Macroprudential Policies and Private Domestic Investment in Developing Countries

An Instrumental Variables Approach

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Abstract

This paper examines the effect of macroprudential policies on private domestic investment using a panel of 87 developing countries from 2000 to 2017. Our instrumental variables strategy exploits the geographic diffusion of macroprudential policies across countries, with the idea that reforms in neighbouring countries can affect the adoption or strengthening of domestic reforms through peer pressure or imitation effects. The findings indicate that the tightening of macroprudential policies significantly reduces private domestic investment. This effect holds for both instruments targeting borrowers and those targeting financial institutions, and is subject to heterogeneity depending on several economic and institutional factors. The transmission channel analysis highlights that the negative impact of macroprudential policies on investment is primarily driven by a reduction in credit supply and financial inclusion.

Keywords: Macroprudential policies; private domestic investment; developing countries; instrumental variables

JEL Classification: E22; E44; G28

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Abbreviations

CG   credit growth

CONC   concentration limits

DTI   debt-to-income

FC   foreign currency loans

FX   foreign exchange

GDP   gross domestic product

GMM   generalised method of moments

IMF   International Monetary Fund

ICRG   International Country Risk Guide

INTER   interbank exposures

IV   instrumental variables

LEV   leverage

LTV   loan-to-value

MPI   macroprudential policy index

SIFI   systemically important financial institutions

WDI   World Bank's World Development Indicators

1   Introduction

Macroprudential policies are increasingly used in advanced and developing economies, especially since the 2008–2009 global financial crisis and following Basel III, which introduced a comprehensive framework aimed at reforming banking oversight, regulation and risk control – such as enhanced capital adequacy requirements, improved leverage management, new capital and liquidity buffers, and leverage ratio limits (Rubio & Carrasco-Gallego, 2016).[1] The role of macroprudential policies in promoting financial stability by regulating credit cycles is all the more crucial, as studies show that financial crises are more likely to occur when they are preceded by private credit booms (Gertler et al., 2020; Schularick & Taylor, 2012). Empirical evidence from a growing body of literature suggests that macroprudential policies tend to reduce credit procyclicality, credit growth, and house prices (e.g. see Alam et al., 2019; Cerutti et al., 2017; De Schryder & Opitz, 2021; Gómez et al., 2020; Kuttner & Shim, 2016; Lim et al., 2011; Teixeira & Venter, 2023). Another strand of the literature shows that by moderating credit and asset price cycles, macroprudential tools help constrain financial cycles and systemic risks (for instance, see Altunbas et al., 2018; Belkhir et al., 2022; Bianchi & Mendoza, 2018; Claessens et al., 2013; Gertler et al., 2020; Fernandez-Gallardo, 2023).

While the literature has widely examined the effects of macroprudential policies on credit growth or procyclicality and financial stability, our study complements existing studies by assessing the side effects of these policies on private domestic investment in developing countries.[2] The effect of macroprudential policies on private domestic investment is not so clear-cut. If successful, they should improve financial stability, thus contributing to reducing economic uncertainty and improving private sector investment over time – especially as financial crises are found to hamper economic growth, employment and investment (e.g. see Barro, 2001; Reinhart & Reinhart, 2015). On the other hand, certain macroprudential policies such as countercyclical capital buffers, liquidity tools, or those targeting borrowers (such as loan-to-value or debt-to-income ratios) have restrictive effects on credit, thereby worsening financial inclusion (Aiyar et al., 2014; Ayyagari et al., 2018; Deléchat et al., 2021). Lower credit supply resulting from macroprudential policies may penalise private sector investment, especially in developing countries, where numerous firms already face significant challenges in accessing adequate financing (Beck et al., 2005; Chauvet & Jacolin, 2017; Harrison et al., 2004).

This paper examines the effect of macroprudential policies on private domestic investment in developing countries. Macroprudential policies are likely to be correlated with (in)observable factors that could also affect the economy's overall performance, including domestic investment. Therefore, to mitigate endogeneity, we draw on existing studies to exploit an exogenous source of variation, instrumenting macroprudential policies by the average regional macroprudential policy index. The results from our instrumental-variables (IV) strategy suggest that macroprudential policies reduce private domestic investment. The effects are statistically and economically significant, and robust to various tests. Heterogeneity analyses show that the negative effect of macroprudential policies on private investment is observed for both policies targeting

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1   The International Monetary Fund (IMF) defines macroprudential policy as "the use of primarily prudential tools to limit systemic risk or system-wide financial risk" (IMF, 2011). See Clement (2010) for the origins and evolution of the term.

2   We focus on developing countries, i.e., emerging and low-income economies, for two main reasons. First, the latter have experienced a surge in macroprudential tools to improve financial stability in recent years, and in contrast to their advanced counterparts, the private sector in these regions is severely penalized by low levels of investment, thus creating a further challenge to achieving development goals. Second, focusing on developing countries allows us to have a relatively homogeneous sample of countries, for instance in terms of several economic, structural, and institutional factors (e.g. per capita income, vulnerability to external shocks, quality of institutions, access to financial markets, etc.).

borrowers and those targeting financial institutions. However, this effect is less pronounced during business cycle expansions, in the aftermath of the 2008–2009 global financial crisis, and under flexible exchange-rate regimes. Additionally, it tends to diminish with larger informal sectors, more developed financial systems, higher per capita income, and better institutional quality. This adverse effect of macroprudential policies on private domestic investment seems to transit through the decline in credit supply and financial inclusion.

The document is organised as follows. The following section briefly reviews the literature dealing with the effects of macroprudential policies and discusses our hypotheses. Section 3 describes our main data and presents stylised facts. Section 4 presents our empirical strategy and the main findings, respectively. Sections 5 and 6 examine the sensitivity of our main results via a series of robustness tests and heterogeneity analyses, respectively. Section 7 empirically examines our main transmission channels. The last section concludes and provides a few policy recommendations.

2   Background and theoretical predictions

An extensive body of literature has examined the effects of macroprudential policies on various economic aggregates.[3] The first part of this research focuses on credit procyclicality, credit growth or house prices. For instance, using a sample of 49 countries, Lim et al. (2011) show that most macroprudential instruments (caps on loan-to-value, caps on debt-to-income, ceilings on credit or credit growth, reserve requirements, countercyclical capital requirements and time-varying/dynamic provisioning) tend to reduce credit procyclicality. Tillmann (2015) employs a qualitative VAR model in Korea from 2000Q1 to 2012Q4 and finds that caps on loan-to-value or debt-to-income ratios reduce credit growth and house price appreciation. Based on a larger sample of 119 countries over 2000–2013, Cerutti et al. (2017) also find that these policies are generally associated with lower credit growth, especially household credit. Subsequent studies yielded similar results, whether for bank loans, mortgages or house prices (e.g. see Akinci & Olmstead-Rumsey, 2018; Alam et al., 2019; Dell'Ariccia et al., 2012; De Schryder & Opitz, 2021; Fendoğlu, 2017; Gómez et al., 2020; Kuttner & Shim, 2016; Meeks, 2017; Richter et al., 2019; Teixeira & Venter, 2023). Another strand of literature shows that, by moderating credit and asset price cycles, macroprudential instruments help promote greater stability in the banking or financial system, or reduce the risk of financial crises. For instance, Claessens et al. (2013) find that measures targeting borrowers, such as caps on debt-to-income and loan-to-value ratios, and limits on credit growth and foreign currency lending can play an important role in mitigating overall systemic risk by reducing the excessive growth of key variables (leverage, assets and the non-core to core liabilities ratio). Other studies yield similar conclusions regarding bank risk-taking or banking crises (e.g. see Altunbas et al., 2018; Belkhir et al., 2022; Bianchi and Mendoza, 2018; Gertler et al., 2020; Fernandez-Gallardo, 2023; Nakatani, 2020). Lastly, studies have also examined the effects of macroprudential policies on real goals and other financial factors.[4] Regarding the former, while Alam et al. (2019) find a weak effect of macroprudential policies on consumption or growth, Madeira (2024) finds that macroprudential tightening

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3   Microprudential regulation, such as the Basel I and II capital accords, focuses on financial institutions individually, primarily ensuring their solvency. However, it tends to overlook systemic risks, such as correlation risk, which extend beyond individual institutions (Acharya, 2009; De Nicoló et al., 2012; Osinski et al., 2013). In contrast, macroprudential policy aims to safeguard the stability of the financial system as a whole and interacts with other public policies that impact systemic financial stability. Nevertheless, as noted by De Nicoló et al. (2012), while the distinction between microprudential and macroprudential policies is conceptually useful, it remains challenging to delineate in practice.

4   Other studies highlight a strong complementarity between monetary and macroprudential policies (e.g. see Altavilla et al., 2020; Kim & Mehrotra, 2017; Maddaloni & Peydró, 2013; Van der Ghote, 2021).

measures significantly reduce manufacturing growth for industries with high external finance dependence. Regarding the latter, macroprudential policies are found to reduce international bank lending (Bussière et al., 2021) or financial inclusion (Deléchat et al., 2021; Raksmey et al., 2022).

