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BANK FUNDING, CREDIT GROWTH AND MACROPRUDENTIAL REGULATION

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BANK FUNDING, CREDIT GROWTH AND MACROPRUDENTIAL REGULATION

Summary

The objective of this dissertation is to investigate the effectiveness of macroprudential policies on bank behaviour, funding costs, and lending activity. The perception of financial regulation has changed following the global financial crisis of 2008 due to its inability to limit the crisis' magnitude and reduce systemic instability. Since then, great emphasis has been placed on establishing new prudential regulations and improving the existing ones so as to avoid the recurrence of such shocks to the economy. This approach to regulating financial institutions, with a focus on the risks arising from the size, interconnectedness and interdependence of financial institutions, holding the potential to cause damage to the entire financial sector, is known as macroprudential policy. Compared to the microprudential approach of financial regulation, previously commonly believed to be sufficient for maintaining financial stability by simply keeping individual financial institutions healthy, the macroprudential approach acknowledges that risks arise not only from individual institutions, but their interconnectedness and size as well. The macroprudential approach has been implemented by many countries via different types of instruments. The effects of macroprudential instruments on bank behaviour, both lending and funding strategies, and the effects on banks' responses which shape economic activity, still require further examination. Moreover, the results of such studies are crucial for all market participants and regulators. Thus, this doctoral dissertation studies the effects of macroprudential instruments on credit growth, bank funding costs, and the supply of bank loans to small and medium-sized enterprises (hereinafter: SMEs).

Using an extensive global database of 12 macroprudential instruments collected by the IMF, in Chapter 1 we study the effects of macroprudential instruments on bank funding costs in 43 advanced and emerging market economies. These data are combined with unconsolidated bank-level data for 2,346 banks, which we collect from the Fitch Connect database and macroeconomic data on various country characteristics, collected from the World Bank and the IMF's International Financial Statistics databases, which enables country heterogeneity to be captured. Using the generalised method of moments estimator, this chapter examines the relationship between macroprudential measures and banks' cost of funding: the cost of debt financing and overall funding costs, which takes account of both the cost of debt and equity financing. In order to measure the macroprudential impact, different macroprudential indices are constructed using the information in the database. The results reveal that macroprudential measures are generally negatively associated with bank funding costs. The chapter further analyses the effects of different groups of macroprudential instruments: those targeting bank borrowers, those targeting bank capital positions, structural instruments targeting bank concentration and interbank exposures, and

those targeting financial institutions' assets and earnings. The overall result is reaffirmed in the case of instruments targeting banks' borrowers, capital, and interbank and concentration risks. As concerns asset-based instruments, the analysis reveals a somewhat positive relationship with the dependent variables. To better understand the differences between countries in the sample, the data are split into subsamples based on the countries' development status according to the IMF classification. The results show macroprudential measures are strongly negatively associated with bank funding costs in advanced countries. However, in the case of emerging market countries, the results include some positive coefficients. While testing different indices based on the target of macroprudential measures, we also find that the effect depends greatly on the characteristics of a given country's financial sector, the availability of different funding sources, and macroeconomic characteristics.

Chapter 2 examines the impact of macroprudential policy on bank lending in European Union countries between 2000 and 2017, covering the pre-crisis, crisis and post-crisis periods. This analysis employs an up-to-date macroprudential database, the *Macroprudential Policies Evaluation Database* (hereinafter MaPPED), designed, collated and published by the European Central Bank. It provides information on the vast number of macroprudential instruments implemented in Europe and documents the activation, tightening, relaxation or deactivation of macroprudential instruments. This database is combined with panel data from the annual financial statements of 3,434 banks collected from the Fitch Connect database, along with several macroeconomic determinants capturing differences among the countries' economic and financial conditions, which we collect from the World Bank along with the IMF's International Financial Statistics databases. Results are obtained using a dynamic panel data model with the generalised method of moments estimator. The results suggest that macroprudential policies are associated with lower bank lending activity as measured by gross loans. It is also shown that when macroprudential measures are tightened, banks respond by lowering their lending activity whereas, when macroprudential measures are relaxed, banks increase their lending activity. However, the interaction of macroprudential tools with bank lending is stronger in policy loosening cycles. This argues for the use of macroprudential policy in the current crisis brought about by the Covid-19 pandemic to support lending, investment and economic growth. When testing different groups of indices of macroprudential policy based upon the measures' target, the results are very similar.

Chapter 3 analyses the effects of macroprudential policy on access to finance by examining bank credit supply to SMEs, namely, firms that account for over 99 percent of the non-financial sector in Europe (European Commission, 2019) and which rely heavily on bank financing. The sample covers SMEs from European Union countries between 2009 and 2017. By making use of the *Survey on the access to finance of SMEs* (hereafter: SAFE), a restricted database collected and published by the European Central Bank, which offers information on company characteristics and their credit applications on a biannual basis,

and the macroprudential database the MaPPED, the chapter investigates the behaviour of banks with respect to SMEs' loan applications in response to the activation, tightening or loosening of macroprudential instruments. By testing the loan application outcome, the empirical part employs a probit model to test whether macroprudential instruments are associated with SMEs' access to bank financing. The results suggest that SMEs are less likely to have access to bank financing when macroprudential instruments are tightened. The relationship is strongest for capital-targeting macroprudential instruments. It is also revealed that the tightening of macroprudential instruments reduces the probability of SMEs having access to bank lending, while an inverse relationship is observed for actions that loosen macroprudential policy.

Keywords: Macroprudential regulation, bank lending, credit growth, credit cycles, financial stability, bank funding costs, funding structure, SMEs, access to finance, generalised method of moments

FINANCIRANJE BANK, KREDITNA RAST IN MAKROBONITETNA REGULACIJA

Povzetek

Namen pričujoče disertacije je raziskati učinek makrobonitetnih politik na delovanje bank, stroške financiranja in njihovo kreditno dejavnost. Posledice finančne krize v letu 2008 so bile vidne v spremenjenem dojemanju obstoječega finančnega nadzora, saj ta ni bil več zmožen omejevati samih razsežnosti krize niti blažiti sistemske nestabilnosti. V letih, ki so sledila krizi, se je poudarjala predvsem vzpostavitev nove makrobonitetne regulacije oziroma okrepitev že obstoječe, da bi se izognili nadaljnjim gospodarskim pretresom. Takšen pristop k regulaciji nad finančnimi ustanovami, s poudarkom na tveganjih zaradi velikosti, medsebojne povezanosti in medsebojne odvisnosti finančnih ustanov, kar vse lahko povzroča težave pri delovanju finančnega sektorja, imenujemo makrobonitetna politika. V primerjavi z mikrobonitetnim pristopom k finančni regulaciji, ki je prej veljal za zadosten ukrep za zagotavljanje finančne stabilnosti, zgolj z zagotavljanjem zdravega delovanja posameznih finančnih ustanov, makrobonitetni pristop upošteva tudi možnost, da tveganja ne izvirajo le iz posameznih ustanov, temveč tudi iz njihove medsebojne povezanosti in velikosti. Makrobonitetni pristop je z različnimi vrstami instrumentov uveljavilo veliko držav. Učinki makrobonitetnih instrumentov na delovanje bank, tako na kreditne strategije kot na financiranje, in na sam odziv bank, ki vpliva na gospodarsko dejavnost, so v večji meri še vedno neraziskani. Izsledki tovrstnih raziskav so ključnega pomena za vse akterje na trgu kot tudi za regulatorne organe. Zato se pričujoča doktorska disertacija ukvarja s preučevanjem učinkov makrobonitetnih instrumentov na kreditno rast, stroške bančnega financiranja in na ponudbo bančnih posojil majhnim in srednje velikim podjetjem (v nadaljevanju MSVP).

Z uporabo razširjene globalne podatkovne baze 12 makrobonitetnih instrumentov, ki jih je zbral Mednarodni denarni sklad (v nadaljevanju MDS), v prvem poglavju preučujemo učinke teh instrumentov na stroške bančnega financiranja v 43 razvitih gospodarstvih in gospodarstvih v razvoju. Omenjeni podatki so nadalje združeni z nekonsolidiranimi podatki na ravni bank, pridobljenimi za skupno 2.346 bank iz podatkovne baze Fitch Connect, ter z makroekonomskimi podatki različnih lastnosti posameznih držav, pridobljenimi iz podatkovne baze Svetovne banke in podatkovne baze MDS o Mednarodnih finančnih statistikah, kar omogoča upoštevanje heterogenosti med državami. Z uporabo cenilke posplošne metode momentov v prvem poglavju preučujemo odnos med makrobonitetnimi ukrepi in stroški financiranja bank: stroški dolžniškega financiranja in celotnimi stroški financiranja, ki zajemajo tako dolgove kot tudi lastniški kapital. Da bi lahko izmerili makrobonitetni učinek, so bili z uporabo podatkov iz podatkovne baze oblikovani različni makrobonitetni indeksi. Rezultati razkrivajo, da so makrobonitetni ukrepi običajno negativno povezani s stroški bančnega financiranja. Poglavje nadalje preučuje učinke

različnih skupin makrobonitetnih instrumentov: tistih, ki so usmerjeni na posojilojemalce, tistih, ki so usmerjeni na kapitalske pozicije bank, strukturnih instrumentov, ki ciljajo bančno koncentracijo in medbančne izpostavljenosti, ter instrumentov, ki so usmerjeni v naložbe in prihodke finančnih institucij. Glavni rezultat je tako potrjen v primerih instrumentov, ki so usmerjeni na posojilojemalce, kapital ter medbančno tveganje in tveganje koncentracije. V primeru naložbenih makrobonitetnih instrumentov, analiza razkriva tudi pozitivne vidike odnosa z odvisnimi spremenljivkami. Da bi v celoti razumeli razlike med državami v vzorcu, so podatki razčlenjeni v podvzorce, ki so oblikovani na podlagi razvitosti države, upoštevajoč klasifikacijo MDS. Rezultati kažejo na močno negativno povezavo makrobonitetnih ukrepov in stroškov bančnega financiranja v razvitih državah. V primeru držav v razvoju pa izsledki kažejo na nekaj pozitivnih koeficientov. Pri testiranju različnih indeksov, ki upoštevajo različne vidike delovanja makrobonitetnih ukrepov, pa se je pokazalo, da je učinek močno odvisen tudi od značilnosti finančnega sektorja v določeni državi, od razpoložljivosti različnih virov financiranja ter od makroekonomskih lastnosti.

V drugem poglavju preučujemo učinke makrobonitetnih politik na posojilno sposobnost bank v Evropski uniji med letoma 2000 in 2017, kar zajema obdobje pred krizo, obdobje krize in obdobje po krizi. Ta analiza tako vključuje podatke iz posodobljene makrobonitetne podatkovne baze, tj. *Podatkovne baze za evalvacijo makrobonitetnih politik* (angl. *Macroprudential Policies Evaluation Database*, v nadaljevanju MaPPED). Gre za bazo, ki jo je vzpostavila, objavila in jo vzdržuje Evropska centralna banka (v nadaljevanju ECB). Podatkovna baza ponuja informacije o številnih makrobonitetnih instrumentih, sprejetih v Evropi, in beleži aktivacijo, zaostrovanje, sproščanje ali deaktivacijo makrobonitetnih instrumentov. Omenjena podatkovna baza je združena s podatki panela letnih finančnih poročil za 3.434 bank, ki so bili pridobljeni iz podatkovne baze Fitch Connect. Številne makroekonomske spremenljivke, ki vključujejo razlike v gospodarstvih in finančnih pogojih različnih držav so pridobljene iz podatkovne baze Svetovne banke in baze MDS o Mednarodnih finančnih statistikah. Rezultati so pridobljeni z uporabo modela dinamičnega panela, s pomočjo cenilke posplošne metode momentov, in kažejo, da so makrobonitetne politike povezane z zmanjšano posojilno dejavnostjo bank, ki je ocenjena z vrednostjo bruto posojil. Izsledki tudi kažejo, da se ob zaostrovanju makrobonitetnih ukrepov banke odzivajo z zmanjšano posojilno dejavnostjo, medtem ko se ob sproščanju makrobonitetnih ukrepov posojilna dejavnost bank poveča. Povezava med makrobonitetnimi instrumenti in posojilno dejavnostjo bank je močnejša v obdobju sproščanja politik. To služi kot jasen argument za uporabo makrobonitetnih politik v trenutnih kriznih razmerah, ki so posledica pandemije COVID-19, saj sproščanje makrobonitetnih ukrepov spodbuja posojilno aktivnost bank, investicije in gospodarsko rast. Testiranje različnih skupin makrobonitetnih politik, osnovanih na ciljno usmerjenih ukrepih, privede do podobnih rezultatov.

Tretje poglavje je namenjeno analizi učinkov makrobonitetnih politik na dostop do finančnih sredstev, ki jih ponujajo banke preko kreditiranja MSVP podjetij, to je podjetij,

ki predstavljajo več kot 99 odstotkov celotnega nefinančnega sektorja v Evropi (Evropska komisija, 2019) in ki se v veliki meri zanašajo na bančno financiranje. Vzorec obsega MSVP v državah Evropske unije med letoma 2009 in 2017. Z uporabo podatkovne baze *Anketa o dostopu MSVP do finančnih sredstev* (angl. *Survey on the access to finance of SMEs,* v nadaljevanju SAFE), ki jo vzdržuje in objavlja ECB, ponuja pa vpogled v lastnosti podjetij in v njihove prošnje za bančne kredite na polletni osnovi, ter baze MaPPED, poglavje preučuje obnašanje bank pri obravnavi kreditnih prošenj MSVP kot odziv na aktivacijo, zaostrovanje ali sproščanje makrobonitetnih instrumentov. V empiričnem delu raziskave z analizo posojilnih prošenj podjetij in uporabo probit modela, ugotavljamo, ali so makrobonitetni instrumenti povezani z dostopnostjo bančnega financiranja za MSVP. Rezultati kažejo, da se dostop MSVP do bančnega financiranja zmanjša, ko se makrobonitetni ukrepi zaostrijo, ta povezava pa je najmočnejša za kapitalsko usmerjene makrobonitetne instrumente. Hkrati analiza pokaže, da zaostrovanje makrobonitetnih ukrepov zmanjšuje verjetnost dostopa MSVP do bančnih posojil, medtem ko za sproščanje makrobonitetnih politik velja ravno obratno.

Ključne besede: makrobonitetna regulacija, bančno posojanje, kreditna rast, kreditni cikli, finančna stabilnost, stroški financiranja bank, MSVP, dostop do finančnih sredstev, splošna metoda momentov

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INTRODUCTION

Research area and motivation for the dissertation

The global financial crisis of 2008, whose origins and consequences are still being explored, was responsible for serious damage to the economic systems of many countries and shattered the world economy. This eroded confidence in the financial sector, which has since been recovering. The crisis was followed by the marking down of investments, an increase in the number of decayed firms, while unemployment rates exploded. Accompanying these events were governments' efforts to save what was possible and their often unorthodox and massive state aid packages, ending in the exhaustion of feasible measures to combat the crisis' inevitable repercussions. The crisis revealed the nature of heightened economic growth based on excessive credit activity, which eventually became a tool for various securitised instruments created and sold in a critical absence of risk assessment and, in many cases, a complete lack of judgement. Meanwhile, housing prices were historically rising, built on a bubble that was about to burst and cost the global economy over $15 trillion (Armour et al., 2016).

Another important aspect exposed in the aftermath of the global financial crisis of 2008 was the serious deficiencies in financial regulation and supervision. Thirteen years later, we are entering a new decade, followed by another economic downturn caused by the exogenous shock of the Covid-19 pandemic with academic and supervisory circles of various countries and international communities still trying to facilitate and study a suitable regulatory mechanism and compulsory rules for market participants able to prevent another financial meltdown or minimise its damage. The crisis and its consequences led to a paradigm shift in what financial regulation should achieve, seeing the word "systemic" being introduced into every major attempt to explain the crisis and predict future regulatory regimes. The mainstream understanding was that protecting the health of individual financial institutions should ensure the entire financial system’s stability – known as the microprudential approach to financial regulation. Although some economists argued this approach was insufficient to ensure financial stability on the aggregate level (Borio, 2003; Crocket, 2000; Davis, 1999), the crisis demonstrated that the stumbling of financial institutions, whose size and exposures are large enough, can bring the whole economic system to a halt, and that microprudential oversight is insufficient for ensuring financial stability. This led regulators to switch over to the macroprudential approach concerned mostly with preventing the manifestation of systemic risk by protecting the financial system ‘as a whole’. The rationale underlying the approach is the recognition that the interconnectedness and interdependence of financial institutions is highly relevant, as is their individual soundness. The difference between the microprudential dimension and the new, macroprudential approach to financial regulation was described by Andrew Crockett, former general manager of BIS, in this way: *“The distinction between the micro- and macro-prudential dimensions of financial stability is best drawn in terms of the objective of the tasks and of the conception of the mechanisms*

influencing economic outcomes. It has less to do with the instruments used in the pursuit of those objectives".[1] Part of the macroprudential toolkit comes from the Basel III framework, while the other instruments are within national jurisdiction. Further, in 2009, the de Larosière report[2] led to the establishment of the European Systemic Risk Board (ESRB) with a mandate to supervise and oversee the EU financial sector with an aim of preventing a future financial crisis as a result of an increase in the systemic risk. It is also a body responsible for the oversight and coordination of macroprudential policies. The current framework of macroprudential tools consists of the existing microprudential instruments along with new instruments that are only part of the macroprudential framework, e.g. *countercyclical capital buffer* (Boissay & Cappiello, 2014). Some tools in this framework and tested in this dissertation are traditionally regarded as microprudential, while they also bear macroprudential effects by reducing the risk of contagion in the financial sector. As noted by Borio (2003, p. 2): *"So defined, by analogy with black and white, the macro- and microprudential souls would normally coexist in the more natural shades of grey of regulatory and supervisory arrangements".* The main difference between these approaches lies in their objective and timing. The objective of macroprudential policy is to mitigate the systemic risk that can arise from financial imbalances and shocks that can hold serious repercussions for the whole economy. While microprudential regulation considers risks to be exogenous, macroprudential regulation takes account of the endogenous risks arising from the collective behaviour of financial institutions, their interconnectedness and the characteristics related to the size of their assets and capital and their significance to the system as a whole (Crockett, 2000).

As Armour et al. (2016) suggest, international and domestic financial regulators were broadly optimistic about further economic growth and financial sector soundness in 2006. This was due to the unobserved rise in risks that had been building up over time following high indebtedness and excessive credit growth. Macroprudential regulation considers the time-series dimension by taming procyclical forces over the financial cycle. It requires banks to build up capital cushions in upturns, which could be relaxed during downturns in order to improve economic activity. This approach has two aims: 1) to avoid excessive lending in good times; and 2) to circumvent a credit crunch. A good example of such an approach is the activation of the *countercyclical capital buffer* in good times, with a view to protecting banks and other participants in the financial system from failure in bad times. The countercyclical capital buffer is a capital cushion with a capital requirement of 0%–2.5% that is activated (increased) in a country when there is an increased risk of systemic instability (Claessens, Ghosh & Mihet, 2013). This allows banks and other participants to remain stable during downturns when financial and economic conditions are deteriorating. This would also help reduce the risk of disruptions while curbing the procyclical behaviour

[1] Speech by A. Crockett: Marrying the micro- and macro-prudential dimensions of financial stability, International Conference of Banking Supervisors, Basel, 20-21 September, 2000.

[2] Report by the de Larosière Group: The high-level group of financial supervision in the EU, February 2009.

of financial institutions. Macroprudential policy also targets specific sectors or financial institutions such as *systematically important financial institutions*, while the aim of microprudential regulation is to address the stability of individual institutions within the financial system.

The current crisis caused by the Covid-19 pandemic raises the potential of the macroprudential 'space' in the frameworks in place today for macroprudential policies. The macroprudential space is created by the moderate building up of cyclical macroprudential tools with accommodating buffers which, when completely phased in, create enough capacity for macroprudential policy to stabilise credit cycles and facilitate an efficient response to economic downturn. In the current economic turmoil, some countries have been more bounded in their macroprudential space because they did not tighten their countercyclical macroprudential tools prior to the crisis. In the aftermath of the global financial crisis of 2008, many countries adopted macroprudential tools, especially ones targeting bank capital adequacy, the loan portfolio risk, and both the assets and liability sides of the bank balance sheet. Some of these tools are structural macroprudential tools, which are not meant to be cyclical. However, many countries only saw a limited build-up of countercyclical macroprudential tools, which are intended to be used to tame the procyclical forces during the financial cycle (ECB, 2019). This is especially evident for the euro are as only seven countries within the eurozone increased the countercyclical capital buffer above zero (Guindos, 2021). These circumstances limited the impact of the relaxation of countercyclical macroprudential tools in the euro area during the current downturn. Another challenge is the reluctance of banks to increase their lending at the expense of jeopardising the market's apprehension of their stability when operating at their capital buffers close to the required threshold. This credit contraction could prolong the crisis and bring risks to financial stability. Such risks could be avoided by creating a sufficiently large macroprudential space so as to substantially enhance the effect of the macroprudential countercyclical tools. On the other hand, in periods of distress, and a cyclical break in credit supply, macroprudential instruments with a specific focus can be relaxed and thereby provide the support needed for monetary policy. Coherence in these approaches also depends on countries' institutional frameworks and mandates for macroprudential policy, which are primarily on the national level.

The design of macroprudential policy and the complexity of implementing such measures, which could significantly impact financial sector participants, means that ever more studies have analysed their effectiveness in promoting financial stability by either mitigating excessive credit growth or reducing risk on both the firm and aggregate level (Akinci & Olmstead-Rumsey, 2018; Altunbas, Binici & Gambacorta, 2018; Cerutti, Claessens & Laeven, 2017; Claessens, Ghosh & Mihet, 2013; Lim et al., 2011).

Taking into account the literature on the subject, which is still developing, and the need to further investigate the effects associated with macroprudential regulation's application to

both the economic and financial systems, this dissertation seeks to expand this area of research and fill the gap in the literature by:

(a) examining the price of banks' funding sources after the activation of macroprudential policies, controlling for heterogeneity across countries in terms of macroeconomic characteristics and economic development;
(b) investigating the impact of macroprudential policy on individual banks' lending, testing different macroprudential instruments in terms of their aim and objective, and separately testing their tightening and loosening cycles; and
(c) analysing the microeconomic effects of macroprudential regulation in the context of banks' response and their lending strategies with respect to firms by looking at SMEs' access to bank funding.

Research questions and objectives of the dissertation

As macroprudential measures were shown to be effective for decreasing bank risk (Altunbas, Binici & Gambacorta, 2018; Claessens, Ghosh & Mihet, 2013; Gaganis, Lozano-Vivas, Papadimitri & Pasiouras, 2020), we expect that this effect could translate into lower funding costs for banks. However, to fully explore these effects, the analysis distinguishes different groups of macroprudential instruments based on their objectives, also with regard to differences in economic development and various macroeconomic determinants across countries. Moreover, bank funding costs are fully captured by two dependent variables, namely debt and overall funding costs. In Chapter 1, we use a macroprudential database collected and published by the IMF (Cerutti, Claessens & Laeven, 2017), which provides information on 12 instruments of the macroprudential approach, and combine it with bank-level data for 43 advanced and emerging market economies, which we gathered from the Fitch Connect database. Following previous studies, we use a dynamic panel data model estimated with a generalised method of moments estimator. The analysis in Chapter 1 addresses the following research questions:

Research question 1.1: Are macroprudential measures significantly and negatively associated with bank funding costs?

To answer this research question, an aggregate macroprudential index is formed that considers all 12 macroprudential instruments available in the database. It is expected that a negative relationship will be found between this index and the dependent variables measuring banks' funding costs. Considering that the use of macroprudential policy makes individual banks safer, increases bank asset quality, reduces the use of leverage, and improves banks' capital position (Galiay & Maurin, 2015; Harimohan & Nelson, 2014; Martinez-Miera & Repullo, 2019), we expect that it could improve the market’s perception of a bank’s stability and have a dampening effect on the cost of bank funding.

Research question 1.2: Is there a difference in the effect of macroprudential policy with respect to debt funding or overall funding costs?

To account for the two sources of bank funding, debt and equity, two dependent variables are formed: 1) the cost of debt, measured by interest expense over average bank interest-bearing liabilities; and 2) overall funding costs, which accounts for both debt and equity and is measured by the weighted average cost of capital.

Research question 1.3. Is there any difference in the effect of macroprudential instruments on banks' funding costs based on the objective of these measures?

Since macroprudential measures have different objectives and affect banks' determinants through various channels, either through the assets or liability side of banks' balance sheets, it is important to analyse these effects through a more granular approach. To this end, four additional macroprudential indices are constructed: 1) Borrower – macroprudential instruments targeting borrowers, i.e., loan-to-value limit; 2) Capital – macroprudential instruments targeting banks' capital positions, i.e., countercyclical capital buffer; 3) Structural – macroprudential tools targeting funding vulnerabilities associated with interbank lending and risks associated with borrower concentration exposures, i.e., interbank limits; and 4) Institution – macroprudential instruments targeting bank assets and earnings, i.e., reserve requirements.

Research question 1.4: Is there a difference in the effects of macroprudential policy based on economic development in different countries?

To analyse differences in macroprudential effects due to country heterogeneity and differences in economic development and institutional settings, the entire analysis is repeated for a subsample of countries belonging to the advanced and emerging market groups based on the IMF classification.

Research question 1.5: Is there a difference in the effects of macroprudential policy based on financial development and the bank regulatory and supervisory environment?

To further disentangle the importance of the institutional, regulatory and supervisory environment across countries, new variables measuring financial development are introduced into the baseline model along with the regulatory quality and supervisory authority indices. The intention is to further increase the analysis' sensitivity and show how the differences in the institutional and regulatory settings affect the impact of macroprudential measures in various countries.

Chapter 2 looks at macroprudential interventions in the banking sector by examining the impact of such interventions on bank lending and whether they are effective in moderating

excessive credit growth. Most macro-level studies examined the use of macroprudential instruments on aggregate credit growth (Borio & Shim, 2007, and Cerutti, Claessens & Laeven, 2017), while some micro-level studies using bank-level data looked at the impact of macroprudential policy on bank risk (Altunbas, Binici & Gambacorta, 2018; Claessens, Ghosh & Mihet, 2013). This chapter investigates the impact of macroprudential measures on individual bank lending behaviour by combining both micro- and macro-level data. In this way, it considers the response of individual banking firms to macroprudential tightening or easing. The following research questions are examined in this chapter.

Research question 2.1: Are macroprudential measures significantly associated with bank lending?

To answer this question, we obtain recent macroprudential data based on policy measures adopted over 17 years (2000–2017) in EU countries and construct an overall macroprudential index that takes account of all instruments and all changes associated with these instruments. We expect the macroprudential index to be significantly and negatively associated with bank lending. Since we are interested in examining the direction of the measures and the banks' response in different macroprudential cycles, we also consider the following questions:

Research question 2.2.1: Is the tightening of macroprudential measures significantly associated with a moderation of bank credit activity?

Research question 2.2.2: Is the relaxation of macroprudential instruments significantly and positively associated with bank lending due to the reduced regulatory burden?

For this part of the analysis, we construct four different indices that capture only the tightening or only the loosening actions of the macroprudential regulator. A full explanation of how these indices are constructed follows in the remainder of this study. This analysis of the tightening and easing actions of macroprudential policy is crucial for understanding its effectiveness with respect to changes in the financial cycle and the conditions in the banking sector. Given that different instruments target different items on bank balance sheets, we are interested in examining the effects of macroprudential measures on bank lending in relation to the objective of these measures and thus develop the following research questions:

Research question 2.3: Which macroprudential instruments are the most effective for curbing credit growth in the banking sector?

Research question 2.4: Which macroprudential instruments have the strongest relationship with an increase in lending activity once they have been relaxed?

The premise of this analysis is to construct indices based on the objective of the measure, and we differentiate instruments according to those that target credit growth, liquidity positions, concentration or resilience. For research question 2.4, we specifically investigate the loosening actions of macroprudential policy with instruments differentiated by their target in order to determine which macroprudential measures are the most effective in cycles of eased macroprudential policy. Since macroprudential measures were introduced chiefly in the period following the 2008 financial crisis, we investigate the research question using subsamples of data based on different time periods.

Research question 2.5: Are there differences in the effects of macroprudential measures on bank lending in different periods of the financial cycle?

Finally, we test a subsample that contains 112 listed banks. These are mostly the largest banks in terms of assets available for EU countries in the Fitch Connect database. The fact some macroprudential tools target this group of banks acts as an additional incentive to observe the response of this group of institutions to the activation of macroprudential tools. We investigate the following research question:

Research question 2.6: How is the activation of macroprudential measures reflected in the listed banks' lending activities?

The methodological approach involves the use of a dynamic panel data model with a generalised method of moments estimator due to the endogeneity bias arising from the activation of macroprudential policy with respect to changes in credit cycles, as explained in greater detail later on in this study. Moreover, our sample with a short time period and large number of banks is an additional determinant of the suitability of this method. This strategy has also been used by other studies that examined the use of macroprudential measures (Lim et al., 2011; Morgan, Regis & Salike, 2018).

Chapter 3 analyses how banks respond to the introduction, tightening or loosening of macroprudential instruments in terms of their lending behaviour. In order to obtain a picture of the real effects of these measures on the supply of credit, we investigate the impact of macroprudential measures on bank lending to SMEs because these firms depend highly on bank financing while they are the key driver of employment and value added in the non-financial sector of the European Union. Earlier studies showed that the use of macroprudential measures reduces bank lending, whereas a study by Ayyagari, Beck and Martinez Peria (2018) found after looking at firm-level data that macroprudential instruments are associated with lower bank lending activity. We extend this work by measuring the effects with survey data from firms, which allows access to direct information on loan applications and whether they were successful or not. First, we analyse the relationship between macroprudential policy and SMEs' access to bank credit by testing the

macroprudential index that we construct by summing all policy actions across countries in a given period.

Research question 3.1: Are macroprudential measures significantly (positively or negatively) associated with SMEs' access to bank finance?

The next step involves creating different macroprudential indices, which encompass various macroprudential instruments grouped by their target such as borrower-based measures, capital-based measures, liquidity-targeting measures, and other macroprudential instruments captured by the database. This analysis seeks to respond to the following research question:

Research question 3.2: Which macroprudential policy instruments have the strongest impact on banks' lending behaviour with respect to SMEs?

Another aspect of this study's innovativeness may be seen in the possibility of analysing the tightening and loosening actions of macroprudential policy separately since the database offers information on the complete life cycle of macroprudential instruments, their activation, tightening, loosening or deactivation. This enables the separate measuring of how banks respond to changes in macroprudential instruments and how that shapes their lending policy vis-à-vis SMEs.

Research question 3.3. How does the tightening (loosening) of macroprudential policies affect banks' willingness to lend to SMEs?

Considering the importance of size and age as determinants of firms' access to finance, as described in the literature (Beck, Demirgüç-Kunt, Laeven & Maksimovic, 2006; Casey & O'Toole, 2014), this chapter additionally analyses the relationship between macroprudential policy and SMEs' access to bank credit with respect to firms' size and age characteristics. This analysis provides more granularity in determining the macroprudential instruments' impact on bank lending behaviour and how the firm's size and age shape a bank's response to their activation.

Research question 3.4: Are the effects of macroprudential policy on SMEs' access to bank financing determined by firm size and age?

As noted in the introductory part, the objective of macroprudential policy is to achieve financial stability, stabilise credit cycles and prevent a future financial crisis as a result of systemic risk manifestation. To achieve this goal, macroprudential policy affects bank behaviour through different channels and ultimately affects bank lending behaviour. Previous studies found that macroprudential policy is negatively associated with bank credit activity (Cerutti, Claessens & Laeven, 2017; Lim et al., 2011, Morgan, Regis & Salike,

2018) that asserts its effectiveness by slowing down excessive credit growth and smoothing credit cycles. Still, the tightening of prudential regulations can also produce undesirable effects and potentially cause a deterioration of SMEs' credit access. This could be followed by a slowdown in economic activity and ultimately decrease investments and economic growth. Accordingly, this chapter considers the following research question.

Research question 3.5: Is there a trade-off between the implementation of macroprudential policies and real economic effects in terms of access to finance?

This chapter includes restricted firm-level data based on a survey conducted by the ECB and the European Commission covering the period between 2009 and 2017, while macroprudential data also come from a database recently published by the European Central Bank containing information on 53 macroprudential policy instruments. The empirical strategy is built on the use of probit analysis based on firm characteristics, macroprudential indices and macroeconomic conditions.

Data and methodology

Chapter 1 analyses the relationship between macroprudential instruments and bank funding costs by combining the macroprudential database compiled and published by the IMF (Cerutti, Claessens & Laeven, 2017) with bank-level data for 2,346 banks from 43 advanced and emerging market economies gathered through the Fitch Connect database. The chapter examines the relationship between 12 macroprudential instruments included in the database and banks' funding costs between 2000 and 2017. Since funding costs affect banks' profits, the amount of lending, the price of lending, and the bank's capital and liquidity position, the objective of this chapter is to analyse how the introduction of macroprudential instruments affects the cost of bank funding through either debt or equity. Different groups of macroprudential measures – those targeting borrowers, capital instruments whose objective is to enhance the capital adequacy of financial institutions, those instruments targeting interbank or concentration exposures of banks, and instruments targeting the assets and revenues of banks – are analysed separately to show which measures are most associated with changes in banks' funding costs. In addition, we examine whether the country's economic development affects the relationship between the macroprudential measures and banks' funding costs.

The empirical approach builds on the literature that proposes the use of the generalised method of moments to control for the endogeneity bias associated with the introduction of macroprudential policy in countries, while controlling for the bias due to the dynamic specification of the model.[3] Banks' cost of funding is captured with two dependent variables:

[3] The decision to adopt macroprudential measures is associated to conditions in the banking system, i.e. countries may adopt macroprudential tools in response to excessive credit activity or concerns related to an increase in systemic risk. This may lead to reverse causality in the analysis of banking variables, as bank

1) *cost of debt*, measured by total interest expense over average interest-bearing liabilities; 2) *overall funding cost*, measured by the weighted average cost of capital, which takes both equity and debt funding costs into account. In the baseline regressions, the dependent variables are regressed on the main macroprudential measure, the index summarising changes in macroprudential instruments documented in the database, various banking variables (size, equity-to-assets ratio, liquidity ratio, and deposits-to-liabilities ratio), macroeconomic variables (volume of GDP, credit to the domestic sector as a percentage of GDP, policy rate, and inflation rate), and the crisis indicator, which has a value of 1 in 2008–2012 and 0 otherwise. The study is further deepened by examining the relationship of banks' funding costs with different groups of macroprudential instruments: 1) those targeting borrowers, 2) those targeting banks' capital position, 3) structural instruments targeting interbank funding and lending concentration exposures, and 4) measures targeting banks' assets and earnings. Four indices are developed and tested to examine the direction in which these types of macroprudential instruments are linked to banks' funding costs and whether some macroprudential instruments have stronger effects relative to the dependent variables. The subsequent analysis examines the effects of individual macroprudential instruments, and finally the entire analysis is repeated for different subsamples based on the level of economic development. In the robustness section, the introduction of different bank variables related to bank risk, size and performance, and macroeconomic determinants is further analysed by controlling for the financial development and regulatory environment and different time periods based on the outbreak of the 2008 financial crisis.

The results for the full sample show that macroprudential measures are significantly and negatively associated with bank funding costs. When we divide macroprudential instruments into different groups, we find there is a statistically significant and negative association between borrower, capital and structural indices, with borrower-oriented measures being the most effective. However, we also find a statistically significant and positive association of the macroprudential index with institution-based measures targeting the assets and earnings of financial institutions. When analysing each instrument individually, we find that the sign of the relationship sometimes varies due to the objective of particular macroprudential instruments and the channel through which they work, while the initial results are confirmed as we establish a positive and significant relationship with some institution-based macroprudential measures such as reserve requirements, limits on credit growth, and taxes. The results based on the subsample estimates also reveal differences in the impact on banks' funding costs depending on financial and economic development, suggesting that macroprudential activation across countries should be carefully calibrated and designed with country characteristics and circumstances in mind, especially in markets where various sources of funding are limited to some extent. The

fundamentals may reflect some of this risk (Claessens, Ghosh & Mihet, 2013; Altunbas, Binici & Gambacorta, 2018). To address the endogeneity bias, macroprudential literature suggests using the dynamic generalised method of moments (GMM) as the estimation method. Detailed explanation of the matter in question follows in the remainder of this study.

chapter ends with concluding remarks and a description of opportunities for further research in this area.

Chapter 2 analyses the effectiveness of macroprudential policies in curbing bank lending using bank-level data combined with macroprudential data captured by indicators and indices. The objective of this chapter is to assess the potency of macroprudential measures activated in a given country in a certain period to mitigate excessive bank lending. By examining the impact of the enforced tightening of macroprudential policies, the analysis shows how banks respond to tighter capital, liquidity or other requirements imposed by regulators and whether such measures reduce bank lending activity. On the other hand, the easing measures are also tested to see whether a significant relationship exists with bank lending when macroprudential tools are relaxed. Further, the analysis considers whether the effectiveness of macroprudential instruments depends on their objective, i.e., whether the instruments aimed at improving banks' capital or liquidity positions have a stronger effect on bank lending. The analysis also examines other groups of instruments intended to limit excessive lending, such as credit constraints or restrictions on borrowers. In addition, the effectiveness of the instruments is tested over time in different periods of the financial and business cycle and on a subsample of the listed banks.

The chapter extends the literature on macroprudential policy and adds to it in several ways. First, we extend this work by increasing the number of policies analysed by using the most recent database on the implementation and use of macroprudential instruments in EU countries. Second, the analysis covers a considerably long period between 2000 and 2017, which enables capturing the entire life cycle of some macroprudential instruments. Third, we measure the impact of the measures using bank-level data for 3,434 banks and, apart from including most of the European banking sector, we also extend previous work in this area that largely focused on macro-level studies. Fourth, we consider key banking and macroeconomic indicators to examine the sensitivity of the analysis to changes in banking determinants or in countries' economic performance. Finally, we structure and analyse various macroprudential policy instruments, including distinguishing their tightening and loosening actions during the period under consideration.

The empirical strategy is based on the use of a dynamic panel data model estimated with the Arellano-Bond generalised method of moments estimator, which is the appropriate choice due to the endogeneity concerns arising from the introduction of macroprudential policies, the presence of a lagged dependent variable on the right-hand side, and a small T (time period) and a large N (number of individuals/groups) of the sample. The analysis begins with the baseline model, in which we regress the logarithm of the banks' gross loans on size, the tier 1 capital ratio, and the policy rate, which helps identify the proper estimation method. In further analysis, we include our variables of interest (macroprudential measures), various bank determinants (liquidity ratio, loans-to-deposits ratio, loan loss provisioning, market share, and bank specialisation) and key macroeconomic controls (GDP growth,

private credit to domestic sector to GDP, gross capital formation growth, gross nonperforming loans to total loans, and inflation rate). In addition, we measure the 2008 global financial crisis' impact by restricting the analysis to different time periods: before the crisis, during the crisis, and after the crisis. Finally, as an additional robustness check, we examine a subsample of 112 listed banks. The results show that macroprudential measures are significantly and negatively associated with gross loans. Subsequent results show that loosening macroprudential policy measures, such as those targeting the lending and capital position of banks, are strongly and positively associated with bank credit supporting these policies' use in supporting bank lending and economic growth in periods of economic downturn.

Chapter 3 focuses on examining the real effects of macroprudential policy by analysing SMEs' loan applications and access to bank financing after the introduction or tightening of some macroprudential instruments. The scope of the analysis includes 36,466 firms from EU between 2009 and 2017, and 53 policy instruments included in the macroprudential database. The chapter innovatively combines two datasets, namely, the recent macroprudential database (as in Chapter 2) and the Survey on the Access to Finance of Enterprises (SAFE) collected and published by the European Central Bank. In this respect, the study contributes to the field of corporate finance and the literature on macroprudential policy by presenting the impact of macroprudential policies on the micro level, which is a gap in the current literature. The chapter seeks to answer the research questions concerned with the impact of macroprudential measures on bank lending to SMEs and to uncover a significant difference in the impact for different types of macroprudential instruments. In addition, this chapter analyses whether a tightening (loosening) of macroprudential measures reduces (increases) the probability of SMEs obtaining bank loans. Moreover, the chapter examines whether the relationship between macroprudential instruments and bank lending to SMEs is determined by the size and age of the firm.

Due to the limited dependent variable on the left side of the model, this chapter uses probit analysis to answer the research questions on the likelihood of SMEs accessing bank financing in countries with respect to the use of macroprudential policies. The first step is to adjust the entire database to the biannual frequency because the main firm-level database relies on questionnaires administered every 6 months. Both the macroprudential database and the macroeconomic data are adjusted to match the firm level data. As well as the macroprudential indices, the following firm characteristics are considered: firm size, age, leverage, turnover results, credit history, degree of decision autonomy, and ownership. In addition, we include variables that show whether certain bank credit requirements have changed from previous conditions (collateral, maturity). Finally, we include macroeconomic variables like GDP growth and the unemployment rate, while also controlling for crisis years. The model is tested in different settings, extending the analysis by: addressing the selection bias by introducing a Heckman correction; testing macroprudential measures which were implemented as recommendations by the regulator;

introducing a measure of monetary policy into the baseline model; and testing various subsamples of firms.

The results show that macroprudential instruments are significantly associated with bank lending to SMEs. It is found that after the enforcement and tightening of macroprudential measures SMEs are less likely to obtain bank credit. The results suggest that after these measures are relaxed, SMEs are more likely to have a positive loan application outcome. The strongest association is established for macroprudential capital measures, whose primary objective is to improve the capital position of banks. After conducting different robustness tests, the results are reaffirmed to a large extent. The results suggest that macroprudential measures taken to maintain financial stability can also hold serious repercussions linked to the availability of credit and ultimately to investment and economic growth. The results point to the need to carefully design and calibrate macroprudential tools, taking account of the characteristics of individual countries and the response of banking institutions belonging to these countries to the introduction of macroprudential measures.

Structure and contents of the dissertation

The dissertation consists of introduction, three chapters and a conclusion. The three chapters are written as individual scientific articles with an independent methodological approach and data used. All three chapters revolve around the effects of macroprudential policy; however, each chapter considers the effectiveness of macroprudential policy from a different angle. Each chapter begins with an introduction and literature review of previous studies in the field and continues with a detailed explanation of the data used in the chapter as well as the sample and scope of the analysis. This is followed by an explanation of the empirical strategy and results, while the final section concludes the chapter.

The remainder of the study is arranged as follows: Chapter 1, entitled *Macroprudential measures and developments in bank funding costs*, examines the important aspects of the introduction of macroprudential measures on the price of banks' funding sources. Chapter 2 analyses the relationship between macroprudential policies and bank lending for EU banks. The chapter is entitled *Tightening and loosening of macroprudential policy, its effects on credit growth, and implications for the Covid-19 crisis*. In an attempt to measure the real impact of macroprudential regulation, the third chapter focuses on bank lending to SMEs and the effect the macroprudential regulator's actions have on SMEs' access to bank financing. This chapter is entitled *Bank lending and small and medium-sized enterprises' access to finance – effects of macroprudential policies*. Finally, the study ends with a discussion and explanation of the contribution made by the thesis, together with some concluding remarks.

1 MACROPRUDENTIAL MEASURES AND DEVELOPMENTS IN BANK FUNDING COSTS*

1.1 Overview

In this chapter, we study how the use of macroprudential policy instruments is associated with bank funding costs. To accomplish this, we develop several macroprudential indices based on policy objectives and include different macroeconomic and bank-level variables, while we also separately analyse the cost of debt and overall cost of funding. Our analysis relies on bank-level data in 43 European countries for the period between 2000 and 2017, and a macroprudential policy dataset based on an IMF survey. The results show the activation of macroprudential policies is chiefly related with lower bank funding costs, with this association being stronger for developed countries than emerging ones. The results also reveal positive links with certain macroprudential measures to bank cost of funding, offering further insight into the repercussions of calibrating and selecting macroprudential tools.

1.2 Introduction

The 2008 financial crisis brought to the surface the risks entailed in banks' relying on certain types of wholesale funding and their vulnerability to those funding structures. As the crisis spread rapidly, some of these funding types evaporated, producing an abrupt rise in funding costs. In turn, the banks were forced to deleverage, restructure their funding models, and recapitalise, typically with government support (Van Rixtel & Gasperini, 2013). Bank funding costs affect a variety of economic factors and are relevant in the context of financial stability. Higher financing costs lead to an increase in lending rates, ultimately bringing more loan defaults, negatively affecting a bank's profits while weakening its capital and liquidity position, and adding to the risk of the entire financial system (Beau, Hill, Hussain & Nixon, 2014). Risks related to funding were also identified by regulators and individual banks in the post-crisis period, a period characterised by superior market liquidity and historically low interest rates. Analysis of liquidity developments and funding conditions across the EU is clear in stating that "the repricing of risk premia remains a serious concern that could rapidly deteriorate access to funding markets and weigh on the funding costs of the banking sector" (EBA, 2018, p. 10)[4]. More recently, efforts have been made to integrate funding costs into macroprudential stress tests so as to quantify financial institutions' resilience to funding shocks and consider the links between solvency and funding costs (Basel Committee for Banking Supervision, 2015; Korsgaard, 2020).

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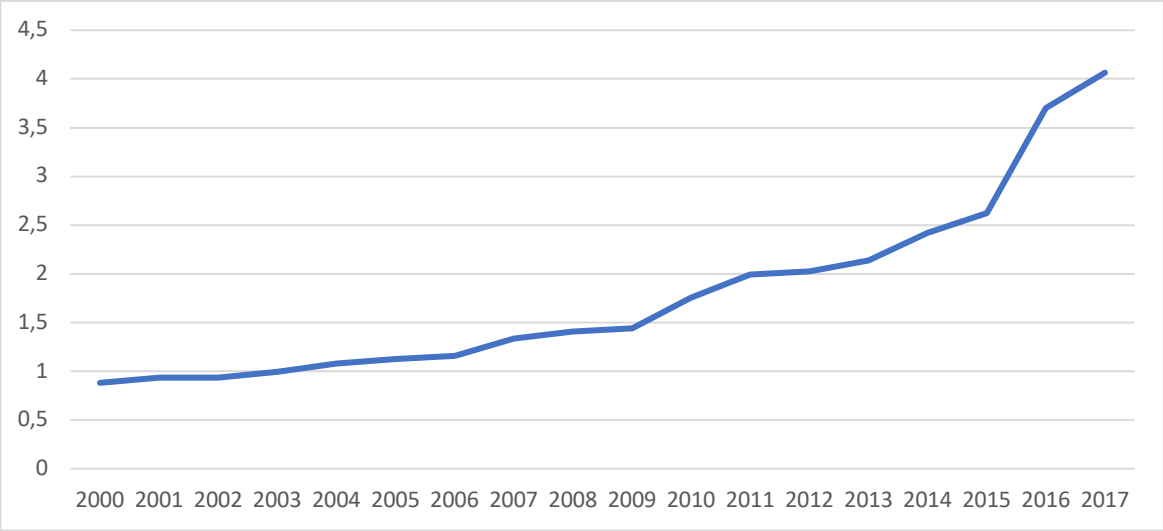
4 Joint Committee Risk Assessment Report (September 2018). Available at: https://www.eba.europa.eu/risk-analysis-and-data/risk-assessment-reports-archive

Although some economists argued the microprudential scope of regulation in place in the years leading up to the 2008 crisis was insufficient to ensure financial stability on the aggregate level (Borio, 2003; Crocket, 2000; Davis, 1999), it was not until the crisis demonstrated that the stumbling of financial institutions, of large enough sizes and exposures, can bring the entire economic system to a halt. The macroprudential approach to financial regulation understands the risks arising from financial institutions' interconnectedness and what this means by way of externalities for the economy as a whole (Crocket, 2000; Tsatsaronis, 2002). The first *objective* of macroprudential policy is to lower the agglomeration of systemic risks triggered by financial disturbances that may significantly damage the economy as a whole. Second, the macroprudential approach considers the risk of the failure of interconnected institutions and their characteristics in terms of size and importance for the overall economy (Borio, 2003). The *time dimension* of macroprudential policy allows for buffers to build up in good times, providing an additional source of funds banks can rely on in times of distress. By requiring banks to hold more capital in good times, macroprudential regulators seek to enable banks to absorb losses during periods of distress without having to sell off their assets at fire-sale prices and cause a credit crunch that would eventually add to the deterioration of many parts of the economy (Adrian & Shin 2010; Allen & Carletti 2008; Borio, 2003; Diamond & Rajan, 2001; Hanson, Kashyap & Stein, 2011; Shleifer & Vishny, 2011). Since the global financial crisis, the use of macroprudential measures has greatly increased (Figure 1.1)[5], while the literature suggests their use has had a considerable impact on banking and related activities (Cerutti, Claessens & Laeven, 2017).

[5] Figure 1.1 is based on data provided by the IMF's Global Macroprudential Policy Instruments survey (GMPI) conducted by IMF's Monetary and Capital Department for the period 2000–2017. The y axis represents the mean of MPP, an aggregate macroprudential index (the sum of the 12 macroprudential instruments in the database) for all countries in the sample (43 European countries), while the x axis represents the time coverage of the database.

Figure 1.1 The use of macroprudential policies over time



Source: Authors' elaboration based on the mean of the aggregate macroprudential index in the total sample of countries, GMPI, IMF database (Cerutti, Claessens & Laeven, 2017).

The literature highlighting the importance of bank funding costs in the context of financial stability and their relationship with solvency offers several important contributions (Admati, DeMarzo, Hellwig & Pfleiderer, 2013; Babihuga & Spaltro, 2014; Belkhir, Ben Naceur, Chami & Samet, 2021; Schmitz, Sigmund & Valderrama, 2017; Vazquez & Federico, 2015), which primarily emphasise the beneficial effects of bank capital regulation. However, macroprudential policy goes beyond capital regulation since the various instruments used for this purpose operate through different channels. Macroprudential tools operate through different balance-sheet channels, either on the asset or liability side of banks, e.g. borrower-based measures like a loan-to-value limit and a debt-to-income limit could improve bank asset quality by restricting the pool of borrowers and lower the loan portfolio's risk by reducing the likely losses due to non-performing loans (Morgan, Regis & Salike, 2018). In the end, this could improve the market perception of banks' assets and bring about lower funding costs. The literature on macroprudential policy is growing and shows the ultimate goal of financial stability studies is generally focused on macroprudential policy's impact on credit growth in a macro setting (Cerutti, Claessens & Laeven, 2017) and bank risk (Altunbas, Binici & Gambacorta, 2018; Meuleman & Vander Vennet, 2020), while to our knowledge no studies have concentrated on the impact of different macroprudential measures on bank funding costs.

The aim of this chapter is therefore to empirically analyse and determine the impact of different macroprudential policies on bank funding costs as a function of different bank determinants and various macroeconomic and financial factors impacting banks' operation. Our study generally contributes to the literature by: (i) analysing the effects of macroprudential policy on bank funding costs by considering different forms of measuring macroprudential instruments and their individual impact on both debt and overall funding

costs; (ii) extending the literature with a discussion of bank financing costs in the context of financial stability beyond capital requirements; (iii) shedding light on individual banks' response to the use of macroprudential policy, using bank-level data and expanding on the relatively scarce micro-level evidence in the relevant literature; and (iv) studying differences in the macroprudential instruments' effectiveness based on various financial systems in which banks operate. Moreover, the effects of macroprudential policy are currently of utmost importance, given the ongoing economic crisis which was caused by the Covid 19 pandemic. The current crisis offers experimental grounds for macroprudential measures in achieving financial stability goals by preventing a new financial crisis, and the effectiveness of its countercyclical design, as regulators loosened some macroprudential tools in order to facilitate investments and economic growth. This is especially important in the context of likelihood of substantial capital outflows from emerging economies that could lead to liquidity shortages (Nakatani, 2020).

We use annual bank balance sheet data covering 43 European countries between 2000 and 2017, together with IMF macroprudential policy database and macroeconomic data collected through the World Bank and IMF's International Financial Statistics. The macroprudential database contains information on the use of 12 macroprudential measures that we examine individually and with different indices, which we construct by combining individual instruments according to their target. Using bank-level data allows a more granular view of the impact of macroprudential policy on individual banks in terms of their characteristics. Moreover, the use of such data is less prone to the endogeneity biases associated with the implementation of macroprudential policy (Claessens, Ghosh & Mihet, 2013)[6]. Considering that the adoption of macroprudential measures relates to conditions in the banking system, countries can implement measures to respond to developments in credit cycles or concerns about systemic risk. The decision to adopt such measures due to certain periods of heightened credit activity or financial stability concerns may lead to reverse causality because bank fundamentals might reflect some of this risk (Altunbas, Binici & Gambacorta, 2017; Claessens, Ghosh & Mihet, 2013). To resolve the endogeneity bias, most of the macroprudential literature suggests using the dynamic generalised method of moments (GMM) as the estimation method. We adopt the choice of this method since it is also based on our small T and large N sample, along with the different bank and macroeconomic variables introduced in our model. By using GMM, we expect to be able to minimise any endogeneity bias that might affect the estimation results.

The findings confirm a significant relationship between macroprudential instruments and the cost of bank financing. The baseline results reveal that most of our indices of macroprudential policies are statistically significant and negative in sign relative to the cost of funding, while the results hold in most robustness tests. Macroprudential instruments targeting borrowers (such as loan-to-value and debt-to-income limits) have the strongest

[6] Macroprudential policies are adopted in response to conditions in financial system at large. It is unlikely that the policies' adoption will result from the behaviour of individual banks (Claessens, Ghosh & Mihet, 2013).

dampening effects on bank financing costs. Capital-related instruments (i.e. countercyclical capital buffers) and structural macroprudential measures (such as interbank limits or concentration limits) are also significantly and negatively associated with bank cost of funding. However, we obtain statistically significant and positive coefficients for certain institution-specific measures (i.e. reserve requirements). While testing the effects of macroprudential indices within panels restricted to subsamples of advanced and emerging economies, the results for advanced economies are largely similar to the results of the baseline estimations, while for emerging economies we obtain some positive coefficients, suggesting that effects of macroprudential policy on the cost of funds depend largely on the characteristics of a given country's financial condition, its financial development, the availability of different sources of finance, and the regulatory environment.

Our findings hold important policy implications for macroprudential regulators with respect to the selection of appropriate instruments. While our results support the use of macroprudential policies, the results clarify which macroprudential policy instruments are most effective and which measures should be used more cautiously, especially in emerging markets.

The remainder of this study is organised as follows. The next section presents the discussion and findings of previous studies by distinguishing articles that examine the use and effectiveness of macroprudential policy in an international and country setting and studies that look at bank funding costs. Section 1.4 describes the data and methodology used in the study. Section 1.5 highlights the study's main findings, Section 1.6 provides extensions and robustness analysis, while the section 1.7 concludes the study.

1.3 Literature review and hypotheses development

The macroprudential dimension of financial regulation is still relatively new, with the need to understand its implications propelling growth in the literature on the effects of macroprudential policy. Since the primary objective of macroprudential policy is to limit systemic risk and enhance financial stability, studies generally focus on its impact on the credit market, based on country-level data (Cerutti, Claessens & Laeven, 2017; De Schryder & Opitz, 2021; Lim et al., 2011), while other studies investigate its effects for bank risk (Altunbas, Binici & Gambacorta, 2018; Claessens, Ghosh & Mihet, 2013; Dell'Ariccia, Igan & Laeven, 2012; Ely, Tabak & Teixeira, 2020; Gaganis, Lozano-Vivas, Papadimitri & Pasiouras, 2020; Meuleman & Vander Vennet, 2020). There is consensus in the literature on the effectiveness of macroprudential measures in curbing excessive credit growth. In an influential and extensive cross-country study covering 49 countries for the period 2000–2010, Lim et al. (2011) find the use of macroprudential tools can dampen the procyclicality of credit. Capital-based instruments limit the procyclicality of debt, while dynamic provisioning minimises the procyclicality of credit and debt. Similarly, focusing on the housing market Akinci and Olmstead-Rumsey (2018) show that macroprudential

instruments have a significant impact on house prices and housing credit and reduce credit growth. Cerutti, Claessens and Laeven (2017) use a detailed survey of the IMF of macroprudential policies and find that credit growth responds negatively to policies targeting borrowers and financial institutions.[7]

Fewer studies have used micro level data rather than aggregate-level data. Using data on banks from the United Kingdom, Aiyar, Calomiris and Wieladek (2015) find that higher capital requirements are negatively associated with credit growth depending on bank size. In a cross-country study Zhang and Zoli (2016) find the decline in credit growth in Asia may be attributed to the introduction of macroprudential measures in the housing sector. While using bank-level data from 61 advanced and emerging market countries Altunbas, Binici and Gambacorta (2018) found macroprudential policies had a significant negative effect on bank risk, conditional upon bank size, capitalisation and funding source. Banks that depended strongly on wholesale funding were greatly altered by the intensity of the macroprudential measures. In a paper by Olszak, Roszkowska and Kowalska (2018) it is suggested that borrower-based measures are most efficient at decreasing the procyclicality of loan-loss provisions among the remaining macroprudential tools. Jiménez, Ongena, Peydro and Saurina Salas (2017) show that countercyclical dynamic provisioning refines credit cycles and supports firm financing in bad periods. The study suggests that bank procyclicality can be alleviated by introducing countercyclical capital buffers.[8]

The above studies focus on the effectiveness of macroprudential policy and its impact on housing prices and credit growth. We analyse the impact of macroprudential instruments on bank financing costs by using bank-level data in a large international study that includes large number of European countries. Our sample is heterogeneous in terms of level of economic development of countries and their institutional framework. In this way we are able to shed the light on potential vulnerabilities arising from growing interconnectedness of banking sectors, which goes beyond national borders. This international approach of our analysis is crucial to understand the impact of macroprudential regulation on cost of bank financing, since some macroprudential tools are intended to be adopted on supranational

[7] In aggregate cross-country studies Borio and Shim (2007) suggest that a macroprudential policy toolkit can support monetary policy objectives, counter financial procyclicality, and reduce credit growth. A paper by Crowe, Dell'Ariccia, Igan and Rabanal (2013) suggests that holding additional bank capital in good times can be used as an additional buffer for bad times, and emphasises the effectiveness of loan-to-value ratios and dynamic provisioning in moderating loan cycles. Kuttner and Shim (2016) by investigating data from 57 economies, argue that macroprudential tools are effective in regulating housing credit growth and housing prices. Using data from CESEE countries Vandenbussche, Vogel and Detragiache (2013) found that several macroprudential instruments were effective in curbing housing prices. Jácome and Mitra (2015) focus on loan-to-value and debt- service-to-income ceilings in six countries and conclude that both measures successfully stabilize credit growth while promoting borrower stability.

[8] Other studies include Akram (2014), Bassett and Marsh (2017), Igan and Kang (2011), and Rubio and Carrasco-Gallego (2016) whose findings support macroprudential measures' effectiveness in stabilising the financial system and curtailing underlying vulnerabilities. Mirzaei, Pasiouras and Samet (2021) find that macroprudential policies are effective in curtailing credit growth. However, these effects are weakened for state owned banks. Macroprudential policy tightening is associated with reduction of credit to private sector and capital flows volatility in CESEE countries (Eller, Hauzenberger, Huber, Schuberth & Vashold, 2021).

level. On the other hand, the use of bank-level data offers taking into account the effects of macroprudential tools adopted at the national level, and enables scarce empirical analysis on micro level. Combining these two approaches gives us the possibility to adequately respond to unaddressed research question in the macroprudential literature and the literature on the cost of capital, which deals with the developments in bank's cost of debt and overall funding costs in association to macroprudential regulatory reforms. Compared to Altunbas, Binici and Gambacorta (2018), we also consider a more recent dataset on macroprudential policies for the period between 2000 and 2017, which includes the period of the heightened increase of macroprudential instrument use, as illustrated in Figure 1.1. Our analysis aims to provide more information about whether the application of macroprudential policies entails higher financing costs for banks, which might ultimately affect the overall conditions in the credit market as well. This argument is frequently proposed by the bankers, in their response to intentions of the regulators to tighten the capital requirements. Still, this depends on the response of banks and the market to such shocks. Banks could choose to pass the higher funding costs on to their borrowers through higher interest rates on loans, or restructure their balance sheets by reducing their assets or raising an additional amount of equity (ESRB, 2014a; Galiay & Maurin, 2015; Harimohan & Nelson, 2014).[9] In regards to capital regulation, further capital demands could be beneficial for banks, as more equity financing could enhance market apprehension of bank risk and thus lead to a decrease of both cost of equity and debt (Belkhir, Ben Naceur, Chami & Samet, 2021), while the effect of higher equity financing in the capital structure on overall funding costs could be smaller than anticipated. To fully address this research question and to empirically evaluate the response of individual banking firms to adoption of macroprudential tools, we test our results on two dependent variables: debt costs and overall costs, which incorporate equity as well. Taking into account the scarcity of such evidence in the empirical literature, this study could shed light on the effects of capital requirements and other macroprudential instruments on banks' cost of financing.

We formulate several hypotheses in our analysis with respect to the: 1) overall macroprudential stance in a country in a certain period 2) the effects of borrower-based measures such as loan-to-value or debt-to-income caps; 3) measures targeting the capital positions of banks; 4) structural macroprudential tools targeting risks associated with bank interconnectedness and concentration exposures; and 5) asset-based macroprudential tools and tax on financial institutions' revenue.

In relation to our first hypothesis, we form an aggregate index of macroprudential policies by summing all the macroprudential instruments in the database across countries and over time. This index measures the overall stance of macroprudential policy in a country in a given year. As stated in Borio (2003), macroprudential regulation takes account of the risk

[9] For a more comprehensive literature review on macroprudential policy studies, see Ebrahimi Kahou and Lehar (2017) and Galati and Moessner (2012).

of interconnected financial institutions' failures, the characteristics of institutions in terms of their size and importance for the entire economy, makes individual institutions safer, and protects the financial stability of the whole macroeconomic system. By decreasing risk for banks and ameliorating their capital positions, the activation of macroprudential tools should improve investors' trust in the financial system's soundness and the financing costs for banks should therefore fall (Galiay & Maurin, 2015; Harimohan & Nelson, 2014). Martinez-Miera and Repullo (2019) show that macroprudential regulation in terms of binding capital requirements not only reduces bank risk, but also causes a transition of investments to stable firms, and reduces the cost of debt. Since macroprudential policy is associated with the beneficial effect of banks shifting their investments to safer firms, and an effective reduction of the risk taken on by banks, the authors conclude that macroprudential policy is an essential tool for addressing financial stability and the underlying risks.

H1. The use of macroprudential policy instruments negatively affects bank funding costs.

