if a bank increased the maturity of loans, and 0 otherwise.

Macroprudential variables include several indices that help predict the probability that firms will receive bank credit. These indices include *MPP*, *Capital*, *Borrower*, *Liquidity*, and *Other*, which are our baseline measures of the macroprudential policy stance. We construct indices according to macroprudential objectives by following a similar approach used in previous studies that examined the impact of macroprudential measures (Lim et al., 2011; Altunbas et al., 2018; Akinci and Olmstead-Rumsey, 2018). These indices represent the sum of macroprudential instruments introduced as tightening or loosening policy actions across countries and waves in the survey. In addition, we construct additional indices that capture only tightening or only loosening actions. This is done for aggregate macroprudential index and other indices in which we group macroprudential measures according to their respective objectives.¹⁵ Following Ferrando et al. (2019), for *macro-level controls* we include real *GDP growth* as a proxy for credit demand and economic conditions, while we also control for the *Unemployment* rate in a country. Finally, we include the *Crisis* dummy, which equals 1 for waves 4–7 (from September 2010 to September 2012), to control for periods of the sovereign debt crisis.

Tables 2 and 3 provide descriptive statistics of our main regression variables and descriptive statistics of the firm variables for each country. Table 2 shows a high mean (0.8) for our dependent variable, *Access to finance*. In terms of standard deviation, we observe considerable variability in the value of our dependent variable in our sample. This is to be expected as our sample period covers the period after the 2008 financial crisis as well as the onset, duration and aftermath of the European sovereign debt crisis, whose severe impact in terms of availability of credit for SMEs in stressed countries was studied extensively by Ferrando et al. (2017). Table 3 shows the country means of the firm characteristics of firms in our sample and that had applied for bank financing. The countries with the highest mean for the *Access to finance* variable are Austria (0.87) and Luxembourg (0.87), followed by the Czech Republic (0.85), Finland (0.85) and Germany (0.84). The country with the lowest mean score for the *Access to finance* variable is Greece (0.49) followed by Cyprus (0.52), the Netherlands (0.57) and Ireland (0.65), some of which experienced turbulent periods due to the sovereign debt crisis. The country with the highest mean value for *Leverage*, a variable that indicates that companies used more leverage in the recent period, is Italy (0.36), while the country with the lowest value is Croatia (0.16). Regarding turnover, the country with the highest mean value for the *Profit* variable is the United Kingdom (0.47), while the country with the lowest value is Greece (0.15). Although we observe significant differences in firm characteristics and access to bank finance across EU countries, these values should be considered together with the proportion of observations for each country in our sample, available in Appendix, Table A2.

4. Empirical results and findings

This section of the study presents the base results of the estimations. First, the impact of macroprudential policies on SMEs' access to bank financing is tested by aggregating various macroprudential policies into five indices: *MPP*, the aggregate index that considers all macroprudential policy actions available in the database, and the *Capital*, *Borrower*, *Liquidity*, and *Other* indices, which are grouped based on the objective of each macroprudential instrument. In addition, country, year and sector dummies are included in all regressions to control for heterogeneity within the sample, while also accounting for the period of the financial crisis.¹⁶ Moreover, various indices of macroprudential policy based on different directions of the measures in terms of policy restrictiveness are tested. Finally, we investigate whether the effects of macroprudential policy vary in relation to firm characteristics in terms of size and age group.

4.1. Base results

Table 4 shows our main results, estimated using pooled probit with robust standard errors clustered on the country level for a sample of 36,466 firms. Following previous studies, we focus on the marginal effects, which are more straightforward to interpret than probit coefficients. Looking at our key variables, we find that the adoption of macroprudential measures is significantly and negatively associated with firm bank-based financing. The marginal effect of the *MPP* index, the aggregate macroprudential index, shows that firms in countries with stricter macroprudential measures are 1 percentage points less likely to have a successful loan application outcome. The results are similar for the *Capital* index, indicating that firms are 1.8 percentage points less likely to obtain bank financing. These results are statistically significant at the 5% level. Other indices are not statistically significant in this specification. The results support our first hypothesis by showing that macroprudential policies are significantly associated with banks' lending behaviour towards SMEs. Similar findings, based on firm financial data, were presented in Ayyagari et al. (2018). The results also suggest that the macroprudential instruments bringing the strongest effect on bank lending to SMEs are those that target bank capital positions, including minimum capital requirements, capital buffers, risk weights and loan loss provisioning.

¹⁵ Tightening indices are equal to the sum of all tightening policy actions in the respective country and wave, and zero otherwise. Higher value of this index indicates tighter macroprudential policy stance, and that more tightening measures were adopted by macroprudential regulator in the respective period. Loosening indices are equal to the sum of all loosening policy actions in the specific country and wave, and zero otherwise. Furthermore, for better comparability, we multiply the loosening indices with -1 . The ranges of the indices are available in Table 2.

¹⁶ The Sector denotes the firm's main activity, if the firm belongs to industry, construction, trade, or services.

Table 2
Summary statistics of the main regression variables.

Variables	(1) Observations	(2) Mean	(3) SD	(4) Min	(5) Max
<i>Dependent variable</i>					
Access to finance	52,189	0.795	0.404	0	1
<i>Macroprudential indices</i>					
MPP	52,189	0.251	0.768	-3	6
Capital	52,189	0.164	0.541	-2	3
Borrower	52,189	0.025	0.193	-1	3
Liquidity	52,189	0.026	0.183	-1	2
Other	52,189	0.036	0.475	-3	3
MPP_tightening	52,189	0.310	0.688	0	6
Capital_tightening	52,189	0.193	0.501	0	3
Borrower_tightening	52,189	0.026	0.187	0	3
Liquidity_tightening	52,189	0.027	0.181	0	2
Other_tightening	52,189	0.103	0.356	0	3
MPP_loosening	52,189	0.059	0.279	0	3
Capital_loosening	52,189	0.028	0.171	0	2
Borrower_loosening	52,189	0.002	0.042	0	1
Liquidity_loosening	52,189	0.001	0.026	0	1
Other_loosening	52,189	0.068	0.289	0	3
<i>Firm determinants</i>					
Micro	52,189	0.235	0.424	0	1
Small	52,189	0.201	0.401	0	1
Large	52,189	0.380	0.485	0	1
Age	52,189	0.812	0.391	0	1
Leverage	52,189	0.300	0.458	0	1
Profit	52,189	0.328	0.470	0	1
Credit history	52,189	0.306	0.461	0	1
Autonomous	52,189	0.863	0.344	0	1
Ownership	52,189	0.698	0.459	0	1
Collateral	52,189	0.048	0.213	0	1
Maturity	52,189	0.099	0.298	0	1
<i>Macroeconomic determinants</i>					
GDP growth (%)	52,189	0.896	2.580	-14.789	23.039
Unemployment (%)	52,189	10.393	5.727	2.875	27.833
Policy rate (%)	51,460	1.019	0.978	-0.5	9.75
APP	52,189	0.359	0.480	0	1
Crisis	52,189	0.218	0.413	0	1

Source: Authors' calculations based on the estimation sample of our base regressions, which includes summary statistics for all variables used in our estimations. The summary statistics is built on estimates which include weights available in SAFE, based on size of the firm (number of employees).²¹¹

When considering firm-level characteristics, we first focus on firm size, as measured by three variables: Micro, Small and Large. Like previous studies (Beck et al., 2008; Mayordomo and Rodríguez-Moreno, 2018), we find that micro and small firms are by 10 and 5 percentage points less likely to have a successful loan application outcome. In contrast, we find that large firms have a 4 percentage points higher likelihood of receiving bank funds, with the results being statistically significant at the 1% level. In terms of age, we find that firms older than 10 years are 4.3 percentage points more likely to be successful with their loan application. If a firm's use of debt financing had increased, it is less likely that firms will receive bank funds, with the difference being 2.3 percentage points. Conversely, if a company's sales had increased recently, it is 2 percentage points more likely to receive a loan. With respect to a firm's credit history and overall relationship with banks, we establish that firms with an improved credit history are 4.3 percentage points more likely to be given bank funds. Our two variables related to ownership – Autonomous and Ownership – are not statistically significant. If the amount of collateral had been reduced by the bank in the last 6 months, firms are 4.5 percentage points more likely to receive bank funds. If the bank had increased the maturity of loans, firms are 5.7 percentage points more likely to have a successful loan application outcome. Turning now to the interpretation of our macroeconomic variables, we find that the GDP growth rate and crisis variable are not statistically significant in this specification, while the rise in the unemployment rate could lead firms to experience a 0.5 of a percentage point lower likelihood of obtaining bank credit.

4.2. Loosening and tightening effects of macroprudential policy

Table 5 shows the results for tightening and loosening macroprudential policy actions separately. We develop the policy indices by constructing indicator variables that denote either tightening or loosening macroprudential policy actions associated with the aggregate MPP index or other indices that group macroprudential measures by their objective. The indices constructed to measure the tightening of macroprudential policy actions were set to have a value of the sum of all macro-

Table 3

Summary statistics of the main firm characteristics by country.

