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Effectiveness of macroprudential policies: Do stringent bank regulation and supervision matter?

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ABSTRACT

In this paper, we examine the effectiveness of macroprudential policies in limiting credit growth conditional on the quality of bank regulation and supervision. Using a large panel data set of 4109 banks from 91 countries over the period 2001–2013, we find that the efficacy of macroprudential measures is more pronounced in countries with stricter bank supervisory power and more private monitoring. This result is robust to a battery of sensitivity tests. Our additional analysis reveals that adopted macroprudential tools limit more the credit growth of small, less-capitalized, and less-liquid banks when accompanied with stringent bank regulation. In particular, low-capital and low-liquid banks reduce their loans more than their high-capital and high-liquid counterparts, following the activation of macroprudential measures. Overall, our findings imply that the quality of bank regulation and supervision conditions the effectiveness of macroprudential measures.

1. Introduction

The health of individual financial institutions is a crucial condition for system-wide financial stability (Osinski et al., 2013). To prevent pro-cyclicality and the buildup of systemic risk (i.e., crises) and to reduce considerable costs associated with it, the so-called macroprudential policies are being increasingly used, notably so since the global financial crisis, by both developed and emerging countries (e.g., Cerutti et al., 2017). The implementation of macroprudential policies can have several objectives, but the most important goal is curbing bank credit growth, because of its link to boom-bust financial cycles (Akinci & Olmstead-Rumsey, 2017). Researchers have recently attempted to examine the effectiveness of macroprudential policies and usually document that the efficacy of such policies is conditional on factors such as bank characteristics (e.g., Altunbas et al., 2018; Gómez et al., 2020). In addition, another strand of literature points to the distinct impact of bank regulation and institutional environment on banking outcomes (e.g., Anginer et al., 2018; Hirtle et al., 2019). Yet, there is no study that examines the effectiveness of macroprudential policies on curbing credit growth conditional on the interaction with bank regulation and supervision. The present paper fills this gap, by examining whether and how the quality of bank regulation (proxied by stringent supervisory powers and more private monitoring) shapes the efficacy of macroprudential policies. Moreover, the paper explores to what extent bank characteristics, such as size, capital, and liquidity, condition the interaction effect between macroprudential policies and bank regulation on credit growth.

Macroprudential measures are activated in order to increase financial stability and to contain excessive credit growth. Macroprudential policies can reduce individual banks' credit growth through either borrower-targeted or financial institutions-targeted instruments. Borrower-targeted instruments, such as the debt-to-income ratio and the loan-to-value ratio, are activated to dampen

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demand for bank credit, whereas, financial institution-targeted instruments, such as the caps on credit growth, local currency lending, and foreign currency lending, are mainly adopted to curb the supply of bank loans.

The quality of bank regulation is a critical tool for the stability and soundness of the financial sector. Hirtle et al. (2019) explore the impact of supervision on the riskiness, profitability, and growth of U.S. banks, and find that the banking supervision plays a critical role in mitigating banking sector risk. Stronger supervisory power enables banking prudential authorities to act in a stringent and timely manner that would help macroprudential policies to be more effective. The recent study by Mirzaei and Moore (2021) shows that the potential adverse impact of macroprudential policies on bank competition could be mitigated by greater bank supervisory powers. Bank private monitoring also provide market discipline and this dampen risk-taking behavior of banks. The literature suggests that countries with strong institutions that foster efficient supervision (e.g., Anginer, Demirgüç-Kunt, & Zhu, 2014) and monitoring of financial institutions (e.g., Hoque et al., 2015) respond better to shocks to their banking systems, and therefore, can make macroprudential policies more effective in curbing credit growth. Finally, there is evidence that the strength of institutional environment matters for banking outcomes and financial stability (e.g., Anginer et al., 2018; Barth et al., 2004; Klomp & De Haan, 2012).

We extend the above studies and contribute to the existing literature on the effectiveness of macroprudential policies in two important ways. *First*, we complement other studies by analysing the effectiveness of macroprudential policies on credit growth at the bank level, utilizing a large panel of both emerging and advanced economies. Advanced economies, in general, used less these policies (especially prior to the recent global financial crisis), as compared to emerging countries. By pooling information relating to countries with heterogeneous experiences in utilizing prudential tools decrease issues about possible omitted variables (Altunbas et al., 2018). We are different from few studies that analyses the effectiveness of macroprudential policies using bank-level data in terms of the dataset, time dimension and the response variables (e.g., Claessens et al., 2013). *Second* and more importantly, we contribute to the literature by examining the distinct impact of banking supervision and private monitoring on the effectiveness of prudential measures in terms of containing lending activities. Previous studies do not provide an in-depth analysis of the question of whether stringent bank supervisory power and/or more bank private monitoring can shape the efficacy of macroprudential policies in limiting credit growth.

We utilize information from the World Bank (WB) database on bank regulations and supervision, following Agoraki et al. (2011), to construct indices that relate to official supervisory power and private monitoring index. These two regulatory policies are vital in the agenda of policy makers while theory suggests that they could determine the efficacy of prudential measures. We are the first to consider these indices, while testing the association between regulations, macroprudential policies, and lending. We then incorporate these indices to a large panel data set of 4109 banks over the period 2001–2013 for a broad cross-section of developed and developing countries. In doing so, we find that the response of bank loan growth to the activation of macroprudential policies differ amongst banks and that bank supervision and bank private monitoring play a moderating role for this response. Particularly, the evidence suggests that the bank-level lending activity reacts more to macroprudential measures in countries with high level of bank supervisory power and more private monitoring. These results remain unchanged if we use sub-components of macroprudential policies: borrower-targeted versus financial-institution targeted. We conduct several sensitivity tests to ensure the robustness of our finding. Our additional analysis reveals that adopted macroprudential tools affects the credit growth of risky banks disproportionately more, if banks are in countries with stringent bank supervisory and private monitoring. In particular, low-capital and low-liquid banks reduce their loans more than their high-capital and high-liquid counterparts, following the activation of macroprudential measures in countries with greater bank supervision and private monitoring.

Our paper is related to an emerging body of empirical studies on the effectiveness of macroprudential policies for financial stability.[1] Lim et al. (2011) find that macroprudential tools, by reducing the correlation between credit growth and GDP growth, decrease the pro-cyclicality of credit growth. IMF (2012) studies the association between monetary and macroprudential policies. It finds that, among different tools, reserve requirements and capital requirements limit credit growth. In another study, Dell'Ariccia et al. (2012) find that some macroprudential tools can decrease the incidence of general credit booms and alleviate the storm of financial crises. In addition, Aysan et al. (2015) find that borrower-based tools (such as the loan-to-value ratio) are effective in reducing credit growth, and financial institutions-based tools (such as limits on foreign and domestic lending) to be desirable in decreasing the effect of cross-border flows on domestic credit. Recently, Cerutti et al. (2017) find that activation of macroprudential polices are associated with a lower credit growth, especially in emerging market economies. Finally, Akinci and Olmstead-Rumsey (2017) study the effectiveness of 7 macroprudential tools and find a positive correlation between tightening policies and a lower bank credit growth. Our paper extends this literature by studying the effectiveness of macroprudential policies at the bank-level and in countries with different levels of banking regulation and supervision.

Other studies find that the effectiveness of macroprudential policies is conditional on some variables. For example, Gómez et al. (2020), by using Colombian experience, find that countercyclical reserve requirements and dynamic provisions have an adverse effect on credit growth conditioning on bank-specific characteristics. Altunbas et al. (2018) use a large bank panel data to study the impact of macro-prudential policies on bank risk. They also find that banks react differently to macro-prudential tools depending on their specific balance sheet characteristics. In particular, reaction of banks to the activation of macroprudential measures is found to be heterogeneous across banks, according to their size, capitalisation and wholesale funding ratios. On the other hand, some other studies also examine the distinct impact of banking supervision and institutional environment on banking outcomes (e.g., Anginer et al., 2018; Hirtle et al., 2019). We particularly relate to these studies by documenting that stringency of bank regulation as a channel through which macroprudential policies become more effective.

[1] See Galati and Moessner (2013), Claessens (2015) and Galati and Moessner (2018) for an overview of the existing studies on the effectiveness of macroprudential policies.

The remainder of this paper is organised as follows. Section 2 presents the literature review and develops our main hypothesis. Section 3 describes the methodology and introduces the data. Section 4 discusses our results, while Section 5 concludes.

2. Literature review

Asymmetric information theory explains the logic for the existence of bank supervisory body and the incentives for private monitoring of banks. Robust and qualitative regulations can dampen risk-taking behaviour of banks. There are two views in regards to the effect of bank regulation on financial stability: the official supervisory view and the private monitoring view (Alam, 2012; Beck et al., 2006; Demirguc-Kunt et al., 2004). The former view argues that official supervisors have the resources to oversee and intervene the market to reduce market failure. Levine (2003) documents that countries with powerful official supervisors have better bank governance. For instance, less politically-connected supervisors can impose restrictions on banks taking on more risk. The latter view argues that the official supervisory body could be politically connected and thus tools that enhance the ability of the private sector to monitor banks will lead to better financial stability. In other words, regulations that qualify the private sector to observe the behaviour of banks will be also effective in reducing bank financial fragility. Barth et al. (2004) document that private monitoring of banks improves their stability.

The 2008 global financial crisis has reinforced the need to smooth the credit cycle to avert turning credit booms into credit busts, and consequently banking and economic crises (Claessens et al., 2012). Prudential tools enhance the resilience of both banking sector and corporate sector to aggregate shocks, by dampening excessive growth (Ayyagari et al., 2017). The main aim of macroprudential policies is to address systemic risk arising from two dimensions: the cross-section and the time dimensions. The former is mainly related to the interconnectedness of financial firms. The latter is the need to restrict financial booms originated from both the supply and demand sides as well as banking firms' behavior (Borio, 2014). In this respect, macroprudential policies can reduce individual banks' credit growth through demand for and supply of loans such as loan-to-value ratio and caps on credit growth.

The effectiveness of macroprudential policies on banking stability at the country-level has been examined in the literature by several studies, showing that these policies indeed affect credit growth (e.g., Cerutti et al., 2017; Claessens, 2015; Lim et al., 2011). However, there is no much research on the impact of macroprudential policies on bank lending activities. This indicates that one could examine the effectiveness of macroprudential policies at the bank level, because of the direct effect of such policies on bank balance-sheet activities. Recent studies investigate the effects of these policies on bank risk (Altunbas et al., 2018; Gaganis et al., 2020), on bank balance sheet structure (Claessens et al., 2013), but not directly on bank loan growth. The available empirical evidence on the performance of macroprudential tools is mixed. While some studies find that macroprudential policies are effective in containing both asset prices and credit, others find that the effectiveness varies for different banks and for different goals (Jacome & Mitra, 2015). Furthermore, there is also disagreement on the effectiveness of different types of macroprudential instruments. For example, Fendoğlu (2017) finds that borrower-related macroprudential instruments are more effective in reducing credit than financial institutions-related measures. One reason why the findings of existing studies are mixed would be that the degree of the effectiveness of prudential policies might be heterogeneous across banks with different characteristics and different balance-sheet structure (e.g., Altunbas et al., 2018; Gómez et al., 2020).