Previous research on the introduction of borrower-based measures like loan-to-value and debt-to-income limits has indicated these measures are efficient for lowering a bank's leverage ratio, affecting the structure of its liabilities, and helping to limit any expansion of non-core liabilities, thereby decreasing the bank's risk taking and risk exposures (Claessens, Ghosh & Mihet, 2013). In a recent study Nakatani (2020) finds that LTV limits are shown to reduce the likelihood of a financial crisis. Furthermore, loan-to-value limits improve borrower discipline related with the selection of property based on its value and increase in down payment (Kinghan, McCarthy & O'Toole, 2019). Countries' use of borrower-based measures can assist in shrinking the volume of non-performing loans by selecting less risky borrowers through instruments such as loan-to-value and debt-to-income caps (Morgan, Regis & Salike, 2018). In this way, the quality of bank assets would improve and lending-related losses could decrease, which may ultimately decrease the risk and lead to lower funding costs for banks.

H2. By decreasing the riskiness of bank assets, borrower-based measures are negatively associated with bank funding costs.

The third hypothesis relates to the impact of capital macroprudential measures. Starting with the well-known Modigliani-Miller Theorem[10], we can say that restructuring the liability side of a bank will have no effect on the overall cost of bank funding. In these circumstances, banks can set their capital requirements without increasing their overall funding costs because any increase in the regulatory capital requirements would be followed by a decrease in leverage and hence in the risk premium, leaving the cost of funding unaltered. However,

[10] Modigliani and Miller (1958): The Cost of Capital, Corporation Finance and the Theory of Investment, The American Economic Review

there are multiple frictions in markets, such as the favourable tax treatment of debt, the existence of deposit insurance, and information asymmetry that leads to agency costs (Altunbas, Tommaso & Thornton, 2016; Harimohan & Nelson, 2014). Moreover, trade-off concerns arise about higher capital requirements in relation to the frequent argument by the bankers that high costs of equity lead to lower lending. However, in the context of Modigliani-Miller theory, if equity becomes cheaper for banks due to higher level of equity capital in their capital structure, higher capital demands set by macroprudential regulators should not result in an increase of overall funding costs. Additionally, more equity financing could also lead to lower debt costs, as market apprehension of bank's risk changes. From this argument, we infer that the increase in macroprudential capital requirements should not lead to rise in overall financing cost, but could lead to its decrease, as stressed by Belkhir, Ben Naceur, Chami and Samet (2021). Our argument is corroborated by different theoretical and empirical contributions to the literature, which we discuss below.

The literature recognises the importance of the link between bank financing costs and solvency (Aymanns, Caceres, Daniel & Schumacher, 2016; Babihuga & Spaltro, 2014; Schmitz, Sigmund & Valderrama, 2017; Vazquez & Federico, 2015), where support is given for bank capital regulation by showing that increasing bank solvency leads to lower funding costs for banks. Babihuga and Spaltro (2014) suggest that a 1% rise in bank regulatory capital lowers bank funding costs by 26 basis points in the long run. Using data for 54 large banks from 6 advanced countries Schmitz, Sigmund and Valderrama (2017) found that a rise by 100 basis points in regulatory capital is related with a decline by 105 basis points in bank funding costs. A study by Aymanns, Caceres, Daniel and Schumacher (2016) shows a significant and negative relationship between wholesale funding costs and bank solvency, stressing the importance of the structure of bank funding for sensitivity to credit risk. Admati, DeMarzo, Hellwig and Pfleiderer (2013) strongly advocate bank capital regulation, by stressing that increasing equity capital leads to decrease of bank's risk, which counterweights its effect on overall funding cost.

By investigating the impact of capital adequacy on funding costs, Gambacorta and Shin (2016) describe how higher capitalisation lowers bank funding costs because it makes funding more secure through either debt or equity. Poorly capitalised banks tend to pay higher interest rates on their funding and, conversely, banks with higher funding costs tend to be weakly capitalised as the capitalisation and fragility on the bank's asset side significantly impact the bank's funding costs. Harimohan and Nelson (2014) argue the impact of macroprudential policies on bank funding costs depends on several factors. First, the effect of the above policies depends on bank policies in terms of changes in bank funding costs on lending conditions. A regulatory requirement for further capitalisation could lead to higher bank funding costs, which could in turn see banks reduce the availability of credit by passing on the higher costs on to their borrowers, thereby dampening the demand for loans. Second, if confidence in the banking system's resilience is low, further regulatory requirements to increase capital adequacy could boost confidence in that sector and

positively influence investors' expectations of its resilience.[11] Looking at the confidence channel, higher bank capitalisation affects bank ratings, which investors perceive as a sign of bank soundness and allowing banks to raise funds more cheaply (Gambacorta & Mistrulli, 2004). Following the literature above, when confidence in bank resilience and capitalisation is low, additional regulatory requirements could lead banks to take on less risk, improve investor confidence, and reduce the cost of bank funding. If our third hypothesis is not rejected, this would mean that macroprudential capital-related measures are associated with a decrease of bank funding costs.

H3. By improving bank capital positions and increasing the market's confidence in bank stability, capital-related macroprudential measures negatively affect bank funding costs.

Structural macroprudential measures like interbank limits and concentration limits aim to reduce the likelihood of contagion in the financial system, which might arise from interconnected financial institutions, a vulnerable funding structure, or high exposures to a concentrated group of borrowers.[12] The risks of banks' reliance on wholesale funding and, in particular, interbank lending for overnight liquidity were exposed in the 2008 financial crisis. As the crisis continued, confidence in the banking sector dropped and these types of funding quickly dried up, leading to liquidity shortages at some banks and the collapse of others. These events directed regulatory focus to the importance of future frameworks for bank funding structures (Demirgüç-Kunt & Huizinga, 2010; Van Rixtel & Gasperini, 2013). Macroprudential measures could in this regard help decrease the risks of banks' heavy reliance on interbank lending and, moreover, contain banks' exposures to a limited number of debtors. By strengthening banks' funding structure by reducing banks' reliance on riskier funding sources and lowering banks' concentration risks, which can act as a signal to the market, we expect a negative relationship between these measures and our dependent variables. For example, macroprudential caps could reduce liquidity risk, which might lower the overall cost of funding (ESRB, 2014a). Limiting concentration and interbank exposures of banks could enhance bank portfolio heterogeneity and decrease contagion risk. Moreover,

[11] In the theoretical literature, it is widely held that increased regulatory requirements with regard to further capital requirements lead to a reduction of bank risk (Haubrich & Wachtel, 1993; Hellmann, Murdock & Stiglitz, 2000; Jacques & Nigro, 1997; Repullo, 2004). On the other hand, some theoretical studies suggest that stringent capital requirements are associated with increased asset portfolio risk, which could eventually lead to a higher probability of default. Although stronger capitalisation is preferred by regulators, this requirement may also lead banks to circumvent this regulation through asset modifications with the intention of reducing the amount of capital required to meet the regulatory requirements. This could lead to an increased default risk for banks (Kim & Santomero, 1988; Koehn & Santomero, 1980; Rochet, 1992; Shrieves & Dahl, 1992). These studies proposed considering different risk classes of assets while calculating capital ratios, which was enforced by the Basel regulation. Basel I and II introduced risk-weighted capital ratios, but the focus of these measures was on individual bank risk. Basel III introduced a comprehensive set of enhanced countercyclical capital requirements for banks that focus on the quality of bank capital and on the risks arising from the interconnectedness of bank portfolios and the systemic size of banks. However, in a recent paper Dautovic (2020) warns about the importance of the pace of implementing bank capital requirements in relation to bank risk-taking and moral hazard incentives. For a comprehensive literature review of capital regulation in banking theory see Santos (2000).

[12] In developing this index, we relied on Ely, Tabak and Teixeira (2020).

the diversification of the interbank funding counterparties should prevent the manifestation of systemic risk (Ma, He, Liu & Wang, 2019; Suhail Rizwan, 2021). A sound bank funding structure reduces the likelihood of bank failure, and related supervisory reforms could significantly impact the structure of bank funding, suggesting their implementation should be calibrated cautiously (Demirgüç-Kunt & Huizinga, 2010; IMF, 2013; Vazquez & Federico, 2015).

H4. Structural measures such as interbank limits and concentration limits are negatively associated with bank funding costs.

Our fifth hypothesis relates to the use of asset-based macroprudential instruments together with the levying of taxes on the revenues of financial institutions with macroprudential objectives. We construct an Institution index by summing the instruments that target the asset side of the bank balance sheet, like limits on domestic credit growth, limits on foreign currency lending, and countercyclical reserve requirements, as well as taxes on financial institutions' revenues. These are more traditional instruments that were used more by the emerging market economies than by the advanced economies in our sample of countries. The following example illustrates the use of asset-based measures in emerging economies, as these types of macroprudential tools were mainly used by those countries (see Table 1.1). Direct limitations on domestic currency loans could lead banks to shift their investments towards higher yield marketable securities, which could result in higher exposure to market risk (Wong, 2008), or increase their foreign currency lending, which could in turn lead to higher exposure of borrowers to exchange rate risk and consequently deteriorate loan performance (Vonnák, 2018). However, limiting foreign currency lending may also have a deteriorating effect on the economy (Brzoza-Brzezina, Kolasa & Makarski, 2017). In normal times, foreign currency lending can have a desirable impact on economy in terms of facilitating an additional steady currency and providing influx of capital (Bitar, 2021). Limiting foreign currency lending can in turn affect credit access and produce increase in capital costs. Reserve requirements have traditionally been used to suppress excessive credit growth through their effect on bank liquidity (Alper, Binici, Demiralp, Kara & Özlü, 2018) while emphasising their significance in terms of financial stability (Kashyap and Stein, 2012). Reserve requirements can work as a complementary to monetary policy and decrease the business volatility. However, these effects are significant only when banks are risk averse (Bustamante & Hamann, 2015). Still, in a recent paper by Ely, Tabak and Teixeira (2020) it was found that these macroprudential tools lower bank stability. These findings were supported in a study by Glocker (2021), which suggests the use of reserve requirements may induce banks to act more riskily by increasing their costs. Banks choose riskier assets for investment to compensate for the higher costs caused by the increase in reserve requirements. However, choosing riskier assets may lead to bank failure.[13] If our fifth

[13] Also see Dassatti Camors, Peydró, Tous and Vicente (2019), Jiménez, Ongena, Peydro and Saurina Salas (2017), Nguyen and Boateng (2015) and Nguyen, Boateng and Pham (2019).

hypothesis is confirmed, that would mean that reserve requirements, together with other institution tools, increase banks' risk-taking and raise the cost of capital.

H5. Asset-based measures and tax on financial institutions' revenues are positively associated with bank funding costs.

Our study is close to Claessens, Ghosh and Mihet (2013), with bank balance-sheet data from banks in 48 countries between 2000 and 2010, showing that borrower-related measures negatively affect credit growth, while the findings also suggest that macroprudential tools are effective at slowing the growth in banks' asset and leverage ratios. The authors also note the likely variation in the implementation and effectiveness of macroprudential policies in advanced and emerging economies given the different sources of risk and different macro financial structures. Therefore, we differentiate the impact of macroprudential policy on bank funding costs by dividing our sample into advanced and emerging economies. We also control for various additional bank controls related to bank riskiness, bank size and performance, country characteristics such as financial openness, financial development, and regulatory environment, and different time periods related to the impact of the financial crisis. Further, we check some specifications of our model that broadly support the robustness of our results.

1.4 Data and methodology

Our main data source is individual bank-level data from the Fitch Connect database, which covers the period between 2000 and 2017. The sample consists of commercial banks from 43 European countries. All balance sheet and income statement data are on an unconsolidated basis, annual and in US dollars. We chose to focus on unconsolidated data to capture the behaviour of individual bank subsidiaries. We use winsorisation to exclude potential outliers and extremes from the bank observations. All bank and macroeconomic variables are winsorised to 1% at both tails of the distribution. All banks in the sample are checked for double counting and duplicate banks are removed. Our sample consists of 2,346 banks with 17,038 observations in 43 countries.[14]

In addition to macroeconomic data obtained from IMF's International Financial Statistics and partly from the World Bank and national sources, we use a macroprudential policy dataset based on the IMF's detailed survey of macroprudential measures, as compiled by Cerutti, Claessens and Laeven (2017). The survey consists of annual data on macroprudential events in 119 countries. The dataset contains information about when various macroprudential policy instruments were introduced. The information collected in

[14] Banks in some countries in our sample switched accounting standards from local GAAP to IFRS (International Financial Reporting Standards) in 2005. As a result, for such banks, the balance-sheet data are reported under two accounting standards – local GAAP before 2005 and IFRS after 2005. To account for this change in accounting standards, we include time effects in our model.

this survey was obtained from the national authorities and central banks of the respective countries. The database contains information on the use of 12 macroprudential policy instruments. In order to assess these instruments and their effects more precisely, we summarise them in several indices (see Altunbas, Binici & Gambacorta, 2018; Cerutti, Claessens & Laeven, 2017; Ely, Tabak & Teixeira, 2020; Olszak, Roszkowska & Kowalska, 2018). We further group macroprudential measures that target borrowers, such as loan-to-value and debt-to-income limits, into instruments that target borrowers – *Borrower*. The loan-to-value (LTV) limit is a tool for reducing systemic risk by limiting the amount of the loan relative to the value of the underlying property. This tool limits the amount of leverage in the housing sector, thereby also dampening house prices. It is typically used in conjunction with a debt-to-income (DTI) cap to reduce the procyclicality of loans and improve the asset quality of banks (Lim et al., 2011).

Capital refers to a group of instruments aimed at providing a capital buffer, among which we include the countercyclical capital buffer (CTC), the dynamic provisioning (DP), the leverage ratio limit (LEV) and the buffer for systematically important financial institutions (SIFI). The countercyclical capital buffer (CTC) serves as a measure that requires a bank to maintain more capital and curbs credit expansion during upturns. Dynamic provisioning (DP) is designed to curb procyclicality by requiring banks to set aside more provisions in good times for possible use in bad times. The leverage ratio (LEV) is a cap on bank leverage. Imposed on systematically important financial institutions (SIFI), capital surcharges serve as a requirement for additional capital for those financial institutions whose failure, with respect to their size and importance, could cause a shock throughout the financial system in the event of a crisis.

Next, the database provides information on the group of instruments targeted to either the asset or liability side of financial institutions, from which we form two different indices: *Structural*, which includes interbank limits and concentration limits, and *Institution*, which includes asset-based instruments like domestic currency credit growth limits, foreign currency lending limits, reserve requirements, and taxes on financial institutions' revenue. Interbank limits (INTER) are measures that limit the portion of bank liabilities that is retained by other banks. Concentration ratios (CONC) are designed to limit the proportion of a bank's assets allocated to a single group of borrowers, while countercyclical reserve requirements (RR) can limit credit growth and provide additional liquidity in the event of a liquidity crisis. Domestic credit growth limits (CG) are limits on bank lending or a specific type of it and serve as a measure for limiting systemic risk. Foreign currency limits (FC) are used to dampen foreign currency risk by limiting foreign currency lending. The financial institutions tax (TAX) is a levy on financial institutions' revenue (Cerutti, Claessens & Laeven, 2017; Lim et al., 2011).

All instruments in the survey take a value of 1 as of the year of their implementation and 0 if they were not implemented or if the instrument was revoked during the period considered

from 2000 until 2017. In the study, we test the instruments separately by groups and also establish another macroprudential aggregate index (MPP), which is the sum of all instruments implemented in a country in a given year.

Table 1.1 shows the frequency of use of individual instruments compared to total instrument use in the total sample and the subsamples of countries.

Table 1.1 Frequency of use of macroprudential instruments between 2000 and 2017

Variables	Total countries (%)	Advanced countries (%)	Emerging countries (%)
LTV	11.71	17.54	6.15
DTI	6.57	4.97	8.10
CTC	1.00	1.61	0.42
DP	3.07	2.34	3.77
LEV	1.71	1.32	2.09
SIFI	4.64	7.02	2.37
INTER	9.79	9.21	10.34
CONC	35.64	38.01	33.38
CG	0.71	0.00	1.40
FC	6.50	1.90	10.89
RR	8.93	0.00	17.46
TAX	9.71	16.08	3.63

Source: Authors' calculations based on the macroprudential policies database (Cerutti, Claessens & Laeven, 2017)

Table 1.2 presents the countries included in the study and the country subsamples in terms of financial development which we test in the extensions and robustness section. Following previous studies by Claessens, Ghosh and Mihet (2013), Cerutti, Claessens and Leaven (2017), and Olszak, Roszkowska and Kowalska (2018) we focus on the level of development and financial conditions of countries by also dividing them into groups of advanced and emerging economies (IMF, 2014).

Table 1.2 List of countries used in the study, subsamples by development, and number of observations for each country in the sample

Total Sample	Advanced	Emerging	No. of observations
Albania	0	1	92
Armenia	0	1	108
Austria	1	0	724
Azerbaijan	0	1	76
Belarus	0	1	89
Belgium	1	0	302
Bosnia and Herzegovina	0	1	132
Bulgaria	0	1	254
Croatia	0	1	429
Cyprus	1	0	57
Czech Republic	1	0	176

(table continues)

(continued)

Total Sample	Advanced	Emerging	No. of observations
Denmark	1	0	828
Estonia	1	0	35
Finland	1	0	124
France	1	0	1,352
Georgia	0	1	21
Germany	1	0	2,505
Greece	1	0	95
Hungary	0	1	208
Ireland	1	0	121
Italy	1	0	1,373
Latvia	1	0	125
Lithuania	0	1	57
Luxembourg	1	0	1,052
North Macedonia	0	1	73
Malta	1	0	91
Moldova	0	1	72
Montenegro	0	1	49
Netherlands	1	0	168
Norway	1	0	223
Poland	0	1	357
Portugal	1	0	176
Romania	0	1	239
Russian Federation	0	1	642
Serbia	0	1	273
Slovak Republic	1	0	91
Slovenia	1	0	149
Spain	1	0	233
Sweden	1	0	275
Switzerland	1	0	1,785
Turkey	0	1	288
Ukraine	0	1	496
United Kingdom	1	0	1,023

Source: Author's elaboration based on IMF, World Economic Outlook (2014)

1.4.1 Empirical model

To test the impact of macroprudential policies on bank funding costs, we specify the following dynamic panel data model in which our dependent variable is a function of bank- and country-specific variables:

$$Y_{j,t} = \alpha Y_{j,\,t-1} + \beta MPI_{j,t} + \gamma BANK_{j,t-1} + \delta MACRO_{j,t} + \mu CRISIS_{j,t} + \lambda_j + \theta_t + \varepsilon_{j,t} \quad (1)$$

where index *j* refers to the bank and *t* to the time period, while $Y_{j,t}$ are bank funding costs in bank *j* at time *t*, as represented by two variables: 1) debt funding costs: total interest expense over average interest bearing liabilities; and 2) overall funding costs: sum of weighted

average debt funding costs and equity funding costs, proxied by return on average equity; $Y_{j,t-1}$ is the lagged dependent variable; $MPI_{j,t}$ represents the macroprudential index, which is captured by different measurements; $BANK_{j,t-1}$ is a vector of lagged bank balance-sheet variables (*logarithm of total assets, equity ratio, liquidity ratio, and deposit-to-liabilities ratio)*; $MACRO_{j,t}$ represents a vector of macroeconomic country-specific characteristics (*logarithm of GDP volume in constant prices, domestic credit to private sector as a percentage of GDP, monetary policy rate and inflation rate*); $CRISIS_{j,t}$ denotes a dummy variable for the financial crisis, which takes value of 1 for the period 2008–2012 and 0 otherwise; λ_j and θ_t are bank and time effects capturing the unobserved heterogeneity, and $\varepsilon_{j,t}$ represents the error term.

1.4.2 Definition of the variables

Bank funding cost (Y) is the dependent variable. As a measure of debt bank funding costs, we use the average funding cost, given by the ratio of total interest expense to average interest-bearing liabilities. The literature on bank funding costs goes in two directions: one approaches the cost of funding with a market indicator like CDS spreads (Babihuga & Spaltro, 2014; Balduzzi, Brancati & Schiantarelli, 2017; Benbouzid, Mallick & Sousa, 2017; Hasan, Liu & Zhang, 2016), while the other considers interest expenses from the balance sheet and income statement of financial institutions (Aymanns, Caceres, Daniel & Schumacher, 2016; Ayyagari, Beck & Demirguc-Kunt, 2007; Bertay, Demirgüç-Kunt & Huizinga, 2013; Mensah, Agbloyor, Harvey & Fiador, 2017). Most studies rely on similar bank determinants, while controlling for different macroeconomic and bank variables. We follow the approach of Aymanns, Caceres, Daniel and Schumacher (2016) who emphasise that this measure of funding costs is able to capture the importance of the impact of potential distress on overall bank functioning. In attempting to account for the ultimate source of bank funding – equity, we follow King (2010) and Gambacorta and Shin (2016) and construct a measure of overall bank funding costs measured by the weighted average cost of capital: the sum of the cost of debt financing and the cost of equity financing, based on their shares of total funding. As a proxy for the cost of equity, we use the average return on equity (ROAE).[15]

Bank-specific determinants

To control for bank determinants able to shape market confidence in a bank and that likely affect the cost of bank funding, we include four main variables that control for the size of the bank, its liquid assets, funding structure, and the amount of equity. Bank size (*Size*) is an important factor in the analysis of bank funding costs and measured as the natural logarithm of a bank's total assets. As previous studies show, larger banks enjoy lower rates

[15] Although a limited approximation strategy due to the ROE's high volatility, this measure, as stated in King (2010), can approximate the cost of equity required by shareholders in the long run and serves as a typical approximation tool found in the literature (Gambacorta & Shin, 2016).

in their funding due to their 'too big to fail' characteristics, due to the belief they will be bailed out by governments should they fail (Bertay, Demirguc-Kunt & Huizinga, 2013; Demirgüç-Kunt & Huizinga, 2010). Thus, a negative relationship is expected. The *Equity* variable is calculated as the ratio of equity to the total assets of a bank. Gambacorta and Shin (2016) argue that a 1-percentage point increase in the equity ratio is associated with a 4-basis point drop in cost of debt financing. Similar results are presented in other studies Babihuga and Spaltro (2014) and Aymanns, Caceres, Daniel and Schumacher (2016). The expected relationship is negative. *Liquidity* is measured as the ratio of a bank's liquid assets to its total assets. Liquid assets consist of trading securities and at fair value through income plus loans and advances with a maturity of less than 3 months.[16] The expected sign of this variable is also negative because banks holding more liquid assets are able to fund their debt and have greater balance-sheet resilience, meaning a higher liquidity ratio should be associated with a lower cost of bank funds. We include the ratio of total deposits to total liabilities (*Deposits*) as a measure of the funding structure and an important indicator of a bank's resilience and strength because banks holding a bigger share of deposits can adapt their interest rates to new conditions less costly and more quickly than banks which rely more on wholesale funding. We expect a negative relationship between the deposit ratio and bank cost of funds given that banks with a higher share of deposit funding in their liabilities tend to have lower funding costs (Altunbas, Binici & Gambacorta, 2018).

Macroprudential measures

We measure the effects of macroprudential policy by constructing several of the indices explained above. First, we aggregate all macroprudential measures together in an overall index – *MPP* – that represents the stance of macroprudential policy in a given country for a given period. We also group the measures according to the target of each instrument and establish four different indices: *Borrower, Capital, Structural and Institution*, while the instruments are also tested separately (*LTV, DTI, INTER, CONC, CTC, DP, LEV, SIFI, CG, FC, RR, TAX*). A similar approach was taken in several other studies (Cerutti, Claessens & Laeven, 2017; Ely, Tabak & Teixeira, 2020; Olszak, Roszkowska & Kowalska, 2018). Since these indices measure the presence of a macroprudential instrument in a country, a higher index value means a more restrictive macroprudential policy in a particular period in a given country while a lower index value means a less restrictive macroprudential stance. The relationship we expect is either positive or negative, depending on the objective of the respective index and the characteristics of the respective country's financial system.[17]

[16] Liquidity, measured as the ratio of liquid assets to total assets, is given as such and obtained from the Fitch Connect database.

[17] For more information on the construction of indices and their measurement, see Section A.2 in the Appendix A. For a similar application, see Ely, Tabak & Teixeira (2020).

Macroeconomic determinants

GDP is measured by a logarithm of the volume of gross domestic product at constant prices. GDP indicates the overall financial and economic condition of a country and also serves as a proxy for credit demand. We expect a negative relationship between bank funding costs and GDP, suggesting that an increase in GDP and overall economic activity should improve the conditions for raising bank funds and lower funding costs, while also reducing banks' systemic risk and increasing their profits (Babihuga, Spaltro, 2014; Bertay, Demirgüç-Kunt & Huizinga, 2016). As our measure of economic development, we include a variable *Private credit* measured by the ratio of domestic credit to private sector as a percentage of GDP. We expect a negative relationship between Private credit and bank funding costs since banks in countries on a higher level of economic development enjoy better conditions while raising funds. The *Policy rate* is a measure of the stance of monetary policy because it can directly affect a bank's cost of funds. Data for the central bank policy rate were taken from the IMF's International Financial Statistics where available; otherwise, we consider the discount rate or repurchase agreement rate and, for euro area countries, the ECB deposit facility rate (Cerutti, Claessens & Laeven, 2017*)*.[18] We expect a positive relationship between the policy rate and our dependent variable. The *Inflation* rate is an important indicator with a significant impact on all parts of the economic system in a country. When inflation is high, banks will incur a high cost of borrowing; otherwise, if inflation is kept at a certain level, it could negatively impact bank funding, leading then to a decrease in bank funding cost, and thus we expect a negative or positive relationship. *Crisis* is a dummy variable that equals 1 for 2008–2012, and 0 otherwise. It is important to consider the impact of the financial and debt crisis to control for the structural break after 2008 and the periods of stress that led to lost confidence in the financial sector and increased funding costs for banks.

Tables 1.3–1.4 present a description and summary statistics of the regression variables.[19] The mean value of bank debt funding costs is 2.898%, whereas 2.911% is the mean of the overall bank funding costs for the entire sample. As for the bank-level variables, the mean bank size is USD 16.3 billion and is measured by its natural logarithm with a mean of 20.84 after winsorisation. The mean ratio of equity to assets of the banks in our sample is 13.73%, while the funding structure is dominated by deposits with a mean of 82.4%, even though the standard deviation shows greater variability of the deposit levels across the banks in our data. The same is seen in the level of liquid assets relative to total assets, which is 25.9% on average. Table 1.4 also shows some variability in the overall macroprudential index (MPP)

[18] As our measure of policy rate, we take the Monetary-policy-related interest rate if available, otherwise the Discount rate or Repurchase agreement rate and the ECB deposit facility rate for eurozone countries (Cerutti, Claessens & Laeven, 2017). For Bosnia and Herzegovina, in the absence of other measures, as an approximation for central bank actions, we took the remuneration rate on excess reserves which banks deposit at the central bank through the required reserves instrument. Since 2016, this rate has been negative and follows the ECB deposit facility rate by 50%. For Montenegro, we took the Treasury Bills rate as our measure for the cost of liquidity and the central bank's policy stance.

[19] Additional bank- and country-level variables in Tables 1.3–1.4 are introduced and discussed in the Section 1.6.

with a mean of 1.97, a standard deviation of 1.51 and a range of 0–8, while the highest mean (1.022) among the constructed indices is seen for the Structural index. Regarding the summary statistics for the main macroeconomic determinants, we observe the mean value of GDP volume, measured by the logarithm, is 10.82, while domestic credit to the private sector averages out at 94.75%, with a high standard deviation in our country sample. The monetary policy interest rate averages out at 2.436% while the inflation rate does so at 2.676%.[20]

Table 1.3 Description of the variables

VARIABLES	Definition	Source
Dependent variable		
Y_1	Debt funding cost: Interest expense over average interest-bearing liabilities (%)	Fitch Connect
Y_2	Overall funding cost: weighted average debt funding cost + cost of equity proxied by return on average equity (%)	Own calculations
Independent variables		
Bank-specific variables		
Size	Total assets (USD thousand)	Fitch Connect
Size	Logarithm of total assets (lag)	Own calculations
Equity	Equity over total assets (%, lag)	Fitch Connect
Liquidity	Liquid assets to total assets (%, lag)	Fitch Connect
Deposits	Deposits to total liabilities (%, lag)	Fitch Connect
Z score	Logarithm of Z score (lag)	Own calculations
LLP	Loan-loss provisions over gross loans (%, lag)	Fitch Connect
Efficiency	Operating expense over total assets (%, lag)	Fitch Connect
Macroprudential instrument variables		
MPP	Macroprudential index (0–8)	IMF(GMPI)
BORROWER	Borrower targeted instruments (0–2)	IMF(GMPI)
CAPITAL	Capital targeting instruments (0–3)	IMF(GMPI)
STRUCTURAL	Structural measures (0–2)	IMF(GMPI)
INSTITUTION	Asset based measures and tax (0–3)	
LTV	Loan-to-value limit (0–1)	IMF(GMPI)
DTI	Debt-to-income limit (0–1)	IMF(GMPI)
CTC	Countercyclical capital requirement (0–1)	IMF(GMPI)
DP	Dynamic loan-loss provisioning (0–1)	IMF(GMPI)
LEV	Leverage ratio (0–1)	IMF(GMPI)
SIFI	Capital surcharges on SIFI (0–1)	IMF(GMPI)
INTER	Limits on interbank exposures (0–1)	IMF(GMPI)
CONC	Caps on concentration exposures (0–1)	IMF(GMPI)
CG	Limits on domestic currency loans (0–1)	IMF(GMPI)
FC	Limits on foreign currency loans (0–1)	IMF(GMPI)
RR	Countercyclical reserve requirements (0–1)	IMF(GMPI)
TAX	Tax on financial institutions' revenues (0–1)	IMF(GMPI)
Macroeconomic variables		
GDP	Logarithm of Gross Domestic Product	World Bank, own calculations

(table continues)

[20] For a matrix showing the correlations of the specified variables, see Tables A.3–A.4 in Appendix A.

(continued)

VARIABLES	Definition	Source
Private credit	Domestic credit to private sector over GDP (%)	World Bank
Policy rate	Monetary policy rate (%)	IMF(IFS), ECB, National sources
Inflation	Inflation rate by CPI (%)	World Bank
Financial openness	Financial openness Index	Chinn and Ito (2008)
FIA	Financial Institution Access	IMF (FDID)
FID	Financial Institution Depth	IMF (FDID)
FMA	Financial Market Access	IMF (FDID)
FME	Financial Market Efficiency	IMF (FDID)
Initial stringency	Initial capital stringency index	Barth, Caprio & Levine (2013), World Bank
Supervisory Power	Country's supervisory authority index	Barth, Caprio & Levine (2013), World Bank
Crisis	Financial crisis dummy (0–1)	Own calculations

Note: All bank and macroeconomic variables are winsorised at the 1% level at both tails of the distribution.

Table 1.4 Summary statistics of the main regression variables

VARIABLES	(1) Observations	(2) Mean	(3) Sd	(4) Min	(5) Max
Dependent variable					
Debt funding cost (%)	16,723	2.898	2.726	0.06	18.74
Overall funding cost (%)	17,038	2.911	2.845	-3.678	17.90
Independent variables					
Size (USD million)	17,038	16,300	95,400	0,575	3,130,000
Size (logarithm, lag)	17,038	20.84	2.005	15.11	25.75
Equity (%, lag)	17,038	13.73	13.45	0.44	97.37
Liquidity (%, lag)	17,038	25.90	25.60	0	94.52
Deposits (%, lag)	17,038	82.40	20.74	0.011	99.60
Z score (logarithm, lag)	16,887	2.669	1.182	-0.614	5.591
LLP (%, lag)	15,051	1.345	2.961	-4.07	15.99
Efficiency (%, lag)	13,110	5.435	7.781	0.192	107.63
MPP (index 0–8)	17,038	1.969	1.510	0	8
BORROWER (index 0–2)	17,038	0.275	0.543	0	2
CAPITAL (index 0–3)	17,038	0.244	0.516	0	3
STRUCTURAL (index 0–2)	17,038	1.022	0.781	0	2
INSTITUTION (index 0–3)	17,038	0.429	0.654	0	3
LTV (0–1)	17,038	0.201	0.401	0	1
DTI (0–1)	17,038	0.073	0.261	0	1
CTC (0–1)	17,038	0.017	0.131	0	1
DP (0–1)	17,038	0.040	0.197	0	1
LEV (0–1)	17,038	0.058	0.235	0	1
SIFI (0–1)	17,038	0.127	0.333	0	1
INTER (0–1)	17,038	0.367	0.482	0	1

(table continues)

(continued)

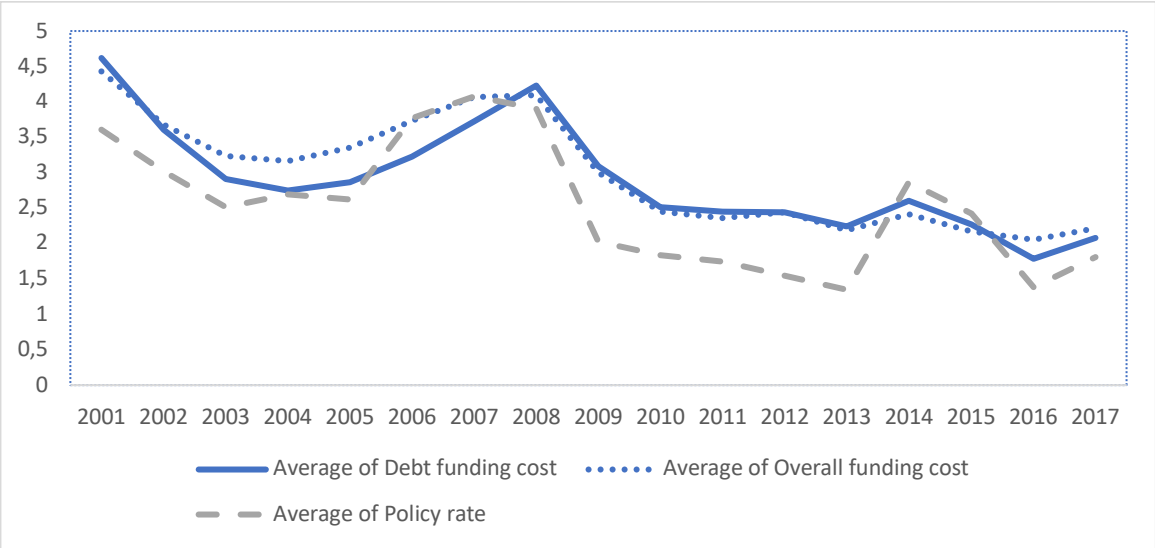
VARIABLES	(1) Observations	(2) Mean	(3) Sd	(4) Min	(5) Max
CONC (0–1)	17,038	0.655	0.475	0	1
CG (0–1)	17,038	0.004	0.060	0	1
FC (0–1)	17,038	0.097	0.296	0	1
RR (0–1)	17,038	0.066	0.249	0	1
TAX (0–1)	17,038	0.263	0.440	0	1
GDP (logarithm)	17,038	10.82	1.176	7.006	14.64
Private credit (%)	17,038	94.75	42.52	11.17	193.74
Policy rate (%)	17,038	2.436	3.682	-0.4	18
Inflation (%)	17,038	2.676	3.562	-0.791	21.46
Financial openness	17,038	0.893	0.309	0	1
FIA	16,916	0.735	0.200	0.088	1
FID	16,916	0.584	0.274	0.029	1
FMA	16,916	0.534	0.303	0	1
FME	16,916	0.609	0.387	0	1
Initial stringency	15,869	1.930	0.715	0	3
Supervisory power	15,153	10.83	2.090	6	14.5
Crisis	17,038	0.305	0.461	0	1

Source: Authors' elaboration based on bank-level data for commercial banks from Fitch Connect and macroeconomic and macroprudential data from the IMF and World Bank.

In the period leading up to the 2008 crisis, many banks were relying heavily on short-term wholesale funding to absorb changes in interest rates. Yet, after the crisis, banks tended to move to more stable sources of funding, ones stable over a longer period of time (Van Rixtel & Gasperini, 2013). In Figure 1.2, we see that the cost of funds moves relative to the policy rate in the pre-crisis period, while the spread widens in the period after the crisis. The global financial crisis of 2008 has led to a rise in the cost of market funding due to the deteriorated money market and consequent increase in the risk premium on financial instruments issued by financial institutions and interbank funding. This is evident in several ways: the crisis has prevented countries from recapitalising their banking systems as they have had to deal with sovereign debt, which has also led to an increase in bond spreads (Zoli, 2013). The cost of deposit funding has been curbed by the zero low bound, while increasing competitive forces have also ever more strongly affected the interest rates for this type of funding (Darracq-Paries, Moccero, Krylova & Marchini, 2014). Taking all of this into account, the post-crisis policy rates do not fully reflect the effective cost of bank funding, i.e. the weighted average cost of liabilities (Beau, Hill, Hussain & Nixon, 2014; Gambacorta, Illes & Lombardi, 2014; Illes, Lombardi & Mizen, 2019).[21]

[21] In Figure 1.2, we observe a spike in policy rate and our measures of bank funding costs in 2014–2015. This is the result of increases in the policy rate to stabilise the currency or as an anti-inflationary measure due to different conditions in the financial sector of five countries included in the sample: Azerbaijan, Belarus, Moldova, Russian Federation and Ukraine.

Figure 1.2 Funding cost measures and policy rate based on average values between 2000 and 2017



Source: Author's elaboration based on developments in bank funding cost measures obtained from Fitch Connect and monetary policy rate from the IMF and country sources.

1.4.3 Endogeneity concerns and model specifications

In a dynamic specification, endogeneity bias can arise with traditional panel data estimators, particularly with small T and large N samples, and in our case $Y_{j,t-1}$ is correlated by construction with the unobserved effects on the individual level (Nickell, 1981). The presence of lagged dependent variable and fixed effects is by definition correlated with the error term, which causes the estimates to be inconsistent (Roodman, 2009). We have several endogeneity concerns. First, conditions in the banking system may affect the implementation of macroprudential tools because countries may implement measures in the light of developments in credit cycles and systemic risk concerns. Countries could implement macroprudential measures following a period of higher credit activity or due to increased risks to financial stability (see Altunbas, Binici & Gambacorta, 2018; Cerutti, Claessens & Laeven, 2017; Claessens, Ghosh & Mihet, 2013; Morgan, Regis & Salike, 2018), which might ultimately lead to reverse causality in the macroprudential measures–bank fundamentals relationship. Countries may take macroprudential actions based on financial stability concerns that may be partly reflected by bank fundamentals, namely, our dependent variable. However, by using micro-level data and, in our case, annual bank balance sheets and income statements, endogeneity concerns are reduced because the adoption of macroprudential measures is likely to depend less on individual bank behaviour than on macroeconomic determinants and the financial system at large. In contrast, macro-level studies face a bigger risk of the endogeneity bias since models typically include aggregate macroeconomic determinants.[22]

[22] The endogeneity bias related to the introduction of macroprudential policies is less pronounced while using bank- level data (Claessens, Ghosh & Mihet, 2013 and Morgan, Regis & Salike, 2018).

Second, the specified model includes explanatory variables that could be endogenous. Bank fundamentals and our dependent variables might be jointly determined. For example, bank funding costs could be determined by equity levels: banks with a lower level of equity are typically perceived to be risky by investors and might try to hold greater equity to increase market confidence (see Arnould, Pancaro & Żochowski, 2021; Bostandzic and Weiß, 2018; Schmitz, Sigmund & Valderrama, 2017). Further, all bank-specific determinants likely depend on their past values (Olszak, Roszkowska & Kowalska, 2018). To eliminate this kind of bias, bank variables are lagged for 1 year ($BANK_{j,t-1}$), (Gambacorta & Shin, 2016). Due to the endogeneity concerns and properties of our data discussed above, we use the dynamic two-step Arellano-Bond generalised method of moments with robust standard errors and a Windmeijer correction as the main estimation method to estimate Eq. 1 (Arellano & Bond, 1991). We follow the relevant literature with similar data characteristics and specifications, as well as concerns about the presence of endogeneity biases that can be reduced by this estimation method (see Altunbas, Binici & Gambacorta, 2018; Cerutti, Claessens & Leaven, 2017; Claessens, Ghosh & Mihet, 2013; Košak, Li, Lončarski & Marinč, 2015). This approach is appropriate, first due to our small T and large N setting and, second, GMM accounts for unobserved individual bank fixed effects that are removed by first-differencing, as well as by using the lagged dependent variable in the regression model that accounts for the underlying autoregressive process. By using GMM, we should be able to reduce any further endogeneity bias associated with the use of bank-level data that might affect the results.[23]

1.5 Empirical results

The validity of the estimation strategy and the consistency of GMM depend on the assumption that the residuals are not serially correlated and that the selected instruments are valid. GMM transforms Eq. 1 in the first-difference, and the system GMM is built on two equations: the original and the transformed (Roodman, 2009). The instruments for transformed variables are their lagged levels – for endogenous variables, while exogenous variables are instrumented by themselves[24]. In our setting, the only strictly exogenous variables are the country determinants, while our bank-specific variables depend on their past realisations and we therefore lag them by one period. As instruments for the bank-specific variables, we use the 1st lag and deeper, and for our dependent variables we use the

[23] We also test the baseline results with ordinary least squares and a fixed effects panel estimator. However, due to the presence of a lagged dependent variable on the right-hand side and the construction of our database, these estimates are probably biased and we do not report them in the text of the dissertation. However, as an additional check for our results, we perform additional robustness tests in terms of the choice of the estimator, and we perform our baseline regressions with one-step GMM estimator with robust standard errors. For one-step estimation, robust option specifies the calculation of the robust estimator of the covariance matrix of the estimates. With this option, the standard error estimates are consistent in the presence of heteroskedasticity and autocorrelation in the panels. From the received results, we can draw the same conclusions in relation to our variable of interest. These regression results are available in Appendix A, Table A.17.

[24] Applied in Blundell and Bond (1998), Brei and Gambacorta (2016) and Altunbas, Binici and Gambacorta (2018).

2nd lag and deeper and apply the collapse function.[25] In all specifications, we performed several estimation tests following Arellano and Bond (1991), Roodman (2009), and Baum (2013), namely autocorrelation tests of the first, AR(1) and second order, AR(2) and the overidentification of restrictions test, Hansen's J test, which all confirmed the consistency of our estimation results. In the case of the first-order autocorrelation test, the error term is usually correlated, but for the second-order test we should not reject the null hypothesis of the absence of an autocorrelation in the second order, while with the Hansen test, we should not reject the null hypothesis that the overidentification restrictions are valid. Our estimation results meet these requirements, although in some cases the p-values for the second-order autocorrelation test are lower, and here we tried to include the second lag of the dependent variable, but it proved not to be significant. In an attempt to further check our results, as we use deeper lags as our instruments, we include the AR (3) test in the data table estimations, which always indicates there is no autocorrelation. In all regressions, we include year dummies to control for unobserved heterogeneity.[26]

1.5.1 Baseline results

The baseline estimations examine the relationship between five indices of macroprudential policy and banks' cost of debt and overall cost of funds. Based on the estimation results in Table 1.5, all bank-specific indicators have the expected sign when significant. However, bank size is not significantly associated with borrowing costs in our specifications. Equity is significant only in the estimations with overall cost with a persistent negative coefficient. These results are consistent with studies on the relationship between solvency and cost of funding that suggest a negative relationship, suggesting that higher solvency lowers the overall cost of funding for banks. Banks that are well capitalised are perceived to be stable and less risky and therefore enjoy better terms while raising funds (Babihuga & Spaltro, 2014; Bertay, Demirgüç-Kunt & Huizinga, 2016; Gambacorta & Shin, 2016). The ratio of liquid assets to total assets, is statistically significant and negatively related to the cost of debt. This relationship is to be expected because banks holding more liquid assets are able to finance their debt. The coefficients of the ratio of deposits to liabilities are negative and statistically significant in all regressions related to debt financing. This variable is an important indicator of a bank's resilience and strength given that banks holding a high proportion of deposits can adjust their interest rates less expensively and more quickly to new conditions than banks that rely more on wholesale funding (Altunbas, Binici & Gambacorta, 2018). It is interesting to note that liquidity and deposits are not significantly

[25] The collapse option in GMM estimation in Stata requests that xtabond2 should create one instrument for each lag distance and variable instead of creating one instrument for each time period, lag distance and variable. Specified in a data setting similar to the one used in this chapter, collapse decreases the biasness of results which arises as an issue of large number of instruments.

[26] As an additional check for our results in terms of lag selection, we perform additional robustness analysis in terms of the number of lags used as internal instruments, and we perform our baseline regressions for the main macroprudential index (MPP) for both debt and overall funding costs. These results are available in Appendix A, Table A.18-A.19.

associated with the overall cost of funding, while the equity ratio is persistently significant in all columns related to the estimations with overall funding costs, indicating the relevance of the equity level within banks in terms of their risk appetite as well as the price of their funds, while supporting the literature on funding costs and bank solvency.[27]

Regarding the interpretation of macroeconomic indicators, we do not find a significant relationship between GDP and bank funding costs. Yet, we find a significant and negative relationship between domestic credit to the private sector relative to GDP and both debt and overall cost. As a proxy for financial development, this variable suggests that higher development should lead to lower bank financing costs. Similarly, the monetary policy rate is highly significant in all specifications and the sign of the relationship is positive, indicating that a rise in the monetary policy rate causes a rise in the interest rates paid for bank funding. When inflation is high, banks face a high cost of funds; otherwise, if inflation is contained to a certain extent, it could have a negative impact on banks' cost of funds, resulting in a curbing of banks' funding rates. In our regressions, the inflation rate is significantly and positively associated with bank funding costs. The financial crisis dummy, when significant, has a positive sign and a high coefficient, reflecting the strong impact of the financial crisis on bank funding conditions.

The aggregate macroprudential policy (MPP) index, our main variable of interest, is statistically significant and of a negative sign in both specifications, suggesting the regulator's use of macroprudential policies is associated with a lower amount a bank must pay to raise its funds. Apart from their statistical significance, the results also hold economic significance. A one standard deviation increase in the aggregate macroprudential index (MPP) is associated with an 8-basis-point reduction in the borrowing cost[28]. The effects for overall costs are statistically significant, and with a somewhat stronger effect of up to a 9-basis-point reduction in overall financing costs. This is in line with our first hypothesis, yet in the next step we consider our estimates for grouped macroprudential indices. Looking at the estimates of other macroprudential indices constructed by summing the measures with

[27] See Schmitz, Sigmund and Valderrama, 2017, Arnould, Pancaro and Żochowski, 2021 and Belkhir, Ben Naceur, Chami and Samet (2021)

[28] The standardization of coefficients is performed by using the following formula (Wooldridge, 2006): $\beta^* = \beta \frac{SD_x}{SD_y}$, where β^* is the standardized coefficient, β is the unstandardized coefficient and SD represents standard deviation of x (independent variable) or y (dependent variable). The calculation of the standardized coefficients for MPP index in relation to the regressions with debt funding costs follows: $\beta^* = \beta \frac{SD_x}{SD_y} = -0.0554 \frac{1.51}{2.726} = -0.03$ meaning that one standard deviation increase of MPP index results in 0.03 (3%) standard deviation (2.726) decrease in debt funding costs. That is, an MPP index increase of 1.51 (one standard deviation) produces an expected decrease of funding costs of about 8 basis points (computed as -0.03*2.726=-0.0836 (Siegel, 2017). The choice to use x- standardization when explaining the economic significance of our estimation results, enables seeing the relative importance of the x – independent variables, and on the other hand keeping the y- dependent variable in its original and meaningful form.

a common objective, the Structural index has the strongest effects in terms of reducing banks' funding costs. The economic effect suggests that a one standard deviation change in the Structural index is associated with a reduction in debt funding costs of up to 9 basis points, while the effect for overall funding costs is even stronger, up to 12 basis points. Structural measures such as interbank limits and concentration limits aim to reduce the likelihood of contagion in the financial system arising from the interconnectedness of financial institutions, vulnerable funding models, and the exposure of financial institutions to a single group of borrowers. These measures have been actively used by both the advanced and emerging market economies in our sample (see Table 1.1). The global financial crisis, with its onset in 2008, exposed the risks of banks' reliance on wholesale funding and, in particular, interbank lending for overnight liquidity. As the crisis unfolded, this ultimately led to the drying up of the wholesale market, resulting in the collapse of some financial institutions, and a shift in regulatory focus to future funding structure frameworks (Demirgüç-Kunt & Huizinga, 2010; Van Rixtel & Gasperini, 2013).

The coefficients on borrower-based measures are statistically significant for both dependent variables. Based on the regression results shown in columns 2 and 7 of Table 1.5, a one standard deviation change in the borrower-based index is associated with up to a 7-basis-point decrease in bank funding costs. Previous research on borrower-based measures, such as loan-to-value and debt-to-income ratios, has established that these measures efficiently limit bank lending growth (Cerutti, Claessens & Leaven, 2017; Morgan, Regis & Salike, 2018; Zhang & Zoli, 2016), lower a bank's leverage ratio, affect the structure of liabilities, and see non-core liabilities expand less, thereby reducing the bank's risk appetite and risk exposure (Claessens, Ghosh & Mihet, 2013; Meuleman & Vander Vennet, 2019; Gaganis, Lozano-Vivas, Papadimitri & Pasiouras, 2020). Our results show that this translates into lower funding costs for banks in those countries which adopted these instruments. The introduction of restrictions in the form of interbank limits related to these exposures could mitigate the risks associated with vulnerable funding models while, on the other hand, measures like LTV and DTI caps which target bank borrowers could improve investor confidence in the quality of bank assets and serve as a signal to the market. In addition, this could reduce the risk of funds being withdrawn from solvent institutions due to noisy signals about banks' fundamentals (Ratnovski & Huang, 2010).

Capital-related macroprudential instruments, represented by the Capital index, are statistically significant for debt funding cost, albeit with a much smaller effect of up to a 4-basis-points reduction in debt funding costs. This is consistent with studies showing that higher equity is associated with lower borrowing costs (Gambacorta and Shin, 2016) and lower bank risk taking (Repullo, 2004 and Altunbas, Tommaso & Thornton, 2016). Our results are in harmony with these studies and show that higher levels of capital are associated with a lower cost of debt financing for banks. Still, the Capital index was not found to be statistically significant in regressions with the overall cost of funds.

Finally, we address the only positive coefficients obtained while analysing the Institution index. The Institution index is formed by summing indicators of asset-based instruments such as reserve requirements, limits on domestic and foreign currency lending, and taxes on revenues. The effect is large since a one standard deviation change in the Institution index leads to an increase of up to 9 basis points in the cost of debt and 10 basis points in overall cost. These results are consistent with the cross-country study by Ely, Tabak and Teixeira (2020), which showed a negative relationship between asset-based measures and bank stability, in particular credit growth limits, foreign currency limits, and reserve requirements, while taxes on revenues also proved to have a somewhat limited negative effect. In a study by Claessens, Ghosh and Mihet (2013) the authors found that reserve requirements are associated with an increase in non-core liabilities, although they reduce debt during the expansionary phase of the cycle. A recent study by Glocker (2021) found that reserve requirements have a negative impact on bank stability through their dampening effect on stability of the loan portfolio.[29] Our results are in line with the above literature and suggest that asset-based instruments and tax on revenue are associated with a rise in bank funding costs. The above results provide support for our hypotheses, yet to ensure a more granular view of the effect of activation of macroprudential policy on bank funding costs in the next step we test each macroprudential instrument separately.

[29] Also see Dassatti Camors, Peydró, R.-Tous and Vicente (2019), Nguyen and Boateng (2015) and Nguyen, Boateng and Pham (2019).

Table 1.5 Impact of macroprudential policy on funding costs

	(1) MPP	(2) Borrower	(3) Capital	(4) Structural	(5) Institution	(6) MPP	(7) Borrower	(8) Capital	(9) Structural	(10) Institution
	Debt funding costs					*Overall funding costs*				
Y_{t-1}	0.631***	0.626***	0.632***	0.634***	0.629***	0.380***	0.379***	0.380***	0.381***	0.380***
	(11.98)	(11.77)	(11.96)	(12.25)	(11.91)	(12.30)	(12.23)	(12.29)	(12.37)	(12.29)
$Size_{t-1}$	-0.0210	-0.0187	-0.0202	-0.0237	-0.0202	-0.0505	-0.0481	-0.0502	-0.0520	-0.0486
	(-0.77)	(-0.68)	(-0.74)	(-0.87)	(-0.74)	(-1.54)	(-1.47)	(-1.54)	(-1.59)	(-1.50)
$Equity_{t-1}$	-0.000797	-0.000338	-0.000424	-0.00172	-0.00112	-0.0382***	-0.0378***	-0.0379***	-0.0389***	-0.0383***
	(-0.08)	(-0.04)	(-0.04)	(-0.18)	(-0.12)	(-4.29)	(-4.23)	(-4.25)	(-4.39)	(-4.31)
$Liquidity_{t-1}$	-0.00347***	-0.00370***	-0.00337***	-0.00328***	-0.00336***	0.0000968	-0.000144	0.000134	0.000335	0.000241
	(-4.85)	(-5.11)	(-4.74)	(-4.68)	(-4.72)	(0.09)	(-0.14)	(0.13)	(0.32)	(0.23)
$Deposits_{t-1}$	-0.0156***	-0.0153***	-0.0152***	-0.0160***	-0.0153***	-0.00692	-0.00672	-0.00647	-0.00712	-0.00646
	(-3.31)	(-3.26)	(-3.26)	(-3.44)	(-3.29)	(-1.31)	(-1.28)	(-1.23)	(-1.36)	(-1.23)
MPI	**-0.0554*** **	**-0.120*** **	**-0.0805** **	**-0.112*** **	**0.139*** **	**-0.0564** **	**-0.128*** **	**0.00866**	**-0.148*** **	**0.155*** **
	(-2.98)	**(-4.21)**	**(-2.05)**	**(-3.69)**	**(3.77)**	**(-2.25)**	**(-2.70)**	**(0.16)**	**(-3.74)**	**(3.19)**
GDP	-0.0209	-0.0107	-0.0200	-0.0261	-0.0140	0.00940	0.0206	0.00970	0.00356	0.0179
	(-1.25)	(-0.62)	(-1.18)	(-1.51)	(-0.86)	(0.40)	(0.87)	(0.41)	(0.15)	(0.75)
Private credit	-0.00155***	-0.00126***	-0.00109***	-0.00177***	-0.000862**	-0.00356***	-0.00326***	-0.00330***	-0.00396***	-0.00281***
	(-3.44)	(-2.97)	(-2.69)	(-3.78)	(-2.10)	(-5.13)	(-4.83)	(-4.87)	(-5.46)	(-4.12)
Policy rate	0.0962***	0.0973***	0.0962***	0.0948***	0.0958***	0.120***	0.121***	0.120***	0.119***	0.120***
	(4.81)	(4.83)	(4.79)	(4.82)	(4.82)	(8.12)	(8.13)	(8.10)	(8.03)	(8.10)
Inflation rate	0.0555***	0.0561***	0.0551***	0.0507***	0.0502***	0.0725***	0.0727***	0.0717***	0.0669***	0.0667***
	(6.05)	(6.10)	(6.06)	(5.64)	(5.56)	(5.50)	(5.50)	(5.45)	(5.09)	(5.04)
Crisis	2.388**	2.133**	2.714***	3.615***	3.141***	3.553***	3.281***	3.393***	4.328***	3.763***
	(2.25)	(2.05)	(2.72)	(3.45)	(3.13)	(3.23)	(3.03)	(3.13)	(3.88)	(3.48)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16723	16723	16723	16723	16723	17038	17038	17038	17038	17038
Instruments	44	44	44	44	44	40	40	40	40	40
AR (1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR (2)	0.067	0.064	0.063	0.072	0.066	0.235	0.240	0.236	0.224	0.227
AR (3)	0.188	0.189	0.190	0.178	0.180	0.341	0.334	0.341	0.336	0.334
Hansen	0.090	0.070	0.084	0.131	0.104	0.151	0.126	0.140	0.197	0.151

Note: The table shows the results of the baseline estimations with the dependent variable of debt funding costs (columns 1-5) and overall funding costs (columns 6-10). The right-hand side includes macroprudential policy indices, bank-specific variables and macroeconomic controls. Y_{t-1} is the lagged dependent variable, bank variables lagged by one period are: $Size_{t-1}$ – measured by the logarithm of total assets, $Equity_{t-1}$ – ratio of equity to total assets, $Liquidity_{t-1}$ – ratio of liquid assets to total assets, and $Deposits_{t-1}$ – ratio of total deposits to total liabilities. Macroprudential indices are: MPP – sum of all instruments in the database implemented in countries over time (columns 1 and 6); Borrower – sum of all measures targeting borrowers (columns 2 and 7); Capital – sum of instruments targeting banks' capital position (columns 3 and 8); Structural – index representing the sum of interbank limits and concentration ratio limits (columns 4 and 9) and Institution – index which is the sum of asset-based tools and tax on revenue (columns 5 and 10). Macroeconomic variables include: GDP – logarithm of GDP volume, Policy rate – monetary policy rate, Inflation – annual inflation rate, Private credit – ratio of domestic credit to the private sector to GDP, Crisis – a dummy variable equal to 1 for 2008–2012, and 0 otherwise. The estimation method is a dynamic two-step system GMM estimator with robust standard errors and a Windmeijer correction. All regressions include time dummy variables to account for unobserved heterogeneity within our sample. T-statistics are reported in parentheses. The following are p-values indicating the significance level of the coefficients: * p <0.10, ** p <0.05, *** p <0.01.

1.5.2 Estimations with individual instruments

To examine the relationship between each macroprudential instrument and its directions in terms of bank funding costs, we test the macroprudential measures separately. The results in Tables 1.6–1.7 show that LTV is negatively associated with our dependent variable, which was expected following the results for the Borrower index. The coefficient on the loan-to-value ratio is statistically significant and has a negative sign for both debt financing and overall financing costs. The economic effects suggest that a one standard deviation change in the LTV index is associated with a 7-basis-point reduction in the cost of debt financing, while the effect is even stronger for the overall cost of financing, with up to a 9-basis-points reduction in overall costs. Another borrower-based measure, the debt-to-income ratio cap, has a significant and negative relationship with borrowing costs. The DTI cap is not significantly associated with overall funding costs in our specification. Both measures also significantly reduce loan growth (Cerutti, Claessens & Laeven, 2017) and beneficially affect bank stability (Claessens, Ghosh & Mihet, 2013). These results further corroborate the effectiveness of borrower-based measures in shaping market perceptions of bank stability, as evident in their impact on the cost of bank financing. We find a somewhat limited negative effect for the CTC instrument with only 10% statistical significance for debt funding costs, while its coefficient is negative. CTC is not significantly associated with overall funding costs. Dynamic provisioning (DP) is not significantly associated with debt funding costs, while it is significantly and positively associated with overall funding costs. Dynamic provisioning is a countercyclical macroprudential tool which helps to build up additional capital in good times, which then helps to smooth bank lending in bad times. Such an increase in capital requirements can also lead to a higher cost of bank capital, which is then offset by higher lending rates and a decrease in the credit supply. This effect is beneficial in the periods of excessive credit growth (Jiménez, Ongena, Peydro & Saurina Salas, 2017). Leverage ratio limit (LEV) is strongly and negatively associated with the cost of debt, while it is only on the 10% level in the overall cost regression. Capital surcharges for systematically important financial institutions (SIFI) are not significantly associated with bank funding costs in our specifications. The results for the individual instruments show that the leverage ratio cap has the strongest effects in reducing banks' cost of debt within the Capital index.

As expected, the coefficients of INTER and CONC are significant in all columns. The signs of these measures are similarly associated with our dependent variables, with negative coefficients in all specifications. Their effects are also strongest since the economic effects suggest that a one standard deviation change in INTER (CONC) reduces the cost of bank financing by 8(5) basis points for debt financing costs and 11(7) basis points for overall costs. Credit growth limits (CG) are statistically significant only for overall costs with a positive sign and an economic effect of up to a 7-basis-point increase in overall costs for banks. The FC limits are significantly and positively associated with debt funding costs, but only at the 10% level of statistical significance. The taxes on financial institutions' revenues

(TAX) are significantly and positively associated to debt funding costs, while countercyclical reserve requirements (RR) are significantly and positively associated with our dependent variables. Our results for CG, FC, RR and TAX are consistent with Ely, Tabak and Teixeira (2020) and Glocker (2021) who found that some of these measures exert a negative effect on bank stability.