Capitalising on existing work, our reading is that macroprudential policies can impact private domestic investment via two main channels. First, a large body of literature shows that, by generating uncertainty, financial instability contributes to worsening the business cycle, thus hampering investment, employment and growth (e.g. see Barro, 2001; Davis & Stone, 2004; Reinhart & Reinhart, 2015). Indeed, it is widely accepted that when faced with uncertainty, investors tend to adopt a "wait-and-see" strategy, thus postponing their investment decisions until the uncertainty is resolved (Bambe et al., 2024; Bloom et al., 2007; Dixit & Pindyck, 1994; Lucas Jr, 1967; Nickell, 1974; Straub & Ulbricht, 2024;). Moreover, the literature highlights the role of uncertainty in increasing borrowing costs (Arellano et al., 2010; Ashraf & Shen, 2019; Christiano et al., 2010; Gozgor et al., 2019). Therefore, assuming that macroprudential policies are successful, they should improve financial stability and thus reduce uncertainty arising from banking and systemic risks, with positive side effects on private sector investment over time. On the other hand, as mentioned earlier, some macroprudential instruments, particularly those targeting borrowers, such as loan-to-value or debt-to-income ratios, tend to reduce credit growth and supply. This can prevent individuals from accessing the credit market, ultimately leading to negative effects on financial inclusion (Akinci & Olmstead-Rumsey, 2018; De Araujo et al., 2020; Deléchat et al., 2021; Malovaná et al., 2022; Raksmey et al., 2022;).[5] Thus, according to the latter hypothesis, macroprudential tools could exert downward pressure on private investment by restricting access to credit and financial inclusion, key drivers of various investment projects. In short, while macroprudential policies can promote private domestic investment in developing countries by improving financial stability, the credit restrictions resulting from these policies make the relationship theoretically ambiguous. Therefore, this calls for a thorough empirical analysis to identify a potential causal relationship.

3 Data and stylised facts

3.1 Data

Our study includes a panel of 87 developing countries (37 emerging markets and 50 low-income countries) over the period 2000–2017.[6] The sample was selected based on data availability, and the study period was determined by data on macroprudential policies provided by Cerutti et al. (2017), which runs from 2000 to 2017. Our dependent variable is proxied by the share of private-sector gross fixed capital formation to GDP, extracted from the Investment and Capital Stock database of the International Monetary Fund (IMF). The Cerutti et al. dataset includes 12 dummy variables related to macroprudential policy instruments, that take on a value of 1 when a particular measure is used for a country i, at the year t, and 0 otherwise. Instruments such as caps on loan-to-value (LTV) ratio and debt-to-income (DTI) target borrowers exclusively, and aim to limit household indebtedness by imposing or encouraging a ceiling. Most of the other instruments target financial institutions by: limiting their leverage ratio ; requiring systemically important financial institutions to hold a higher level of capital than other financial institutions;

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5   Although macroprudential tools are designed to stabilise the financial system and mitigate systemic risk, they are sometimes perceived as a politically and economically acceptable form of financial repression (e.g. see Fisseha, 2023; Hoffmann, 2019; Reinhart, 2012; Reinhart & Sbrancia, 2015).

6   Our classification of developing countries comes from the International Monetary Fund (IMF), which considers criteria such as per capita income, export base, and financial integration.

imposing restrictions on interbank exposures; reducing asset concentration, foreign currency loans, and credit growth. The macroprudential policy index – abbreviated as MPI in this paper – is therefore an aggregate index, which is the yearly sum of the 12 instruments, and ranges from 0 to 10 in our sample and over our study period. The instruments are summarised and described in Table 1.

Based on existing studies, we include a series of control variables that may be potential drivers of private domestic investment, namely: the logarithm of the employment rate, trade globalisation, and institutional quality (approximated by corruption control and the logarithm of government durability). We expect higher employment rates to improve domestic savings, via higher household incomes, with (potentially) positive effects on private-sector investment.[7] Regarding trade globalisation, long-standing literature suggests that it can exert important effects on domestic investment and growth, though the relationship remains theoretically ambiguous. Trade globalisation can promote domestic investment, by providing access to new capital assets, but also by lowering the price of capital (see Baldwin & Seghezza, 1996), attracting foreign investment flows, and promoting technology transfer and domestic innovation capacity (see Dollar & Kraay, 2004; Krugman, 1994; Levine & Renelt, 1991; Rivera-Batiz & Romer, 1991). On the other hand, globalisation can exert downward pressure on domestic investment due to stronger international competition, but also because higher globalisation can trigger economic uncertainty due to the instabilities it can generate (Montalbano, 2011). The expected effect of institutional quality on investment is intuitive. A sound institutional environment, with low levels of corruption, should improve the transparency of the business environment and encourage private-sector initiative. Similarly, government durability should reduce fiscal policy volatility and provide investors with greater investment predictability. However, this argument needs to be nuanced. Indeed, as suggested by Apeti et al. (2024b), government durability in autocratic or less democratic regimes may reflect poor institutions, with potentially negative effects on private sector investment. Lastly, taking due notice that even within developing countries there is some heterogeneity in terms of per capita income, we include the logarithm of GDP per capita to account for this and expect a positive effect given the positive relationship between economic performance and institutional quality (Acemoglu et al., 2008).

Employment and per capita income are extracted from the World Bank's World Development Indicators (WDI) database. The KOF Globalisation Index ranges from 15 to 85 in our sample and over our study period, where higher values indicate a higher degree of globalisation. The corruption control index is from the International Country Risk Guide (ICRG) database; it ranges from 0.5 to 5 in our sample and over our study period (higher values indicate better institutions). Lastly, government durability measures the number of years since the last change in the political regime and comes from the Polity IV dataset.

3.2   Stylised facts

We provide stylised facts regarding private domestic investment and the macroprudential policy index. The sample includes a panel of 87 developing countries (37 emerging markets and 50 low-income countries) from 2000 to 2017. We report an average investment rate of 13% of GDP for the total sample, with a (slightly) higher level in emerging markets than in low-income countries (14.6% of GDP versus 11.8% of GDP). Figure 1 shows an upward trend in domestic investment in developing countries since the 2000s, with a drop between 2008 and 2009, probably due to the financial crisis. A recovery is observed from 2010 onwards, and the trend in investment looks broadly stable from 2012 to the end of our study period, fluctuating around 14% of GDP. With regard to the variable of interest, we report an average macroprudential policy

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7   We lag the employment rate by one year to limit reverse causality with the dependent variable.

index of 2, with emerging markets exhibiting a (slightly) higher average index compared to low-income countries (2.7 versus 1.6). Macroprudential tools have grown steadily since the 2000s (see Figures 2 and 3). Indeed, out of our sample of 87 developing countries, 49 used at least one macroprudential instrument in 2000, and the number rose to 79 in 2017. This results in a macroprudential policy index rising from 1 in 2000 to 3.4 at the end of our study period. Although both policies targeting borrowers and financial institutions displayed an upward trend over our study period, those targeting financial institutions appear to be more in vogue, adopted by 77 countries at the end of our study period, compared with 37 countries for instruments targeting borrowers. The strengthening of macroprudential policies has been coupled with an increasing diversification of the tools used, probably in response to financial risks. Financial institution-targeted instruments such as concentration limits (CONC) appear to be dominant over the study period, while others such as limits on interbank exposures (INTER), leverage ratio (LEV), loan-to-value ratio (LTV) caps have become increasingly important in recent years. This reflects the growing contributions of the various financial tools mobilised by financial institutions to reduce financial and systemic risks but also the complexity of the financial environment.

Figure 1: Trends in private domestic investment by income level
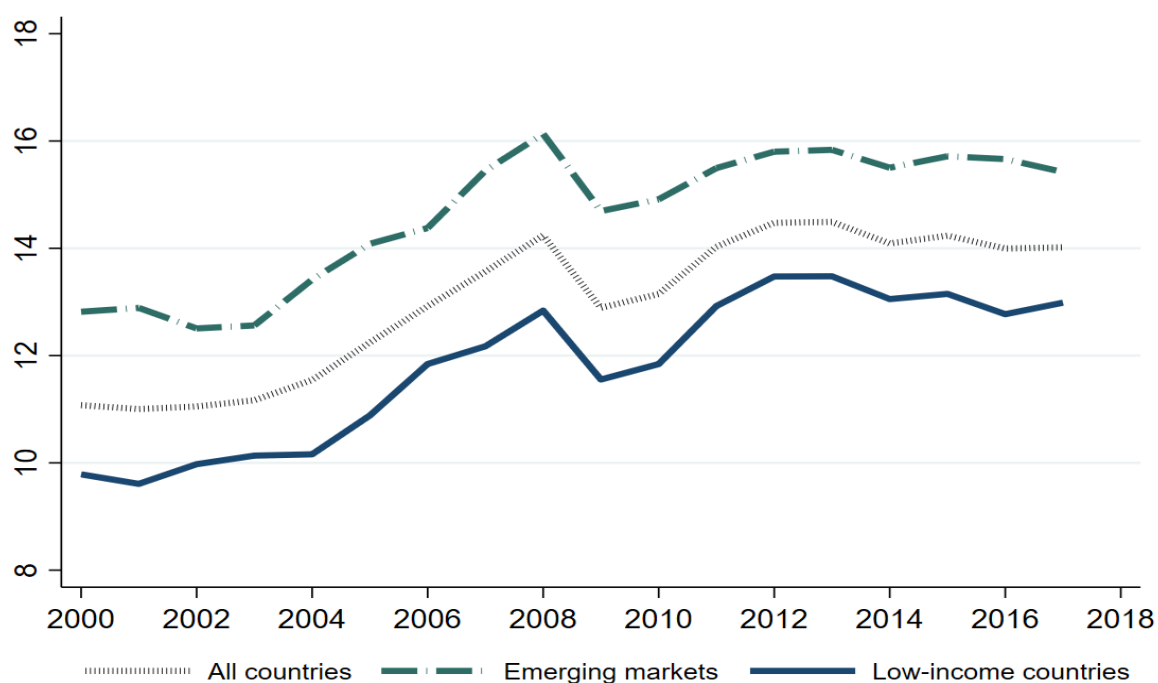
Source: Author, based on International Monetary Fund (IMF)'s Investment and Capital Stock database