Our present paper connects these two strands of literature (literature on bank supervision and bank private monitoring as well as literature on macroprudential policies) and investigates to what extend stringent bank supervisory power and more private monitoring affect the effectiveness of macroprudential policies. There are significant cross-country differences in terms of banking regulation and supervision (e.g., Barth et al., 2008; Beck et al., 2013) that can have significant impact on financial stability (e.g., Anginer et al., 2018; Barth et al., 2004; Klomp & De Haan, 2012, Fonseca & González, 2010). Stronger bank regulation enables banking prudential authorities to act in a stringent and timely manner that would help macroprudential policies to be more effective.

Overall, we extend the literature by arguing that the response of banks to adopted macroprudential policies might be different since banks are located in countries with different levels of bank supervision and regulations.[2] Thus, we hypothesis that:

H1. the effectiveness of macroprudential policies in limiting bank credit growth is conditional on the rigidity of national bank regulation and supervision.

3. Methodology and data

3.1. Methodology

Our aim in this paper is to test whether the level of bank supervision and the strength of private monitoring conditions the effectiveness of macroprudential policies in curbing credit growth at the bank level. Besides macroprudential policies, we control for other factors that can affect credit growth such as bank balance sheet structure and demand for credit. We apply the following empirical model:

[2] We acknowledge that the effectiveness of macroprudential polices could be also different across countries with different monetary, fiscal, exchange rate, and microprudential polices. In addition, by analysing the changes in the intensity in the usage of several widely used prudential tools by accumulation of policy actions, Cerutti et al., (2016) find that the usage of macroprudential policies is affected by business and financial cycles.

$$\Delta Loan_{i,c,t} = \beta_0 + \beta_1 .MaP_{c,t} + \beta_2 .R_{c,t} + \boldsymbol{\beta_3 .MaP_{c,t} \times R_{c,t}} + \beta_4 .Size_{i,c,t} + \beta_{i=5,\ldots 10} .CAMEL^{+}_{i,c,t-1} + \beta_{i=11,\ldots 14} .X_{c,t-1} + \varphi_i + \varepsilon_{i,c,t} \quad (1)$$

where the dependent variable is growth of credit in bank i, country c and in year t. It is the variation of bank loan from the end of period $t-1$ to the end of period t. MaP_{ct} is a proxy for total macroprudential policies used in a country in a specific year. We use an aggregate index that allows us to examine the overall effectiveness of macroprudential instrument in affecting bank credit growth when more than one measure is adopted. However, this aggregate index constitutes a rough estimation, as macroprudential instruments may be very different in nature (Altunbas et al., 2018). Hence, in addition to using a total index, we also decompose macroprudential tools based on their nature into two groups: borrower-targeted versus financial institution-targeted instruments. The former includes the loan-to-value and the debt-to-income ratios that are activated to dampen demand for credit. The latter includes all other macroprudential instruments aimed at reducing supply of credit. Ayyagari et al. (2017) find that, in emerging markets, it is mainly borrower-targeted macroprudential tools that reduce firm credit growth, while in advanced countries, both borrower-targeted and financial institution-targeted macroprudential tools seem to be effective.

$R_{c,t}$ is a proxy for the stringency of bank regulation. We consider two variables capturing banking system supervisions and private monitoring as follows: (i) *Supervisory power*: which measures whether the supervisors have the authority to take specific actions to prevent and correct problems; and (ii) *Private monitoring*: which measures whether there incentives/ability for the private monitoring of banks.

The main variable of interest is the interaction term $MaP_{c,t} \times R_{c,t}$ and the coefficient of interest is β_3. If it is negative and statistically significant, we can infer that utilizing macroprudential policies reduce bank credit growth in countries with stringent bank supervisory power and more private monitoring. In other words, the effectiveness of macroprudential policies is conditional on the quality of countries' national banking system regulation and supervision.

As control variables, we first include a proxy for size of a bank (*Size*) since banks with different sizes may have different business models and hence, different lending policies. We next consider six variables (including the five CAMEL[3] components) that have been shown to be instrumental in explaining bank credit growth ($CAMEL^{+}$). We believe that components of CAMEL represent the healthiness of a bank, which directly affect lending strategy (Boubakri et al., 2017). First, we include a proxy for capital adequacy that is the ratio of equity to total assets (E/TA). Well-capitalized banks face lower costs of funding and lower risk of bankruptcy, and have more ability to develop business and invest in risky assets such as loans. Second, we include non-performing loans to total loans ratio (NPL/TL) as a proxy for the quality of bank asset portfolio. It is expected that banks with low loan quality lend less. Third, we include a proxy for bank management quality, expressed by the logarithm of overheads to total assets ratio (OVE/TA). It is believed that efficient banks have more resources to extend credit. Fourth, we use a proxy for earnings that is net interest margin (*NIM*), as more profitable banks may lend more. Fifth, we capture the degree of bank liquidity by including liquid assets to total assets ratio (LA/TA), as one may expect that liquid banks have a lower potential to growth. And finally sixth, a part of those five CAMEL variables, we also include a proxy for bank revenue diversification (*DIV*), as it is argued that diversified banks generate more profit and hence, are more resilient to financial instability and thus more willing to allocate funds (Elsas et al., 2010). The above six variables insulate the effect of macroprudential policy on bank credit growth from business model differences, liquidity and capital regulations, and other bank-specific effects.

Furthermore, X is a vector of country-level variables that may affect bank credit growth, capturing mostly the demand side for bank loans. Specifically, we include four variables: (i) a proxy for the degree of bank competition (*CONC*), measured by the share of the three largest banks, as one may expect that more competitive market reduces lending rates and hence more demand for loans, (ii) a proxy for real interest rate (*INT*) to capture the impact of monetary policy, as the lack of coordination of macroprudential policy with monetary policy may dampen the effectiveness of the former (Galati & Moessner, 2018), (iii) a proxy for the economic activity that is GDP growth (*GDPG*), and (iv) an indicator for macroeconomic stability that is inflation (*INF*). The above four variables insulate the effect of macroprudential policy on bank credit growth from the degree of market competition and demand for credit. Appendix Table A1 reports detailed definition and sources of all variables used in this study.

We use bank fixed effects (φ_i) to control for time-invariant bank-level fixed effects. Nonetheless, one may point to the reverse causality and omitted variables bias of our empirical strategy. Regarding the former, it is unlikely to be a major concern for our model. We believe that it is implausible that policy makers activate any macroprudential measures owing to loan growth in a particular bank and hence, reverse causality should not be a serious concern for this research. Nevertheless, since the so-called "too big to fail" and large banks may be influential in regulating the banking sector, as a robust test we exclude these banks from the sample. In addition, to mitigate endogeneity problems among controls, we lag all $CAMEL^{+}$ and X control variables by one year. Regarding the latter, we include additional control variables such as bank risk, exchange rate regime and financial freedom to reduce concerns related to the omitted variables bias.

3.2. Data

To check the effectiveness of macroprudential policies at the bank level and the role of bank regulation/supervision, we need to pool information for a large number of banks operating in different countries with different bank regulations and with different levels

[3] CAMEL rating is a supervisory rating system to classify a bank's overall condition. The components of a bank's condition assessed are as follows: (C) capital adequacy; (A) assets quality (M) management capability; (E) earnings; and (L) liquidity.

of experience in the utilization of macroprudential tools. This section describes the data we employ to examine the effectiveness macroprudential policies in curbing bank credit growth when considering the role of bank regulation/supervision. We merge data from several sources as follows:

3.2.1. Macroprudential variables

As for macroprudential data, we depend on a comprehensive IMF survey, namely Global Macroprudential Policy Instruments, carried out by the IMF's Monetary and Capital Department during 2013–2014. Cerutti et al. (2017) organized and documented these data in a cross-country database, covering the period from 2000 to 2013. The dataset is very detailed and covers 12 instruments: (1) loan to value ratio (*LTV*), which constrains highly levered mortgage down payments, (2) debt to income ratio (*DTI*), which constrains household indebtedness, (3) limits on foreign currency loans (*FC*), which reduces vulnerability to foreign-currency risks; (4) limits on domestic currency loans (*CG*), which limits credit growth directly; (5) reserve requirement ratio (*RR*), which is the minimum amount of reserves that must be held by a bank; (6) limits on interbank exposures (*INTER*), which limits the fraction of liabilities held by the banking sector or by individual banks; (7) general countercyclical capital buffer/requirement (*CTC*), which requires banks to hold more capital during upturns; (8) time-varying/dynamic loan loss provisioning (*DP*), which requires banks to hold more loan-loss provisions during upturns; (9) leverage ratio for banks (*LEV*), which limits banks from exceeding a fixed minimum leverage ratio; (10) capital surcharges on systematically important financial institutions (*SIFI*), to hold a higher capital level than other financial institutions; (11) concentration limits (*CONC*), which limit the fraction of assets held by a limited number of borrowers, and (12) tax on financial institutions (*TAX*), which reduce revenues of financial institutions.

For each of these twelve policy measures, Cerutti et al. (2017) create a yearly binary variable assigned a value of one if the measure was introduced or was in place, and zero otherwise. Note that the value of dummy variable does not capture the intensity or change in intensity of the instrument per se. Rather it suggests whether or not a specific macroprudential instrument is in place.

Following Cerutti et al. (2017), we aggregate these measures to create an overall index, which takes a value between 0 when none of those instruments adopted and 12 when all measures are in place. In addition, we also divide measures based on the following two categories: (1) *Borrower-targeted*: which is the sum of the scores on the two instruments *LTV* and *DTI*, aimed at borrowers' leverage and financial positions; (2) *Financial institution-targeted*: which is the sum of the scores on the other ten instruments, aimed at improving liquidity position of banks. Based on such classifications, for a given country, the value of *Borrower-targeted* variable is between 0 and 2 (0 if none instruments of *LTV* and *DTI* were imposed and 2 if these two instruments were simultaneously activated). Similarly, the value of *Financial institution-targeted* variable is between 0 and 10. Note that we combine macroprudential measures in such way because of potential interactions within each category. For instance, as Claessens et al. (2013) point, *LTV* and *DTI* could be substitute in the sense that both can dampen borrowers' debt obligations. They can also complement each other if one does not sufficiently limit credit that can be extended by banks.