Table 1.6 Estimations with individual macroprudential instruments – debt funding costs

	(1) LTV	(2) DTI	(3) CTC	(4) DP	(5) LEV	(6) SIFI	(7) INTER	(8) CONC	(9) CG	(10) FC	(11) RR	(12) TAX
Y_{t-1}	0.627***	0.629***	0.631***	0.631***	0.630***	0.631***	0.633***	0.633***	0.631***	0.633***	0.628***	0.631***
	(11.81)	(11.85)	(11.90)	(11.91)	(11.94)	(11.92)	(12.25)	(12.04)	(11.92)	(12.02)	(11.78)	(11.96)
$Size_{t-1}$	-0.0195	-0.0196	-0.0202	-0.0204	-0.0223	-0.0207	-0.0256	-0.0206	-0.0202	-0.0192	-0.0195	-0.0225
	(-0.71)	(-0.71)	(-0.74)	(-0.74)	(-0.82)	(-0.76)	(-0.93)	(-0.76)	(-0.74)	(-0.71)	(-0.72)	(-0.82)
$Equity_{t-1}$	-0.000151	-0.000512	-0.000199	-0.000456	-0.000699	-0.000331	-0.00155	-0.000914	-0.000245	-0.0000688	-0.000495	-0.00118
	(-0.02)	(-0.05)	(-0.02)	(-0.05)	(-0.07)	(-0.03)	(-0.16)	(-0.10)	(-0.03)	(-0.01)	(-0.05)	(-0.12)
$Liquidity_{t-1}$	-0.00381***	-0.00343***	-0.00347***	-0.00342***	-0.00330***	-0.00344***	-0.00335***	-0.00333***	-0.00344***	-0.00340***	-0.00352***	-0.00334***
	(-5.27)	(-4.76)	(-4.82)	(-4.77)	(-4.68)	(-4.76)	(-4.76)	(-4.68)	(-4.77)	(-4.76)	(-4.86)	(-4.69)
$Deposits_{t-1}$	-0.0153***	-0.0152***	-0.0152***	-0.0152***	-0.0154***	-0.0152***	-0.0160***	-0.0156***	-0.0153***	-0.0153***	-0.0150***	-0.0153***
	(-3.27)	(-3.26)	(-3.23)	(-3.26)	(-3.30)	(-3.28)	(-3.43)	(-3.35)	(-3.28)	(-3.29)	(-3.23)	(-3.29)
MPI	**-0.168*** **	**-0.132** **	**-0.176***	**-0.0566**	**-0.154** **	**-0.0160**	**-0.176*** **	**-0.113*** **	**0.296**	**0.129***	**0.220** **	**0.114*** **
	(-4.68)	**(-2.20)**	**(-1.89)**	**(-0.75)**	**(-2.56)**	**(-0.27)**	**(-3.69)**	**(-2.70)**	**(1.47)**	**(1.75)**	**(2.37)**	**(2.67)**
GDP	-0.00941	-0.0186	-0.0159	-0.0220	-0.0234	-0.0204	-0.0324*	-0.0185	-0.0189	-0.0181	-0.0212	-0.0175
	(-0.55)	(-1.09)	(-0.92)	(-1.31)	(-1.37)	(-1.22)	(-1.79)	(-1.10)	(-1.12)	(-1.11)	(-1.24)	(-1.05)
Private credit	-0.00109**	-0.00140***	-0.00125***	-0.00128***	-0.00108***	-0.00126***	-0.00165***	-0.00154***	-0.00126***	-0.00124***	-0.00109***	-0.00107***
	(-2.58)	(-3.24)	(-3.00)	(-3.05)	(-2.67)	(-3.02)	(-3.65)	(-3.44)	(-3.02)	(-2.98)	(-2.59)	(-2.60)
Policy rate	0.0952***	0.0982***	0.0959***	0.0962***	0.0991***	0.0961***	0.0965***	0.0945***	0.0950***	0.0938***	0.0917***	0.100***
	(4.73)	(4.88)	(4.78)	(4.79)	(4.85)	(4.86)	(4.88)	(4.75)	(4.76)	(4.85)	(4.70)	(4.95)
Inflation	0.0564***	0.0549***	0.0552***	0.0552***	0.0533***	0.0548***	0.0458***	0.0564***	0.0554***	0.0516***	0.0551***	0.0532***
	(6.14)	(5.99)	(6.05)	(6.08)	(5.85)	(5.99)	(5.09)	(6.15)	(6.06)	(5.72)	(6.08)	(5.83)
Crisis	2.120**	2.219**	3.173***	2.250**	2.314**	2.738***	3.684***	3.336***	2.210**	2.177**	2.198**	2.232**
	(2.04)	(2.12)	(3.13)	(2.15)	(2.20)	(2.75)	(3.47)	(3.27)	(2.11)	(2.10)	(2.12)	(2.14)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16723	16723	16723	16723	16723	16723	16723	16723	16723	16723	16723	16723
Instruments	44	44	44	44	44	44	44	44	44	44	44	44
AR (1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR (2)	0.063	0.065	0.062	0.064	0.065	0.064	0.076	0.065	0.062	0.064	0.064	0.066
AR (3)	0.191	0.187	0.189	0.189	0.186	0.187	0.170	0.189	0.188	0.185	0.180	0.188
Hansen	0.068	0.079	0.079	0.086	0.091	0.087	0.131	0.102	0.0861	0.087	0.102	0.094

Note: The table shows the results of the baseline estimations with the dependent variable of debt funding costs, while the right-hand side includes macroprudential policy instruments, bank-specific variables and macroeconomic controls. Y_{t-1} is the lagged dependent variable, bank variables lagged by one period are: $Size_{t-1}$ – measured by the logarithm of total assets, $Equity_{t-1}$ – ratio of equity to total assets, $Liquidity_{t-1}$ – ratio of liquid assets to total assets, and $Deposits_{t-1}$ – ratio of total deposits to total liabilities. Macroprudential indices are: LTV – loan-to-value limit, DTI – debt-to-income cap, CTC – countercyclical capital buffer, DP – dynamic provisioning, LEV – leverage ratio limit, SIFI – capital caps for systematically important financial institutions, INTER -interbank limits, CONC - concentration limits, CG – caps on domestic loans, FC – foreign currency loans limits, RR – countercyclical reserve requirements and TAX – taxes on financial institutions' revenue; the indices' scopes are 0–1. Macroeconomic variables include: GDP – logarithm of GDP volume, Policy rate – monetary policy rate, Inflation – annual inflation rate, Private credit – ratio of domestic credit to the private sector to GDP, Crisis – a dummy variable equal to 1 for 2008–2012, and 0 otherwise. The estimation method is a dynamic two-step system GMM estimator with robust standard errors and a Windmeijer correction. All regressions include time dummy variables to account for unobserved heterogeneity within our sample. T-statistics are reported in parentheses. The following are p-values indicating the significance level of the coefficients: * p <0.10, ** p <0.05, *** p <0.01.

Table 1.7 Estimations with individual macroprudential instruments – overall funding costs

	(1) LTV	(2) DTI	(3) CTC	(4) DP	(5) LEV	(6) SIFI	(7) INTER	(8) CONC	(9) CG	(10) FC	(11) RR	(12) TAX
Y_{t-1}	0.379***	0.380***	0.380***	0.380***	0.380***	0.381***	0.381***	0.381***	0.380***	0.380***	0.381***	0.380***
	(12.23)	(12.28)	(12.28)	(12.27)	(12.29)	(12.30)	(12.33)	(12.34)	(12.27)	(12.29)	(12.33)	(12.29)
$Size_{t-1}$	-0.0490	-0.0499	-0.0499	-0.0532	-0.0521	-0.0496	-0.0542*	-0.0493	-0.0486	-0.0485	-0.0466	-0.0513
	(-1.50)	(-1.52)	(-1.53)	(-1.63)	(-1.59)	(-1.52)	(-1.66)	(-1.51)	(-1.49)	(-1.49)	(-1.43)	(-1.56)
$Equity_{t-1}$	-0.0378***	-0.0380***	-0.0378***	-0.0377***	-0.0382***	-0.0378***	-0.0386***	-0.0385***	-0.0378***	-0.0377***	-0.0373***	-0.0382***
	(-4.23)	(-4.26)	(-4.24)	(-4.24)	(-4.29)	(-4.24)	(-4.36)	(-4.33)	(-4.24)	(-4.23)	(-4.22)	(-4.28)
$Liquidity_{t-1}$	-0.000362	0.000148	0.000114	0.000140	0.000290	0.000142	0.000230	0.000284	0.000107	0.000164	0.0000161	0.000178
	(-0.34)	(0.14)	(0.11)	(0.13)	(0.27)	(0.13)	(0.22)	(0.27)	(0.10)	(0.16)	(0.02)	(0.17)
$Deposits_{t-1}$	-0.00672	-0.00646	-0.00647	-0.00629	-0.00662	-0.00643	-0.00719	-0.00667	-0.00652	-0.00653	-0.00626	-0.00659
	(-1.28)	(-1.23)	(-1.23)	(-1.20)	(-1.27)	(-1.23)	(-1.37)	(-1.27)	(-1.25)	(-1.25)	(-1.19)	(-1.26)
MPI	**-0.221*****	**-0.0453**	**-0.116**	**0.404*****	**-0.151***	**-0.127**	**-0.228*****	**-0.155****	**1.116*****	**0.135**	**0.407*****	**0.0478**
	(-3.55)	**(-0.46)**	**(-0.82)**	**(3.52)**	**(-1.90)**	**(-1.41)**	**(-3.76)**	**(-2.43)**	**(3.55)**	**(1.32)**	**(3.29)**	**(0.73)**
GDP	0.0249	0.0106	0.0127	0.0197	0.00684	0.0120	-0.00474	0.0131	0.0159	0.0120	0.0104	0.0110
	(1.04)	(0.45)	(0.52)	(0.83)	(0.29)	(0.51)	(-0.20)	(0.55)	(0.67)	(0.51)	(0.44)	(0.46)
Private credit	-0.00302***	-0.00333***	-0.00326***	-0.00329***	-0.00307***	-0.00317***	-0.00378***	-0.00365***	-0.00322***	-0.00324***	-0.00292***	-0.00320***
	(-4.44)	(-4.91)	(-4.85)	(-4.87)	(-4.56)	(-4.67)	(-5.42)	(-5.06)	(-4.78)	(-4.80)	(-4.30)	(-4.74)
Policy rate	0.118***	0.121***	0.120***	0.121***	0.123***	0.119***	0.121***	0.119***	0.117***	0.119***	0.110***	0.122***
	(7.95)	(8.17)	(8.08)	(8.06)	(8.19)	(8.04)	(8.18)	(7.94)	(7.85)	(8.02)	(7.66)	(8.17)
Inflation	0.0736***	0.0717***	0.0720***	0.0683***	0.0700***	0.0723***	0.0607***	0.0742***	0.0743***	0.0685***	0.0722***	0.0712***
	(5.56)	(5.45)	(5.45)	(5.15)	(5.25)	(5.51)	(4.54)	(5.60)	(5.65)	(5.14)	(5.54)	(5.39)
Crisis	3.240***	3.909***	3.881***	3.846***	3.472***	3.866***	3.840***	4.014***	3.282***	3.875***	3.241***	3.929***
	(2.99)	(3.59)	(3.59)	(3.54)	(3.18)	(3.56)	(3.45)	(3.66)	(3.02)	(3.56)	(2.99)	(3.62)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17038	17038	17038	17038	17038	17038	17038	17038	17038	17038	17038	17038
Instruments	40	40	40	40	40	40	40	40	40	40	40	40
AR (1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR (2)	0.241	0.237	0.241	0.239	0.233	0.233	0.218	0.236	0.237	0.232	0.233	0.234
AR (3)	0.334	0.340	0.343	0.337	0.343	0.344	0.333	0.342	0.341	0.343	0.333	0.340
Hansen	0.127	0.137	0.136	0.138	0.156	0.131	0.204	0.156	0.135	0.136	0.139	0.145

Note: The table shows the results of the baseline estimations with the dependent variable of overall funding costs, while the right-hand side includes macroprudential policy instruments, bank-specific variables and macroeconomic controls. Y_{t-1} is the lagged dependent variable, bank variables lagged by one period are: $Size_{t-1}$ – measured by the logarithm of total assets, $Equity_{t-1}$ – ratio of equity to total assets, $Liquidity_{t-1}$ – ratio of liquid assets to total assets, and $Deposits_{t-1}$ – ratio of total deposits to total liabilities. Macroprudential indices are: LTV – loan-to-value limit, DTI – debt-to-income cap, CTC – countercyclical capital buffer, DP – dynamic provisioning, LEV – leverage ratio limit, SIFI – capital caps for systematically important financial institutions, INTER – interbank limits, CONC – concentration limits, CG – caps on domestic loans, FC – foreign currency loans limits, RR – countercyclical reserve requirements and TAX – taxes on financial institutions' revenue; the indices' scopes are 0–1. Macroeconomic variables include: GDP – logarithm of GDP volume, Policy rate – monetary policy rate, Inflation – annual inflation rate, Private credit – ratio of domestic credit to the private sector to GDP, Crisis – a dummy variable equal to 1 for 2008–2012, and 0 otherwise. The estimation method is a dynamic two-step system GMM estimator with robust standard errors and Windmeijer correction. All regressions include time dummy variables to account for unobserved heterogeneity within our sample. T-statistics are reported in parentheses. The following are p-values indicating the significance level of the coefficients: * p <0.10, ** p <0.05, *** p <0.01.

1.6 Extensions and robustness analysis

To check the robustness of our results, we perform several additional tests. First, we subdivide our sample by economic development and check the coefficients and significance of macroprudential policy in the subsample of advanced and emerging economies. Second, we examine the robustness of our results by introducing different variables at the bank and country level. Third, we control for the financial crisis' impact in interaction with country variables and additionally divide our sample into different time periods by running regressions on data restricted to the pre- and post-crisis period.

1.6.1 Subsamples

To test whether our results are affected by the level of development of countries, we split our sample into advanced and emerging economies. We thereby control for different institutional settings and country characteristics and also account for differences in the application of macroprudential policy (Altunbas, Binici & Gambacorta, 2018). Macroprudential policies have been actively applied in advanced and emerging countries (see Table 1.1). However, emerging market countries already made more active use of macroprudential policy in the pre-crisis period, making more frequent use of instruments such as reserve requirements and direct limits on domestic credit growth. On the other side, advanced countries have not actively used these more traditional tools; instead, they have been more active in applying borrower-based measures such as loan-to-value limits (LTV). Structural tools such as interbank and concentration limits were used in both subsamples. In a recent study by Suhail Rizwan (2021) it is suggested that macroprudential policy instruments have heterogeneous effect on systemic risk, which is dependent on institutional framework and financial development of the respective country. The author warns on inappropriateness of "one size fits all approach" in terms of macroprudential oversight in choosing and applying macroprudential measures. Macroprudential policy has negative association to systemic risk in high income and upper middle-income countries but in low and lower middle-income economies, a positive association was found indicating that some macroprudential tools have undesirable effects on systemic stability. Similar findings on the lack of coordination of prudential regulation which benefits advanced economies were reported in a recent theoretical paper by Chen and Phelan (2021). Moreover, emerging economies have less perfect financial markets and are more exposed to external instability. In some cases, they are characterised by fewer open capital accounts with lower levels of liberalisation. The cyclical shifts from downturns to upturns are also more pronounced in emerging markets (Claessens, Ghosh & Mihet, 2013), which may indicate higher financial volatility and ultimately affect the effectiveness of macroprudential policy. Given these differences, we expect different results in the advanced and emerging market samples.

Bank variables are similarly related to bank funding costs as in our subsample results, yet the negative effect of size on the cost of debt is more relevant for emerging markets. Banks

with higher equity face lower overall costs. The liquidity ratio and the ratio of deposits to liabilities, when significant, largely exhibit a negative relationship with the cost of funding. Banks that hold more liquid assets and a bigger proportion of deposits in their funding structure have lower funding costs. The GDP variable has a stronger relationship with our dependent variable in the case of advanced economies, while the policy rate has a positive coefficient with respect to the cost of funding, as expected. Similar results are seen for the inflation rate, while the crisis variable enters strongly and with a positive coefficient, suggesting that banks faced higher funding costs during the crisis. Domestic credit to the private sector shows a positive relationship with financing costs in some of the specifications in the emerging market subsample. Emerging markets experienced increased private sector lending in the post-crisis period, driven by the influx of investments, influenced by macroeconomic conditions in advanced countries and the pursuit of higher returns. Yet, this has seen some of the emerging economies develop a significant credit overhang (ECB, 2016). This may point to potential financial stability concerns that affect risk premia for the cost of bank funds and may somewhat explain the positive coefficients on the Private credit variable in the emerging market subsample.

Turning to the interpretation of our variables of interest, the results of these estimations show that in the subsample of advanced economies the results reflect our baseline estimates and most macroprudential indices are associated with a reduced cost of funding for banks. Based on the estimation results in Tables 1.8–1.9, the MPP index is statistically significant and negatively related to the cost of funding for both overall and cost of debt in the advanced economies. The Borrower, Capital and Structural indices are also significantly and negatively associated with bank funding costs, while the Institution index is positively associated with funding costs, but only at the 10% level. The weak results for the Institution index are to be expected for advanced economies since most countries have not introduced asset-based macroprudential instruments (i.e. reserve requirements or limits on domestic lending), while they have more actively used the fiscal instrument.

The coefficient of the MPP index in the emerging countries subsample is statistically significant yet positively associated with the cost of debt financing, as is the Institution index at the 1% level of significance. This result could be due to the institutional characteristics of emerging economies along with greater heterogeneity within the emerging market sub-sample. The MPP index is not significant for overall costs, however we find a positive link with Capital index on 5% level of statistical significance. Borrower-based measures are significantly associated only with the overall cost of funding and their impact on our dependent variables is persistently negative. This implies that borrower-based measures have a strong and negative effect that does not fully depend on country heterogeneity given that the results are strong in both subsamples. The Structural index is not significantly associated with bank funding costs, while the results for the Institution index are confirmed for emerging markets. We can explain these uncertain results for emerging markets by pointing to the significant differences among these country subsamples, especially in terms

of financial development and the ability to raise funds from various sources, which are more limited in emerging markets. In addition Galán (2020) suggests there are clear differences in the effects of macroprudential policy in advanced and emerging countries, stressing that this may be associated with differences in the selection of macroprudential instruments and potentially lead to a bigger lag in macroprudential effects.

To explain the above results in more detail, we decide to test the individual macroprudential instruments in the subsamples (Table 1.10). The results show that the loan-to-value measure is strongly associated with our dependent variables. The coefficients on the loan-to-value ratio are significant and with a negative sign in the advanced country subsample, while the relationship is also negative in the emerging market countries, but only significant for the overall cost of funds. The other borrower-based measure, DTI, is not significantly associated with our dependent variables in any specification. The borrower-based measures also turn out to be significant for reductions in loan growth, leverage, and bank risk-taking (Cerutti, Claessens & Laeven, 2017; Claessens, Ghosh & Mihet, 2013) and thus we expected the results obtained while we also observe the stronger effects of the loan-to-value ratio. The LTV ratio was widely used by countries in our sample, especially among the advanced countries (see Table 1.1). Dynamic provisioning is not significantly related to financing costs in advanced economies. However, we observe a positive and significant coefficient for emerging economies with respect to overall cost. The countercyclical capital buffer is significantly and negatively related to funding costs in emerging economies, while capital surcharges for systematically important financial institutions are negatively associated with overall funding costs in advanced economies, although their effects appear to vary across country characteristics, with a positive sign for the coefficient in the emerging economies subsample.

We find similar results for LEV, which is strongly and negatively associated with financing costs in advanced economies, while the sign changes for emerging economies. This is also evident for concentration limits. On the other hand, interbank limits have negative and statistically significant coefficients in all specifications. Foreign currency credit ceilings are only significantly and positively related to debt funding costs in emerging markets, but only on 10% level of statistical significance, while domestic credit growth ceilings are statistically significant and positive in sign in emerging economies. In advanced economies, traditional measures like credit growth ceilings were not used in our sample or during the period under consideration. Countercyclical reserve requirements, also used exclusively by the emerging market economies in our sample, have a significant and positive coefficient in this group of countries. TAX is significantly and positively associated with the cost of funding in advanced economies. The results allow us to conclude that the impact of macroprudential instruments on the cost of bank funding depends on the choice of instruments, their objective, and the level of development and institutional characteristics of countries. This leads us to conclude that differences in countries' level of development, exposure to external shocks, and market perceptions of banking stability in emerging market

and advanced economies should be considered while selecting and designing macroprudential instruments, and underscore the need to adapt macroprudential instruments in the light of countries' financial market development and the characteristics of their specific conditions (Belkhir, Ben Naceur, Chami & Samet, 2021; Claessens, Ghosh & Mihet, 2013; Galán, 2020; Poutineau & Vermandel, 2017).

Table 1.8 Subsample analysis for advanced and emerging countries – debt funding costs

	MPP		*Borrower*		*Capital*		*Structural*		*Institution*	
	(1) Advanced	(2) Emerging	(3) Advanced	(4) Emerging	(5) Advanced	(6) Emerging	(7) Advanced	(8) Emerging	(9) Advanced	(10) Emerging
Y_{t-1}	0.663***	0.474***	0.659***	0.474***	0.662***	0.467***	0.657***	0.476***	0.656***	0.442***
	(10.77)	(4.44)	(10.33)	(4.36)	(10.51)	(4.38)	(10.62)	(4.47)	(10.27)	(4.00)
$Size_{t-1}$	-0.0519*	-0.143***	-0.0444	-0.118**	-0.0466	-0.139**	-0.0528*	-0.123**	-0.0454	-0.122**
	(-1.72)	(-2.62)	(-1.48)	(-2.16)	(-1.54)	(-2.50)	(-1.76)	(-2.34)	(-1.52)	(-2.42)
$Equity_{t-1}$	-0.00865	-0.0207	-0.00610	-0.0200	-0.00694	-0.0198	-0.00943	-0.0191	-0.00699	-0.0223
	(-0.82)	(-1.47)	(-0.58)	(-1.40)	(-0.65)	(-1.38)	(-0.90)	(-1.33)	(-0.66)	(-1.59)
$Liquidity_{t-1}$	-0.00260**	-0.00176	-0.00267**	-0.00115	-0.00230**	-0.00211	-0.00213**	-0.00143	-0.00228**	-0.00185
	(-3.34)	(-0.61)	(-3.36)	(-0.41)	(-2.89)	(-0.75)	(-2.71)	(-0.50)	(-2.84)	(-0.62)
$Deposits_{t-1}$	-0.0220**	0.00958	-0.0212**	0.00769	-0.0213**	0.00819	-0.0232**	0.00750	-0.0216**	0.00856
	(-3.71)	(1.12)	(-3.64)	(0.89)	(-3.65)	(0.97)	(-3.90)	(0.89)	(-3.72)	(1.04)
MPI	**-0.115*** (-4.42)**	**0.0902** (1.99)**	**-0.105*** (-2.79)**	**-0.0717 (-0.83)**	**-0.119*** (-2.79)**	**0.202 (1.61)**	**-0.152*** (-3.93)**	**-0.0526 (-0.59)**	**0.0782* (1.90)**	**0.310*** (3.02)**
GDP	-0.0425*	-0.0284	-0.0460*	-0.0372	-0.0559**	-0.0307	-0.0673**	-0.0402	-0.0627**	-0.0326
	(-1.69)	(-0.96)	(-1.78)	(-1.23)	(-2.26)	(-1.03)	(-2.60)	(-1.26)	(-2.43)	(-1.07)
Private credit	-0.00237**	0.0162**	-0.00155**	0.0155**	-0.00137*	0.0150**	-0.00253**	0.0168**	-0.00134*	0.0151**
	(-3.90)	(4.45)	(-2.74)	(3.98)	(-2.44)	(4.00)	(-4.00)	(4.44)	(-2.34)	(4.36)
Policy rate	0.127***	0.137***	0.144***	0.134***	0.138***	0.140***	0.122***	0.135***	0.142***	0.138***
	(4.16)	(4.24)	(4.53)	(4.17)	(4.43)	(4.32)	(3.97)	(4.20)	(4.48)	(4.34)
Inflation	0.0329	0.0754**	0.0667**	0.0787**	0.0498**	0.0764**	0.0245	0.0762**	0.0590**	0.0701**
	(1.54)	(5.25)	(3.01)	(5.28)	(2.32)	(5.24)	(1.13)	(5.36)	(2.67)	(5.14)
Crisis	3.623***	2.840*	3.167**	2.782	4.224***	3.059*	5.017***	3.346*	3.372***	2.882*
	(2.79)	(1.67)	(2.51)	(1.62)	(3.47)	(1.77)	(3.92)	(1.85)	(2.68)	(1.71)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12752	3971	12752	3971	12752	3971	12752	3971	12752	3971
Instruments	44	43	44	43	44	43	44	43	44	43

(table continues)

(continued)

	MPP		*Borrower*		*Capital*		*Structural*		*Institution*	
	(1) Advanced	(2) Emerging	(3) Advanced	(4) Emerging	(5) Advanced	(6) Emerging	(7) Advanced	(8) Emerging	(9) Advanced	(10) Emerging
AR (1)	0.000	0.000	0.000	0.000	0.0001	0.000	0.000	0.000	0.000	0.000
AR (2)	0.176	0.548	0.167	0.494	0.164	0.552	0.177	0.519	0.163	0.634
AR (3)	0.288	0.168	0.312	0.187	0.300	0.148	0.292	0.170	0.309	0.171
Hansen	0.282	0.115	0.243	0.074	0.262	0.086	0.405	0.084	0.302	0.159

Note: The table shows the results of the baseline estimations with the dependent variable of debt funding costs, while the right-hand side includes macroprudential policy indices, bank-specific variables and macroeconomic controls. Y_{t-1} is the lagged dependent variable, bank variables lagged by one period are: $Size_{t-1}$ – measured by the logarithm of total assets, $Equity_{t-1}$ – ratio of equity to total assets, $Liquidity_{t-1}$ – ratio of liquid assets to total assets, and $Deposits_{t-1}$ – ratio of total deposits to total liabilities. Macroprudential indices are: MPP – sum of all instruments in the database implemented in countries over time (columns 1–2); Borrower – sum of all measures targeting borrowers (columns 3–4); Capital – sum of instruments targeting banks' capital position (columns 5–6); Structural – index representing the sum of interbank limits and concentration ratio limits (columns 7–8) and Institution – index which is the sum of asset-based tools and tax on revenues (columns 9–10). Macroeconomic variables include: GDP – logarithm of GDP volume, Policy rate – monetary policy rate, Inflation – annual inflation rate, Private credit – ratio of domestic credit to the private sector to GDP, Crisis – a dummy variable equal to 1 for 2008–2012, and 0 otherwise. The estimation method is a dynamic two-step system GMM estimator with robust standard errors and a Windmeijer correction. All regressions include time dummy variables to account for unobserved heterogeneity within our sample. T-statistics are reported in parentheses. The following are p-values indicating the significance level of the coefficients: * p <0.10, ** p <0.05, *** p <0.01.

Table 1.9 Subsample analysis for advanced and emerging countries – overall funding costs

	MPP		*Borrower*		*Capital*		*Structural*		*Institution*	
	(1) Advanced	(2) Emerging	(3) Advanced	(4) Emerging	(5) Advanced	(6) Emerging	(7) Advanced	(8) Emerging	(9) Advanced	(10) Emerging
Y_{t-1}	0.407***	0.349***	0.406***	0.346***	0.406***	0.349***	0.406***	0.348***	0.406***	0.348***
	(9.47)	(8.66)	(9.38)	(8.49)	(9.41)	(8.77)	(9.45)	(8.66)	(9.38)	(8.70)
$Size_{t-1}$	-0.0105	-0.0788	-0.00353	-0.0442	-0.00789	-0.0957	-0.0114	-0.0675	-0.00567	-0.0656
	(-0.29)	(-1.13)	(-0.10)	(-0.61)	(-0.22)	(-1.39)	(-0.31)	(-1.02)	(-0.16)	(-1.00)
$Equity_{t-1}$	-0.0242**	-0.0629**	-0.0223**	-0.0633**	-0.0236**	-0.0613**	-0.0250**	-0.0613**	-0.0235**	-0.0621**
	(-2.42)	(-3.72)	(-2.24)	(-3.70)	(-2.36)	(-3.68)	(-2.51)	(-3.60)	(-2.35)	(-3.68)
$Liquidity_{t-1}$	-0.00132	0.00220	-0.00147	0.00280	-0.00103	0.00111	-0.000857	0.00205	-0.000963	0.00214
	(-1.21)	(0.63)	(-1.39)	(0.80)	(-0.94)	(0.34)	(-0.78)	(0.58)	(-0.88)	(0.60)
$Deposits_{t-1}$	-0.00268	-0.00915	-0.00157	-0.0120	-0.00196	-0.00855	-0.00307	-0.0102	-0.00180	-0.00913
	(-0.46)	(-0.68)	(-0.27)	(-0.90)	(-0.34)	(-0.64)	(-0.53)	(-0.79)	(-0.31)	(-0.70)
MPI	**-0.106*****	**0.0185**	**-0.117****	**-0.260****	**-0.148*****	**0.369****	**-0.131*****	**-0.179**	**0.0969***	**0.188****
	(-3.67)	**(0.31)**	**(-2.12)**	**(-2.17)**	**(-2.96)**	**(2.07)**	**(-2.97)**	**(-1.53)**	**(1.67)**	**(2.29)**
GDP	0.0579**	-0.0219	0.0572**	-0.0224	0.0459*	-0.00678	0.0368	-0.0345	0.0400	-0.0146
	(2.04)	(-0.59)	(2.01)	(-0.62)	(1.66)	(-0.19)	(1.32)	(-0.96)	(1.44)	(-0.39)
Private credit	-0.00349***	0.000321	-0.00267***	-0.00306	-0.00243***	-0.00258	-0.00358***	0.00147	-0.00239***	-0.000884
	(-4.36)	(0.06)	(-3.49)	(-0.57)	(-3.14)	(-0.53)	(-4.34)	(0.29)	(-3.02)	(-0.18)
Policy rate	0.0992***	0.0985***	0.115***	0.0936***	0.110***	0.104***	0.0942***	0.0988***	0.112***	0.0944***
	(2.90)	(4.98)	(3.38)	(4.79)	(3.21)	(5.14)	(2.70)	(5.08)	(3.29)	(4.84)

(table continues)

(continued)

	MPP		*Borrower*		*Capital*		*Structural*		*Institution*	
	(1) Advanced	(2) Emerging	(3) Advanced	(4) Emerging	(5) Advanced	(6) Emerging	(7) Advanced	(8) Emerging	(9) Advanced	(10) Emerging
Inflation	0.0446*	0.100***	0.0774**	0.103***	0.0575**	0.0959**	0.0385	0.0954**	0.0685**	0.0937**
	(1.78)	(5.60)	(3.14)	(5.77)	(2.30)	(5.40)	(1.55)	(5.31)	(2.74)	(5.23)
Crisis	1.444	5.429**	0.961	4.753**	2.115*	5.661***	1.722	5.142**	1.160	4.720**
	(1.14)	(2.46)	(0.79)	(2.13)	(1.71)	(2.61)	(1.32)	(2.34)	(0.94)	(2.12)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13083	3955	13083	3955	13083	3955	13083	3955	13083	3955
Instruments	48	38	48	38	48	38	48	38	48	38
AR (1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR (2)	0.112	0.826	0.119	0.792	0.119	0.823	0.109	0.841	0.117	0.851
AR (3)	0.125	0.256	0.125	0.256	0.124	0.289	0.122	0.269	0.122	0.241
Hansen	0.089	0.302	0.063	0.249	0.079	0.315	0.097	0.318	0.072	0.361

Note: The table shows the results of the baseline estimations with the dependent variable of overall funding costs, while the right-hand side includes macroprudential policy indices, bank-specific variables and macroeconomic controls. Y_{t-1} is the lagged dependent variable, bank variables lagged by one period are: $Size_{t-1}$ – measured by the logarithm of total assets, $Equity_{t-1}$ – ratio of equity to total assets, $Liquidity_{t-1}$ – ratio of liquid assets to total assets, and $Deposits_{t-1}$ – ratio of total deposits to total liabilities. Macroprudential indices are: MPP – sum of all instruments in the database implemented in countries over time (columns 1–2); Borrower – sum of all measures targeting borrowers (columns 3–4); Capital – sum of instruments targeting banks' capital position (columns 5–6); Structural – index representing the sum of interbank limits and concentration ratio limits (columns 7–8) and Institution – index which is the sum of asset-based tools and tax on revenues (columns 9–10). Macroeconomic variables include: GDP – logarithm of GDP volume, Policy rate – monetary policy rate, Inflation – annual inflation rate, Private credit – ratio of domestic credit to the private sector to GDP, Crisis – a dummy variable equal to 1 for 2008–2012, and 0 otherwise. The estimation method is a dynamic two-step system GMM estimator with robust standard errors and a Windmeijer correction. All regressions include time dummy variables to account for unobserved heterogeneity within our sample. T-statistics are reported in parentheses. The following are p-values indicating the significance level of the coefficients: * p <0.10, ** p <0.05, *** p <0.01.

Table 1.10 Impact of individual macroprudential instruments on bank financing costs by subsamples[30]

Dependent variable	*Debt funding costs*		*Overall funding costs*	
	(1) Advanced	(2) Emerging	(3) Advanced	(4) Emerging
LTV	-0.133***	-0.157	-0.188***	-0.540***
	(-3.19)	(-1.14)	(-2.89)	(-2.81)
DTI	-0.0213	-0.0806	0.183	-0.309
	(-0.21)	(-0.58)	(1.55)	(-1.56)
CTC	-0.207	-0.633**	0.216	-1.087**
	(-1.47)	(-2.12)	(1.39)	(-2.07)
DP	-0.0489	0.196	0.122	0.477*
	(-0.53)	(1.07)	(0.80)	(1.84)
LEV	-0.155**	0.572**	-0.317***	0.732**
	(-2.43)	(2.21)	(-4.04)	(2.39)
SIFI	-0.0801	0.262	-0.240***	0.629**

(table continues)

[30] Where missing, the estimation results are not available because some macroprudential instruments were not used in the covered period in certain subsamples, meaning the indicator used to measure the instrument is 0. All instruments were tested in separate regressions along with other macroeconomic and bank controls, but for brevity we pool them together, split by subsample. The full results of these estimations are available in the Appendix A (Tables A.6-A.11).

(continued)

Dependent variable	*Debt funding costs*		*Overall funding costs*	
	(1) Advanced	(2) Emerging	(3) Advanced	(4) Emerging
	(-1.36)	(1.62)	(-2.87)	(2.33)
INTER	-0.206***	-0.390***	-0.156**	-0.464***
	(-3.33)	(-2.88)	(-2.10)	(-3.06)
CONC	-0.224***	0.348***	-0.220***	0.174
	(-4.02)	(2.64)	(-3.18)	(1.00)
CG		0.492*		1.049***
		(1.93)		(3.13)
FC	-0.0926	0.254*	-0.151	0.0867
	(-1.10)	(1.72)	(-0.97)	(0.61)
RR		0.475***		0.444***
		(3.43)		(2.81)
TAX	0.138***	0.151	0.181***	-0.114
	(2.76)	(0.82)	(2.69)	(-0.49)
Observations	12752	3971	13083	3955

Note: The table shows the results of the estimations with the dependent variable of debt funding costs (columns 1–2), and overall funding costs (columns 3–4) while the right-hand side includes macroprudential policy instruments, bank-specific variables and macroeconomic controls. Y_{t-1} is the lagged dependent variable, bank variables lagged by one period are: $Size_{t-1}$ – measured by the logarithm of total assets, $Equity_{t-1}$ – ratio of equity to total assets, $Liquidity_{t-1}$ – ratio of liquid assets to total assets, and $Deposits_{t-1}$ – ratio of total deposits to total liabilities. Macroprudential indices are: LTV – loan-to-value limit, DTI – debt-to-income cap, CTC – countercyclical capital buffer, DP – dynamic provisioning, LEV – leverage ratio limit, SIFI – capital caps for systematically important financial institutions, INTER – interbank limits, CONC – concentration limits, CG – caps on domestic loans, FC – foreign currency loans limits, RR – countercyclical reserve requirements and TAX – taxes on financial institutions; the indices' scopes are 0–1. Macroeconomic variables include: GDP – logarithm of GDP volume, Policy rate – monetary policy rate, Inflation – annual inflation rate, Private credit – ratio of domestic credit to the private sector to GDP, Crisis – a dummy variable equal to 1 for 2008–2012, and 0 otherwise. The estimation method is a dynamic two-step system GMM estimator with robust standard errors and a Windmeijer correction. All regressions include time dummy variables to account for unobserved heterogeneity within our sample. T-statistics are reported in parentheses. The following are p-values indicating the significance level of the coefficients: * p <0.10, ** p <0.05, *** p <0.01.

1.6.2 Additional bank controls

To check the robustness of our results, we first include an additional bank variable that controls for individual bank risk. The previous literature shows a significant negative relationship between the use of macroprudential measures and bank risk (Meuleman & Vander Vennet, 2020; Altunbas, Binici & Gambacorta, 2018), while the market perception of bank risk and general confidence in the soundness of the bank determines the price of its funding (Harimohan & Nelson, 2014; Arnould, Pancaro & Żochowski, 2021). In this regard, it is interesting to analyse whether our results experience significant changes after including the risk control variable. We use a traditional measure of bank risk by calculating the Z-score according to the following formula: $Z - score = \frac{(Equity+ROAA)}{\sigma_{ROAA}}$, where $Equity$ is the ratio of total equity to total assets, $ROAA$ is the return on average assets, while σ_{ROAA} is the standard deviation of return on average assets. Z-score measures how much the bank's ROAA must fall for a bank to deplete its equity. A higher value of the Z-score indicates

greater bank stability, while a lower Z-score indicates greater risk.[31] We take the natural logarithm of the Z-score and introduce its lagged value into the regression model. Table 1.11 shows the estimation results of four different regression specifications. Although we perform individual regression analysis for each index and dependent variable along with the inclusion of the control variables, we suppress these results to save space while showing only the coefficients of our variables of interest and the new control variables.[32] In our first specification, we include the Z-score and, based on the obtained estimates, the Z-score is strongly and negatively associated with bank funding costs, while our macroprudential measures are largely robust. In the case of overall funding costs, the MPP index is no longer significant, while majority of other indices reflect our main results.

In the second specification, we include the squared term of bank size to check for any nonlinearities in the relationship with funding costs. Following the literature, larger banks, along with their 'too big to fail' status, enjoy lower funding costs because these institutions are assumed to be likely to be bailed out by governments if they fail (Bertay, Demirguc-Kunt & Huizinga, 2013; Demirgüç-Kunt & Huizinga, 2010). In our analysis, we found a weak association between our dependent variables and bank size in the baseline estimations and therefore decided to test for nonlinearities in their relationship. Based on the obtained estimates, size and the squared term of size are not significantly associated with total funding costs, reflecting our baseline estimates. On the other hand, in the estimations with cost of debt, we observe a change in the relationship between the dependent variable and bank size. The squared term of bank size is now significant and negative in sign, with a significance level of 10%, suggesting that the higher the bank size, the lower the cost of bank financing. Benbouzid, Leonida and Mallick (2018) examine the non-monotonic relationship between bank size and CDS spreads as a measure of credit risk[33]. The authors' results suggest that when a bank's size exceeds a certain threshold, its relationship with CDS spreads is no longer negative, but has a positive effect on CDS spreads, increasing its credit risk. We find no such evidence with respect to our accounting-based dependent variables. Still, our results should be treated with caution given the non-significance of the results for the main size variable and the limited significance level for the squared term of bank size as well as the differences in the sample selection.

We also control for loan loss provisioning (LLP) and a bank's cost efficiency measured by the ratio of operating expenses to the bank's total assets (Efficiency). These ratios serve as proxies for bank performance as they shape market perceptions of bank stability and can affect risk premia on the cost of funds. Loan loss provisions are estimated based on the probability of bank losses related to their credit function (Olszak, Roszkowska & Kowalska,

[31] See Demirgüç-Kunt and Huizinga (2010), Altunbas, Binici and Gambacorta (2018) and Gaganis, Lozano-Vivas, Papadimitri and Pasiouras (2020) for an application of the Z-score as a measure of bank risk.
[32] We test separately for the inclusion of selected bank controls. Results are truncated for brevity. Full estimations are available in the Appendix A (Tables A.12-A.15).
[33] CDS spreads are sometimes used to proxy for bank funding costs based on market data (see Babihuga & Spaltro, 2014; Schmitz, Sigmund & Valderrama, 2017).

2018). Belkhir, Ben Naceur, Chami and Samet (2021) suggest that higher provisioning in banks may be associated with a higher cost of capital because investors may expect greater compensation. Efficiency is an important indicator of bank performance since the market may perceive a bank with high operating costs to be inefficient. In the end, this could lead to an increase in funding costs (Belkhir, Ben Naceur, Chami & Samet, 2021). We separately test for the inclusion of the lagged ratio of loan loss provisions to total loans (LLP_{t-1}) and the lagged ratio of operating expenses to total assets ($Efficiency_{t-1}$). The construction of the cost efficiency variable suggests that a lower value is more favourable and indicates higher bank efficiency, while a higher value of this variable indicates lower bank efficiency. Thus, a positive association is expected in relation to the dependent variables. The coefficients for the loan loss provisioning variable are not statistically significant, while the efficiency variable is statistically significant in regressions with overall funding costs as the dependent variable. Bank efficiency is positively associated with overall funding costs; yet, this does not change the outcome of our variable of interest.

Table 1.11 Additional bank controls

Dependent variable	*Debt funding costs*					*Overall costs*				
	(1) MPP	(2) Borrower	(3) Capital	(4) Structural	(5) Institution	(6) MPP	(7) Borrower	(8) Capital	(9) Structural	(10) Institution
$Z\text{-score}_{t-1}$	-0.0551**	-0.0662**	-0.0542**	-0.0519**	-0.0563**	-0.0625**	-0.0691**	-0.0653**	-0.0570**	-0.0612**
	(-2.32)	(-2.59)	(-2.31)	(-2.37)	(-2.34)	(-2.21)	(-2.36)	(-2.31)	(-2.01)	(-2.13)
MPI	-0.0529**	-0.140***	-0.0571	-0.0868**	0.101**	-0.0283	-0.109**	0.0405	-0.0806**	0.111**
	(-2.52)	(-4.68)	(-1.36)	(-2.14)	(2.14)	(-1.05)	(-2.22)	(0.74)	(-2.03)	(2.33)
$Size_{t-1}$	0.461	0.444	0.480	0.488	0.504*	-0.309	-0.313	-0.308	-0.286	-0.257
	(1.52)	(1.45)	(1.55)	(1.62)	(1.66)	(-0.67)	(-0.68)	(-0.67)	(-0.62)	(-0.56)
$Size\ squared_{t-1}$	-0.0113*	-0.0109	-0.0118*	-0.0120*	-0.0123*	0.00600	0.00615	0.00598	0.00544	0.00482
	(-1.67)	(-1.59)	(-1.69)	(-1.77)	(-1.80)	(0.58)	(0.59)	(0.57)	(0.52)	(0.46)
MPI	-0.0541**	-0.116***	-0.0874**	-0.115***	0.148***	-0.0549**	-0.127***	0.0167	-0.145***	0.152***
	(-2.87)	(-4.05)	(-2.04)	(-3.67)	(4.03)	(-2.18)	(-2.69)	(0.29)	(-3.60)	(3.10)
LLP_{t-1}	0.000331	0.00169	0.000750	-0.000161	0.00153	-0.00393	-0.00232	-0.00219	-0.00541	-0.00224
	(0.04)	(0.19)	(0.09)	(-0.02)	(0.18)	(-0.31)	(-0.18)	(-0.17)	(-0.42)	(-0.18)
MPI	-0.0425**	-0.0903**	-0.0515	-0.103***	0.128***	-0.0663**	-0.103**	0.0374	-0.183***	0.137***
	(-2.23)	(-3.70)	(-1.31)	(-2.77)	(3.13)	(-2.56)	(-2.18)	(0.65)	(-4.63)	(2.86)
$Efficiency_{t-1}$	0.00419	0.00432	0.00357	0.00422	0.00332	0.0333**	0.0330**	0.0328**	0.0335**	0.0325***
	(0.84)	(0.85)	(0.70)	(0.84)	(0.66)	(2.78)	(2.75)	(2.72)	(2.79)	(2.69)
MPI	-0.0454**	-0.130***	-0.0875**	-0.0891**	0.153***	-0.0649**	-0.165***	-0.000535	-0.127***	0.120**
	(-2.45)	(-4.47)	(-2.10)	(-2.91)	(4.03)	(-2.42)	(-3.23)	(-0.01)	(-3.03)	(2.35)

(table continues)

(continued)

Dependent variable	*Debt funding costs*					*Overall costs*				
	(1) MPP	(2) Borrower	(3) Capital	(4) Structural	(5) Institution	(6) MPP	(7) Borrower	(8) Capital	(9) Structural	(10) Institution
Dependent variable Y_{t-1}	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank controls$_{t-1}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macro controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: The table shows the results of the estimations with the dependent variable of debt funding costs (columns 1–5) and overall funding costs (columns 6–10) while the right-hand side includes macroprudential policy indices, bank-specific variables and macroeconomic controls. Y_{t-1} is the lagged dependent variable, bank variables lagged by one period are: Size$_{t-1}$ – measured by the logarithm of total assets, Equity$_{t-1}$ – ratio of equity to total assets, Liquidity$_{t-1}$ – ratio of liquid assets to total assets, and Deposits$_{t-1}$ – ratio of total deposits to total liabilities, Z-score$_{t-1}$ – bank risk indicator based on standard deviation of return on average assets, Size squared$_{t-1}$ – squared bank size, LLP$_{t-1}$ – loan loss provisioning over gross loans ratio, Efficiency$_{t-1}$ – ratio of operating expenses over total assets. Macroprudential indices are: MPP – sum of all instruments in the database implemented in countries over time; Borrower – sum of all measures targeting borrowers; Capital – sum of instruments targeting banks' capital position; Structural – index representing the sum of interbank limits and concentration ratio limits and Institution – index which is the sum of asset-based tools and tax on revenues. Macroeconomic variables include: GDP – logarithm of GDP volume, Policy rate – monetary policy rate, Inflation – annual inflation rate, Private credit – ratio of domestic credit to the private sector to GDP, Crisis – a dummy variable equal to 1 for 2008–2012, and 0 otherwise. The estimation method is a dynamic two-step system GMM estimator with robust standard errors and a Windmeijer correction. All regressions include time dummy variables to account for unobserved heterogeneity within our sample. T-statistics are reported in parentheses. The following are p-values indicating the significance level of the coefficients: * p <0.10, ** p <0.05, *** p <0.01.

1.6.3 Financial development and regulatory surroundings

To control the robustness of our results while controlling for different macroeconomic variables, we conduct several tests for the aggregate macroprudential index (MPP), (see Table 1.12). First, we control for financial openness by including the variable *Financial openness*, measured by the index KAOPEN from Chinn and Ito (2008). This measure has a range from 0 to 1, where 1 indicates that a country has an open financial account.[34] The literature has established some variation in the effectiveness of macroprudential policy based on countries' financial openness along with a different selection of policies adopted since countries with a closed or less liberalised capital account tend to have greater volatility in financial variables and be more vulnerable to external factors related to systemic risk concerns. Financial openness increases the availability of different financing sources and lowers the cost of long-term debt (Agca, De Nicolò & Detragiache, 2015) and may also determine the effectiveness of macroprudential policies and their possible circumvention (Cerutti, Claessens & Laeven, 2017; Claessens, Ghosh & Mihet, 2013). We follow this literature and find a significant and negative association between financing costs and financial openness. Our results suggest that banks in countries with liberalised and open

[34] The index is widely used in the finance literature and especially in the literature on macroprudential policies (see Garcia Revelo, Lucotte & Pradines-Jobet, 2020).

capital accounts have lower funding costs than those in closed countries. Still, the results for the MPP index do not change.

In the next two specifications, we introduce a different set of two variables: *FIA* – Financial Institution Access and *FID* – Financial Institution Depth (columns 2 and 6), and *FMA* – Financial Market Access and *FME* – Financial Market Efficiency (columns 3 and 7)[35]. These indices are introduced to improve our initial measure of financial development, domestic credit to the private sector as a percentage of GDP, which may not fully account for the complexity of financial development. We use these controls to check for other effects of differences in the level of financial development across countries. These indices fall in a range of 0 to 1, with a higher value indicating greater development. We find that FID and FMA are significantly and negatively associated with the cost of debt financing, suggesting that the depth of financial institutions and the access to financial markets are relevant to determining the cost of debt. On the other hand, none of these variables is significantly associated with overall cost. The coefficients on the MPP index are similar to those in our baseline regressions. As a final test, we decide to introduce controls for bank regulation to control for the regulatory environment. We hypothesise that the impact of macroprudential policies on bank funding costs may be affected by heterogeneity across countries in terms of differences in the regulatory environment. To control for such differences, we include two indices developed by Barth, Caprio and Levine (2013): *Initial stringency* and *Supervisory Power*, based on surveys of bank supervision and regulation conducted by the World Bank.[36] Initial Stringency is an index built on the information about the funds that can be used for the initial capital of banks and are verified by the official regulator. The index has a range of 0–3. On the other hand, the Supervisory power index is much broader and has a range of 6 to 14.5 for our sample. It is composed of responses to various questions about the strength of supervisory power, revealing whether supervisors have the power to counteract and resolve issues in the banking sector. However, only Supervisory power enters significantly and is negatively associated with the cost of debt, suggesting that banks have lower funding costs in countries with higher and stringent supervisory power. We do not obtain statistically significant coefficients for overall costs. The statistical significance of the MPP index does not change.

[35] These indices were downloaded from the IMF's Financial Development Index Database. For more information on the construction of the indices, see Sahay et al. (2015). The database is available at: https://data.imf.org/?sk=f8032e80-b36c-43b1-ac26-493c5b1cd33b

[36] We download already available data for the period 2000–2013, while we construct further data based on a new survey updated to 2016 and code the indices based on Barth, Caprio and Levine (2013). There are no data for 2017 and thus our sample shrinks to some extent following the introduction of these indices.

Table 1.12 Additional country controls

Dependent variable	*Debt funding costs*				*Overall costs*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Y_{t-1}	0.621***	0.629***	0.631***	0.657***	0.374***	0.380***	0.381***	0.355***
	(11.51)	(12.03)	(11.95)	(5.01)	(12.04)	(12.27)	(12.26)	(10.91)
$Size_{t-1}$	-0.0247	-0.0206	-0.0212	-0.00718	-0.0522	-0.0525	-0.0540	-0.0516
	(-0.91)	(-0.75)	(-0.77)	(-0.22)	(-1.60)	(-1.59)	(-1.64)	(-1.39)
$Equity_{t-1}$	-0.00247	-0.000564	-0.00123	0.00142	-0.0390***	-0.0387***	-0.0387***	-0.0391***
	(-0.26)	(-0.06)	(-0.13)	(0.11)	(-4.39)	(-4.34)	(-4.34)	(-3.99)
$Liquidity_{t-1}$	-0.00379***	-0.00329***	-0.00335***	-0.00319**	-0.000362	0.000221	0.000174	-0.000377
	(-5.09)	(-4.85)	(-4.63)	(-2.25)	(-0.34)	(0.21)	(0.16)	(-0.33)
$Deposits_{t-1}$	-0.0167***	-0.0159***	-0.0156***	-0.0122**	-0.00912*	-0.00711	-0.00725	-0.00575
	(-3.60)	(-3.40)	(-3.35)	(-2.29)	(-1.76)	(-1.35)	(-1.38)	(-0.97)
MPP	**-0.0540*** **	**-0.0631*** **	**-0.0589*** **	**-0.0487** **	**-0.0532** **	**-0.0627** **	**-0.0630** **	**-0.0518***
	(-2.92)	**(-3.29)**	**(-3.21)**	**(-2.11)**	**(-2.23)**	**(-2.45)**	**(-2.57)**	**(-1.80)**
Financial openness	-0.643***				-1.137***			
	(-5.66)				(-7.59)			
Financial Institution Access		-0.0368				-0.0504		
		(-0.37)				(-0.36)		
Financial Institution Depth		-0.424***				-0.167		
		(-3.05)				(-0.88)		
Financial Market Access			-0.139**				-0.0172	
			(-2.12)				(-0.17)	
Financial Market Efficiency			-0.0654				0.0295	
			(-1.19)				(0.34)	
Initial stringency				-0.0123				0.00563
				(-0.51)				(0.16)
Supervisory Power				-0.0402***				-0.00602
				(-4.60)				(-0.51)
GDP	-0.0274	-0.0230	-0.0168	-0.0196	-0.000383	0.00835	0.0106	0.00284
	(-1.58)	(-1.32)	(-1.00)	(-0.88)	(-0.02)	(0.35)	(0.44)	(0.11)
Private credit	-0.00116**	0.000321	-0.00118***	-0.00147*	-0.00286***	-0.00286**	-0.00370***	-0.00402***
	(-2.53)	(0.47)	(-2.73)	(-1.94)	(-3.96)	(-2.56)	(-5.12)	(-5.49)
Policy rate	0.0846***	0.0882***	0.0913***	0.100**	0.0954***	0.117***	0.122***	0.120***
	(4.48)	(4.77)	(4.58)	(2.24)	(6.67)	(7.83)	(7.93)	(7.69)
Inflation	0.0315***	0.0532***	0.0555***	0.0458***	0.0282**	0.0702***	0.0705***	0.0885***
	(3.55)	(5.84)	(6.07)	(3.57)	(2.04)	(5.25)	(5.26)	(6.08)
Crisis	4.384***	3.550***	2.984***	3.126**	5.687***	3.708***	4.193***	3.848***
	(4.12)	(3.38)	(2.93)	(2.13)	(5.18)	(3.35)	(3.78)	(3.03)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16723	16601	16601	14852	17038	16916	16916	15151
Instruments	45	46	46	43	41	42	42	41
AR (1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR (2)	0.071	0.070	0.070	0.030	0.233	0.242	0.240	0.278
AR (3)	0.168	0.184	0.186	0.882	0.317	0.357	0.362	0.808
Hansen	0.141	0.115	0.108	0.325	0.166	0.210	0.201	0.0712

Note: The table shows the results of the estimations with the dependent variable of debt funding costs (columns 1–4), and overall funding costs (columns 5–8) while the right-hand side includes macroprudential policy index, bank-specific variables and macroeconomic controls. Y_{t-1} is the lagged dependent variable, bank variables lagged by one period are: $Size_{t-1}$ – measured by the logarithm of total assets, $Equity_{t-1}$ – ratio of equity to total assets, $Liquidity_{t-1}$ – ratio of liquid assets to total assets, and $Deposits_{t-1}$ – ratio of total deposits to total liabilities. Macroprudential index is MPP – sum of all instruments in the database implemented in countries over time. Additional control variables include: Financial openness index, Financial Institution Access, Financial Institution Depth, Financial Market Access, Financial Market Efficiency, Initial Stringency, Supervisory Power. Macroeconomic variables include: GDP – logarithm of GDP volume, Policy rate – monetary policy rate, Inflation – annual inflation rate, Private credit – ratio of domestic credit to the private sector to GDP, Crisis – a dummy variable equal to 1 for 2008–2012, and 0 otherwise. The estimation method is a dynamic two-step system GMM estimator with robust standard errors and a Windmeijer correction. All regressions include time dummy variables to account for unobserved heterogeneity within our sample. T-statistics are reported in parentheses. The following are p-values indicating the significance level of the coefficients: * p <0.10, ** p <0.05, *** p <0.01.

1.6.4 Different periods and the effect of the financial crisis

Table 1.13 shows the results of our baseline index (MPP) in regressions where we restrict our sample to the pre-crisis period (2000–2007) and the post-crisis period (2013–2017). These tests are motivated by the change in market perceptions of bank stability and the potential risks associated with their leverage that characterised the period following the 2008 financial crisis. Studies such as Belkhir, Ben Naceur, Chami and Samet (2021) and Calomiris and Nissim (2014) suggest that the crisis and post-crisis periods were characterised by a change in the market's apprehension of bank characteristics, particularly asset quality and leverage, which was exacerbated by the changing regulatory environment. These changes could also be reflected in the responsiveness of our dependent variables to macroprudential policy. In addition, we examine differences in the effects of macroprudential policy by analysing the subsamples of advanced and emerging market countries. In the pre-crisis period, the MPP index is significantly and negatively associated with bank funding costs in all specifications. Yet, the results change for the post-crisis period as the MPP index has a significant and negative coefficient only for advanced economies. With respect to overall costs, the MPP index is not significantly associated with our dependent variables in the post-crisis period. Although we exclude a large part of our sample by excluding four years of data (2008–2012), we find macroprudential policy has a limited association with overall funding costs in the post-crisis period, while we find that the use of macroprudential policy is strongly associated with a decline in the cost of borrowing due to the shift in risk premia in advanced economies. This may be a consequence of differences in market perceptions of the stability of banking institutions in advanced countries, along with the higher regulatory quality there (Belkhir, Ben Naceur, Chami & Samet, 2021). These results highlight the differences in our country samples and the need for macroprudential regulators to take account of the specific economic conditions of a given country while selecting macroprudential tools.

Table 1.13 Macroprudential policy and funding costs before and after the financial crisis

Dependent variable	*Debt funding costs*						*Overall funding costs*					
Period	*Pre-crisis*			*Post-crisis*			*Pre-crisis*			*Post-crisis*		
	(1) All	(2) Advanced	(3) Emerging	(4) All	(5) Advanced	(6) Emerging	(7) All	(8) Advanced	(9) Emerging	(10) All	(11) Advanced	(12) Emerging
Y_{t-1}	0.539***	0.686***	0.267**	0.805***	0.883***	0.672***	0.392***	0.374***	0.423***	0.420***	0.410***	0.384***
	(6.35)	(6.94)	(2.05)	(11.51)	(12.99)	(8.25)	(8.28)	(6.36)	(5.64)	(6.54)	(3.93)	(4.41)
$Size_{t-1}$	0.0863*	0.0770*	-0.0414	0.0125	0.0216*	-0.0461	-0.0356	-0.0208	-0.0595	0.0370*	0.0266	-0.144
	(1.95)	(1.93)	(-0.46)	(0.84)	(1.66)	(-1.07)	(-0.56)	(-0.31)	(-0.31)	(1.74)	(1.48)	(-1.20)
$Equity_{t-1}$	0.00232	0.0162	-0.0288	0.0124	0.0237**	0.00793	-0.0459*	-0.0434**	-0.0628	0.00254	0.00802	-0.0388
	(0.13)	(0.88)	(-1.41)	(1.34)	(2.32)	(0.80)	(-2.55)	(-2.22)	(-1.21)	(0.28)	(0.79)	(-1.61)
$Liquidity_{t-1}$	-0.00432**	-0.00356**	-0.00657	-0.000791	-0.000668	0.000460	-0.000599	-0.000659	-0.00145	-0.000482	-0.00104	0.0156
	(-3.73)	(-3.01)	(-1.51)	(-0.75)	(-0.80)	(0.10)	(-0.41)	(-0.41)	(-0.33)	(-0.29)	(-0.69)	(1.62)
$Deposits_{t-1}$	-0.00853	-0.0115	0.00441	-0.00452	-0.00699*	0.000996	-0.00279	-0.00134	0.0277	0.00000573	-0.00319	0.0358
	(-1.00)	(-1.26)	(0.16)	(-1.20)	(-1.78)	(0.12)	(-0.29)	(-0.14)	(0.54)	(0.00)	(-0.58)	(1.50)
MPP	**-0.185*** **	**-0.189*** **	**-0.222*** **	**-0.00995**	**-0.0482****	**0.0331**	**-0.141*** **	**-0.126***	**-0.237****	**0.0572**	**0.000841**	**0.250**
	(-3.63)	**(-3.26)**	**(-2.64)**	**(-0.41)**	**(-2.39)**	**(0.53)**	**(-2.82)**	**(-1.91)**	**(-1.99)**	**(1.61)**	**(0.02)**	**(1.56)**

(table continues)

(continued)

Dependent variable	*Debt funding costs*						*Overall funding costs*					
Period	*Pre-crisis*			*Post-crisis*			*Pre-crisis*			*Post-crisis*		
	(1) All	(2) Advanced	(3) Emerging	(4) All	(5) Advanced	(6) Emerging	(7) All	(8) Advanced	(9) Emerging	(10) All	(11) Advanced	(12) Emerging
GDP	-0.0785**	-0.0645	-0.109	0.0235	0.00877	0.0355	-0.00777	0.0164	-0.0712	0.0530*	0.106***	0.00348
	(-2.07)	(-1.41)	(-1.33)	(1.56)	(0.46)	(1.41)	(-0.19)	(0.36)	(-0.61)	(1.68)	(3.03)	(0.06)
Private credit	-0.00191	-0.00155	0.0215**	0.0000710	0.0000817	0.0246**	-0.000780	-0.0000567	0.0212	-0.00238**	-0.00277**	0.0334**
	(-1.57)	(-1.09)	(2.75)	(0.15)	(0.16)	(5.05)	(-0.65)	(-0.04)	(1.39)	(-2.41)	(-2.66)	(3.53)
Policy rate	0.0879**	0.0524	0.253***	0.0216	-0.0551	0.0582*	0.114***	0.0881*	0.119***	0.112***	0.0540	0.107***
	(2.50)	(1.01)	(4.22)	(0.74)	(-0.66)	(1.95)	(4.18)	(1.85)	(3.11)	(4.05)	(0.39)	(2.66)
Inflation	0.0611***	0.180***	0.0325	0.0621***	-0.00501	0.0656**	0.0541*	0.136**	0.0596*	0.0715***	0.0530	0.0920**
	(3.24)	(3.59)	(1.46)	(4.83)	(-0.23)	(4.23)	(2.00)	(2.34)	(1.67)	(3.27)	(1.31)	(3.02)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5941	5020	921	5894	4197	1697	5941	5020	921	5894	4197	1697
Instruments	30	30	30	28	28	24	30	30	30	28	28	24
AR (1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR (2)	0.750	0.328	0.349	0.439	0.279	0.518	0.750	0.328	0.349	0.439	0.279	0.518
AR (3)	0.716	0.467	0.309	0.208	0.201	0.677	0.716	0.467	0.309	0.208	0.201	0.677
Hansen	0.149	0.626	0.158	0.0354	0.415	0.216	0.149	0.626	0.158	0.0354	0.415	0.216

Note: The table shows the results of the estimations with the dependent variable of debt funding costs (columns 1–6) and overall funding costs (columns 7–12) while the right-hand side includes macroprudential policy index, bank-specific variables and macroeconomic controls. Y_{t-1} is the lagged dependent variable, bank variables lagged by one period are: $Size_{t-1}$ – measured by the logarithm of total assets, $Equity_{t-1}$ – ratio of equity to total assets, $Liquidity_{t-1}$ – ratio of liquid assets to total assets, and $Deposits_{t-1}$ – ratio of total deposits to total liabilities. Macroprudential index is MPP – sum of all instruments in the database implemented in countries over time. Macroeconomic variables include: GDP – logarithm of GDP volume, Policy rate – monetary policy rate, Inflation – annual inflation rate, Private credit – ratio of domestic credit to the private sector to GDP, Crisis – a dummy variable equal to 1 for 2008–2012, and 0 otherwise. The estimation method is a dynamic two-step system GMM estimator with robust standard errors and a Windmeijer correction. All regressions include time dummy variables to account for unobserved heterogeneity within our sample. T-statistics are reported in parentheses. The following are p-values indicating the significance level of the coefficients: * p <0.10, ** p <0.05, *** p <0.01.

To further investigate the financial crisis' impact, we extend our baseline model to include interaction terms between the financial crisis dummy and macroeconomic variables (Table 1.14). This analysis provides greater insight into the impact of the crisis in terms of the cost of finance and provides an additional robustness check for our main results. The crisis coefficient is significantly and positively associated with the cost of financing, while its interaction term with the GDP variable and the inflation rate is not significant. On the other hand, the *Crisis*Policy* rate indicates the increased effect of monetary policy during the crisis years. For overall costs, we observe a negative relationship in some specifications, indicating that the policy rate had a dampening effect on banks' overall costs during the financial crisis. *Crisis*Private credit* is negatively associated with our dependent variables in all estimations, suggesting that banks in countries at higher levels of economic development, as measured by domestic credit to GDP, had lower funding costs during the crisis. The introduction of these interaction terms does not change the significance of the results obtained for our variables of interest.[37]

[37] These estimations are suppressed for clarity. The full results of these estimates are available in the Appendix A, Table A.16.