Country	(1) Access to finance	(2) Micro	(3) Small	(4) Large	(5) Age	(6) Leverage	(7) Profit	(8) History	(9) Autonomous	(10) Ownership	(11) Collateral	(12) Maturity
Austria	0.87	0.26	0.35	0.11	0.79	0.21	0.37	0.35	0.87	0.84	0.03	0.08
Belgium	0.82	0.34	0.37	0.07	0.81	0.31	0.34	0.34	0.85	0.78	0.06	0.07
Bulgaria	0.79	0.16	0.31	0.13	0.74	0.23	0.28	0.38	0.93	0.76	0.05	0.10
Croatia	0.78	0.21	0.26	0.16	0.81	0.16	0.39	0.33	0.89	0.72	0.06	0.15
Cyprus	0.52	0.29	0.28	0.12	0.87	0.26	0.18	0.20	0.90	0.79	0.03	0.20
Czech Republic	0.85	0.15	0.27	0.16	0.80	0.25	0.39	0.31	0.83	0.69	0.06	0.08
Denmark	0.77	0.24	0.33	0.11	0.76	0.29	0.46	0.37	0.82	0.66	0.04	0.09
Estonia	0.69	0.15	0.36	0.11	0.81	0.28	0.30	0.25	0.77	0.69	0.02	0.05
Finland	0.85	0.25	0.35	0.11	0.84	0.34	0.38	0.20	0.88	0.75	0.03	0.11
France	0.82	0.26	0.31	0.12	0.79	0.30	0.28	0.28	0.88	0.74	0.04	0.07
Germany	0.84	0.19	0.30	0.15	0.80	0.22	0.38	0.36	0.91	0.83	0.05	0.08
Greece	0.49	0.34	0.34	0.07	0.83	0.29	0.15	0.17	0.95	0.83	0.03	0.13
Hungary	0.79	0.18	0.32	0.12	0.80	0.27	0.32	0.31	0.85	0.72	0.05	0.10
Ireland	0.65	0.32	0.37	0.06	0.85	0.27	0.36	0.31	0.89	0.88	0.04	0.08
Italy	0.75	0.33	0.31	0.10	0.80	0.36	0.20	0.23	0.92	0.83	0.03	0.07
Latvia	0.66	0.18	0.29	0.13	0.71	0.21	0.34	0.28	0.83	0.64	0.01	0.10
Lithuania	0.69	0.12	0.32	0.15	0.73	0.25	0.43	0.30	0.93	0.52	0.03	0.11
Luxembourg	0.87	0.24	0.33	0.08	0.82	0.22	0.25	0.30	0.86	0.71	0.04	0.05
Malta	0.73	0.27	0.31	0.07	0.77	0.23	0.34	0.23	0.73	0.81	0.03	0.11
Netherlands	0.57	0.25	0.31	0.13	0.78	0.29	0.45	0.42	0.80	0.79	0.05	0.09
Poland	0.83	0.27	0.21	0.13	0.77	0.30	0.38	0.29	0.91	0.59	0.09	0.11
Portugal	0.72	0.26	0.34	0.09	0.82	0.29	0.27	0.25	0.93	0.83	0.04	0.10
Romania	0.77	0.12	0.29	0.17	0.79	0.30	0.42	0.31	0.94	0.67	0.05	0.09
Slovakia	0.82	0.23	0.27	0.15	0.79	0.24	0.39	0.31	0.81	0.70	0.05	0.10
Slovenia	0.78	0.21	0.28	0.12	0.85	0.21	0.38	0.37	0.82	0.69	0.06	0.15
Spain	0.71	0.28	0.31	0.11	0.82	0.33	0.25	0.27	0.92	0.78	0.04	0.11
Sweden	0.79	0.20	0.30	0.13	0.73	0.31	0.42	0.34	0.73	0.62	0.05	0.11
United Kingdom	0.78	0.21	0.28	0.16	0.76	0.26	0.47	0.37	0.85	0.78	0.04	0.09

Note: Authors' elaboration based on the estimation sample from SAFE data.

prudential policy actions with a positive sign, indicating tightening actions, and restrictive macroprudential policy stance, while attributing 0 for the opposite actions or no change. In contrast, the indicators for loosening macroprudential policy actions have a value of the sum of macroprudential policy easing actions during the observed period, and 0 otherwise. The estimation results provide support for our second hypothesis since we obtained a negative and statistically significant coefficient for both macroprudential and capital-related tightening actions. Estimated marginal effects indicate that a one-unit change in the macroprudential tightening index is associated, as revealed in our results, with a 1.1 percentage points decline in firms' likelihood of obtaining bank financing. The tightening of capital-related macroprudential measures is associated with firms being 2 percentage points less likely to access bank financing.

On the other hand, as shown in columns 6–10, when macroprudential measures are relaxed firms are 1.5 percentage points more likely to have a successful loan application outcome. This result is statistically significant at the 10% level. The marginal effect is even greater in the case of capital-related measures, as firms are 3 percentage points more likely to obtain bank funds when these measures are relaxed. Moreover, in the case of the *Other_loosening* index, we also obtained a statistically significant coefficient, with a marginal effect indicating that firms are 1.5 percentage points more likely to be successful with their loan application in association with the relaxation of these policy measures. In the case of the *Liquidity_loosening* index, surprisingly, we obtained negative relationship, showing that the relaxation of liquidity measures is associated with a 4.5 percentage points lower likelihood of firms obtaining credit. Banks can respond in different ways to changes in the way liquidity is regulated. As suggested by [Ananou et al. \(2021\)](#), in response to tighter liquidity regulation banks might increase their core funding via deposits or issue new stock, which could ultimately lead to an increased supply of credit to firms, including SMEs as well as households. On the other hand, banks could also shrink their balance sheets by making reductions on the asset side which may result in decreased credit supply and potentially affect investments and output as well. Alternatively, as suggested by [Banerjee and Mio \(2018\)](#), banks can respond to such regulation by changing the mix of their assets and liabilities, without affecting the size of their balance sheets. Both of the aforementioned studies analysed the response of banks in relation to stricter liquidity requirements. Similar to our results for *Liquidity_tightening*, while investigating the effects of liquidity requirements on UK banks, [Banerjee and Mio \(2018\)](#) did not find a negative effect on

¹⁷ Firms in SAFE are classified by size as follows: a) micro (from 1 employee to 9 employees), b) small (from 10 to 49 employees), c) medium (from 50 to 249 employees), and d) large (250 employees or more). We also examined firm groups in terms of ownership, but these results were not significant and we do not report them in the paper.

Table 4
The effects of macroprudential policy on SMEs' access to finance.

Dependent variable	(1)	(2)	(3)	(4)	(5)
Access to finance	MPP	Capital	Borrower	Liquidity	Other
Micro	−0.102*** (0.0107)	−0.102*** (0.0107)	−0.101*** (0.0107)	−0.101*** (0.0107)	−0.101*** (0.0107)
Small	−0.0510*** (0.00673)	−0.0510*** (0.00678)	−0.0510*** (0.00673)	−0.0510*** (0.00671)	−0.0509*** (0.00672)
Large	0.0362*** (0.00917)	0.0362*** (0.00915)	0.0362*** (0.00920)	0.0362*** (0.00915)	0.0362*** (0.00919)
Age	0.0431*** (0.00925)	0.0431*** (0.00921)	0.0430*** (0.00925)	0.0429*** (0.00921)	0.0430*** (0.00929)
Leverage	−0.0232*** (0.00724)	−0.0232*** (0.00725)	−0.0233*** (0.00729)	−0.0233*** (0.00729)	−0.0233*** (0.00730)
Profit	0.0202*** (0.00609)	0.0204*** (0.00615)	0.0202*** (0.00609)	0.0203*** (0.00606)	0.0202*** (0.00611)
History	0.0425*** (0.00427)	0.0426*** (0.00432)	0.0427*** (0.00434)	0.0427*** (0.00434)	0.0427*** (0.00431)
Autonomous	0.00573 (0.00725)	0.00571 (0.00729)	0.00558 (0.00729)	0.00570 (0.00729)	0.00566 (0.00727)
Ownership	0.00171 (0.0110)	0.00162 (0.0110)	0.00173 (0.0111)	0.00168 (0.0111)	0.00169 (0.0111)
Collateral	0.0448*** (0.0129)	0.0446*** (0.0130)	0.0446*** (0.0130)	0.0446*** (0.0130)	0.0446*** (0.0130)
Maturity	0.0565*** (0.0115)	0.0565*** (0.0115)	0.0566*** (0.0115)	0.0567*** (0.0115)	0.0566*** (0.0115)
MPP	−0.0104** (0.00454)				
Capital		−0.0178** (0.00714)			
Borrower			−0.00766 (0.00817)		
Liquidity				−0.00910 (0.0115)	
Other					−0.00201 (0.00536)
GDP growth	0.00479 (0.00292)	0.00462 (0.00284)	0.00499 (0.00308)	0.00500 (0.00306)	0.00501 (0.00308)
Unemployment	−0.00593*** (0.00229)	−0.00595** (0.00238)	−0.00581** (0.00251)	−0.00580** (0.00250)	−0.00587** (0.00247)
Crisis	−0.0312 (0.0278)	−0.0327 (0.0274)	−0.0350 (0.0266)	−0.0349 (0.0267)	−0.0343 (0.0264)
Country dummies	YES	YES	YES	YES	YES
Wave dummies	YES	YES	YES	YES	YES
Sector dummies	YES	YES	YES	YES	YES
Observations	52,189	52,189	52,189	52,189	52,189
Pseudo R squared ¹	0.0854	0.0856	0.0851	0.0851	0.0851

Note: This table reports average marginal effects after pooled probit estimations for different macroprudential indices. The estimation period is January 2009–September 2017 (wave 1 – wave 17). Access to finance is the dependent variable, which equals 1 if a firm had applied for a loan or line of credit and was successful, and 0 if a firm applied and was unsuccessful. MPP is an index that represents the sum of all policy changes over waves in a given country. Capital index is the sum of all macroprudential measures that target banks' capital positions. Borrower index is the sum of all macroprudential measures targeting borrowers. Liquidity index sums all policy actions over the waves whose primary objective is to improve banks' liquidity positions. Other is an index that is the sum of the remaining macroprudential measures. See Table A3 in Appendix for more information on the construction of macroprudential indices. See Table A4 in Appendix for definitions of all variables. Robust standard errors, clustered at the country level are in parentheses. All regressions include sample weights, country, time, and sector dummies. * indicates $p < 0.10$, ** indicates $p < 0.05$, *** indicates $p < 0.01$.