We initially selected all 119 countries reported in Cerutti et al. (2017). However, we eliminate 27 countries for which we do not have data for bank supervision and private monitoring. We also exclude the US as its number of banks dominates the sample, leaving us with 91 countries.

3.2.2. Bank-level variables

We collect bank-level panel data for those 91 economies, retrieved from Bankscope, for the years 2001–2013. We restrict our analysis to banks with similar products, clientele and objectives, by considering commercial (both conventional and Islamic) banks. We use data from consolidated accounts if available, and otherwise from unconsolidated accounts to avoid double-counting. The total number of banks is 4109. We winsorize our main variables at the 1st and 99th percentiles of their respective distributions. Table A2 in the Appendix reports the number of banks in the sample by country.

3.2.3. Bank regulation variables

We collect from the World Bank surveys on bank regulation (Barth et al., 2013)[4] the data for bank *supervisory power* and *private monitoring*. We follow Barth et al. (2004) and form two variables to assess the rigidity of bank regulation: (1) bank supervisory power and (2) bank private monitoring. These variables are based on the World Bank's Bank Regulation and Supervision Survey conducted in 2001, 2003, 2007, and 2011.

Supervisory Power consists of the following questions addressing whether the supervisors have the authority to take specific actions to prevent and correct problems: "1. Can supervisors meet external auditors to discuss report without bank approval? 2. Are auditors legally required to report misconduct by managers/directors to supervisory agency? 3. Can supervisors force banks to change internal organizational structure? 4. Are off-balance sheet items disclosed to supervisors? 5. Can the supervisory agency order directors/management to constitute provisions to cover actual/potential losses? 6. Can the supervisory agency suspend director's decision to distribute: dividends, bonuses, and management fees? 7. Can the supervisory agency supersede bank shareholder rights and declare bank insolvent? 8. Does banking law allow supervisory agency to suspend some or all ownership rights of a problem bank? 9. Regarding bank restructuring & reorganization, can supervisory agency or any other govt. agency do the following: supersede

[4] Note that the Surveys were conducted in 1999, 2003, 2007, and 2011 for 180 countries. Since the impact of the nation-level regulations is perceived slowly over time and also following Mirzaei and Moore (2014) and Anginer, Demirgüç-Kunt, and Zhu (2014), we specify the previously available survey data until a new survey becomes available. Specifically, the survey data of 1999 are used for 2001–2002, the survey data of 2003 for 2003–2006, the survey data of 2007 for 2007–2010, the survey data of 2011 for 2011–2013.

shareholder rights, remove and replace management, remove and replace directors?"

Private Monitoring is designed to measure the degree to which bank supervision forces banks to disclose accurate information to the public and induces private sector monitoring of banks. It measures whether there are incentives/ability for the private monitoring of firms, and is constructed based on the following questions: "1. Is subordinated debt allowable (required) as part of capital? 2. Are off-balance sheet items disclosed to public? and 3. Are there any mechanisms of cease-desist type orders whose infraction leads to automatic imposition of civil & penal sanctions on banks directors and managers?"

Finally, the data on macroeconomic variables are obtained from standard sources such as the Global Financial Development Database (World Bank).

Before proceeding, we present some stylized facts about bank credit growth and the usage of macroprudential policy over time and across countries. Fig. 1 depicts the movement of bank credit growth and assets growth over the period 2001–2013. We notice a significant increase in bank lending and assets up to the 2007 financial crisis. Bank credit decreased dramatically during the crisis period 2008–2009, but started to recover the onset the crisis although far to reach their pre-crisis levels.

Fig. 2 displays the activation of macroprudential instruments over the period 2001–2013 for our sample of 91 countries. Countries usually increased their utilization of measures over time, starting with an average total index of about 1.0 in 2001 and reaching at nearly 2.6 in 2013. This increase comes mostly from the significant employment of financial institution-targeted measures, which raised from 1.0 in 2001 to about 2.3 in 2013. The usage of borrower-targeted measures also increased but slightly over the same period.

Table 1 displays summary statistics of all the variables used in this study. The number of bank-level observations varies because of data availability. We notice that average bank credit growth over the period 2001–2013 is 26% with a standard deviation of 63%. Countries adopted on average 1.6 instruments over this period with an average 0.2 and 1.4 for borrower-targeted and financial institution-targeted instruments, respectively.

Overall, we observe (i) bank credit grew significantly over the period 200–2007 and countries responded to this by adopting macroprudential measures and (ii) the nature of macroprudential measures is different across countries. In the next section, we examine whether these macroprudential tools statistically and significantly affect bank credit growth and if this effect is conditional on the countries' levels of banking supervision and the quality of institutions.

4. Results

4.1. Baseline results

The baseline results, obtained by running Eq. (1), are reported in Table 2. We use either total macroprudential index or sub-components as a proxy for macroprudential policy (*MaP*), and bank supervisory power or bank private monitoring as a proxy the stringency of national bank regulation (*R*). The variable of interest is the interaction term $MaP \times R$. The coefficient on $MaP \times R$ in columns (1) and (4) is negative and statistically highly significant, indicating that adoption of macroprudential policies in countries with stringent bank supervisory power and more bank private monitoring reduces individual banks loan growth. In Columns (2) to (3) and (5) to (6), we divide macroprudential policies into two separate indices. One for macroprudential tools aimed at dampening demand for credit (Borrower-targeted) and another one for macroprudential tools whose main objective is to reduce supply of credit (Financial institution-targeted). We again find that macroprudential policies curb bank credit growth in countries with tougher bank regulation, regardless considering all macroprudential tools or the ones related to financial institution-targeted and borrower-targeted separately.

These results show that the outcome of activating macroprudential measures are much more favourable in countries with effective bank regulation and supervision. In other words, the results suggest that powerful bank supervision body increases efficiency of macroprudential policies in enhancing financial stability, by possibly fostering the implementation of prudential tools and legitimizing macroprudential actions. For instance, tougher regulations could allow prudential authorities to obtain information from other policy

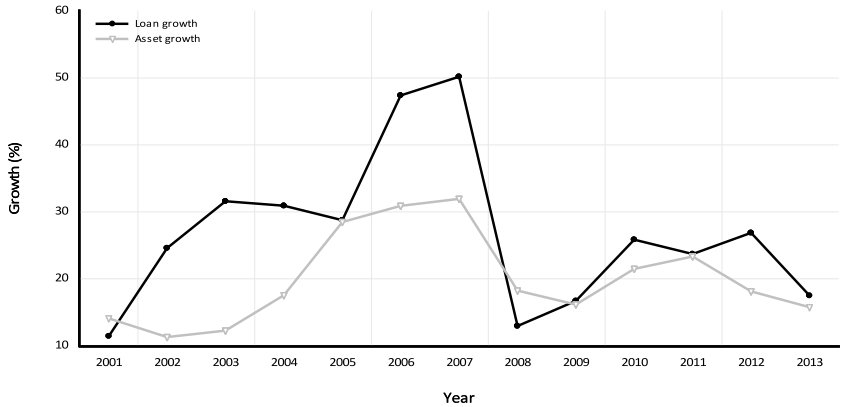

Fig. 1. Average bank credit and asset growth in 91 countries over 2001–13.

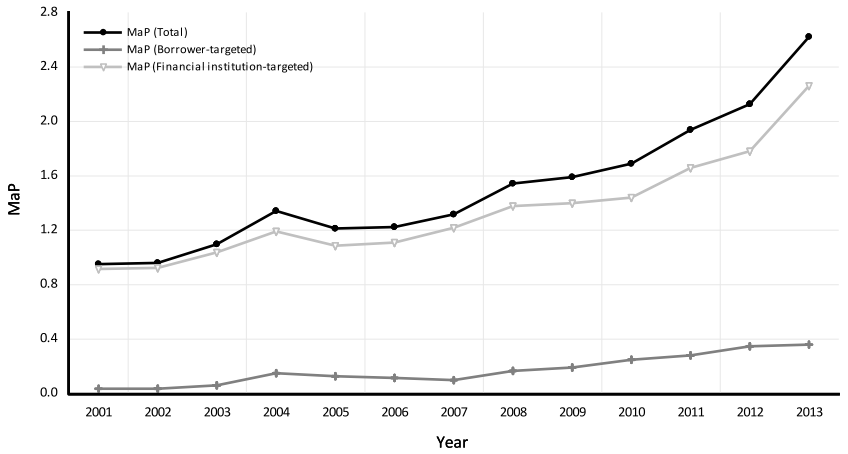

Fig. 2. Average use of macroprudential policies in 91 countries over 2001–13.

Table 1
Summary statistics of main variables.

Variable	N	Mean	S.D.	Min.	0.25	Mdn.	0.75	Max.
Loan growth	22821	0.26	0.63	−0.65	−0.01	0.13	0.35	4.28
Macroprudential measures								
MaP (total)	22821	1.61	1.53	0	1	1	2	8
Borrower-targeted	22821	0.19	0.52	0	0	0	0	2
Financial institution-targeted	22821	1.42	1.21	0	1	1	2	6
Supervisions and institutions								
Supervisory power	19713	10.33	2.67	4	8	10	13	16
Private monitoring	22821	7.79	1.4	4	7	8	9	11
Bank controls (Control 1)								
Size (log)	22821	13.36	2.45	8.65	11.52	13.13	15.13	19.29
E/TA [%]	22821	16.14	14.44	0.96	7.45	11.5	19.03	88.81
NPL/TL [%]	16967	5.57	8.51	0	1.06	2.95	6.47	64.29
OVE/TA [log]	22821	−3.14	1.17	−6.5	−4	−3.28	−2.4	−0.31
NIM [%]	22821	5.1	4.17	−0.89	2.14	4.06	6.84	25.5
LA/TA	22821	0.28	0.21	0.01	0.12	0.23	0.39	0.98
DIV	22821	0.49	0.33	−1.24	0.29	0.52	0.74	0.98
Macro controls (Control 2)								
CONC	22821	0.46	0.21	0.1	0.33	0.4	0.62	1
INT [%]	22821	4.19	9.55	−38.77	−1.34	3.08	5.73	54.68
GDPG [%]	22821	3.35	3.99	−14.81	1.44	3.64	5.64	34.5
INF [%]	22821	5.68	4.91	−18.11	2.11	5.07	8.44	59.22

makers and consequently influence the types of instruments to be used and their calibrations. Indeed, efficient supervision enables banking prudential authorities to act in a promptly and stringent manner that would help macroprudential policies to be more effective. Moreover, more private monitoring can reduce market power and improve market discipline among banks, and therefore, facilitates the compliance of banks to macroprudential policies.