Table 1.14 Effects of the crisis – interactions with macroeconomic variables

Dependent variable	*Debt funding costs*					*Overall funding cost*				
	(1) MPP	(2) Borrower	(3) Capital	(4) Structural	(5) Institution	(6) MPP	(7) Borrower	(8) Capital	(9) Structural	(10) Institution
MPI	-0.0502**	-0.132***	-0.0889**	-0.0872**	0.127***	-0.0500**	-0.118**	-0.0168	-0.142***	0.176***
	(-2.43)	(-5.02)	(-2.03)	(-2.04)	(2.70)	(-1.98)	(-2.47)	(-0.30)	(-3.49)	(3.65)
Crisis	2.578**	2.404**	2.507**	2.765**	2.532**	4.523***	4.331***	4.445***	4.632***	4.268***
	(2.25)	(2.12)	(2.21)	(2.39)	(2.28)	(4.04)	(3.91)	(3.99)	(4.12)	(3.87)
Crisis*GDP	-0.0168	-0.0222	-0.0200	-0.00573	-0.0106	-0.0171	-0.0224	-0.0184	0.00121	-0.00870
	(-0.76)	(-1.01)	(-0.92)	(-0.25)	(-0.47)	(-0.48)	(-0.63)	(-0.51)	(0.03)	(-0.24)
Crisis*Inflation rate	-0.0103	-0.00718	-0.00874	-0.00746	-0.00270	0.0283	0.0318	0.0335	0.0287	0.0364
	(-0.82)	(-0.57)	(-0.70)	(-0.60)	(-0.21)	(1.27)	(1.43)	(1.51)	(1.29)	(1.63)
Crisis*Policy rate	0.0513**	0.0496**	0.0450**	0.0441**	0.0341**	-0.0380	-0.0400	-0.0474*	-0.0417*	-0.0564**
	(3.32)	(3.07)	(2.90)	(2.84)	(2.00)	(-1.53)	(-1.62)	(-1.92)	(-1.67)	(-2.27)
Crisis*Private credit	-0.00176***	-0.00177***	-0.00209***	-0.00180***	-0.00222***	-0.00388***	-0.00392***	-0.00410***	-0.00382***	-0.00446***
	(-3.41)	(-3.47)	(-4.19)	(-3.45)	(-4.43)	(-4.25)	(-4.30)	(-4.50)	(-4.19)	(-4.86)
Dependent variable Y_{t-1}	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank controls$_{t-1}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16600	16600	16600	16600	16600	16915	16915	16915	16915	16915
Instruments	48	48	48	48	48	44	44	44	44	44
AR (1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR (2)	0.050	0.050	0.050	0.050	0.045	0.191	0.196	0.195	0.187	0.192
AR (3)	0.388	0.396	0.388	0.384	0.386	0.334	0.327	0.333	0.331	0.319
Hansen	0.632	0.582	0.693	0.757	0.743	0.269	0.251	0.336	0.392	0.380

Note: The table shows the results of the estimations with the dependent variable of debt funding costs (columns 1–6), and overall funding costs (columns 6–10) while the right-hand side includes macroprudential policy index, bank-specific variables and macroeconomic controls. Y_{t-1} is the lagged dependent variable, bank variables lagged by one period are: $Size_{t-1}$ – measured by the logarithm of total assets, $Equity_{t-1}$ – ratio of equity to total assets, $Liquidity_{t-1}$ – ratio of liquid assets to total assets, and $Deposits_{t-1}$ – ratio of total deposits to total liabilities. Macroprudential indices are: MPP – sum of all instruments in the database implemented in countries over time; Borrower – sum of all measures targeting borrowers; Capital – sum of instruments targeting banks' capital position; Structural – index representing the sum of interbank limits and concentration ratio limits and Institution – index which is the sum of asset-based tools and tax on revenues. Macroeconomic variables include: GDP – logarithm of GDP volume, Policy rate – monetary policy rate, Inflation – annual inflation rate, Private credit – ratio of domestic credit to the private sector to GDP, Crisis – a dummy variable equal to 1 for 2008–2012, and 0 otherwise. The estimation method is a dynamic two-step system GMM estimator with robust standard errors and a Windmeijer correction. All regressions include time dummy variables to account for unobserved heterogeneity within our sample. T-statistics are reported in parentheses. The following are p-values indicating the significance level of the coefficients: * p <0.10, ** p <0.05, *** p <0.01.

1.7 Conclusion

The chapter has studied the impact of macroprudential instruments on bank funding costs using data on individual bank balance sheets and income statements. Taking interest expense relative to average interest-bearing liabilities as the dependent variable, and

additionally a measure of bank overall funding costs, we find that the implementation of macroprudential instruments in European countries is associated with lower bank funding costs. The sign of the relationship varies by dividing the sample into country subgroups as they reflect different levels of financial development and institutional framework. In advanced countries, we obtained mainly negative coefficients, suggesting that macroprudential measures tend to be associated with lower cost of bank financing, in contrast to the sign of the positive relationship for some groups of macroprudential instruments obtained for emerging markets. We also find that the impact of macroprudential instruments on bank funding costs also depends on the objective of these measures, which is consistent with the results we obtained for estimates with individual macroprudential measures and indices set according to their common target. Moreover, with respect to funding costs, we find that macroprudential measures featured stronger effectiveness in the pre-crisis period, while these measures have stronger effects in the post-crisis period in advanced economies. Borrower-based measures and interbank limits appear to have the strongest relationship with bank funding costs and are effective in both advanced and emerging market economies.

Changes in the structure of bank funding and its cost no doubt exert a significant impact on the availability of credit, and hence on economic growth. The cost of bank financing is under the direct influence of monetary as well as microprudential and macroprudential policies and should be integrated into macroprudential stress tests. However, the way in which this impact is transmitted depends on various factors related to the development of macroeconomic and financial sectors as well as the position of individual banks (Beau, Hill, Hussain & Nixon, 2014; ECB, 2016). The significant differences in the impact on the cost of funding that emerge in our results after the introduction of macroprudential regulation in advanced and emerging countries confirm the need for national targeting of macroprudential policy by the policymakers, which should be adapted to the development conditions of each country and its financial sector (Poutineau & Vermandel, 2017). We see the opportunities for further research lying in the inclusion of information on the intensity of macroprudential measures. Further steps in examining this relationship might also include the restructuring of bank funding costs in order to observe the funding structure and differences in the impact of macroprudential measures.

2 TIGHTENING AND LOOSENING OF MACROPRUDENTIAL POLICY, ITS EFFECTS ON CREDIT GROWTH AND IMPLICATIONS FOR THE COVID-19 CRISIS*

2.1 Overview

In this study, we analyse the effects of macroprudential measures on bank lending in the European Union. We develop several dedicated macroprudential policy indices that reflect different policy actions taken by the authorities in individual member countries intended to affect credit activity in national banking sectors. In our empirical model, we measure the responsiveness of gross loans in banks to selected macroprudential policy indices, taking a set of bank-level and macroeconomic control variables into account. We use the Fitch Connect bank-level dataset with financial statements for 3,434 European banks with 18,616 observations and macroeconomic data provided by World Bank and IMF statistics covering the period between 2000 and 2017. Information on the use of macroprudential instruments is taken from a new macroprudential policy database, the MaPPED, gathered and published by the European Central Bank, from which we were able to extract information on both timing and direction of use of the macroprudential policy instruments. Our findings show that macroprudential instruments can be used effectively for the regulatory modulation of banks' credit activity, with the level of the effectiveness somewhat fluctuating through the business cycles. Therefore, during cycles of loosening, macroprudential measures are found to be strongly and positively associated with bank lending. In contrast, tightening actions are found to have a downward effect on bank lending, although these effects are less pronounced. These results are extremely important during the current crisis arising from the impact of COVID-19, as policymakers are trying to support the economy by easing the macroprudential regulatory constraints to ensure lending to the real sector.

2.2 Introduction

Financial stability concerns have been the dominant theme of many research papers and regulatory discussions, particularly following the 2008 global financial crisis. Focus has been given to establishing systemic regulatory mechanisms to protect the entire financial sector from the risks arising from financial institutions' interconnectedness and their procyclical behaviour. Macroprudential policy has been assigned with the role of systemic surveillance and stability. The Covid-19 crisis has once again placed macroprudential policy at the centre of academic and institutional discussions regarding its effectiveness in mitigating the worsening effects of the pandemic-related crisis on investments and economic growth. Although the recent crisis has triggered a significant decline in bank share prices, the crisis has not destabilised the financial sector. This might be a result of a shift in

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financial regulation, characterised by the introduction of stricter capital demands and various macroprudential tools following the 2008 financial crisis (Borri & Giorgio, 2021).

In the period leading up to the 2008 financial crisis, it was believed that microprudential measures were sufficient to ensure the financial sector's financial stability. Microprudential measures aim to ensure the safety of individual financial institutions and counter idiosyncratic risks, while macroprudential measures seek to protect the entire financial system by taking account of the interactions and interdependencies of individual financial institutions and systemic vulnerabilities, while limiting the collective exposure to system-wide risks (Aikman, Nelson & Tanaka, 2015). The shift from the micro to the macro perspective called for the calibration of macroprudential instruments in two dimensions: cross-sectional and time. The cross-sectional dimension of macroprudential policy requires a broader regulatory scope and an assessment of the system-wide importance of particular institutions. On the other hand, the time dimension requires macroprudential buffers to be tightened in good times and relaxed in downturns, namely the "countercyclical" approach. This approach could increase the probability of institutions surviving and ensure access to credit for the real economy, while reducing procyclical behaviour in the financial system (Borio, 2003).

Macroprudential measures are intended to address financial sector vulnerabilities that could trigger the development of systemic risk. As suggested by Yellen (2011), the risks manifest themselves in cyclical and structural forms, either through "too big to fail" concerns or through credit booms and soaring asset prices. Yellen (2011) adds that some policies address certain risks which are present in all economic conditions, while cyclical risks should be addressed with countercyclical tools with the goal of maintaining financial stability while ensuring that economic development can continue unimpeded. Countercyclical capital requirements imposed by the macroprudential regulator in good times can serve as an additional safety buffer in bad times. The dynamic nature of macroprudential instruments could contain banks' procyclicality more efficiently and reduce government spending in times of crisis (Jiménez, Ongena, Peydro & Saurina Salas, 2017).

The present crisis connected to the Covid-19 pandemic makes the effectiveness of macroprudential policy hugely important. In the crisis the effectiveness of countercyclical design should be demonstrated as policymakers loosen the built-up macroprudential buffers to allow credit to flow to the real economy (Araujo, Patnam, Popescu, Valencia & Yao, 2020; Nakatani, 2020). This calls for further evidence on the effectiveness of macroprudential policy, in particular on its easing cycles and their impact on credit availability.

The aim of this chapter is to investigate the impact of macroprudential policy on bank lending, using a sample of 3,434 European banks spanning over 28 EU countries and covering the period between 2000 and 2017. This study contributes to the literature on financial regulation in several ways. First, to our knowledge, this is the first study to examine

the effects of macroprudential policy on bank lending, using the recently collected and published database, MaPPED, covering all EU member states.[38] This database is unlike the existing datasets provided by Cerutti, Claessens and Laeven (2017), which only capture the presence of the instrument, or Lim et al. (2011), which captures the direction of tools but only covers a limited number of macroprudential instruments. The MaPPED contains information on a larger number of tools by covering over 50 policy instruments and recording their activation, tightening, loosening or deactivation, thereby providing complete information on the life of an instrument. Second, we study these effects using bank-level data that allow us to control for bank heterogeneity and the response of bank subsidiaries operating in different countries. The use of bank-level data also reduces the sensitivity of our analysis to endogeneity biases associated with the introduction of macroprudential measures.[39] Third, we are also able to analyse the tightening and loosening actions of macroprudential policy separately because the macroprudential policy database provides this information in full. This allows us to observe the life cycle of macroprudential policy instruments, the effects of the activation, tightening, easing and deactivation of the instruments, and how the instruments work over the cycle. Fourth, considering the objective of the macroprudential policies and the intention in activating them, we also examine the effectiveness of different groups of macroprudential instruments based on their particular objective.

Following Altunbas, Binici and Gambacorta (2018), we design our main macroprudential measures by summing all policy changes, both tightening and easing, over time. This permits us to capture the overall macroprudential stance in a given country and time period. A higher index value indicates a tighter stance, while a lower value of the index indicates a looser macroprudential policy stance. To investigate whether the tightening and easing measures have an asymmetric effect, we form additional indices that capture only tightening or only loosening actions. Further, we measure the effectiveness of different types of macroprudential instruments based on their initial target and objective. This approach was also followed by other studies (Cerutti, Claessens & Laeven, 2017; Meuleman & Vander Vennet, 2020; Olszak, Roszkowska & Kowalska, 2018). In the section on robustness checks, we additionally perform several tests by examining the effectiveness of groups of macroprudential instruments partitioned by their economic objective. To observe the relationship between macroprudential instruments and bank lending in different periods of the financial cycle, we run several estimations for the pre-crisis, crisis, and post-crisis periods. Finally, we also test whether macroprudential measures have stronger effects on a subsample of listed banks.

To account for the endogeneity biases associated with the introduction of macroprudential policies, we conduct the empirical analysis using the Arellano-Bond generalised method of

[38] Macroprudential Policies Evaluation Database, available at: https://www.ecb.europa.eu/pub/research/working-papers/html/mapped.en.html
[39] see Morgan, Regis and Salike, 2018 and Claessens, Ghosh and Mihet (2013).

moments estimator that corresponds to our small T and long N panel.[40] This estimator is referred to in the literature as a standard tool for the analysis of macroprudential measures (see Altunbas, Binici & Gambacorta, 2018; Cerutti, Claessens & Laeven, 2017; Morgan, Regis & Salike, 2018; Olszak, Roszkowska & Kowalska, 2018; Zhang & Zoli, 2016).

Our results show that macroprudential measures are significantly associated with credit cycle movements. Macroprudential indices are significantly and negatively associated with bank lending when controlling for different bank and macroeconomic variables. This indicates that the macroprudential policy framework is successful in curbing credit growth and limiting excessive bank lending. When we test tightening and loosening actions separately, we find that macroprudential loosening actions have a stronger effect on bank behaviour, i.e. when macroprudential measures are relaxed or deactivated we can expect banks to increase their lending activity. Testing various indices of macroprudential policy, we find similar results, establishing that credit-related macroprudential measures are the most effective in curbing excessive lending. Testing the macroprudential easing measures shows that capital- and credit-related instruments are positively associated and have the strongest relationship with credit activity. The results suggest that relaxing macroprudential tools during a downturn, such as the current one caused by the Covid-19 pandemic, can successfully improve market liquidity and support monetary policy efforts to stabilise credit supply in order to promote investment and economic growth. Nevertheless, various macroprudential measures still in place could alleviate concerns about deteriorating bank asset quality and keep bank capital from falling to dangerous levels.

The rest of the chapter is structured as follows. The next part presents an overview of existing studies in the field. In section 2.4, we describe the data and the methodological approach in the chapter and the findings. Section 2.5 presents extensions and additional robustness analysis, while section 2.6 concludes the chapter.

2.3 Existing literature and hypotheses development

The literature on macroprudential policy can be divided into three distinct categories: cross-country macro studies and single-country studies, both of which cover most of the existing macroprudential literature and, to a lesser extent, studies that combine macro- and firm-level data.

Some of the most important contributions to the field have been macro-level studies, which have also provided the first datasets on macroprudential instruments in different countries.

[40] Countries might take macroprudential measures in response to excessive credit activity or systemic risk concerns. This may lead to reverse causality in our dependent variable. However, using bank-level data makes macroprudential policy studies less prone to this bias as it is unlikely that regulators' decisions to apply macroprudential tools depend on the determinants of individual banks. It is more likely that these decisions depend on aggregate macroeconomic conditions (Cerutti, Claessens & Laeven, 2017 and Morgan, Regis & Salike, 2018).

One of these is the study by Lim et al. (2011), which uses a sample of 49 countries between 2000 and 2010 to show the effectiveness of macroprudential instruments in containing credit and debt financing and hence limiting the manifestation of systemic risks.

In a study by Cerutti, Claessens and Laeven (2017) which employs an extensive macroprudential database for 119 countries during the period 2000–2013, the authors analysed the effectiveness of macroprudential instruments in reducing credit growth and house prices. The paper shows that loan-to-value and debt-to-income limits, dynamic provisioning, and leverage ratio limits are the most effective for curbing excessive lending. The effects were found to be stronger in upturns, whereas macroprudential tools were found to be less effective in downturns. As the authors note, the impact of macroprudential measures depends on the level of economic development and capital openness of countries, and macroprudential measures were found to have a weaker relationship with credit growth in more open and financially developed economies than in developing countries.

Vandenbussche, Vogel and Detragiache (2013) found that reserve requirements associated with credit growth and restrictions on foreign-based financing have a strong impact on house price appreciation. Crowe, Dell'Ariccia, Igan and Rabanal (2013) established that macroprudential tools such as loan-to-value limits or dynamic provisioning are effective for dampening house prices. A paper by Bruno, Shim and Shin (2017), which investigates the effects of macroprudential instruments and capital flow management measures in 12 countries over the period 2004–2013, shows that capital flow management measures are associated with reductions in bank inflows, while also providing some evidence of the increased effectiveness of macroprudential policy when implemented in a manner that complements monetary policy measures. Dell' Ariccia et al. (2012) found that macroprudential policy could be effective in reducing the impact of and containing credit booms, while the authors also caution against possible circumvention and avoidance of these policies and the need for coordination with other macroeconomic policies.

Some studies combining both macro and micro data have examined the impact of macroprudential measures on overall bank risk. For example, a study by Claessens, Ghosh and Mihet (2013) confirmed that macroprudential measures are effective in curbing bank leverage and asset and non-core liability growth during upswings. A study by Altunbas, Binici and Gambacorta (2018) shows that macroprudential measures are significantly associated with banks' risk exposure and that the effects of these measures depend strongly on banks' characteristics. The authors also suggest that a tightening of macroprudential measures has stronger effects on bank risk. Zhang and Zoli (2016) examine whether macroprudential measures have an impact on financial stability in 13 Asian economies. The results reveal that borrower-based macroprudential measures and tax measures are effective for stabilising property prices, lending, and bank leverage.

Morgan, Regis and Salike (2018) analyse the effects of a specific macroprudential measure – the loan-to-value ratio – introduced in many countries in the period 2000–2013, using a panel of 4,000 banks. The results suggest that loan-to-value (LTV) ratios strongly affect banks' mortgage lending, while the impact is less pronounced for larger banks and banks with a high share of non-performing loans. They also suggest that the introduction of LTV should be followed by other macroprudential measures that could enhance and complement their effects. Igan and Kang (2011) analyse whether loan-to-value and debt-to-income limits dampen house prices and stabilise the housing market. Their results show that after the activation of borrower-targeting macroprudential measures, a significant stabilisation effect on prices is observed, while their activation, especially loan-to-value limits, also curbs expectations and speculative incentives.

Jiménez, Ongena, Peydro and Saurina Salas (2017) examine the effects of macroprudential measures on the procyclicality of credit and the supply of credit to firms. For the period 2000–2013, the authors study dynamic provisioning in Spain and find that this instrument constrains credit procyclicality and positively affects the credit supply to firms in bad times. The effects are weaker in good times and may also cause an increase in bank risk induced by the demand for higher profits. The paper points to the beneficial effects of increasing capital requirements in good times, which stabilises the supply of credit in bad times.

In a study by Akinci and Olmstead-Rumsey (2018) covering 57 countries, macroprudential policies are found to be effective in mitigating excessive lending and house prices. The most effective tools are those that target borrowers, such as loan-to-value and debt-to-income limits. In a recent paper by Gambacorta and Murcia (2019), the authors use central bank lending data from five Latin American countries to examine the impact of macroprudential policies on bank lending and find that macroprudential policies are effective in mitigating the procyclicality of lending, while the impact is amplified when combined with tight monetary policy.

In summary, the literature shows that macroprudential measures are associated with restrained credit growth (Akinci & Olmstead-Rumsey, 2018; Cerutti, Claessens & Laeven, 2017; Gambacorta & Murcia, 2019; Lim et al., 2011; Morgan, Regis & Salike, 2018). To test whether macroprudential instruments have a mitigating effect on lending in the banking sector in the European Union (EU), we develop our first hypothesis using the macroprudential policy database (Budnik & Kleibl, 2018) containing extensive information on over 50 policy instruments.

H1. Macroprudential policy measures are significantly and negatively associated with bank lending volumes.

We test this hypothesis by examining the overall impact of the macroprudential policy stance in a country on banking sector lending, as captured by the aggregate macroprudential indices.

Since the database captures all instances of the activation, tightening and loosening of all macroprudential instruments, we can test the effectiveness of these policy actions separately. Given that macroprudential instruments were mostly introduced as tightening measures during the period under consideration, requiring banks to either raise more capital, restrict lending to borrowers, or hold more liquid assets, we expect a negative relationship between the macroprudential policy index and lending. On the other hand, if macroprudential measures are loosened, we expect a positive relationship with credit growth, like in Poghosyan (2020). Accordingly, we develop the following hypotheses.

H2a. Tightening policy actions of macroprudential policy are negatively associated with bank lending.

H2b. Bank lending activity increases in response to macroprudential policy easing.

We test these hypotheses by studying the relationship between indices that capture only tightening actions or only loosening actions and bank lending.

Following previous evidence (Cerutti, Claessens & Laeven, 2017; Morgan, Regis & Salike, 2018) and considering the goal of macroprudential tools of directly targeting the credit market and limiting excessive lending and overheating in the mortgage market, we expect credit-related instruments to be the most effective in curbing credit growth. We thus develop the fourth hypothesis.

H3. Credit-related macroprudential measures have the strongest association with the curbing of bank lending.

2.4 Data and methodology

To conduct our analysis, we combine bank- and country-level data obtained from different databases. For macroprudential data, we use the recently published database, the MaPPED, collected by ECB researchers and national authorities (Budnik & Kleibl, 2018). This database is based on a survey conducted with the help of national authorities in EU countries. The MaPPED provides data on prudential and macroprudential measures covering 1,700 actions and 53 prudential instruments grouped into 11 categories according to their objective. The database shows the life span of an instrument: its introduction, tightening or loosening actions, and its deactivation. The database also captures some policy measures that are ambiguous in nature, which we exclude from our analysis because we wish to capture the accurate direction of the policy. We also exclude policies introduced by

the regulator by way of recommendations, meaning that our analysis only captures measures that are binding on banks.[41] We are able to construct different indices for prudential measures, either the overall direction of macroprudential policy in a country in a given period or indices based on the direction of the measures, i.e. whether the macroprudential measure was introduced as a tightening or easing tool.[42] In addition, the database offers the possibility of measuring the effectiveness of macroprudential instruments with regard to their objective.

2.4.1 Macroprudential policy measurement design

The MaPPED database is based on a survey designed to capture the majority of regulatory actions over time. It was conducted with the help of the central banks of the participating countries and other regulatory and supervisory institutions. The policy instruments the database encompasses are macroprudential or have a macroprudential character, meaning that they affect the entire financial sector. The MaPPED describes the complete life of a policy instrument, distinguishing three possible responses to the question of changes and policy actions: a) tightening, b) loosening, and c) other and with an ambiguous effect.[43] We capture these changes numerically by assigning 1 to tightening policy actions, -1 to loosening policy actions, and 0 to no change or actions with other and ambiguous effects (see Altunbas, Binici & Gambacorta, 2018). This information is captured in the database on a monthly and quarterly basis, and since our bank-level data is available on an annual basis, we capture policy changes across quarters and then sum them to obtain annualised information. Using this approach, we obtain an annual policy stance with a positive or negative sign, while we can also obtain 0 if the summed measures cancel each other out or if there were no changes in the respective period.

Given the design and construction of the MaPPED database, we form six indices of macroprudential stance. First, we sum all annualised indicators of macroprudential policy

[41] The MaPPED database offers information on both: legally binding macroprudential measures adopted by the regulator or recommendations set by the regulator. Legally binding measures are usually adopted through legislation or a rule/decree/regulation by a central bank or another regulatory authority. Violating the binding measure can result in serious fines and procedures. On the other hand, recommendations or guidelines are implemented in a "comply-or-explain" form (Budnik & Kleibl, 2018). We decide to exclude the recommendations to be able to accurately measure the impact of the binding macroprudential tools on bank lending, which banks must adhere to.

[42] To develop these indices, we follow several approaches from the literature (see Akinci & Olmstead-Rumsey, 2018; Altunbas, Binici & Gambacorta, 2018; Garcia Revelo, Lucotte & Pradines-Jobet, 2020; Lim et al., 2011).

[43] Tightening policy actions resulted either through the activation of macroprudential instruments or the recalibration of existing ones. Furthermore, the loosening policy actions resulted from the deactivation of the existing instruments or their recalibration. Lastly, policy actions denoted as ambiguous are associated with either the maintenance of the same level and scope of the already activated instruments or their recalibration (Budnik & Kleibl, 2018). Other and ambiguous policy actions do not result neither with a tightening nor the loosening of the instrument, or there is not enough information to determine the direction of the policy. For this reason, we exclude these policy actions, and keep only policy actions denoted as loosening or tightening of macroprudential policy.

actions across all countries in the sample consisting of all macroprudential measures and form the *MPP* index. We construct additional indices as an alternative measure of the macroprudential stance or a measure specifically designed to capture either periods of policy tightening or easing. Finally, we also construct various indices based on the target of these measures.

The *MPP* index is the sum of all policy actions over the macroprudential instruments recorded in the database. The index can take values from -4 to 9 within our sample and time coverage. A lower index value indicates a looser macroprudential policy stance, or simply put, more macroprudential policy easing actions were activated during this period. A higher value of the index indicates a tighter macroprudential policy, with more tightening policy actions. The design of the index is given below:

$$MPP_{k,t} = \sum_j X_{j,k,t} \tag{2}$$

$X_{j,k,t}$ represents each policy action attached to the respective macroprudential instrument in country k and time t. As this index represents the sum of all policy actions (tightening and easing), a higher value of this measurement represents a macroprudential policy with a tightening stance. On the contrary, a lower or negative value indicates a looser macroprudential policy stance within a given period.[44]

In order to test the robustness of our results to an alternative kind of measurement, we design our second index *MPP2* similarly to the former, but here the index is bounded and can take a value of -1, 0 and 1 (for an application, see Garcia Revelo, Lucotte & Pradines-Jobet, 2020). It is constructed based on the overall macroprudential stance and orientation of the policy in countries over different periods. The index's construction is shown below:

$$MPP2_{k,t} = \begin{cases} 1 & if \quad \sum_j X_{j,k,t} > 0 \\ 0 & if \quad \sum_j X_{j,k,t} = 0 \\ -1 & if \quad \sum_j X_{j,k,t} < 0 \end{cases} \tag{3}$$

where $MPP2_{k,t}$ = {-1,1}. It is equal to 1 if the stance of the macroprudential policy in respective country k and year t has a tightening nature, which means the $\sum_j X_{j,k,t}$ is higher than 0 and indicates a restrictive macroprudential stance. It thus follows that the number of instances of tightening exceeds the number of instances of loosening policy actions. Otherwise, when the macroprudential stance in country k at time t is of a loosening nature and more relaxed, $\sum_j X_{j,k,t}$ is lower than 0, which means there were more loosening macroprudential actions in the respective period.

[44] $X_{j,k,t}$ represents the annualized sum of each policy action attached to the respective macroprudential instrument in country k and time t (see Table 2.1). It can have both positive (tightening policy actions denoted with +1) and negative (loosening policy actions denoted with -1) values or the value of 0 (if in that year in a certain country an instrument was not activated in any of the quarters so the annualized value is 0, or if two policy actions with opposite signs cancel each other out).

We also construct several indices to serve as an additional measurement in order to ensure the accurateness and robustness of our results, while minimising the limitations of our initial indices. The limitations of MPP and MPP2 are seen in the fact that these measures take account of all policy actions, all instances of tightening and loosening of all instruments, yet they do not show the direction of the policies. Meanwhile, due to design of the indices, some of these policy actions, when summed up, cancel each other out, thus neutralising their effect. Accounting for the separate effects of tightening and loosening actions of macroprudential policy is relevant and may be seen as a major contribution of the study.

With the next four indices, we aim to separately measure the effects of the tightening and loosening actions of macroprudential policy and distinguish between these two directions of policy action. Our third macroprudential index, MPP3, takes the macroprudential stance into account, and is equal to 1 if the sum of all policy actions is higher than 0, which reflects a tightened macroprudential stance. The index's design is as follows:

$$MPP3_{k,t} = \begin{cases} 1 & if \quad \sum_j X_{j,k,t} > 0 \\ 0 & if \quad \sum_j X_{j,k,t} \leq 0 \end{cases} \tag{4}$$

where $MPP3_{k,t} = \{0,1\}$. It is equal to 1 if the stance of the macroprudential policy in respective country k and year t has a tightening nature, which means $\sum_j X_{j,k,t}$ is higher than 0 and indicates a restrictive macroprudential stance. If $\sum_j X_{j,k,t}$ is equal to or lower than 0, the index takes the value of 0.

Our next index, MPP4, considers the loosening stance of macroprudential policy in a certain period.

$$MPP4_{k,t} = \begin{cases} 1 & if \quad \sum_j X_{j,k,t} < 0 \\ 0 & if \quad \sum_j X_{j,k,t} \geq 0 \end{cases} \tag{5}$$

where $MPP4_{k,t} = \{0,1\}$. It is equal to 1 if the stance of the macroprudential policy in respective country k and year t has a loosening nature, which means $\sum_j X_{j,k,t}$ is lower than 0 and indicates a looser macroprudential stance. If $\sum_j X_{j,k,t}$ is equal to or higher than 0, the index takes the value of 0.

However, the potential limitation of our previous indices MPP3 and MPP4, whose values lie between 0 and 1, is that they do not weight the macroprudential stance by considering the number of tightening or loosening policy actions in a certain period. One possibility for measuring how restrictive macroprudential policy is during a given period of time is to take the sum of all tightening policy actions, leaving 0 for all the loosening policy actions and if there is no change. The index's design is given below:

$$MPP5_{k,t} = \sum_r X_{r,k,t} \tag{6}$$

where $MPP5_{k,t}$ corresponds to the sum of all restrictive (tightening) policy actions in respective country k and year t. The higher the value of this index, the more restrictive the macroprudential stance. On the contrary, a lower value indicates a less restrictive macroprudential policy stance within a certain period.

We do the same to measure a loosening macroprudential policy stance as we only take account of loosening policy actions with our last index, MPP6, whose design is as follows:

$$MPP6_{k,t} = \sum_l X_{l,k,t} \quad (7)$$

where $MPP6_{k,t}$ equals the sum of all loosening policy actions in country k and year t. The higher the value of the index, the more relaxed the macroprudential policy stance in a given period.[45]

To show the design and structure of our macroprudential measures, we review exemplary country case studies of Cyprus and Lithuania for 2011 (see Table 2.1). The table shows the path of our indices' design, from recording the policy actions over quarters, annualising them and, finally, putting together macroprudential indices.

Table 2.1 Exemplary design of macroprudential indices based on country cases of Cyprus and Lithuania in 2011

	Cyprus			*Lithuania*		
Macroprudential instruments	Tax on assets/liabilities	Single-client exposure limits	Sector and market segment exposure limits	Loan to value	Debt Service to Income	Maturity and amortisation restrictions
Policy actions in quarters: Tightening: (+1) Loosening: (-1)	Q1:0 Q2:1 Q3:0 Q4:0	Q1: -1 Q2:0 Q3:0 Q4:0	Q1:1 Q2:0 Q3:0 Q4:0	Q1:0 Q2:0 Q3:0 Q4:1	Q1:0 Q2:0 Q3:0 Q4:1	Q1:0 Q2:0 Q3:0 Q4:1
Policy actions annualised ($X_{j,k,t}$)	1	-1	1	1	1	1
Number of tightening actions	2			3		
Number of loosening actions	1			0		
MPP	1			3		
MPP2	1			1		
MPP3	1			1		
MPP4	0			0		
MPP5	2			3		
MPP6	1			0		

Source: Budnik and Kleibl, 2018: Macroprudential Policies Evaluation Database (MaPPED), based on authors' elaboration

[45] Since we code loosening actions with -1, in the process of constructing the MPP6 index we multiply the index with -1 to have a comparable measurement similar to the MPP5 index.

2.4.2 Bank- and country-level data

We collect bank-level data from the platform Fitch Connect. The sample includes data from 3,434 banks, with balance sheet and income statement data for the period between 2000 and 2017. We cover data for all EU member states, including commercial, savings and cooperative banks and both inactive and active banks.[46] We exclude negative values for total assets and gross loans and winsorise all other variables at the 1% level at both ends of the distribution. Summary statistics of the bank variables can be found in Table 2.2. The database was checked for double counting and all duplicate observations were manually removed. All bank statements are annual and denominated in US dollars. In the unbalanced panel, we include all banks with data available for our dependent variable for two consecutive years, with the average bank observed for five periods. Since most macroprudential measures are introduced by national authorities, we analyse unconsolidated bank data to capture the impact on individual bank subsidiaries.

To control for macroeconomic differences across countries in the sample, we include several macroeconomic variables by drawing on the IMF data platform International Financial Statistics along with World Bank, and national central bank databases. Summary statistics for country variables are presented in Table 2.3.[47]

Table 2.2 Summary statistics of bank variables

Variable	Observations	Mean	Std. Dev.	Min	Max
Gross loans (USD, million)	18,616	2, 830	9,720	0.93	75,400
Gross loans (logs)	18,616	19.871	1.779	13.743	25.045
Size (total assets, logs)	18,616	20.431	1.721	15.115	25.746
Liquidity ratio (%)	16,186	15.081	20.151	0	94.52
Tier 1 ratio (%)	18,616	16.452	8.532	5.73	66.4
Loans to deposits (logs)	18,430	4.640	0.787	1.188	10.589
Loan loss provisioning (%)	18,207	0.666	1.464	-4.07	15.99
Market share (%)	18,616	0.761	3.848	0.0000142	81.985
Commercial (0-1)	18,616	0.237	0.425	0	1
Savings (0-1)	18,616	0.188	0.391	0	1
Cooperative (0-1)	18,616	0.575	0.494	0	1

Note: Summary statistics reflect the period 2000–2017. All variables, except categorical ones, are winsorised 1% on both tails of the distribution.

[46] We included all banks in the period covered, even if they had withdrawn from the market in a given year for various reasons such as merger and acquisition activity, or if the banks were liquidated or went bankrupt. This also means that our sample does not suffer from a survival bias (Košak, Li, Lončarski & Marinč, 2015).
[47] For description of all variables used in regression analysis and their sources, see Appendix B, Table B.2.

Table 2.3 Summary statistics of country variables

Variable	Observations	Mean	Std. Dev.	Min	Max
Macroeconomic variables					
Δ Policy rate	18,616	-0.182	0.608	-10.46	4.5
GDP growth (%)	18,616	0.741	2.167	-6.600	10
Credit to private sector (%)	18,554	89.959	28.038	26.280	191.189
Gross capital formation growth (%)	18,616	-0.125	6.887	-19.465	20.058
NPL gross (%)	15,020	6.348	5.013	0.379	18.064
Inflation rate (%)	18,616	1.707	1.253	-0.791	21.458
Macroprudential data					
Indices – all actions					
MPP	18,616	0.704	1.216	-4	9
MPP2	18,616	0.323	0.621	-1	1
MPP3	18,616	0.406	0.491	0	1
MPP4	18,616	0.084	0.277	0	1
MPP5	18,616	0.868	1.185	0	9
MPP6	18,616	0.164	0.458	0	6
Indices by target					
Credit	18,616	0.103	0.513	-4	4
Market liquidity	18,616	0.031	0.338	-1	5
Concentration	18,616	0.044	0.395	-3	3
Resilience	18,616	0.526	0.789	-2	4
Sub-indices by target					
Credit growth	18,616	0.002	0.140	-3	4
Lending caps	18,616	0.042	0.293	-3	4
Risk weights	18,616	0.059	0.400	-2	2
Liquidity measures	18,616	0.031	0.338	-1	5
Exposures	18,616	0.044	0.395	-3	3
MCR	18,616	0.336	0.695	-1	3
Capital buffers	18,616	0.089	0.348	-1	3
Taxes	18,616	0.027	0.173	-1	2
Provisioning	18,616	0.000	0.118	-2	2
Other requirements	18,616	0.072	0.271	-3	2
Leverage ratio	18,616	0.003	0.050	0	1

Note: Summary statistics is for the period 2000–2017. All variables are lagged for one period, except policy rate which was transformed with first difference. All variables apart from indicator variables are winsorised 1% on both tails of the distribution.

2.4.3 Empirical model and findings

To examine the effects of macroprudential policies on bank loans, we specify the following model.

$$Y_{j,t} = \alpha Y_{j,t-1} + \beta MaPru_{j,t-1} + \gamma X_{j,t} + \delta Z_{j,t-1} + \lambda_j + \theta_t + \varepsilon_{j,t} \quad (8)$$

where $Y_{j,t}$ is the dependent variable, measured by the logarithm of gross loans. $Y_{j,t-1}$ represents the lagged dependent variable included on the right-hand side to account for an underlying autoregressive process. $MaPru_{j,t}$ represents the macroprudential index, our variable of interest, which is captured by different measurements. We expect that macroprudential measures are negatively associated with developments in lending activity (Akinci & Olmstead-Rumsey, 2018; Cerutti, Claessens & Laeven, 2017; Gambacorta & Murcia, 2019), although some studies have revealed a positive association of some macroprudential tools (Lim et al., 2011).

$X_{j,t}$ represents the vector of bank variables. In the main regressions, bank size, measured by the logarithm of total assets, and tier 1 capital ratio are included as bank controls. At various stages of the analysis, the liquidity ratio, measured by the ratio of liquid assets to total assets, and the loans-to-deposit ratio, which shows the funding position of a bank, are also included. As an important factor of the bank's credit activity and risk assessment, we additionally test for the relevance of loan loss provisions (LLP), measured by the ratio of loan loss provisions to gross loans. To control for a bank's market power, we include market share measured by the size of the bank relative to the total assets of the entire banking sector in a country. Finally, we also test for the relevance of the bank's specialisation by using dummies indicating whether it is a commercial, savings or cooperative bank. $Z_{j,t-1}$ is a vector of macroeconomic variables. All regressions include the change in the policy rate, while at different stages we include the real GDP growth rate, private sector credit as a percentage of GDP, gross capital formation growth, the gross NPL rate, the level of gross non-performing loans as a percentage of a country's GDP, and the inflation rate. λ_j and θ_t are bank- and time-fixed effects, while $\varepsilon_{j,t}$ is the error term.

The introduction of the lagged dependent variable on the right-hand side raises endogeneity problems. According to Nickell (1981), the lagged dependent variable is correlated with the error term for small T-panel data and in the presence of fixed effects, leading to general biases associated with dynamic panel models. To control for endogeneity, the literature suggests use of the dynamic generalised method of moments. The choice of this method is also appropriate for our small T and large N sample. Another endogeneity problem arises from the introduction of macroprudential measures in countries with elevated credit activity and systemic risk concerns. Namely, when countries experience an unsteady increase in overall credit activity that is accompanied by financial stability concerns, they are more likely to enforce macroprudential measures. Since we expect a negative association of the implementation of macroprudential measures with credit growth, especially because most macroprudential measures are introduced as tightening measures, we are concerned that this effect may arise as a result of reverse causality. The GMM estimation method should reduce such endogeneity concerns. Moreover, by using bank-level data, our estimates are less prone to endogeneity than macro-level studies as the credit levels of individual banks are less

relevant to policymakers while selecting regulatory instruments (Claessens, Ghosh & Mihet, 2013 and Morgan, Regis & Salike, 2018). Finally, we lag our country variables by one period to further reduce endogeneity problems.

Since the summary statistics presented in Table 2.2 show considerable variability and differences in our bank variables, such as the liquidity ratio and the loans to deposits ratio, which reveal the different liquidity and funding strategies of the banks in our sample, we are concerned about possible effects of outliers. To address such outlier concerns, all variables, except indicator variables, are winsorised by 1% at both tails of the distribution. Since our sample consists of 28 EU countries, each with different numbers of banks and observations in the database, we also include weights that give each country equal importance in all our regression estimates. The weights are constructed as the inverse of the sum of each country's observations.

2.4.4 Base results

We start our analysis with the baseline model consisting of four variables on the right-hand side: the lagged dependent variable, a bank's gross loans transformed into the natural logarithm, and other variables on the bank level: size, measured by total assets and transformed into the natural logarithm, tier 1 capital ratio and, finally, the change in the policy rate as a country-level determinant. Bank size should show whether large banks lend more due to their size and access to many different forms of funding, while the tier 1 capital ratio shows a bank's overall capital position. The central bank policy rate is an important indicator of credit market developments associated with monetary policy decisions.

The following dynamic panel data model is specified as:

$$Y_{j,t} = \alpha Y_{j,\,t-1} + \gamma X_{j,t} + \delta Z_{j,t-1} + \lambda_j + \theta_t + \varepsilon_{j,t} \qquad (9)$$

where the dependent variable is gross loans transformed into the natural logarithm of bank j at time t, $Y_{j,t}$, as a function of lagged dependent variable $Y_{j,t-1}$, and vector of bank (X) and lagged macroeconomic (Z) variables. λ_j and θ_t are bank- and time-fixed effects, while $\varepsilon_{j,t}$ is the disturbance term.

Although we have already chosen system-GMM as the primary estimation method, like in Morgan, Regis and Salike (2018) we decide to also estimate this model using ordinary least squares (OLS) and a fixed effects panel estimator (FE) to compare the magnitude of the coefficients of the lagged dependent variable. When the coefficient of the lagged dependent variable is greater than zero, its OLS estimate is biased upward, while the fixed effects estimate is biased downward due to the correlation between the lagged dependent variable and the error term (Nickell, 1981). Since the system GMM estimator uses instruments in levels and first differences and reduces endogeneity bias, we expect the GMM estimate of the lagged coefficient of the dependent variable to lie between the OLS and FE estimates.

Table 2.4 presents the estimation results of equation 9. Looking at the coefficient of the lagged dependent variable, we can see that the OLS estimate (0.847) is biased upward while the FE estimate (0.380) is biased downward. The GMM estimates are within the interval 0.380–0.847 with coefficients around 0.7, as expected. This reinforces our decision to choose the system GMM as the main estimator.

Since the GMM two-step estimator is applied together with a Windmeijer correction for small samples and robust standard errors (Windmeijer, 2005), we estimate all of our subsequent regressions with this estimator. We use up to 5 lags of the dependent variable as instruments to address the endogeneity problem, while instrumenting our exogenous variables with their lags in levels. The lagged dependent variable is treated as endogenous variable and all other variables as exogenous. In all regressions, we include year dummies to control for unobserved heterogeneity over time. To check whether our estimates are consistent, we need to confirm whether the chosen instruments are valid and whether the residuals show serial correlation. We check the choice of instruments with the Hansen test for overidentifying restrictions and the autocorrelation of the residuals with first- and second-order autocorrelation tests (see Arellano & Bond, 1991; Baum, 2013; Roodman, 2009). In the case of the first-order autocorrelation test, the error term is expected to be correlated, and in the case of the second-order serial correlation test we should not reject the null hypothesis of the absence of a second-order autocorrelation. When it comes to Hansen's test, we should not reject the null hypothesis that the overidentification restrictions are valid. Table 2.4 shows these tests, namely first-, AR (1) and second-order autocorrelation tests, AR (2) and overidentification test of the restrictions, Hansen's J-test, which confirms that our estimates are consistent.

In column 5, we introduce the MPP index, which measures the overall stance of a macroprudential policy. The index is lagged by one period, and its coefficient, obtained using the GMM two-step system estimator, is statistically significant at the 5% level and has a negative sign, as expected. Consistent with previous findings on macroprudential policy, our empirical results show that tighter macroprudential policy is associated with a decrease in the supply of credit. For a one-unit increase in the MPP index indicating a tightening of policy, we find a negative effect of -0.76% on credit supply. The coefficient on bank size is statistically significant and positively associated with bank lending, while the tier 1 ratio is statistically significant and negatively associated with bank lending. The policy rate is not significantly associated with the dependent variable in this specification. This may indicate that monetary policy is less effective in dampening credit growth during the period under consideration, which is characterised by an expansionary monetary policy and historically low interest rates (Borio & Gambacorta, 2017).

Table 2.4 Comparison of different estimation methods of our initial model

	(1) OLS	(2) FE	(3) GMM one-step	(4) GMM two-step	(5) GMM two-step
Dependent variable (lag)	0.847***	0.380***	0.730***	0.765***	0.765***
	(27.01)	(4.36)	(7.96)	(13.66)	(16.20)
Size (total assets, logs)	0.142***	0.648***	0.255***	0.226***	0.226***
	(4.45)	(4.70)	(2.82)	(4.03)	(4.75)
Tier 1 ratio	-0.00556***	-0.000537	-0.00803***	-0.00698***	-0.00699***
	(-4.36)	(-0.18)	(-3.67)	(-5.10)	(-5.57)
Δ Policy rate	-0.00908	0.00390	-0.0103	-0.00885	-0.00828
	(-1.23)	(0.60)	(-1.59)	(-1.55)	(-1.40)
MPP (lag)					**-0.00759****
					(-2.01)
Observations	18616	18616	18616	18616	18616
Instruments			77	77	78
AR (1)			0.039	0.070	0.068
AR (2)			0.166	0.172	0.186
Hansen			0.260	0.260	0.226

Note: The dependent variable is gross loans in logs. OLS (column 1) stands for ordinary least squares, while FE (column 2) stands for the panel fixed effects estimation method. The estimation method in columns 3–5 is a dynamic one-step (3) or two-step (4–5) system generalised method of moments (GMM) estimator with robust standard errors and a Windmeijer correction. The lagged dependent variable is treated as endogenous, and all other variables as exogenous. All regressions include year fixed effects. T statistics are reported in parentheses. All regressions include weights based on the number of observations of each country. Macroeconomic variables are lagged one period, while all variables, apart from indicators, are winsorised 1% on both tails of the distribution. The following are p-values indicating the significance level of coefficients: * p < 0.10, ** p < 0.05, *** p < 0.01.

Table 2.5 shows the estimates for equation 8, with an extended set of variables designed to control for various bank characteristics. These results were obtained using two alternative macroprudential measures, the MPP index (right) and the MPP2 index (left). To allow for a better comparison of the results, we report the estimates in the same table. Banks' control variables were introduced at different stages of the regression analysis. In addition to bank size and the tier 1 capital ratio, which were already introduced in our baseline model, we include the liquidity ratio to capture the quality of short-term asset management at an individual bank and the overall liquidity position. To control for the funding structure of banks, we enter the ratio of loans to deposits, transformed into logarithms. To control for asset quality and banks' assessment of credit risk based on estimated loan losses, we also introduce the ratio of loan loss provisions to gross loans (LLP). Then, to control for banks' market power, we include market share, a variable formed by the size of a bank's total assets standardised to the total size of the banking sector for a given country. Finally, we also include dummy variables indicating the bank's specialisation: Commercial, Cooperative or

Savings. These variables were chosen to take account of the overall performance and health of the bank.[48]

In six out of seven model specifications, the coefficient of the MPP index remains statistically significant and negative in sign, supporting our first hypothesis. For a one-unit increase in the MPP index, we find a negative impact of -0.5% to -0.8% on credit supply. The results obtained with our alternative measure, the MPP2 index, show similar results, with the second measure revealing a stronger relationship with bank lending. A one-unit increase in the MPP2 index is associated with a decrease in credit supply of -2.26% to -2.99%. These results suggest the effectiveness of macroprudential policy in mitigating credit booms, while supporting the view that macroprudential policy should be given the primary mandate of promoting financial stability (Martinez-Miera & Repullo, 2019). The results also warn of the importance of the comparison of different measurements of the macroprudential stance in related studies being reflected in the difference in the coefficients obtained.

Bank size is statistically significant at the 1% level and shows a positive association with credit supply in all estimations. On the other hand, the tier 1 capital ratio remains statistically significant and with a negative sign in all estimations. The liquidity ratio is statistically significant at the 5% and 10% levels and with a negative coefficient in most specifications, indicating that an increase in liquid assets is associated with a decrease in credit activity. The loans-to-deposits ratio is positively associated with lending activity and statistically significant at the 1% level. LLP, entered in columns 3 and 10, is statistically significant and negatively associated with lending. These estimates suggest that an increase in loan loss provisioning hinders credit activity in banks. Policy rate is not significantly associated with bank lending in majority of these specifications. To summarise, the coefficients on bank controls show that larger banks and better performing banks with stable sources of funding tend to lend more. The estimations also show that liquidity needs or capital demands can hinder bank lending activities. On the other side, a rise in loan loss provisioning could indicate an increase in credit risk assessments, which might also prompt banks to reduce their loan supply. This can come as a result of the procyclicality of loan loss provisioning, caused by a delay in provisioning during economic downturn (Laeven & Majnoni, 2003). Our results show a negative relationship between loan loss provisioning and bank lending, in line with Pool, de Haan and Jacobs (2015) and Bouvatier and Lepetit (2013). We find market share to be significantly and positively associated with bank lending. Numerous studies have shown that banks with greater market power have access to many alternative sources of financing, along with easier access to financial markets, which allows them to lend more than banks with smaller market shares. These effects were found for normal times and for periods of economic downturn (Cubillas & Suárez, 2018 and Fungáčová, Solanko

[48] For a similar variables selection approach see Hasan, Liu and Zhang, (2016); Demirgüç-Kunt and Huizinga, (2010) and Garcia Revelo, Lucotte and Pradines-Jobet (2020).

& Weill, 2014). Among the specialisation dummies, only the coefficient received for savings banks is significantly associated with bank lending, but only on the 10-percent level. This may be a result of savings banks' business model characteristics that largely focus on the lending business.

Table 2.5 The impact of macroprudential policy on bank lending – bank controls

	MPP								*MPP2*						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)		(8)	(9)	(10)	(11)	(12)	(13)	(14)
Dependent variable (lag)	0.735***	0.692***	0.783***	0.697***	0.688***	0.693***	0.689***	Dependent variable (lag)	0.736***	0.688***	0.768***	0.693***	0.685***	0.688***	0.685***
	(12.42)	(7.69)	(10.47)	(7.45)	(7.38)	(7.63)	(7.49)		(13.18)	(8.26)	(10.20)	(7.48)	(8.00)	(8.14)	(8.12)
MPP (lag)	**-0.00568**	**-0.00782****	**-0.00886****	**-0.00819****	**-0.00767****	**-0.00812****	**-0.00773****	**MPP2 (lag)**	**-0.0232****	**-0.0287*****	**-0.0226****	**-0.0298*****	**-0.0296*****	**-0.0299*****	**-0.0288*****
	(-1.43)	**(-2.05)**	**(-2.23)**	**(-2.11)**	**(-2.03)**	**(-2.09)**	**(-2.05)**		**(-2.23)**	**(-2.80)**	**(-2.31)**	**(-2.87)**	**(-2.82)**	**(-2.79)**	**(-2.82)**
Size (total assets, logs)	0.253***	0.286***	0.202***	0.268***	0.293***	0.287***	0.290***	Size (total assets, logs)	0.251***	0.290***	0.217***	0.271***	0.296***	0.291***	0.293***
	(4.37)	(3.32)	(2.80)	(3.10)	(3.23)	(3.28)	(3.27)		(4.66)	(3.64)	(3.01)	(3.15)	(3.56)	(3.58)	(3.61)
Tier 1 ratio	-0.00762***	-0.00827***	-0.00570***	-0.00802***	-0.00826***	-0.00821***	-0.00832***	Tier 1 ratio	-0.00737***	-0.00830***	-0.00596***	-0.00800***	-0.00832***	-0.00827***	-0.00836***
	(-4.53)	(-4.43)	(-3.21)	(-4.05)	(-4.34)	(-4.39)	(-4.40)		(-4.19)	(-4.48)	(-3.42)	(-4.05)	(-4.32)	(-4.39)	(-4.46)
Liquidity ratio	-0.00145**	-0.00111*	-0.000549	-0.00102*	-0.001000*	-0.00105*	-0.00110*	Liquidity ratio	-0.00149**	-0.00115*	-0.000682	-0.00103**	-0.00102*	-0.00109*	-0.00113*
	(-2.00)	(-1.73)	(-0.74)	(-1.90)	(-1.66)	(-1.67)	(-1.75)		(-2.26)	(-1.87)	(-0.94)	(-1.99)	(-1.74)	(-1.80)	(-1.87)
Δ Policy rate	-0.00700	-0.00837	-0.00665	-0.00485	-0.00905	-0.00829	-0.00866	Δ Policy rate	-0.00686	-0.00950	-0.00781	-0.00610	-0.0102*	-0.00941	-0.00981*
	(-1.13)	(-1.41)	(-1.12)	(-0.74)	(-1.48)	(-1.38)	(-1.43)		(-1.07)	(-1.64)	(-1.33)	(-0.95)	(-1.70)	(-1.61)	(-1.67)
Loans to deposits (logs)		0.109***	0.0687**	0.109***	0.110***	0.109***	0.109***	Loans to deposits (logs)		0.110***	0.0732**	0.109***	0.111***	0.110***	0.111***
		(2.93)	(2.52)	(2.80)	(2.87)	(2.91)	(2.91)			(3.15)	(2.54)	(2.94)	(3.09)	(3.11)	(3.14)
LLP			-0.0119***					LLP			-0.0128***				
			(-3.54)								(-3.62)				
Market share				0.00472***				Market share				0.00476***			
				(3.16)								(3.38)			
Commercial					-0.0269			Commercial					-0.0282		
					(-1.20)								(-1.39)		
Savings						0.0347*		Savings						0.0355*	
						(1.78)								(1.93)	
Cooperative							0.00596	Cooperative							0.00730
							(0.33)								(0.43)
Observations	16,186	16,065	15,771	16,065	16,065	16,065	16,065	Observations	16,186	16,065	15,771	16065	16065	16065	16065
Instruments	79	80	81	81	81	81	81	Instruments	79	80	81	81	81	81	81
AR (1)	0.108	0.108	0.000201	0.106	0.108	0.108	0.108	AR (1)	0.104	0.102	0.000102	0.101	0.102	0.102	0.102
AR (2)	0.344	0.465	0.247	0.484	0.461	0.465	0.463	AR (2)	0.356	0.450	0.272	0.478	0.442	0.449	0.446
Hansen	0.324	0.582	0.117	0.461	0.595	0.577	0.586	Hansen	0.334	0.589	0.0979	0.483	0.612	0.582	0.598

Note: The dependent variable is gross loans in logs. The estimation method is a dynamic two-step system generalised method of moments (GMM) estimator with robust standard errors and a Windmeijer correction. The lagged dependent variable is treated as endogenous, and all other variables as exogenous. All regressions include year fixed effects. T statistics are reported in parentheses. All regressions include weights based on the number of observations of each country. Macroeconomic variables are lagged one period, while all variables, apart from indicators variables, are winsorised 1% on both tails of the distribution. The following are p-values indicating the significance level of coefficients: * p < 0.10, ** p < 0.05, *** p < 0.01.

Table 2.6 shows estimations with different macroeconomic variables introduced in the model. The most relevant bank variables from the previous analysis remain in the set of controls for these regressions. To complement our bank controls, we include additional macroeconomic variables in different stages of the analysis. First, we include the GDP real growth rate as our proxy for credit demand and economic development. We find that an increase in GDP growth is significantly associated with bank lending, but only at the 10% level. This association is expected as higher credit demand and economic development stimulates heightened credit activity in banks. We also control for private credit growth as a percentage of GDP, as an additional measure of financial development (Morgan, Regis & Salike, 2018); gross capital formation growth, in order to account for the level of investments and the contribution to the economic activity in a country (Festić, Kavkler & Repina, 2011); NPL gross as a percentage of GDP, as a financial soundness indicator; and inflation rate, as an additional measure of credit demand. Domestic bank credit to the private sector to GDP and the country-level NPL ratio are not significantly associated with individual bank lending in our specifications. As expected, gross capital formation growth is significantly and positively associated with bank lending, while the inflation rate is also significantly and positively associated with bank lending (Beutler, Bichsel, Bruhin & Danton, 2020).

Our macroprudential indices remain significantly and negatively associated with credit supply in most specifications. For a one-unit increase in MPP, bank lending exhibits a decrease from 0.7% to 1%. A unit increase in the MPP2 index is significantly associated with around a 3% decline in bank lending.

Table 2.6 The impact of macroprudential policy on gross loans – macroeconomic variables

	MPP						*MPP2*				
	(1)	(2)	(3)	(4)	(5)		(6)	(7)	(8)	(9)	(10)
Dependent variable (lag)	0.697***	0.673***	0.684***	0.698***	0.685***	Dependent variable (lag)	0.693***	0.668***	0.674***	0.703***	0.682***
	(8.09)	(6.99)	(7.63)	(3.92)	(8.20)		(8.24)	(7.67)	(7.66)	(3.64)	(8.58)
MPP (lag)	**-0.00991*** **	**-0.00734** **	**-0.00804** **	**-0.00669**	**-0.00871** **	**MPP2 (lag)**	**-0.0322*** **	**-0.0295*** **	**-0.0301*** **	**-0.0299** **	**-0.0309*** **
	(-2.85)	**(-1.97)**	**(-2.05)**	**(-1.61)**	**(-2.21)**		**(-3.51)**	**(-2.85)**	**(-2.98)**	**(-2.45)**	**(-2.91)**
Size (total assets, logs)	0.281***	0.304***	0.293***	0.284	0.294***	Size (total assets, logs)	0.285***	0.308***	0.302***	0.279	0.296***
	(3.41)	(3.33)	(3.42)	(1.64)	(3.69)		(3.53)	(3.73)	(3.59)	(1.48)	(3.90)
Tier 1 ratio	-0.00802***	-0.00799***	-0.00836***	-0.00825*	-0.00859***	Tier 1 ratio	-0.00808***	-0.00801***	-0.00863***	-0.00803*	-0.00861***
	(-4.16)	(-4.10)	(-4.26)	(-1.95)	(-4.85)		(-4.12)	(-4.58)	(-4.31)	(-1.70)	(-4.90)
Liquidity ratio	-0.00121**	-0.00123**	-0.00134**	-0.00191	-0.00106*	Liquidity ratio	-0.00123**	-0.00131**	-0.00138**	-0.00182	-0.00107*
	(-1.96)	(-1.98)	(-2.11)	(-1.34)	(-1.65)		(-2.10)	(-2.13)	(-2.22)	(-1.20)	(-1.73)
Loans to deposits (logs)	0.108***	0.114***	0.109***	0.109	0.115***	Loans to deposits (logs)	0.108***	0.117***	0.114***	0.106	0.115***
	(2.97)	(2.65)	(3.00)	(1.53)	(3.13)		(3.15)	(2.87)	(3.18)	(1.38)	(3.35)
Δ Policy rate	-0.00780	-0.00461	-0.00981	0.00337	-0.00601	Δ Policy rate	-0.00911	-0.00609	-0.0112*	-0.00148	-0.00704
	(-1.30)	(-0.81)	(-1.56)	(0.49)	(-0.98)		(-1.55)	(-1.21)	(-1.85)	(-0.21)	(-1.14)
GDP growth (lag)	0.00714*					GDP growth (lag)	0.00726*				
	(1.74)						(1.86)				
Private credit to GDP (lag)		-0.000252				Private credit to GDP (lag)		-0.000301			
		(-1.41)						(-1.62)			
Gross capital formation growth (lag)			0.00243**			Gross capital formation growth (lag)			0.00259**		
			(2.06)						(2.19)		
NPL gross (lag)				-0.00105		NPL gross (lag)				-0.00170	
				(-0.46)						(-0.75)	
Inflation rate (lag)					0.00859**	Inflation rate (lag)					0.00911***
					(2.54)						(2.70)
Observations	16,065	16,005	16,065	12,609	16,065	Observations	16,065	16,005	16,065	12,609	16,065
Instruments	81	81	81	69	81	Instruments	81	81	81	69	81
AR (1)	0.105	0.121	0.107	0.206	0.106	AR (1)	0.0992	0.115	0.101	0.204	0.0998
AR (2)	0.431	0.646	0.436	0.485	0.395	AR (2)	0.409	0.638	0.401	0.549	0.374
Hansen	0.589	0.644	0.494	0.471	0.641	Hansen	0.597	0.639	0.522	0.531	0.648

Note: The dependent variable is gross loans in logs. The estimation method is a dynamic two-step system generalised method of moments (GMM) estimator with robust standard errors and a Windmeijer correction. The lagged dependent variable is treated as endogenous, and all other variables as exogenous. All regressions include year fixed effects. T statistics are reported in parentheses. All regressions include weights based on the number of observations of each country. Macroeconomic variables are lagged one period, while all variables, apart from indicator variables, are winsorised 1% on both tails of the distribution. The following are p-values indicating the significance level of coefficients: * p < 0.10, ** p < 0.05, *** p < 0.01.

2.4.5 The tightening and loosening of macroprudential policy

In order to analyse the existence of asymmetric effects in the macroprudential response, we investigate the impact of tightening and loosening policy actions separately. The results of these estimations are given in Table 2.7. In these estimations, we include several important bank and macroeconomic determinants (see column 1 in Table 2.6), along with our four indices measuring the policy stance: 1) tightening: MPP3 and MPP5, and 2) loosening: MPP4 and MPP6. Tightening actions of macroprudential policy are significantly associated with bank lending on the 10% level of statistical significance when measured with the MPP3 index. These results are in line with Poghosyan (2020) where the author investigated the effectiveness of lending restrictions on credit supply and found only a weak association of tightening policy actions with banks' lending activity. On the other side, when we analyse loosening actions of macroprudential policy, we find these actions are strongly associated with an increase in the lending activity of banks. We obtain a statistically significant coefficient with positive signs for both the MPP4 and MPP6 indices, which are followed by an increase in bank lending of 8% (MPP4) and 2.5% (MPP6). The difference in the effects lies in the measurement design and suggests that is important while comparing and determining the effects of the policy. This analysis suggests that the deactivation or loosening of macroprudential policy has stronger effects on bank lending and is associated with increased credit activities. The asymmetry of the results while analysing tightening and loosening policy actions of macroprudential policy separately could be a consequence of regulatory leakages due to the circumvention of regulatory measures (e.g., through window dressing). On the other hand, some borrowers might turn to non-bank institutions, while there is also the question of national jurisdiction for many macroprudential policies which could cause the circumvention of policies (see Aiyar, Calomiris & Wieladek, 2015; Poghosyan, 2020; Reinhardt & Sowerbutts, 2015).

Table 2.7 Impact of the tightening and loosening stance of macroprudential policy on bank lending

	(1) MPP3	(2) MPP4	(3) MPP5	(4) MPP6
Dependent variable (lag)	0.698***	0.728***	0.704***	0.698***
	(7.36)	(7.60)	(6.98)	(6.94)
MPP3 (lag)	**-0.0196***			
	(-1.68)			
MPP4 (lag)		**0.0791*****		
		(4.14)		
MPP5 (lag)			**0.00423**	
			(1.12)	
MPP6 (lag)				**0.0254*****
				(4.24)

(table continues)

(continued)

	(1) MPP3	(2) MPP4	(3) MPP5	(4) MPP6
Size (total assets, logs)	0.266***	0.240***	0.261***	0.268***
	(3.02)	(2.70)	(2.81)	(2.88)
Liquidity ratio	-0.00116**	-0.000886*	-0.00112**	-0.00104**
	(-2.27)	(-1.86)	(-2.13)	(-2.08)
Tier 1 ratio	-0.00789***	-0.00716***	-0.00793***	-0.00787***
	(-3.72)	(-3.01)	(-3.39)	(-3.55)
Loans to deposits (logs)	0.108***	0.0994**	0.107***	0.112***
	(2.85)	(2.54)	(2.67)	(2.62)
Market share	0.00460***	0.00390**	0.00449***	0.00414***
	(2.95)	(2.57)	(2.61)	(2.67)
Δ Policy rate	-0.00579	-0.00415	-0.00464	0.00111
	(-0.92)	(-0.67)	(-0.74)	(0.17)
GDP growth (lag)	0.00401	0.00600	0.00321	0.00494
	(0.84)	(1.32)	(0.58)	(0.97)
Observations	16,065	16,065	16,065	16,065
Instruments	82	82	82	82
AR (1)	0.104	0.0980	0.108	0.104
AR (2)	0.475	0.446	0.484	0.468
Hansen	0.480	0.471	0.457	0.565

Note: The dependent variable is gross loans in logs. The estimation method is a dynamic two-step system generalised method of moments (GMM) estimator with robust standard errors and a Windmeijer correction. The lagged dependent variable is treated as endogenous, and all other variables as exogenous. All regressions include year fixed effects. T statistics are reported in parentheses. All regressions include weights based on the number of observations of each country. Macroeconomic variables are lagged one period, while all variables, apart from indicator variables, are winsorised 1% on both tails of the distribution. The following are p-values indicating the significance level of coefficients: * p < 0.10, ** p < 0.05, *** p < 0.01.