¹ McFadden's pseudo R-squared values are typically much lower than the ordinary R-squared index and should not be considered with the same standard of goodness of fit as in ordinary regression analysis (McFadden, 1978).

bank lending to firms nor on its cost. Further, regarding Dutch banks Ananou et al. (2021), found that liquidity regulations affected the mix of assets within banks, and loan maturities, eventually leading to a rise in both corporate and retail loans. One explanation of our results may be that banks faced with relaxed liquidity requirements could choose to reduce their stable funding in terms of equity or deposits, leading to a bigger share of more sensitive wholesale funding. In the search for higher yields, banks could also choose riskier investments, which might then lead to a decrease in bank-based firm financing. In addition, the relaxation of liquidity requirements could also be responsible for a negative effect on depositors' confidence, negatively affecting the customer deposits base and thus bank lending. These results also carry importance for policymakers by emphasising the beneficial effects of liquidity-related macroprudential instruments, which could support lending to firms and households, while at the same time strengthening banks' balance sheets and alleviating potential funding-associated risks.

Table 5
The impact of macroprudential tightening and loosening policy actions on SMEs' access to finance.

<i>Tightening policy actions</i>						<i>Loosening policy actions</i>					
<i>Dependent variable</i>	(1)	(2)	(3)	(4)	(5)	<i>Dependent variable</i>	(6)	(7)	(8)	(9)	(10)
Access to finance						Access to finance					
Micro	-0.102*** (0.0107)	-0.102*** (0.0108)	-0.101*** (0.0107)	-0.101*** (0.0107)	-0.101*** (0.0107)	Micro	-0.101*** (0.0107)	-0.101*** (0.0107)	-0.101*** (0.0107)	-0.101*** (0.0107)	-0.101*** (0.0107)
Small	-0.0511*** (0.00673)	-0.0510*** (0.00677)	-0.0510*** (0.00674)	-0.0510*** (0.00671)	-0.0510*** (0.00674)	Small	-0.0509*** (0.00673)	-0.0509*** (0.00676)	-0.0510*** (0.00674)	-0.0509*** (0.00672)	-0.0510*** (0.00671)
Large	0.0361*** (0.00917)	0.0362*** (0.00915)	0.0362*** (0.00919)	0.0362*** (0.00914)	0.0362*** (0.00918)	Large	0.0362*** (0.00918)	0.0363*** (0.00919)	0.0362*** (0.00920)	0.0362*** (0.00918)	0.0362*** (0.00918)
Age	0.0431*** (0.00926)	0.0432*** (0.00923)	0.0430*** (0.00925)	0.0429*** (0.00921)	0.0429*** (0.00926)	Age	0.0429*** (0.00925)	0.0429*** (0.00923)	0.0429*** (0.00925)	0.0429*** (0.00926)	0.0430*** (0.00928)
Leverage	-0.0233*** (0.00726)	-0.0232*** (0.00726)	-0.0233*** (0.00729)	-0.0233*** (0.00728)	-0.0233*** (0.00729)	Leverage	-0.0233*** (0.00726)	-0.0233*** (0.00727)	-0.0233*** (0.00730)	-0.0233*** (0.00730)	-0.0233*** (0.00727)
Profit	0.0202*** (0.00609)	0.0204*** (0.00611)	0.0202*** (0.00609)	0.0203*** (0.00606)	0.0203*** (0.00614)	Profit	0.0203*** (0.00609)	0.0203*** (0.00615)	0.0203*** (0.00608)	0.0203*** (0.00608)	0.0202*** (0.00610)
History	0.0426*** (0.00429)	0.0427*** (0.00433)	0.0427*** (0.00434)	0.0427*** (0.00434)	0.0427*** (0.00435)	History	0.0426*** (0.00431)	0.0426*** (0.00434)	0.0427*** (0.00434)	0.0427*** (0.00434)	0.0426*** (0.00431)
Autonomous	0.00562 (0.00723)	0.00572 (0.00726)	0.00555 (0.00730)	0.00571 (0.00729)	0.00566 (0.00730)	Autonomous	0.00579 (0.00730)	0.00564 (0.00732)	0.00562 (0.00727)	0.00565 (0.00728)	0.00578 (0.00729)
Ownership	0.00173 (0.0110)	0.00163 (0.0110)	0.00175 (0.0111)	0.00168 (0.0111)	0.00169 (0.0111)	Ownership	0.00167 (0.0111)	0.00166 (0.0110)	0.00170 (0.0111)	0.00171 (0.0111)	0.00171 (0.0111)
Collateral	0.0448*** (0.0130)	0.0446*** (0.0130)	0.0446*** (0.0130)	0.0446*** (0.0130)	0.0445*** (0.0130)	Collateral	0.0446*** (0.0129)	0.0445*** (0.0130)	0.0446*** (0.0130)	0.0446*** (0.0130)	0.0448*** (0.0130)
Maturity	0.0566*** (0.0115)	0.0567*** (0.0115)	0.0566*** (0.0115)	0.0567*** (0.0115)	0.0566*** (0.0115)	Maturity	0.0565*** (0.0115)	0.0564*** (0.0115)	0.0566*** (0.0115)	0.0566*** (0.0115)	0.0566*** (0.0115)
MPP_tightening	-0.0115** (0.00577)					MPP_loosening	0.0146* (0.00824)				
Capital_tightening		-0.0201** (0.00944)				Capital_loosening		0.0314** (0.0150)			
Borrower_tightening			-0.00941 (0.00734)			Borrower_loosening			-0.0189 (0.0590)		
Liquidity_tightening				-0.0104 (0.0115)		Liquidity_loosening				-0.0451*** (0.0131)	
Other_tightening					0.00635 (0.00900)	Other_loosening					0.0152*** (0.00579)
GDP growth	0.00484* (0.00291)	0.00465 (0.00286)	0.00499 (0.00308)	0.00499 (0.00306)	0.00497 (0.00309)	GDP growth	0.00491 (0.00304)	0.00488 (0.00297)	0.00501 (0.00308)	0.00498 (0.00308)	0.00499 (0.00312)
Unemployment	-0.00586** (0.00232)	-0.00602** (0.00240)	-0.00582** (0.00251)	-0.00579** (0.00250)	-0.00580** (0.00258)	Unemployment	-0.00595** (0.00241)	-0.00575** (0.00244)	-0.00587** (0.00251)	-0.00583** (0.00250)	-0.00592** (0.00245)
Crisis	-0.0303 (0.0276)	-0.0318 (0.0277)	-0.0349 (0.0266)	-0.0349 (0.0267)	-0.0366 (0.0265)	Crisis	-0.0355 (0.0271)	-0.0358 (0.0264)	-0.0347 (0.0266)	-0.0349 (0.0266)	-0.0352 (0.0270)
Country dummies	YES	YES	YES	YES	YES	Country dummies	YES	YES	YES	YES	YES
Wave dummies	YES	YES	YES	YES	YES	Wave dummies	YES	YES	YES	YES	YES

Table 5 (continued)

<i>Tightening policy actions</i>					<i>Loosening policy actions</i>						
<i>Dependent variable</i>	(1)	(2)	(3)	(4)	(5)	<i>Dependent variable</i>	(6)	(7)	(8)	(9)	(10)
Access to finance						Access to finance					
Sector dummies	YES	YES	YES	YES	YES	Sector dummies	YES	YES	YES	YES	YES
Observations	52,189	52,189	52,189	52,189	52,189	Observations	52,189	52,189	52,189	52,189	52,189
Pseudo R-squared	0.0854	0.0855	0.0851	0.0851	0.0851	Pseudo R-squared	0.0852	0.0853	0.0851	0.0851	0.0852