Figure 2: Trends in MPI by income level
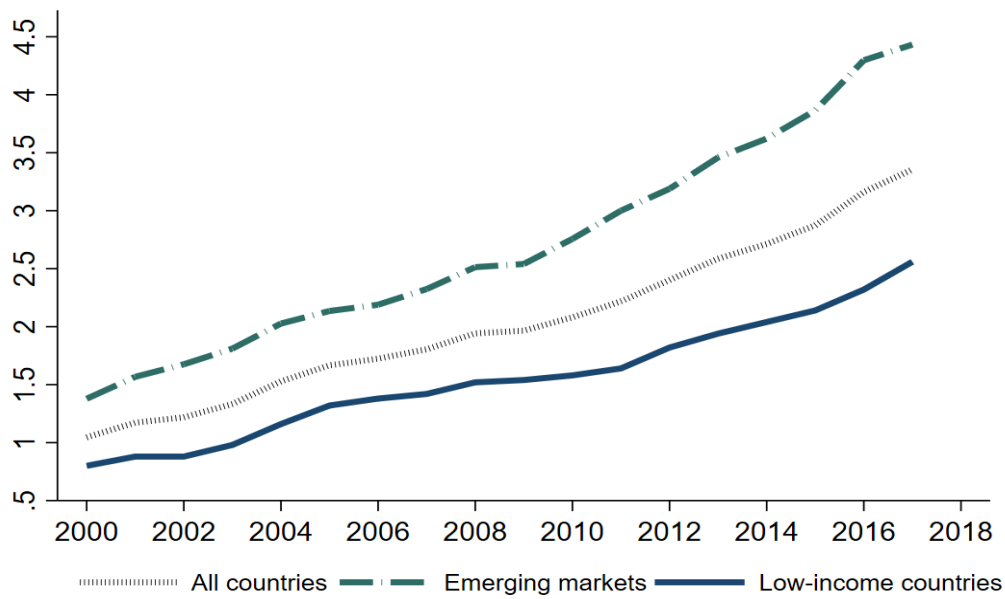
Source: Author, based on Cerutti et al. (2017)

Figure 3: Trends in MPI by category
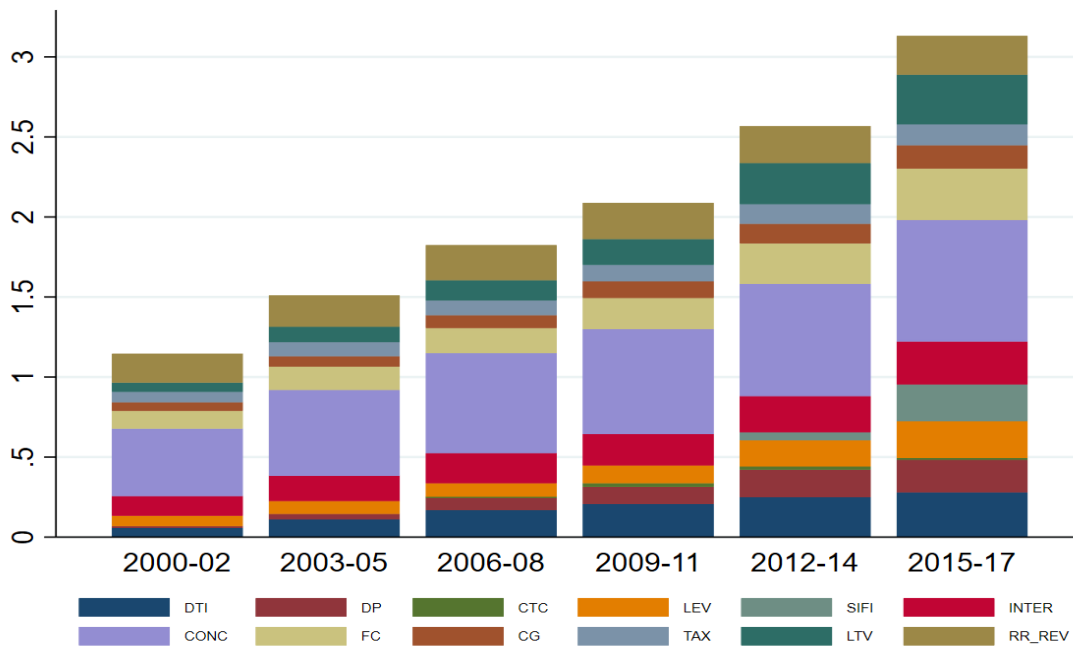
Source: Author, based on Cerutti et al. (2017)

Table 1: Global macroprudential policy instruments survey

Instrument/Group	Abbreviation	Definition
Survey instruments (0–1)		
Debt-to-income ratio	DTI	Constrains household indebtedness by enforcing or encouraging a limit
Time-varying/dynamic loan-loss provisioning	DP	Requires banks to hold more loan-loss provisions during upturns.
General countercyclical capital buffer/requirement	CTC	Requires banks to hold more capital during upturns.
Leverage ratio	LEV	Limits banks from exceeding a fixed minimum leverage ratio.
Capital surcharges on SIFIs	SIFI	Requires Systemically Important Financial Institutions to hold a higher capital level than other financial institutions.
Limits on interbank exposures	INTER	Limits the fraction of liabilities held by the banking sector or by individual banks.
Concentration Limits	CONC	Limits the fraction of assets held by a limited number of borrowers.
Limits on Foreign Currency Loans	FC	Limits banks' foreign currency loans, as a way to reduce vulnerability to foreign currency risks.
Limits on Domestic Currency Loans	CG	Limits credit growth directly.
Levy/Tax on Financial Institutions	TAX	Taxes revenues of financial institutions.
Loan-to-Value Ratio Caps	LTV_CAP	Restrictions to LTV used as a strictly enforced cap on new loans, as opposed to a supervisory guideline or merely a determinant of risk weights.
and/or Countercyclical Reserve Requirements	RR_REV	Restrictions to RR which i) imposes a wedge on foreign currency deposits, or ii) is adjusted countercyclically
Groups		
Macroprudential policy index (0–12)	MPI	LTV_CAP + DTI + DP + CTC + LEV + SIFI + INTER + CONC + FC + RR_REV + CG + TAX
Borrower-targeted instruments (0–2)	BORROWER	LTV_CAP + DTI
Financial institution-targeted instruments (0–10)	FINANCIAL	DP+ CTC + LEV + SIFI + INTER + CONC + FC + RR_REV + CG + TAX

Source: Author, based on Cerutti et al. (2017)

Notes: Column [2] includes abbreviations from Cerutti et al. (2017)

4 Methodology and main findings

4.1 Instrumental variables strategy

Macroprudential policies may be endogenous, as their adoption or tightening may be associated with other alternative measures, creating an identification bias due to unobservables. In other words, estimating a causal effect is challenging, as it is difficult to determine whether the observed effect is genuinely due to macroprudential policies or rather to alternative policies. Hence, purging macroprudential policy actions to resolve potential endogeneity problems is crucial. At the same time, finding a relevant and valid instrument is widely acknowledged as a challenging task. Many studies examining the effect of reforms explore the regional diffusion of these reforms as an instrumental variable, in the idea that structural reforms often occur as regional waves. The underlying intuition is that reforms in neighbouring countries can have a strong spillover effect in the adoption or strengthening of domestic reforms – via simple imitation mechanisms, peer pressure, learning or competition (see Buera et al., 2011; Dobbin et al., 2007; Huntington, 1991; Shipan & Volden, 2008). Studies exploring the influence of regional democratic reforms as a driving force or instrument for initiating national democratic reforms include, among others, Acemoglu et al., 2019; Giuliano et al., 2013; Kalenborn & Lessmann, 2013; Persson & Tabellini, 2009. Similarly, other works exploit fiscal rules in neighbouring countries, with the idea that countries draw on the experience of their neighbours when introducing such reforms (e.g. see Altunbaş & Thornton, 2017; Apeti et al., 2024a; Balvir, 2024; Caselli & Reynaud, 2020). In the case of monetary reforms, for instance, Balima et al. (2017) use the proportion of neighbouring countries that have adopted inflation targeting as an instrumental variable for a country's decision to adopt the monetary framework.

Based on the literature discussed above, we use the average of macroprudential policies in regional countries as an instrumental variable for domestic macroprudential policies, to provide a source of exogenous variation. There are several reasons why a country may adopt or strengthen its macroprudential policies, drawing on the experience of its neighbouring countries. For example, economic integration may lead a country to strengthen its macroprudential regulations due to pressure from its peers, to reduce systemic risks. The spread of macroprudential policies in the Eurozone, under the ECB's influence, is a striking example. The same applies in Africa, where macroprudential policies have spread among the member countries of monetary unions to strengthen the resilience of banking systems in response to economic shocks. In Asia, many countries adopted or strengthened their macroprudential tools after the 1997 Asian financial crisis to prevent future financial instability. Our identifying hypothesis is therefore that macroprudential regulations in regional peer countries can play an important role in strengthening domestic macroprudential policies, without directly affecting private sector investment in the domestic country – conditional on the vector of controls. However, we recognise that if macroprudential policies successfully reduce systemic risks, they may (indirectly) affect regional economic performance. To address this limitation of our IV methodology, we include regional banking crises and regional economic growth as additional controls in our main regression for robustness.