2.5 Extensions and robustness tests

As we are interested in providing additional analysis to extend and provide further insights to help understand the relationship between bank lending behaviour and macroprudential policy, we perform additional tests which consider the measurement, time period and sample of the banks. First, we divide our main index into measures directed at certain regulatory targets. Second, we inspect the impact of time period and the state of the financial cycle by dividing the sample with respect to the outbreak of the 2008 financial crisis. Lastly, we measure the impact of the macroprudential policy on a subsample of listed banks since we are interested in determining if there is a stronger association between the macroprudential instruments' activation and the institutions which form this subsample.[49]

[49] To further strengthen the confidence into our main results, we performed additional robustness checks in order to check whether our results are robust to different model specification. We repeat the regression analysis for our main macroprudential index (MPP) for reduced or increased number of lags of our dependent variable, for both one-step and two-step GMM estimation. With one-step estimation and the robust option, with the heteroskedasticity or autocorrelation presence in panels, the standard errors are consistent. On the other side, with two-step estimation, robust option invocates the Windmeijer's finite sample correction. However, deriving these robustness test does not change our main conclusions and findings, as we receive substantially

2.5.1 Different types of macroprudential instruments

Macroprudential data based on the MaPPED consist of different macroprudential tools with numerous objectives. Following Meuleman and Vander Vennet (2020), we group macroprudential tools based on their target into four indices: 1) *Credit*, tools directed at curbing excessive lending; 2) *Market liquidity,* tools aimed at improving the liquidity position of banks; 3) *Concentration*, policy tools intended to reduce different bank exposures to certain types of loans or lenders, and 4) *Resilience*, macroprudential measures directed at the capital position of banks, as well as specific macroprudential measures aimed at banking sector resilience.

The first column of Table 2.8 presents the baseline results for the MPP index for the purpose of comparability.[50] Column 2 shows results obtained with four groups of indices. We find statistically significant results only for the *Concentration* index, which indicates that macroprudential measures targeted at limiting banks' exposures to different types of loans or lenders are effective in reducing bank lending by around 2%.

We also further examine the subdivision of the aforementioned indices and form different subgroups of these indices to test macroprudential indices with a more granular approach to their objectives. This is evident in column 3. Among the credit-targeting macroprudential measures, we find lending caps to be the most effective. Following the activation or tightening of existing lending caps, bank lending declines by 2.6%, a finding similar to Poghosyan (2020). This is expected as these tools specifically target excessive credit growth and overheating in the credit market. These results are in line with Cerutti, Claessens and Laeven (2017) and Morgan, Regis and Salike (2018), whose papers specifically investigate loan-to-value measures, and other studies whose findings show these measures are also effective in limiting bank risk (Meuleman & Vander Vennet, 2020; Altunbas, Binici & Gambacorta, 2018; Claessens, Ghosh & Mihet, 2013). Surprisingly, we obtain a significant and positive coefficient for credit growth tools, which consist of reserve requirements. Similar results were found by Akinci and Olmstead-Rumsey (2018), who suggested this might be caused by the presence of euro area countries in the sample prone to the effects of the ECB's actions, which could have some countercyclical effects depending on a country's characteristics.

Due to the ever-growing interest in the loosening effects of macroprudential policies and so as to assess the beneficial effects of relaxing certain macroprudential measures to counter the effects of the current crisis and to support the supply of credit, we decide to examine in

similar results for our variables of interest. However, we observe that increasing the number of lags as internal instruments for the dependent variable, as we did in the main analysis of this chapter, does affect the range of Hansen's J test statistics in terms of facilitating higher consistency of our results. These estimations are available in the Appendix B, Table B.7-B.8.

[50] The results in Table 2.8–2.9 were minimised for brevity. Complete estimation results, with all variables coefficients, are available in Appendix B (Tables B.3–B.6).

particular the loosening actions of different groups of macroprudential instruments. The results in Table 2.9 show that the strongest effects on bank lending come from capital buffers and lending caps. After the relaxation of capital buffers, bank lending increases by about 10.7%, while the loosening of lending caps leads to a 10.4% increase in the credit supply. The first column shows results obtained for the MPP4 and MPP6 indices which we include for a comparison of the coefficients. We also obtain statistically significant and positive coefficients for provisioning- and exposures-related indices. These results confirm the effectiveness of macroprudential policies in easing cycles, which also backs their use in the current Covid-19 crisis. However, we stress that use of these policies should be accompanied by a cautious approach that should maintain the ultimate macroprudential objective of financial stability. This means that policymakers should still have other tools available to prevent a deterioration of the quality of bank assets and the riskiness of the borrower base. We also emphasise the importance of coordinating different macroprudential policies on the national and supranational levels (e.g. in the euro area) to maximise the positive effects of some instruments being eased that may lead to an increase in the credit supply and economic growth.[51]

Table 2.8 Macroprudential indices and subindices based on the target of the measures

	(1)	(2)	(3)
MPP	-0.00991***		
	(-2.85)		
Credit (lag)		-0.00497	
		(-0.75)	
Credit growth (lag)			0.0276**
			(2.55)
Lending caps (lag)			-0.0260**
			(-1.99)
Risk weights (lag)			-0.00919
			(-0.65)
Market liquidity (lag)		-0.00793	
		(-0.55)	
Liquidity measures			-0.00837
			(-0.59)
Concentration (lag)		-0.0196**	
		(-2.35)	
Exposures (lag)			-0.0198**
			(-2.36)
Resilience (lag)		-0.00594	
		(-1.12)	
MCR (lag)			0.00457
			(0.60)
Capital buffers (lag)			-0.0120
			(-1.61)
Taxes (lag)			-0.0114
			(-0.56)
Provisioning (lag)			-0.0218
			(-1.42)

(table continues)

[51] The coefficient for the leverage ratio limit is not reported in Table 2.9 as the data do not report any loosening policy actions of the leverage ratio limit within our sample and time coverage.

(continued)

	(1)	(2)	(3)
Leverage ratio (lag)			0.103
			(1.21)
Other requirements (lag)			-0.00908
			(-0.64)

Note: The dependent variable is gross loans in logs. The estimation method is a dynamic two-step system generalised method of moments (GMM) estimator with robust standard errors and a Windmeijer correction. The lagged dependent variable is treated as endogenous, and all other variables as exogenous. All regressions include year fixed effects. T statistics are reported in parentheses. All regressions include weights based on the number of observations of each country. Macroeconomic variables are lagged one period, while all variables, apart from indicator variables, are winsorised 1% on both tails of the distribution. The following are p-values indicating the significance level of coefficients: * p < 0.10, ** p < 0.05, *** p < 0.01.

Table 2.9 Loosening cycles of different macroprudential indices and subindices based on the target of the measures

	(1)	(2)	(3)
MPP4 (lag)	0.0791***		
	(4.14)		
MPP6 (lag)	0.0254***		
	(4.24)		
Credit (lag)		0.0370**	
		(2.53)	
Credit growth (lag)			-0.00114
			(-0.06)
Lending caps (lag)			0.104***
			(3.09)
Risk weights (lag)			0.0206
			(0.90)
Market liquidity (lag)		0.0294	
		(1.57)	
Liquidity measures			0.0295
			(1.56)
Concentration (lag)		0.0798***	
		(3.30)	
Exposures (lag)			0.0801***
			(3.32)
Resilience (lag)		0.0933***	
		(3.58)	
MCR (lag)			0.0113
			(0.26)
Capital buffers (lag)			0.107***
			(3.83)
Taxes (lag)			0.0712
			(1.58)
Provisioning (lag)			0.0717**
			(2.07)
Other requirements (lag)			0.0693*
			(1.89)

Note: The dependent variable is gross loans in logs. The estimation method is a dynamic two-step system generalised method of moments (GMM) estimator with robust standard errors and a Windmeijer correction. The lagged dependent variable is treated as endogenous, and all other variables as exogenous. All regressions include year fixed effects. T statistics are reported in parentheses. All regressions include weights based on the number of observations of each country. Macroeconomic variables are lagged one period, while all variables, apart from indicator variables, are winsorised 1% on both tails of the distribution. The following are p-values indicating the significance level of coefficients: * p < 0.10, ** p < 0.05, *** p < 0.01.

2.5.2 Macroprudential policy in different periods

In order to test the effects of macroprudential instruments on bank lending in different periods to reflect the impact of the global financial crisis of 2008, we decide to split our sample into different time periods: pre-crisis, crisis and post-crisis. We analyse the effects of the MPP index, our base macroprudential index and the two initial indices (MPP3 and MPP4) formulated to measure tightening and loosening policy actions separately.

The analysis shows that macroprudential instruments are the most effective in the easing cycle in a pre-crisis period, with the coefficient indicating that when macroprudential measures are loosened the credit supply increases by 7%. Other macroprudential indices are not significant in this setting. When we move on to the crisis period, we observe that macroprudential measures are effective in curbing credit growth during the economic downturn. For a one-unit increase in the MPP and MPP3 index, bank lending declines by 1.2% and 5%. When looking at the MPP4 index, the loosening effect of macroprudential policy is somewhat weaker, suggesting that if macroprudential measures are loosened the credit supply increases by 5%, at a 10% level of significance. In the post-crisis period, we find only the MPP4 index is significantly associated with bank lending. For a unit increase in the MPP4 index, we find that bank lending rises by more than 10%. This relationship shows that loosening policy actions have a stronger effect on bank lending, as found in Poghosyan (2020). This finding is especially important in the current state of affairs when most countries are relaxing their regulatory demands imposed on banks in order to combat the negative economic effects of the Covid-19 pandemic and further corroborates our previous analysis. Interestingly, we also find that the coefficient of the policy rate is strongly and negatively associated with bank lending in the pre-crisis and post-crisis periods, yet estimations restricted to the crisis period show the coefficient of the policy rate is not statistically significant. This might be a sign of monetary policy being less effective on credit activity in a period of distress, although this investigation goes beyond the scope of this research (see Table 2.10).

Table 2.10 Macroprudential indices vs. crisis

	Pre-crisis			*Crisis*			*Post-crisis*		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent variable (lag)	0.787***	0.789***	0.798***	0.697***	0.626***	0.642***	0.448	0.509***	0.533***
	(15.94)	(15.72)	(16.44)	(4.90)	(5.46)	(5.11)	(1.08)	(2.82)	(2.97)
MPP (lag)	**0.00120**			**-0.0123****			**-0.00283**		
	(0.08)			**(-1.99)**			**(-0.41)**		
MPP3 (lag)		**0.0112**			**-0.0508****			**0.00547**	
		(0.22)			**(-1.99)**			**(0.32)**	
MPP4 (lag)			**0.0708****			**0.0507***			**0.103****
			(2.35)			**(1.89)**			**(2.30)**
Size (total assets, logs)	0.173***	0.171***	0.164***	0.258**	0.321***	0.308***	0.173***	0.171***	0.164***
	(3.90)	(3.78)	(3.77)	(1.98)	(3.09)	(2.68)	(3.90)	(3.78)	(3.77)

(table continues)

(continued)

	Pre-crisis			*Crisis*			*Post-crisis*		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Tier 1 ratio	-0.00570**	-0.00557**	-0.00556**	-0.0128**	-0.0158***	-0.0146***	-0.00570**	-0.00557**	-0.00556**
	(-3.63)	(-3.65)	(-3.60)	(-2.37)	(-3.30)	(-2.91)	(-3.63)	(-3.65)	(-3.60)
Liquidity ratio	0.000984*	0.000984*	0.00109**	-0.00177*	-0.00238**	-0.00203**	0.000984*	0.000984*	0.00109**
	(1.96)	(1.91)	(2.32)	(-1.88)	(-2.38)	(-2.04)	(1.96)	(1.91)	(2.32)
Loans to deposits (logs)	0.0715***	0.0729***	0.0695***	0.114*	0.137***	0.134***	0.0715***	0.0729***	0.0695***
	(2.70)	(2.71)	(2.69)	(1.92)	(2.81)	(3.02)	(2.70)	(2.71)	(2.69)
Market share	0.00124	0.00120	0.000961	0.00569**	0.00620**	0.00640**	0.00564	0.00546**	0.00467*
	(0.78)	(0.75)	(0.62)	(3.08)	(3.07)	(2.97)	(0.87)	(2.07)	(1.85)
Δ Policy rate	-0.0180**	-0.0182**	-0.0164**	0.00708	-0.0133*	-0.0141	-0.0180**	-0.0182**	-0.0164**
	(-2.38)	(-2.31)	(-2.13)	(0.78)	(-1.83)	(-1.50)	(-2.38)	(-2.31)	(-2.13)
GDP growth (lag)	0.0297***	0.0291***	0.0296***	0.00217	0.00533**	0.00374	0.0297***	0.0291***	0.0296***
	(4.26)	(3.85)	(4.36)	(0.49)	(1.99)	(1.16)	(4.26)	(3.85)	(4.36)
Observations	3,889	3,889	3,889	4,090	4,090	4,090	8,086	8,086	8,086
Instruments	28	28	28	38	34	34	32	29	29
AR (1)	0.001	0.001	0.001	0.065	0.073	0.083	0.326	0.273	0.265
AR (2)	0.419	0.420	0.441	0.657	0.421	0.375	0.741	0.784	0.846
Hansen	0.156	0.151	0.124	0.390	0.030	0.004	0.253	0.0003	0.0002

Note: The dependent variable is gross loans in logs. The estimation method is a dynamic two-step system generalised method of moments (GMM) estimator with robust standard errors and a Windmeijer correction. The lagged dependent variable is treated as endogenous, and all other variables as exogenous. All regressions include year fixed effects. T statistics are reported in parentheses. All regressions include weights based on the number of observations of each country. Macroeconomic variables are lagged one period, while all variables, apart from indicator variables, are winsorised 1% on both tails of the distribution. The following are p-values indicating the significance level of coefficients: * p < 0.10, ** p < 0.05, *** p < 0.01.

2.5.3 Subsample of listed banks

To examine whether our results are robust to a limited set of institutions, we analyse the subsample of 112 listed banks available in the Fitch Connect database for EU countries. The majority of these banks are also the largest EU banks and systemically important. This gives us an additional incentive to measure the impact of macroprudential measures on the lending behaviour of these institutions. Since certain macroprudential tools are specifically aimed at systematically large banks, we expected to find a significant relationship between macroprudential policy and lending behaviour in this subsample. We estimate the effects using all of our six macroprudential indices as we wish to account for both the overall macroprudential stance and the effects of the tightening and easing cycles of policy. The results obtained show that, like in our previous analysis of the full sample of banks, the overall macroprudential policies and the MPP and MPP2 indices are significantly and negatively associated with bank lending at the 1% level, as expected. The tightening of macroprudential measures is followed by declines in lending activity of 1.86% (MPP) and 3.7% (MPP2). When we analyse tightening policy actions, we see the tightening effects are even stronger for the listed banks, with both indices significantly associated with bank credit at the 1% (MPP3) and 5% (MPP5) levels. The tightening of macroprudential instruments is followed by a reduction of bank credit by about 5% (MPP3) and 1.16% (MPP5). These

estimates suggest the listed banks are more responsive to a tightening of macroprudential measures. Finally, we consider the results obtained for the MPP4 and MPP6 easing indices. The obtained coefficients statistically significant at the 10% (MPP4) and 5% (MPP6) levels indicate that bank credit increases by 5% (MPP4) and 2.18% (MPP6) following a relaxation of macroprudential instruments (see Table 2.11).

Table 2.11 The impact of macroprudential policy on the listed banks

	(1) MPP	(2) MPP2	(3) MPP3	(4) MPP4	(5) MPP5	(6) MPP6
Dependent variable (lag)	0.604***	0.651***	0.667***	0.668***	0.649***	0.649***
	(5.65)	(6.15)	(6.28)	(6.85)	(6.25)	(5.46)
MPP (lag)	**-0.0186*** (-4.21)**					
MPP2 (lag)		**-0.0369*** (-3.08)**				
MPP3 (lag)			**-0.0509*** (-3.05)**			
MPP4 (lag)				**0.0502* (1.93)**		
MPP5 (lag)					**-0.0116** (-2.20)**	
MPP6 (lag)						**0.0218** (2.48)**
Size (total assets, logs)	0.370***	0.328***	0.313***	0.312***	0.327***	0.331***
	(3.76)	(3.43)	(3.29)	(3.54)	(3.42)	(3.02)
Tier 1 ratio	-0.00368	-0.00268	-0.00257	-0.00290	-0.00327	-0.00412
	(-1.16)	(-0.98)	(-0.90)	(-1.15)	(-1.12)	(-1.20)
Liquidity ratio	0.000889	0.000874	0.000775	0.000901	0.000746	0.000947
	(1.59)	(1.46)	(1.30)	(1.32)	(1.17)	(1.39)
Loans to deposits (logs)	0.294***	0.263***	0.251***	0.250***	0.258***	0.256***
	(3.29)	(2.88)	(2.66)	(2.87)	(3.10)	(2.63)
Market share	0.0000616	-0.000262	-0.000390	-0.000503	-0.00000114	-0.000815
	(0.05)	(-0.19)	(-0.28)	(-0.33)	(-0.00)	(-0.49)
Δ Policy rate	0.0114	0.00560	0.00470	0.00729	0.00676	0.0122
	(1.28)	(0.59)	(0.49)	(0.73)	(0.66)	(1.36)
GDP growth (lag)	0.00300	0.00221	0.00194	0.00130	0.000819	0.00312
	(0.88)	(0.63)	(0.52)	(0.36)	(0.22)	(0.78)
Observations	876	876	876	876	876	876
Instruments	82	82	82	82	82	82
AR (1)	0.096	0.081	0.088	0.071	0.094	0.075
AR (2)	0.375	0.575	0.784	0.388	0.586	0.283
Hansen	0.244	0.243	0.251	0.175	0.225	0.197

Note: The dependent variable is gross loans in logs. The estimation method is a dynamic two-step system generalised method of moments (GMM) estimator with robust standard errors and a Windmeijer correction. The lagged dependent variable is treated as endogenous, and all other variables as exogenous. All regressions include year fixed effects. T statistics are reported in parentheses. All regressions include weights based on the number of observations of each country. Macroeconomic variables are lagged one period, while all variables, apart from indicator variables, are winsorised 1% on both tails of the distribution. The following are p-values indicating the significance level of coefficients: * p < 0.10, ** p < 0.05, *** p < 0.01.

2.6 Conclusion

In this study, we investigated whether macroprudential measures are effective for curtailing bank lending in a sample of 28 EU countries over the 17-year span between 2000 and 2017. By employing the Arellano-Bond generalised method of moments, which enabled us to minimise endogeneity issues related to the introduction of these measures, we find that macroprudential measures are negatively associated with bank lending. We assessed alternative measures of macroprudential policy. First, we analysed two macroprudential indices, which take all instruments available in the database into account along with all instances of tightening and loosening policy actions. We find these measures are significantly and negatively associated with credit supply when controlling for different bank and macroeconomic variables.

In an attempt to differentiate the effect of the tightening and loosening measures, we constructed four different indices capturing only tightening or loosening actions. We obtained a weak association between the tightening indices and the credit activity of banks. On the contrary, the analysis shows the effects on bank lending are stronger when macroprudential measures are loosened or deactivated. The coefficient for loosening actions is significantly and positively associated with bank lending when introducing different bank and macroeconomic variables which might have an effect on bank lending activity. These findings are particularly important in the current situation and economic consequences of the Covid-19 pandemic as policymakers and governments relax the prudential requirements to increase market liquidity and support investment and economic growth. The unloosing of macroprudential measures during an economic downturn can also support monetary policy efforts to promote market liquidity without jeopardising financial stability. In addition, the use of macroprudential measures for specific sectors, such as SME borrowers or particular industries, should also take into account the special needs of the given country's sector. More efforts could also be made to better coordinate regulatory actions on both the supranational and national levels (Guindos, 2021). As a robustness test, we further analysed which macroprudential measures have the strongest relationship with bank lending. As expected, we found that lending constraints are significantly and negatively associated with lending, while credit growth measures, such as reserve requirements on the liability and asset side of the bank balance sheet, show some procyclical effect, since we obtained a positive coefficient. Moreover, we found that capital buffers and lending measures have the strongest relationship with credit in macroprudential policy easing cycles.

To show whether differences exist in the effects of macroprudential indices in different periods of the financial cycle, we separately tested the effects of three indices, the overall macroprudential stance, tightening and loosening policy actions in the pre-crisis, crisis, and post-crisis periods. We established that macroprudential measures are the most efficient at controlling credit activity in the crisis period, while the effect of easing policy actions is somewhat limited. In the pre-crisis and post-crisis periods, the loosening cycle of

macroprudential policy has a stronger impact on bank lending. In addition, we checked our results against a subsample of listed banks. The results for these banks are even stronger since all of our macroprudential indices are statistically significant and exhibit the expected relationship. When analysing policy instruments, policymakers should evaluate all measures introduced in a country in a given period (both macroprudential and microprudential instruments that could have some macroprudential effect), while also analysing their interaction with monetary policy. We also support the proposition that macroprudential policy should be a primary tool for curbing credit booms and financial system vulnerabilities, as it effectively limits excessive bank lending. On the other hand, the effectiveness of macroprudential policy is significantly challenged by regulatory leakages and national responsibility for many macroprudential measures in the internationalised and interconnected European banking sector.

3 BANK LENDING AND SMALL AND MEDIUM-SIZED ENTERPRISES' ACCESS TO FINANCE – EFFECTS OF MACROPRUDENTIAL POLICIES*

3.1 Overview

This chapter 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 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.

3.2 Introduction

This chapter 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.[52] 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 & Steffen, 2015; Aiyar, Al-Eyd, Barkbu & Jobst, 2015; Campello, Graham & Harvey, 2010; Chava & Purnanandam, 2011; European Banking Authority, 2016; Popov & Udell, 2012). Aiyar, Al-Eyd, Barkbu and Jobst (2015) highlight that SMEs

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[52] See Annual Report on European SMEs 2018/2019 by European Commission.

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 firms (Jin, Luo & Wan, 2018; Santos, 2011; Tsuruta, 2015) and the determinants of constraints on bank lending to firms (Beck, Demirgüç-Kunt, Laeven & Maksimovic, 2006; Beck, Demirgüç-Kunt & Pería, 2011; Becker & Ivashina, 2014; Behr, Foos & Norden, 2017; Dell'Ariccia, Igan & Laeven, 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, Ghosh & Mihet, 2013; ESRB, 2014b). 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 & Hakura, 2011; Duygan-Bump, Levkov & Montoriol-Garriga, 2015; Francis & 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, Beck & Martinez Peria, 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 chapter 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 chapter 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.[53] 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 3.3 presents an overview of the literature and the hypotheses development. Section 3.4 describes the data and the empirical framework for the study. Section 3.5 presents the main results and findings of the chapter, while section 3.6 sets out further extensions and robustness checks. Section 3.7 presents the conclusion of the study.

3.3 Literature review and hypotheses development

The role of banks in financial intermediation as providers of debt financing to businesses is essential for the healthy functioning of economic systems. This is a central role for business growth, investment and ultimately economic growth. The perfect capital markets in Modigliani and Miller's (1958) world make a firm's capital structure irrelevant to its value, meaning that sources of financing are irrelevant to the investments a firm makes. In contrast, in the real world, there are several market imperfections that make capital structure decisions relevant and give a premium on external sources of financing. These imperfections include transaction costs incurred by the financier, agency costs, tax preference for debt, and imperfect information between parties leading to the problem of information asymmetry. External financing for firms, apart from the associated transaction costs, may also be costly and unavailable to firms due to the existence of asymmetric information, resulting in

[53] See Cerutti, Claessens and Laeven (2017), Claessens, Ghosh and Mihet (2013), and Kang, Wu, Chen and Jeon (2021).

investors being inadequately informed about the future of firms and wary of the underlying risk (Akerlof, 1970).

The presence of asymmetric information means that complete information about the firm is available only to firm managers, not external agents. This may be due to the non-disclosure of information, which may create the undesirable effect of information disclosure to competitors or due to the superior knowledge held by managers compared to external investors (Myers and Majluf, 1984). If a lender cannot distinguish between good and bad borrowers, this may lead to an increase in lending rates or the unavailability of financing for certain borrowers (Fazzari, Hubbard & Petersen, 1988; Stiglitz & Weiss, 1981). In addition, Calomiris, Hubbard and Stock (1986) show that credit rationing is associated more with firms that rely on external bank financing for several factors. These factors include the presence of asymmetric information, collateral dependence, bank strength, and borrower cash flow. As information asymmetry increases, so does the cost of external finance and its availability. The seminal studies by Fazzari, Hubbard and Petersen (1988) and Gertler (1988) suggest that information asymmetry is more pronounced for smaller and newer firms due to the lack of relationship history with their creditors. Later works found that smaller firms have greater difficulty obtaining finance (Beck, Demirgüç-Kunt, Laeven & Maksimovic, 2006; Ghosh, Mookherjee & Ray, 2000; Schiffer and Weder, 2001), with this being due to problems in determining their default risk, their lack of collateral, and the high monitoring costs for banks.

Several strands emerge in the literature when it comes to measuring firms' access to finance and financing constraints. The paper by Fazzari, Hubbard and Petersen (1988) suggests measuring firms' constraints using balance sheet data. Following this approach, firms' constraints should be measured using investment cash flow sensitivity, which serves as a way to sort financially constrained and unconstrained firms. Firms are sorted into those that are more cash-flow sensitive and those that are less sensitive and not constrained. The logic behind this approach is that financially constrained firms depend on internal sources of cash. In contrast Kaplan and Zingales (1997) challenge this and show that cash-flow and investment sensitivity can be heightened when financing constraints decrease. Similar findings were reached by Almeida and Campello (2004) when focusing on the financial and macroeconomic circumstances in which firms operate. This was followed by studies measuring the financing constraints on firms by dividing them into constrained and unconstrained firms, as in Fazzari, Hubbard and Petersen (1988) based on various firm characteristics like age and size (Devereux & Schiantarelli, 1990), sector, market value of debt relative to the market value of the firm, interest expense, and bond rating (Whited, 1992). In contrast to these studies and along the path taken by Beck, Demirgüç-Kunt, Laeven and Maksimovic (2006), we choose to use the SAFE survey data collected by the ECB and the European Commission. The data were collected directly from firms and contain information on the outcomes of their credit applications and difficulties experienced while seeking finance.

This chapter 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. Garcia-Posada Gomez (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.

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, Han, and Huang (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, Popov and Udell (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.[54]

Ferrando, Popov and Udell (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

[54] See also Correa, Sapriza and Zlate (2013).

concerning the effects of expansionary monetary policy were found by Jin, Luo and Wan (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, Lin, Ma, Seade and Song (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 & Lehar, 2017). Using data on banks in the United Kingdom, Aiyar, Calomiris and Wieladek (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, Prašnikar and Trobec (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, Shan and Warusawitharana (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, Claessens & Laeven, 2017; Claessens, Ghosh & Mihet, 2013; Lim et al., 2011; Morgan, Regis & Salike, 2018; Olszak, Roszkowska & Kowalska, 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, Dell'Ariccia, Igan and Rabanal (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 of 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 & Olmstead-Rumsey, 2018; Cerutti, Claessens & Laeven, 2017; Crowe, Dell'Ariccia, Igan & Rabanal, 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, Lozano-Vivas, Papadimitri & Pasiouras, 2020), by analysing the Z-score and expected default frequency of over 3,000 banks in 61 advanced and emerging countries (Altunbas, Binici & Gambacorta, 2018) or by analysing the effects on listed banks in EU countries with recent macroprudential data (Meuleman & Vander Vennet, 2020). The study by Ely, Tabak and Teixeira (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, McCarthy and O'Toole (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 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, with a strong and positive relationship found in contrast for loosening measures. A recent study by Mirzaei, Pasiouras and Samet (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, Beck and Martinez Peria (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 of 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' 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, Beck and Martinez Peria (2018) we use firm-level, survey-based data focused on EU countries and macroprudential data published by researchers at 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, in which macroprudential policies were most actively used (Cerutti, Claessens & Laeven, 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 requirement; *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 chapter. First, we test whether macroprudential policies affect the availability of credit for SMEs. Since macroprudential instruments have a negative impact on bank lending (Cerutti, Claessens & Laeven, 2017; Claessens, Ghosh & Mihet, 2013; Lim et al., 2011; Morgan, Regis & Salike, 2018; Poghosyan, 2020), we expect a negative relationship between macroprudential measures and SMEs' access to bank financing. Further, a recent study by Kang, Wu, Chen and Jeon (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, Wu, Chen and Jeon (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, Demirgüç-Kunt & Maksimovic, 2005; Beck & Demirguc-Kunt, 2006; Petersen & 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 & Udell, 2006; and Mascia & 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.[55] 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.

[55] For more information on the construction of the indices, see Section 3.4.2, and for more information on the macroprudential measures included in the MaPPED database, see Appendix C, Table C.4.

3.4 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, industry 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.[56] 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.

3.4.1 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.[57] 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).[58] The sample is further stratified by main activity, age, and ownership. In addition, SAFE provides weights based on firm size, measured by

[56] For more information on the survey, see:
https://www.ecb.europa.eu/stats/ecb_surveys/safe/html/index.en.html
[57] For more information on the reference period of the data, see Appendix C, Table C.1.
[58] 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.

the number of employees across firm size, activity, and country, which we include in all regressions.

Table 3.1 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 & 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.

Table 3.1 Firm frequency and share of observations based on firm characteristics

	Frequency	Share (%)
Size		
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
Sector		
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
Age		
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

(table continues)

(continued)

	Frequency	Share (%)
Ownership		
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.

3.4.2 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 & Kleibl, 2018). Entitled the Macroprudential Policies Evaluation Database (MaPPED)[59], 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.[60] 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 & Olmstead-Rumsey 2018; Altunbas, Binici & Gambacorta, 2018; Kuttner & 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.[61] We are able to capture information on the intensity of macroprudential instruments with three possible

[59] Database available at: https://www.ecb.europa.eu/pub/research/working-papers/html/mapped.en.html
[60] For a list of instruments included in the MaPPED database, see Appendix C, Table C.4.
[61] Legally binding measures are generally adopted through a legislative act, or a regulation by a central bank or another regulatory authority, responsible for regulating the financial sector. Breaching this type of binding measure can result in serious fines or certain actions such as for example withdrawal of licence. On the other hand, recommended actions or guidelines are implemented in a "comply-or-explain" form, although they might become the criteria used for onsite inspection (Budnik & Kleibl, 2018). For this reason, we perform additional analysis in Section 3.6.2, where we conduct a robustness test by including measures which were recommended by the regulator.

responses to the direction 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 & Kleibl, 2018; Altunbas, Binici & Gambacorta, 2018). We also denote "other and ambiguous" as 0 because we do not have enough information on the magnitude and intensity of a change.[62] 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, Binici & Gambacorta, 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 (wave) (see Appendix C, Table C.1), 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 are summed across all waves for each country in the sample. This means the index can 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, over waves, attributing zero elsewhere.[63]

[62] Policy actions, reported in MaPPED are either of tightening direction, loosening direction or denoted as other and with ambiguous impact. Tightening policy actions resulted either through the activation of macroprudential instruments or the recalibration of existing ones. Furthermore, the loosening policy actions resulted from the deactivation of the existing instruments or their recalibration. Lastly, policy actions denoted as ambiguous are associated with either the maintenance of the same level and scope of the already activated instruments or their recalibration (Budnik & Kleibl, 2018). Other and ambiguous policy actions do not result neither with a tightening nor the loosening of the instrument, or there is not enough information to determine the direction of the policy. For this reason, we exclude these policy actions, and keep only policy actions denoted as loosening or tightening actions of macroprudential policy. 60% of policy actions in the database are of tightening direction.

[63] For similar application see Altunbas, Binici and Gambacorta (2018).

3.4.3 Empirical model

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

$$\Pr(y^{*}_{i,k,t} = 1) = F(\alpha + \beta MPI_{k,t} + \gamma CRISIS_{k,t} + \delta MACRO_{k,t} + \theta FIRM_{i,k,t} + \lambda_k + \nu_t + \mu_s + \varepsilon_{i,k,t}) \quad (10)$$

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 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 weights[64] as well as country (λ_k), time (ν_t), and sector (μ_s) dummies to capture unobserved heterogeneity and time effects in our data.[65]

3.4.4 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, Han and Huang (2020) and Moro, Wisniewski and Mantovani (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.[66] Since smaller firms are traditionally more financially constrained than large ones (Petersen & Rajan, 1994; Beck, Demirgüç-Kunt & Maksimovic 2005; Beck & 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

[64] 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

[65] We follow the approach in Beck, Demirgüç-Kunt and Peria (2011), Mascia and Rossi (2017), and Bremus and Neugebauer (2018).

[66] 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.

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, Demirgüç-Kunt, Laeven and Maksimovic (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 & Rajan, 1994; Petersen & Rajan, 1995; Casey & 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, Demirgüç-Kunt, Laeven and Maksimovic (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 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.[67] 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, Binici & Gambacorta, 2018; Akinci & 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 both aggregate macroprudential index and other indices in which we group macroprudential measures according to their respective objectives.[68] Following (Ferrando, Popov & Udell,

[67] For more details on the construction of the indices and the instruments included, see Appendix C, Table C.4.

[68] 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

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 3.2 and 3.3 provide descriptive statistics of our main regression variables and descriptive statistics of the firm variables for each country. Table 3.2 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, Popov and Udell (2017). Table 3.3 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 C in Table C.2.

Table 3.2 Summary statistics of the main regression variables

Variables	(1) Observations	(2) Mean	(3) SD	(4) Min	(5) Max
Dependent variable					
Access to finance	52,189	0.795	0.404	0	1
Macroprudential indices					
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

(table continues)

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 3.2.

(continued)

Variables	(1) Observations	(2) Mean	(3) SD	(4) Min	(5) Max
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
Firm determinants					
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
Macroeconomic determinants					
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).[69]

Table 3.3 Summary statistics of the main firm characteristics by country

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Country	Access to finance	Micro	Small	Large	Age	Levera	Profit	History	Autono mous	Owner ship	Collate ral	Maturit y
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

(table continues)

[69] See Ferrando, Popov and Udell (2017) and Mayordomo and Rodriguez-Moreno (2018).

(continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Country	Access to finance	Micro	Small	Large	Age	Leverage	Profit	History	Autonomous	Ownership	Collateral	Maturity
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

3.5 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.[70] 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.

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

3.5.1 Base results

Table 3.4 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 (columns 6–10), which are more straightforward to interpret than probit coefficients. However, our probit estimates are comparable in terms of statistical significance and the sign of the 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, Beck and Martinez Peria (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.

When considering firm-level characteristics, we first focus on firm size, as measured by three variables: Micro, Small and Large. Like previous studies (Beck, Demirguc-Kunt, Laeven & Levine, 2008; Mayordomo & 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.

Table 3.4 The effects of macroprudential policy on SMEs' access to finance

Dependent variable Access to finance	(1) MPP	(2) Capital	(3) Borrower	(4) Liquidity	(5) Other	(6) MPP	(7) Capital	(8) Borrower	(9) Liquidity	(10) Other
			Coefficients					*Marginal effects*		
Micro	-0.392***	-0.392***	-0.392***	-0.392***	-0.392***	-0.102***	-0.102***	-0.101***	-0.101***	-0.101***
	(0.0423)	(0.0424)	(0.0423)	(0.0423)	(0.0423)	(0.0107)	(0.0107)	(0.0107)	(0.0107)	(0.0107)
Small	-0.197***	-0.197***	-0.197***	-0.197***	-0.197***	-0.0510***	-0.0510***	-0.0510***	-0.0510***	-0.0509***
	(0.0264)	(0.0265)	(0.0263)	(0.0263)	(0.0263)	(0.00673)	(0.00678)	(0.00673)	(0.00671)	(0.00672)
Large	0.140***	0.140***	0.140***	0.140***	0.140***	0.0362***	0.0362***	0.0362***	0.0362***	0.0362***
	(0.0358)	(0.0357)	(0.0359)	(0.0357)	(0.0359)	(0.00917)	(0.00915)	(0.00920)	(0.00915)	(0.00919)
Age	0.166***	0.167***	0.166***	0.166***	0.166***	0.0431***	0.0431***	0.0430***	0.0429***	0.0430***
	(0.0359)	(0.0357)	(0.0359)	(0.0358)	(0.0361)	(0.00925)	(0.00921)	(0.00925)	(0.00921)	(0.00929)
Leverage	-0.0898***	-0.0897***	-0.0899***	-0.0899***	-0.0899***	-0.0232***	-0.0232***	-0.0233***	-0.0233***	-0.0233***
	(0.0277)	(0.0278)	(0.0279)	(0.0279)	(0.0280)	(0.00724)	(0.00725)	(0.00729)	(0.00729)	(0.00730)
Profit	0.0781***	0.0787***	0.0782***	0.0783***	0.0781***	0.0202***	0.0204***	0.0202***	0.0203***	0.0202***
	(0.0237)	(0.0239)	(0.0236)	(0.0235)	(0.0237)	(0.00609)	(0.00615)	(0.00609)	(0.00606)	(0.00611)
History	0.164***	0.165***	0.165***	0.165***	0.165***	0.0425***	0.0426***	0.0427***	0.0427***	0.0427***
	(0.0162)	(0.0164)	(0.0165)	(0.0164)	(0.0163)	(0.00427)	(0.00432)	(0.00434)	(0.00434)	(0.00431)
Autonomous	0.0221	0.0221	0.0215	0.0220	0.0218	0.00573	0.00571	0.00558	0.00570	0.00566
	(0.0280)	(0.0281)	(0.0281)	(0.0281)	(0.0280)	(0.00725)	(0.00729)	(0.00729)	(0.00729)	(0.00727)
Ownership	0.00662	0.00626	0.00669	0.00647	0.00654	0.00171	0.00162	0.00173	0.00168	0.00169
	(0.0427)	(0.0426)	(0.0428)	(0.0428)	(0.0428)	(0.0110)	(0.0110)	(0.0111)	(0.0111)	(0.0111)
Collateral	0.173***	0.172***	0.172***	0.172***	0.172***	0.0448***	0.0446***	0.0446***	0.0446***	0.0446***
	(0.0499)	(0.0501)	(0.0502)	(0.0503)	(0.0501)	(0.0129)	(0.0130)	(0.0130)	(0.0130)	(0.0130)
Maturity	0.218***	0.218***	0.219***	0.219***	0.219***	0.0565***	0.0565***	0.0566***	0.0567***	0.0566***
	(0.0450)	(0.0450)	(0.0450)	(0.0450)	(0.0449)	(0.0115)	(0.0115)	(0.0115)	(0.0115)	(0.0115)
MPP	**-0.0403****					**-0.0104****				
	(0.0175)					**(0.00454)**				
Capital		**-0.0689****					**-0.0178****			
		(0.0276)					**(0.00714)**			
Borrower			**-0.0296**					**-0.00766**		
			(0.0316)					**(0.00817)**		
Liquidity				**-0.0351**					**-0.00910**	
				(0.0444)					**(0.0115)**	
Other					**-0.00776**					**-0.00201**
					(0.0207)					**(0.00536)**
GDP growth	0.0185	0.0179	0.0193	0.0193	0.0193	0.00479	0.00462	0.00499	0.00500	0.00501
	(0.0113)	(0.0110)	(0.0119)	(0.0118)	(0.0119)	(0.00292)	(0.00284)	(0.00308)	(0.00306)	(0.00308)
Unemployment	-0.0229***	-0.0230**	-0.0224**	-0.0224**	-0.0227**	-0.00593***	-0.00595**	-0.00581**	-0.00580**	-0.00587**
	(0.00888)	(0.00921)	(0.00970)	(0.00966)	(0.00957)	(0.00229)	(0.00238)	(0.00251)	(0.00250)	(0.00247)
Crisis	-0.121	-0.126	-0.135	-0.135	-0.133	-0.0312	-0.0327	-0.0350	-0.0349	-0.0343
	(0.107)	(0.106)	(0.102)	(0.103)	(0.102)	(0.0278)	(0.0274)	(0.0266)	(0.0267)	(0.0264)
Country dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Wave dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Sector dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	52,189	52,189	52,189	52,189	52,189	52,189	52,189	52,189	52,189	52,189
Pseudo R squared[71]	0.0854	0.0856	0.0851	0.0851	0.0851	0.0854	0.0856	0.0851	0.0851	0.0851

Note: This table reports pooled probit estimation results with robust standard errors clustered at the country level (Columns 1–5) and average marginal effects after pooled probit estimations for different macroprudential indices (Column 6–10). 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 C.4 in Appendix C for more information on the construction of macroprudential indices. See Table C.5 in Appendix C 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 $p < 0.01$.

[71] 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).

3.5.2 Loosening and tightening effects of macroprudential policy

Table 3.5 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 macroprudential 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, Chronopoulos, Tarazi and Wilson (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 bank lending to firms nor on its cost. Further, regarding Dutch banks Ananou,

Chronopoulos, Tarazi and Wilson (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 3.5 The impact of macroprudential tightening and loosening policy actions on SMEs' access to finance

	Tightening policy actions					*Loosening policy actions*				
Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Access to finance	MPP	Capital	Borrower	Liquidity	Other	MPP	Capital	Borrower	Liquidity	Other
Micro	-0.102***	-0.102***	-0.101***	-0.101***	-0.101***	-0.101***	-0.101***	-0.101***	-0.101***	-0.101***
	(0.0107)	(0.0108)	(0.0107)	(0.0107)	(0.0107)	(0.0107)	(0.0107)	(0.0107)	(0.0107)	(0.0107)
Small	-0.0511***	-0.0510***	-0.0510***	-0.0510***	-0.0510***	-0.0509***	-0.0509***	-0.0510***	-0.0509***	-0.0510***
	(0.00673)	(0.00677)	(0.00674)	(0.00671)	(0.00674)	(0.00673)	(0.00676)	(0.00674)	(0.00672)	(0.00671)
Large	0.0361***	0.0362***	0.0362***	0.0362***	0.0362***	0.0362***	0.0363***	0.0362***	0.0362***	0.0362***
	(0.00917)	(0.00915)	(0.00919)	(0.00914)	(0.00918)	(0.00918)	(0.00919)	(0.00920)	(0.00918)	(0.00918)
Age	0.0431***	0.0432***	0.0430***	0.0429***	0.0429***	0.0429***	0.0429***	0.0429***	0.0429***	0.0430***
	(0.00926)	(0.00923)	(0.00925)	(0.00921)	(0.00926)	(0.00925)	(0.00923)	(0.00925)	(0.00926)	(0.00928)
Leverage	-0.0233***	-0.0232***	-0.0233***	-0.0233***	-0.0233***	-0.0233***	-0.0233***	-0.0233***	-0.0233***	-0.0233***
	(0.00726)	(0.00726)	(0.00729)	(0.00728)	(0.00729)	(0.00726)	(0.00727)	(0.00730)	(0.00730)	(0.00727)
Profit	0.0202***	0.0204***	0.0202***	0.0203***	0.0203***	0.0203***	0.0203***	0.0203***	0.0203***	0.0202***
	(0.00609)	(0.00611)	(0.00609)	(0.00606)	(0.00614)	(0.00609)	(0.00615)	(0.00608)	(0.00608)	(0.00610)
History	0.0426***	0.0427***	0.0427***	0.0427***	0.0427***	0.0426***	0.0426***	0.0427***	0.0427***	0.0426***
	(0.00429)	(0.00433)	(0.00434)	(0.00434)	(0.00435)	(0.00431)	(0.00434)	(0.00434)	(0.00434)	(0.00431)
Autonomous	0.00562	0.00572	0.00555	0.00571	0.00566	0.00579	0.00564	0.00562	0.00565	0.00578
	(0.00723)	(0.00726)	(0.00730)	(0.00729)	(0.00730)	(0.00730)	(0.00732)	(0.00727)	(0.00728)	(0.00729)
Ownership	0.00173	0.00163	0.00175	0.00168	0.00169	0.00167	0.00166	0.00170	0.00171	0.00171
	(0.0110)	(0.0110)	(0.0111)	(0.0111)	(0.0111)	(0.0111)	(0.0110)	(0.0111)	(0.0111)	(0.0111)
Collateral	0.0448***	0.0446***	0.0446***	0.0446***	0.0445***	0.0446***	0.0445***	0.0446***	0.0446***	0.0448***
	(0.0130)	(0.0130)	(0.0130)	(0.0130)	(0.0130)	(0.0129)	(0.0130)	(0.0130)	(0.0130)	(0.0130)
Maturity	0.0566***	0.0567***	0.0566***	0.0567***	0.0566***	0.0565***	0.0564***	0.0566***	0.0566***	0.0566***
	(0.0115)	(0.0115)	(0.0115)	(0.0115)	(0.0115)	(0.0115)	(0.0115)	(0.0115)	(0.0115)	(0.0115)
MPP_tightening	**-0.0115****					**0.0146***				
	(0.00577)					**(0.00824)**				
Capital_tightening		**-0.0201****					**0.0314****			
		(0.00944)					**(0.0150)**			
Borrower_tightening			**-0.00941**					**-0.0189**		
			(0.00734)					**(0.0590)**		
Liquidity_tightening				**-0.0104**					**-0.0451*****	
				(0.0115)					**(0.0131)**	
Other_tightening					**0.00635**					**0.0152*****
					(0.00900)					**(0.00579)**
GDP growth	0.00484*	0.00465	0.00499	0.00499	0.00497	0.00491	0.00488	0.00501	0.00498	0.00499
	(0.00291)	(0.00286)	(0.00308)	(0.00306)	(0.00309)	(0.00304)	(0.00297)	(0.00308)	(0.00308)	(0.00312)
Unemployment	-0.00586**	-0.00602**	-0.00582**	-0.00579**	-0.00580**	-0.00595**	-0.00575**	-0.00587**	-0.00583**	-0.00592**
	(0.00232)	(0.00240)	(0.00251)	(0.00250)	(0.00258)	(0.00241)	(0.00244)	(0.00251)	(0.00250)	(0.00245)
Crisis	-0.0303	-0.0318	-0.0349	-0.0349	-0.0366	-0.0355	-0.0358	-0.0347	-0.0349	-0.0352
	(0.0276)	(0.0277)	(0.0266)	(0.0267)	(0.0265)	(0.0271)	(0.0264)	(0.0266)	(0.0266)	(0.0270)
Country dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Wave dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Sector dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	52,189	52,189	52,189	52,189	52,189	52,189	52,189	52,189	52,189	52,189
Pseudo R-squared	0.0854	0.0855	0.0851	0.0851	0.0851	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 C.4 in Appendix C for more information on the construction of the macroprudential indices. See Table C.5 in Appendix C 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 $p < 0.01$.

3.5.3 Marginal effects by size and age

Given the importance of size and age for firms' access to credit, as presented in the literature (Beck, Demirgüç-Kunt, Laeven & Maksimovic, 2006; Casey & 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.[72]

Table 3.6 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 & Purnanandam, 2011; Beck & Demirguc-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.

Table 3.6 Marginal effects of macroprudential policy on access to bank finance by firms' size and age

	Dependent variable Access to finance		
MPP index			
Size		*Age*	
Micro	-0.013241***	<2 years	-0.0108866***
	(0.0057057)		(0.0047893)
Small	-0.0117131***	2–4 years	-0.0106925***
	(0.0050955)		(0.0047093)
Medium	-0.0099654***	5–9 years	-0.0104963***
	(0.0044215)		(0.0046295)

(table continues)

[72] 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 text of the dissertation.

(continued)

	Dependent variable Access to finance		
MPP index			
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 industry dummies. * indicates $p < 0.10$, ** indicates $p < 0.05$, *** indicates $p < 0.01$.

3.6 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 different subsample settings, in relation to firm size and the sample of countries which were part of all the SAFE surveys.

3.6.1 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 equations 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, Popov and Udell (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 3.7 shows estimates for heckprobit and estimated marginal effects. Column 1 presents heckprobit results for the outcome equation of the probability of obtaining credit, while the Column 2 presents heckprobit results for the selection equation. Column 3 presents the estimated marginal effects of the probability of credit access conditional upon a firm being selected, while Column 4 represents estimated marginal effects of the probability that the dependent variable is observed, i.e., credit demand. Column 4 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 statistically significant in the estimated marginal effects that capture the probability of accessing credit (Column 3). 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 significant for 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.[73]

[73] 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 4).
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).

Table 3.7 The effects of macroprudential policy on SMEs' access to funds – probit with a Heckman correction

	(1)	(2)	(3)	(4)
	Probit with sample selection	Probit with sample selection	Probit with sample selection	Probit with sample selection
Dependent variable				
Access to finance	Outcome equation	Selection equation	Outcome equation	Selection equation
	Coefficients		*Marginal effects*	
Competition		**0.0317*** **	**0.000686**	**0.0117*** **
		(0.00836)	**(0.00156)**	**(0.00313)**
Micro	-0.355***	-0.413***	-0.101***	-0.153***
	(0.0697)	(0.0250)	(0.0104)	(0.00845)
Small	-0.180***	-0.188***	-0.0510***	-0.0695***
	(0.0250)	(0.00857)	(0.00668)	(0.00302)
Large	0.123***	0.192***	0.0362***	0.0711***
	(0.0430)	(0.0253)	(0.00917)	(0.00935)
Age	0.167***	-0.0218***	0.0431***	-0.00807***
	(0.0359)	(0.00780)	(0.00932)	(0.00288)
Leverage	-0.132	0.532***	-0.0229***	0.197***
	(0.0815)	(0.0426)	(0.00733)	(0.0147)
Profit	0.0750***	0.0336***	0.0203***	0.0124***
	(0.0190)	(0.00795)	(0.00615)	(0.00298)
History	0.154***	0.118**	0.0426***	0.0437**
	(0.0324)	(0.0479)	(0.00429)	(0.0175)
Autonomous	-0.00393	0.309***	0.00566	0.114***
	(0.0579)	(0.0232)	(0.00730)	(0.00811)
Ownership	-0.00125	0.0953**	0.00174	0.0352**
	(0.0447)	(0.0444)	(0.0111)	(0.0163)
Collateral	0.172***		0.0448***	
	(0.0483)		(0.0129)	
Maturity	0.217***		0.0565***	
	(0.0448)		(0.0115)	
MPP	**-0.0373***	**-0.0335*** **	**-0.0104** **	**-0.0124*** **
	(0.0217)	**(0.0106)**	**(0.00455)**	**(0.00393)**
GDP growth	0.0186*	-0.00243	0.00479*	-0.000900
	(0.0109)	(0.0105)	(0.00291)	(0.00388)
Unemployment	-0.0226***	-0.00136	-0.00592***	-0.000505
	(0.00792)	(0.0132)	(0.00229)	(0.00489)
Crisis	-0.118	-0.0295	-0.0313	-0.0109
			(0.0277)	(0.0330)
Year dummies	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES
Sector dummies	YES	YES	YES	YES
Observations	136,764	136,764	136,764	136,764

Note: This table reports coefficients and 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 C.4 in Appendix C for more information about the construction of the macroprudential indices. See Table C.5 in Appendix C 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 $p < 0.01$.

3.6.2 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 3.8–3.9. 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 3.9 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.

Table 3.8 The impact of macroprudential measures implemented as either legally binding or recommendations on SMEs' access to finance

Dependent variable Access to finance	(1) MPP	(2) Capital	(3) Borrower	(4) Liquidity	(5) Other
Micro	-0.101***	-0.101***	-0.101***	-0.101***	-0.101***
	(0.0107)	(0.0108)	(0.0107)	(0.0107)	(0.0107)
Small	-0.0509***	-0.0509***	-0.0509***	-0.0510***	-0.0509***
	(0.00674)	(0.00679)	(0.00673)	(0.00671)	(0.00672)
Large	0.0362***	0.0362***	0.0362***	0.0362***	0.0362***
	(0.00916)	(0.00914)	(0.00919)	(0.00916)	(0.00919)
Age	0.0431***	0.0431***	0.0430***	0.0429***	0.0430***
	(0.00926)	(0.00923)	(0.00926)	(0.00922)	(0.00929)
Leverage	-0.0233***	-0.0233***	-0.0233***	-0.0233***	-0.0233***
	(0.00724)	(0.00725)	(0.00727)	(0.00729)	(0.00730)
Profit	0.0202***	0.0204***	0.0202***	0.0203***	0.0202***
	(0.00606)	(0.00612)	(0.00608)	(0.00608)	(0.00611)
History	0.0426***	0.0426***	0.0427***	0.0427***	0.0427***
	(0.00432)	(0.00436)	(0.00434)	(0.00434)	(0.00431)
Autonomous	0.00567	0.00570	0.00555	0.00569	0.00566
	(0.00723)	(0.00728)	(0.00729)	(0.00727)	(0.00727)
Ownership	0.00163	0.00153	0.00172	0.00166	0.00169
	(0.0111)	(0.0111)	(0.0111)	(0.0111)	(0.0111)
Collateral	0.0448***	0.0444***	0.0446***	0.0446***	0.0446***
	(0.0130)	(0.0131)	(0.0130)	(0.0130)	(0.0130)
Maturity	0.0566***	0.0565***	0.0566***	0.0567***	0.0566***
	(0.0115)	(0.0115)	(0.0115)	(0.0115)	(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	0.00460	0.00499	0.00498	0.00501
	(0.00294)	(0.00287)	(0.00309)	(0.00306)	(0.00308)

(table continues)

(continued)

Dependent variable	(1)	(2)	(3)	(4)	(5)
Access to finance	MPP	Capital	Borrower	Liquidity	Other
Unemployment	-0.00596***	-0.00588**	-0.00586**	-0.00580**	-0.00587**
	(0.00231)	(0.00239)	(0.00250)	(0.00249)	(0.00247)
Crisis	-0.0314	-0.0327	-0.0348	-0.0349	-0.0343
	(0.0279)	(0.0275)	(0.0266)	(0.0267)	(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 C.4 in Appendix C for more information about the construction of the macroprudential indices. See Table C.5 in Appendix C for definitions of all variables. Robust standard errors clustered at the country level are in parentheses. All regressions include sample weights and country, time, and industry dummies. * indicates $p < 0.10$, ** indicates $p < 0.05$, *** indicates $p < 0.01$.

Table 3.9 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)	(6)	(7)	(8)	(9)	(10)
Access to finance	MPP	Capital	Borrower	Liquidity	Other	MPP	Capital	Borrower	Liquidity	Other
Micro	-0.102***	-0.101***	-0.101***	-0.101***	-0.101***	-0.101***	-0.101***	-0.101***	-0.101***	-0.101***
	(0.0107)	(0.0108)	(0.0107)	(0.0107)	(0.0107)	(0.0107)	(0.0107)	(0.0107)	(0.0107)	(0.0107)
Small	-0.0510***	-0.0509***	-0.0509***	-0.0510***	-0.0510***	-0.0509***	-0.0509***	-0.0509***	-0.0509***	-0.0510***
	(0.00674)	(0.00677)	(0.00673)	(0.00671)	(0.00674)	(0.00673)	(0.00676)	(0.00673)	(0.00672)	(0.00671)
Large	0.0361***	0.0362***	0.0362***	0.0362***	0.0362***	0.0362***	0.0363***	0.0362***	0.0362***	0.0362***
	(0.00916)	(0.00913)	(0.00918)	(0.00916)	(0.00918)	(0.00918)	(0.00919)	(0.00918)	(0.00918)	(0.00918)
Age	0.0431***	0.0431***	0.0430***	0.0428***	0.0429***	0.0430***	0.0429***	0.0430***	0.0429***	0.0430***
	(0.00927)	(0.00924)	(0.00926)	(0.00922)	(0.00926)	(0.00925)	(0.00923)	(0.00927)	(0.00926)	(0.00928)
Leverage	-0.0234***	-0.0233***	-0.0233***	-0.0233***	-0.0233***	-0.0232***	-0.0233***	-0.0233***	-0.0233***	-0.0233***
	(0.00726)	(0.00727)	(0.00727)	(0.00729)	(0.00729)	(0.00725)	(0.00727)	(0.00729)	(0.00730)	(0.00727)
Profit	0.0203***	0.0204***	0.0203***	0.0203***	0.0203***	0.0202***	0.0203***	0.0202***	0.0203***	0.0202***
	(0.00606)	(0.00608)	(0.00608)	(0.00607)	(0.00614)	(0.00609)	(0.00615)	(0.00609)	(0.00608)	(0.00610)
History	0.0427***	0.0427***	0.0427***	0.0427***	0.0427***	0.0426***	0.0426***	0.0427***	0.0427***	0.0426***
	(0.00434)	(0.00437)	(0.00435)	(0.00434)	(0.00435)	(0.00429)	(0.00434)	(0.00433)	(0.00434)	(0.00431)
Autonomous	0.00556	0.00570	0.00554	0.00569	0.00566	0.00585	0.00564	0.00569	0.00565	0.00578
	(0.00722)	(0.00725)	(0.00730)	(0.00727)	(0.00730)	(0.00731)	(0.00732)	(0.00729)	(0.00728)	(0.00729)
Ownership	0.00167	0.00153	0.00174	0.00166	0.00169	0.00161	0.00166	0.00165	0.00171	0.00171
	(0.0111)	(0.0111)	(0.0111)	(0.0111)	(0.0111)	(0.0111)	(0.0110)	(0.0111)	(0.0111)	(0.0111)
Collateral	0.0446***	0.0444***	0.0446***	0.0446***	0.0445***	0.0448***	0.0445***	0.0447***	0.0446***	0.0448***
	(0.0131)	(0.0131)	(0.0130)	(0.0130)	(0.0130)	(0.0128)	(0.0130)	(0.0129)	(0.0130)	(0.0130)
Maturity	0.0567***	0.0566***	0.0567***	0.0567***	0.0566***	0.0564***	0.0564***	0.0566***	0.0566***	0.0566***
	(0.0115)	(0.0115)	(0.0115)	(0.0115)	(0.0115)	(0.0115)	(0.0115)	(0.0115)	(0.0115)	(0.0115)
MPP_tightening	**-0.00956****					**0.0179*****				
	(0.00429)					**(0.00684)**				
Capital_tightening		**-0.0177****					**0.0314****			
		(0.00831)					**(0.0150)**			
Borrower_tightening			**-0.00683**					**0.0137**		
			(0.00563)					**(0.0111)**		
Liquidity_tightening				**-0.0117**					**-0.0451*****	
				(0.0102)					**(0.0131)**	
Other_tightening					**0.00635**	**Other_loosening**				**0.0152*****
					(0.00900)					**(0.00579)**
GDP growth	0.00479	0.00464	0.00497	0.00497	0.00497	0.00494	0.00488	0.00503	0.00498	0.00499
	(0.00296)	(0.00290)	(0.00309)	(0.00306)	(0.00309)	(0.00303)	(0.00297)	(0.00307)	(0.00308)	(0.00312)
Unemployment	-0.00588**	-0.00594**	-0.00586**	-0.00579**	-0.00580**	-0.00601**	-0.00575**	-0.00585**	-0.00583**	-0.00592**
	(0.00234)	(0.00241)	(0.00250)	(0.00249)	(0.00258)	(0.00240)	(0.00244)	(0.00251)	(0.00250)	(0.00245)
Crisis	-0.0309	-0.0320	-0.0348	-0.0349	-0.0366	-0.0356	-0.0358	-0.0349	-0.0349	-0.0352
	(0.0278)	(0.0278)	(0.0266)	(0.0267)	(0.0265)	(0.0272)	(0.0264)	(0.0266)	(0.0266)	(0.0270)
Country dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Wave dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Sector dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	52,189	52,189	52,189	52,189	52,189	52,189	52,189	52,189	52,189	52,189
Pseudo R-squared	0.0854	0.0855	0.0852	0.0852	0.0851	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 C.4 in Appendix C for more information on the construction of the macroprudential indices. See Table C.5 in the Appendix C 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 $p < 0.01$.

3.6.3 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.[74]

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 3.10 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.

Table 3.10 SME's access to finance and the unconventional monetary policy measures

Dependent variable Access to finance	(1) MPP	(2) Capital	(3) Borrower	(4) Liquidity	(5) Other
Micro	-0.101***	-0.101***	-0.101***	-0.101***	-0.101***
	(0.0108)	(0.0108)	(0.0108)	(0.0108)	(0.0108)
Small	-0.0509***	-0.0509***	-0.0509***	-0.0509***	-0.0508***
	(0.00679)	(0.00683)	(0.00679)	(0.00676)	(0.00677)
Large	0.0363***	0.0363***	0.0363***	0.0363***	0.0363***
	(0.00921)	(0.00919)	(0.00923)	(0.00918)	(0.00923)
Age	0.0432***	0.0433***	0.0431***	0.0430***	0.0431***
	(0.00932)	(0.00928)	(0.00932)	(0.00928)	(0.00936)
Leverage	-0.0230***	-0.0230***	-0.0230***	-0.0230***	-0.0230***
	(0.00735)	(0.00735)	(0.00739)	(0.00739)	(0.00740)

(table continues)

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

(continued)

Dependent variable	(1)	(2)	(3)	(4)	(5)
Access to finance	MPP	Capital	Borrower	Liquidity	Other
Profit	0.0202***	0.0203***	0.0202***	0.0202***	0.0202***
	(0.00612)	(0.00617)	(0.00611)	(0.00609)	(0.00614)
History	0.0425***	0.0426***	0.0427***	0.0427***	0.0427***
	(0.00433)	(0.00438)	(0.00440)	(0.00440)	(0.00437)
Autonomous	0.00594	0.00594	0.00581	0.00593	0.00588
	(0.00732)	(0.00737)	(0.00738)	(0.00737)	(0.00735)
Ownership	0.00233	0.00223	0.00233	0.00228	0.00230
	(0.0111)	(0.0110)	(0.0111)	(0.0111)	(0.0111)
Collateral	0.0454***	0.0451***	0.0451***	0.0451***	0.0452***
	(0.0129)	(0.0130)	(0.0131)	(0.0131)	(0.0130)
Maturity	0.0564***	0.0564***	0.0565***	0.0566***	0.0565***
	(0.0116)	(0.0116)	(0.0116)	(0.0116)	(0.0116)
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)
GDP growth	0.00476*	0.00460*	0.00500	0.00500	0.00501
	(0.00288)	(0.00279)	(0.00307)	(0.00305)	(0.00307)
Unemployment	-0.00571**	-0.00574**	-0.00559**	-0.00558**	-0.00566**
	(0.00231)	(0.00240)	(0.00252)	(0.00251)	(0.00248)
Crisis	0.00885	0.000121	0.0116	0.0122	0.0130
	(0.0147)	(0.0153)	(0.0158)	(0.0155)	(0.0152)
APP	0.0355	0.0287	0.0433*	0.0436**	0.0438**
	(0.0231)	(0.0236)	(0.0222)	(0.0222)	(0.0221)
Policy rate	-0.00343	-0.00313	-0.00188	-0.00215	-0.00211
	(0.0115)	(0.0123)	(0.0116)	(0.0114)	(0.0115)
Policy rate* APP	0.0115	0.0108	0.0116	0.0117	0.0117
	(0.0107)	(0.0111)	(0.0107)	(0.0106)	(0.0107)
Observations	51,460	51,460	51,460	51,460	51,460
Pseudo R-squared	0.0855	0.0856	0.0851	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 C.4 in Appendix C for more information about the construction of the macroprudential indices. See Table C.5 in Appendix C 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 $p < 0.01$.