Note: This table reports average marginal effects after pooled probit estimations for macroprudential indices based on their direction. Columns 1–5 represent the estimations with tightening indices and Columns 6–10 present the estimates with loosening indices. The estimation period is January 2009–September 2017 (wave 1 – wave 17). Access to finance is our dependent variable, which equals 1 if a firm applied for a loan or line of credit and was successful, and equals 0 if a firm applied and was unsuccessful. MPP_tightening is an index that represents the sum of all tightening policy actions across waves and countries and 0 otherwise. Capital_tightening is an index that represents the sum of all tightening policy actions targeting the capital positions of banks across waves and countries and 0 otherwise. Borrower_tightening is an index that represents the sum of all tightening borrower-based policy actions across waves and countries and 0 otherwise. Liquidity_tightening is an index that represents the sum of all tightening liquidity targeting policy actions across waves and countries and 0 otherwise. Other_tightening is an index that represents the sum of all other tightening policy actions across waves and countries and 0 otherwise. MPP_loosening is an index that represents the sum of all loosening policy actions across waves and countries and 0 otherwise. Capital_loosening is an index that represents the sum of all loosening policy actions targeting the capital positions of banks across waves and countries and 0 otherwise. Borrower_loosening is an index that represents the sum of all loosening borrower-based policy actions across waves and countries and 0 otherwise. Liquidity_loosening is an index that represents the sum of all loosening liquidity targeting policy actions across waves and countries and 0 otherwise. Other_loosening is an index that represents the sum of all other loosening policy actions across waves and countries and 0 otherwise. See Table A3 in Appendix for more information on the construction of the macroprudential indices. See Table A4 in Appendix for definitions of all variables. Robust standard errors clustered at the country level are in parentheses. All regressions include sample weights, country, time, and sector dummies. * indicates $p < 0.10$, ** indicates $p < 0.05$, *** indicates $p < 0.01$.

4.3. Marginal effects by size and age

Given the importance of size and age for firms' access to credit, as presented in the literature (Beck et al., 2006; Casey and O'Toole, 2014), we decide to additionally analyse the impact of macroprudential policies on SMEs' access to credit in terms of firm size and age. With respect to the heterogeneity of our data in terms of size, age and other firm characteristics, we expect the magnitude of the macroprudential measures' impact to vary when different groups of firms based on size and age are being considered.¹⁷ Table 6 shows the marginal effects for the MPP index after a pooled probit estimation based on different size and age groups of the firms in our sample. We expect the effect of macroprudential policy actions to be larger for smaller firms because smaller firms rely more heavily on bank loans and have fewer alternative financing sources (Chava and Purnanandam, 2011; Beck and Demircuc-Kunt, 2006). The results give some support for our fourth hypothesis because we find that the effect is indeed larger for smaller firms. The marginal effect is about 1.3 percentage points for micro firms, about 1.2 percentage points for small firms, 1 percentage point for medium firms, while the effect for large firms is much smaller at about 0.8 of a percentage point. It is also evident that the effect of macroprudential policy decreases as a firm's size increases. As for age, we find little variation in the effect of macroprudential policy, but can confirm that the effect decreases as firms' age increases. The marginal effect for new firms is 1.09 percentage points, while it is 1.03 percentage points for firms older than 10 years. These results indicate that policymakers should take the sensitivity of bank-based financing towards smaller firms into account while selecting instruments from the macroprudential toolkit.

5. Extensions and robustness tests

In this section, we perform different robustness tests to provide greater confidence in our base results. First, we perform the Heckman correction procedure to check whether our estimations are affected by possible selection bias. Second, we introduce measures adopted as recommendations by the regulators into our main macroprudential database, which otherwise consisted of binding measures. We are interested in determining whether the main results are affected by the introduction of these non-binding measures. Third, we control for monetary policy and unconventional monetary policy measures conducted by the ECB in order to explore any correlation between the results we obtained and monetary policy measures. Finally, we again test our model in a different subsample setting by excluding large firms from our sample.

5.1. Heckman correction

Since our sample includes only firms that applied for a bank loan, it is necessary to account for possible selection bias resulting from the exclusion of other firms from our data. Firms did not apply for bank financing either because they were discouraged by the expectation of rejection or by high loan interest rates, they used another type of financing, or simply because they had a sufficient amount of internal funds. We solve this issue by using the Heckman correction (Heckman, 1979), which is able to reduce bias arising from truncated data. The Heckman selection procedure consists of two equations, namely the outcome equation, which includes all our independent variables as in our baseline regressions, and the selection equation, which contains another additional variable that serves as an exclusion restriction. The exclusion restriction is the variable that explains the probability of being observed, in our case loan demand, but does not affect the outcome in terms of loan supply, i.e., our dependent variable that serves as a measure of the loan application outcome (*Access to finance*). In the selection equation, we regress the loan demand variable, i.e., the measure of credit demand that has a value of 1 if a firm applied for a bank loan and a value of 0 otherwise, on all of our variables included in the equation of our baseline analysis, with an additional regressor, the exclusion restriction variable. The exclusion restriction should have an effect on loan demand, i.e., the selection variable, while it should have no effect on *Access to finance*, our main dependent variable.

We follow Ferrando et al. (2017) and Bremus and Neugebauer (2018) and decide to include *Competition* as a selection variable. The variable is available in the SAFE database and has a value of 1 if competition is the most pressing problem facing the firm and 0 otherwise. Namely, if a firm encounters high competition, lower sales and lower profitability, followed by insufficient funds, it may have a stronger need for bank financing. We expect that the need for bank financing does not affect the bank's decision to approve the loan, meaning that it affects the demand for credit but not the supply of it, which satisfies the requirements of the exclusion restriction.

Table 7 shows estimated marginal effects after heckprobit regression. Column 1 presents the estimated marginal effects of the probability of credit access conditional upon a firm being selected, while Column 2 represents estimated marginal effects of the probability that the dependent variable is observed, i.e., credit demand. Column 2 shows that the exclusion restriction variable *Competition* is significant and has a positive sign, indicating that those firms facing significant competition problems display a positive demand for bank financing. As expected, the variable is not significant in the estimated marginal effects that capture the probability of accessing credit (Column 1). The effect of firm size is similar for both loan access and loan demand, with an even stronger effect in the case of loan demand. The age variable is statistically significant for

¹⁷ Firms in SAFE are classified by size as follows: a) micro (from 1 employee to 9 employees), b) small (from 10 to 49 employees), c) medium (from 50 to 249 employees), and d) large (250 employees or more). We also examined firm groups in terms of ownership, but these results were not significant and we do not report them in the paper.

Table 6
Marginal effects of macroprudential policy's impact on access to bank finance by firms' size and age.

<i>Dependent variable: Access to Finance</i>			
<i>Size</i>		<i>Age</i>	
Micro	−0.013241***(0.0057057)	<2 years	−0.0108866***(0.0047893)
Small	−0.0117131***(0.0050955)	2–4 years	−0.0106925***(0.0047093)
Medium	−0.0099654***(0.0044215)	5–9 years	−0.0104963***(0.0046295)
Large	−0.0081555***(0.0037328)	>=10 years or more	−0.0102984***(0.00455)

Note: This table reports average marginal effects after a probit estimation for the macroprudential aggregate index (MPP) for different classes of firms' age and size. The estimation period is January 2009–September 2017 (wave 1 – wave 17). Robust standard errors clustered at the country level are in parentheses. All regressions include sample weights, country, time, and sector dummies. * indicates $p < 0.10$, ** indicates $p < 0.05$, *** indicates $p < 0.01$.

Table 7
The effects of macroprudential policy on SMEs' access to funds – probit with a Heckman correction.

<i>Dependent variable</i>	(1)	(2)
<i>Access to finance</i>	Probit with sample selection Outcome equation	Probit with sample selection Selection equation
Competition	0.000686 (0.00156)	0.0117*** (0.00313)
Micro	−0.101*** (0.0104)	−0.153*** (0.00845)
Small	−0.0510*** (0.00668)	−0.0695*** (0.00302)
Large	0.0362*** (0.00917)	0.0711*** (0.00935)
Age	0.0431*** (0.00932)	−0.00807*** (0.00288)
Leverage	−0.0229*** (0.00733)	0.197*** (0.0147)
Profit	0.0203*** (0.00615)	0.0124*** (0.00298)
History	0.0426*** (0.00429)	0.0437** (0.0175)
Autonomous	0.00566 (0.00730)	0.114*** (0.00811)
Ownership	0.00174 (0.0111)	0.0352** (0.0163)
Collateral	0.0448*** (0.0129)	
Maturity	0.0565*** (0.0115)	
MPP	−0.0104** (0.00455)	−0.0124*** (0.00393)
GDP growth	0.00479* (0.00291)	−0.000900 (0.00388)
Unemployment	−0.00592*** (0.00229)	−0.000505 (0.00489)
Crisis	−0.0313 (0.0277)	−0.0109 (0.0330)
Year dummies	YES	YES
Country dummies	YES	YES
Sector dummies	YES	YES
Observations	136,764	136,764