Our results are in line with the literature highlighting the quality of the supervisory function as an important determinant of bank risk (e.g., Barth et al., 2004; Lee & Hsieh, 2014; Shehzad & De Haan, 2015; Avignone et al., 2021). The results specifically support the recent study by Mirzaei and Moore (2021) who report evidence of the mitigating role of supervisory power for the adverse impact of macroprudential policies on banking market competition. Finally, our findings support studies by Ezer (2019) and Gaganis et al. (2020) who point to the use of micro-level data rather than aggregate country-level data in investigating the efficacy of macroprudential measures.

The analysis of the bank-level and country-level control variables also provide several interesting insights. (i) Banks with better capital positions tend to lend more, consistent with the view that high capital levels would increase bank risk-taking behaviour (Allen & Gale, 2004). (ii) As expected, cost-inefficient banks with a high level of overheads to total asset tend to lend less. (iii) Safer banks in terms of liquidity tend to lend more in the future. Finally (iv), we find that banks in countries with prospect economic conditions lend more. We find no evidence on the impact of other controls on bank credit growth.

We next do a number of tests to check the robustness of our baseline results to (i) subsamples and (ii) more control variables. Table 3 reports the results: Columns (1) to (5) show results when supervisory power is a proxy for stringent bank regulation, and Columns (6) to (10) when private monitoring is a proxy. We first define a bank as too-big-to-fail if it has total assets greater than $100 billion. Our

Table 2
Macroprudential policy, bank supervision and private monitoring and credit growth. Baseline results.
This table reports the results estimating

$$\Delta Loan_{i,c,t} = \beta_0 + \beta_1 .MaP_{c,t} + \beta_2 .R_{c,t} + \boldsymbol{\beta_3 .MaP_{c,t} \times R_{c,t}} + \beta_4 .Size_{i,c,t} + \beta_{i=5,\ldots 10} .CAMEL^{+}_{i,c,t-1} + \beta_{i=11,\ldots 14} .X_{c,t-1} + \varphi_i + \varepsilon_{i,c,t}$$

where the dependent variable is growth of credit in bank*i*, country *c* and in year *t*. MaP_{ct} is a proxy for total macroprudential policies used in a country in a specific year. $R_{c,t}$ is a proxy for the stringency of bank regulation. $CAMEL^{+}$ is a vector of six bank-level control variables. *X* is a vector of country-level control variables. See Table A1 for detail definition of variables. We estimate all regressions using fixed effects estimator. Robust T-values are in parentheses. *, **, *** denote significance level at the 10%, 5%, and 1%, respectively. Sample size varies across regression specifications because not all variables are available for all banks, all countries or all years.

	Supervisory power			Private monitoring		
	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)
	[1]	[2]	[3]	[4]	[5]	[6]
MaP	0.011	0.083	0.031	0.044	0.022	0.037
	(0.400)	(1.053)	(0.949)	(1.314)	(0.240)	(0.961)
R (regulation)	0.049***	0.040***	0.050***	0.071***	0.057***	0.066***
	(8.440)	(9.711)	(8.124)	(6.791)	(7.217)	(6.398)
MaP* × *R	−0.007***	−0.024***	−0.008***	−0.014***	−0.019**	−0.012**
	(-3.231)	(-3.794)	(-3.105)	(-3.327)	(-2.015)	(-2.547)
Size	0.217***	0.206***	0.213***	0.193***	0.180***	0.190***
	(8.522)	(8.324)	(8.388)	(8.036)	(7.711)	(7.927)
Controls 1 (lag):						
C: Capital Adequacy (E/TA)	0.022***	0.022***	0.021***	0.021***	0.021***	0.021***
	(9.203)	(9.191)	(9.184)	(9.246)	(9.219)	(9.228)
A: Asset Quality (NPL/TL)	0.001	0.001	0.001	0.000	−0.000	0.000
	(0.481)	(0.428)	(0.392)	(0.147)	(-0.039)	(0.081)
M: Management (OVE/TA)	−0.035**	−0.036**	−0.034**	−0.045***	−0.045***	−0.045***
	(-2.125)	(-2.193)	(-2.095)	(-2.875)	(-2.902)	(-2.852)
E: Earnings (NIM)	0.002	0.001	0.002	0.003	0.002	0.003
	(0.294)	(0.228)	(0.280)	(0.514)	(0.406)	(0.499)
L: Liquidity (LA/TA)	1.475***	1.455***	1.477***	1.372***	1.355***	1.377***
	(13.130)	(12.942)	(13.124)	(13.060)	(12.902)	(13.092)
DIV	0.008	0.004	0.007	0.035	0.033	0.035
	(0.218)	(0.106)	(0.215)	(1.171)	(1.128)	(1.174)
Controls 2 (lag):						
CONC	−0.019	0.101	0.021	0.279***	0.477***	0.310***
	(-0.180)	(0.971)	(0.201)	(2.839)	(4.771)	(3.151)
INT	−0.000	0.001	−0.000	0.002	0.002*	0.002
	(-0.004)	(0.628)	(-0.043)	(1.562)	(1.827)	(1.415)
GDPG	0.004**	0.005***	0.004**	0.005***	0.005***	0.005***
	(2.193)	(2.728)	(2.202)	(2.736)	(2.955)	(2.731)
INF	0.005**	0.005**	0.005***	0.010***	0.009***	0.010***
	(2.486)	(2.498)	(2.589)	(5.218)	(5.087)	(5.244)
Constant	−3.937***	−3.826***	−3.931***	−3.917***	−3.779***	−3.867***
	(-9.757)	(-9.539)	(-9.712)	(-9.923)	(-9.667)	(-9.770)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,827	11,827	11,827	13,912	13,912	13,912
R2	0.144	0.143	0.143	0.135	0.133	0.133

baseline results remain intact in Columns (1) and (6) if excluding these banks. Columns (2) and (7) report the results when we exclude large banks (those with assets greater than $ 50 billion, following Berger and Bouwman (2013)), and find similar results. Note that the reason why we drop too-big-to-fail and large banks is that these banks may not change their lending policies, as compared to smaller banks, in response to the activated macroprudential measures, if they expect to have access to public assistance in case of distress. This also addresses potential endogeneity issues further, as one may argue that prudential regulators activate a specific tool based on the growth of systematically important banks. In Columns (3) and (8), we exclude advanced economies where the use of macroprudential tools is less frequent, and find that our main results still hold. In Columns (4) and (9), we exclude Islamic banks and our results remain unchanged when considering only conventional banks.

Next, we add to the equation several other potential control variables to further address potential omitted variable bias. We consider two new bank-level variables: Core deposit ratio (*CORE*), as measured by the ratio of long-term funds to total liabilities; and bank risk, using the Z-score (e.g., Boubakri et al., 2017) that is computed as $ZSCOR = \frac{ROA+ETA}{sigROA}$ where *ROA* is the return on assets, *ETA* indicates the equity to asset ratio and *SigROA* is the standard deviation of *ROA*. We also add three new country-level variables to control for any remaining factors that may affect bank lending activity. We include a proxy for direct lending that is the size of capital market (*CAPIT*). We use market capitalization of listed companies. Also, we control for two other macroeconomic policies (other than monetary policy) that may affect the effectiveness of macroprudential policies on bank lending. Specifically, we include a proxy for exchange rate regime (*EXCHAG*), as measured by official exchange rate (from the World Bank), and a proxy for financial freedom

Table 3
Sensitivity tests.

	Supervisory power					Private monitoring				
	Excluding "too big to fail" banks	Excluding large banks	Excluding advanced economies	Excluding Islamic banks	Including other controls	Excluding "too big to fail" banks	Excluding large banks	Excluding advanced economies	Excluding Islamic banks	Including other controls
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
MaP (total)	0.010	0.021	−0.082**	0.013	0.011	0.034	0.039	0.032	0.043	0.067*
	(0.334)	(0.684)	(-2.219)	(0.457)	(0.326)	(0.982)	(1.126)	(0.800)	(1.271)	(1.704)
R (regulation)	0.049***	0.052***	0.067***	0.050***	0.063***	0.071***	0.073***	0.084***	0.071***	0.091***
	(8.315)	(8.329)	(9.603)	(8.555)	(9.111)	(6.663)	(6.712)	(7.239)	(6.770)	(7.693)
MaP* × *R	−0.007***	−0.008***	−0.007***	−0.007***	−0.010***	−0.013***	−0.014***	−0.018***	−0.013***	−0.018***
	(-3.211)	(-3.401)	(-2.886)	(-3.269)	(-3.931)	(-3.097)	(-3.162)	(-3.727)	(-3.276)	(-3.834)
Size	0.222***	0.228***	0.242***	0.220***	0.296***	0.199***	0.205***	0.202***	0.195***	0.246***
	(8.649)	(8.783)	(8.724)	(8.587)	(10.292)	(8.192)	(8.310)	(7.779)	(8.071)	(8.927)
Controls 1 (lag):	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Controls 2 (lag):	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Other controls (lag)	×	×	×	×		×	×	×	×	
CORE					−0.187**					−0.294***
					(-2.062)					(-3.327)
ZSCOR					−0.033***					−0.036***
					(-4.084)					(-5.430)
CAPIT					−0.001***					−0.000
					(-4.017)					(-0.224)
EXCHAG					0.000***					0.000***
					(2.843)					(4.032)
FREE					−0.020***					−0.010***
					(-12.608)					(-9.686)
Constant	−3.993***	−4.080***	−4.285***	−3.986***	−3.731***	−3.972***	−4.044***	−4.000***	−3.951***	−4.102***
	(-9.869)	(-9.989)	(-9.989)	(-9.832)	(-8.933)	(-10.056)	(-10.162)	(-9.705)	(-9.948)	(-9.737)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,593	11,402	9595	11,703	9836	13,492	13,111	10,410	13,782	11,509
R2	0.146	0.148	0.158	0.145	0.184	0.138	0.140	0.147	0.135	0.163

(*FREE*), captured by the Heritage Foundation's measure of financial freedom. The results, including these new five control variables, are reported in Columns (5) and (10), which are quantitatively similar to our baseline findings.

Overall, we find robust results that showing that stringent bank supervisory power and more private monitoring strengthen the effectiveness of macroprudential policies in curbing credit growth.