3.6.4 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).[75] 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 3.1). 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 3.11 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.

Table 3.11 SMEs access to finance – the control sample without large firms

Dependent variable Access to finance	(1) MPP	(2) Capital	(3) Borrower	(4) Liquidity	(5) Other
Micro	-0.119***	-0.119***	-0.119***	-0.119***	-0.119***
	(0.0124)	(0.0124)	(0.0124)	(0.0124)	(0.0124)
Small	-0.0586***	-0.0586***	-0.0586***	-0.0586***	-0.0585***
	(0.00718)	(0.00723)	(0.00718)	(0.00716)	(0.00715)
Age	0.0400***	0.0401***	0.0401***	0.0401***	0.0401***
	(0.00541)	(0.00537)	(0.00541)	(0.00540)	(0.00544)
Leverage	-0.0389***	-0.0389***	-0.0391***	-0.0391***	-0.0391***
	(0.00958)	(0.00960)	(0.00958)	(0.00959)	(0.00960)
Profit	0.0301***	0.0303***	0.0301***	0.0301***	0.0301***
	(0.00413)	(0.00417)	(0.00418)	(0.00418)	(0.00418)
History	0.0551***	0.0551***	0.0553***	0.0554***	0.0553***
	(0.00641)	(0.00638)	(0.00644)	(0.00646)	(0.00649)
Autonomous	0.00194	0.00219	0.00207	0.00219	0.00215
	(0.0113)	(0.0112)	(0.0112)	(0.0112)	(0.0112)
Ownership	-0.00537	-0.00552	-0.00533	-0.00539	-0.00536
	(0.00591)	(0.00588)	(0.00597)	(0.00596)	(0.00600)
Collateral	0.0345**	0.0344**	0.0344**	0.0344**	0.0345**
	(0.0137)	(0.0137)	(0.0137)	(0.0137)	(0.0136)
Maturity	0.0417***	0.0418***	0.0419***	0.0419***	0.0418***
	(0.0138)	(0.0138)	(0.0138)	(0.0138)	(0.0138)
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)**
GDP growth	0.00573*	0.00559*	0.00593*	0.00594*	0.00596*
	(0.00307)	(0.00296)	(0.00331)	(0.00331)	(0.00331)
Unemployment	-0.00650***	-0.00651***	-0.00641***	-0.00645***	-0.00651***
	(0.00198)	(0.00204)	(0.00223)	(0.00225)	(0.00215)

(table continues)

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

(continued)

Dependent variable Access to finance	(1) MPP	(2) Capital	(3) Borrower	(4) Liquidity	(5) Other
Crisis	-0.0291	-0.0309	-0.0330	-0.0328	-0.0315
	(0.0254)	(0.0247)	(0.0233)	(0.0233)	(0.0237)
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 C.4 in Appendix C for more information about the construction of the macroprudential indices. See Table C.5 in Appendix C for definitions of all variables. Robust standard errors clustered at the country level are in parentheses. All regressions include sample weights and country, time, and industry dummies. * indicates $p < 0.10$, ** indicates $p < 0.05$, *** indicates $p < 0.01$.

3.6.5 Subset of countries present in all waves

In order to check whether our results are affected by the choice of sample which includes all waves of the survey, we re-estimate our model in a setting which includes only firms from countries which were surveyed in all waves (both the ECB rounds and the Common rounds). Doing so allows us to check the strength of our results when choosing countries within the database with the highest number of firms and amount of information available. These countries include 11 eurozone countries: Austria, Belgium, Germany, Spain, Finland, France, Greece, Ireland, Italy, the Netherlands and Portugal. The results of these estimations are given in Table 3.12. As we obtained very similar results as in our main regressions, for our control variables and for macroeconomic determinants, we only comment on macroprudential variables. We again confirm the strongest results for the MPP and Capital indices, as well as somewhat weaker results for Borrower index. An increase in these indices indicates a more stringent macroprudential policy with firms being 1.2 (MPP), 2 (Capital) and 1.7 (Borrower) percentage points more likely to be credit-constrained following implementation of restrictive macroprudential measures, especially capital-targeting macroprudential instruments. We also test the direction of the policies by testing loosening and tightening policy actions separately. Table 3.13 shows the marginal effects obtained for tightening and loosening indices. The marginal effects of the MPP_tightening, Capital_tightening and Borrower_tightening indices indicate that the tightening of macroprudential measures leads to firms being 1.3 (MPP_tightening), 2 (Capital_tightening) and 1.5 (Borrower_tightening) percentage points less likely to access bank credit. In the case of loosening actions, we find that when macroprudential measures are relaxed SMEs are 2.6 (MPP_loosening), 5.4 (Capital_loosening), 7.6 (Borrower_loosening) or 2 (Other_loosening) percentage points more likely to have access to bank funding.[76]

[76] The results for Liquidity_loosening index are missing as there were no loosening macroprudential policy actions with respect to the Liquidity recorded in the macroprudential database for this subset of countries.

Table 3.12 The effects of macroprudential policies on SMEs' access to funding – subset of countries present in all waves

Dependent variable	(1)	(2)	(3)	(4)	(5)
Access to finance	MPP	Capital	Borrower	Liquidity	Other
Micro	-0.100***	-0.100***	-0.100***	-0.100***	-0.100***
	(0.0119)	(0.0120)	(0.0119)	(0.0119)	(0.0119)
Small	-0.0503***	-0.0502***	-0.0502***	-0.0501***	-0.0501***
	(0.00779)	(0.00786)	(0.00781)	(0.00777)	(0.00778)
Large	0.0356***	0.0356***	0.0356***	0.0357***	0.0356***
	(0.0107)	(0.0107)	(0.0107)	(0.0107)	(0.0107)
Age	0.0418***	0.0420***	0.0418***	0.0416***	0.0417***
	(0.0113)	(0.0112)	(0.0113)	(0.0112)	(0.0113)
Leverage	-0.0264***	-0.0264***	-0.0265***	-0.0265***	-0.0265***
	(0.00822)	(0.00823)	(0.00827)	(0.00827)	(0.00830)
Profit	0.0192**	0.0194**	0.0192**	0.0193**	0.0192**
	(0.00757)	(0.00763)	(0.00756)	(0.00752)	(0.00757)
History	0.0450***	0.0451***	0.0452***	0.0453***	0.0452***
	(0.00367)	(0.00369)	(0.00373)	(0.00373)	(0.00368)
Autonomous	0.00434	0.00421	0.00397	0.00426	0.00420
	(0.00830)	(0.00836)	(0.00840)	(0.00838)	(0.00832)
Ownership	0.00691	0.00679	0.00704	0.00689	0.00690
	(0.0118)	(0.0118)	(0.0119)	(0.0118)	(0.0118)
Collateral	0.0595***	0.0592***	0.0594***	0.0593***	0.0593***
	(0.0115)	(0.0115)	(0.0114)	(0.0114)	(0.0114)
Maturity	0.0496***	0.0497***	0.0496***	0.0497***	0.0497***
	(0.0128)	(0.0128)	(0.0128)	(0.0128)	(0.0128)
MPP	**-0.0123****				
	(0.00494)				
Capital		**-0.0193*****			
		(0.00747)			
Borrower			**-0.0167***		
			(0.00905)		
Liquidity				**-0.00951**	
				(0.0131)	
Other					**-0.00257**
					(0.00601)
GDP growth	0.00593	0.00557	0.00605	0.00610	0.00613
	(0.00372)	(0.00366)	(0.00401)	(0.00397)	(0.00398)
Unemployment	-0.00553**	-0.00560**	-0.00549*	-0.00543*	-0.00551*
	(0.00268)	(0.00278)	(0.00294)	(0.00296)	(0.00291)
Crisis	-0.0315	-0.0340	-0.0360	-0.0359	-0.0351
	(0.0345)	(0.0341)	(0.0335)	(0.0336)	(0.0332)
Country dummies	YES	YES	YES	YES	YES
Wave dummies	YES	YES	YES	YES	YES
Sector dummies	YES	YES	YES	YES	YES
Observations	41,848	41,848	41,848	41,848	41,848
Number of firms	25,956	25,956	25,956	25,956	25,956
Pseudo R-squared	0.0861	0.0862	0.0857	0.0857	0.0857

Note: This table reports 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 our dependent variable, equal to 1 if a firm had applied for a loan or a credit line and was successful, and 0 if a firm applied and was unsuccessful. MPP is an index which represents the sum of all policy changes over waves in a particular country. Capital index is the sum of all macroprudential measures targeting the capital positions of banks. Borrower index is the sum of all instrument actions targeting borrowers. Liquidity is an index which sums up all policy actions over the course of waves whose primary target is the enhancement of liquidity positions in a bank. Other is an index, which is the sum of the remaining measures. See Table C.4 in Appendix C for more information about the construction of macroprudential indices. See Table C.5 in Appendix C for definitions of all variables. Robust standard errors are in parentheses. All regressions include country, time, and sector dummies. All regressions include sampling weights. * indicates $p < 0.10$, ** indicates $p < 0.05$, *** indicates $p < 0.01$.

Table 3.13 The impact macroprudential policy on SMEs' access to finance based on the direction of the measures – subset of countries present in all waves

	Tightening policy actions					Loosening policy actions				
Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Access to finance	MPP	Capital	Borrower	Liquidity	Other	MPP	Capital	Borrower	Other	
	-0.100***	-0.100***	-0.100***	-0.100***	-0.100***	-0.100***	-0.100***	-0.100***	-0.100***	
	(0.0119)	(0.0119)	(0.0119)	(0.0119)	(0.0119)	(0.0119)	(0.0119)	(0.0119)	(0.0119)	
Small	-0.0503***	-0.0502***	-0.0502***	-0.0501***	-0.0501***	-0.0501***	-0.0502***	-0.0501***	-0.0501***	
	(0.00778)	(0.00783)	(0.00781)	(0.00777)	(0.00781)	(0.00780)	(0.00788)	(0.00780)	(0.00778)	
Large	0.0356***	0.0356***	0.0356***	0.0357***	0.0357***	0.0357***	0.0357***	0.0357***	0.0357***	
	(0.0107)	(0.0107)	(0.0107)	(0.0107)	(0.0107)	(0.0107)	(0.0107)	(0.0107)	(0.0107)	
Age	0.0419***	0.0420***	0.0418***	0.0416***	0.0417***	0.0416***	0.0417***	0.0418***	0.0418***	
	(0.0113)	(0.0113)	(0.0113)	(0.0112)	(0.0113)	(0.0113)	(0.0113)	(0.0113)	(0.0113)	
Leverage	-0.0265***	-0.0264***	-0.0265***	-0.0265***	-0.0265***	-0.0264***	-0.0265***	-0.0265***	-0.0265***	
	(0.00824)	(0.00824)	(0.00827)	(0.00827)	(0.00829)	(0.00824)	(0.00825)	(0.00829)	(0.00826)	
Profit	0.0192**	0.0194**	0.0192**	0.0193**	0.0193**	0.0192**	0.0194**	0.0192**	0.0192**	
	(0.00758)	(0.00760)	(0.00756)	(0.00752)	(0.00759)	(0.00753)	(0.00766)	(0.00755)	(0.00756)	
History	0.0450***	0.0452***	0.0452***	0.0453***	0.0453***	0.0451***	0.0450***	0.0452***	0.0452***	
	(0.00370)	(0.00371)	(0.00373)	(0.00373)	(0.00369)	(0.00367)	(0.00369)	(0.00372)	(0.00371)	
Autonomous	0.00423	0.00424	0.00399	0.00426	0.00415	0.00440	0.00410	0.00419	0.00434	
	(0.00829)	(0.00832)	(0.00839)	(0.00838)	(0.00834)	(0.00838)	(0.00843)	(0.00833)	(0.00837)	
Ownership	0.00697	0.00681	0.00702	0.00689	0.00690	0.00678	0.00682	0.00689	0.00689	
	(0.0118)	(0.0118)	(0.0119)	(0.0118)	(0.0118)	(0.0118)	(0.0118)	(0.0118)	(0.0118)	
Collateral	0.0595***	0.0592***	0.0594***	0.0593***	0.0592***	0.0592***	0.0591***	0.0593***	0.0594***	
	(0.0114)	(0.0115)	(0.0114)	(0.0114)	(0.0114)	(0.0114)	(0.0114)	(0.0114)	(0.0114)	
Maturity	0.0496***	0.0498***	0.0496***	0.0497***	0.0497***	0.0496***	0.0492***	0.0497***	0.0496***	
	(0.0128)	(0.0128)	(0.0128)	(0.0128)	(0.0128)	(0.0128)	(0.0128)	(0.0128)	(0.0128)	
MPP_tightening	**-0.0130****					**0.0261****				
	(0.00611)					**(0.0110)**				
Capital_tightening		**-0.0202****					**0.0543*****			
		(0.00998)					**(0.0150)**			
Borrower_tightening			**-0.0145***					**0.0764*****		
			(0.00812)					**(0.0170)**		
Liquidity_tightening				**-0.00951**						
				(0.0131)						
Other_tightening					**0.00426**	**Other_loosening**				**0.0191****
					(0.00963)					**(0.00892)**
GDP growth	0.00596	0.00574	0.00607	0.00610	0.00606	0.00602	0.00557	0.00601	0.00626	
	(0.00375)	(0.00373)	(0.00401)	(0.00397)	(0.00399)	(0.00389)	(0.00376)	(0.00399)	(0.00412)	
Unemployment	-0.00559**	-0.00568**	-0.00549*	-0.00543*	-0.00544*	-0.00537*	-0.00530*	-0.00551*	-0.00535*	
	(0.00270)	(0.00282)	(0.00294)	(0.00296)	(0.00303)	(0.00289)	(0.00277)	(0.00293)	(0.00299)	
Crisis	-0.0310	-0.0331	-0.0359	-0.0359	-0.0369	-0.0363	-0.0381	-0.0361	-0.0355	
	(0.0341)	(0.0342)	(0.0335)	(0.0336)	(0.0333)	(0.0341)	(0.0335)	(0.0335)	(0.0338)	
Country dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	
Wave dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	
Sector dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	
Observations	41,848	41,848	41,848	41,848	41,848	41,848	41,848	41,848	41,848	
Number of firms	25,956	25,956	25,956	25,956	25,956	25,956	25,956	25,956	25,956	
Pseudo R-squared	0.0861	0.0861	0.0857	0.0857	0.0857	0.0859	0.0860	0.0857	0.0858	

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 6–9 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. Other_loosening is an index that represents the sum of all other loosening policy actions across waves and countries and 0 otherwise. See Table C.4 in Appendix C for more information on the construction of the macroprudential indices. See Table C.5 in the Appendix C 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 $p < 0.01$.

3.7 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 subsets 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.

GENERAL DISCUSSION AND CONCLUSION

This part of the study contains a discussion of the findings and contributions of the dissertation. The dissertation's primary objective is to investigate and assess the impact of macroprudential regulation on credit growth, bank funding costs and SMEs' access to bank funding. First, we outline the main findings of each chapter of the thesis. Then, the main contributions of the study are discussed and, finally, a general discussion is presented with a brief conclusion of the dissertation.

Summary of the main findings of the study

In an attempt to examine the impact of macroprudential regulation on the liability side of banks' balance sheets, Chapter 1 examines the impact of the adoption of macroprudential measures on banks' funding costs. The overall empirical analysis includes regressions with two dependent variables: debt funding costs and overall funding costs measured by the weighted average cost of capital. The empirical results show a negative relationship between the macroprudential indices and the two dependent variables. The results suggest that macroprudential policies increase investor confidence by reducing bank risk and ameliorating bank capital positions, and thus lower the price of raising bank funds. To further investigate this relationship, we analyse different types of macroprudential measures separately: borrower-based measures, capital-based measures, structural measures, and institution-based instruments that target financial institutions' assets and earnings. Borrower-based measures are found to be negatively related to bank funding costs for both dependent variables. For capital-related measures, we obtained a statistically significant and negative association with the cost of debt financing. Structural measures are also strongly and negatively associated with the dependent variables, but a positive relationship is found for institution-related instruments, suggesting that some macroprudential measures, such as reserve requirements, could also have a negative impact on bank stability and thus increase the cost of funding for banks. By improving the quality of bank assets and reducing the riskiness of the loan portfolio, credit-related macroprudential measures such as loan-to-value limits and debt-to-income limits have the strongest impact on bank funding costs. Since the study includes bank-level data from 43 European countries – both advanced and emerging – we decide to analyse subsamples based on countries' economic development status. The results show that macroprudential indices have statistically significant and negative effects for bank funding costs in advanced countries, while for emerging economies we find some positive coefficients that reveal a difference in the macroprudential measures' impact based on subsamples of countries as they reflect different levels of financial development and varying institutional frameworks. Moreover, macroprudential policies are found to be more effective in the pre-crisis period for the total sample and emerging market economies, while in advanced economies macroprudential policies are also effective in the post-crisis period. The chapter concludes that macroprudential regulation matters significantly in terms of the evolution of banks' funding costs, but also

shows that macroprudential policies must be implemented carefully and designed according to country-specific needs and in a more coordinated manner.

Chapter 2 analyses the impact of macroprudential regulation on bank lending behaviour. We hypothesise that macroprudential measures are negatively associated with bank lending. We also hypothesise that a relaxation (tightening) of macroprudential measures is associated with an increase (decrease) in bank lending. The results support our first hypothesis as we find that the macroprudential index accounting for all policy measures, both tightening and easing, over the years in our sample has a statistically significant and negative impact on bank credit. The results are robust when we introduce various bank variables and macroeconomic determinants that could potentially have important effects on the volume of bank loans. We find weak results when we measure tightening measures separately, while macroprudential measures are found to have a stronger impact on bank lending in the easing cycle. These findings support the use of macroprudential tools in the face of the economic downturn caused by the Covid-19 pandemic with the aim to improve bank lending and market liquidity and support economic growth. Yet, we stress the need for a careful selection of measures and an approach that does not compromise the initial objective of macroprudential policy and maintains financial stability. Further, macroprudential capital measures turn out to be the most effective during periods of stress, as we find statistically significant and negative coefficients in regressions based on the financial crisis period. Finally, it is also found that the listed banks are more responsive to the introduction, tightening or relaxation of macroprudential measures.

Chapter 3 analyses the effects of macroprudential measures on SMEs' access to bank credit in 28 EU countries. The chapter uses information on a firm's loan application and the subsequent bank decision to successfully separate the credit-constrained firms based on direct information from the surveyed firms. The results of the empirical analysis show that macroprudential measures are significantly associated with a deterioration in SMEs' access to credit, with capital-related macroprudential instruments having the strongest impact. When we test tightening and loosening measures separately, we find a negative association with tightening macroprudential measures and a positive association with loosening measures, as expected. The effects of macroprudential measures decrease with firm size, suggesting that the effects are less pronounced for larger firms. Similar results were found when examining the marginal effects by age. Macroprudential effects decrease as the age of firms increases. The results are robust to examining different subsamples, a Heckman correction, the introduction of measures adopted by way of recommendations to the main macroprudential database, and to controlling for the monetary policy stance. The results obtained in this chapter confirm the potential trade-off between achieving financial stability goals and subsequent repercussions, as measured by firms' access to finance, which can negatively affect investment, employment, and economic growth.

Contribution of the doctoral dissertation

The dissertation contributes to the literature on financial regulation, financial intermediation, and corporate finance. The contribution made by Chapter 1 is seen in the study of the importance of bank funding costs in the context of financial stability. The empirical strategy focuses on the analysis of the debt funding costs and overall funding costs of individual bank subsidiaries in 43 advanced and emerging market economies. In this way, Chapter 1 fills an important gap in the literature regarding the channels through which macroprudential regulation might affect developments in the banking sector. First, the analysis reveals that most macroprudential instruments are negatively associated with banks' funding costs. In addition, Chapter 1 analyses the impact of different groups of macroprudential instruments and their individual effects, helping to disentangle the strength of the effect of each instrument on banks' cost of funding. Chapter 1 thereby extends the literature on macroprudential policy with a discussion of bank financing costs in the context of financial stability beyond capital requirements, as it analyses different groups of macroprudential policy instruments that affect banks through different channels. Second, the analysis examines the effectiveness of macroprudential instruments in different subsamples of countries, based on economic performance, and provides insight into differences in banks' response to the activation of macroprudential instruments. This analysis showed that the impact of macroprudential policies depends on countries' economic development, with the analysis finding that some macroprudential instruments are positively associated with the cost of funding in emerging markets, suggesting that the activation of macroprudential policies is associated with higher funding costs. Finally, by using bank-level data, this chapter builds on the relatively scarce literature on the microeconomic effects of macroprudential policy and contributes by controlling for bank-level effects, which are not controlled for in studies based purely on macro-level data.

The central contributions of Chapter 2 are reflected in the analysis and investigation of the relationship between macroprudential regulation and bank lending behaviour. The analysis uses bank-level data and examines the effectiveness of macroprudential policy using characteristics of banks' financial statements. Thus, the analysis focuses on the responses of individual banks and their subsidiaries that conduct their business in many countries. Apart from the macroprudential tools established and developed as part of Basel III, such as the countercyclical capital buffer or the capital buffer for systematically important financial institutions, many other macroprudential tools are activated on a national basis. In view of this, the analysis of the impact of macroprudential measures using unconsolidated bank balance sheets and profit and loss accounts is crucial for understanding its effectiveness. This chapter explicitly examines the impact of macroprudential measures on banks in European Union countries by using an extensive and rich macroprudential database with immense information on regulatory activities. The analysis shows that macroprudential instruments are negatively associated with bank lending. Moreover, the contribution of the chapter is seen in the separate examination of different macroprudential measures, which

provide information on which type of instruments have the strongest impact on lending. The chapter also analyses the impact of tightening and loosening macroprudential measures on bank lending separately. In this way, the study contributes to a better understanding of macroprudential instruments and their impact on credit cycles in different circumstances. It deepens what is known about the performance of these regulations in different economic states by analysing them based on different periods of the financial cycle. The results suggest the stronger effectiveness of macroprudential measures in easing cycles when macroprudential instruments are relaxed in order to facilitate economic recovery. These findings are particularly relevant to current decisions by policymakers in the context of their efforts to stimulate economic activity and reactivate growth following the Covid-19-induced standstill.

The main contribution of Chapter 3 is the analysis of the real effects of macroprudential regulation by analysing bank's supply of credit to SMEs. This chapter fills a relevant gap in the corporate finance and growing macroprudential literature since it analyses SMEs' access to finance by examining firms' direct loan applications in combination with firms' characteristics, macroeconomic conditions and macroprudential actions taken in European Union countries. The analysis covers an extensive period after the financial crisis of 2008 until 2017, during which many macroprudential actions were taken. The probit analysis shows that when macroprudential instruments are activated, SMEs are less likely to be successful in their loan applications with banks. Moreover, the empirical investigation shows that measures targeting bank lending and those targeting bank capital positions have the strongest effects on the probability of SMEs obtaining bank financing. Finally, the tightening and easing cycles of macroprudential measures are also examined. The analysis shows that when macroprudential measures are tightened, SMEs are less likely to obtain bank credit. On the contrary, when macroprudential measures are relaxed, SMEs are more likely to access bank credit, with this effect being more pronounced. In addition, the results are found to hold when various robustness tests are conducted.

Table 4.1 presents a summary and an overview of the main data characteristics and sources, the methodological approach and results, and the contribution made by each chapter. The thesis includes a detailed and comprehensive analysis of the microeconomic impact of macroprudential regulation by examining bank-level and firm-level data. It also uses two macroprudential databases and demonstrates innovation in the design and measurement of macroprudential indices, while informing policymakers and industry participants about their implications.

Table 4.1 Overview of the description, methodology, findings and contribution of the dissertation

Main contributions and findings of the dissertation					
Title of the chapter	**Sample**	**Data sources**	**Methodology**	**Findings**	**Contribution**
Chapter 1: Macroprudential measures and developments in bank funding costs	2000–2017 European banks (43 advanced and emerging economies	Fitch Connect; IMF (GMPI); World Bank	Generalised Method of Moments	The analysis shows that macroprudential regulation is significantly associated with the developments in bank funding costs. The main index of macroprudential policy (MPP) is significantly and negatively associated with bank funding costs. The results reveal borrower-oriented, capital-oriented and structural macroprudential measures have the strongest effects on banks' funding costs. Institution-based tools targeting bank assets and revenues are found to have a positive association with bank financing costs. Still, the analysis shows the impact of macroprudential measures depends strongly on an individual country's economic development and institutional settings as well as the target of the instruments.	To our knowledge, this is the first study to examine the relationship between the price of bank funding and macroprudential requirements. The study uses bank-level data while investigating bank funding costs and combines these data with the IMF's recently updated macroprudential database. We examine the individual banks' cost of debt and overall cost of funding and consider both debt and equity sources of bank funding.
Chapter 2: Tightening and loosening of macroprudential policy, its effects on credit growth and implications for the Covid-19 crisis	2000–2017 European Union banks	Fitch Connect; MaPPED, ECB; World Bank; IMF	Generalised Method of Moments	Macroprudential measures are significantly associated with bank lending. The main macroprudential index (MPP) is significantly and negatively associated with bank lending. Macroprudential tightening is negatively associated with bank lending, although the effects are less pronounced during the tightening cycle. The analysis shows macroprudential measures have stronger effects in the easing cycle. The loosening indices are significantly and positively associated with bank lending. It is found that capital-oriented macroprudential measures are the most effective tools in relation to bank lending. The listed banks are more responsive to changes in the macroprudential framework.	The chapter investigates the impact of macroprudential regulation on bank lending behaviour using bank-level data for 28 EU countries. Several macroprudential indices were developed for the study's purposes. The study uses the most recent macroprudential database, the MaPPED, which captures a large number of policy actions. This chapter examines banks' lending behaviour by testing not only the presence of instruments but their direction in terms of tightening or loosening.
Chapter 3: Bank lending and small and medium-sized enterprises' access to finance – effects of macroprudential policy	2009–2017 European Union SMEs	SAFE, ECB; MaPPED, World Bank; IMF	Pooled Probit model; Heckman correction	Macroprudential measures are significantly related to bank lending to SMEs. Capital-related macroprudential measures show the strongest association with the likelihood of SMEs gaining access to bank credit. Tightening macroprudential measures reduce the likelihood of SMEs obtaining bank credit. When macroprudential measures are relaxed, SMEs are more likely to obtain bank funding. The results withstand various robustness tests.	This is the first study to examine the impact of macroprudential measures on SMEs' access to bank credit using direct firm-level information on bank applications and decisions. The study includes a large sample of 36,466 firms in 28 EU countries. The time period considered is extensive and captures important changes in prudential regulation.

(table continues)

(continued)

Main contributions and findings of the dissertation					
Title of the chapter	**Sample**	**Data sources**	**Methodology**	**Findings**	**Contribution**
					The chapter examines both the tightening and loosening actions of individual macroprudential instruments and their impact on SMEs' access to finance.

Note: This table presents a summary of the main findings and contributions of the dissertation by chapter.

Conclusion

This dissertation analyses macroprudential regulation and its effects on bank behaviour. First, the relationship between macroprudential policy and the cost of bank funding is examined to establish whether the activation of macroprudential policies has a statistically significant effect on the price of bank financing. The objective of the analysis is to determine whether the introduction of these instruments is associated with an increase or a decrease in the above-mentioned costs. Both debt funding and overall bank costs are considered, with the analysis being extended by examining the effects of different groups of macroprudential measures and whether their impact varies in terms of the economic development of countries. Next, the impact of macroprudential measures on bank lending is investigated by looking at the volumes of gross loans both after activation and during the period of activated macroprudential measures. The empirical analysis examines tightening and loosening macroprudential policy measures separately, while different groups of macroprudential instruments are analysed to assess which instruments are the most effective for curbing bank lending. Finally, the dissertation examines whether macroprudential measures have potentially important effects for firms' access to finance. The analysis focuses on SMEs' bank loan applications and the likelihood of being successful relative to various firm characteristics, macroeconomic determinants of countries, and the macroprudential measures implemented. The study also considers the tightening and loosening of macroprudential policies separately and their impact on SME loan applications. In addition, the study is extended to consider the importance of the age and size of firms in determining the impact of macroprudential instruments.

A summary of relevant findings of this dissertation follows. First, macroprudential measures are an important factor to be considered while analysing banks' funding costs. The results show that macroprudential measures are mostly associated with lower funding costs, with the strongest effects observed for borrower, structural and capital-related macroprudential instruments. Second, the effect of macroprudential measures on banks' funding costs is shown to depend on a country's economic development, the development of its financial markets and its institutional and regulatory settings. In this regard, it is emphasised that macroprudential instruments should be carefully selected and activated in the light of individual country characteristics. Third, macroprudential policies are effective for curbing

excessive lending when measured with the overall macroprudential policy index, which includes all actions taken by regulators over the period studied. Fourth, macroprudential policies have stronger effects on bank lending in the easing cycle. Fifth, the analysis in the third chapter provides empirical evidence concerning the existence of a potential trade-off between financial stability and economic development in terms of the availability of finance for firms, which may ultimately affect investment, the unemployment rate and economic growth. In this respect, macroprudential regulators should make intensive efforts to promote the necessary pillars of financial stability and avoid the undesirable consequence of a slowdown in economic activity.

The methodology used in this study contributes to the literature in the field of macroprudential policy by extending the work in terms of the data used, the construction of macroprudential indices based on publicly available databases, and the extension of models and relevant factors to be considered in the analysis of these measures, which can help both practitioners and policymakers better understand the microeconomic impact of macroprudential regulation.

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APPENDICES

APPENDIX A: Chapter 1

A.1 Description of macroprudential instruments recorded in the macroprudential database of the IMF

As a primary data source for macroprudential instruments, we use a database collected through a survey conducted by the IMF entitled *"Global Macroprudential Policy Instruments (GMPI)"*. The responses in the survey were collected directly from country authorities, e.g., the macroprudential supervisory authority of each country, and cross-checked with other datasets by Kuttner and Shim (2016) and Crowe, Dell'Ariccia, Igan and Rabanal (2013) to ensure the quality of the data provided. This database allows us to examine policy use in many countries over 18 years. In this way, we capture a particular pattern following the introduction of these policies in different countries and different time periods. The macroprudential measures are also differentiated in this database according to their objective.

The first group of instruments focuses on borrower-based instruments, namely *loan-to-value limits (LTV)* and *debt-to-income limits (DTI).* These instruments are the most commonly used macroprudential tools and aim to suppress excessive credit growth by restricting lending to highly indebted borrowers. The essence of these instruments is to prevent excessive risk taking by banks in terms of credit supply while maintaining their asset quality (Lim et al., 2011). The tools are used to prevent credit excesses in the upturns, but also to avoid losses that might occur in bad times, thus limiting banks' procyclical behaviour, which serves as a macroprudential objective (Morgan, Regis & Salike, 2018). These tools are considered a crucial part of the macroprudential framework in the academic literature and in the official reports of regulators (Aikman, Bridges, Kashyap & Siegert, 2019; Borio, 2003; Cerutti, Claessens & Laeven, 2017; ESRB, 2014a; Jácome & Mitra, 2015; Claessens, Ghosh & Mihet, 2013; Igan & Kang, 2011; Altunbas, Binici & Gambacorta, 2018; Gambacorta & Murcia, 2019; Kahou & Lehar, 2017; Galati & Moessner, 2013; Akinci & Olmstead-Rumsey, 2018).

Other instruments that target the capital positions of financial institutions include capital instruments such as the *countercyclical capital buffer (CTC)*, the countercyclical dynamic provisioning, and additional capital requirements for systematically important financial institutions. By design, these instruments are part of the macroprudential framework. The objective of the instruments is to prevent bank losses by building buffers and reserves during upturns. A good example of *dynamic provisioning (DP)* as a macroprudential tool is the Spanish dynamic provisioning tool, which was activated in 2000 and recalibrated in 2005 and 2008. Jiménez, Ongena, Peydro and Saurina Salas (2017) show that countercyclical dynamic provisioning enhanced firms' access to finance during the crisis while smoothing credit cycles. Dynamic loan loss provisioning is a precautionary measure, i.e., it means saving for bad times through the net income generated during upturns, which the bank can

later use to absorb losses from bad loans. By its design and nature, the instrument is considered countercyclical, which is the essence of the proposed macroprudential solutions. The results of their study, based on the analysis with firm-level credit data, strongly confirm that procyclical forces within the banking sector can be stabilized by this instrument. The authors also point out that the capital level of individual banks matters for overall capitalisation and the macroeconomy as a whole.

Leverage ratio limit is used to account for banks' indebtedness and risk associated to it. It works as a limitation to bank leverage. The US authorities introduced leverage ratio as a microprudential tool, but it also served as macroprudential action by limiting increasing vulnerabilities in financial systems through excessive debt (Lim et al., 2011). It can also work with counter-cyclical adjustments in regard to systemic risk arising. Brei and Gambacorta (2016) suggest that leverage ratio is more countercyclical than the rest of capital buffers.

The *capital surcharge for systemically important institutions (SIFI)* is another instrument included in the database we use. This is a macroprudential instrument that requires additional capitalisation of banks whose size is significant to the entire financial system and whose failure could threaten the entire financial system of a country or globally. The SIFI instrument is introduced as part of the Basel III and requires additional capacity to absorb risks equal to 1-2.5% of risk-weighted assets (BCBS, 2015; Cerutti, Claessens & Laeven, 2017; Claessens, Ghosh & Mihet, 2013; Budnik & Kleibl, 2018; Dautovic, 2020). The objective of this tool is to prevent the spillover of systemic risk, which is essentially a macroprudential objective.

Limits on interbank lending serve as a tool to prevent the build-up of funding that has proven to be unstable over longer periods of time and during the crisis. Another channel through which interbank deposits can cause damage to the entire financial system is their interconnectedness, which allows a financial crisis to spread to different regions in times of distress. Setting limits on such exposures aims to make funding models more stable and aligned with stronger funding structure within banks' balance sheets. Interbank limits are seen as a macroprudential measure because the 2008 financial crisis highlighted the risks of large banks' reliance on certain types of wholesale funding and their vulnerability due to such funding structures (Demirgüç-Kunt & Huizinga, 2010; Suhail Rizwan, 2021).

Concentration limits serve as a limit on the proportion of assets placed with a limited group of borrowers. The essence here is that a stress in one sector or asset class would result in all banks with similar exposures in the same sector becoming vulnerable. These risks arise through the contagion channel as a result of interconnectedness of banks, liquidity shortages or contraction of bank assets (ESRB, 2014a; Cerutti, Claessens & Laeven, 2017; Claessens, Ghosh & Mihet, 2013; Ayyagari, Beck & Martinez Peria, 2018; Olszak, Roszkowska & Kowalska, 2018).

Domestic currency limits, foreign currency lending limits, and countercyclical reserve requirements are prudential tools used to reduce credit growth directly or banks' foreign currency exposure. Countercyclical reserve requirements can also serve as a monetary policy tool, and in this framework we consider reserve requirements measures in countries that adopt such a cycle- adjusted tool (Olszak, Roszkowska & Kowalska, 2018; Lim et al., 2011).

Taxes on financial institutions' revenues, imposed as a fiscal tool are also part of the macroprudential toolkit within this database.

A.2 Construction of macroprudential indices

The macroprudential instruments covered by the IMF's GMPI survey take a value 1 if they were implemented in a given year in a given country, and 0 if they were not or if the instrument was repealed in the respective period 2000–2017. All individual instruments take a value of 0–1, while different groups of instruments, namely the Borrower, Capital, Structural and Institution indices, are constructed by summing all instruments that target either borrowers, capital positions of banks, interconnectedness and concentration risks, or financial institutions' assets and revenues. In the study, we test instruments separately by group and also take a measure of the overall macroprudential index – MPP, which sums all implemented instruments in a country over years. Yet we note the maximum values of the indices depend on the adoption of policies within our sample. Theoretically, the maximum value for the MPP index is 12 (if all instruments were adopted in a specific country and time period), yet in our sample the maximum value of MPP is 8. This is also reflected in the other macroprudential indices. Tables A.1–A.2 provide more detailed information about the construction of the indices.

Table A.1 Construction of macroprudential indices

Instrument	Description	Indicator	Index by target	Agg. Index
LTV	Loan-to-value limit	(0–1)	Borrower (LTV+DTI) 0-2	MPP (LTV+DTI+ CTC+ DP+SIFI+ LEV+INTER+CONC+CG +FC+RR+TAX) 0-8
DTI	Debt-to-income limit	(0–1)		
CTC	Countercyclical capital buffer	(0–1)	Capital (CTC+DP+LEV+ SIFI) 0-3	
DP	Dynamic loan-loss provisioning	(0–1)		
LEV	Leverage ratio limit	(0–1)		

(table continues)

(continued)

Instrument	Description	Indicator	Index by target	Agg. Index
SIFI	Capital requirement for SIFI	(0–1)		
INTER	Limits on interbank exposures	(0–1)	Structural (INTER+CONC) 0-2	
CONC	Caps on concentration exposures	(0–1)		
CG	Limits on domestic currency loans	(0–1)	Institution (CG+FC+RR+TAX) 0-3	
FC	Limits on foreign currency loans	(0–1)		
RR	Countercyclical reserve requirements	(0–1)		
TAX	Tax on financial institutions	(0–1)		

Source: Authors' elaboration, Data (IMF-GMPI; Cerutti, Claessens & Laeven, 2017)

Table A.2 Exemplary design of macroprudential indices based on country cases for four countries in 2015

Macroprudential measure	**LTV**	**DTI**	**CTC**	**DP**	**LEV**	**SIFI**	**INTER**	**CONC**	**CG**	**FC**	**RR**	**TAX**
Austria	1	0	0	0	0	0	0	1	0	1	0	1
Lithuania	1	1	0	0	0	1	0	1	0	0	0	1
Spain	1	0	0	1	0	0	1	1	0	0	0	1
Turkey	1	1	0	1	1	0	0	1	0	1	1	0
	Austria			Lithuania			Spain			Turkey		
Borrower (LTV+DTI)	1			2			1			2		
Capital (CTC+DP+LEV+SIFI)	0			1			1			2		
Structural (INTER+CONC)	1			1			2			1		
Institution (CG+FC+RR+TAX)	2			1			1			2		
MPP (Sum of all measures)	4			5			5			7		

Source: Authors' elaboration, Data (IMF-GMPI; Cerutti, Claessens & Laeven, 2017)

Table A.3 Correlation matrix of the main regression variables and debt funding costs as a dependent variable

Variables	Y	Y_{t-1}	$Size_{t-1}$	$Equity_{t-1}$	$Liquidity_{t-1}$	$Deposits_{t-1}$	MPP	Borrower	Capital	Structural	Institution	GDP	Private credit	Policy rate	Inflation	Crisis
Y	1															
Y_{t-1}	0.8715*	1														
$Size_{t-1}$	-0.0692*	-0.0567*	1													
$Equity_{t-1}$	0.1318*	0.1185*	-0.4369*	1												
$Liquidity_{t-1}$	0.1354*	0.1316*	-0.1480*	0.0741*	1											
$Deposits_{t-1}$	0.1233*	0.1192*	-0.2105*	0.0984*	0.0471*	1										
MPP	-0.1030*	-0.1137*	0.0694*	-0.0635*	-0.2190*	-0.0904*	1									
Borrower	0.0741*	0.0724*	-0.0726*	0.0109	-0.1426*	-0.0580*	0.5232*	1								
Capital	-0.1650*	-0.1741*	0.0443*	-0.0426*	-0.0338*	-0.0701*	0.6489*	-0.2970*	1							
Structural	0.1371*	0.1420*	-0.1138*	0.0017	-0.1223*	-0.1171*	0.6177*	-0.0836*	0.2592*	1						
Institution	-0.1160*	-0.1028*	0.0700*	-0.1239*	-0.2146*	-0.0338*	0.6282*	-0.2399*	0.1573*	-0.1049*	1					
GDP	0.0459*	0.0599*	-0.0407*	0.0044*	-0.0668*	-0.0052	0.0193*	-0.1810*	0.0478*	-0.0990*	0.1152*	1				
Private credit	0.2885*	0.2920*	-0.0447*	0.0612*	-0.2526*	-0.0464*	0.1897*	-0.0017	0.1403*	-0.1753*	0.3378*	0.1450*	1			
Policy rate	0.5593*	0.5279*	-0.2423*	0.2010*	-0.1089*	-0.0341*	0.0011	-0.0006	-0.1066*	-0.1171*	0.2170*	-0.0620*	-0.4235*	1		
Inflation rate	0.5039*	0.4666*	-0.1871*	0.1807*	-0.1236*	-0.0185*	0.0529*	-0.0112	-0.0660*	-0.0945*	0.2762*	-0.0170*	-0.4068*	0.8263*	1	
Crisis	0.0221*	0.0412*	-0.0835*	0.0174*	-0.0500*	-0.0028	0.0525*	-0.0178*	-0.1063*	-0.0356*	0.0648*	-0.0350*	-0.0874*	0.0521*	0.0939*	1

Note: * $p < 0.05$

Table A.4 Correlation matrix of the main regression variables and overall funding costs as a dependent variable

Variables	Y	Y_{t-1}	$Size_{t-1}$	$Equity_{t-1}$	$Liquidity_{t-1}$	$Deposits_{t-1}$	MPP	Borrower	Capital	Structural	Institution	GDP	Private credit	Policy rate	Inflation	Crisis
Y	1															
Y_{t-1}	0.7044*	1														
$Size_{t-1}$	-0.0065	-0.0048	1													
$Equity_{t-1}$	0.0290*	0.0663*	-0.4585*	1												
$Liquidity_{t-1}$	0.0464*	0.0414*	-0.1587*	0.0818*	1											
$Deposits_{t-1}$	0.0633*	0.0644*	-0.1756*	0.1528*	0.0434*	1										
MPP	-0.1243*	-0.1336*	0.0670*	-0.0629*	-0.2159*	-0.0897*	1									
Borrower	0.0679*	0.0772*	-0.0765*	-0.0132*	-0.1478*	-0.0548*	0.5186*	1								
Capital	-0.1225*	-0.1296*	0.0411*	-0.0414*	-0.0262*	-0.0697*	0.6485*	-0.2897*	1							
Structural	0.1343*	0.1274*	-0.1065*	0.0008	-0.1151*	-0.1119*	0.6213*	-0.0875*	0.2654*	1						
Institution	-0.0263*	-0.0098	0.0685*	-0.1225*	-0.2180*	-0.0270*	0.6264*	-0.2445*	0.1509*	-0.1049*	1					
GDP	0.0098	0.0052	-0.0351*	0.0129*	-0.0688*	0.0101	0.0212*	-0.1779*	0.0484*	-0.0977*	0.1189*	1				

(table continues)

(continued)

Variables	Y	Y_{t-1}	$Size_{t-1}$	$Equity_{t-1}$	$Liquidity_{t-1}$	$Deposits_{t-1}$	MPP	Borrower	Capital	Structural	Institution	GDP	Private credit	Policy rate	Inflation	Crisis
Private credit	-0.2173*	-0.2117*	0.0292*	0.0393*	0.2646*	0.0466*	0.1858*	0.0069	0.1492*	0.1679*	0.3408*	0.1471*	1			
Policy rate	-0.3868*	-0.3654*	0.2227*	0.1622*	0.1101*	0.0386*	0.0086	0.0048	0.1084*	0.1218*	0.2072*	0.0658*	-0.4221*	1		
Inflation rate	-0.3457*	-0.3243*	0.1701*	0.1467*	0.1275*	0.0228*	0.0480*	0.0165*	0.0689*	0.0990*	0.2698*	0.0153*	-0.4093*	0.8247*	1	
Crisis	-0.0163*	-0.0185*	0.0758*	0.0104	0.0439*	0.0055	0.0502*	0.0185*	0.1011*	0.0357*	0.0635*	0.0375*	-0.0886*	0.0510*	0.0956*	1

Note: * $p < 0.05$

Table A.5 Fisher type unit root test

Variable	*Transformation*	
	First-Difference Lags (1)	*Levels Lags (1)*
Debt funding cost	- 55.4856 (0.0000)	-19.1213 (0.0000)
Overall funding costs	-50.7710 (0.0000)	-18.6704 (0.0000)
Size	-29.2992 (0.0000)	-5.517 (0.0000)
Equity	-36.8135 (0.0000)	-0.2213 (0.4124)
Liquidity	-49.3357 (0.0000)	-8.9153 (0.0000)
Deposits	-55.9551 (0.0000)	-15.0485 (0.0000)
GDP	-38.7266 (0.0000)	-11.0682 (0.0000)
Private credit	-61.9786 (0.0000)	-25.0621 (0.0000)
Policy rate	-47.3423 (0.0000)	-24.1503 (0.0000)
Inflation rate	-57.5801 (0.0000)	-40.9786 (0.0000)

Note: The panel unit root ADF test was performed to check for panels with unit roots within our data (stationarity). While performing the test, we demean all variables. The null hypothesis in this test is that all panels contain unit roots. Z statistics (Inverse normal statistics) reported.

Table A.6 Impact of individual macroprudential instruments on bank financing costs by subsamples – LTV and DTI

Dependent variable	*Debt funding costs*		*Overall funding costs*		*Debt funding costs*		*Overall funding costs*	
	(1) Advanced	(2) Emerging	(3) Advanced	(4) Emerging	(5) Advanced	(6) Emerging	(7) Advanced	(8) Emerging
Y_{t-1}	0.659***	0.473***	0.407***	0.344***	0.656***	0.477***	0.406***	0.347***
	(10.40)	(4.40)	(9.41)	(8.44)	(10.28)	(4.40)	(9.41)	(8.58)
$Size_{t-1}$	-0.0454	-0.118**	-0.00466	-0.0455	-0.0453	-0.122**	-0.00623	-0.0544
	(-1.51)	(-2.19)	(-0.13)	(-0.65)	(-1.52)	(-2.22)	(-0.17)	(-0.75)
$Equity_{t-1}$	-0.00609	-0.0197	-0.0223**	-0.0634***	-0.00654	-0.0200	-0.0231**	-0.0628***
	(-0.58)	(-1.38)	(-2.24)	(-3.72)	(-0.62)	(-1.41)	(-2.31)	(-3.66)

(table continues)

(continued)

Dependent variable	*Debt funding costs*		*Overall funding costs*		*Debt funding costs*		*Overall funding costs*	
	(1) Advanced	(2) Emerging	(3) Advanced	(4) Emerging	(5) Advanced	(6) Emerging	(7) Advanced	(8) Emerging
$Liquidity_{t-1}$	-0.00270***	-0.00116	-0.00163	0.00297	-0.00236***	-0.00120	-0.000983	0.00242
	(-3.35)	(-0.41)	(-1.54)	(0.85)	(-2.97)	(-0.42)	(-0.90)	(0.68)
$Deposits_{t-1}$	-0.0213***	0.00766	-0.00167	-0.0110	-0.0214***	0.00774	-0.00160	-0.0119
	(-3.66)	(0.90)	(-0.29)	(-0.85)	(-3.70)	(0.89)	(-0.28)	(-0.88)
LTV	**-0.133*** **	**-0.157**	**-0.188*** **	**-0.540*** **				
	(-3.19)	**(-1.14)**	**(-2.89)**	**(-2.81)**				
DTI					**-0.0213**	**-0.0806**	**0.183**	**-0.309**
					(-0.21)	**(-0.58)**	**(1.55)**	**(-1.56)**
GDP	-0.0452*	-0.0354	0.0638**	-0.0161	-0.0642**	-0.0381	0.0318	-0.0266
	(-1.75)	(-1.17)	(2.26)	(-0.45)	(-2.45)	(-1.26)	(1.14)	(-0.74)
Private credit	-0.00152***	0.0157***	-0.00259***	-0.00226	-0.00169***	0.0158***	-0.00285***	-0.00220
	(-2.68)	(4.12)	(-3.36)	(-0.44)	(-3.02)	(4.10)	(-3.75)	(-0.41)
Policy rate	0.141***	0.134***	0.108***	0.0977***	0.141***	0.134***	0.108***	0.0977***
	(4.50)	(4.14)	(3.16)	(5.00)	(4.50)	(4.14)	(3.16)	(5.00)
Inflation	0.0575***	0.0779***	0.0596**	0.101***	0.0575***	0.0779***	0.0596**	0.101***
	(2.66)	(5.28)	(2.37)	(5.65)	(2.66)	(5.28)	(2.37)	(5.65)
Crisis	3.191**	2.656	1.771	5.052**	4.293***	2.830*	1.299	5.425**
	(2.52)	(1.48)	(1.45)	(2.29)	(3.55)	(1.65)	(1.06)	(2.46)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12752	3971	13083	3955	12752	3971	13083	3955
Instruments	44	43	48	38	44	43	48	38
AR (1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR (2)	0.166	0.480	0.119	0.783	0.165	0.506	0.119	0.810
AR (3)	0.312	0.192	0.126	0.261	0.308	0.181	0.125	0.255
Hansen	0.243	0.077	0.063	0.259	0.296	0.077	0.075	0.262

Note: The table shows the results of the estimations with the dependent variable of debt funding costs (columns 1–2 and 5–6), and overall funding costs (columns 3–4 and 7–8) while the right-hand side includes macroprudential policy instruments, bank-specific variables and macroeconomic controls. Y_{t-1} is the lagged dependent variable, bank variables lagged by one period are: $Size_{t-1}$ – measured by the logarithm of total assets, $Equity_{t-1}$ – ratio of equity to total assets, $Liquidity_{t-1}$ – ratio of liquid assets to total assets, and $Deposits_{t-1}$ – ratio of total deposits to total liabilities. Y_{t-1} – the lagged dependent variable, bank variables are: Size – measured by the logarithm of total assets, Equity – ratio of equity to total assets, Liquidity – ratio of liquid assets to total assets, and Deposits – ratio of total deposits to total liabilities. Macroprudential indices are: LTV – loan-to-value limit, DTI – debt-to-income cap; the indices' scopes are 0–1. Macroeconomic variables include: GDP – logarithm of GDP volume, Policy rate – monetary policy rate, Inflation – annual inflation rate, Private credit – ratio of domestic credit to the private sector to GDP, Crisis – a dummy variable equal to 1 for 2008–2012, and 0 otherwise. The estimation method is a dynamic two-step system GMM estimator with robust standard errors and a Windmeijer correction. All regressions include time dummy variables to account for unobserved heterogeneity within our sample. T-statistics are reported in parentheses. The following are p-values indicating the significance level of the coefficients: * p <0.10, ** p <0.05, *** p <0.01

Table A.7 Impact of individual macroprudential instruments on bank financing costs by subsamples – CTC and DP

Dependent variable	*Debt funding costs*		*Overall funding costs*		*Debt funding costs*		*Overall funding costs*	
	(1) Advanced	(2) Emerging	(3) Advanced	(4) Emerging	(5) Advanced	(6) Emerging	(7) Advanced	(8) Emerging
Y_{t-1}	0.655***	0.490***	0.405***	0.345***	0.658***	0.481***	0.406***	0.347***
	(10.24)	(4.78)	(9.41)	(8.48)	(10.38)	(4.50)	(9.41)	(8.61)
$Size_{t-1}$	-0.0454	-0.123**	-0.00524	-0.0714	-0.0460	-0.127**	-0.00665	-0.0865
	(-1.51)	(-2.37)	(-0.15)	(-1.08)	(-1.53)	(-2.32)	(-0.18)	(-1.27)
$Equity_{t-1}$	-0.00674	-0.0192	-0.0231**	-0.0621***	-0.00660	-0.0180	-0.0231**	-0.0606***
	(-0.64)	(-1.34)	(-2.31)	(-3.66)	(-0.63)	(-1.25)	(-2.31)	(-3.56)
$Liquidity_{t-1}$	-0.00241***	-0.00131	-0.000996	0.00190	-0.00234***	-0.00182	-0.000987	0.00115
	(-3.03)	(-0.47)	(-0.92)	(0.53)	(-2.87)	(-0.64)	(-0.89)	(0.35)
$Deposits_{t-1}$	-0.0211***	0.00658	-0.00144	-0.0125	-0.0216***	0.00695	-0.00172	-0.0105
	(-3.63)	(0.79)	(-0.25)	(-0.97)	(-3.72)	(0.82)	(-0.30)	(-0.80)
CTC	**-0.207**	**-0.633****	**0.216**	**-1.087****				
	(-1.47)	**(-2.12)**	**(1.39)**	**(-2.07)**				
DP					**-0.0489**	**0.196**	**0.122**	**0.477***
					(-0.53)	**(1.07)**	**(0.80)**	**(1.84)**
GDP	-0.0526*	-0.0309	0.0247	-0.0188	-0.0656**	-0.0290	0.0400	-0.00574
	(-1.93)	(-1.07)	(0.86)	(-0.52)	(-2.48)	(-1.00)	(1.42)	(-0.16)
Private credit	-0.00171***	0.0160***	-0.00283***	-0.000270	-0.00166***	0.0150***	-0.00295***	-0.00302
	(-3.03)	(4.47)	(-3.70)	(-0.05)	(-2.86)	(3.98)	(-3.73)	(-0.60)
Policy rate	0.143***	0.136***	0.110***	0.107***	0.140***	0.137***	0.113***	0.107***
	(4.54)	(4.21)	(3.22)	(5.50)	(4.45)	(4.12)	(3.29)	(5.11)
Inflation	0.0636***	0.0729***	0.0585**	0.0952***	0.0567**	0.0745***	0.0643**	0.0939***
	(2.92)	(5.17)	(2.28)	(5.29)	(2.54)	(5.18)	(2.58)	(5.24)
Crisis	3.270***	2.866*	2.256*	5.639***	3.448***	2.789	2.127*	5.103**
	(2.58)	(1.69)	(1.88)	(2.59)	(2.70)	(1.54)	(1.71)	(2.31)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12752	3971	13083	3955	12752	3971	13083	3955
Instruments	44	43	48	38	44	43	48	38
AR (1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR (2)	0.165	0.521	0.118	0.793	0.166	0.521	0.117	0.829
AR (3)	0.310	0.165	0.122	0.250	0.308	0.162	0.125	0.282
Hansen	0.270	0.086	0.075	0.301	0.295	0.072	0.071	0.274

Note: The table shows the results of the estimations with the dependent variable of debt funding costs (columns 1–2 and 5–6), and overall funding costs (columns 3–4 and 7–8) while the right-hand side includes macroprudential policy instruments, bank-specific variables and macroeconomic controls. Y_{t-1} is the lagged dependent variable, bank variables lagged by one period are: $Size_{t-1}$ – measured by the logarithm of total assets, $Equity_{t-1}$ – ratio of equity to total assets, $Liquidity_{t-1}$ – ratio of liquid assets to total assets, and $Deposits_{t-1}$ – ratio of total deposits to total liabilities. Y_{t-1} – the lagged dependent variable, bank variables are: Size – measured by the logarithm of total assets, Equity – ratio of equity to total assets, Liquidity – ratio of liquid assets to total assets, and Deposits – ratio of total deposits to total liabilities. Macroprudential indices are: CTC – countercyclical capital buffer, DP – dynamic provisioning; the indices' scopes are 0–1. Macroeconomic variables include: GDP – logarithm of GDP volume, Policy rate – monetary policy rate, Inflation – annual inflation rate, Private credit – ratio of domestic credit to the private sector to GDP, Crisis – a dummy variable equal to 1 for 2008–2012, and 0 otherwise. The estimation method is a dynamic two-step system GMM estimator with robust standard errors and a Windmeijer correction. All regressions include time dummy variables to account for unobserved heterogeneity within our sample. T-statistics are reported in parentheses. The following are p-values indicating the significance level of the coefficients: * p <0.10, ** p <0.05, *** p <0.01

Table A.8 Impact of individual macroprudential instruments on bank financing costs by subsamples – LEV and SIFI

Dependent variable	*Debt funding costs*		*Overall funding costs*		*Debt funding costs*		*Overall funding costs*	
	(1) Advanced	(2) Emerging	(3) Advanced	(4) Emerging	(5) Advanced	(6) Emerging	(7) Advanced	(8) Emerging
Y_{t-1}	0.660***	0.477***	0.404***	0.351***	0.657***	0.478***	0.407***	0.349***
	(10.51)	(4.55)	(9.39)	(8.79)	(10.32)	(4.53)	(9.41)	(8.69)
$Size_{t-1}$	-0.0473	-0.129**	-0.0102	-0.0774	-0.0460	-0.131**	-0.00791	-0.0857
	(-1.56)	(-2.45)	(-0.28)	(-1.18)	(-1.54)	(-2.49)	(-0.22)	(-1.28)
$Equity_{t-1}$	-0.00693	-0.0182	-0.0239**	-0.0600***	-0.00663	-0.0203	-0.0237**	-0.0636***
	(-0.65)	(-1.29)	(-2.39)	(-3.60)	(-0.63)	(-1.43)	(-2.36)	(-3.76)
$Liquidity_{t-1}$	-0.00220***	-0.00212	-0.000782	0.00128	-0.00234***	-0.00138	-0.00105	0.00204
	(-2.80)	(-0.76)	(-0.71)	(0.38)	(-2.92)	(-0.49)	(-0.96)	(0.58)
$Deposits_{t-1}$	-0.0215***	0.00725	-0.00196	-0.00979	-0.0215***	0.00771	-0.00174	-0.00966
	(-3.68)	(0.88)	(-0.34)	(-0.75)	(-3.71)	(0.94)	(-0.30)	(-0.75)
LEV	**-0.155****	**0.572****	**-0.317*****	**0.732****				
	(-2.43)	**(2.21)**	**(-4.04)**	**(2.39)**				
SIFI					**-0.0801**	**0.262**	**-0.240*****	**0.629****
					(-1.36)	**(1.62)**	**(-2.87)**	**(2.33)**
GDP	-0.0643**	-0.0222	0.0362	-0.00538	-0.0627**	-0.0412	0.0432	-0.0320
	(-2.48)	(-0.77)	(1.29)	(-0.15)	(-2.46)	(-1.35)	(1.58)	(-0.86)
Private credit	-0.00149***	0.0166***	-0.00245***	0.000714	-0.00164***	0.0161***	-0.00266***	-0.000794
	(-2.73)	(4.59)	(-3.22)	(0.15)	(-2.89)	(4.36)	(-3.43)	(-0.16)
Policy rate	0.139***	0.134***	0.111***	0.0966***	0.140***	0.136***	0.111***	0.101***
	(4.45)	(4.26)	(3.24)	(4.95)	(4.46)	(4.28)	(3.26)	(5.16)
Inflation	0.0435**	0.0760***	0.0383	0.0982***	0.0555**	0.0776***	0.0627**	0.100***
	(2.01)	(5.29)	(1.45)	(5.56)	(2.54)	(5.31)	(2.52)	(5.57)
Crisis	3.449***	2.789*	2.360*	5.264**	3.413***	3.024*	2.104*	5.324**
	(2.67)	(1.65)	(1.88)	(2.40)	(2.69)	(1.78)	(1.70)	(2.42)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12752	3971	13083	3955	12752	3971	13083	3955
Instruments	44	43	48	38	44	43	48	38
AR (1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR (2)	0.163	0.527	0.119	0.830	0.165	0.542	0.117	0.800
AR (3)	0.301	0.151	0.120	0.282	0.304	0.166	0.125	0.247
Hansen	0.283	0.088	0.088	0.313	0.298	0.099	0.078	0.342

Note: The table shows the results of the estimations with the dependent variable of debt funding costs (columns 1–2 and 5–6), and overall funding costs (columns 3–4 and 7–8) while the right-hand side includes macroprudential policy instruments, bank-specific variables and macroeconomic controls. Y_{t-1} is the lagged dependent variable, bank variables lagged by one period are: $Size_{t-1}$ – measured by the logarithm of total assets, $Equity_{t-1}$ – ratio of equity to total assets, $Liquidity_{t-1}$ – ratio of liquid assets to total assets, and $Deposits_{t-1}$ – ratio of total deposits to total liabilities. Y_{t-1} – the lagged dependent variable, bank variables are: Size – measured by the logarithm of total assets, Equity – ratio of equity to total assets, Liquidity – ratio of liquid assets to total assets, and Deposits – ratio of total deposits to total liabilities. Macroprudential indices are: LEV – leverage ratio limit, SIFI – capital caps for systematically important financial institutions; the indices' scopes are 0–1. Macroeconomic variables include: GDP – logarithm of GDP volume, Policy rate – monetary policy rate, Inflation – annual inflation rate, Private credit – ratio of domestic credit to the private sector to GDP, Crisis – a dummy variable equal to 1 for 2008–2012, and 0 otherwise. The estimation method is a dynamic two-step system GMM estimator with robust standard errors and a Windmeijer correction. All regressions include time dummy variables to account for unobserved heterogeneity within our sample. T-statistics are reported in parentheses. The following are p-values indicating the significance level of the coefficients: * p <0.10, ** p <0.05, *** p <0.01

Table A.9 Impact of individual macroprudential instruments on bank financing costs by subsamples – INTER and CONC