4.2 Econometric specification and main results

We estimate the effect of macroprudential policies on private domestic investment based on the following econometric specification

$$Y_{it} = \alpha_i + {}_\beta X_{it} + \eta Z_{it} + \mu_i + \psi_t + \varepsilon_{it} \qquad (1)$$

where Y_{it} represents private domestic investment (as a percentage of GDP) for a country i in year t. $X_{i,t}$ is the macroprudential policy index, and Z_{it} is the set of control variables of the baseline model. μ_i and ψ_t denote country and time-fixed effects, respectively. Country-fixed effects

capture unobserved country-specific and time-invariant factors; and time-fixed effects account for common time-varying shocks correlated with macroprudential policies and private domestic investment. ε_{it} is the usual residual error term. Column [1] of Table 2 reports the main results, including the baseline model controls and country and year fixed effects. The coefficient on the macroprudential policy index is negative and significant at the 1% threshold, suggesting that macroprudential policies are associated with a significant drop in private sector investment in developing countries. Specifically, a one-unit increase in the Cerutti et al. (2017) index is associated with a drop of roughly 1.4 percentage points in private domestic investment. More importantly, statistical tests show that this result is not due to a lack of relevance of the instrument. Indeed, the Kleibergen-Paap F-statistic of the baseline model gives a value well above the value of 10 of the rule of thumb of Staiger and Stock (1997), suggesting that, in our exactly identified model, the weak instrument bias is rather low (Angrist & Pischke, 2009). Another way to check the instrument's relevance is to refer to the results of the first-stage equation reported in Table 3. These results show a positive and significant effect of regional macroprudential policies on domestic macroprudential policies, reinforcing the relevance of the instrument. Lastly, with regard to the baseline model controls, the results show that employment, corruption control and per capita income enhance investment, while government durability is negatively associated. Another important question relates to the economic size of the main estimates. In our sample and over our study period, we report an average private domestic investment of 13% of GDP. Consequently, the main results suggest that for an average country in the sample, a one-unit increase in the Cerutti et al. (2017) index — or MPI — reduces private investment by around 11%, indicating an economically significant effect.

5 Robustness checks

In the previous section, we have established a statistically and economically significant negative effect of macroprudential policies on private domestic investment in developing countries. In this section, we conduct a series of robustness tests. Specifically, we re-estimate Equation 1 by including additional controls, considering alternative subsamples and measures of macro-prudential policies, and using the System-GMM method, respectively.

5.1 Alternative specifications and additional controls

First, we consider alternative specifications by lagging the instrumental variable by one and two years respectively. This allows us to account for potential lags in convergence dynamics between regional and domestic macroprudential policies. In other words, we consider that the regional diffusion of reforms could increase over time, with potential influence on the baseline model estimates. Although the new coefficients reported in Columns [2] and [3] of Table 2 increase slightly compared to that of the baseline model, their magnitude remains very similar. The same applies to the coefficients of the first-stage regression reported in Columns [2] and [3] of Table 3. Second, instead of the KOF Globalisation Index used in the main model, in Column [4], we consider the trade openness variable from the World Bank's WDI database, measured as the sum of exports and imports as a percentage of GDP. The results hold.

We further augment the baseline model using additional controls, which might affect our dependent variable. First, in addition to the trade globalisation variable included in the main model, we also control for financial openness. Next, we include the terms of trade to capture the potential influence of costly shocks on private domestic investment. We further consider monetary factors such as the inflation rate, the exchange rate regime and the real effective exchange rate. We expect inflation to reduce domestic investment, via the macroeconomic uncertainty and volatility it generates (e.g. see Bambe et al., 2024; Bloom et al., 2007; Dixit &

Pindyck, 1994; Lucas Jr, 1967; Nickell, 1974). The exchange rate regime may equally be a key determinant of inflation performance and macroeconomic volatility, with potentially important side effects on private sector investment decisions (e.g. see Edwards, 1993; Ghosh et al., 1996). Appreciations in the real effective exchange rate may dampen investment by exacerbating competition challenges in the export sector. Fourth, we consider public investment and remittances, since they can exert significant upward or downward effects on private domestic investment (Borensztein et al., 1998; Buiter, 1977; Chauvet & Jacolin, 2017; Dash, 2023; Fry, 1993). Fifth, we include natural resources, which are probably a key determinant of private-sector investment, particularly in the manufacturing sector. Indeed, the literature shows that natural resource booms in highly dependent countries tend to generate exchange rate appreciations, with adverse effects on the competitiveness of the non-extractive sector (see Corden, 1984 and Sachs & Warner, 2001 for pioneering work on the literature dealing with Dutch disease). Sixth, we complement the institutional variables of the baseline model by including the V-Dem (Varieties of Democracy) "property rights" index and the QOG (Quality of Government) "political pressures and controls on the media index". Seventh, we consider other reforms that could also impact domestic investment, including IMF programmes and an index of economic freedom that includes 12 quantitative and qualitative variables – from property rights to financial freedom – capturing government reforms.[8] Lastly, to reduce the risk that the effect observed in the baseline model is biased by the potential influence of the instrument on regional performance, we account for regional GDP growth and regional banking crises.

Columns [5]-[18] of Table 2 include the new controls independently, and the last column considers them in the same regression. The new coefficients for the variable of interest remain strongly robust. The same holds for the baseline model controls, except for institutional variables, probably due to the high correlation with the new institutional indices. Regarding the new controls, we find that capital openness increases private domestic investment, while natural resources are negatively associated. More importantly, accounting for IMF programmes and economic freedom does not alter our results, suggesting that the effects obtained are likely due to macroprudential policies and not to alternative economic reforms or policies. Similarly, accounting for regional economic growth and regional banking crises does not affect our results, which is reassuring, as it reinforces the exclusion condition stipulated above.

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8   The terms of trade, inflation, natural resources, and remittances are from the World Bank's World Development Indicators (WDI) database. Capital openness is from Chinn and Ito (2008) and varies approximately between -2 and 2 (higher values indicate greater openness). The exchange rate regime is computed based on Ilzetzki et al. (2019)'s classification. We construct a dummy equal to 1 if country i is classified as having a fixed exchange rate regime in the year t, and to 0 otherwise. The real effective exchange rate variable is from Darvas (2012), 2007 is the reference year with a base of 100. Public investment is proxied by government gross fixed capital formation (as a percentage of GDP) and is from the IMF's Investment and Capital Stock dataset. IMF programmes are captured by a dummy variable equal to 1 if a country i has benefited from any type of IMF-supported programme in the year t, and to 0 otherwise. The variable is from Dreher (2006b). The V-Dem property rights index ranges between 0.1 and 0.9 in our sample, where higher values indicate better performance. The QOG index of political pressures and controls on the media index ranges between 2 and 40 in our sample, where 2 indicates better performance. The economic freedom/reform index can range from 0 to 100 and is from the Heritage Foundation. Following Furceri and Loungani (2018), we identify major reform episodes using a dummy equal to 1 when, for a given country at a given time, the annual change in the index exceeds the overall average annual change across all observations by two standard deviations, and 0 otherwise. Banking crises are captured by a dummy equal to 1 during times of crisis, and 0 otherwise, and are from Laeven and Valencia (2020).

Table 2: The effect of macroprudential policies on private domestic investment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
MPI	-1.430***	-2.071***	-3.104***	-1.327***	-1.494***	-1.600***	-1.397***	-1.701***	-1.560***	-1.407***	-1.499***	-1.526***	-1.384***	-1.675***	-1.462***	-1.416***	-1.025**	-1.410***	-1.597***
	(0.446)	(0.566)	(0.819)	(0.416)	(0.485)	(0.477)	(0.451)	(0.493)	(0.438)	(0.432)	(0.438)	(0.451)	(0.434)	(0.490)	(0.466)	(0.442)	(0.445)	(0.449)	(0.526)
Log. Employment	10.406***	11.298***	14.588***	11.861***	12.777***	11.006***	10.825***	9.604***	11.528***	10.329***	11.023***	10.778***	11.580***	9.825***	13.016***	10.446***	10.591***	10.316***	14.964***
	(2.248)	(2.593)	(3.547)	(2.257)	(2.294)	(2.402)	(2.342)	(2.441)	(2.335)	(2.213)	(2.322)	(2.247)	(2.252)	(2.399)	(2.268)	(2.259)	(2.097)	(2.248)	(2.509)
Trade globalisation	-0.007	-0.011	-0.026		-0.018	-0.012	-0.008	0.003	0.001	-0.006	-0.002	0.008	-0.012	0.003	-0.013	-0.006	-0.005	-0.006	0.027
	(0.017)	(0.018)	(0.023)		(0.018)	(0.017)	(0.017)	(0.017)	(0.018)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.016)	(0.017)	(0.020)
Corruption control	0.515***	0.591***	0.457*	0.408**	0.387**	0.515***	0.434**	0.623***	0.508***	0.516***	0.189	0.534***	0.348*	0.604***	0.431**	0.516***	0.487***	0.517***	0.054
	(0.182)	(0.202)	(0.240)	(0.175)	(0.190)	(0.188)	(0.183)	(0.193)	(0.184)	(0.182)	(0.190)	(0.183)	(0.191)	(0.200)	(0.182)	(0.182)	(0.175)	(0.182)	(0.206)
Log. Government durability	-0.297***	-0.304**	-0.285*	-0.237**	-0.343***	-0.285**	-0.367***	-0.249**	-0.151	-0.298***	-0.181	-0.285***	-0.314***	-0.257**	-0.352***	-0.303***	-0.270**	-0.295***	-0.077
	(0.109)	(0.119)	(0.147)	(0.119)	(0.116)	(0.113)	(0.110)	(0.118)	(0.114)	(0.108)	(0.116)	(0.110)	(0.116)	(0.118)	(0.110)	(0.109)	(0.105)	(0.109)	(0.143)
Log. GDP per capita	5.970***	6.626***	8.006***	5.252***	5.967***	6.153***	5.971***	6.174***	5.170***	5.927***	7.579***	5.855***	6.254***	6.160***	5.933***	5.968***	5.800***	5.972***	6.916***
	(1.183)	(1.293)	(1.663)	(1.393)	(1.209)	(1.199)	(1.221)	(1.201)	(1.331)	(1.189)	(1.267)	(1.192)	(1.242)	(1.193)	(1.186)	(1.182)	(1.124)	(1.176)	(1.419)
Observations	1412	1412	1329	1316	1350	1398	1373	1330	1395	1412	1380	1412	1361	1330	1378	1412	1412	1412	1178
R-squared	0.785	0.752	0.681	0.793	0.783	0.777	0.783	0.782	0.780	0.786	0.791	0.783	0.787	0.783	0.785	0.786	0.802	0.786	0.806
Kleibergen-Paap LM stat (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Kleibergen-Paap F-stat	58.51	44.35	26.01	68.13	50.28	54.53	57.21	51.13	64.19	63.88	58.79	58.28	62.74	51.32	54.09	59.29	54.81	58.29	43.84