4.2. Additional analysis

So far, we have established a robust negative association between macroprudential policies and loan growth in countries with stricter bank regulation/supervision. We next conduct a number of additional tests to deepen our understanding of how tougher supervisory power and more private monitoring influence the efficacy of macroprudential policies, conditional of bank characteristics. Previous studies highlight the effect of bank balance sheet conditions on the efficacy of macroprudential policies in enhancing financial stability. Morgan et al. (2019) find that macroprudential policies reduce mortgage loans but the efficacy weakens in the case of large banks. Dobson (2020) also finds that a bank's size can influence its response to activation of macroprudential tools. Gómez et al. (2020) highlight the role of bank size and leverage on effectiveness of macroprudential policies. Finally, Cantú et al. (2020) document the role of bank liquidity for the effect of macroprudential policies on credit growth.

Thus, in this section, we aim to provide evidence on whether the effectiveness of macroprudential policies in countries where their banking systems are supervised/monitored better, are also affected by some important bank characteristics (that are size, capitalization and liquidity) as well as some country features (that are financial structure and financial development). We do so by modifying Eq. (1) as follows:

$$\begin{aligned}\Delta Loan_{i,c,t} = {} & \beta_0 + \beta_1.MaP_{c,t} + \beta_2.R_{c,t} + \beta_3.MaP_{c,t} \times R_{c,t} + \varnothing_1.\boldsymbol{MaP_{c,t}} \times \boldsymbol{R_{c,t}} \times \boldsymbol{Z_{i,c,t}} + \varnothing_2.MaP_{c,t} \times Z_{i,c,t} + \varnothing_3.R_{c,t} \times Z_{i,c,t} + \varnothing_4.Z_{i,c,t} \\ & + \beta_4.Size_{i,c,t} + \beta_{i=5,\ldots10}.CAMEL^{+}_{i,c,t-1} + \beta_{i=11,\ldots14}.X_{c,t-1} + \varphi_i + \varepsilon_{i,c,t} \end{aligned} \quad (2)$$

Above, $Z_{i,c,t}$ is a proxy for bank variables of size, capital, or liquidity, or country factors of financial structure or financial development. All other variables are analogous to those in Eq. (1). Our interest variable is now the triple interaction $\boldsymbol{MaP_{c,t}} \times \boldsymbol{R_{c,t}} \times \boldsymbol{Z_{i,c,t}}$. The coefficient of $\varnothing_1$ can help us exploring the mechanisms and what drives our baseline results further. For example, would small, less-capitalized, and less-liquid banks in a country with stricter bank regulations reduce their loan more if macroprudential policy is activated in that country?[5]

Table 4, Panel A reports the results where the variable of interest is bank size. We find that when the proxy for tougher bank regulation is supervisory power, small banks reduce their lending relatively more, following the activation of macroprudential measures. This is revealed by positive and statistically significant coefficient on $\boldsymbol{MaP_{c,t}} \times \boldsymbol{R_{c,t}} \times \boldsymbol{Z_{i,c,t}}$ in Columns (1) and (3). On the other hand, we find some evidence that, in countries with more private monitoring, larger banks allocate less credit when conducting the macroprudential policy (Column 5). This suggests that incentives that encourage the private sector monitor the performance of banks help more in dampening of credit growth of large banks in response to adopting macroprudential tools.

We repeat the regressions in Table 4, Panel A but now with bank capital ratio as the variable of interest. Table 4, Panels B1, B2 and B3 report the results when capital is measured by equity-to-asset ratio, Tier 1 ratio, or total regulatory ratio, respectively. We find that risky banks, as measured by low capital, reduce their loan more than their well-capitalized counterparts, if the activation of macroprudential policies is backed by stronger supervisory power and more private monitoring.

We next check the sensitivity of our findings when the variable of interest is bank liquidity ratio. Table 4, Panel C reports the results. We find that low-liquid banks respond disproportionately more to the activated macroprudential measures when these banks are located in countries with stricter bank regulations/supervisions.

The results of Table 4, Panel B1, B2, B3 and C reveal that the effectiveness of macroprudential policies in curbing credit growth in countries with greater bank supervisory powers and more private monitoring is more pronounced for small, less-capitalized, and less-liquid banks. These results add to Klomp and De Haan (2012) findings who show that bank regulations affect the risk-taking behaviour of risky banks, as compared to stable banks.

Finally, we check whether the structure and development of financial sector in an economy affect the efficacy of macroprudential policies when accompanied by stringent regulation. Table 4, Panels D and E present these results. In Panel D, the interest variable is a proxy for financial structure that is measured as the ratio of domestic credit to GDP to market capitalization of listed companies to GDP. The higher the ratio the more bank-based the economy is. In Panel E, the variable of interest is a proxy for financial development, computed as the sum of domestic credit to private sector and market capitalization of listed companies as percentage of GDP. Higher ratio indicates more financially-developed economy. In terms of financial structure, the results are mixed. While we find that stringent bank supervisory power in bank-based economies strengthen the efficacy of macroprudential policy, the reverse results observed when considering private monitoring as a proxy for rigid bank regulation. This may support the argument by Deli and Hasan (2017) who point to the limited alternative sources of finance in bank-based economies, which imply high demand for bank credit. With regard to financial deepening, the empirical results serve to provide the heterogeneous effects of the stringent bank regulation on the relationship between macroprudential policy and bank credit growth. In particular, we find that tougher bank supervisory power and more private monitoring in financially developed countries improve the efficacy of macroprudential policies.

Overall, our bank level evidence indicates that macroprudential policies are effective in addressing financial stability through

[5] We thank an anonymous referee for raising this point.

Table 4
Macroprudential policy, bank supervision and private monitoring and credit growth. Baseline results.
This table reports the results estimating

$$\Delta Loan_{i,c,t} = \beta_0 + \beta_1.MaP_{c,t} + \beta_2.R_{c,t} + \beta_3.MaP_{c,t} \times R_{c,t} + \varnothing_1.\boldsymbol{MaP_{c,t} \times R_{c,t} \times Z_{i,c,t}} + \varnothing_2.MaP_{c,t} \times Z_{i,c,t} + \varnothing_3.R_{c,t} \times Z_{i,c,t} + \varnothing_4.Z_{i,c,t} + \beta_4.Size_{i,c,t} + \beta_{i=5,\ldots10}.CAMEL^{+}_{i,c,t-1} + \beta_{i=11,\ldots14}.X_{c,t-1} + \varphi_i + \varepsilon_{i,c,t}$$

where the dependent variable is growth of credit in bank*i*, country *c* and in year *t*. MaP_{ct} is a proxy for total macroprudential policies used in a country in a specific year. $R_{c,t}$ is a proxy for the stringency of bank regulation. $Z_{i,c,t}$ is a proxy for the bank size, capital, liquidity, financial structure, or financial development. $CAMEL^{+}$ is a vector of six bank-level control variables. *X* is a vector of country-level control variables. See Table A1 for detail definition of variables. We estimate all regressions using fixed effects estimator. Robust T-values are in parentheses. *, **, *** denote significance level at the 10%, 5%, and 1%, respectively. Sample size varies across regression specifications because not all variables are available for all banks, all countries or all years.

Panel A: Z is a proxy for bank size

	Supervisory power			Private monitoring		
	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)
	[1]	[2]	[3]	[4]	[5]	[6]
MaP	0.967***	1.309*	1.170***	0.327	1.779**	0.266
	(4.091)	(1.863)	(4.692)	(1.472)	(2.467)	(0.987)
R (regulation)	0.265***	0.200***	0.279***	0.351***	0.333***	0.342***
	(6.376)	(6.894)	(6.529)	(5.885)	(7.110)	(5.690)
MaP × R	−0.059***	−0.098*	−0.073***	−0.023	−0.021***	−0.011
	(-3.444)	(-1.787)	(-3.980)	(-0.869)	(-6.265)	(-0.327)
MaP × R × Size	0.004***	0.006	0.005***	0.001	−0.170**	0.001
	(3.369)	(1.610)	(3.839)	(0.739)	(-2.369)	(0.289)
MaP × Size	−0.068***	−0.090**	−0.081***	−0.024*	0.012***	−0.022
	(-4.354)	(-1.974)	(-4.831)	(-1.679)	(2.601)	(-1.206)
R × Size	−0.016***	−0.012***	−0.017***	−0.022***	−0.130***	−0.022***
	(-5.428)	(-5.704)	(-5.575)	(-5.280)	(-2.894)	(-5.241)
Size	0.430***	0.342***	0.439***	0.392***	0.354***	0.389***
	(8.401)	(8.626)	(8.444)	(8.377)	(8.831)	(8.274)
Controls 1 (lag):						
C: Capital Adequacy (E/TA)	0.022***	0.022***	0.022***	0.022***	0.021***	0.021***
	(9.518)	(9.437)	(9.503)	(9.427)	(9.372)	(9.413)
A: Asset Quality (NPL/TL)	0.001	0.001	0.001	−0.000	−0.000	−0.000
	(0.452)	(0.404)	(0.345)	(-0.105)	(-0.262)	(-0.177)
M: Management (OVE/TA)	−0.025	−0.023	−0.025	−0.044***	−0.043***	−0.043***
	(-1.561)	(-1.425)	(-1.509)	(-2.815)	(-2.762)	(-2.785)
E: Earnings (NIM)	0.000	−0.000	0.000	0.003	0.002	0.003
	(0.037)	(-0.070)	(0.008)	(0.489)	(0.362)	(0.473)
L: Liquidity (LA/TA)	1.480***	1.462***	1.484***	1.388***	1.371***	1.394***
	(13.271)	(13.088)	(13.273)	(13.241)	(13.058)	(13.276)
DIV	0.007	0.008	0.007	0.037	0.036	0.037
	(0.195)	(0.236)	(0.190)	(1.254)	(1.211)	(1.245)
Controls 2 (lag):						
CONC	0.065	0.165	0.101	0.183*	0.352***	0.208**
	(0.623)	(1.589)	(0.955)	(1.898)	(3.652)	(2.165)
INT	0.000	0.001	0.000	0.003**	0.003**	0.003*
	(0.363)	(0.973)	(0.297)	(2.049)	(2.386)	(1.926)
GDPG	0.006***	0.007***	0.006***	0.005***	0.006***	0.005***
	(3.044)	(3.535)	(3.031)	(3.051)	(3.380)	(3.008)
INF	0.004**	0.004**	0.005**	0.011***	0.011***	0.012***
	(2.429)	(2.158)	(2.507)	(6.086)	(6.027)	(6.114)
Constant	−6.852***	−5.640***	−7.024***	−6.391***	−5.955***	−6.334***
	(-9.200)	(-9.619)	(-9.292)	(-9.480)	(-10.188)	(-9.285)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,827	11,827	11,827	13,912	13,912	13,912
R2	0.151	0.148	0.150	0.141	0.139	0.141