Dependent variable	*Debt funding costs*		*Overall funding costs*		*Debt funding costs*		*Overall funding costs*	
	(1) Advanced	(2) Emerging	(3) Advanced	(4) Emerging	(5) Advanced	(6) Emerging	(7) Advanced	(8) Emerging
Y_{t-1}	0.655***	0.457***	0.407***	0.346***	0.658***	0.478***	0.406***	0.347***
	(10.53)	(4.28)	(9.45)	(8.62)	(10.54)	(4.57)	(9.43)	(8.62)
$Size_{t-1}$	-0.0536*	-0.131**	-0.0120	-0.0716	-0.0477	-0.132**	-0.00654	-0.0753
	(-1.77)	(-2.51)	(-0.33)	(-1.09)	(-1.61)	(-2.49)	(-0.18)	(-1.12)
$Equity_{t-1}$	-0.00859	-0.0210	-0.0241**	-0.0616***	-0.00858	-0.0200	-0.0247**	-0.0621***
	(-0.82)	(-1.46)	(-2.42)	(-3.64)	(-0.81)	(-1.40)	(-2.46)	(-3.64)
$Liquidity_{t-1}$	-0.00225***	-0.00152	-0.000953	0.00210	-0.00212***	-0.00130	-0.000862	0.00206
	(-2.86)	(-0.53)	(-0.87)	(0.59)	(-2.68)	(-0.46)	(-0.78)	(0.58)
$Deposits_{t-1}$	-0.0228***	0.00686	-0.00314	-0.0103	-0.0226***	0.00743	-0.00232	-0.0105
	(-3.83)	(0.82)	(-0.54)	(-0.80)	(-3.87)	(0.89)	(-0.40)	(-0.82)
INTER	**-0.206*** **	**-0.390*** **	**-0.156** **	**-0.464*** **				
	(-3.33)	**(-2.88)**	**(-2.10)**	**(-3.06)**				
CONC					**-0.224*** **	**0.348*** **	**-0.220*** **	**0.174**
					(-4.02)	**(2.64)**	**(-3.18)**	**(1.00)**
GDP	-0.0862***	-0.0510	0.0221	-0.0364	-0.0453*	-0.0264	0.0580**	-0.0190
	(-3.16)	(-1.56)	(0.77)	(-0.98)	(-1.78)	(-0.88)	(2.00)	(-0.53)
Private credit	-0.00229***	0.0198***	-0.00329***	0.00417	-0.00228***	0.0173***	-0.00345***	0.000798
	(-3.73)	(4.75)	(-4.15)	(0.79)	(-3.78)	(4.61)	(-4.19)	(0.16)
Policy rate	0.125***	0.146***	0.0978***	0.106***	0.130***	0.138***	0.101***	0.100***
	(4.07)	(4.39)	(2.79)	(5.40)	(4.19)	(4.33)	(2.94)	(5.00)
Inflation	0.0183	0.0629***	0.0382	0.0797***	0.0508**	0.0718***	0.0596**	0.0974***
	(0.81)	(4.97)	(1.53)	(4.45)	(2.35)	(5.13)	(2.40)	(5.43)
Crisis	5.129***	3.724**	1.781	5.571**	4.484***	2.607	2.222*	4.835**
	(3.87)	(2.05)	(1.34)	(2.54)	(3.70)	(1.55)	(1.78)	(2.19)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12752	3971	13083	3955	12752	3971	13083	3955
Instruments	44	43	48	38	44	43	48	38
AR (1)	0.0000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR (2)	0.171	0.740	0.111	0.907	0.177	0.588	0.112	0.840
AR (3)	0.292	0.121	0.123	0.297	0.301	0.172	0.123	0.263
Hansen	0.359	0.119	0.091	0.387	0.399	0.106	0.085	0.307

Note: The table shows the results of the estimations with the dependent variable of debt funding costs (columns 1–2 and 5–6), and overall funding costs (columns 3–4 and 7–8) while the right-hand side includes macroprudential policy instruments, bank-specific variables and macroeconomic controls. Y_{t-1} is the lagged dependent variable, bank variables lagged by one period are: $Size_{t-1}$ – measured by the logarithm of total assets, $Equity_{t-1}$ – ratio of equity to total assets, $Liquidity_{t-1}$ – ratio of liquid assets to total assets, and $Deposits_{t-1}$ – ratio of total deposits to total liabilities. Y_{t-1} – the lagged dependent variable, bank variables are: Size – measured by the logarithm of total assets, Equity – ratio of equity to total assets, Liquidity – ratio of liquid assets to total assets, and Deposits – ratio of total deposits to total liabilities. Macroprudential indices are: INTER – interbank limits, CONC – concentration limits; the indices' scopes are 0–1. Macroeconomic variables include: GDP – logarithm of GDP volume, Policy rate – monetary policy rate, Inflation – annual inflation rate, Private credit – ratio of domestic credit to the private sector to GDP, Crisis – a dummy variable equal to 1 for 2008–2012, and 0 otherwise. The estimation method is a dynamic two-step system GMM estimator with robust standard errors and a Windmeijer correction. All regressions include time dummy variables to account for unobserved heterogeneity within our sample. T-statistics are reported in parentheses. The following are p-values indicating the significance level of the coefficients: * p <0.10, ** p <0.05, *** p <0.01

Table A.10 Impact of individual macroprudential instruments on bank financing costs by subsamples – CG and FC

Dependent variable	*Debt funding costs*		*Overall funding costs*		*Debt funding costs*		*Overall funding costs*	
	(1) Advanced	(2) Emerging	(3) Advanced	(4) Emerging	(5) Advanced	(6) Emerging	(7) Advanced	(8) Emerging
Y_{t-1}	0.657***	0.485***	0.406***	0.348***	0.657***	0.486***	0.407***	0.348***
	(10.33)	(4.65)	(9.40)	(8.63)	(10.34)	(4.72)	(9.41)	(8.65)
$Size_{t-1}$	-0.0458	-0.120**	-0.00569	-0.0651	-0.0467	-0.124**	-0.00749	-0.0715
	(-1.53)	(-2.30)	(-0.16)	(-0.98)	(-1.56)	(-2.40)	(-0.21)	(-1.08)
$Equity_{t-1}$	-0.00654	-0.0188	-0.0230**	-0.0614***	-0.00672	-0.0201	-0.0233**	-0.0619***
	(-0.62)	(-1.31)	(-2.30)	(-3.60)	(-0.64)	(-1.40)	(-2.32)	(-3.64)
$Liquidity_{t-1}$	-0.00233***	-0.00140	-0.00104	0.00187	-0.00237***	-0.00141	-0.00109	0.00205
	(-2.91)	(-0.49)	(-0.96)	(0.53)	(-2.95)	(-0.49)	(-1.01)	(0.58)
$Deposits_{t-1}$	-0.0215***	0.00753	-0.00173	-0.0107	-0.0215***	0.00814	-0.00161	-0.0102
	(-3.71)	(0.91)	(-0.30)	(-0.83)	(-3.70)	(0.97)	(-0.28)	(-0.78)
CG		**0.492***		**1.049***				
		(1.93)		**(3.13)**				
FC					**-0.0926**	**0.254***	**-0.151**	**0.0867**
					(-1.10)	**(1.72)**	**(-0.97)**	**(0.61)**
GDP	-0.0649**	-0.0312	0.0373	-0.0135	-0.0655**	-0.0311	0.0362	-0.0220
	(-2.49)	(-1.06)	(1.34)	(-0.37)	(-2.52)	(-1.09)	(1.30)	(-0.60)
Private credit	-0.00170***	0.0170***	-0.00285***	0.00179	-0.00171***	0.0154***	-0.00287***	0.000104
	(-3.03)	(4.53)	(-3.73)	(0.36)	(-3.06)	(4.50)	(-3.76)	(0.02)
Policy rate	0.140***	0.131***	0.111***	0.0945***	0.140***	0.133***	0.110***	0.0984***
	(4.46)	(4.19)	(3.26)	(4.80)	(4.44)	(4.23)	(3.23)	(5.01)
Inflation	0.0565**	0.0782***	0.0656***	0.103***	0.0590***	0.0694***	0.0695***	0.0977***
	(2.56)	(5.36)	(2.64)	(5.73)	(2.66)	(5.25)	(2.85)	(5.33)
Crisis	4.326***	2.633	2.126*	4.633**	4.353***	2.806*	2.164*	4.940**
	(3.55)	(1.54)	(1.71)	(2.07)	(3.58)	(1.66)	(1.74)	(2.22)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12752	3971	13083	3955	12752	3971	13083	3955
Instruments	43	43	47	38	44	43	48	38
AR (1)	0.000	0.000	0.000	0.000	0.0000	0.000	0.000	0.000
AR (2)	0.165	0.505	0.117	0.823	0.166	0.562	0.118	0.834
AR (3)	0.308	0.177	0.125	0.264	0.308	0.165	0.124	0.254
Hansen	0.238	0.084	0.052	0.293	0.304	0.089	0.072	0.305

Note: The table shows the results of the estimations with the dependent variable of debt funding costs (columns 1–2 and 5–6), and overall funding costs (columns 3–4 and 7–8) while the right-hand side includes macroprudential policy instruments, bank-specific variables and macroeconomic controls. Y_{t-1} is the lagged dependent variable, bank variables lagged by one period are: $Size_{t-1}$ – measured by the logarithm of total assets, $Equity_{t-1}$ – ratio of equity to total assets, $Liquidity_{t-1}$ – ratio of liquid assets to total assets, and $Deposits_{t-1}$ – ratio of total deposits to total liabilities. Y_{t-1} – the lagged dependent variable, bank variables are: Size – measured by the logarithm of total assets, Equity – ratio of equity to total assets, Liquidity – ratio of liquid assets to total assets, and Deposits – ratio of total deposits to total liabilities. Macroprudential indices are: CG – caps on domestic loans, FC – foreign currency loans limits; the indices' scopes are 0–1. Macroeconomic variables include: GDP – logarithm of GDP volume, Policy rate – monetary policy rate, Inflation – annual inflation rate, Private credit – ratio of domestic credit to the private sector to GDP, Crisis – a dummy variable equal to 1 for 2008–2012, and 0 otherwise. The estimation method is a dynamic two-step system GMM estimator with robust standard errors and a Windmeijer correction. All regressions include time dummy variables to account for unobserved heterogeneity within our sample. T-statistics are reported in parentheses. The following are p-values indicating the significance level of the coefficients: * p <0.10, ** p <0.05, *** p <0.01

Table A.11 Impact of individual macroprudential instruments on bank financing costs by subsamples – RR and TAX

Dependent variable	*Debt funding costs*		*Overall funding costs*		*Debt funding costs*		*Overall funding costs*	
	(1) Advanced	(2) Emerging	(3) Advanced	(4) Emerging	(5) Advanced	(6) Emerging	(7) Advanced	(8) Emerging
Y_{t-1}	0.657***	0.427***	0.406***	0.350***	0.655***	0.473***	0.405***	0.349***
	(10.33)	(3.88)	(9.40)	(8.83)	(10.25)	(4.44)	(9.38)	(8.65)
$Size_{t-1}$	-0.0458	-0.128**	-0.00569	-0.0654	-0.0467	-0.122**	-0.00770	-0.0699
	(-1.53)	(-2.49)	(-0.16)	(-1.02)	(-1.55)	(-2.30)	(-0.21)	(-1.05)
$Equity_{t-1}$	-0.00654	-0.0209	-0.0230**	-0.0607***	-0.00755	-0.0193	-0.0243**	-0.0605***
	(-0.62)	(-1.51)	(-2.30)	(-3.65)	(-0.71)	(-1.36)	(-2.41)	(-3.57)
$Liquidity_{t-1}$	-0.00233***	-0.00258	-0.00104	0.00185	-0.00229***	-0.00126	-0.000960	0.00170
	(-2.91)	(-0.84)	(-0.96)	(0.52)	(-2.86)	(-0.45)	(-0.88)	(0.49)
$Deposits_{t-1}$	-0.0215***	0.00881	-0.00173	-0.00777	-0.0217***	0.00701	-0.00176	-0.0115
	(-3.71)	(1.06)	(-0.30)	(-0.59)	(-3.73)	(0.84)	(-0.31)	(-0.89)
RR		**0.475*** **		**0.444*** **				
		(3.43)		**(2.81)**				
TAX					**0.138*** **	**0.151**	**0.181*** **	**-0.114**
					(2.76)	**(0.82)**	**(2.69)**	**(-0.49)**
GDP	-0.0649**	-0.0418	0.0373	-0.0170	-0.0620**	-0.0380	0.0413	-0.0227
	(-2.49)	(-1.29)	(1.34)	(-0.47)	(-2.41)	(-1.25)	(1.49)	(-0.63)
Private credit	-0.00170***	0.0179***	-0.00285***	0.000799	-0.00108*	0.0157***	-0.00203**	0.000900
	(-3.03)	(4.74)	(-3.73)	(0.16)	(-1.85)	(4.25)	(-2.57)	(0.17)
Policy rate	0.140***	0.141***	0.111***	0.0906***	0.141***	0.135***	0.111***	0.0980***
	(4.46)	(4.30)	(3.26)	(4.69)	(4.48)	(4.24)	(3.26)	(4.99)
Inflation	0.0565**	0.0816***	0.0656***	0.100***	0.0647***	0.0765***	0.0760***	0.101***
	(2.56)	(5.49)	(2.64)	(5.62)	(2.90)	(5.31)	(3.05)	(5.55)
Crisis	4.326***	2.840*	2.126*	4.898**	3.369***	2.897*	1.147	5.434**
	(3.55)	(1.66)	(1.71)	(2.22)	(2.68)	(1.67)	(0.93)	(2.47)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12752	3971	13083	3955	12752	3971	13083	3955
Instruments	43	43	47	38	44	43	48	38
AR (1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR (2)	0.165	0.613	0.117	0.879	0.162	0.499	0.117	0.839
AR (3)	0.308	0.141	0.125	0.289	0.309	0.191	0.119	0.273
Hansen	0.238	0.177	0.052	0.333	0.312	0.089	0.075	0.275

Note: The table shows the results of the estimations with the dependent variable of debt funding costs (columns 1–2 and 5–6), and overall funding costs (columns 3–4 and 7–8) while the right-hand side includes macroprudential policy instruments, bank-specific variables and macroeconomic controls. Y_{t-1} is the lagged dependent variable, bank variables lagged by one period are: $Size_{t-1}$ – measured by the logarithm of total assets, $Equity_{t-1}$ – ratio of equity to total assets, $Liquidity_{t-1}$ – ratio of liquid assets to total assets, and $Deposits_{t-1}$ – ratio of total deposits to total liabilities. Y_{t-1} – the lagged dependent variable, bank variables are: Size – measured by the logarithm of total assets, Equity – ratio of equity to total assets, Liquidity – ratio of liquid assets to total assets, and Deposits – ratio of total deposits to total liabilities. Macroprudential indices are: RR – countercyclical reserve requirements and TAX – taxes on financial institutions; the indices' scopes are 0–1. Macroeconomic variables include: GDP – logarithm of GDP volume, Policy rate – monetary policy rate, Inflation – annual inflation rate, Private credit – ratio of domestic credit to the private sector to GDP, Crisis – a dummy variable equal to 1 for 2008–2012, and 0 otherwise. The estimation method is a dynamic two-step system GMM estimator with robust standard errors and a Windmeijer correction. All regressions include time dummy variables to account for unobserved heterogeneity within our sample. T-statistics are reported in parentheses. The following are p-values indicating the significance level of the coefficients: * p <0.10, ** p <0.05, *** p <0.01

Table A.12 Additional bank controls – Z-score

Dependent variable	*Debt funding costs*					*Overall costs*				
	(1) MPP	(2) Borrower	(3) Capital	(4) Structural	(5) Institution	(6) MPP	(7) Borrower	(8) Capital	(9) Structural	(10) Institution
Y_{t-1}	0.719***	0.714***	0.727***	0.710***	0.718***	0.439***	0.439***	0.440***	0.439***	0.439***
	(6.83)	(6.64)	(6.95)	(6.91)	(6.81)	(13.08)	(13.03)	(13.09)	(13.08)	(13.03)
$Size_{t-1}$	-0.0282	-0.0246	-0.0277	-0.0311	-0.0280	0.0610	0.0643*	0.0620*	0.0580	0.0620*
	(-1.00)	(-0.87)	(-0.98)	(-1.11)	(-1.00)	(1.63)	(1.72)	(1.66)	(1.55)	(1.67)
$Equity_{t-1}$	0.000334	0.00146	0.000631	-0.000824	0.000141	-0.00645	-0.00578	-0.00585	-0.00747	-0.00693
	(0.03)	(0.15)	(0.06)	(-0.08)	(0.01)	(-0.55)	(-0.49)	(-0.50)	(-0.64)	(-0.59)
$Liquidity_{t-1}$	-0.00229**	-0.00259**	-0.00213*	-0.00222**	-0.00220**	-0.00140	-0.00165	-0.00144	-0.00123	-0.00131
	(-2.01)	(-2.20)	(-1.93)	(-2.05)	(-1.97)	(-1.35)	(-1.58)	(-1.37)	(-1.17)	(-1.25)
$Deposits_{t-1}$	-0.0165***	-0.0162***	-0.0159***	-0.0170***	-0.0162***	0.00943	0.00986	0.00984	0.00873	0.0100
	(-3.26)	(-3.21)	(-3.16)	(-3.38)	(-3.22)	(1.28)	(1.34)	(1.34)	(1.20)	(1.36)
$Z\text{-}score_{t-1}$	-0.0551**	-0.0662***	-0.0542**	-0.0519**	-0.0563**	-0.0625**	-0.0691**	-0.0653**	-0.0570**	-0.0612**
	(-2.32)	(-2.59)	(-2.31)	(-2.37)	(-2.34)	(-2.21)	(-2.36)	(-2.31)	(-2.01)	(-2.13)
MPI	**-0.0529****	**-0.140*****	**-0.0571**	**-0.0868****	**0.101****	**-0.0283**	**-0.109****	**0.0405**	**-0.0806****	**0.111****
	(-2.52)	**(-4.68)**	**(-1.36)**	**(-2.14)**	**(2.14)**	**(-1.05)**	**(-2.22)**	**(0.74)**	**(-2.03)**	**(2.33)**
GDP	-0.00924	0.00268	-0.00755	-0.0148	-0.00423	0.0111	0.0207	0.0115	0.00794	0.0170
	(-0.47)	(0.14)	(-0.38)	(-0.71)	(-0.23)	(0.49)	(0.89)	(0.50)	(0.35)	(0.73)
Private credit	-0.00105*	-0.000701	-0.000614	-0.00123*	-0.000470	-0.00205***	-0.00184***	-0.00199***	-0.00234***	-0.00157**
	(-1.85)	(-1.39)	(-1.34)	(-1.94)	(-1.08)	(-3.00)	(-2.82)	(-3.03)	(-3.24)	(-2.39)
Policy rate	0.0646*	0.0651*	0.0621*	0.0672**	0.0641*	0.101***	0.101***	0.101***	0.101***	0.101***
	(1.87)	(1.86)	(1.80)	(1.99)	(1.87)	(6.39)	(6.34)	(6.34)	(6.38)	(6.38)
Inflation	0.0520***	0.0528***	0.0512***	0.0487***	0.0480***	0.0714***	0.0719***	0.0706***	0.0684***	0.0676***
	(5.06)	(5.09)	(5.01)	(5.08)	(4.97)	(5.58)	(5.59)	(5.53)	(5.31)	(5.25)
Crisis	2.222*	3.017***	3.083***	2.454*	2.005*	-0.214	-1.029	-0.326	0.0237	-1.017
	(1.80)	(2.64)	(2.70)	(1.94)	(1.68)	(-0.16)	(-0.78)	(-0.25)	(0.02)	(-0.77)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16533	16533	16533	16533	16533	16887	16887	16887	16887	16887
Instruments	46	46	46	46	46	43	43	43	43	43
AR (1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR (2)	0.050	0.0485	0.0478	0.0528	0.0487	0.140	0.142	0.141	0.137	0.138
AR (3)	0.275	0.277	0.278	0.263	0.266	0.583	0.575	0.581	0.579	0.576
Hansen	0.233	0.184	0.208	0.272	0.218	0.053	0.043	0.051	0.067	0.057

Note: The table shows the results of the estimations with the dependent variable of debt funding costs (columns 1–5) and overall funding costs (columns 6–10) while the right-hand side includes macroprudential policy indices, bank-specific variables and macroeconomic controls. Y_{t-1} is the lagged dependent variable, bank variables lagged by one period are: $Size_{t-1}$ – measured by the logarithm of total assets, $Equity_{t-1}$ – ratio of equity to total assets, $Liquidity_{t-1}$ – ratio of liquid assets to total assets, and $Deposits_{t-1}$ – ratio of total deposits to total liabilities, $Z\text{-}score_{t-1}$ – bank risk indicator based on standard deviation of return on average assets. Macroprudential indices are: MPP – sum of all instruments in the database implemented in countries over time; Borrower – sum of all measures targeting borrowers; Capital – sum of instruments targeting banks' capital position; Structural – index representing the sum of interbank limits and concentration ratio limits and Institution – index which is the sum of asset-based tools and tax on revenues. Macroeconomic variables include: GDP – logarithm of GDP volume, Policy rate – monetary policy rate, Inflation – annual inflation rate, Private credit – ratio of domestic credit to the private sector to GDP, Crisis – a dummy variable equal to 1 for 2008–2012, and 0 otherwise. The estimation method is a dynamic two-step system GMM estimator with robust standard errors and a Windmeijer correction. All regressions include time dummy variables to account for unobserved heterogeneity within our sample. T-statistics are reported in parentheses. The following are p-values indicating the significance level of the coefficients: * p <0.10, ** p <0.05, *** p <0.01

Table A.13 Additional bank controls – Size squared

Dependent variable	*Debt funding costs*					*Overall costs*				
	(1) MPP	(2) Borrower	(3) Capital	(4) Structural	(5) Institution	(6) MPP	(7) Borrower	(8) Capital	(9) Structural	(10) Institution
Y_{t-1}	0.629***	0.624***	0.629***	0.630***	0.627***	0.381***	0.380***	0.381***	0.382***	0.381***
	(11.88)	(11.67)	(11.86)	(12.16)	(11.81)	(12.30)	(12.24)	(12.29)	(12.36)	(12.28)
$Size_{t-1}$	0.461	0.444	0.480	0.488	0.504*	-0.309	-0.313	-0.308	-0.286	-0.257
	(1.52)	(1.45)	(1.55)	(1.62)	(1.66)	(-0.67)	(-0.68)	(-0.67)	(-0.62)	(-0.56)
Size $squared_{t-1}$	-0.0113*	-0.0109	-0.0118*	-0.0120*	-0.0123*	0.00600	0.00615	0.00598	0.00544	0.00482
	(-1.67)	(-1.59)	(-1.69)	(-1.77)	(-1.80)	(0.58)	(0.59)	(0.57)	(0.52)	(0.46)
$Equity_{t-1}$	-0.00139	-0.00113	-0.00113	-0.00195	-0.00159	-0.0395***	-0.0392***	-0.0392***	-0.0400***	-0.0395***
	(-0.14)	(-0.11)	(-0.11)	(-0.20)	(-0.16)	(-4.27)	(-4.22)	(-4.24)	(-4.34)	(-4.27)
$Liquidity_{t-1}$	-0.00356***	-0.00376***	-0.00344***	-0.00338***	-0.00345***	0.000170	-0.0000673	0.000201	0.000393	0.000301
	(-4.89)	(-5.12)	(-4.79)	(-4.75)	(-4.76)	(0.16)	(-0.06)	(0.19)	(0.37)	(0.28)
$Deposits_{t-1}$	-0.0154***	-0.0149***	-0.0150***	-0.0161***	-0.0152***	-0.00627	-0.00604	-0.00582	-0.00658	-0.00588
	(-3.20)	(-3.14)	(-3.14)	(-3.37)	(-3.19)	(-1.15)	(-1.11)	(-1.07)	(-1.21)	(-1.09)
MPI	**-0.0541*** **	**-0.116*** **	**-0.0874** **	**-0.115*** **	**0.148*** **	**-0.0549** **	**-0.127*** **	**0.0167**	**-0.145*** **	**0.152*** **
	(-2.87)	**(-4.05)**	**(-2.04)**	**(-3.67)**	**(4.03)**	**(-2.18)**	**(-2.69)**	**(0.29)**	**(-3.60)**	**(3.10)**
GDP	-0.0242	-0.0143	-0.0233	-0.0296*	-0.0169	0.0101	0.0212	0.0103	0.00434	0.0181
	(-1.46)	(-0.84)	(-1.40)	(-1.73)	(-1.05)	(0.43)	(0.90)	(0.44)	(0.19)	(0.76)
Private credit	-0.00143**	-0.00114**	-0.000957*	-0.00168**	-0.000716	-0.00359**	-0.00330**	-0.00336**	-0.00398**	-0.00285**
	(-3.24)	(-2.74)	(-2.37)	(-3.62)	(-1.78)	(-5.21)	(-4.89)	(-4.91)	(-5.52)	(-4.19)
Policy rate	0.0978***	0.0989***	0.0979***	0.0965***	0.0974***	0.120***	0.120***	0.120***	0.119***	0.119***
	(4.89)	(4.90)	(4.88)	(4.92)	(4.90)	(8.11)	(8.12)	(8.08)	(8.02)	(8.09)
Inflation	0.0577***	0.0582***	0.0575***	0.0529***	0.0522***	0.0717***	0.0719***	0.0708***	0.0663***	0.0661***
	(6.41)	(6.45)	(6.44)	(6.03)	(5.88)	(5.42)	(5.43)	(5.37)	(5.04)	(4.99)
Crisis	-1.694	-1.752	-2.548	-2.762	-2.388	6.796	6.597	6.102	6.230	5.409
	(-0.50)	(-0.51)	(-0.74)	(-0.82)	(-0.71)	(1.37)	(1.32)	(1.22)	(1.26)	(1.09)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16723	16723	16723	16723	16723	17038	17038	17038	17038	17038
Instruments	45	45	45	45	45	41	41	41	41	41
AR (1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR (2)	0.070	0.064	0.063	0.071	0.066	0.230	0.235	0.231	0.220	0.223
AR (3)	0.190	0.192	0.193	0.180	0.182	0.338	0.331	0.337	0.333	0.331
Hansen	0.072	0.051	0.066	0.112	0.084	0.160	0.134	0.148	0.205	0.157

Note: The table shows the results of the estimations with the dependent variable of debt funding costs (columns 1–5) and overall funding costs (columns 6–10) while the right-hand side includes macroprudential policy indices, bank-specific variables and macroeconomic controls. Y_{t-1} is the lagged dependent variable, bank variables lagged by one period are: $Size_{t-1}$ – measured by the logarithm of total assets, $Equity_{t-1}$ – ratio of equity to total assets, $Liquidity_{t-1}$ – ratio of liquid assets to total assets, and $Deposits_{t-1}$ – ratio of total deposits to total liabilities, Size $squared_{t-1}$ – squared bank size. Macroprudential indices are: MPP – sum of all instruments in the database implemented in countries over time; Borrower – sum of all measures targeting borrowers; Capital – sum of instruments targeting banks' capital position; Structural – index representing the sum of interbank limits and concentration ratio limits and Institution – index which is the sum of asset-based tools and tax on revenues. Macroeconomic variables include: GDP – logarithm of GDP volume, Policy rate – monetary policy rate, Inflation – annual inflation rate, Private credit – ratio of domestic credit to the private sector to GDP, Crisis – a dummy variable equal to 1 for 2008–2012, and 0 otherwise. The estimation method is a dynamic two-step system GMM estimator with robust standard errors and a Windmeijer correction. All regressions include time dummy variables to account for unobserved heterogeneity within our sample. T-statistics are reported in parentheses. The following are p-values indicating the significance level of the coefficients: * p <0.10, ** p <0.05, *** p <0.01

Table A.14 Additional bank controls – Loan loss provisioning

Dependent variable	*Debt funding costs*					*Overall costs*				
	(1) MPP	(2) Borrower	(3) Capital	(4) Structural	(5) Institution	(6) MPP	(7) Borrower	(8) Capital	(9) Structural	(10) Institution
Y_{t-1}	0.657***	0.652***	0.657***	0.653***	0.652***	0.399***	0.399***	0.400***	0.399***	0.399***
	(7.83)	(7.70)	(7.89)	(7.86)	(7.75)	(11.57)	(11.57)	(11.61)	(11.62)	(11.60)
$Size_{t-1}$	-0.0157	-0.0135	-0.0153	-0.0179	-0.0144	-0.0508	-0.0487	-0.0506	-0.0527	-0.0494
	(-0.53)	(-0.46)	(-0.51)	(-0.60)	(-0.49)	(-1.37)	(-1.32)	(-1.37)	(-1.43)	(-1.34)
$Equity_{t-1}$	-0.00213	-0.00161	-0.00173	-0.00293	-0.00197	-0.0448***	-0.0442***	-0.0441***	-0.0456***	-0.0446***
	(-0.20)	(-0.15)	(-0.16)	(-0.27)	(-0.18)	(-3.59)	(-3.53)	(-3.54)	(-3.66)	(-3.57)
$Liquidity_{t-1}$	-0.00307***	-0.00329***	-0.00303***	-0.00296***	-0.00309***	0.000358	0.000129	0.000341	0.000650	0.000412
	(-3.49)	(-3.68)	(-3.52)	(-3.48)	(-3.50)	(0.31)	(0.11)	(0.30)	(0.57)	(0.36)
$Deposits_{t-1}$	-0.0121***	-0.0119***	-0.0120***	-0.0128***	-0.0122***	-0.0101*	-0.00976*	-0.00958*	-0.0105**	-0.00962*
	(-2.75)	(-2.74)	(-2.74)	(-2.88)	(-2.80)	(-1.94)	(-1.90)	(-1.86)	(-2.03)	(-1.88)
LLP_{t-11}	0.000331	0.00169	0.000750	-0.000161	0.00153	-0.00393	-0.00232	-0.00219	-0.00541	-0.00224
	(0.04)	(0.19)	(0.09)	(-0.02)	(0.18)	(-0.31)	(-0.18)	(-0.17)	(-0.42)	(-0.18)
MPI	**-0.0425****	**-0.0903*****	**-0.0515**	**-0.103*****	**0.101****	**-0.0663****	**-0.103****	**0.0374**	**-0.183*****	**0.137*****
	(-2.23)	**(-3.70)**	**(-1.31)**	**(-2.77)**	**(2.14)**	**(-2.56)**	**(-2.18)**	**(0.65)**	**(-4.63)**	**(2.86)**
GDP	-0.0197	-0.0126	-0.0192	-0.0246	-0.00423	0.0169	0.0261	0.0177	0.00994	0.0238
	(-1.11)	(-0.71)	(-1.08)	(-1.30)	(-0.23)	(0.69)	(1.05)	(0.71)	(0.40)	(0.94)
Private credit	-0.00120**	-0.000965*	-0.000885*	-0.00148**	-0.000470	-0.00380***	-0.00345***	-0.00361***	-0.00431***	-0.00307***
	(-2.42)	(-2.11)	(-2.09)	(-2.66)	(-1.08)	(-5.51)	(-5.09)	(-5.20)	(-5.99)	(-4.46)
Policy rate	0.0860***	0.0872***	0.0861***	0.0868***	0.0641*	0.110***	0.111***	0.110***	0.109***	0.110***
	(3.10)	(3.12)	(3.11)	(3.16)	(1.87)	(7.13)	(7.13)	(7.08)	(7.07)	(7.15)
Inflation	0.0580***	0.0586***	0.0573***	0.0535***	0.0480***	0.0818***	0.0813***	0.0796***	0.0749***	0.0755***
	(6.06)	(6.18)	(6.06)	(5.97)	(4.97)	(5.89)	(5.85)	(5.78)	(5.45)	(5.42)
Crisis	2.906***	2.710**	1.739	3.164***	2.005*	4.299***	3.458***	3.559***	4.625***	3.994***
	(2.69)	(2.56)	(1.59)	(2.84)	(1.68)	(3.48)	(2.83)	(2.90)	(3.70)	(3.28)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	14880	14880	14880	14880	14880	15051	15051	15051	15051	15051
Instruments	44	44	44	44	44	41	41	41	41	41
AR (1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR (2)	0.024	0.024	0.023	0.027	0.025	0.520	0.522	0.523	0.502	0.504
AR (3)	0.752	0.764	0.752	0.718	0.726	0.678	0.671	0.672	0.655	0.665
Hansen	0.272	0.237	0.276	0.331	0.301	0.070	0.061	0.069	0.107	0.081

Note: The table shows the results of the estimations with the dependent variable of debt funding costs (columns 1–5) and overall funding costs (columns 6–10) while the right-hand side includes macroprudential policy indices, bank-specific variables and macroeconomic controls. Y_{t-1} is the lagged dependent variable, bank variables lagged by one period are: $Size_{t-1}$ – measured by the logarithm of total assets, $Equity_{t-1}$ – ratio of equity to total assets, $Liquidity_{t-1}$ – ratio of liquid assets to total assets, and $Deposits_{t-1}$ – ratio of total deposits to total liabilities, LLP_{t-1} – loan loss provisioning over gross loans ratio. Macroprudential indices are: MPP – sum of all instruments in the database implemented in countries over time; Borrower – sum of all measures targeting borrowers; Capital – sum of instruments targeting banks' capital position; Structural – index representing the sum of interbank limits and concentration ratio limits and Institution – index which is the sum of asset-based tools and tax on revenues. Macroeconomic variables include: GDP – logarithm of GDP volume, Policy rate – monetary policy rate, Inflation – annual inflation rate, Private credit – ratio of domestic credit to the private sector to GDP, Crisis – a dummy variable equal to 1 for 2008–2012, and 0 otherwise. The estimation method is a dynamic two-step system GMM estimator with robust standard errors and a Windmeijer correction. All regressions include time dummy variables to account for unobserved heterogeneity within our sample. T-statistics are reported in parentheses. The following are p-values indicating the significance level of the coefficients: * p <0.10, ** p <0.05, *** p <0.01

Table A.15 Additional bank controls –Efficiency

Dependent variable	*Debt funding costs*					*Overall costs*				
	(1) MPP	(2) Borrower	(3) Capital	(4) Structural	(5) Institution	(6) MPP	(7) Borrower	(8) Capital	(9) Structural	(10) Institution
Y_{t-1}	0.614***	0.608***	0.615***	0.616***	0.613***	0.374***	0.372***	0.374***	0.374***	0.373***
	(11.32)	(11.15)	(11.35)	(11.48)	(11.29)	(11.13)	(11.07)	(11.12)	(11.16)	(11.10)
$Size_{t-1}$	-0.0242	-0.0224	-0.0238	-0.0258	-0.0237	-0.0495	-0.0471	-0.0491	-0.0499	-0.0479
	(-0.95)	(-0.88)	(-0.93)	(-1.01)	(-0.93)	(-1.45)	(-1.38)	(-1.44)	(-1.46)	(-1.41)
$Equity_{t-1}$	-0.00513	-0.00507	-0.00485	-0.00586	-0.00581	-0.0490***	-0.0486***	-0.0486***	-0.0496***	-0.0490***
	(-0.56)	(-0.55)	(-0.53)	(-0.64)	(-0.63)	(-4.68)	(-4.63)	(-4.65)	(-4.75)	(-4.69)
$Liquidity_{t-1}$	-0.00337***	-0.00359***	-0.00322***	-0.00326***	-0.00318***	0.00144	0.00120	0.00158	0.00159	0.00165
	(-4.43)	(-4.71)	(-4.25)	(-4.29)	(-4.21)	(1.20)	(1.01)	(1.33)	(1.32)	(1.38)
$Deposits_{t-1}$	-0.0139***	-0.0137***	-0.0136***	-0.0141***	-0.0136***	-0.00830	-0.00835	-0.00796	-0.00821	-0.00794
	(-2.64)	(-2.60)	(-2.59)	(-2.71)	(-2.59)	(-1.45)	(-1.46)	(-1.39)	(-1.44)	(-1.40)
$Efficiency_{t-1}$	0.00419	0.00432	0.00357	0.00422	0.00332	0.0333***	0.0330***	0.0328***	0.0335***	0.0325***
	(0.84)	(0.85)	(0.70)	(0.84)	(0.66)	(2.78)	(2.75)	(2.72)	(2.79)	(2.69)
MPI	**-0.0454****	**-0.130*****	**-0.0875****	**-0.0891*****	**0.153*****	**-0.0649****	**-0.165*****	**-0.000535**	**-0.127*****	**0.120****
	(-2.45)	**(-4.47)**	**(-2.10)**	**(-2.91)**	**(4.03)**	**(-2.42)**	**(-3.23)**	**(-0.01)**	**(-3.03)**	**(2.35)**
GDP	-0.0232	-0.0129	-0.0225	-0.0273	-0.0163	0.0150	0.0290	0.0143	0.00958	0.0203
	(-1.34)	(-0.73)	(-1.31)	(-1.54)	(-0.98)	(0.60)	(1.15)	(0.57)	(0.38)	(0.80)
Private credit	-0.00174***	-0.00154***	-0.00135***	-0.00187***	-0.00109***	-0.00354***	-0.00328***	-0.00329***	-0.00373***	-0.00292***
	(-3.68)	(-3.43)	(-3.18)	(-3.89)	(-2.49)	(-4.59)	(-4.34)	(-4.35)	(-4.70)	(-3.83)
Policy rate	0.104***	0.105***	0.104***	0.104***	0.103***	0.122***	0.121***	0.121***	0.122***	0.121***
	(5.03)	(5.06)	(5.00)	(5.03)	(5.01)	(7.68)	(7.61)	(7.58)	(7.67)	(7.60)
Inflation	0.0542***	0.0554***	0.0546***	0.0506***	0.0499***	0.0705***	0.0716***	0.0710***	0.0656***	0.0674***
	(5.85)	(5.92)	(5.92)	(5.52)	(5.44)	(5.06)	(5.13)	(5.11)	(4.71)	(4.84)
Crisis	3.398***	3.187***	2.302**	3.550***	2.201**	3.551***	3.267***	3.966***	3.671***	3.266***
	(3.26)	(3.11)	(2.19)	(3.37)	(2.11)	(2.97)	(2.77)	(3.34)	(3.04)	(2.78)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	15315	15315	15315	15315	15315	15629	15629	15629	15629	15629
Instruments	45	45	45	45	45	41	41	41	41	41
AR (1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR (2)	0.611	0.601	0.592	0.640	0.617	0.072	0.074	0.073	0.069	0.069
AR (3)	0.099	0.101	0.102	0.094	0.095	0.309	0.298	0.309	0.304	0.302
Hansen	0.272	0.237	0.276	0.331	0.301	0.139	0.125	0.131	0.155	0.137

Note: The table shows the results of the estimations with the dependent variable of debt funding costs (columns 1–5) and overall funding costs (columns 6–10) while the right-hand side includes macroprudential policy indices, bank-specific variables and macroeconomic controls. Y_{t-1} is the lagged dependent variable, bank variables lagged by one period are: $Size_{t-1}$ – measured by the logarithm of total assets, $Equity_{t-1}$ – ratio of equity to total assets, $Liquidity_{t-1}$ – ratio of liquid assets to total assets, and $Deposits_{t-1}$ – ratio of total deposits to total liabilities, $Efficiency_{t-1}$ – ratio of operating expenses over total assets. Macroprudential indices are: MPP – sum of all instruments in the database implemented in countries over time; Borrower – sum of all measures targeting borrowers; Capital – sum of instruments targeting banks' capital position; Structural – index representing the sum of interbank limits and concentration ratio limits and Institution – index which is the sum of asset-based tools and tax on revenues. Macroeconomic variables include: GDP – logarithm of GDP volume, Policy rate – monetary policy rate, Inflation – annual inflation rate, Private credit – ratio of domestic credit to the private sector to GDP, Crisis – a dummy variable equal to 1 for 2008–2012, and 0 otherwise. The estimation method is a dynamic two-step system GMM estimator with robust standard errors and a Windmeijer correction. All regressions include time dummy variables to account for unobserved heterogeneity within our sample. T-statistics are reported in parentheses. The following are p-values indicating the significance level of the coefficients: * p <0.10, ** p <0.05, *** p <0.01

Table A.16 Effects of the crisis – interactions with macroeconomic variables

Dependent variable	*Debt funding costs*					*Overall funding cost*				
	(1) MPP	(2) Borrower	(3) Capital	(4) Structural	(5) Institution	(6) MPP	(7) Borrower	(8) Capital	(9) Structural	(10) Institution
Y_{t-1}	0.694***	0.685***	0.694***	0.681***	0.675***	0.381***	0.380***	0.381***	0.382***	0.380***
	(7.27)	(7.01)	(7.32)	(7.29)	(6.97)	(12.20)	(12.16)	(12.20)	(12.27)	(12.19)
$Size_{t-1}$	-0.0338	-0.0314	-0.0336	-0.0360	-0.0341	-0.0562*	-0.0544	-0.0563*	-0.0579*	-0.0555*
	(-1.28)	(-1.19)	(-1.26)	(-1.36)	(-1.28)	(-1.70)	(-1.64)	(-1.70)	(-1.75)	(-1.68)
$Equity_{t-1}$	-0.00657	-0.00620	-0.00653	-0.00739	-0.00746	-0.0400***	-0.0397***	-0.0398***	-0.0408***	-0.0406***
	(-0.71)	(-0.67)	(-0.70)	(-0.79)	(-0.80)	(-4.44)	(-4.40)	(-4.42)	(-4.54)	(-4.51)
$Liquidity_{t-1}$	-0.00266**	-0.00294**	-0.00254**	-0.00265**	-0.00270**	0.000257	0.0000449	0.000316	0.000471	0.000441
	(-2.56)	(-2.78)	(-2.52)	(-2.67)	(-2.63)	(0.24)	(0.04)	(0.30)	(0.44)	(0.41)
$Deposits_{t-1}$	-0.0138***	-0.0137***	-0.0136***	-0.0145***	-0.0141***	-0.00828	-0.00819	-0.00811	-0.00862	-0.00822
	(-2.86)	(-2.86)	(-2.84)	(-3.00)	(-2.95)	(-1.56)	(-1.55)	(-1.54)	(-1.62)	(-1.56)
MPI	-0.0502**	-0.132***	-0.0889**	-0.0872**	0.127***	-0.0500**	-0.118**	-0.0168	-0.142***	0.176***
	(-2.43)	(-5.02)	(-2.03)	(-2.04)	(2.70)	(-1.98)	(-2.47)	(-0.30)	(-3.49)	(3.65)
GDP	-0.0220	-0.00989	-0.0204	-0.0313	-0.0208	-0.00566	0.00637	-0.00465	-0.0169	0.000755
	(-1.03)	(-0.46)	(-0.97)	(-1.33)	(-1.00)	(-0.21)	(0.23)	(-0.17)	(-0.63)	(0.03)
Private credit	-0.000288	-0.0000386	0.000258	-0.000490	0.000389	-0.00214**	-0.00186**	-0.00180**	-0.00257**	-0.00123
	(-0.43)	(-0.06)	(0.48)	(-0.66)	(0.75)	(-2.70)	(-2.42)	(-2.34)	(-3.13)	(-1.57)
Policy rate	0.0603*	0.0639*	0.0616*	0.0655**	0.0701**	0.122***	0.123***	0.125***	0.121***	0.125***
	(1.81)	(1.85)	(1.86)	(2.01)	(2.04)	(6.72)	(6.85)	(6.88)	(6.70)	(6.98)
Inflation	0.0622***	0.0618***	0.0613***	0.0581***	0.0550***	0.0659***	0.0646***	0.0632***	0.0605***	0.0561***
	(5.33)	(5.42)	(5.32)	(5.30)	(5.06)	(3.94)	(3.88)	(3.80)	(3.62)	(3.34)
Crisis	2.578**	2.404**	2.507**	2.765**	2.532**	4.523***	4.331***	4.445***	4.632***	4.268***
	(2.25)	(2.12)	(2.21)	(2.39)	(2.28)	(4.04)	(3.91)	(3.99)	(4.12)	(3.87)
Crisis*GDP	-0.0168	-0.0222	-0.0200	-0.00573	-0.0106	-0.0171	-0.0224	-0.0184	0.00121	-0.00870
	(-0.76)	(-1.01)	(-0.92)	(-0.25)	(-0.47)	(-0.48)	(-0.63)	(-0.51)	(0.03)	(-0.24)
Crisis*Inflation rate	-0.0103	-0.00718	-0.00874	-0.00746	-0.00270	0.0283	0.0318	0.0335	0.0287	0.0364
	(-0.82)	(-0.57)	(-0.70)	(-0.60)	(-0.21)	(1.27)	(1.43)	(1.51)	(1.29)	(1.63)
Crisis*Policy rate	0.0513***	0.0496***	0.0450***	0.0441***	0.0341**	-0.0380	-0.0400	-0.0474*	-0.0417*	-0.0564**
	(3.32)	(3.07)	(2.90)	(2.84)	(2.00)	(-1.53)	(-1.62)	(-1.92)	(-1.67)	(-2.27)
Crisis*Private credit	-0.00176**	-0.00177**	-0.00209**	-0.00180**	-0.00222**	-0.00388**	-0.00392**	-0.00410**	-0.00382**	-0.00446**
	(-3.41)	(-3.47)	(-4.19)	(-3.45)	(-4.43)	(-4.25)	(-4.30)	(-4.50)	(-4.19)	(-4.86)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16600	16600	16600	16600	16600	16915	16915	16915	16915	16915
Instruments	48	48	48	48	48	44	44	44	44	44
AR (1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR (2)	0.050	0.050	0.050	0.050	0.045	0.191	0.196	0.195	0.187	0.192
AR (3)	0.388	0.396	0.388	0.384	0.386	0.334	0.327	0.333	0.331	0.319
Hansen	0.632	0.582	0.693	0.757	0.743	0.269	0.251	0.336	0.392	0.380

Note: The table shows the results of the estimations with the dependent variable of debt funding costs (columns 1–6), and overall funding costs (columns 7–12) while the right-hand side includes macroprudential policy index, bank-specific variables and macroeconomic controls. Y_{t-1} is the lagged dependent variable, bank variables lagged by one period are: $Size_{t-1}$ – measured by the logarithm of total assets, $Equity_{t-1}$ – ratio of equity to total assets, $Liquidity_{t-1}$ – ratio of liquid assets to total assets, and $Deposits_{t-1}$ – ratio of total deposits to total liabilities. Macroprudential indices are: MPP – sum of all instruments in the database implemented in countries over time; Borrower – sum of all measures targeting borrowers; Capital – sum of instruments targeting banks' capital position; Structural – index representing the sum of interbank limits and concentration ratio limits and Institution – index which is the sum of asset-based tools and tax on revenues. Macroeconomic variables include: GDP – logarithm of GDP volume, Policy rate – monetary policy rate, Inflation – annual inflation rate, Private credit – ratio of domestic credit to the private sector to GDP, Crisis – a dummy variable equal to 1 for 2008–2012, and 0 otherwise. The estimation method is a dynamic two-step system GMM estimator with robust standard errors and a Windmeijer correction. All regressions include time dummy variables to account for unobserved heterogeneity within our sample. T-statistics are reported in parentheses. The following are p-values indicating the significance level of the coefficients: * p <0.10, ** p <0.05, *** p <0.01

Table A.17 Base results on the impact of macroprudential policy on funding costs with one-step GMM estimator

	(1) MPP	(2) Borrower	(3) Capital	(4) Structural	(5) Institution	(6) MPP	(7) Borrower	(8) Capital	(9) Structural	(10) Institution
Y_{t-1}	0.635***	0.630***	0.634***	0.639***	0.635***	0.393***	0.392***	0.393***	0.394***	0.393***
	(12.94)	(12.81)	(12.91)	(13.20)	(12.94)	(12.20)	(12.19)	(12.22)	(12.24)	(12.21)
$Size_{t-1}$	-0.0160	-0.0147	-0.0161	-0.0162	-0.0152	-0.0601*	-0.0581*	-0.0599*	-0.0612*	-0.0585*
	(-0.57)	(-0.52)	(-0.57)	(-0.58)	(-0.54)	(-1.76)	(-1.71)	(-1.76)	(-1.80)	(-1.73)
$Equity_{t-1}$	0.00162	0.00179	0.00177	0.00134	0.00139	-0.0393***	-0.0389***	-0.0389***	-0.0400***	-0.0395***
	(0.17)	(0.19)	(0.19)	(0.14)	(0.15)	(-4.27)	(-4.23)	(-4.24)	(-4.35)	(-4.29)
$Liquidity_{t-1}$	-0.00327***	-0.00352***	-0.00315***	-0.00308***	-0.00314***	-0.0000296	-0.000244	0.000000106	0.000179	0.0000941
	(-4.58)	(-4.87)	(-4.46)	(-4.38)	(-4.43)	(-0.03)	(-0.23)	(0.00)	(0.17)	(0.09)
$Deposits_{t-1}$	-0.0166***	-0.0166***	-0.0164***	-0.0164***	-0.0162***	-0.00741	-0.00731	-0.00707	-0.00755	-0.00707
	(-3.46)	(-3.48)	(-3.45)	(-3.42)	(-3.41)	(-1.36)	(-1.35)	(-1.30)	(-1.39)	(-1.30)
MPI	**-0.0605*** **	**-0.136*** **	**-0.107*** **	**-0.106*** **	**0.140*** **	**-0.0533** **	**-0.120** **	**0.00481**	**-0.144*** **	**0.155*** **
	(-3.19)	**(-4.81)**	**(-2.64)**	**(-3.55)**	**(3.95)**	**(-2.06)**	**(-2.52)**	**(0.08)**	**(-3.55)**	**(3.13)**
GDP	-0.0228	-0.0115	-0.0219	-0.0266	-0.0154	0.00898	0.0197	0.00942	0.00266	0.0173
	(-1.42)	(-0.70)	(-1.36)	(-1.61)	(-0.98)	(0.38)	(0.83)	(0.40)	(0.11)	(0.72)
Private credit	-0.00162**	-0.00130**	-0.00107**	-0.00178**	-0.000894*	-0.00366**	-0.00338**	-0.00341***	-0.00405**	-0.00293**
	(-3.46)	(-3.01)	(-2.59)	(-3.64)	(-2.11)	(-5.29)	(-5.04)	(-5.05)	(-5.60)	(-4.29)
Policy rate	0.0951***	0.0967***	0.0956***	0.0924***	0.0939***	0.116***	0.116***	0.116***	0.114***	0.115***
	(5.18)	(5.25)	(5.19)	(5.12)	(5.16)	(7.77)	(7.77)	(7.74)	(7.68)	(7.74)
Inflation rate	0.0518***	0.0520***	0.0516***	0.0478***	0.0466***	0.0687***	0.0687***	0.0679***	0.0637***	0.0631***
	(5.78)	(5.78)	(5.79)	(5.39)	(5.24)	(5.20)	(5.19)	(5.15)	(4.81)	(4.76)
Crisis	2.375**	2.151**	2.224**	2.970***	2.079**	3.794***	3.544***	3.647***	4.013***	4.052***
	(2.28)	(2.10)	(2.16)	(2.88)	(2.04)	(3.34)	(3.18)	(3.26)	(3.50)	(3.63)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16723	16723	16723	16723	16723	17038	17038	17038	17038	17038
Instruments	44	44	44	44	44	40	40	40	40	40
AR (1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR (2)	0.065	0.063	0.061	0.069	0.063	0.190	0.192	0.191	0.182	0.183
AR (3)	0.190	0.192	0.192	0.182	0.182	0.352	0.346	0.352	0.347	0.344
Hansen	0.090	0.066	0.084	0.131	0.104	0.151	0.126	0.140	0.197	0.151

Note: The table shows the results of the baseline estimations with the dependent variable of debt funding costs (columns 1–5) and overall funding costs (columns 6–10). The right-hand side includes macroprudential policy indices, bank-specific variables and macroeconomic controls. Y_{t-1} is the lagged dependent variable, bank variables lagged by one period are: $Size_{t-1}$ – measured by the logarithm of total assets, $Equity_{t-1}$ – ratio of equity to total assets, $Liquidity_{t-1}$ – ratio of liquid assets to total assets, and $Deposits_{t-1}$ – ratio of total deposits to total liabilities. Macroprudential indices are: MPP – sum of all instruments in the database implemented in countries over time (columns 1 and 6); Borrower – sum of all measures targeting borrowers (columns 2 and 7); Capital – sum of instruments targeting banks' capital position (columns 3 and 8); Structural – index representing the sum of interbank limits and concentration ratio limits (columns 4 and 9) and Institution – index which is the sum of asset-based tools and tax on revenue (columns 5 and 10). Macroeconomic variables include: GDP – logarithm of GDP volume, Policy rate – monetary policy rate, Inflation – annual inflation rate, Private credit – ratio of domestic credit to the private sector to GDP, Crisis – a dummy variable equal to 1 for 2008–2012, and 0 otherwise. The estimation method is a dynamic one-step system GMM estimator with robust standard errors. All regressions include time dummy variables to account for unobserved heterogeneity within our sample. T-statistics are reported in parentheses. The following are p-values indicating the significance level of the coefficients: * p <0.10, ** p <0.05, *** p <0.01.

Table A.18 Estimation results for the main macroprudential index (MPP) with different specifications of lags used as internal instruments – debt funding costs

	(1) Up to 5 lags as instruments for the dependent variable	(2) Up to 4 lags as instruments for the dependent variable	(3) Up to 3 lags as instruments for the dependent variable	(4) Up to 2 lags as instruments for the dependent variable	(5) Up to 4 lags as instruments for bank specific variables	(6) Up to 3 lags as instruments for bank specific variables
Y_{t-1}	0.635***	0.633***	0.617***	0.622***	0.622***	0.622***
	(12.95)	(12.84)	(12.54)	(12.78)	(12.75)	(12.75)
$Size_{t-1}$	-0.0160	-0.0157	-0.0133	-0.0138	-0.0139	-0.0131
	(-0.57)	(-0.56)	(-0.47)	(-0.49)	(-0.50)	(-0.47)
$Equity_{t-1}$	0.00162	0.00166	0.00232	0.00227	0.00232	0.00262
	(0.17)	(0.18)	(0.24)	(0.24)	(0.25)	(0.28)
$Liquidity_{t-1}$	-0.00327***	-0.00329***	-0.00346***	-0.00342***	-0.00341***	-0.00342***
	(-4.58)	(-4.60)	(-4.82)	(-4.81)	(-4.80)	(-4.81)
$Deposits_{t-1}$	-0.0166***	-0.0166***	-0.0169***	-0.0169***	-0.0170***	-0.0170***
	(-3.45)	(-3.45)	(-3.51)	(-3.51)	(-3.52)	(-3.52)
MPI	**-0.0604*** **	**-0.0606*** **	**-0.0630*** **	**-0.0625*** **	**-0.0627*** **	**-0.0628*** **
	(-3.18)	**(-3.19)**	**(-3.28)**	**(-3.30)**	**(-3.31)**	**(-3.32)**
GDP	-0.0227	-0.0230	-0.0252	-0.0246	-0.0245	-0.0244
	(-1.41)	(-1.43)	(-1.53)	(-1.48)	(-1.47)	(-1.47)
Private credit	-0.00162***	-0.00162***	-0.00170***	-0.00168***	-0.00169***	-0.00169***
	(-3.46)	(-3.47)	(-3.60)	(-3.61)	(-3.60)	(-3.61)
Policy rate	0.0950***	0.0957***	0.101***	0.0991***	0.0989***	0.0988***
	(5.17)	(5.18)	(5.40)	(5.33)	(5.30)	(5.30)
Inflation rate	0.0518***	0.0520***	0.0529***	0.0526***	0.0525***	0.0525***
	(5.78)	(5.78)	(5.83)	(5.81)	(5.79)	(5.79)
Crisis	2.371**	2.377**	2.961***	2.950***	2.960***	2.409**
	(2.27)	(2.28)	(2.91)	(2.89)	(2.90)	(2.31)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16723	16723	16723	16723	16723	16723
Instruments	43	42	41	40	36	34
AR (1)	0.000	0.000	0.000	0.000	0.000	0.000
AR (2)	0.065	0.064	0.063	0.062	0.062	0.062
AR (3)	0.190	0.189	0.183	0.181	0.181	0.181
Hansen	0.070	0.049	0.226	0.173	0.088	0.037

Note: The table shows the results of the baseline estimations with the dependent variable of debt funding costs with different specifications of lags used as internal instruments. In columns 1–4 we use reduced number of lags as internal instruments for our dependent variable. The number of lags is specified in the title of each column. In columns 5–6 we use 2 lags as internal instruments for our dependent variable and different number of lags for our bank specific variables, indicated in each column. The right-hand side includes macroprudential policy indices, bank-specific variables and macroeconomic controls. Y_{t-1} is the lagged dependent variable, bank variables lagged by one period are: $Size_{t-1}$ – measured by the logarithm of total assets, $Equity_{t-1}$ – ratio of equity to total assets, $Liquidity_{t-1}$ – ratio of liquid assets to total assets, and $Deposits_{t-1}$ – ratio of total deposits to total liabilities. Macroprudential index is: MPP – sum of all instruments in the database implemented in countries over time. Macroeconomic variables include: GDP – logarithm of GDP volume, Policy rate – monetary policy rate, Inflation – annual inflation rate, Private credit – ratio of domestic credit to the private sector to GDP, Crisis – a dummy variable equal to 1 for 2008–2012, and 0 otherwise. The estimation method is a dynamic two-step system GMM estimator with robust standard errors and a Windmeijer correction. All regressions include time dummy variables to account for unobserved heterogeneity within our sample. T-statistics are reported in parentheses. The following are p-values indicating the significance level of the coefficients: * p <0.10, ** p <0.05, *** p <0.01.

Table A.19 Estimation results for the main macroprudential index (MPP) with different specifications of lags used as internal instruments – overall funding costs

	(1) Up to 5 lags as instruments for the dependent variable	(2) Up to 4 lags as instruments for the dependent variable	(3) Up to 3 lags as instruments for the dependent variable	(4) Up to 2 lags as instruments for the dependent variable	(5) Up to 3 lags as instruments for bank specific variables	(6) Up to 2 lags as instruments for bank specific variables
Y_{t-1}	0.380***	0.380***	0.376***	0.367***	0.366***	0.381***
	(12.28)	(12.24)	(12.09)	(11.88)	(11.89)	(11.74)
$Size_{t-1}$	-0.0503	-0.0503	-0.0485	-0.0433	-0.0468	-0.0566*
	(-1.54)	(-1.53)	(-1.48)	(-1.30)	(-1.39)	(-1.65)
$Equity_{t-1}$	-0.0382***	-0.0382***	-0.0374***	-0.0359***	-0.0366***	-0.0394***
	(-4.29)	(-4.29)	(-4.18)	(-3.96)	(-4.03)	(-4.28)
$Liquidity_{t-1}$	0.0000990	0.0000993	0.0000202	-0.000102	-0.0000478	-0.000114
	(0.09)	(0.09)	(0.02)	(-0.09)	(-0.04)	(-0.10)
$Deposits_{t-1}$	-0.00686	-0.00685	-0.00721	-0.00690	-0.00733	-0.00649
	(-1.28)	(-1.28)	(-1.34)	(-1.29)	(-1.38)	(-1.21)
MPI	**-0.0563****	**-0.0564****	**-0.0581****	**-0.0582****	**-0.0586****	**-0.0541****
	(-2.23)	**(-2.23)**	**(-2.29)**	**(-2.28)**	**(-2.30)**	**(-2.11)**
GDP	0.00938	0.00944	0.00986	0.00950	0.00753	0.00643
	(0.40)	(0.40)	(0.42)	(0.40)	(0.32)	(0.27)
Private credit	-0.00356***	-0.00356***	-0.00360***	-0.00370***	-0.00374***	-0.00362***
	(-5.13)	(-5.12)	(-5.16)	(-5.25)	(-5.33)	(-5.12)
Policy rate	0.120***	0.120***	0.121***	0.122***	0.123***	0.119***
	(8.10)	(8.10)	(8.12)	(8.19)	(8.26)	(7.89)
Inflation rate	0.0726***	0.0726***	0.0727***	0.0727***	0.0721***	0.0724***
	(5.47)	(5.47)	(5.47)	(5.44)	(5.40)	(5.42)
Crisis	3.545***	3.544***	3.553***	3.454***	3.600***	3.731***
	(3.20)	(3.20)	(3.22)	(3.11)	(3.22)	(3.30)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17038	17038	17038	17038	17038	17038
Instruments	39	38	37	36	34	32
AR (1)	0.000	0.000	0.000	0.000	0.000	0.000
AR (2)	0.236	0.236	0.251	0.267	0.269	0.210
AR (3)	0.341	0.341	0.336	0.331	0.331	0.342
Hansen	0.108	0.073	0.059	0.064	0.053	0.056

Note: The table shows the results of the baseline estimations with the dependent variable of overall funding costs with different specifications of lags used as internal instruments. In columns 1–4 we use reduced number of lags as internal instruments for our dependent variable. The number of lags is specified in the title of each column. In columns 5–6 we use 2 lags as internal instruments for our dependent variable and different number of lags for our bank specific variables, indicated in each column. The right-hand side includes macroprudential policy indices, bank-specific variables and macroeconomic controls. Y_{t-1} is the lagged dependent variable, bank variables lagged by one period are: $Size_{t-1}$ – measured by the logarithm of total assets, $Equity_{t-1}$ – ratio of equity to total assets, $Liquidity_{t-1}$ – ratio of liquid assets to total assets, and $Deposits_{t-1}$ – ratio of total deposits to total liabilities. Macroprudential index is: MPP – sum of all instruments in the database implemented in countries over time. Macroeconomic variables include: GDP – logarithm of GDP volume, Policy rate – monetary policy rate, Inflation – annual inflation rate, Private credit – ratio of domestic credit to the private sector to GDP, Crisis – a dummy variable equal to 1 for 2008–2012, and 0 otherwise. The estimation method is a dynamic two-step system GMM estimator with robust standard errors and a Windmeijer correction. All regressions include time dummy variables to account for unobserved heterogeneity within our sample. T-statistics are reported in parentheses. The following are p-values indicating the significance level of the coefficients: * p <0.10, ** p <0.05, *** p <0.01.

APPENDIX B: Chapter 2

Table B.1 Macroprudential instruments recorded in the MaPPED database

Instrument group	Instruments
Minimum capital requirements (MCR)	Capital adequacy ratio (CAR)
	Tier 1 capital ratio
	Common Equity Tier 1 capital ratio (CET 1)
	Core Tier 1 capital ratio
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
Leverage ratio	Leverage ratio limit
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 amortization 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
Levies/taxes on financial institutions	Tax on assets/liabilities
	Tax on financial activities
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
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. and Kleibl, J. (2018). Macroprudential regulation in the European Union in 1995–2014: introducing a new data set on policy actions of a macroprudential nature. Macroprudential Policies Evaluation Database (MaPPED).