Note: This table reports average marginal effects after probit with a Heckman selection estimation (heckprobit) with the MPP index as our variable of interest. The estimation period is January 2009–September 2017 (wave 1 – wave 17). Access to finance is our dependent variable, which equals 1 if a firm had applied for a loan or line of credit and was successful, and equals 0 if a firm applied and was unsuccessful. MPP is an index that represents the sum of all policy changes across waves in a given country. Competition is our exclusion restriction variable, which equals 1 if the firm reports competition as its most pressing problem and 0 otherwise. See Table A3 in Appendix for more information about the construction of the macroprudential indices. See Table A4 in Appendix for definitions of all variables. Robust standard errors clustered at the country level are in parentheses. All regressions include sample weights, country, time, and sector dummies. * indicates $p < 0.10$, ** indicates $p < 0.05$, *** indicates $p < 0.01$.

credit demand, and with a stronger value in our outcome equation as older firms are 4.3 percentage points more likely to access bank funds. Leverage enters significantly in both the access and demand equations, but with different signs. Firms with an increase in leverage ratios are 20 percentage points more likely to demand credit, while being 2 percentage points less likely to successfully obtain bank credit. Increased profit and improved credit history enter significantly and with positive signs for both credit access and credit demand, while our ownership variables are only statistically significant in the credit demand equation. Firms that are independent in decision-making and are family- or entrepreneur-owned are 11.4 and 3.5 percentage points more likely to exhibit credit demand, respectively. The results obtained for the macroprudential index MPP support our previous findings. For a one-unit change in the MPP index, SMEs are about 1 percentage point more likely to be credit-constrained and also 1.2 percentage points more likely to be discouraged from seeking bank credit. The significance and signs of the macroeconomic determinants are similar to our baseline results, while these variables have no statistically significant effect on loan demand.¹⁸

5.2. Macroprudential measures implemented as recommendations

Several measures adopted by macroprudential regulators that are available in the MaPPED database were implemented by way of recommendations by the authorities. Although these measures were not legally binding, in some countries, banks chose to adopt them as if they were. To test whether our results are affected by the inclusion of such measures, we decided to re-estimate our model in a setting that also includes the recommended macroprudential measures. The results of these estimations are reported in Tables 8 and 9. Since we obtained very similar results as in our main regressions for our control variables and macroeconomic determinants, we only comment on the macroprudential variables. We reconfirm the strongest results are found for the MPP and the Capital index. For a one-unit increase in these indices, which indicates the tightening of macroprudential policy, firms are 1 (MPP) and 1.6 (Capital) percentage points more likely to be credit-constrained.

In addition, we test the direction of the measures by testing loosening and tightening policy actions separately. Table 9 shows the estimated average marginal effects, which indicate that tightening macroprudential measures are associated with firms being 1 (MPP_tightening) and 1.8 (Capital_tightening) percentage points less likely to obtain bank credit, respectively, at a statistical significance level of 5%. We do not find a statistically significant relationship for the other tightening indices. On the other hand, macroprudential loosening actions are associated with an increase in the probability of SMEs obtaining bank credit. The marginal effects indicate differences of 1.8 (MPP_loosening), 3 (Capital_loosening) and 1.5 (Other_loosening) percentage points. In the case of Liquidity_loosening, we established a negative link in association with SMEs' credit access, as in our base results. The borrower-based index is not statistically significant in relation to SMEs' credit access in this specification.

5.3. Unconventional monetary policy and access to finance

Following the sovereign debt crisis that erupted in 2010, many countries embarked on extensive monetary policy interventions that were accompanied by a low interest rate environment and eventually led to the ECB's introduction of negative interest rates in June 2014. The ECB also initiated asset-purchasing programmes starting in March 2015 aimed at stimulating the economy by easing financing conditions and further injecting money. Given the historically low levels of interest rates, these additional unconventional monetary policy measures were intended to make financing accessible at a lower cost.¹⁹

As an additional check, we investigate whether our results are driven by monetary policy interest rate changes or by unconventional monetary policy measures initiated by the ECB during the observed period. We perform the subsequent robustness analysis by introducing two different variables that are related to monetary policy actions. First, we control for each country's monetary policy rate (*Policy rate*) obtained through the IMF's International Financial Statistics, while for the euro area we use the marginal lending facility rate. Second, to control for the unconventional monetary policy measures implemented by the ECB, we construct an indicator (*APP*) that equals 1 in the period of activation of the asset-purchase programmes from March 2015 to December 2018 (wave 12–wave 17) and 0 otherwise. Further, we interact the two variables to analyse whether the effect is stronger in the period of the unconventional measures introduced by the ECB. The results in Table 10 suggest that the unconventional monetary policy measures in the form of asset purchase programmes increase the probability that small firms obtain access to bank credit. Following activation of the asset-purchase programme, firms are about 4 percentage points more likely to obtain bank funds. On the other hand, the policy rate and the interaction term are not significantly associated with access to finance in this specification. The results for the macroprudential indices are broadly similar to those from our previous analysis.

¹⁸ The variables Collateral and Maturity are only available for firms that applied for bank credit and as such are not part of the estimation for demand (Column 2). The dependent variable in the selection equation is loan demand (loan application=1 if a firm had applied for a bank loan or line of credit; loan application=0 if a firm had not applied for bank financing).

¹⁹ ECB press release, 22 January 2015. Available at: https://www.ecb.europa.eu/press/pr/date/2015/html/pr150122_1.en.html

Table 8

The impact of macroprudential measures implemented as either legally binding or recommendations on SMEs' access to finance.

Dependent variable	(1)	(2)	(3)	(4)	(5)
Access to finance	MPP	Capital	Borrower	Liquidity	Other
Micro	−0.101*** (0.0107)	−0.101*** (0.0108)	−0.101*** (0.0107)	−0.101*** (0.0107)	−0.101*** (0.0107)
Small	−0.0509*** (0.00674)	−0.0509*** (0.00679)	−0.0509*** (0.00673)	−0.0510*** (0.00671)	−0.0509*** (0.00672)
Large	0.0362*** (0.00916)	0.0362*** (0.00914)	0.0362*** (0.00919)	0.0362*** (0.00916)	0.0362*** (0.00919)
Age	0.0431*** (0.00926)	0.0431*** (0.00923)	0.0430*** (0.00926)	0.0429*** (0.00922)	0.0430*** (0.00929)
Leverage	−0.0233*** (0.00724)	−0.0233*** (0.00725)	−0.0233*** (0.00727)	−0.0233*** (0.00727)	−0.0233*** (0.00730)
Profit	0.0202*** (0.00606)	0.0204*** (0.00612)	0.0202*** (0.00608)	0.0203*** (0.00608)	0.0202*** (0.00611)
History	0.0426*** (0.00432)	0.0426*** (0.00436)	0.0427*** (0.00434)	0.0427*** (0.00434)	0.0427*** (0.00431)
Autonomous	0.00567 (0.00723)	0.00570 (0.00728)	0.00555 (0.00729)	0.00569 (0.00727)	0.00566 (0.00727)
Ownership	0.00163 (0.0111)	0.00153 (0.0111)	0.00172 (0.0111)	0.00166 (0.0111)	0.00169 (0.0111)
Collateral	0.0448*** (0.0130)	0.0444*** (0.0131)	0.0446*** (0.0130)	0.0446*** (0.0130)	0.0446*** (0.0130)
Maturity	0.0566*** (0.0115)	0.0565*** (0.0115)	0.0566*** (0.0115)	0.0567*** (0.0115)	0.0566*** (0.0115)
MPP	−0.00917*** (0.00355)				
Capital		−0.0164** (0.00658)			
Borrower			−0.00729 (0.00455)		
Liquidity				−0.0106 (0.0102)	
Other					−0.00216 (0.00536)
GDP growth	0.00477 (0.00294)	0.00460 (0.00287)	0.00499 (0.00309)	0.00498 (0.00306)	0.00501 (0.00308)
Unemployment	−0.00596*** (0.00231)	−0.00588** (0.00239)	−0.00586** (0.00250)	−0.00580** (0.00249)	−0.00587** (0.00247)
Crisis	−0.0314 (0.0279)	−0.0327 (0.0275)	−0.0348 (0.0266)	−0.0349 (0.0267)	−0.0343 (0.0264)
Country dummies	YES	YES	YES	YES	YES
Wave dummies	YES	YES	YES	YES	YES
Sector dummies	YES	YES	YES	YES	YES
Observations	52,189	52,189	52,189	52,189	52,189
Pseudo R-squared	0.0855	0.0856	0.0852	0.0852	0.0851

Note: This table reports average marginal effects after pooled probit estimations for different macroprudential indices. The estimation period is January 2009–September 2017 (wave 1 – wave 17). Access to finance is the dependent variable, which equals 1 if a firm had applied for a loan or line of credit and was successful, and 0 if a firm applied and was unsuccessful. MPP is an index that represents the sum of all policy changes over waves in a given country. Capital index is the sum of all macroprudential measures that target banks' capital positions. Borrower index is the sum of all macroprudential measures targeting borrowers. Liquidity index sums all policy actions over the waves whose primary objective is to improve banks' liquidity positions. Other is an index that is the sum of the remaining macroprudential measures. See Table A3 in Appendix for more information about the construction of the macroprudential indices. See Table A4 in Appendix for definitions of all variables. Robust standard errors clustered at the country level are in parentheses. All regressions include sample weights, country, time, and sector dummies. * indicates $p < 0.10$, ** indicates $p < 0.05$, *** indicates $p < 0.01$.