Panel B1: Z is a proxy for bank capital (equity to total assets ratio)

	Supervisory power			Private monitoring		
	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)
	[1]	[2]	[3]	[4]	[5]	[6]
MaP	0.274***	0.348**	0.291***	0.276***	0.357***	0.307***
	(5.427)	(2.443)	(5.501)	(5.424)	(3.036)	(4.983)
R (regulation)	0.066***	0.065***	0.064***	0.096***	0.095***	0.092***

(*continued on next page*)

Table 4 (*continued*)

Panel B1: Z is a proxy for bank capital (equity to total assets ratio)

	Supervisory power			Private monitoring		
	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)
	[1]	[2]	[3]	[4]	[5]	[6]
	(11.548)	(13.416)	(10.910)	(9.447)	(11.101)	(9.023)
MaP × *R*	−0.027***	−0.046***	−0.028***	−0.041***	−0.003***	−0.045***
	(-6.674)	(-3.654)	(-6.607)	(-6.491)	(-9.267)	(-5.843)
MaP* × *R* × *Capital	0.002***	0.002**	0.002***	0.002***	−0.056***	0.003***
	(6.142)	(2.071)	(6.059)	(5.985)	(-4.238)	(5.753)
MaP × *Capital*	−0.020***	−0.018*	−0.022***	−0.019***	0.003**	−0.022***
	(-6.003)	(-1.781)	(-5.942)	(-5.704)	(2.527)	(-5.519)
R × *Capital*	−0.002***	−0.002***	−0.002***	−0.003***	−0.022**	−0.003***
	(-7.227)	(-8.935)	(-7.018)	(-8.310)	(-2.200)	(-8.395)
Size	0.121***	0.121***	0.118***	0.104***	0.093***	0.101***
	(5.340)	(5.324)	(5.234)	(4.820)	(4.412)	(4.736)
Controls 1 (lag):						
C: Capital Adequacy (E/TA)	0.029***	0.028***	0.029***	0.028***	0.029***	0.028***
	(11.044)	(10.720)	(11.056)	(10.970)	(10.899)	(10.976)
A: Asset Quality (NPL/TL)	0.001	0.001	0.001	0.000	0.000	0.000
	(0.531)	(0.476)	(0.465)	(0.243)	(0.181)	(0.190)
M: Management (OVE/TA)	−0.027*	−0.038**	−0.026*	−0.036**	−0.037**	−0.036**
	(-1.778)	(-2.410)	(-1.710)	(-2.453)	(-2.517)	(-2.443)
E: Earnings (NIM)	−0.001	0.001	−0.001	0.000	0.001	0.000
	(-0.187)	(0.213)	(-0.233)	(0.092)	(0.108)	(0.048)
L: Liquidity (LA/TA)	1.486***	1.468***	1.490***	1.399***	1.388***	1.404***
	(14.268)	(13.843)	(14.281)	(14.247)	(13.971)	(14.296)
DIV	0.006	−0.005	0.007	0.026	0.022	0.025
	(0.187)	(-0.163)	(0.221)	(0.925)	(0.762)	(0.880)
Controls 2 (lag):						
CONC	−0.008	−0.005	0.014	0.187**	0.369***	0.204**
	(-0.084)	(-0.046)	(0.135)	(1.974)	(3.785)	(2.161)
INT	−0.002	−0.001	−0.002	−0.001	−0.001	−0.001
	(-1.532)	(-0.819)	(-1.564)	(-0.459)	(-0.429)	(-0.608)
GDPG	0.003	0.003*	0.003	0.003	0.003*	0.003
	(1.437)	(1.710)	(1.489)	(1.601)	(1.787)	(1.611)
INF	0.004**	0.005**	0.004**	0.008***	0.007***	0.008***
	(2.110)	(2.547)	(2.211)	(4.472)	(3.888)	(4.565)
Constant	−2.623***	−2.647***	−2.590***	−2.588***	−2.571***	−2.541***
	(-7.409)	(-7.345)	(-7.321)	(-7.553)	(-7.396)	(-7.424)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,827	11,827	11,827	13,912	13,912	13,912
R2	0.192	0.183	0.192	0.182	0.176	0.182

Panel B2: Z is a proxy for bank capital (Tier 1 ratio)

	Supervisory power			Private monitoring		
	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)
	[1]	[2]	[3]	[4]	[5]	[6]
MaP	0.057	0.104	0.115**	0.074	0.064	0.077
	(1.283)	(0.982)	(1.996)	(1.330)	(0.477)	(1.048)
R (regulation)	0.035***	0.024***	0.040***	0.026*	0.018	0.021
	(3.881)	(3.367)	(4.478)	(1.800)	(1.591)	(1.533)
MaP × *R*	−0.011***	−0.021**	−0.017***	−0.017**	−0.018	−0.018**
	(-3.386)	(-2.335)	(-3.657)	(-2.472)	(-1.179)	(-2.006)
MaP* × *R* × *Capital (Tier 1)	0.000**	0.001	0.001**	0.001*	0.001	0.001**
	(2.345)	(1.223)	(2.105)	(1.926)	(1.139)	(2.078)
MaP × *Capital*	−0.005**	−0.009*	−0.006*	−0.007**	−0.013	−0.009**
	(-2.229)	(-1.756)	(-1.888)	(-2.048)	(-1.465)	(-1.998)
R × *Capital*	−0.001**	−0.001**	−0.001***	−0.001**	−0.013	−0.001***
	(-2.482)	(-2.469)	(-2.620)	(-2.273)	(-1.465)	(-2.868)
Size	0.028	0.018	0.022	0.041	0.025	0.035
	(1.020)	(0.677)	(0.795)	(1.566)	(1.023)	(1.339)

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Table 4 (*continued*)

Panel B2: Z is a proxy for bank capital (Tier 1 ratio)

	Supervisory power			Private monitoring		
	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)
	[1]	[2]	[3]	[4]	[5]	[6]
Controls 1 (lag):						
C: Capital Adequacy (Tier 1/TA)	0.020***	0.019***	0.020***	0.019***	0.019***	0.019***
	(4.593)	(4.543)	(4.574)	(4.885)	(4.811)	(4.846)
A: Asset Quality (NPL/TL)	−0.005*	−0.005*	−0.005**	−0.005**	−0.005**	−0.006**
	(-1.953)	(-1.915)	(-1.990)	(-2.441)	(-2.463)	(-2.537)
M: Management (OVE/TA)	0.152***	0.154***	0.154***	0.178***	0.177***	0.178***
	(2.629)	(2.661)	(2.661)	(3.277)	(3.277)	(3.274)
E: Earnings (NIM)	0.007	0.008	0.007	0.007	0.007	0.006
	(1.005)	(1.107)	(0.930)	(0.861)	(0.871)	(0.805)
L: Liquidity (LA/TA)	0.623***	0.608***	0.636***	0.549***	0.524***	0.568***
	(5.409)	(5.218)	(5.521)	(5.742)	(5.471)	(5.921)
DIV	−0.005	−0.001	−0.006	0.035	0.031	0.035
	(-0.113)	(-0.025)	(-0.151)	(1.049)	(0.935)	(1.021)
Controls 2 (lag):						
CONC	−0.004	0.029	0.021	0.135	0.263**	0.140
	(-0.032)	(0.230)	(0.176)	(1.246)	(2.395)	(1.272)
INT	0.002	0.002	0.001	0.001	0.001	0.001
	(0.804)	(0.925)	(0.655)	(0.592)	(0.508)	(0.418)
GDPG	0.000	0.001	0.000	0.000	0.000	−0.000
	(0.228)	(0.388)	(0.203)	(0.049)	(0.073)	(-0.019)
INF	0.002	0.002	0.002	0.002	0.001	0.002
	(0.911)	(0.696)	(0.948)	(0.982)	(0.647)	(1.025)
Constant	−0.265	−0.097	−0.244	−0.233	−0.076	−0.104
	(-0.613)	(-0.222)	(-0.570)	(-0.539)	(-0.178)	(-0.243)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4092	4092	4092	5818	5818	5818
R2	0.144	0.142	0.141	0.130	0.126	0.127

Panel B3: Z is a proxy for bank capital (Total regulatory capital ratio)

	Supervisory power			Private monitoring		
	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)
	[1]	[2]	[3]	[4]	[5]	[6]
MaP	0.182***	0.032	0.261***	0.198***	0.037	0.253***
	(4.330)	(0.286)	(5.657)	(4.387)	(0.340)	(4.904)
R (regulation)	0.060***	0.058***	0.064***	0.100***	0.087***	0.091***
	(9.476)	(12.046)	(9.574)	(8.958)	(10.116)	(8.387)
MaP × R	−0.021***	−0.025***	−0.026***	−0.034***	−0.031**	−0.040***
	(-6.238)	(-2.728)	(-6.831)	(-6.105)	(-2.517)	(-6.180)
MaP × R × Liquidity	0.075***	−0.003	0.082***	0.098***	0.039	0.139***
	(6.032)	(-0.044)	(6.258)	(5.380)	(0.914)	(6.308)
MaP × Liquidity	−0.894***	0.359	−1.003***	−0.718***	0.081	−1.053***
	(-5.861)	(0.471)	(-6.284)	(-4.820)	(0.195)	(-6.009)
R × Liquidity	−0.079***	−0.087***	−0.076***	−0.139***	−0.132***	−0.135***
	(-7.415)	(-8.461)	(-7.291)	(-9.076)	(-9.327)	(-9.006)
Size	0.209***	0.198***	0.205***	0.188***	0.172***	0.186***
	(8.473)	(8.219)	(8.329)	(8.108)	(7.636)	(8.040)
Controls 1 (lag):						
C: Capital Adequacy (E/TA)	1.809***	1.753***	1.814***	1.736***	1.709***	1.739***
	(14.293)	(13.845)	(14.327)	(14.397)	(14.074)	(14.444)
A: Asset Quality (NPL/TL)	0.022***	0.021***	0.022***	0.021***	0.021***	0.021***
	(9.266)	(9.215)	(9.247)	(9.350)	(9.329)	(9.330)
M: Management (OVE/TA)	0.001	0.001	0.001	0.001	0.001	0.001
	(0.861)	(0.808)	(0.824)	(0.607)	(0.450)	(0.532)
E: Earnings (NIM)	−0.028*	−0.033**	−0.027*	−0.038**	−0.038***	−0.037**
	(-1.757)	(-2.062)	(-1.697)	(-2.503)	(-2.579)	(-2.490)

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Table 4 (*continued*)