This table reports estimates of the effect of macroprudential policies on private domestic investment, using the instrumental variables (IV). The instrument (Contiguity) is the average macroprudential policy index in regional countries. Column [1] displays the main results. In Columns [2] and [3], we consider alternative specifications by lagging the instrumental variable by one and two years, respectively. In Column [4], instead of the KOF Globalisation Index used in the main model, we consider the trade openness variable from the World Bank's WDI database, measured as the sum of exports and imports as a percentage of GDP. Columns [5]-[18] include the following additional controls independently, and the last column considers them in the same regression: capital openness, log. terms of trade, inflation, exchange rate regime, real effective exchange rate, public investment, remittances, log. natural resources, property rights, political pressures and controls on media, IMF programmes, economic freedom/reforms, regional economic growth and regional banking crises. Regarding the new controls, we find that capital openness increases private domestic investment, while natural resources are negatively associated. Robust standard errors are in parentheses. All regressions include the constant, not reported in the table. * p < 0.1, ** p < 0.05, *** p < 0.01

Table 3: The effect of macroprudential policies on private domestic investment: first stage results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
Contiguity	0.851***			0.941***	0.803***	0.828***	0.852***	0.851***	0.893***	0.884***	0.859***	0.839***	0.893***	0.856***	0.821***	0.854***	0.859***	0.852***	0.861***
	(0.107)			(0.110)	(0.109)	(0.108)	(0.108)	(0.114)	(0.107)	(0.106)	(0.108)	(0.106)	(0.108)	(0.115)	(0.107)	(0.107)	(0.112)	(0.107)	(0.124)
Log. Employment	0.874	0.945	1.586**	0.664	0.989	0.961	0.958	0.508	0.492	0.772	0.871	0.918	0.853	0.367	1.175*	0.889	0.888	0.869	0.003
	(0.659)	(0.673)	(0.711)	(0.680)	(0.641)	(0.667)	(0.678)	(0.668)	(0.667)	(0.644)	(0.675)	(0.653)	(0.674)	(0.655)	(0.637)	(0.667)	(0.663)	(0.662)	(0.662)
Trade globalisation	-0.004	-0.006	-0.009**		-0.007*	-0.005	-0.003	-0.001	-0.006	-0.004	-0.003	-0.002	-0.002	-0.001	-0.006	-0.004	-0.004	-0.004	0.000
	(0.004)	(0.004)	(0.005)		(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
Corruption control	0.051	0.066	0.045	0.009	0.037	0.053	0.037	0.054	0.059	0.054	0.039	0.053	0.060	0.076*	0.041	0.052	0.051	0.051	0.052
	(0.042)	(0.043)	(0.045)	(0.044)	(0.044)	(0.043)	(0.042)	(0.041)	(0.041)	(0.041)	(0.043)	(0.042)	(0.045)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.046)
Log. Government durability	0.013	0.011	0.014	-0.044	0.012	0.015	0.001	0.028	-0.020	0.011	0.005	0.015	0.014	0.027	0.009	0.012	0.014	0.014	-0.031
	(0.034)	(0.034)	(0.035)	(0.038)	(0.036)	(0.035)	(0.035)	(0.037)	(0.036)	(0.034)	(0.037)	(0.034)	(0.037)	(0.036)	(0.035)	(0.035)	(0.035)	(0.034)	(0.045)
Log. GDP per capita	0.326	0.373	0.498*	0.765**	0.312	0.353	0.327	0.278	0.529*	0.262	0.424	0.304	0.332	0.278	0.333	0.327	0.326	0.327	0.550*
	(0.259)	(0.261)	(0.285)	(0.302)	(0.262)	(0.259)	(0.267)	(0.263)	(0.276)	(0.264)	(0.271)	(0.259)	(0.271)	(0.262)	(0.260)	(0.259)	(0.259)	(0.259)	(0.300)
t-1 Contiguity		0.768***																	
		(0.111)																	
t-2 Contiguity			0.624***																
			(0.117)																
Observations	1412	1412	1329	1316	1350	1398	1373	1330	1395	1412	1380	1412	1361	1330	1378	1412	1412	1412	1178
R-squared	0.870	0.868	0.870	0.872	0.875	0.870	0.868	0.879	0.872	0.872	0.873	0.871	0.871	0.880	0.874	0.870	0.870	0.870	0.890

This table reports the results of the first stage IV estimation of Table 2. Robust standard errors are in parentheses. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5.2 Alternative subsamples and measures

Next, we explore the sensitivity of our main results using alternative subsamples. We start by re-estimating our baseline specification, excluding hyperinflation periods, defined in Lin and Ye (2009) as country-year observations with inflation rates of 40% or more.[9] The underlying intuition is that, since such high inflation rates would reflect significant economic imbalances, this could affect private sector investment independently of macroprudential policies. Along the same lines, we exclude from the sample the years 2008–2009, given the economic imbalances resulting from the global financial crisis. Third, our sample includes 14 fragile states, classified by the IMF as countries with strong economic, institutional and structural vulnerabilities hindering their economic development. Given that these cases exhibit significantly different characteristics from the rest of the sample, it is worth considering whether their inclusion in the study affects the main results. Hence, for robustness, we exclude them from the main sample. Fourth, we explore the sensitivity of our results to outliers, by excluding country-year observations with values above the 95th percentile of the sample, for the variable of interest and the dependent variable respectively. Fifth, we re-estimate the baseline model using exclusively countries that have implemented at least one macroprudential instrument during the study period. In other words, we exclude from the main sample the eight countries for which the macroprudential policy index is zero over the entire study period thus focusing solely on within-country variation.[10] In all cases (Columns [1]-[6] of Table A1 in the appendix), the results are very similar to our baseline results, indicating that outliers or specific subsamples do not drive our results. Furthermore, the Kleibergen-Paap F-statistics and the results of the first-stage equation support the relevance and the instrument in all cases.

In Column [7] of Table A1, we further consider an alternative measure of the instrumental variable, weighting the instrumental variable by annual GDP to assign greater influence to regional neighbours with larger economic size. Next, the macroprudential policy data used so far is drawn from the Cerutti et al. (2017) database, which covers 162 advanced and developing countries from 2000 to 2017. The integrated Macroprudential Policy (iMaPP) database, published by the International Monetary Fund (Alam et al., 2019), also provides a summary measure of macroprudential actions for a panel of 135 countries over 1990–2021. The main advantage of the Cerutti et al. index is that it covers a larger sample of countries, enabling greater international comparability, albeit over a relatively shorter period than the IMF database. The iMaPP dataset includes 17 main categories of macroprudential tools, classifying them into no action (0), tightening (+1), or loosening (-1). Based on this database, we conduct additional robustness checks (Table A1), considering the iMaPP dataset. In Column [8], we use the sum of the 17 instruments. In Column [9], we follow Sever and Yücel (2022) and compute tightening episodes through a dummy variable equal to 1 if the number of tightening episodes across months is greater than the number of easing episodes in a given year, and 0 otherwise. In both cases, the coefficient of the variable of interest is negative and significant, although the magnitude of the coefficient increases slightly compared to that of the main model.

In Appendix A, we perform additional robustness tests, based on the two-step System-GMM method and using variables aggregated into non-overlapping three-year average to reduce stationarity issues, respectively. The results remain stable.

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9   The results remain robust when considering alternative thresholds, such as inflation rates above 50%, 70%, 90%, or 100%. These results are not reported but are available on request.

10   These countries include: Burkina Faso, Guyana, Madagascar, Mali, Niger, Senegal, Togo, and Venezuela.

6   Heterogeneity

This section conducts a series of heterogeneity analyses, first distinguishing the effect of macro-prudential policies between borrower-targeted and financial-institution-targeted instruments.[11] We could expect a higher impact of policies targeting borrowers on investment, as they have the most restrictive effects on credit and financial inclusion (see our discussion in Section 2). However, as highlighted by Cerutti et al. (2017), even tools targeted at financial institutions tend to lower credit growth, notably in emerging and developing markets – driven by tools such as dynamic provisioning, leverage ratios, counter-cyclical requirements, tax measures, inter-connection and concentration limits. Indeed, although these instruments target financial institutions to mitigate systemic risk, they largely influence intermediary tools to regulate credit. Along the same lines, using data on 900,000 firms from 48 countries from 2003–2011, Ayyagari et al. (2018) find that young firms have lower investment and sales growth after implementation of both borrower-targeted and financial institution-targeted policies. The results reported in Columns [1] and [2] of Table 4 show that both instruments targeting borrowers and financial institutions significantly reduce investment, almost to roughly the same scale.