Table B.2 Description of the variables

Variable	*Description*	*Source*
Bank specific variables		
Gross loans (logs)	The natural logarithm of gross loans	Fitch Connect, Own calculations
Size (total assets, logs)	The natural logarithm of total assets	Fitch Connect, Own calculations
Liquidity ratio (%)	Liquid assets/Total assets ratio	Fitch Connect
Tier 1 ratio (%)	Tier 1 capital ratio/Total risk-weighted assets ratio	Fitch Connect
Loans to deposits (logs)	The natural logarithm of Gross loans/Total customer deposits ratio	Fitch Connect, Own calculations
Loan loss provisioning (%)	The ratio of loan-loss provisioning/Gross loans	Fitch Connect
Market share (%)	Total assets of bank *j* in country *k* and year *t* over total assets of the banking sector in country *k* in year *t*	Fitch Connect, Own calculations
Commercial (0-1)	Dummy variable equal to 1 if bank specialisation is commercial, and 0 otherwise	Fitch Connect, Own calculations
Savings (0-1)	Dummy variable equal to 1 if bank specialisation is savings, and 0 otherwise	Fitch Connect, Own calculations
Cooperative (0-1)	Dummy variable equal to 1 if bank specialisation is cooperative, and 0 otherwise	Fitch Connect, Own calculations
Macroeconomic variables		
Δ Policy rate	The yearly change in central bank policy rate, calculated by taking the first difference	IMF, European Central Bank, Own calculations
GDP growth (%)	Annual real growth rate of GDP, lagged	World Bank
Credit to private sector (%)	Domestic credit to private sector as a percentage of annual GDP growth rate, lagged	World Bank
Gross capital formation growth (%)	Gross capital formation as a percentage of GDP growth rate, lagged	World Bank
NPL gross (%)	Gross bank non-performing loans to total gross loans, lagged	World Bank
Inflation rate (%)	Inflation rate, based on CPI, in a country *k* at time *t*, lagged	World Bank
Macroprudential data		
MPP	The sum of all macroprudential policy actions in the database over country *k* in year *t,* lagged	MaPPED, ECB, Own calculations

(table continues)

(continued)

Variable	*Description*	*Source*
MPP2	The sum of all macroprudential policy actions in the database over country *k* in year *t* bounded to the interval -1 to 1, lagged	MaPPED, ECB, Own calculations
MPP3	The sum of all macroprudential tightening policy actions in the database over country *k* in year *t* bounded to the interval 0 to 1, lagged	MaPPED, ECB, Own calculations
MPP4	The sum of all macroprudential loosening policy actions in the database over country *k* in year *t* bounded to the interval 0 to 1, lagged	MaPPED, ECB, Own calculations
MPP5	The sum of all macroprudential tightening policy actions in the database over country *k* in year *t*, lagged	MaPPED, ECB, Own calculations
MPP6	The sum of all macroprudential loosening policy actions in the database over country *k* in year *t*, lagged	MaPPED, ECB, Own calculations
Credit	The sum of all macroprudential credit-related policy actions in the database over country *k* in year *t*, lagged	MaPPED, ECB, Own calculations
Market Liquidity	The sum of all macroprudential liquidity-related policy actions in the database over country *k* in year *t*, lagged	MaPPED, ECB, Own calculations
Concentration	The sum of all macroprudential policy actions aiming to limit different bank exposures in the database over country *k* in year *t*, lagged	MaPPED, ECB, Own calculations
Resilience	The sum of all macroprudential policy actions aimed to strengthen the resilience of the financial sector in the database over country *k* in year *t*, lagged	MaPPED, ECB, Own calculations
Credit growth	The sum of all macroprudential policy actions related with reserve requirements in the database over country *k* in year *t*, lagged	MaPPED, ECB, Own calculations
Lending caps	The sum of all macroprudential policy actions aimed to limit excessive lending in the database over country *k* in year *t*, lagged	MaPPED, ECB, Own calculations
Risk weights	The sum of all macroprudential policy actions related with risk weighing in banks in the database over country *k* in year *t*, lagged	MaPPED, ECB, Own calculations
Liquidity	The sum of all macroprudential policy actions aimed to strengthen the liquidity position of banks in the database over country *k* in year *t*, lagged	MaPPED, ECB, Own calculations
Exposures	The sum of all macroprudential policy actions aimed to limit different bank exposures in the database over country *k* in year *t*, lagged	MaPPED, ECB, Own calculations

(table continues)

(continued)

Variable	*Description*	*Source*
MCR	The sum of all macroprudential policy actions aimed at the capital position of banks in the database over country *k* in year *t*, lagged	MaPPED, ECB, Own calculations
Capital buffers	The sum of all countercyclical macroprudential policy actions aimed at the capital positions of banks in the database over country *k* in year *t*, lagged	MaPPED, ECB, Own calculations
Taxes	The sum of all macroprudential policy actions related with taxation of bank assets/liabilities or other financial activities in the database over country *k* in year *t*, lagged	MaPPED, ECB, Own calculations
Provisioning	The sum of all macroprudential policy actions related with provisioning in the database over country *k* in year *t*, lagged	MaPPED, ECB, Own calculations
Leverage ratio	The leverage ratio policy actions in the database over country *k* in year *t*, lagged	MaPPED, ECB, Own calculations
Other requirements	The sum of all other macroprudential policy actions in the database over country *k* in year *t*, lagged	MaPPED, ECB, Own calculations

Table B.3 Macroprudential indices based on the target of the measures

	(1) Credit	(2) Liquidity measures	(3) Concentration	(4) Resilience
Dependent variable (lag)	0.723***	0.720***	0.727***	0.723***
	(6.81)	(7.51)	(7.03)	(7.04)
Index (lag)	**-0.00497**	**-0.00793**	**-0.0196****	**-0.00594**
	(-0.75)	**(-0.55)**	**(-2.35)**	**(-1.12)**
Size (total assets, logs)	0.246**	0.247***	0.243**	0.246***
	(2.52)	(2.82)	(2.54)	(2.61)
Liquidity ratio	-0.00106**	-0.00111**	-0.00112**	-0.00104*
	(-1.96)	(-2.07)	(-2.19)	(-1.92)
Tier 1 ratio	-0.00778***	-0.00787***	-0.00768***	-0.00772***
	(-2.87)	(-3.29)	(-2.88)	(-3.00)
Loans to deposits (logs)	0.106**	0.107**	0.105**	0.105**
	(2.31)	(2.57)	(2.35)	(2.40)
Market share	0.00343*	0.00372**	0.00339**	0.00344**
	(1.96)	(2.20)	(2.01)	(1.97)
Δ Policy rate	-0.0360**	-0.0369**	-0.0283*	-0.0348**
	(-2.09)	(-2.27)	(-1.72)	(-2.14)
GDP growth (lag)	0.00612	0.00593	0.00660	0.00596
	(1.34)	(1.41)	(1.53)	(1.34)

(table continues)

(continued)

	(1) Credit	(2) Liquidity measures	(3) Concentration	(4) Resilience
Observations	16065	16065	16065	16065
Instruments	82	82	82	82
AR (1)	0.109	0.105	0.107	0.107
AR (2)	0.378	0.357	0.385	0.394
Hansen	0.644	0.656	0.604	0.678

Note: The dependent variable is gross loans in logs. The estimation method is a dynamic two-step system generalised method of moments (GMM) estimator with robust standard errors and a Windmeijer correction. The lagged dependent variable is treated as endogenous, and all other variables as exogeneous. All regressions include year fixed effects. T statistics are reported in parentheses. All regressions include weights based on the number of observations of each country. Macroeconomic variables are lagged one period, while all variables, apart from indicator variables, are winsorised 1% on both tails of the distribution. The following are p-values indicating the significance level of coefficients: * p < 0.10, ** p < 0.05, *** p < 0.01.

Table B.4 Macroprudential subindices based on the target of the measures

	(1) Credit growth	(2) Lending caps	(3) Risk weights	(4) Liquidity measures	(5) Concentration	(6) MCR	(7) Capital buffers	(8) Taxes	(9) Provisioning	(10) LEV	(11) Other requirements
Dependent variable (lag)	0.727***	0.730***	0.712** *	0.718***	0.724***	0.719***	0.717***	0.722***	0.720***	0.721***	0.722***
	(7.11)	(6.61)	(5.44)	(7.41)	(6.80)	(6.75)	(6.88)	(6.82)	(6.79)	(6.89)	(7.34)
Index (lag)	**0.0276****	**- 0.0260****	**- 0.0091 9**	**- 0.00837**	**-0.0198****	**0.00457**	**-0.0120**	**-0.0114**	**-0.0218**	**0.103**	**- 0.00908 (-0.64)**
	(2.55)	**(-1.99)**	**(-0.65)**	**(-0.59)**	**(-2.36)**	**(0.60)**	**(-1.61)**	**(-0.56)**	**(-1.42)**	**(1.21)**	
Size (total assets, logs)	0.240**	0.239**	0.256**	0.248***	0.244**	0.248**	0.250***	0.245**	0.247**	0.247**	0.245***
	(2.55)	(2.34)	(2.15)	(2.79)	(2.47)	(2.53)	(2.59)	(2.51)	(2.53)	(2.55)	(2.70)
Liquidity ratio	- 0.00105 **	- 0.00098 4*	- 0.0010 4*	- 0.00113 **	-0.00114**	- 0.00109 **	- 0.00110 **	- 0.00108 **	-0.00102*	- 0.00109 **	- 0.00109 **
	(-1.98)	(-1.87)	(-1.76)	(-2.15)	(-2.25)	(-2.07)	(-2.08)	(-2.04)	(-1.88)	(-2.05)	(-2.05)
Tier 1 ratio	- 0.00768 ***	- 0.00774 ***	- 0.0082 8**	- 0.00791 ***	-0.00772***	- 0.00788 ***	- 0.00788 ***	- 0.00772 ***	- 0.00769** *	- 0.00784 ***	- 0.00779 ***
	0.240**	(-2.76)	(-2.34)	(-3.25)	(-2.78)	(-2.91)	(-3.01)	(-2.94)	(-2.97)	(-3.00)	(-3.14)
Loans to deposits (logs)	0.105**	0.103**	0.108*	0.108**	0.106**	0.107**	0.107**	0.106**	0.107**	0.107**	0.106**
	(2.41)	(2.18)	(1.94)	(2.56)	(2.30)	(2.33)	(2.38)	(2.34)	(2.35)	(2.37)	(2.51)
Market share	0.00401 **	0.00380 **	0.0036 7*	0.00424 ***	0.00389**	0.00402 ***	0.00408 ***	0.00398 **	0.00397**	0.00401 ***	0.00406 ***
	(2.55)	(2.44)	(1.79)	(2.80)	(2.53)	(2.58)	(2.63)	(2.52)	(2.57)	(2.59)	(2.62)
Δ Policy rate	- 0.0358**	- 0.0380**	- 0.0365*	- 0.0366**	-0.0279*	- 0.0375**	- 0.0357**	- 0.0359**	-0.0386**	- 0.0366**	- 0.0357**
	(-2.01)	(-2.10)	(-1.74)	(-2.22)	(-1.65)	(-2.10)	(-2.06)	(-2.08)	(-2.39)	(-2.11)	(-2.20)
GDP growth (lag)	0.00440	0.00597	0.0056 2	0.00563	0.00632	0.00508	0.00533	0.00545	0.00530	0.00523	0.00545
	(0.87)	(1.29)	(1.08)	(1.35)	(1.46)	(1.07)	(1.17)	(1.21)	(1.17)	(1.16)	(1.23)
Observations	16065	16065	16065	16065	16065	16065	16065	16065	16065	16065	16065
Instruments	82	82	82	82	82	82	82	82	82	82	82
AR (1)	0.109	0.112	0.112	0.105	0.108	0.108	0.108	0.108	0.106	0.108	0.107
AR (2)	0.354	0.320	0.383	0.359	0.389	0.380	0.385	0.386	0.417	0.375	0.379
Hansen	0.497	0.637	0.589	0.660	0.604	0.618	0.604	0.643	0.727	0.650	0.682

Note: The dependent variable is gross loans in logs. The estimation method is a dynamic two-step system generalised method of moments (GMM) estimator with robust standard errors and a Windmeijer correction. The lagged dependent variable is treated as endogenous, and all other variables as exogeneous. All regressions include year fixed effects. T statistics are reported in parentheses. All regressions include weights based on the number of observations of each country. Macroeconomic variables are lagged one period, while all variables, apart from indicator variables, are winsorised 1% on both tails of the distribution. The following are p-values indicating the significance level of coefficients: * p < 0.10, ** p < 0.05, *** p < 0.01.

Table B.5 Loosening cycles of different macroprudential indices based on the target of the measures

	(1) Credit	(2) Liquidity measures	(3) Concentration	(4) Resilience
Dependent variable (lag)	0.731***	0.726***	0.718***	0.732***
	(7.34)	(7.39)	(6.61)	(8.25)
Index (lag)	**0.0370****	**0.0294**	**0.0798*****	**0.0933*****
	(2.53)	**(1.57)**	**(3.30)**	**(3.58)**
Size (total assets, logs)	0.251***	0.254***	0.262**	0.249***
	(2.65)	(2.74)	(2.56)	(2.97)
Liquidity ratio	-0.00102*	-0.00106*	-0.00115*	-0.00100*
	(-1.66)	(-1.71)	(-1.80)	(-1.81)
Tier 1 ratio	-0.00749***	-0.00772***	-0.00784***	-0.00753***
	(-2.99)	(-3.12)	(-2.78)	(-3.47)
Loans to deposits (logs)	0.100**	0.102**	0.107**	0.0981***
	(2.46)	(2.54)	(2.34)	(2.72)
Market share	-0.000249	-0.000118	-0.0000429	-0.000210
	(-0.49)	(-0.24)	(-0.08)	(-0.47)
Δ Policy rate	-0.0372**	-0.0392**	-0.0316*	-0.0336**
	(-2.04)	(-2.27)	(-1.68)	(-1.98)
GDP growth (lag)	0.00800**	0.00693	0.00726	0.00839**
	(2.01)	(1.59)	(1.63)	(2.39)
Observations	16065	16065	16065	16065
Instruments	82	82	82	82
AR (1)	0.105	0.107	0.109	0.101
AR (2)	0.331	0.355	0.390	0.352
Hansen	0.622	0.653	0.745	0.788

Note: The dependent variable is gross loans in logs. The estimation method is a dynamic two-step system generalised method of moments (GMM) estimator with robust standard errors and a Windmeijer correction. The lagged dependent variable is treated as endogenous, and all other variables as exogeneous. All regressions include year fixed effects. T statistics are reported in parentheses. All regressions include weights based on the number of observations of each country. Macroeconomic variables are lagged one period, while all variables, apart from indicator variables, are winsorised 1% on both tails of the distribution. The following are p-values indicating the significance level of coefficients: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B.6 Loosening cycles of different macroprudential subindices based on the target of the measures

	(1) Credit growth	(2) Lending caps	(3) Risk weights	(4) Liquidity measures	(5) Concentration	(6) MCR	(7) Capital buffers	(8) Taxes	(9) Provisioning	(11) Other requirements
Dependent variable (lag)	0.727***	0.720***	0.723***	0.723***	0.715***	0.727***	0.720***	0.727***	0.726***	0.740***
	(7.20)	(7.07)	(7.38)	(7.24)	(6.48)	(7.75)	(7.70)	(7.26)	(7.06)	(8.58)
Index (lag)	**-0.00114**	**0.104*** **	**0.0206**	**0.0295**	**0.0801*** **	**0.0113**	**0.107*** **	**0.0712**	**0.0717** **	**0.0693***
	(-0.06)	**(3.09)**	**(0.90)**	**(1.56)**	**(3.32)**	**(0.26)**	**(3.83)**	**(1.58)**	**(2.07)**	**(1.89)**
Size (total assets, logs)	0.253***	0.260***	0.257***	0.256***	0.264**	0.254***	0.259***	0.253***	0.254***	0.240***
	(2.64)	(2.69)	(2.76)	(2.70)	(2.52)	(2.85)	(2.92)	(2.66)	(2.61)	(2.95)
Liquidity ratio	-0.00107*	0.00112*	-0.00113*	-0.00107*	-0.00116*	-0.00109*	-0.00110*	-0.00109*	-0.000937	-0.00100*
	(-1.72)	(-1.74)	(-1.74)	(-1.72)	(-1.82)	(-1.79)	(-1.83)	(-1.75)	(-1.51)	(-1.74)
Tier 1 ratio	-0.00771**	-0.00786**	-0.00786**	-0.00780**	-0.00791***	-0.00773**	-0.00784**	-0.00770**	-0.00766***	-0.00738***
	(-3.05)	(-3.25)	(-3.14)	(-3.09)	(-2.75)	(-3.35)	(-3.39)	(-3.08)	(-3.00)	(-3.47)
Loans to deposits (logs)	0.102**	0.108**	0.106**	0.103**	0.108**	0.102***	0.104***	0.102**	0.102**	0.0978***
	(2.48)	(2.40)	(2.55)	(2.53)	(2.33)	(2.60)	(2.64)	(2.49)	(2.46)	(2.73)
Market share	-0.0000289	-0.0000109	-0.000105	-0.0000495	0.0000446	-0.0000328	0.0000555	-0.0000380	-0.0000609	-0.0000644
	(-0.07)	(-0.02)	(-0.23)	(-0.11)	(0.10)	(-0.08)	(0.12)	(-0.09)	(-0.14)	(-0.16)
Δ Policy rate	-0.0391**	-0.0459***	-0.0383**	-0.0392**	-0.0316*	-0.0356*	-0.0308*	-0.0398**	-0.0398**	-0.0402**
	(-2.16)	(-2.63)	(-2.14)	(-2.23)	(-1.65)	(-1.89)	(-1.84)	(-2.20)	(-2.13)	(-2.45)
GDP growth (lag)	0.00683	0.00641	0.00748*	0.00673	0.00710	0.00686	0.00795**	0.00712*	0.00624	0.00821**
	(1.59)	(1.50)	(1.76)	(1.53)	(1.58)	(1.64)	(2.01)	(1.71)	(1.42)	(2.26)
Observations	16065	16065	16065	16065	16065	16065	16065	16065	16065	16065
Instruments	82	82	82	82	82	82	82	82	82	82
AR (1)	0.108	0.105	0.107	0.107	0.109	0.108	0.108	0.106	0.108	0.104
AR (2)	0.349	0.297	0.357	0.355	0.390	0.352	0.353	0.360	0.333	0.320
Hansen	0.666	0.659	0.553	0.666	0.757	0.630	0.750	0.673	0.760	0.675

Note: The dependent variable is gross loans in logs. The estimation method is a dynamic two-step system generalised method of moments (GMM) estimator with robust standard errors and a Windmeijer correction. The lagged dependent variable is treated as endogenous, and all other variables as exogeneous. All regressions include year fixed effects. T statistics are reported in parentheses. All regressions include weights based on the number of observations of each country. Macroeconomic variables are lagged one period, while all variables, apart from indicator variables, are winsorised 1% on both tails of the distribution. The following are p-values indicating the significance level of coefficients: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B.7 One-step estimation for different macroprudential indices

	(1) MPP	(2) MPP2	(3) MPP3	(4) MPP4	(5) MPP5	(6) MPP6
Dependent variable (lag)	0.715***	0.711***	0.714***	0.718***	0.712***	0.709***
	(5.84)	(5.90)	(5.91)	(5.85)	(5.80)	(5.75)
MPP (lag)	**-0.0165*** (-3.20)**					
MPP2 (lag)		**-0.0442*** (-3.22)**				
MPP3 (lag)			**-0.0414** (-2.13)**			
MPP4 (lag)				**0.000879 (0.19)**		
MPP5 (lag)					**0.0958*** (3.63)**	
MPP6 (lag)						**0.0322*** (3.99)**
Size (total assets, logs)	0.245**	0.248**	0.245**	0.241**	0.247**	0.250**
	(2.21)	(2.26)	(2.23)	(2.16)	(2.22)	(2.24)
Tier 1 ratio	-0.00907***	-0.00915***	-0.00908***	-0.00905***	-0.00918***	-0.00933***
	(-2.76)	(-2.83)	(-2.80)	(-2.74)	(-2.78)	(-2.80)
Liquidity ratio	-0.000730	-0.000770	-0.000778	-0.000779	-0.000761	-0.000738
	(-0.92)	(-0.97)	(-0.98)	(-0.98)	(-0.95)	(-0.93)
Loans to deposits (logs)	0.108**	0.108**	0.107**	0.106**	0.108**	0.109**
	(2.11)	(2.15)	(2.13)	(2.08)	(2.11)	(2.13)
Market share	0.00473**	0.00476**	0.00488**	0.00480**	0.00455**	0.00439**
	(2.23)	(2.26)	(2.30)	(2.26)	(2.16)	(2.12)
Δ Policy rate	-0.00569	-0.00994	-0.00848	-0.00531	-0.00813	-0.00192
	(-0.83)	(-1.48)	(-1.29)	(-0.79)	(-1.19)	(-0.27)
GDP growth (lag)	0.00397	0.00368	0.00310	0.00212	0.00330	0.00355
	(0.77)	(0.72)	(0.59)	(0.39)	(0.63)	(0.67)
Observations	16065	16065	16065	16065	16065	16065
Instruments	82	82	82	82	82	82
AR (1)	0.060	0.057	0.059	0.063	0.055	0.060
AR (2)	0.405	0.393	0.435	0.431	0.358	0.385
Hansen	0.488	0.512	0.480	0.457	0.471	0.565

Note: The dependent variable is gross loans in logs. The estimation method is a dynamic one-step system generalised method of moments (GMM) estimator with robust standard errors. The lagged dependent variable is treated as endogenous, and all other variables as exogenous. All regressions include year fixed effects. T statistics are reported in parentheses. All regressions include weights based on the number of observations of each country. Macroeconomic variables are lagged one period, while all variables, apart from indicator variables, are winsorised 1% on both tails of the distribution. The following are p-values indicating the significance level of coefficients: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B.8 Different number of lags for one-step and two-step estimations

	One-step					*Two-step*				
	(1) Up to 2 lags as instruments for the dependent variable	(2) Up to 3 lags as instruments for the dependent variable	(3) Up to 4 lags as instruments for the dependent variable	(4) Up to 5 lags as instruments for the dependent variable	(5) Up to 6 lags as instruments for the dependent variable	(6) Up to 2 lags as instruments for the dependent variable	(7) Up to 3 lags as instruments for the dependent variable	(8) Up to 4 lags as instruments for the dependent variable	(9) Up to 5 lags as instruments for the dependent variable	(10) Up to 6 lags as instruments for the dependent variable
Dependent variable (lag)	0.879***	0.833***	0.780***	0.715***	0.694***	0.858***	0.804***	0.753***	0.704***	0.689***
	(12.08)	(9.82)	(7.65)	(5.84)	(5.41)	(14.00)	(9.67)	(7.47)	(7.62)	(6.49)
MPP (lag)	**-0.0154*****	**-0.0157*****	**-0.0160*****	**-0.0165*****	**-0.0166*****	**-0.00736***	**-0.00837****	**-0.00856****	**-0.00955*****	**-0.00969*****
	(-2.99)	**(-3.06)**	**(-3.13)**	**(-3.20)**	**(-3.20)**	**(-1.71)**	**(-2.13)**	**(-2.43)**	**(-2.81)**	**(-2.79)**
Size (total assets, logs)	0.0975	0.139*	0.186**	0.245**	0.263**	0.123**	0.172**	0.218**	0.262***	0.274***
	(1.47)	(1.78)	(2.00)	(2.21)	(2.26)	(2.15)	(2.25)	(2.36)	(3.06)	(2.83)
Tier 1 ratio	-0.00468**	-0.00591**	-0.00731**	-0.00907**	-0.00961**	-0.00441**	-0.00580**	-0.00702**	-0.00776**	-0.00860**
	(-2.48)	(-2.64)	(-2.69)	(-2.76)	(-2.78)	(-2.87)	(-2.86)	(-2.87)	(-3.84)	(-3.37)
Liquidity ratio	0.000139	-0.000104	-0.000382	-0.000730	-0.000837	-0.000413	-0.000744	-0.000827	-0.00108**	-0.00134**
	(0.24)	(-0.17)	(-0.56)	(-0.92)	(-1.01)	(-0.90)	(-1.42)	(-1.52)	(-2.18)	(-2.13)
Loans to deposits (logs)	0.0559*	0.0704*	0.0870**	0.108**	0.114**	0.0572**	0.0733**	0.0918**	0.107***	0.116**
	(1.85)	(1.96)	(1.99)	(2.11)	(2.15)	(2.24)	(2.17)	(2.26)	(2.80)	(2.28)
Market share	0.00276**	0.00331**	0.00395**	0.00473**	0.00498**	0.00194**	0.00267**	0.00327**	0.00443**	0.00476**
	(2.20)	(2.29)	(2.24)	(2.23)	(2.24)	(2.01)	(1.97)	(2.07)	(2.87)	(2.78)
Δ Policy rate	-0.00448	-0.00482	-0.00521	-0.00569	-0.00583	-0.00114	-0.00130	-0.00263	-0.00465	-0.000778
	(-0.68)	(-0.73)	(-0.78)	(-0.83)	(-0.84)	(-0.20)	(-0.25)	(-0.47)	(-0.72)	(-0.13)
GDP growth (lag)	0.00985**	0.00820**	0.00632	0.00397	0.00324	0.0133***	0.0103***	0.00805*	0.00523	0.00452
	(2.94)	(2.17)	(1.46)	(0.77)	(0.60)	(4.16)	(2.59)	(1.90)	(1.15)	(1.12)
Observations	16065	16065	16065	16065	16065	16065	16065	16065	16065	16065
Instruments	49	61	72	82	91	49	61	72	82	91
AR (1)	0.100	0.0821	0.072	0.060	0.055	0.102	0.103	0.106	0.104	0.105
AR (2)	0.435	0.430	0.422	0.405	0.398	0.470	0.467	0.461	0.463	0.467
Hansen	0.096	0.084	0.248	0.488	0.371	0.096	0.084	0.248	0.488	0.371

Note: The dependent variable is gross loans in logs. The estimation method in columns 1-5 is a dynamic one-step system generalised method of moments (GMM) estimator with robust standard errors. The estimation method in columns 6-10 is a dynamic two-step system generalised method of moments (GMM) estimator with robust standard errors and a Windmeijer correction. The lagged dependent variable is treated as endogenous, and all other variables as exogenous. All regressions include year fixed effects. T statistics are reported in parentheses. All regressions include weights based on the number of observations of each country. Macroeconomic variables are lagged one period, while all variables, apart from indicator variables, are winsorised 1% on both tails of the distribution. The following are p-values indicating the significance level of coefficients: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

APPENDIX C: Chapter 3

Table C.1 Survey Reference periods

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

Source: Author's elaboration.

Table C.2 Firm observations by country and wave

	Wave	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
	Coun																		Tota
1	AT	38	51	56	140	135	161	144	161	152	134	117	196	130	222	124	175	136	2,27
2	BE	47	29	47	160	124	160	142	159	144	155	146	232	121	263	149	231	137	2,44
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	4,99
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	7,35
10	FI	10	17	19	74	84	89	87	101	103	94	118	129	133	103	138	137	117	1,55
11	FR	219	272	368	403	433	420	396	411	433	415	560	518	534	537	552	570	498	7,53
12	GB	82	0	0	0	220	0	0	0	206	0	217	0	218	0	221	0	156	1,32
13	GR	87	66	60	158	140	157	82	111	117	124	109	169	103	127	88	158	97	1,95
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

(table continues)

(continued)

	Wave	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
	Coun																		Tota
16	IE	16	22	32	123	123	138	142	126	121	118	127	115	103	131	105	105	90	1,73
17	IT	320	344	385	469	375	437	448	458	462	440	549	591	580	593	546	546	538	8,08
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	1,60
23	PL	116	0	0	0	305	0	0	0	279	0	337	0	358	0	320	0	308	2,02
24	PT	79	56	70	144	115	119	121	122	125	134	115	214	152	241	148	225	132	2,31
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	1,10
	Total	2,05	1,57	1,77	2,41	3,77	2,47	2,33	2,44	3,99	2,37	4,37	3,24	4,36	3,36	4,27	3,26	4,07	52,1

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 C.3 Share of constrained firms by country and wave (%)

	Wave	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	Country																	
1	AT	35	29	5	8	10	4	10	16	9	12	11	23	17	16	12	11	15
2	BE	22	27	17	16	18	19	24	23	20	23	20	15	22	15	18	17	14
3	BG	59				27				18		23		24		18		11
4	CY	26				29				48		88		60		50		59
5	CZ	40				13				15		16		18		11		14
6	DE	31	38	20	12	15	10	13	11	6	11	16	17	17	18	15	13	13
7	DK	48				24				23		21		24		28		16
8	EE	47				56				20		24		13		26		21
9	ES	57	52	28	30	31	36	34	36	29	24	29	24	20	21	18	18	17
10	FI	20	18	16	9	8	18	11	17	16	11	17	13	15	17	18	18	13
11	FR	21	18	18	18	18	16	19	21	20	21	23	18	20	18	18	13	14
12	GB	49				24				21		23		18		20		16
13	GR	66	53	29	35	44	57	49	46	58	50	61	64	54	54	51	50	49
14	HR	47				15				7		30		16		20		19
15	HU	33				19				17		27		14		18		27
16	IE	35	61	42	40	45	39	44	37	35	38	29	33	26	27	30	28	24
17	IT	33	41	22	17	23	30	30	25	21	25	36	33	28	21	21	19	17
18	LT	42				28				30		37		33		33		29
19	LU	20				10				14		12		11		9		24
20	LV	67				18				32		43		33		35		29
21	MT	35				18				18		24		20		28		33
22	NL	47	56	33	33	42	40	60	41	50	48	56	49	45	41	36	36	28
23	PL	41				15				14		20		16		16		14
24	PT	51	43	27	29	34	26	43	28	25	30	34	30	21	21	27	20	24
25	RO	60				23				22		28		25		15		17
26	SE	41				11				23		28		17		16		19
27	SI	23				18				20		38		20		16		18
28	SK	25				15				17		23	24	21	18	17	17	15

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

Table C.4 Macroprudential instruments in the MaPPED database and construction of base indices

Instrument group	Instruments	Index	
Minimum capital requirements	Capital adequacy ratio (CAR)	**Capital =** (Minimum capital requirements + Capital Buffers + Risk weights + Loan loss provisioning)	**MPP =** (Capital + Borrower + Liquidity + Other)
	Tier 1 capital ratio		
	Common Equity Tier 1 capital ratio (CET 1)		
	Core Tier 1 capital ratio		
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		
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	**Borrower =** (Lending standards restrictions + Limits on credit growth and volume)	
	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		

(table continues)

(continued)

Instrument group	Instruments	Index	
	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	**Liquidity =** (Liquidity requirements and limits on currency and maturity mismatch)	
	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		
Leverage ratio	Leverage ratio	**Other =** (Leverage ratio + Levies on financial institutions + Limits on large exposures and concentration + Other measures)	
Levies/taxes on financial institutions	Tax on assets/liabilities		
	Tax on financial activities		
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 C.5 Sources for the Variables

Variable	***Description***	***Source***
Dependent variable		
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
Macroprudential indices		
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 policies 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 policies, 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

(table continues)

(continued)

Variable	***Description***	***Source***
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
Firm variables		
Micro	Dummy variable that takes the value 1 if the firm has 1 to 9 employees, and 0 otherwise.	ECB, SAFE
Small	Dummy variable takes the value 1 if the firm has 10 to 49 employees, and 0 otherwise.	ECB, SAFE
Large	Dummy variable takes the value 1 if the firm has more than 250 employees, and 0 otherwise.	ECB, SAFE
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 has 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	Dummy variable equal to 1 if the firm is an autonomous profit-oriented firm, and 0 otherwise.	ECB, SAFE
Ownership	Dummy variable equal to 1 if the firm is owned by an individual, family, or entrepreneur, and 0 otherwise.	ECB, SAFE
Collateral	Dummy variable equal to 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 equal to 1 if the bank increased the maturity of the loans, and 0 otherwise.	ECB, SAFE
Macroeconomic variables		
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 (October 2010-September 2012) and 0 otherwise.	Own calculation

(table continues)

(continued)

Variable	***Description***	***Source***
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 refinancing 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

APPENDIX D: Extended Summary in the Slovenian language

DALJŠI POVZETEK DISERTACIJE V SLOVENSKEM JEZIKU

Raziskovalno področje in povod za disertacijo

Globalna finančna kriza v letu 2008, katere izvor in posledice se preučujejo še danes, je pustila resne posledice na gospodarskih sistemih številnih držav in je temeljito pretresla celotno svetovno gospodarstvo. To je vodilo v upad zaupanja v finančni sektor, katerega okrevanje je trajalo daljši čas. Krizi je sledil upad naložb, povečalo se je število propadlih podjetij, stopnja brezposelnosti je poskočila. Celotno dogajanje so spremljala prizadevanja vlad, da bi rešile, kar se je dalo rešiti, pogosto z neobičajnimi in obsežnimi paketi državnih pomoči, s čimer so pogosto tudi bile izčrpane možnosti za boj proti neizprosnim posledicam krize. Kriza je razkrila pravo naravo gospodarske ekspanzije, izhajajoče iz pretirane kreditne dejavnosti, ki je bila tudi osnova za nastanek številnih izvedenih finančnih instrumentov, ki so bili ustvarjeni in prodajani brez ustrezne ocene in presoje tveganj. Medtem pa so cene nepremičnin neverjetno poskočile in ustvarile cenovni balon, katerega pok je bil neizogiben, svetovno gospodarstvo pa je stal dobrih 15 tisoč milijard dolarjev (Armour in drugi, 2016).

Drugi ključen vidik, prav tako razkrit v obdobju po finančni krizi leta 2008, so bile številne resne zmote glede delovanja finančnega nadzora. Trinajst let pozneje vstopamo v novo obdobje, ki mu sledi ponoven gospodarski zastoj, ki ga je tokrat povzročil zunanji šok zaradi pandemije COVID-19. V akademskih krogih in v nadzorniških institucijah se še vedno ukvarjajo s preučevanjem in oblikovanjem ustreznih nadzornih mehanizmov in predpisov za udeležence na finančnih trgih, ki bi bili učinkoviti pri preprečevanju ponovnih finančnih in gospodarskih kriz. Ta prizadevanja so privedla do spremenjene paradigme finančnega nadzora, ki daje bistveno večji poudarek sistemskemu vidiku finančnega nadzora, ki je postal tudi vodilo pri oblikovanju bodočih nadzornih režimov. V preteklosti prevladujoče razumevanje finančnega nadzora, ki je temeljilo na nadzoru posameznih finančnih ustanov, s ciljem zagotovljanja stabilnost celotnega finančnega sistema (gre za mikrobonitetni pristop k finančnemu nadzoru), se je postopoma umaknilo širšemu razumevanju nadzora. Četudi so bili nekateri ekonomisti že pred finančno krizo mnenja, da je mikrobonitetni pristop nezadosten za zagotovitev finančne stabilnosti na agregatni ravni (Borio, 2003; Davis, 1999; Crocket, 2000), je bilo šele po krizi jasno, da motnje pri delovanju velikih in tveganjem zelo izpostavljenih finančnih institucij, lahko privedejo do popolne ohromitve gospodarskega sistema ter da v tem primeru mikrobonitetni pristop ni zadosten garant za zagotovljanje finančne stabilnosti. To je nadzorniške institucije vodilo k uveljavljanju makrobonitetnega pristopa, katerega glavni cilj je preprečitev manifestacije sistemskega tveganja, z zaščito finančnega sistema kot celote. Racionalno izhodišče za takšen pristop je zavedanje, da sta medsebojna povezanost in medsebojna odvisnost finančnih ustanov ključnega pomena, enako kot je pomembno tudi finančno zdravje posameznih institucij.

Razliko med mikrobonitetno dimenzijo in novim, makrobonitetnim pristopom k finančnemu nadzoru dobro opiše Andrew Crockett, nekdanji generalni direktor Banke za mednarodne poravnave, ki pravi: "*Razlika med mikro- in makrobonitetno dimenzijo finančne stabilnosti se najbolje kaže kot razlika glede ciljev in razlika glede koncipiranja mehanizmov, ki vplivajo na končni rezultat. Sami instrumenti, uporabljeni pri zasledovanju cilja finančne stabilnosti, tu ne igrajo velike vloge*". Del makrobonitetnih instrumentov izvira tudi iz regulatornega okvira Basel III, medtem ko je preostanek v pristojnosti posameznih držav. Na podlagi izsledkov Larosièrjevega poročila leta 2009 je v EU prišlo do ustanovitve Evropskega odbora za sistemska tveganja (angl. European Systemic Risk Board, v nadaljevanju ESRB), katerega mandat je nadzor finančnega sektorja EU, z namenom preprečevanja bodočih finančnih kriz, ki bi se pojavile kot posledica povečanja sistemskih tveganj. Poleg tega gre za organ, ki je odgovoren za pregled in koordinacijo makrobonitetnih politik. Trenutni okvir makrobonitetnih instrumentov sestoji iz že obstoječih mikrobonitetnih instrumentov in novih instrumentov, ki so vključeni le v makrobonitetni okvir, kot denimo proticiklične kapitalske rezerve (Boissay & Cappiello, 2014). Nekateri od omenjenih instrumentov, ki so vključeni tudi v analizo v pričujočem doktorskem delu, so tradicionalno obravnavani kot mikrobonitetni, vendar imajo hkrati tudi makrobonitetne učinke, ko zmanjšujejo tveganja v finančnem sektorju kot celoti. Kot pravi Borio (2003, str. 2): "*V kolikor uporabimo analogijo črno-belega, bi makro- in mikrobonitetne duše soobstajale v naravnejšem odtenku sive barve regulatornih in nadzorniških ureditev.*" Ključna razlika med naštetima pristopoma leži predvsem v njunem cilju in časovnici. Cilj makrobonitetne politike je lajšanje sistemskega tveganja, ki lahko vznikne iz finančnega neravnovesja in pretresov, kar lahko vodi v resne posledice za celotno gospodarstvo. Medtem ko mikrobonitetna regulacija tveganje razume kot nekaj zunanjega, makrobonitetna regulacija upošteva tudi endogena tveganja, ki izhajajo iz kolektivnega obnašanja finančnih institucij, njihove medsebojne povezanosti in lastnosti, povezanih z velikostjo njihovih naložb in kapitala, ter z njihovo pomembnostjo za sam sistem (Crockett, 2000).

Armour et al. (2016) ugotavljajo, da so bili tako mednarodni kot domači nadzorniki zelo optimistični glede bodoče gospodarske rasti in zdravega poslovanja finančnega sektorja v letu 2006. To je izviralo iz neopazne rasti tveganj, ki so se postopoma kopičila, kot posledica zadolženosti in pretirane kreditne rasti. Makrobonitetna regulacija upošteva tudi časovno dimenzijo, z brzdanjem procikličnih sil, ki so del finančnega cikla. To zahteva, da banke vzpostavijo kapitalske blažilce v obdobjih rasti, kar se potem lahko sprosti med upadom gospodarstva, z namenom okrepitve gospodarske dejavnosti. Namen tovrstnega pristopa je dvojen: 1) izogibanje pretirani posojilni dejavnosti v obdobju stabilnosti in 2) preprečevanje kreditnega krča v obdobju gospodarskega zastoja. Dober primer tovrstnega pristopa je aktivacija proticikličnega kapitalskeg blažilnika v obdobju stabilnosti, z namenom zaščite bank in drugih udeležencev v finančnem sistemu pred negativnimi učinki krize. Proticiklični kapitalski blažilnik je blažilnik s kapitalsko zahtevo 0–0.25 %, ki se v državi aktivira

(poveča), ko pride do povečanega tveganja sistemske nestabilnosti (Claessens, Ghosh & Mihet, 2013). To bankam in ostalim akterjem omogoča, da zadržijo stabilnost tudi v obdobju gospodarskega zastoja, ko se finančni in gospodarski pogoji poslabšajo. To posledično pomaga omejevati prociklično obnašanje finančnih institucij in zmanjšuje tveganja prekinitve poslovanja. Makrobonitetne politike ciljajo tudi posamezne sektorje ali finančne institucije, kot npr. sistemsko pomembne finančne ustanove, medtem ko je namen mikrobonitetne regulacije naslavljanje stabilnosti posameznih ustanov znotraj finančnega sistema.

Način oblikovanja makrobonitetnih politik in zapletenosti implementacije tovrstnih ukrepov, ki imajo lahko resen vpliv na udeležence finančnega sektorja, pomeni, da število študij, ki analizirajo učinkovitost politik za spodbujanje finančne stabilnosti, bodisi z blaženjem pretirane kreditne rasti bodisi z zmanjševanjem tveganja, tako na ravni podjetij kot tudi na agregatni ravni, le še narašča (Akinci & Olmstead-Rumsey, 2018; Altunbas, Binici & Gambacorta, 2018; Cerutti, Claessens & Laeven, 2017; Claessens, Ghosh & Mihet, 2013; Lim in drugi, 2011).

Glede na že obstoječo literaturo, ki se še vedno dopolnjuje, in potrebo po nadaljnjih raziskavah učinkov, povezanih z implementacijo makrobonitetnih ukrepov v gospodarskih in finančnih sistemih, skuša pričujoča disertacija razširiti omenjeno raziskovalno področje in zapolniti vrzel v literautri na naslenje načine:

(a) s preučevanjem cen virov bančnega financiranja po aktiviranju makrobonitetnih politik, z upoštevanjem heterogenosti po državah v smislu makroekonomskih lastnosti in gospodarske razvitosti;
(b) z raziskovanjem učinka makrobonitetnih politik na posojilne dejavnosti posameznih bank, s testiranjem različnih makrobonitetnih instrumentov, v smislu namena in cilja in s testiranjem delovanja teh instrumentov v obdobjih njihovega zaostrovanja in sproščanja;
(c) z analizo mikroekonomskih učinkov makrobonitetne regulacije v okviru odzivanja bank in njihovih posojilnih strategij do podjetij, z uporabo podatkov o dostopu MSVP do bančnega financiranja.

Povzetek ključnih ugotovitev študije

Z namenom preučitve učinka makrobonitetne regulacije na stran obveznosti bančnih bilanc stanja, se prvo poglavje ukvarja z učinkom makrobonitetnih ukrepov na stroške bančnega financiranja. Celovita empirična analiza vključuje tudi regresijo z dvema ključnima spremenljivkama: stroški financiranja dolgov in celotnimi stroški financiranja, merjeni s povprečnimi kapitalskimi stroški. Empirični rezultati kažejo negativno povezavo med makrobonitetnimi indikatorji in omenjenima dvema spremenljivkama. Rezultati nakazujejo, da makrobonitetne politike povečujejo zaupanje vlagateljev zaradi zmanjševanja bančnih tveganj in izboljšanja kapitalskega položaja bank, kar posledično zmanjšuje stroške

bančnega financiranja. Za nadaljnje preučevanje omenjenega odnosa ločeno analiziramo različne vrste makrobonitetnih ukrepov: ukrepe, usmerjene na posojilojemalce, ukrepe, usmerjene na kapital, strukturne ukrepe in institucionalne instrumente, usmerjene v strukturo naložb in dohodke finančnih institucij. Ukrepi, usmerjeni na posojilojemalce, so dokazano negativno povezani s stroški bančnega financiranja za obe odvisni spremenljivki. Za kapitalske ukrepe je dokazana močna negativna povezava s stroški financiranja dolgov. Strukturni ukrepi so prav tako močno negativno povezani z odvisnima spremenljivkama, najdemo pa pozitivno povezavo za institucionalne instrumente, kjer je dokazano, da imajo določeni makrobonitetni instrumenti, kot denimo zahtevane rezerve, lahko negativen vpliv na stabilnost bank, s čimer povečajo stroške bančnega financiranja. Z izboljšanjem kakovosti bančnih naložb in z zmanjšanjem tveganja posojilnega portfelja imajo kreditni makrobonitetni ukrepi, kot denimo razmerje med posojilom in vrednostjo zavarovanja in razmerje med dolgom in prihodki, najmočnejši vpliv na stroške bančnega financiranja. Ker študija vključuje podatke na ravni bank 43 razvitih evropskih držav oziroma evropskih držav v razvoju, smo se odločili za analizo podvzorcev, osnovanih na stopnji gospodarskega razvoja posamezne države. Rezultati kažejo, da imajo makrobonitetni indikatorji statistično znatno negativen vpliv na stroške bančnega financiranja v razvitih državah, medtem ko v državah v razvoju najdemo nekaj pozitivnih koeficientov, ki razkrivajo razliko v vplivu makrobonitetnih ukrepov, osnovanih na podvzorcih držav, in odražajo različne stopnje finančnega razvoja in institucionalnih okvirov. Makrobonitetne politike so prav tako dokazano učinkovitejše v obdobju pred krizo, kar velja za celoten vzorec in tržna gospodarstva v razvoju, medtem ko so makrobonitetne politike v razvitih državah učinkovite tudi v obdobju po krizi. Poglavje zaključuje, da je makrobonitetna regulacija ključna tudi v smislu razvoja stroškov bančnega financiranja, hkrati pa pojasnjuje, da morajo biti makrobonitetne politike implementirane previdno in usklajene s potrebami vsake posamezne države.

V drugem poglavju se analizira učinek makrobonitetne regulacije na posojilno vedenje bank. Postavimo hipotezo, da so makrobonitetni ukrepi negativno povezani z bančnim posojilnim delovanjem. Dodatno testiramo hipotezo, da je sproščanje (zaostrovanje) makrobonitetnih ukrepov povezano s porastom (upadom) bančnega posojanja. Rezultati podpirajo prvo hipotezo, saj ima makrobonitetni indeks, ki upošteva zaostrovanje in sproščanje vseh instumentov, na uporabljenem vzorcu skozi celotno obdobje, statistično značilno negativen vpliv na bančno kreditiranje. Rezultati so robustni tudi ko uvedemo različne bančne spremenljivke in makroekonomske determinante, ki lahko vplivajo na količino bančnih posojil. Šibke rezultate dobimo, ko merimo zaostrovanje posameznih ukrepov, medtem ko imajo makrobonitetni ukrepi močnejši učinek na bančna posojila v obdobjih njihovega sproščanja. Te ugotovitve podpirajo uporabo makrobonitetnih instrumentov v obdobju gospodarskega zastoja, ki ga je povzročila pandemija COVID-19, z namenom izboljšanja bančne posojilne dejavnosti, tržne likvidnosti in podpore gospodarske rasti. Hkrati poudarjamo potrebo po premišljenem izboru ukrepov in pristopu, ki ne ogroža prvotnega cilja makrobonitetne politike ter ohranja finančno stabilnost. Poleg

tega so se makrobonitetni kapitalski ukrepi izkazali kot najbolj učinkoviti v obdobju krize, saj so bili ocenjeni regresijski koeficienti statistično značilni in negativni. Rezultati tudi pokažejo, da so banke, katerih delnice kotirajo na borzah, bolj odzivne, ko gre za vpeljavo, zaostrovanje ali sproščanje makrobonitetnih ukrepov.

V tretjem poglavju analiziramo učinke makrobonitetnih ukrepov na dostopnost do bančnih kreditov za MSVP v 28 državah EU. Uporabljeni so anketni podatki o prošnjah podjetij za bančna posojila, s podatki o bančnih odobritvah in zavrnitvah, s čimer so zajeti podatki s strani samih podjetij glede njihove dejanske dostopnosti do bančnega kreditiranja. Izsledki emipirične analize kažejo, da so makrobonitetni ukrepi značilno povezani z zmanjševanjem dostopnosti kreditov za MSVP, pri čemer imajo največji vpliv kapitalski makrobonitetni instrumenti. Ko ločeno testiramo ukrepe zaostrovanja in sproščanja instrumentov, so ti učinki manj izraziti, opazna pa je negativna povezanost z zaostrovanjem makrobonitetnih ukrepov, medtem ko je povezanost s sprostitvenimi ukrepi pozitivna. Učinki makrobonitetnih ukrepov upadajo z velikostjo podjetja, kar dokazuje, da je ta vpliv pri velikih podjetjih manj izrazit. Podobne rezultate dobimo pri preučevanju marginalnih učinkov glede na starost. Makrobonitetni učinki so namreč za starejša (uveljavljena) podjetja manjši. Rezultati se izkažejo kot robustni tudi na različnih podvzorcih, ob uvedbi Heckmanovega popravka, ob uvedbi ukrepov, ki so sprejeti kot makrobonitetna priporočila in ob različnih naravnanostih denarne politike. Rezultati, pridobljeni v pričujočem poglavju, potrjujejo potencialno možnost medsebojnega izključevanja ciljev finančne stabilnosti in posledic, ki se lahko pokažejo v dostopu podjetij do finančnih virov, kar ima lahko nadalje negativen vpliv na investicije, zaposlovanje in samo gospodarsko rast.

Prispevek doktorskega dela

Disertacija predstavlja dodano vrednost na področju virov in literature o finančnem nadzoru, finančnem posredovanju in korporativnih financah. Prispevek prvega poglavja se odraža v študiji o pomenu stroškov bančnega financiranja v kontekstu finančne stabilnosti. Empirična strategija se osredoča na analizo stroškov zadolženosti in celotnih stroškov financiranja posameznih podružnic bank v 43 razvitih tržnih gospodarstvih oziroma gospodarastvih v razvoju. Tako prvo poglavje zapolnjuje pomembno vrzel v literaturi, glede kanalov prenosa, skozi katere lahko makrobonitetna regulacija vpliva na razvoj bančnega sektorja. Analiza razkriva, da je večina makrobonitetnih instrumentov negativno povezana s stroški bančnega financiranja. Poleg tega poglavje preučuje tudi učinke različnih skupin makrobonitetnih instrumentov in njihovih posamičnihi učinkov, s prikazom vpliva posameznega instrumenta na stroške bančnega financiranja. Prvo poglavje dopolnjuje vire in literaturo s področja makrobonitetnih politik z razpravo o stroških bančnega financiranja v okviru finančne stabilnosti, ki presega kapitalske zahteve, z analizo različnih skupin instrumentov makrobonitetnih politik, ki vplivajo na banke skozi različne kanale. Nadalje se analiza posveča tudi učinkom makrobonitetnih instrumentov v različnih podvzorcih posameznih držav, ki so oblikovani glede na gospodarsko moč the držav, in predstavlja podroben

vpogled v razlike v odzivih bank na aktivacijo makrobonitetnih instrumentov. Analiza kaže, da je učinek makrobonitetnih politik odvisen tudi od stopnje razvitosti posamezne države. Pojasnjeno je namreč, da so nekateri makrobonitetni instrumenti pozitivno povezani s stroški bančnega financiranja v državah v razvoju, kar nakazuje, da je aktivacija makrobonitetnih politik povezana z višjimi stroški financiranja. Nenazadnje pa poglavje z uporabo podatkov na ravni bank nadgrajuje relativno skromno literaturo o mikroekonomskih učinkih makrobonitetnih politik, kjer so dodane kontrolne spremenljivke na ravni bank, ki v študijah, osnovanih izključno na podatkih na makro ravni, seveda ne morejo biti vključene.

Ključni prispevki drugega poglavja so vidni v analizi in raziskavi odnosa med makrobonitetno regulacijo in bančno posojilno dejavnostjo. Analiza uporablja podatke na ravni bank in preučuje učinke makrobonitetnih politik z uporabo podatkov iz bančnih finančnih poročil. Tako se analiza osredotoča na odzive posameznih bank in njihovih podružnic, ki poslujejo v različnih državah. Poleg makrobonitetnih instrumentov, razvitih v sklopu ukrepov Basel III, kot denimo proticiklični kapitalski blažilnik ali kapitalski blažilnik za sistemsko pomembne finančne institucije, so številni drugi makrobonitetni instrumenti aktivirani tudi po posameynih državah. Izhajajoč iz zapisanega je analiza učinkov makrobonitetnih instrumentov na banke v posameznih državah Evropske unije s pomočjo nekonsolidiranih bilanc stanja in izkazov poslovnega izida ključna za razumevanje učinkovitosti. Poglavje tako podrobno preučuje tudi učinek makrobonitetnih ukrepov na banke v državah Evropske unije z uporabo razširjene in bogate makrobonitetne podatkove baze s podrobnostmi o delovanju regulatorjev. Analiza hkrati prikazuje, da so makrobonitetni instrumenti negativno povezani z bančno posojilno dejavnostjo. Prispevek poglavja je odražen tudi v ločenih pregledih posameznih makrobonitetnih ukrepov, kar ponuja vpogled v to, kateri instrumenti najmočneje vplivajo na posojilno dejavnost. Poglavje je namenjeno tudi proučevanju vpliva zaostrovanja in sproščanja makrobonitetnih ukrepov na bančno posojilno dejavnost. Dodana vrednost študije se kaže v tem, da pomaga bolje razumeti makrobonitetne instrumente ter njihove učinke na kreditne cikle v različnih okoliščinah. Hkrati poglablja znanje o izvajanju nadzora v različnih gospodarstvih, s pomočjo analize različnih obdobij finančnega cikla. Rezultati nakazujejo na močnejši učinek makrobonitetnih ukrepov v sprostitvenih ciklih, ko se makrobonitetni instrumenti sproščajo, z namenom pospeševanja gospodarskega okrevanja. Omenjene ugotovitve so še posebej pomembne za snovalce politik v aktualnih razmerah, ko je možno s sproščanjem makrobonitetnih politik vzpodbuditi gospodarsko dejavnost in ponovno zagnali rast, zaradi zastoja, ki ga je povzročila pandemija COVIDa-19.

Ključni prispevek tretjega poglavja je analiza realnih učinkov makrobonitetne regulacije, s študijo ponudbe bančnih kreditov MSVP podjetjem. Pričujoče poglavje zapolnjuje pomembno vrzel v literaturi s področja poslovnih financ in makrobonitetnih politik, saj preučuje dostopnost finančnih sredstev za MSVP z uporabo anketnih podatkov o prošnjah za bančne kredite s strani omenjenih podjetij, analizira pa tudi lastnosti teh podjetij,

makroekonomske pogoje in makrobonitetno delovanje v državah Evropske unije. Analiza pokriva daljše obdobje med in po finančni krizi od 2008 in vse do leta 2017, ko so bili uporabljeni številni makrobonitetni ukrepi. Probit analiza pokaže, da obstaja ob aktivaciji makrobonitetnih ukrepov manjša verjetnost, da bodo prošnje MSVP za bančne kredite odobrene. Poleg tega empirična raziskava dokazuje, da ukrepi, usmerjeni v bančno posojilno aktivnost in kapitalsko pozicijo bank, močneje vplivajo na verjetnost bančnega financiranja MSVP. Poleg tega so preučeni tudi procesi zaostrovanja in sproščanja makrobonitetnih ukrepov. Analiza kaže, da ob zaostrovanju makrobonitetnih ukrepov obstaja manjša verjetnost za odobritev bančnega kredita MSVP. Ta učinek je načeloma manj izrazit. Ko se makrobonitetni ukrepi sproščajo, obstaja večja verjetnost za odobritev bančnega kredita MSVP. Ti rezultati se ne spreminjajo tudi ko se izvedejo preizkusi robustnosti.

Tabela 4.1 predstavlja povzetek in pregled ključnih lastnosti in virov podatkov, metodoloških pristopov in samih rezultatov, hkrati pa izpostavlja tudi prispevek vsakega posameznega poglavja. Disertacija vključuje podrobno in izčrpno analizo mikroekonomskega učinka makrobonitetne regulacije, doseženo z analizo podatkov na ravni bank in podjetij. Poleg tega vsebuje tudi dve makrobonitetni podatkovni bazi in prikazuje inovacije na področju načrtovanja in meritev makrobonitetnih indikatorjev, kar predstavlja pomembne informacije za snovalce politik in akterjev v finančni industriji.

Tabela 4.1 Pregled opisa, metodologije, ugotovitev in doprinosov disertacije

Ključni doprinosi in ugotovitve doktorske disertacije					
Naslov poglavja	**Vzorec**	**Podatkovne baze**	**Metodologija**	**Ugotovitve**	**Doprinos**
Poglavje 1: Makrobonitetni ukrepi in razvoj v stroških bančnega financiranja	2000-2017 Evropske banke (43 razvitih gospodarstev in gospodarstev v razvoju)	Fitch Connect; MDS (GMOP), Svetovna banka	Splošna metoda momentov (SMM)	Analiza je pokazala, da je makrobonitetna regulacija značilno povezana z razvojem stroškov bančnega financiranja. Glavni kazalec makrobonitetne politike (MaBP) je značilno in negativno povezan s stroški bančnega financiranja. Izsledki raziskave so pokazali, da imajo posojilni, kapitalski in strukturni makrobonitetni ukrepi največji učinek na stroške bančnega financiranja. Instrumenti, osnovani na samih ustanovah, usmerjeni v premoženje bank in njihove prihodke, imajo pozitiven učinek na stroške bančnega financiranja. Raziskava pa je pokazala tudi, da je učinek makrobonitetnih ukrepov močno odvisen tudi od gospodarskega razvoja in institucionalnih pogojev v posameznih državah kot tudi od usmerjenosti instrumentov.	Gre za prvo tovrstno študijo, ki raziskuje odnos med stroški bančnega financiranja in makrobonitetnimi zahtevami. Študija za preučevanje stroškov bančnega financiranja uporablja podatke na ravni bank in te združuje s podatki iz nedavno posodobljene makrobonitetne podatkovne baze MDS. Preučujemo stroške financiranja dolgov in celotne stroške financiranja, pri čemer upoštevamo tako dolgove kot tudi vire lastniškega kapitala bančnega financiranja.

(table continues)

(continued)

Ključni doprinosi in ugotovitve doktorske disertacije					
Naslov poglavja	**Vzorec**	**Podatkovne baze**	**Metodologija**	**Ugotovitve**	**Doprinos**
Poglavje 2: Zaostrovanje in spro-ščanje makro-bonitetne politike, učinki na kreditno rast in vpletenost v krizo COVID-19	2000-2017 Banke Evropske unije	Fitch Connect; OPBMaBP, ECB, Svetovna banka, MDS	Splošna metoda momentov	Makrobonitetni ukrepi so tesno povezani z bančnimi posojili. MaBP je značilno in negativno povezan z bančno posojilno sposobnostjo. Makrobonitetno zaostrovanje je negativno povezano z bančno posojilno dejavnostjo, četudi so učinki v obdobjih zaostrovanja manj izpostavljeni. Analiza je pokazala, da imajo makrobonitetni ukrepi močnejši učinek v obdobjih sproščanja. Sprostitveni indikatorji so značilno in pozitivno povezani z bančno posojilno dejavnostjo. Znanstveno dokazano je, da so makrobonitetni ukrepi, usmerjeni v kapital, najučinkovitejši. Naštete banke se bolje odzivajo na spremembe v makrobnitetnem okviru.	Poglavje preučuje učinek makrobonitetne regulacije nad bančnim posojilnim delovanjem z uporabo podatkov na ravni bank v 28 državah EU. Za namene pričujoče raziskave so bili razviti številni makrobonitetni indikatorji. Študija uporablja najsodobnejšo makrobonitetno podatkovno bazo, OPBMaBP, ki zajema obširen nabor politik. Poglavje preučuje bančno posojilno delovanje s preizkušanjem ne zgolj prisotnosti instrumentov, temveč tudi z njihovo usmeritvijo v smislu krčenja in širjenja.
Poglavje 3: Bančna posojila ter dostop MSVP do finančnih virov – učinki makrobonitetne politike	2009-2017 Evropska unija (MSVP)	RDFS, OBMaBP, ECB; Svetovna banka; MDS	Zbirni model probit; panel probit z naključnimi učinki; Heckmanov popravek	Makrobonitetni ukrepi so značilno povezani z bančnimi posojili MSVP. Makrobonitetni ukrepi, usmerjeni v kapital, imajo največji učinek na verjetnost dostopa MSVP do bančnega financiranja. Zaostrovanje makrobonitetnih ukrepov zmanjšuje verjetnost pridobitve kredita za MSVP. Ob sproščanju makrobonitetnih ukrepov imajo MSVP večjo možnost za dostop do bančnega financiranja. Rezultati so prestali številne preizkuse robustnosti.	Gre za prvo tovrstno študijo, ki preučuje učinek makrobonitetnih ukrepov na dostop MSVP do bančnih kreditov z uporabo podatkov na ravni podjetij in na odločanje bank o odobritvi kredita. Študija zajema velik vzorec 36.466 podjetij v kar 28 državah EU. Obseg vzorca je velik in zajema ključne spremembe v bonitetnem nadzoru. Poglavje preučuje tudi zaostrovanje in sproščanje delovanja posameznih makrobonitetnih instrumentov in njihov učinek na dostop MSVP do finančnih sredstev.

Opomba: Zgornja tabela predstavlja povzetek ključnih ugotovitev in prispevkov doktorske disertacije po posameznih poglavjih.

Zaključek

Pričujoča disertacija analizira makrobonitetno regulacijo in njen učinek na delovanje bank. Preučen je odnos med makrobonitetno politiko in stroški bančnega financiranja, raziskano pa je tudi vprašanje, ali ima aktivacija makrobonitetnih politik statistično značilen učinek

na ceno bančnega financiranja. Cilj analize je določiti, ali je vpeljava omenjenih instrumentov povezana s porastom ali upadom zgoraj omenjenih stroškov. Analizirani so tako stroški dolžniškega financiranja kot tudi celotni bančni stroški financiranja, analiza pa je dopolnjena še s pregledom učinkov različnih skupin makrobonitetnih ukrepov. Hkrati preuči tudi tezo, da je učinek odvisen od gospodarske razvitosti države. Učinek makrobonitetnih ukrepov na bančna posojila je preučen z analizo bruto posojil v obdobju aktiviranja makrobonitetnih ukrepov in po njihovem prenehanju. Empirična analiza preučuje zaostrovanje in sproščanje posameznih ukrepov makrobonitetne politike, medtem ko so različne skupine makrobonitetnih instrumentov analizirane, z namenom ugotavljanja njihove učinkovitosti pri omejevanju bančnih posojil. Disertacija preučuje tudi vpliv makrobonitetnih ukrepov na dostopnost MSVP do finančnih virov. Analiza se osredotoča na vloge majhnih in srednje velikih podjetij za posojila in verjetnost za njihovo odobritev v povezavi z različnimi lastnostmi podjetij, makroekonomskimi determinantami držav in makrobonitetnimi ukrepi, ki so se izvajali v določeni državi. Študija prav tako preučuje zaostrovanje in sproščanje posameznih makrobonitetnih politik ter njihov vpliv na posojilne vloge majhnih in srednje velikih podjetij. Poleg tega raziskava upošteva tudi pomen starosti in velikosti podjetja pri določanju vpliva makrobonitetnih instrumentov.

Sledi povzetek ključnih ugotovitev disertacije. Makrobonitetni ukrepi so pomemben dejavnik pri analizi stroškov bančnega financiranja. Izsledki raziskave kažejo, da so makrobonitetni ukrepi večinoma povezani z zmanjševanjem stroškov financiranja, z močnejšim učinkom pri instrumentih usmerjenih na posojilojemalce ter pri strukturnih in kapitalskih makrobonitetnih instrumentih. Poleg tega izsledki kažejo tudi, da je učinek makrobonitetnih ukrepov na stroške bančnega financiranja odvisen od gospodarske razvitosti posamezne države, od razvitosti finančnega trga ter institucionalnega in nadzornega delovanja. Izhajajoč iz tega se izpostavlja, da morajo biti makrobonitetni instrumenti skrbno izbrani in aktivirani v skladu z lastnostmi posamezne države oz gospodarstva. Makrobonitetne politike so izkažejo kot učinkovite pri obvladovanju posojilne aktivnosti bank, ko so merjene s celovitim makrobonitetnim indeksom, ki zajema vse uporabljene instrumente makrobonitetnega nadzora v preučevanem obdobju. Makrobonitetne politike kažejo močnejši učinek na posojilno dejavnost bank v obdobjih sproščanja ukrepov. Poleg tega analiza v tretjem poglavju pokaže na potencialno nezdružljivost cilja finančne stabilnosti s ciljem gospodarskega razvoja, ki je v veliki meri pogojen z razpoložljivostjo finančnih virov za podjetja, kar vpliva na investicije, stopnjo brezposelnosti in samo gospodarsko rast. V tej luči je smiselno, da si makrobonitetni regulatorji prizadevajo za krepitev stebrov finančne stabilnosti in da se izognejo neželenim posledicam zastoja v gospodarski aktivnosti.

Metodologija, uporabljena v pričujočem doktorskem delu, predstavlja dodano vrednost na področju makrobonitetnih politik, saj z uporabljenimi podatki, oblikovanjem makrobonitetnih indikatorjev, z uporabo podatkov iz javno dostopnih podatkovnih baz, ter z razširitvijo modelov in relevantnih dejavnikov, ki so upoštevani v analizi makrobonitetnih

ukrepov, prispeva k novim spoznanjem na obravnavanem področju. Ta spoznanja so lahko koristna tako za praktike kot tudi za snovalce politik, pri njihovem boljšem razumevanju mikroekonomskih učinkov makrobonitetne regulacije.