5.4. Adding a control group without large firms

We designed our identification strategy to include all firms which applied for bank funding available in the SAFE database. However, a limited portion of the database consists of large companies (+250 employees).²⁰ The main reason for the mentioned approach was to enable a better comparison in terms of size relative to firm developments with respect to their characteristics and the macroprudential policy changes. Moreover, almost 90% of our sample consists of small and medium-sized firms, meaning large enterprises account for a fairly small proportion (Table 1). Still, as an additional robustness test in order to check whether our results are affected by the presence of large firms in our data, we test the control group of firms by excluding large enterprises from our sample. The results obtained in Table 11 are largely similar to our base results. As expected, the MPP and Capital indices have statistically significant coefficients, while the marginal effects suggest that SMEs are 1.1(1.7) percentage points less likely to access bank credit for a one-unit change in the MPP (Capital) index.

²⁰ In SAFE database, large firms are designated to be enterprises with more than 250 employees. We adopt the firm size identification from SAFE.

Table 9

The impact of macroprudential tightening and loosening policy actions implemented as either legally binding or recommendations on SMEs' access to finance.

Tightening policy actions						Loosening policy actions					
Dependent variable	(1)	(2)	(3)	(4)	(5)	Dependent variable	(6)	(7)	(8)	(9)	(10)
Access to finance						Access to finance					
Micro	-0.102*** (0.0107)	-0.101*** (0.0108)	-0.101*** (0.0107)	-0.101*** (0.0107)	-0.101*** (0.0107)	Micro	-0.101*** (0.1017)	-0.101*** (0.0107)	-0.101*** (0.0107)	-0.101*** (0.0107)	-0.101*** (0.0107)
Small	-0.0510*** (0.00674)	-0.0509*** (0.00677)	-0.0509*** (0.00673)	-0.0510*** (0.00671)	-0.0510*** (0.00674)	Small	-0.0509*** (0.00673)	-0.0509*** (0.00676)	-0.0509*** (0.00673)	-0.0509*** (0.00672)	-0.0510*** (0.00671)
Large	0.0361*** (0.00916)	0.0362*** (0.00913)	0.0362*** (0.00918)	0.0362*** (0.00916)	0.0362*** (0.00918)	Large	0.0362*** (0.00918)	0.0363*** (0.00919)	0.0362*** (0.00918)	0.0362*** (0.00918)	0.0362*** (0.00918)
Age	0.0431*** (0.00927)	0.0431*** (0.00924)	0.0430*** (0.00926)	0.0428*** (0.00922)	0.0429*** (0.00926)	Age	0.0430*** (0.00925)	0.0429*** (0.00923)	0.0430*** (0.00927)	0.0429*** (0.00926)	0.0430*** (0.00928)
Leverage	-0.0234*** (0.00726)	-0.0233*** (0.00727)	-0.0233*** (0.00727)	-0.0233*** (0.00729)	-0.0233*** (0.00729)	Leverage	-0.0232*** (0.00725)	-0.0233*** (0.00727)	-0.0233*** (0.00729)	-0.0233*** (0.00730)	-0.0233*** (0.00727)
Profit	0.0203*** (0.00606)	0.0204*** (0.00608)	0.0203*** (0.00608)	0.0203*** (0.00607)	0.0203*** (0.00614)	Profit	0.0202*** (0.00609)	0.0203*** (0.00615)	0.0202*** (0.00609)	0.0203*** (0.00608)	0.0202*** (0.00610)
History	0.0427*** (0.00434)	0.0427*** (0.00437)	0.0427*** (0.00435)	0.0427*** (0.00434)	0.0427*** (0.00435)	History	0.0426*** (0.00429)	0.0426*** (0.00434)	0.0427*** (0.00433)	0.0427*** (0.00434)	0.0426*** (0.00431)
Autonomous	0.00556 (0.00722)	0.00570 (0.00725)	0.00554 (0.00730)	0.00569 (0.00727)	0.00566 (0.00730)	Autonomous	0.00585 (0.00731)	0.00564 (0.00732)	0.00569 (0.00729)	0.00565 (0.00728)	0.00578 (0.00729)
Ownership	0.00167 (0.0111)	0.00153 (0.0111)	0.00174 (0.0111)	0.00166 (0.0111)	0.00169 (0.0111)	Ownership	0.00161 (0.0111)	0.00169 (0.0110)	0.00165 (0.0111)	0.00171 (0.0111)	0.00171 (0.0111)
Collateral	0.0446*** (0.0131)	0.0444*** (0.0131)	0.0446*** (0.0130)	0.0446*** (0.0130)	0.0445*** (0.0130)	Collateral	0.0448*** (0.0128)	0.0445*** (0.0130)	0.0447*** (0.0129)	0.0446*** (0.0130)	0.0448*** (0.0130)
Maturity	0.0567*** (0.0115)	0.0566*** (0.0115)	0.0567*** (0.0115)	0.0567*** (0.0115)	0.0566*** (0.0115)	Maturity	0.0564*** (0.0115)	0.0564*** (0.0115)	0.0566*** (0.0115)	0.0566*** (0.0115)	0.0566*** (0.0115)
MPP_tightening	-0.00956** (0.00429)					MPP_loosening	0.0179*** (0.00684)				
Capital_tightening		-0.0177** (0.00831)				Capital_loosening		0.0314** (0.0150)			
Borrower_tightening			-0.00683 (0.00563)			Borrower_loosening			0.0137 (0.0111)		
Liquidity_tightening				-0.0117 (0.0102)		Liquidity_loosening				-0.0451*** (0.0131)	
Other_tightening					0.00635 (0.00900)	Other_loosening					0.0152*** (0.00579)
GDP growth	0.00479 (0.00296)	0.00464 (0.00290)	0.00497 (0.00309)	0.00497 (0.00306)	0.00497 (0.00309)	GDP growth	0.00494 (0.00303)	0.00488 (0.00297)	0.00503 (0.00307)	0.00498 (0.00308)	0.00499 (0.00312)
Unemployment	-0.00588** (0.00234)	-0.00594** (0.00241)	-0.00586** (0.00250)	-0.00579** (0.00249)	-0.00580** (0.00258)	Unemployment	-0.00601** (0.00240)	-0.00575** (0.00244)	-0.00585** (0.00251)	-0.00583** (0.00250)	-0.00592** (0.00245)
Crisis	-0.0309 (0.0278)	-0.0320 (0.0278)	-0.0348 (0.0266)	-0.0349 (0.0267)	-0.0366 (0.0265)	Crisis	-0.0356 (0.0272)	-0.0358 (0.0264)	-0.0349 (0.0266)	-0.0349 (0.0266)	-0.0352 (0.0270)
Country dummies	YES	YES	YES	YES	YES	Country dummies	YES	YES	YES	YES	YES
Wave dummies	YES	YES	YES	YES	YES	Wave dummies	YES	YES	YES	YES	YES
Sector dummies	YES	YES	YES	YES	YES	Sector dummies	YES	YES	YES	YES	YES

Table 9 (continued)

<i>Tightening policy actions</i>						<i>Loosening policy actions</i>					
<i>Dependent variable</i>	(1)	(2)	(3)	(4)	(5)	<i>Dependent variable</i>	(6)	(7)	(8)	(9)	(10)
Access to finance						Access to finance					
Observations	52,189	52,189	52,189	52,189	52,189	Observations	52,189	52,189	52,189	52,189	52,189
Pseudo R-squared	0.0854	0.0855	0.0852	0.0852	0.0851	Pseudo R-squared	0.0853	0.0853	0.0851	0.0851	0.0852

Note: This table reports average marginal effects after pooled probit estimations for macroprudential indices based on their direction. Columns 1–5 represent the estimations with tightening indices and Columns 6–10 present the estimates with loosening indices. The estimation period is January 2009–September 2017 (wave 1 – wave 17). Access to finance is our dependent variable, which equals 1 if a firm had applied for a loan or line of credit and was successful, and equals 0 if a firm applied and was unsuccessful. MPP_tightening is an index that represents the sum of all tightening policy actions across waves and countries and 0 otherwise. Capital_tightening is an index that represents the sum of all tightening policy actions targeting the capital positions of banks across waves and countries and 0 otherwise. Borrower_tightening is an index that represents the sum of all tightening borrower-based policy actions across waves and countries and 0 otherwise. Liquidity_tightening is an index that represents the sum of all tightening liquidity targeting policy actions across waves and countries and 0 otherwise. Other_tightening is an index that represents the sum of all other tightening policy actions across waves and countries and 0 otherwise. MPP_loosening is an index that represents the sum of all loosening policy actions across waves and countries and 0 otherwise. Capital_loosening is an index that represents the sum of all loosening policy actions targeting the capital positions of banks across waves and countries and 0 otherwise. Borrower_loosening is an index that represents the sum of all loosening borrower-based policy actions across waves and countries and 0 otherwise. Liquidity_loosening is an index that represents the sum of all loosening liquidity targeting policy actions across waves and countries and 0 otherwise. Other_loosening is an index that represents the sum of all other loosening policy actions across waves and countries and 0 otherwise. See Table A3 in Appendix for more information on the construction of the macroprudential indices. See Table A4 in the Appendix for definitions of all variables. Robust standard errors clustered at the country level are in parentheses. All regressions include sample weights, country, time, and sector dummies. * indicates $p < 0.10$, ** indicates $p < 0.05$, *** indicates $p < 0.01$.