Next, we examine the role of several macroeconomic, institutional, and structural factors. More precisely, we consider our main model (Equation 1) and augment it with several interactive terms. First, we interact the macroprudential policy index with the business cycle, approximated by annual GDP growth and the output gap, respectively.[12] Since credit tightening can be more pronounced during economic downturns (Lown & Morgan, 2006), one may expect the negative effect of macroprudential policies on investment to be less pronounced during the expansion phase of the business cycle. The results reported in Columns [3] and [4] seem to confirm our hypothesis. Second, we consider financial and monetary factors, namely: the level of financial development (proxied by domestic credit to the private sector), financial openness and the exchange rate regime.[13] The potential effect of macroprudential policies on private sector investment with regard to the level of financial development is not so clear-cut. As greater financial development comes with greater economic development, and probably with better institutional frameworks, it can be argued that financially more developed countries are more likely to strengthen their macroprudential policies effectively. On the other hand, following the perspective of Cerutti et al. (2017) perspective, we can consider that a more developed financial system also implies greater sophistication, making the application of macroprudential policies more complex, which can weaken their effectiveness. Regarding financial openness, we can expect borrowers in more open economies to successfully circumvent macroprudential policies, by finding ways to access other sources of financing, such as non-bank or cross-border banking activities. In this case, the effect of macroprudential policies on private sector investment would be more limited, given the potential substitution between domestic credit and other sources of financing. Regarding the exchange rate regime, Cerutti et al. (2017) note that it is more

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11 Borrower-targeted instruments include loan-to-value ratios and debt-to-income ratios. Financial-institution-targeted instruments include dynamic loan-loss provisioning; countercyclical capital buffer requirement; leverage ratio; capital surcharges on systemically important financial institutions; limits on interbank exposures; concentration limits; limits on foreign currency loans; reserve requirement ratios, limits of domestic currency loans; and levy/tax on financial institutions.

12 We compute the output gap by extracting potential output from observed real GDP, using the Hodrick–Prescott filter.

13 We have also considered potential heterogeneity with regard to the central bank interest rate, since monetary policy decisions have significant demand effects as well. The interactive term does not suggest any heterogeneity between macroprudential policies and the central bank interest rate. However, these results should be interpreted with caution, as monetary policy decisions may themselves be strongly endogenous to macroprudential policies (see Kim & Mehrotra, 2018 for a comprehensive discussion).

challenging for economies to control overall credit in more flexible exchange rate regimes, particularly given the impact of exchange rate appreciations or depreciation on capital movements. This suggests that the effect of macroprudential policies may be more limited in flexible exchange rate regimes. The results reported in Columns [5]-[7] reveal that the negative effect of macroprudential policies on investment is less pronounced in countries with more developed financial systems and flexible exchange rate regimes. However, no heterogeneity seems to emerge with regard to financial openness. Third, Column [8] examines potential heterogeneity in macroprudential policies according to the size of the informal sector, with the idea that policies targeting borrowers could lead them to shift towards informal financial services as an alternative form of financing.[14] The results seem to corroborate this hypothesis. In Columns [9]-[11], we cross the macroprudential policy index with per capita income – using a dummy variable based on deviations from the sample mean – and the quality of institutions – proxied by corruption control and the level of democracy, respectively. We find strong evidence that the adverse effect of macroprudential policies on investment is mitigated in economically and institutionally more developed countries. These results can be aligned with our findings and discussion on the degree of financial development. In the last column, we differentiate the effect based on the periods before and after the 2008–2009 global financial crisis, in the idea that the impact of macroprudential policies may have been more pronounced after the crisis, as these policies were significantly intensified during that time. However, one may equally expect the effect to be less pronounced after the crisis, as the post-crisis intensification of macroprudential policies may also be associated with greater complexity in the application of macroprudential tools and the financial environment, thus hindering the effective and rigorous implementation of these tools. The results appear to align with the second hypothesis, indicating a diminished impact of macroprudential policies in the post-crisis period. Finally, Table A4 (in the appendix), which reports the results of the first-stage equation, does not invalidate the relevance of the instrument, regardless of the heterogeneity analysed.

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14 The informal sectoral is from the World Bank's Prospects Group (Elgin et al., 2021) which measures the informal economic activity using Multiple Indicators Multiple Causes (MIMIC) model-based estimates of informal output.

Table 4: The effect of macroprudential policies on private domestic investment: heterogeneity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Borrower-Targeted Instruments	-1.464**											
	(0.695)											
Financial Institution-Targeted Instruments		-1.977***										
		(0.654)										
MPI			-1.406***	-1.750***	-3.246***	-1.495***	-4.554***	-2.610***	-2.813***	-3.235***	-6.271***	-2.599***
			(0.434)	(0.544)	(1.048)	(0.471)	(1.518)	(0.778)	(0.833)	(1.204)	(2.232)	(0.837)
MPI x Annual GDP growth			0.065***									
			(0.018)									
MPI x Output gap				0.661***								
				(0.184)								
MPI x Financial development					0.032***							
					(0.009)							
MPI x Capital openness						-0.002						
						(0.076)						
MPI x Exchange rate regime							0.397***					
							(0.137)					
MPI x Informal sector								0.060***				
								(0.019)				
MPI x High income									1.883***			
									(0.521)			
MPI x Democracy										0.557**		
										(0.221)		
MPI x Corruption control											2.167***	
											(0.777)	
MPI x Post 2008-09 crisis												1.018***
												(0.344)
Observations	1412	1412	1412	1412	1222	1350	1330	1373	1412	1412	1412	1412
R-squared	0.811	0.774	0.796	0.785	0.782	0.783	0.726	0.778	0.752	0.747	0.697	0.745
Kleibergen-Paap LM stat (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Kleibergen-Paap F-stat	123.55	44.67	67.46	49.39	18.40	53.55	26.07	69.23	28.51	26.90	15.29	27.99

Notes: In Columns [3]-[11] vector X variables in isolation (without interaction with macroprudential policies) and controls are included but not reported for the sake of space. Robust standard errors are in parentheses. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

7   Mechanisms

So far, we have mainly supported our potential transmission channels through theoretical discussions. In this section, we attempt to examine them empirically, drawing on existing work and the literature dealing with causal mediation analysis (for instance, see Acemoglu et al., 2019; Apeti & Edoh, 2023; Bambe, 2023; Bambe et al., 2024; Imai et al., 2010). First, we estimate the effect of macroprudential policies on the potential channel, accounting for key potential determinants of the channel. The findings from the first three columns of Table 5 indicate that macroprudential policies significantly reduce credit growth, financial inclusion and the probability of banking crises, highlighting the importance of these factors as potential trans-mission channels.[15] Second, in columns [4]-[6] we re-estimate the effect of macroprudential policies on private domestic investment (Equation 1), including the potential channel among the vector of controls. The results in Column [4] are particularly noteworthy: when credit growth is included, the effect of macroprudential policies diminishes and becomes statistically insignificant. Moreover, the coefficient for credit growth is positive and significant, indicating that the latter is a key transmission channel. In Column [5], accounting for financial inclusion slightly reduces the effect of macroprudential policies compared to the coefficient of the baseline model (Table 2, Column [1]). Still, the coefficient of the financial inclusion index is positive and significant, suggesting that the latter is also an important channel. In the last column, although the results indicate that banking crises reduce investment, the inclusion of this variable does not significantly alter the coefficient of macroprudential policies, whose effect remains close to that of the baseline model. In other words, while financial stability – particularly banking crises – may be a channel through which macroprudential policies can promote domestic investment, the negative effect of these policies on investment, via the reduction in credit supply and financial inclusion, appears to outweigh their potentially beneficial impact via financial stability. In short, these results seem to support our theoretical hypotheses, providing evidence that the reduction in credit supply and financial inclusion resulting from macroprudential policies are relevant channels through which these policies affect private sector investment in developing countries – though credit growth seems to be the most dominant channel.

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15 We follow previous studies (e.g. see Bozkurt et al., 2018; Ozili, 2022) and compute a composite index to capture financial inclusion. We consider two dimensions of financial inclusion, using data from the Financial Access Survey (IMF). The access dimension includes the number of commercial bank branches per 100,000 adults and the number of deposit accounts with commercial banks per 1,000 adults. The usage dimension includes outstanding loans from commercial banks (percent of GDP). We further consider the availability dimension, including the number of ATMs per 1,000 km2 and 100,000 adults. The index is computed following Anderson (2008), i.e., using generalised least squares estimators that account for variables with missing data, giving them less weight. Since the determinants of the channels considered may differ from those of private investment, in Columns [1] and [2] (Table 5) we draw on the literature on the determinants of financial inclusion (for instance, see Bozkurt et al., 2018) and consider the following control variables: per capita GDP, the level of education, the quality of institutions (proxied by government durability), the employment rate, the size of the informal sector, and financial sector reforms. In Column [3], we consider the following determi-nants of banking crises: inflation, lagged GDP growth, financial development, trade and financial globalisation.