Panel B3: Z is a proxy for bank capital (Total regulatory capital ratio)						
	Supervisory power			Private monitoring		
	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)
	[1]	[2]	[3]	[4]	[5]	[6]
L: Liquidity (LA/TA)	0.004	0.003	0.003	0.005	0.004	0.005
	(0.612)	(0.508)	(0.601)	(0.833)	(0.681)	(0.824)
DIV	0.016	0.012	0.015	0.039	0.038	0.039
	(0.467)	(0.361)	(0.452)	(1.327)	(1.306)	(1.328)
Controls 2 (lag):						
CONC	0.073	0.218**	0.135	0.366***	0.582***	0.395***
	(0.712)	(2.122)	(1.291)	(3.757)	(5.845)	(4.062)
INT	0.001	0.001	0.001	0.002*	0.003**	0.002
	(0.442)	(1.059)	(0.414)	(1.737)	(1.968)	(1.598)
GDPG	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***
	(3.052)	(3.288)	(3.093)	(3.377)	(3.545)	(3.377)
INF	0.007***	0.007***	0.007***	0.012***	0.011***	0.012***
	(3.626)	(3.615)	(3.688)	(6.026)	(5.609)	(6.166)
Constant	−3.885***	−3.830***	−3.928***	−3.952***	−3.800***	−3.893***
	(-10.019)	(-9.792)	(-10.032)	(-10.285)	(-9.951)	(-10.122)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,827	11,827	11,827	13,912	13,912	13,912
R2	0.172	0.165	0.172	0.166	0.162	0.165
Panel C: Z is a proxy for bank liquidity (liquid assets to total assets ratio)						
	Supervisory power			Private monitoring		
	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)
	[1]	[2]	[3]	[4]	[5]	[6]
MaP	−0.006	−0.064	0.001	0.150***	0.291**	0.200***
	(-0.213)	(-0.611)	(0.023)	(3.545)	(2.275)	(4.153)
R (regulation)	0.062***	0.062***	0.061***	0.100***	0.076***	0.098***
	(10.283)	(13.997)	(9.542)	(8.822)	(9.213)	(8.487)
MaP × R	−0.005**	−0.027***	−0.002	−0.029***	−0.051***	−0.034***
	(-2.263)	(-3.478)	(-0.850)	(-5.679)	(-4.209)	(-5.605)
MaP × R × FS	0.000	0.000	−0.002***	0.008***	0.012***	0.011***
	(0.926)	(0.088)	(-3.884)	(4.837)	(3.282)	(4.407)
R × FS	−0.004	0.091***	−0.010***	−0.054***	−0.084***	−0.082***
	(-1.583)	(2.671)	(-3.371)	(-4.301)	(-2.787)	(-4.149)
MaP × FS	−0.013***	−0.016***	−0.010***	−0.012***	−0.011***	−0.011***
	(-11.513)	(-17.164)	(-8.960)	(-11.562)	(-9.393)	(-9.396)
Size	0.249***	0.245***	0.248***	0.228***	0.214***	0.226***
	(9.168)	(9.342)	(9.169)	(8.970)	(8.683)	(8.898)
Controls 1 (lag):						
C: Capital Adequacy (E/TA)	0.021***	0.021***	0.021***	0.020***	0.020***	0.020***
	(8.334)	(8.342)	(8.337)	(8.229)	(8.144)	(8.231)
A: Asset Quality (NPL/TL)	0.003	0.003	0.003	0.002	0.002	0.002
	(1.463)	(1.288)	(1.515)	(0.922)	(0.815)	(0.890)
M: Management (OVE/TA)	−0.043**	−0.040**	−0.047***	−0.051***	−0.048***	−0.051***
	(-2.403)	(-2.259)	(-2.613)	(-2.980)	(-2.831)	(-3.005)
E: Earnings (NIM)	−0.005	−0.006	−0.005	−0.001	−0.001	−0.001
	(-0.688)	(-0.843)	(-0.728)	(-0.115)	(-0.206)	(-0.123)
L: Liquidity (LA/TA)	1.304***	1.295***	1.301***	1.240***	1.232***	1.244***
	(11.246)	(11.202)	(11.227)	(11.385)	(11.315)	(11.406)
DIV	0.041	0.040	0.042	0.060**	0.059*	0.061**
	(1.117)	(1.100)	(1.170)	(1.982)	(1.952)	(2.021)
Controls 2 (lag):						
FS	0.028***	0.018***	0.044***	0.013**	0.014**	0.013**
	(3.698)	(2.700)	(5.122)	(2.154)	(2.218)	(2.015)
CONC	−0.139	0.043	−0.180	0.210*	0.326***	0.226**
	(-1.088)	(0.343)	(-1.390)	(1.839)	(2.862)	(1.968)
INT	0.002	0.003**	0.002	0.004***	0.005***	0.004***
	(1.411)	(2.086)	(1.404)	(3.019)	(3.294)	(2.798)
GDPG	0.004**	0.006***	0.004**	0.005***	0.005***	0.005***

(*continued on next page*)

Table 4 (*continued*)

Panel C: Z is a proxy for bank liquidity (liquid assets to total assets ratio)						
	Supervisory power			Private monitoring		
	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)
	[1]	[2]	[3]	[4]	[5]	[6]
	(2.203)	(2.869)	(2.004)	(2.853)	(2.959)	(2.799)
INF	−0.008***	−0.010***	−0.009***	0.001	−0.000	0.001
	(-3.623)	(-4.314)	(-4.294)	(0.363)	(-0.043)	(0.500)
Constant	−4.179***	−4.179***	−4.173***	−4.386***	−4.131***	−4.368***
	(-9.683)	(-9.836)	(-9.689)	(-10.317)	(-9.903)	(-10.240)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9732	9732	9732	11,588	11,588	11,588
R2	0.165	0.169	0.166	0.149	0.146	0.148
Panel D: Z is a proxy for financial structure (domestic credit to market capitalization ratio)						
	Supervisory power			Private monitoring		
	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)
	[1]	[2]	[3]	[4]	[5]	[6]
MaP	−0.006	−0.064	0.001	0.150***	0.291**	0.200***
	(-0.213)	(-0.611)	(0.023)	(3.545)	(2.275)	(4.153)
R (regulation)	0.062***	0.062***	0.061***	0.100***	0.076***	0.098***
	(10.283)	(13.997)	(9.542)	(8.822)	(9.213)	(8.487)
MaP × R	−0.005**	−0.027***	−0.002	−0.029***	−0.051***	−0.034***
	(-2.263)	(-3.478)	(-0.850)	(-5.679)	(-4.209)	(-5.605)
MaP × R × FS	0.000	0.000	−0.002***	0.008***	0.012***	0.011***
	(0.926)	(0.088)	(-3.884)	(4.837)	(3.282)	(4.407)
R × FS	−0.004	0.091***	−0.010***	−0.054***	−0.084***	−0.082***
	(-1.583)	(2.671)	(-3.371)	(-4.301)	(-2.787)	(-4.149)
MaP × FS	−0.013***	−0.016***	−0.010***	−0.012***	−0.011***	−0.011***
	(-11.513)	(-17.164)	(-8.960)	(-11.562)	(-9.393)	(-9.396)
Size	0.249***	0.245***	0.248***	0.228***	0.214***	0.226***
	(9.168)	(9.342)	(9.169)	(8.970)	(8.683)	(8.898)
Controls 1 (lag):						
C: Capital Adequacy (E/TA)	0.021***	0.021***	0.021***	0.020***	0.020***	0.020***
	(8.334)	(8.342)	(8.337)	(8.229)	(8.144)	(8.231)
A: Asset Quality (NPL/TL)	0.003	0.003	0.003	0.002	0.002	0.002
	(1.463)	(1.288)	(1.515)	(0.922)	(0.815)	(0.890)
M: Management (OVE/TA)	−0.043**	−0.040**	−0.047***	−0.051***	−0.048***	−0.051***
	(-2.403)	(-2.259)	(-2.613)	(-2.980)	(-2.831)	(-3.005)
E: Earnings (NIM)	−0.005	−0.006	−0.005	−0.001	−0.001	−0.001
	(-0.688)	(-0.843)	(-0.728)	(-0.115)	(-0.206)	(-0.123)
L: Liquidity (LA/TA)	1.304***	1.295***	1.301***	1.240***	1.232***	1.244***
	(11.246)	(11.202)	(11.227)	(11.385)	(11.315)	(11.406)
DIV	0.041	0.040	0.042	0.060**	0.059*	0.061**
	(1.117)	(1.100)	(1.170)	(1.982)	(1.952)	(2.021)
Controls 2 (lag):						
FS	0.028***	0.018***	0.044***	0.013**	0.014**	0.013**
	(3.698)	(2.700)	(5.122)	(2.154)	(2.218)	(2.015)
CONC	−0.139	0.043	−0.180	0.210*	0.326***	0.226**
	(-1.088)	(0.343)	(-1.390)	(1.839)	(2.862)	(1.968)
INT	0.002	0.003**	0.002	0.004***	0.005***	0.004***
	(1.411)	(2.086)	(1.404)	(3.019)	(3.294)	(2.798)
GDPG	0.004**	0.006***	0.004**	0.005***	0.005***	0.005***
	(2.203)	(2.869)	(2.004)	(2.853)	(2.959)	(2.799)
INF	−0.008***	−0.010***	−0.009***	0.001	−0.000	0.001
	(-3.623)	(-4.314)	(-4.294)	(0.363)	(-0.043)	(0.500)
Constant	−4.179***	−4.179***	−4.173***	−4.386***	−4.131***	−4.368***
	(-9.683)	(-9.836)	(-9.689)	(-10.317)	(-9.903)	(-10.240)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9732	9732	9732	11,588	11,588	11,588
R2	0.165	0.169	0.166	0.149	0.146	0.148
Panel E: Z is a proxy for financial development (domestic credit plus market capitalization)						

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Table 4 (*continued*)