Table 10
SME's access to finance and the unconventional monetary policy measures.^a

Dependent variable	(1)	(2)	(3)	(4)	(5)
Access to finance	MPP	Capital	Borrower	Liquidity	Other
MPP	-0.0107** (0.00455)				
Capital		-0.0179** (0.00708)			
Borrower			-0.00762 (0.00816)		
Liquidity				-0.00980 (0.0114)	
Other					-0.00238 (0.00534)
Policy rate	-0.00343 (0.0115)	-0.00313 (0.0123)	-0.00188 (0.0116)	-0.00215 (0.0114)	-0.00211 (0.0115)
APP	0.0355 (0.0231)	0.0287 (0.0236)	0.0433* (0.0222)	0.0436** (0.0222)	0.0438** (0.0221)
Policy rate* APP	0.0115 (0.0107)	0.0108 (0.0111)	0.0116 (0.0107)	0.0117 (0.0106)	0.0117 (0.0107)
Observations	51,460	51,460	51,460	51,460	51,460
Pseudo R-squared	0.0855	0.0856	0.0852	0.0852	0.0852

Note: This table reports average marginal effects after pooled probit estimations for different macroprudential indices. The estimation period is January 2009–September 2017 (wave 1–wave 17). Access to finance is the dependent variable, which equals 1 if a firm had applied for a loan or line of credit and was successful, and 0 if a firm applied and was unsuccessful. MPP is an index that represents the sum of all policy changes over waves in a given country. Capital index is the sum of all macroprudential measures that target banks' capital positions. Borrower index is the sum of all macroprudential measures targeting borrowers. Liquidity index sums all policy actions over the waves whose primary objective is to improve banks' liquidity positions. Other is an index that is the sum of the remaining macroprudential measures. See Table A3 in Appendix for more information about the construction of the macroprudential indices. See Table A4 in Appendix for definitions of all variables. Robust standard errors clustered at the country level are in parentheses. All regressions include sample weights, country, time, and sector dummies. * indicates $p < 0.10$, ** indicates $p < 0.05$, *** indicates $p < 0.01$.

^a All regressions include firm level and country level variables, which we do not report for brevity. The full estimation results of these regressions are available upon request from authors.

Table 11
SMEs access to finance – the control sample without large firms.^a

Dependent variable	(1)	(2)	(3)	(4)	(5)
Access to finance	MPP	Capital	Borrower	Liquidity	Other
MPP	-0.0110*** (0.00370)				
Capital		-0.0171*** (0.00481)			
Borrower			-0.00964 (0.0116)		
Liquidity				-0.000896 (0.0102)	
Other					-0.00543 (0.00567)
Observations	46,302	46,302	46,302	46,302	46,302
Pseudo R-squared	0.0696	0.0697	0.0694	0.0694	0.0694

Note: This table reports average marginal effects after pooled probit estimations for different macroprudential indices. The estimation period is January 2009–September 2017 (wave 1–wave 17). Access to finance is the dependent variable, which equals 1 if a firm had applied for a loan or line of credit and was successful, and 0 if a firm applied and was unsuccessful. MPP is an index that represents the sum of all policy changes over waves in a given country. Capital index is the sum of all macroprudential measures that target banks' capital positions. Borrower index is the sum of all macroprudential measures targeting borrowers. Liquidity index sums all policy actions over the waves whose primary objective is to improve banks' liquidity positions. Other is an index that is the sum of the remaining macroprudential measures. See Table A3 in Appendix for more information about the construction of the macroprudential indices. See Table A4 in Appendix for definitions of all variables. Robust standard errors clustered at the country level are in parentheses. All regressions include sample weights, country, time, and sector dummies. * indicates $p < 0.10$, ** indicates $p < 0.05$, *** indicates $p < 0.01$.

^a All regressions include firm level and country level variables, which we do not report for brevity. The full estimation results of these regressions are available upon request from authors.

6. Conclusion

We examined the impact of macroprudential policy on the availability of bank financing for small and medium-sized firms. Our results suggest the implementation of macroprudential policy is associated with SMEs having a lower probability of obtaining bank financing. Further, we also tested different directions of these policies, namely tightening vs. loosening macroprudential policy actions. Our results suggest that restrictive macroprudential policy actions are associated with a

lower likelihood of SMEs gaining access to bank-based financing, while the opposite result is evident for estimates with loosening macroprudential policies in the respective period. We extended the empirical part by testing the results by including macroprudential measures introduced by the regulator by way of recommendations. The overall results remain the same. The strongest relationship between macroprudential policy and SME financing is found in the estimates with the Capital index, which captures macroprudential policies whose objective is to improve banks' capital position. In addition, we analysed the impact of unconventional monetary policy stimulus as a robustness check, which was shown to be a supportive factor for SMEs' access to bank funds. After performing additional robustness tests with subset of the sample, the results for the macroprudential indices were again confirmed.

These results confirm the trade-off associated with the implementation of macroprudential policies and the strengthening of regulatory activity, which may ultimately worsen the availability of finance to small firms while slowing economic activity through the supply of credit. We argue that macroprudential measures should be chosen cautiously and calibrated judiciously in light of the institutional, market and business conditions in the financial sector of each country. Policymakers should consider the response made by banks to the implementation of macroprudential measures, and how banks adjust their balance sheets, the overall riskiness of their assets, and their borrower selection in reaction to regulatory interventions. Further research should look for other factors that might explain banks' borrowing channels and how the introduction of macroprudential measures affects firms' financing costs. We are aware of the limitations of using survey-based data and the lack of real firm-level financial data, which at the same time represents potential for further research in this area.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix

(See Tables A1–A4)

Table A1

Survey reference periods.

Survey round	Round	Wave	Reference period – last 6 months	Macroprudential and macroeconomic data
2009H1	Common	1	January–June 2009	1 & 2Q of 2009
2009H2	ECB round	2	July–December 2009	3 & 4 Q of 2009
2010H1	ECB round	3	March–September 2010	1, 2 & 3 Q of 2010
2010H2	ECB round	4	September 2010–February 2011	4Q of 2010 & 1Q of 2011
2011H1	Common	5	April–September 2011	2 & 3 Q of 2011
2011H2	ECB round	6	October 2011–March 2012	4Q of 2011 & 1Q of 2012
2012H1	ECB round	7	April–September 2012	2 & 3 Q of 2012
2012H2	ECB round	8	October 2012–March 2013	4Q of 2012 & 1Q of 2013
2013H1	Common	9	April–September 2013	2 & 3 Q of 2013
2013H2	ECB round	10	October 2013–March 2014	4Q of 2013 & 1Q of 2014
2014H1	Common	11	April–September 2014	2 & 3 Q of 2014
2014H2	ECB round	12	October 2014–March 2015	4Q of 2014 & 1Q of 2015
2015H1	Common	13	April–September 2015	2 & 3 Q of 2015
2015H2	ECB round	14	October 2015–March 2016	4Q of 2015 & 1Q of 2016
2016H1	Common	15	April–September 2016	2 & 3 Q of 2016
2016H2	ECB round	16	October 2016–March 2017	4Q of 2016 & 1Q of 2017
2017H1	Common	17	April–September 2017	2 & 3 Q of 2017

Source: Author's elaboration based on SAFE data.

Table A2
Firm observations by country and wave.

	Wave	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total
	Country																		
1	AT	38	51	56	140	135	161	144	161	152	134	117	196	130	222	124	175	136	2,272
2	BE	47	29	47	160	124	160	142	159	144	155	146	232	121	263	149	231	137	2,446
3	BG	26	0	0	0	120	0	0	0	138	0	106	0	98	0	129	0	109	726
4	CY	28	0	0	0	26	0	0	0	27	0	14	0	25	0	15	0	28	163
5	CZ	32	0	0	0	132	0	0	0	111	0	123	0	103	0	101	0	82	684
6	DE	236	262	279	269	242	289	272	314	313	306	302	312	325	312	320	333	306	4,992
7	DK	28	0	0	0	80	0	0	0	106	0	76	0	73	0	75	0	77	515
8	EE	19	0	0	0	10	0	0	0	6	0	17	0	13	0	17	0	19	101
9	ES	367	414	419	401	390	415	413	412	397	374	479	519	479	542	416	530	390	7,357
10	FI	10	17	19	74	84	89	87	101	103	94	118	129	133	103	138	137	117	1,553
11	FR	219	272	368	403	433	420	396	411	433	415	560	518	534	537	552	570	498	7,539
12	GB	82	0	0	0	220	0	0	0	206	0	217	0	218	0	221	0	156	1,320
13	GR	87	66	60	158	140	157	82	111	117	124	109	169	103	127	88	158	97	1,953
14	HR	17	0	0	0	30	0	0	0	24	0	79	0	71	0	73	0	84	378
15	HU	25	0	0	0	97	0	0	0	133	0	111	0	103	0	87	0	106	662
16	IE	16	22	32	123	123	138	142	126	121	118	127	115	103	131	105	105	90	1,737
17	IT	320	344	385	469	375	437	448	458	462	440	549	591	580	593	546	546	538	8,081
18	LT	18	0	0	0	81	0	0	0	97	0	61	0	59	0	60	0	65	441
19	LU	17	0	0	0	27	0	0	0	28	0	24	0	16	0	31	0	25	168
20	LV	11	0	0	0	47	0	0	0	22	0	50	0	25	0	34	0	35	224
21	MT	20	0	0	0	16	0	0	0	26	0	27	0	21	0	22	0	22	154
22	NL	53	37	35	77	79	92	90	74	101	85	124	143	111	146	119	126	114	1,606
23	PL	116	0	0	0	305	0	0	0	279	0	337	0	358	0	320	0	308	2,023
24	PT	79	56	70	144	115	119	121	122	125	134	115	214	152	241	148	225	132	2,312
25	RO	40	0	0	0	134	0	0	0	104	0	136	0	135	0	126	0	127	802
26	SE	38	0	0	0	69	0	0	0	73	0	76	0	84	0	61	0	71	472
27	SI	41	0	0	0	38	0	0	0	52	0	70	0	62	0	69	0	69	401
28	SK	22	0	0	0	102	0	0	0	95	0	109	111	131	148	131	125	133	1,107
	Total	2,052	1,570	1,770	2,418	3,774	2,477	2,337	2,449	3,995	2,379	4,379	3,249	4,366	3,365	4,277	3,261	4,071	52,189