Table 5: Macroprudential policies and private domestic investment: channels

	(1) Credit growth	(2) Financial inclusion	(3) Banking crises	(4) Investment	(5) Investment	(6) Investment
MPI	-5.732**	-0.130*	-0.032*	-0.342	-0.965**	-1.380***
	(2.646)	(0.067)	(0.019)	(0.409)	(0.478)	(0.437)
Credit growth				0.012***		
				(0.005)		
Financial inclusion					0.071***	
					(0.015)	
Banking crises						-1.047***
						(0.351)
Observations	821	785	1234	1194	1145	1412
R-squared	0.111	0.704	0.332	0.826	0.820	0.788
Kleibergen-Paap LM stat (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
Kleibergen-Paap F-stat	31.66	21.19	62.84	54.29	48.89	61.26

Notes: In Columns [1] and [2], we consider the following determinants of financial inclusion: per capita GDP, the level of education, the quality of institutions (proxied by government durability), the employment rate, the size of the informal sector, and financial sector reforms. In Column [3], we consider the following determinants of banking crises: inflation, lagged GDP growth, financial development, trade and financial globalisation. Robust standard errors are in parentheses. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

8 Conclusions and policy recommendations

The study examines the effect of macroprudential policies on private domestic investment, using a panel of 87 developing countries from 2000 to 2017. The empirical strategy exploits regional macroprudential policies as an exogenous source of variation in strengthening domestic macro-prudential policies. The results indicate negative and significant effects of macroprudential policies on domestic investment. A series of robustness tests do not alter our main findings. The negative effect of macroprudential policies on private investment holds for both policies targeting borrowers and those targeting financial institutions, and the effect is less pronounced during business cycle expansions, the period following the 2008-2009 global financial, and in flexible exchange rate regimes. Furthermore, we find that the adverse effect of macroprudential policies on private domestic investment decreases with the size of the informal sector, financial system development, per capita income, and institutional quality. A decline in credit supply and financial inclusion resulting from macroprudential policies mainly drives this negative impact.

Although macroprudential policies can provide substantial benefits in promoting financial stability and reducing systemic risk, our results show that they can equally trigger significant adverse effects on the real sector, especially private domestic investment. Our findings, therefore, align with previous work highlighting the negative effects of macroprudential policies on economic growth or financial inclusion (e.g. see Deléchat et al., 2021; Galán, 2020; Kim & Mehrotra, 2018; Ma, 2020; Madeira, 2024) – alongside extensive literature focusing on their benefits in curbing credit growth and mitigating financial risks. Our results have important policy implications. Macroprudential instruments remain highly desirable for promoting financial

stability, as crises and instabilities themselves result in strong adverse effects on economic performance. However, it is important to consider their potential to exacerbate challenges for the private sector, particularly in developing countries, where many firms already face significant financing constraints. That said, it is crucial to consider each country's specificities when designing and implementing these policies (see Shin, 2013 for a comprehensive discussion on adapting macroprudential policies in developing countries). More specifically, macroprudential policies could target high-risk lending sectors, while applying special treatment to the most financially constrained or strategic sectors, such as SMEs. More generally, policies promoting greater financial inclusion and access to finance, particularly for SMEs, remain essential to achieving the SDGs. Policymakers in developing countries should, therefore, promote greater financial inclusion and resilience among investors and SMEs. This entails, among other measures, diversifying sources of finance for enterprises – for instance, through local capital markets, participatory financing platforms, microfinance institutions, and reforms to enhance the attractiveness of private investors.

It is also worth noting that, beyond access to finance, the private sector in developing countries faces numerous other challenges that hinder firms' growth and the implementation of projects with potential significant socio-economic benefits. Consequently, decision-makers should also tackle these bottlenecks by fostering good governance and sound regulatory frameworks, ensuring socio-economic stability, improving infrastructure quality, enhancing levels of human capital, etc. Last but not least, it is equally important to ensure better coordination between macroprudential, fiscal and monetary policies to limit endogenous shocks and mitigate their potentially asymmetric effects on economic performance.

Finally, while this paper focuses on macro data, we believe that further work exploring the impact of macroprudential policies at more disaggregated levels, such as the firm level, represents a promising avenue for future research.

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Appendix A: Further robustness

GMM estimates

Without valid external instruments, the literature sometimes relies on alternative econometric strategies, such as the Generalised Method of Moments (GMM), to mitigate endogeneity issues. In addition to correcting for endogeneity bias using internal instruments, the GMM method also allows correcting for Nickell bias (Nickell, 1981), which is common in dynamic panel models. Therefore, for robustness, we rely on the two-step System-GMM method of Blundell and Bond (1998) which combines lagged differences and levels of explanatory variables as instruments, thus improving estimation efficiency. The GMM estimates are reported in Column [1] of Table A3. The new coefficient of the variable of interest remains comparable to that obtained from the main model, supporting our main conclusions.

Three-year window

The stationarity of our variables is an important consideration, as it plays a key role in ensuring the reliability of our results. Hence, to address potential stationarity issues, we draw on previous studies (e.g. see De Haan & Sturm, 2017 and Apeti et al., 2025) and re-estimate our baseline model using variables aggregated into non-overlapping three-year averages. The results are reported in the last column of Table A3 and align with our initial conclusions. Furthermore, the magnitude of the new coefficients is highly consistent with those of the main model, indicating that non-stationarity is unlikely to introduce bias into our main estimates. The results of the first-stage equation (not reported, but available on request) also support the validity of the instrumental variable.

Table A1: Macroprudential policies (MPI) and private domestic investment: alternative subsamples and measures

	(1) invest	(2) invest	(3) invest	(4) invest	(5) invest	(6) invest	(7) invest	(8) invest	(9) invest
MPI	-1.535***	-1.467***	-1.576***	-2.477***	-2.019***	-1.378***	-0.918*		
	(0.464)	(0.437)	(0.473)	(0.622)	(0.563)	(0.509)	(0.540)		
Log. Employment	11.057***	12.354***	9.816***	11.915***	10.978***	11.315***	9.693***	8.753***	10.129***
	(2.455)	(2.524)	(2.348)	(2.689)	(2.254)	(2.317)	(2.154)	(2.027)	(2.216)
Trade globalisation	-0.016	-0.005	-0.016	0.003	0.003	-0.011	-0.003	-0.003	0.001
	(0.017)	(0.019)	(0.017)	(0.018)	(0.017)	(0.018)	(0.016)	(0.019)	(0.019)
Corruption control	0.398**	0.368*	0.718***	0.631***	0.689***	0.505**	0.454***	0.375**	0.325
	(0.187)	(0.208)	(0.198)	(0.193)	(0.188)	(0.196)	(0.174)	(0.189)	(0.202)
Log. Government durability	-0.305***	-0.253*	-0.306***	-0.127	-0.265**	-0.240**	-0.290***	-0.076	-0.082
	(0.110)	(0.135)	(0.113)	(0.127)	(0.115)	(0.117)	(0.103)	(0.110)	(0.112)
Log. GDP per capita	6.077***	4.942***	5.744***	5.986***	3.405***	6.022***	5.446***	2.343**	2.197**
	(1.267)	(1.429)	(1.211)	(1.088)	(1.031)	(1.202)	(1.131)	(1.101)	(1.106)
MPI (Alam et al., 2019)								-5.760*	
								(3.409)	
MPI Tightening									-3.045***
									(0.845)
Observations	1356	1181	1244	1367	1357	1293	1412	1174	1174
R-squared	0.778	0.764	0.775	0.753	0.757	0.781	0.803	0.805	0.781
Kleibergen-Paap LM stat (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Kleibergen-Paap F-stat	54.99	61.32	53.10	35.95	36.76	45.24	35.38	31.57	89.80

This table reports estimates of the effect of macroprudential policies (MPI) on private domestic investment, using alternative subsamples and measures. In all cases, the instrumental variables (IV) is the average macroprudential policy index in regional countries. In Columns [1]-[3] we re-estimate our baseline specification, excluding hyperinflation periods; fragile states; and the 2008–2009 global final crisis, respectively. Columns [4] and [5] exclude outliers, i.e., country-year observations with values above the 95th percentile of the sample, for the variable of interest and the dependent variable respectively. Column [6] uses exclusively countries that have implemented at least one macroprudential instrument during the study period. In Column [7], we weight the instrumental variable by annual GDP to assign greater influence to regional neighbours with larger economic size. Column [8] considers the sum of the 17 macroprudential tools from the integrated Macroprudential Policy (iMaPP) database (Alam et al., 2019). Column [9] uses tightening episodes through a dummy variable equal to 1 if the number of tightening episodes across months is greater than the number of easing episodes in a given year, and 0 otherwise. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A2: Alternative subsamples and measures: first stage results

	(1)	(2)	(3)	(4)	(5) pi	(6)	(7)	(8)	(9)
Contiguity	0.842***	0.910***	0.833***	0.629***	0.646***	0.754***			
	(0.109)	(0.112)	(0.109)	(0.101)	(0.102)	(0.108)			
Log. Employment	1.168*	0.794	0.837	1.113*	0.978	0.217	0.934	-0.021	0.542*
	(0.685)	(0.734)	(0.682)	(0.648)	(0.622)	(0.696)	(0.672)	(0.065)	(0.289)
Trade globalisation	-0.004	-0.007	-0.005	-0.003	-0.002	-0.004	-0.003	0.001	0.003
	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)	(0.001)	(0.002)
Corruption control	0.029	0.026	0.095**	0.062	0.078*	0.017	0.061	-0.004	-0.030
	(0.042)	(0.051)	(0.043)	(0.040)	(0.042)	(0.046)	(0.042)	(0.007)	(0.027)
Log. Government durability	0.006	-0.066	0.025	0.073**	0.063**	-0.005	-0.001	-0.006**	-0.014
	(0.034)	(0.044)	(0.036)	(0.029)	(0.029)	(0.038)	(0.033)	(0.003)	(0.013)
Log. GDP per capita	0.395	0.411	0.316	0.233	-0.135	0.179	0.727***	0.013	0.006
	(0.270)	(0.301)	(0.268)	(0.214)	(0.226)	(0.267)	(0.259)	(0.024)	(0.098)
Weighted contiguity							0.482***		
							(0.078)		
Contiguity (Alam et al., 2019)								1.059***	
								(0.181)	
Contiguity MPI Tightening									1.023***
									(0.104)
Observations	1356	1181	1244	1367	1357	1293	1412	1174	1174
R-squared	0.870	0.865	0.865	0.848	0.881	0.859	0.866	0.598	0.586