Panel E: Z is a proxy for financial development (domestic credit plus market capitalization)						
	Supervisory power			Private monitoring		
	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)
	[1]	[2]	[3]	[4]	[5]	[6]
	Supervisory power			Private monitoring		
	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)	MaP (Total)	MaP (Borrower-targeted)	MaP (Financial institution-targeted)
	[1]	[2]	[3]	[4]	[5]	[6]
MaP	−0.275***	0.244***	−0.323***	−0.224***	0.391***	−0.281***
	(-5.129)	(2.713)	(-5.606)	(-4.045)	(3.238)	(-4.586)
R (regulation)	0.029***	0.011**	0.033***	0.055***	0.022**	0.046***
	(3.929)	(2.213)	(3.990)	(4.894)	(2.563)	(4.063)
MaP × R	0.007*	−0.016**	0.006	0.010	−0.033**	0.016**
	(1.886)	(-2.264)	(1.511)	(1.634)	(-2.251)	(2.318)
MaP × R × FD	−0.000***	−0.000***	−0.000***	−0.000***	−0.000***	−0.000***
	(-5.463)	(-4.447)	(-5.452)	(-7.731)	(-3.391)	(-7.015)
MaP × FD	0.002***	−0.027**	0.002***	0.002***	−0.047***	0.002***
	(7.039)	(-2.511)	(7.675)	(8.677)	(-4.865)	(8.241)
R × FD	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(8.918)	(14.011)	(7.284)	(11.600)	(15.484)	(10.739)
Size	0.240***	0.234***	0.242***	0.220***	0.205***	0.219***
	(8.345)	(8.656)	(8.366)	(8.345)	(8.104)	(8.304)
Controls 1 (lag):						
C: Capital Adequacy (E/TA)	0.021***	0.021***	0.021***	0.021***	0.021***	0.021***
	(8.407)	(8.395)	(8.421)	(8.420)	(8.343)	(8.418)
A: Asset Quality (NPL/TL)	0.002	0.002	0.002	0.001	0.002	0.001
	(0.830)	(0.786)	(0.780)	(0.705)	(0.760)	(0.619)
M: Management (OVE/TA)	−0.048***	−0.052***	−0.047***	−0.050***	−0.048***	−0.051***
	(-2.649)	(-2.877)	(-2.610)	(-2.935)	(-2.800)	(-2.974)
E: Earnings (NIM)	−0.003	−0.003	−0.003	−0.002	−0.002	−0.002
	(-0.498)	(-0.376)	(-0.501)	(-0.333)	(-0.340)	(-0.318)
L: Liquidity (LA/TA)	1.339***	1.357***	1.342***	1.245***	1.268***	1.253***
	(11.537)	(11.674)	(11.566)	(11.403)	(11.654)	(11.475)
DIV	0.053	0.059	0.054	0.071**	0.069**	0.073**
	(1.479)	(1.645)	(1.489)	(2.354)	(2.280)	(2.436)
Controls 2 (lag):						
FD	−0.002***	−0.002***	−0.002***	−0.001***	−0.001***	−0.001***
	(-7.326)	(-8.983)	(-7.239)	(-6.965)	(-6.495)	(-7.146)
CONC	−0.328**	−0.349***	−0.347***	0.047	0.053	0.056
	(-2.546)	(-2.773)	(-2.706)	(0.415)	(0.457)	(0.498)
INT	0.005***	0.006***	0.004***	0.007***	0.006***	0.007***
	(3.138)	(3.702)	(2.924)	(4.600)	(4.157)	(4.422)
GDPG	0.007***	0.008***	0.007***	0.008***	0.007***	0.008***
	(3.268)	(3.656)	(3.111)	(3.975)	(3.527)	(3.931)
INF	−0.010***	−0.009***	−0.009***	−0.003	−0.004*	−0.002
	(-4.350)	(-4.121)	(-4.070)	(-1.467)	(-1.918)	(-1.227)
Constant	−3.725***	−3.647***	−3.718***	−4.047***	−3.764***	−3.955***
	(-8.282)	(-8.469)	(-8.173)	(-9.455)	(-8.979)	(-9.214)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9732	9732	9732	11,588	11,588	11,588
R2	0.164	0.160	0.163	0.157	0.153	0.155

reducing banks' loan growth. This was especially true if banks were located in countries where activation of macroprudential measures is accompanied with stringent bank supervision and regulation. These results suggest that paying attention to the quality of bank regulation may assist macroprudential policies in mitigating the credit growth of risky banks. The findings also suggest that a significant part of the mixed results found in the literature about the effectiveness of macroprudential policies (e.g., Altunbas et al., 2018; Gaganis et al., 2020) can be explained by countries' level of bank supervision. Tougher supervisory power and more private monitoring can provide banks with better risk management tools, and thus, improve the effectiveness of prudential policies.

5. Conclusion

The recent subprime financial crisis highlighted the importance of curbing credit growth to enhance financial stability. Policy makers around the world have been increasingly adopting more macroprudential tools to limit credit growth. While there is a growing literature focusing on the effectiveness of these polices, there is little evidence on whether the quality of bank regulation in a country plays a role in strengthening the efficacy of macroprudential policies.

Using bank data from 91 countries over the period 2001–2013, we provide evidence indicating that the response of banks to adopted macroprudential measures is more pronounced in countries with tougher supervision and more private monitoring. These results indicate that stringent bank supervisory power and more bank private monitoring enhances the effectiveness of prudential tools in improving the stability of the banking sector. We further observe that macroprudential policies limit more the credit growth of small, less-capitalized, and less-liquid banks, when accompanied with high quality of bank regulation.

Overall, our results suggest that macroprudential policies need to be designed and calibrated based on the country's characteristics and conditions. In fact, to achieve their objectives, macroprudential policies need to be appropriately selected and accurately calibrated depending on the country's quality of bank regulation.

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CRediT author statement

Ali Mirzaei: Conceptualization, Methodology, Data Collection, Writing- Original draft preparation. **Anis Samet**: Visualization, Investigation, Empirical Results Writing- Reviewing and Editing.

Table A1
Variables definition and sources.

Variable	Definition	Source
Credit growth	The growth of bank credit measured as year-by-year total gross loans' growth.	Bankscope.
Size	Natural logarithm of a bank total assets.	"
Macroprudential measures		
Total macroprudential index (MaP) (0 12)	Sum of total macroprudential instruments used (i.e. sum of 12 macroprudential tools: LTV, DTI, DP, CTC, LEV, SIFI, INTER, CONC, FC, RR, CG, and TAX).	Cerutti et al. (2016).
Borrower-targeted (0 2)	Sum of those instruments (LTV CAP and DTI ratios) aimed at borrowers' leverage and financial positions.	"
Financial institution-targeted (0 10)	Sum of those instruments (DP, CTC, LEV, SIFI, INTER, CONC, FC, RR REV, CG, and TAX) capture financial institutions-based policies.	"
Ownership and institutions		
Supervisory power	Supervisory power captures whether the supervisory authorities have the authority to take specific actions to prevent and correct problems. It takes value between 0 and 14, with higher values indicating more power.	WB Surveys on Bank Regulation.
Private monitoring	Private monitoring index measures whether there are incentives/abilities for the private monitoring of firms. It takes value between 0 and 12, with higher values indicating more private monitoring.	"
Bank controls (Control 1)		
Capital adequacy (E/TA)	The ratio of equity to total assets of a bank.	"
Asset quality (NPL/TL)	Bank non-performing loans to total loans ratio.	"
Management quality (OVE/TA)	The natural log of bank overheads to total assets ratio.	"
Earnings (NIM)	Bank net interest margin.	"
Liquidity (LA/TA)	Bank liquid assets to total assets ratio.	"
Diversification (DIV)	Income diversification computed as 1-|(Net interest income – Other operating income)/(Total operating income)|. It takes values between zero and one with higher values indicating greater diversification.	"
Macro controls (Control 2)		
Concentration (CONC)	Assets of five largest banks as a share of total commercial banking assets.	WB: The GFD Database.
Real interest rate (INT)	Lending interest rate adjusted for inflation.	WB-WDI Database.
GDP growth (GDPG)	The real annual growth of GDP.	"
Inflation (INF)	Inflation measured by consumer price index (CPI) is defined as the yearly change in the prices of a basket of goods and services.	"
Other controls		
Core deposits (CORE)	Core deposit ratio calculated as long-term funding to total liabilities ratio.	Bankscope.
Bank risk (ZSCOR)	It is the Z-score calculated as (ROA + CAR)/SROA, where CAR represents capital assets ratio, and SROA stands for standard deviation of return on assets.	"
Capitalization (CAPIT)	Stock market capitalization of listed companies to GDP. Market capitalization is calculated by multiplying a company's shares outstanding by the current market price of one share.	WB-WDI Database.
Exchange rate (EXCHAG)	Official exchange rate (local currency per US$).	"

(*continued on next page*)

Table A1 (*continued*)

Variable	Definition	Source
Financial freedom (FREE)	It is a measure of banking efficiency as well as a measure of independence from government control and interference in the financial sector.	Heritage Foundation.

Table A2
Number of banks by country.

ID	Country	N	ID	Country	N
1	Albania	3	47	Kosovo	4
2	Algeria	15	43	Kuwait	14
3	Angola	14	49	Kyrgyzstan	11
4	Armenia	16	50	Latvia	22
5	Australia	32	51	Lebanon	34
6	Azerbaijan	14	52	Lesotho	5
7	Bahrain	33	53	Lithuania	11
8	Bangladesh	35	54	Macedonia	16
9	Belarus	24	55	Malawi	7
10	Belgium	34	56	Malaysia	56
11	Belize	6	57	Malta	9
12	Bhutan	3	58	Mauritius	18
13	Bosnia and Herz.	25	59	Mexico	44
14	Botswana	10	60	Morocco	5
15	Brazil	152	61	Mozambique	11
16	Bulgaria	26	62	Netherlands	39
17	Burundi	6	63	New Zealand	15
18	Canada	50	64	Norway	15
19	Chile	24	65	Pakistan	37
20	China	160	66	Paraguay	11
21	Colombia	33	67	Peru	19
22	Costa Rica	21	68	Philippines	34
23	Croatia	31	69	Poland	40
24	Cyprus	15	70	Republic of Korea	14
25	Czech Republic	23	71	Republic of Moldava	17
26	Dominican Rep.	40	72	Romania	27
27	Ecuador	26	73	Russia	1075
28	Estonia	4	74	Saint Kitts and	2
29	Finland	1	75	Serbia	25
30	France	130	76	Singapore	20
31	Gambia	4	77	Slovakia	12
32	Georgia	7	78	Slovenia	18
33	Germany	116	79	South Africa	23
34	Guyana	3	80	Spain	16
35	Honduras	26	81	Sri Lanka	17
36	Hungary	33	82	Sweden	16
37	Iceland	8	83	Switzerland	191
38	India	77	84	Tajikistan	2
39	Indonesia	85	85	Thailand	27
40	Ireland	11	86	Tonga	1
41	Israel	16	87	Trinidad and Tob	10
42	Italy	162	ES	Uganda	18
43	Jamaica	8	89	Ukraine	172
44	Japan	149	90	United Kingdom	157
45	Jordan	14	91	Zambia	9
46	Kenya	38			
			Total		4109

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