Note: The table represents observations by country of firms which applied for a bank loan, across all waves, and includes both the ECB and Common rounds.

Table A3

Macroprudential instruments in the MaPPED database and construction of the base indices.

Instrument group	Instruments	Index	
Minimum capital requirements	Capital adequacy ratio (CAR) Tier 1 capital ratio Common Equity Tier 1 capital ratio (CET 1) Core Tier 1 capital ratio	Capital =(Minimum capital requirements + Capital Buffers + Risk weights + Loan loss provisioning)	MPP = (Capital + Borrower + Liquidity + Other)
Capital buffers	Countercyclical capital buffer Capital conservation buffer Systemic risk buffer G-SII capital buffer O-SII capital buffer Other capital requirements targeting most important institutions Other capital surcharges and own funds requirements Profit distribution restrictions		
Risk weights	Risk weights for loans backed by residential property Risk weights for loans backed by commercial property Other sectoral risk weights	Borrower =(Lending standards restrictions + Limits on credit growth and volume)	
Loan loss provisioning	Loan classification rules Minimum specific provisioning General provisioning Capital treatment of loan loss reserve		
Lending standards restrictions	Loan-to-value (LTV) limits Loan-to-income (LTI) limits Debt-to-income (DTI) limits Debt-service-to-income (DSTI) limits incl. interest rate stress testing Limits on interest rates on loans Maturity and amortisation restrictions Other income requirements for loan eligibility Limits on the volume of personal loans Other restrictions on lending standards		
Limits on credit growth and volume	Reserve requirements related to banks' liabilities Asset-based reserve requirements		
Liquidity requirements and limits on currency and maturity mismatch	Loan to deposit (LTD) ratios Other stable funding req. incl. Net Stable Funding Requirement Short-term liquidity coverage ratios incl. Liquidity Coverage Ratio Liquidity ratios and deposit coverage ratios Limits on FX mismatches Other liquidity requirements	Liquidity =(Liquidity requirements and limits on currency and maturity mismatch)	
Leverage ratio Levies/taxes on financial institutions	Leverage ratio Tax on assets/liabilities Tax on financial activities	Other =(Leverage ratio + Levies on financial institutions + Limits on large exposures and concentration + Other measures)	

(continued on next page)

Table A3 (continued)

Instrument group	Instruments	Index
Limits on large exposures and concentration	Single client exposure limits Intragroup exposures limits Sector and market segment exposure limits Funding concentration limits Limits on qualified holdings outside financial sector Other exposure and concentration limits	
Other measures	Structural measures Margin requirements Other regulatory restrictions on financial activities Limits on deposit rates Debt resolution policies Crisis management tools Changes in regulatory framework Other	

Source: Budnik, K., Kleibl, J. (2018). Macroprudential regulation in the European Union in 1995–2014: introducing a new dataset on policy actions of a macroprudential nature, Macroprudential Policies Evaluation Database (MaPPED).

Table A4

Sources for the variables.

Variable	Description	Source
<i>Dependent variable</i>		
Access to finance	Dummy variable equal to 1 if the firm applied for a bank loan or line of credit in the last six months and was successful, and 0 otherwise.	ECB, SAFE
<i>Macroprudential indices</i>		
MPP	An indicator that represents a sum of all policy changes over waves in a given country, with a range from –3 to 6. The higher the index, the tighter the macroprudential policy in a country.	ECB, MaPPED
Capital	An index representing a sum of all macroprudential policy actions that target banks' capital positions, with a range of –2 to 3.	ECB, MaPPED
Borrower	An index representing the sum of all instrument actions targeting borrowers, with scope –1 to 3.	ECB, MaPPED
Liquidity	An index representing a sum of all policy actions over the waves whose primary objective is to improve banks' liquidity positions, with scope –1 to 2.	ECB, MaPPED
Other	An index representing a sum of all other macroprudential policy actions, with the scope ranging from –3 to 3.	ECB, MaPPED
MPP_tightening	An index equal to the sum of all macroprudential policy tightening actions during the observed period, and 0 otherwise.	ECB, MaPPED
Capital_tightening	An index equal to the sum of macroprudential capital based tightening actions during the observed period, and 0 otherwise.	ECB, MaPPED
Borrower_tightening	An index equal to the sum of macroprudential borrower based tightening actions during the observed period, and 0 otherwise.	ECB, MaPPED
Liquidity_tightening	An index equal to the sum of macroprudential liquidity targeting tightening actions during the observed period, and 0 otherwise.	ECB, MaPPED
Other_tightening	An index equal to the sum of other macroprudential tightening actions during the observed period, and 0 otherwise.	ECB, MaPPED
MPP_loosening	An index equal to the sum of all macroprudential policy loosening actions during the observed period, and 0 otherwise.	ECB, MaPPED
Capital_loosening	An index equal to the sum of macroprudential capital based loosening actions during the observed period, and 0 otherwise.	ECB, MaPPED
Borrower_loosening	An index equal to the sum of macroprudential borrower based loosening actions during the observed period, and 0 otherwise.	ECB, MaPPED
Liquidity_loosening	An index equal to the sum of macroprudential liquidity targeting loosening actions during the observed period, and 0 otherwise.	ECB, MaPPED
Other_loosening	An index equal to the sum of other macroprudential loosening actions during the observed period, and 0 otherwise.	ECB, MaPPED
<i>Firm variables</i>		
Micro	Dummy variable that takes the value 1 if the firm has 1 to 9 employees, and 0 otherwise.	ECB, SAFE
Small	Dummy variable that takes the value 1 if the firm has 10 to 49 employees, and 0 otherwise.	ECB, SAFE
Large	Dummy variable that takes the value 1 if the firm has more than 250 employees, and 0 otherwise.	ECB, SAFE

Table A4 (continued)

Variable	Description	Source
Age	Dummy variable that takes the value 1 if the firm is older than 10 years, and 0 otherwise.	ECB, SAFE
Leverage	Dummy variable that takes the value 1 if the firm has increased the use of debt in the last six months, and 0 otherwise.	ECB, SAFE
Profit	Dummy variable that takes the value 1 if the firm's profit increased in the last six months and 0 if the firm's profit decreased.	ECB, SAFE
Credit history	Dummy variable that equals 1 if the firm's credit history has improved in the last six months, and 0 otherwise.	ECB, SAFE
Autonomous Ownership	Dummy variable that equals 1 if the firm is an autonomous profit-oriented firm, and 0 otherwise.	ECB, SAFE
	Dummy variable that equals 1 if the firm is owned by an individual, family, or entrepreneur, and 0 otherwise.	ECB, SAFE
Collateral	Dummy variable that equals 1 if the bank reduced the amount of collateral required from firms when applying for a bank loan, and 0 otherwise.	ECB, SAFE
Maturity	Dummy variable that equals 1 if the bank increased the maturity of the loans, and 0 otherwise.	ECB, SAFE
<i>Macroeconomic variables</i>		
GDP growth (%)	The growth rate of gross domestic product (GDP), based on the averages of quarterly data corresponding to each wave.	World Bank Database
Unemployment (%)	The unemployment rate in a country, based on the averages of the quarterly data corresponding to each wave.	World Bank Database
Crisis	The dummy variable equal to 1 for waves 4–7 (September 2010–September 2012) and 0 otherwise.	Own calculation
Policy rate (%)	The monetary policy rate, based on quarterly data averaged to correspond to waves of the survey. The IMF monetary policy rate; for the euro area, marginal lending facility rate.	ECB, IMF
APP	Dummy variable equal to 1 for the period of activation of asset purchasing programs by ECB (wave 12–wave 17) and 0 otherwise.	ECB, Own calculation

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