This table reports the results of the first stage IV estimation of Table A1. Robust standard errors are in parentheses. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A3: Macroprudential policies and private domestic investment: System-GMM and IV-three-year window estimates

	(1) System-GMM	(2) IV-three-year window
Lag. Investment	0.676**	
	(0.135)	
MPI	-1.097*	-1.744**
	(0.606)	(0.823)
Log. Employment	23.781*	8.877**
	(12.998)	(4.015)
Trade globalisation	-0.143	-0.016
	(0.093)	(0.027)
Corruption control	0.030	1.112**
	(0.751)	(0.362)
Log. Government durability	-0.836	-0.395**
	(1.221)	(0.201)
Log. GDP per capita	7.381**	5.294**
	(3.113)	(1.876)
Observations	1412	499
R-squared		0.8018

The AR (1), AR(2), and Hansen test p-values reported in Column [1] are respectively 0.002, 0.794, and 0.730. We report 84 groups for 42 instruments in the first column. In Column [2], we use variables aggregated into non-overlapping three-year averages, to reduce stationarity issues. Robust standard errors are in parentheses. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A4: Heterogeneity: first stage results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Contiguity	0.920***											
	(0.080)											
Log. Employment	0.245	0.599	0.837	0.608	1.024*	0.382	0.887**	0.980***	-1.104***	0.215	-1.197***	-0.663
	(0.275)	(0.500)	(0.597)	(0.611)	(0.572)	(0.566)	(0.430)	(0.306)	(0.408)	(0.409)	(0.240)	(0.544)
Trade globalisation	-0.003	-0.002	-0.004	-0.005	0.008*	-0.007*	0.001	-0.004*	-0.012***	-0.013***	-0.002	-0.006*
	(0.002)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)
Corruption control	0.027	0.021	0.038	0.052	0.060	0.033	0.059**	0.063***	0.030	-0.079***	-0.643***	-0.016
	(0.019)	(0.035)	(0.039)	(0.040)	(0.039)	(0.043)	(0.025)	(0.023)	(0.036)	(0.028)	(0.045)	(0.037)
Log. Government durability	0.005	0.010	0.026	0.043	0.031	0.008	0.040***	0.063***	-0.009	-0.036**	0.017	-0.028
	(0.015)	(0.025)	(0.030)	(0.030)	(0.027)	(0.038)	(0.014)	(0.014)	(0.027)	(0.018)	(0.014)	(0.025)
Log. GDP per capita	-0.125	0.432**	-0.184	0.163	-0.276	0.468*	-0.101	0.482*	0.430**	0.306	0.401***	0.239
	(0.098)	(0.200)	(0.235)	(0.234)	(0.190)	(0.246)	(0.168)	(0.247)	(0.180)	(0.186)	(0.103)	(0.180)
Contiguity		0.864***										
		(0.124)										
Contiguity			0.859***	0.701***	0.410***	0.829***	0.301***	0.473***	0.475***	0.352***	0.212***	0.468***
			(0.101)	(0.096)	(0.091)	(0.109)	(0.057)	(0.055)	(0.085)	(0.065)	(0.052)	(0.085)
Observations	1412	1412	1412	1412	1222	1350	1330	1373	1412	1412	1412	1412
R-squared	0.785	0.869	0.887	0.894	0.941	0.877	0.964	0.970	0.918	0.953	0.970	0.911

This table reports the results of the first stage IV estimation of Table 4. In Columns [3]-[12] vector X variables in isolation (without interaction with macroprudential policies) and the interactive terms with macroprudential polices are not reported for the sake of space. Robust standard errors are in parentheses. All regressions include the constant, not reported in the table. * p < 0.1, ** p < 0.05, *** p < 0.01

Appendix B: Sample and descriptive statistics

Table B1: Summary statistics of the baseline model variables

Variables	Obs.	Mean	Sd.	Min.	Max.
MPI	1,566	2.044	1.869	0	10
Private domestic investment	1,555	13.003	6.083	0.036	33.490
Log. Employment	1,566	4.035	0.199	3.427	4.453
Trade globalisation	1,566	49.849	15.471	15.934	85.464
Corruption control	1,560	2.171	0.733	0.5	5
Log. Government durability	1,524	2.429	1.125	0	4.595
Log. GDP per capita	1,548	9.058	1.035	6.588	11.453

Table B2: Sample

Country	Average MPI	Country	Average MPI	Country	Average MPI
Albania	1.28	Jordan	2.83	Turkey	3.94
Algeria	1.94	Kazakhstan	1.44	Uganda	2.33
Angola	1	Kenya	0.61	Ukraine	2.89
Argentina	4.78	Kuwait	5.11	Uruguay	1.89
Armenia	3	Lebanon	3.83	Venezuela, RB	0
Azerbaijan	2.39	Liberia	1.67	Vietnam	1.83
Bahamas, The	2.56	Madagascar	0	Zambia	1
Bahrain	3	Malawi	1.78		
Bangladesh	3.78	Malaysia	2		
Belarus	1.5	Mali	0		
Bolivia	2.61	Mexico	2.33		
Botswana	1.11	Moldova	2.56		
Brazil	4.28	Mongolia	2.89		
Brunei Darussalam	1.94	Morocco	3		
Bulgaria	2.39	Mozambique	2.94		
Burkina Faso	0	Myanmar	0.11		
Chile	6.5	Namibia	1.44		
China	4.83	Nicaragua	0.11		
Colombia	6.61	Niger	0		
Congo, Dem Rep	1.67	Nigeria	1.17		
Costa Rica	3	Oman	1.56		
Cote d'Ivoire	0.28	Pakistan	7.5		
Croatia	2	Panama	1.33		
Dominican Republic	2.17	Paraguay	3.89		
Ecuador	5.11	Peru	4.28		
Egypt, Arab Rep	0.22	Philippines	2.61		
El Salvador	1	Poland	1.89		
Ethiopia	0.39	Romania	3.28		
Gambia, The	1.78	Russian Federation	1.28		
Ghana	2	Saudi Arabia	2.22		
Guatemala	0.28	Senegal	0		
Guinea-Bissau	0.06	Serbia	3.11		
Guyana	0	Sierra Leone	0.67		
Haiti	2.5	South Africa	0.94		
Honduras	1.11	Sri Lanka	1.22		
Hungary	1.78	Sudan	1.78		
India	2.17	Tanzania	1		
Indonesia	1.39	Thailand	1.78		
Iran, Islamic Rep	0.44	Togo	0		
Iraq	0.83	Tunisia	2.11		

Table B3: Sources of variables

Variables	Nature	Sources
1. Main model variables		
Macroprudential Policy Index	Scores ranging from 0 to 10	Cerutti et al. (2017)
Private domestic investment	Continuous	International Monetary Fund (IMF)'s Investment and Capital Stock database
Employment rate	Continuous	World Bank's World Development Indicators (WDI) database
Trade globalisation	Index ranging from 0 to 100	KOF index (Dreher, 2006a; Gygli et al., 2019)
Corruption control	Index ranging from 0 to 6	International Country Risk Guide (ICRG)
Government durability	Continuous	Polity IV
2. Additional variables		
Trade openness	Continuous	WDI
Terms of trade	Continuous	WDI
Capital openness	Index ranging from -2 to 2	Chinn and Ito (2008)
Inflation	Continuous	WDI
Remittances	Continuous	WDI
Exchange rate regime	Dummy	Authors, from Ilzetzki et al. (2019)
Real effective exchange rate	Continuous	Darvas (2012)
Public investment	Continuous	IMF's Investment and Capital Stock database
Natural resources	Continuous	WDI
Property rights	Index ranging from 0 to 1	V-DEM
Political Pressures and Controls on Media Content	Index ranging from 0 to 40	Quality of Government (Teorell et al., 2016)
IMF programmes	Dummy	Dreher (2006b)
Economic freedom	Index ranging from 0 to 100	The Heritage Foundation
Regional GDP growth	Continuous	Authors, from WDI
Borrower-Targeted Instruments	Scores ranging from 0 to 2	Cerutti et al. (2017)
Financial Institution-Targeted Instruments	Scores ranging from 0 to 8	Cerutti et al. (2017)
Output gap	Dummy	Authors, using real GDP from WDI
Financial openness	Index ranging approximately from -2 to 2	Chinn and Ito (2008)
Financial development	Continuous	WDI
Informal sector	Index ranging from 0 to 100	Elgin et al. (2021)
Democracy	Index ranging from 0 to 6	International Country Risk Guide (ICRG)
Credit growth	Continuous	Authors, using data from WDI
Financial inclusion	Index ranging from 0 to 100	Authors, using data from the Financial Access Survey (IMF)
Banking crises	Dummy	Laeven and Valencia (2020)