

# Macroprudential frameworks: implementation and effectiveness<sup>1</sup>

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## Abstract

We use questionnaire responses as well as new data sets to assess the deployment and effectiveness of macroprudential instruments for a sample of emerging market economies. First, we highlight the challenges that authorities face in the measurement of financial stability and systemic risk, the “ultimate objective” of macroprudential frameworks. We argue that these challenges naturally extend to measuring “macroprudential policy stance”. Second, we document the “inaction bias” for our sample of EM economies and highlight the limited use of numerous instruments that authorities have in their toolkits. Third, we discuss and provide some evidence that governance frameworks, especially the role of central banks, may be relevant for both implementation and outcomes. Fourth, we infer from questionnaires that macroprudential tools are commonly tailored for specific sectors (especially the property sector), regions and institutions. Finally, we provide some evidence that macroprudential measures, indeed, have an impact on a number of financial risk indicators.

Keywords: Macroprudential frameworks, financial stability

JEL classification: E61, E58

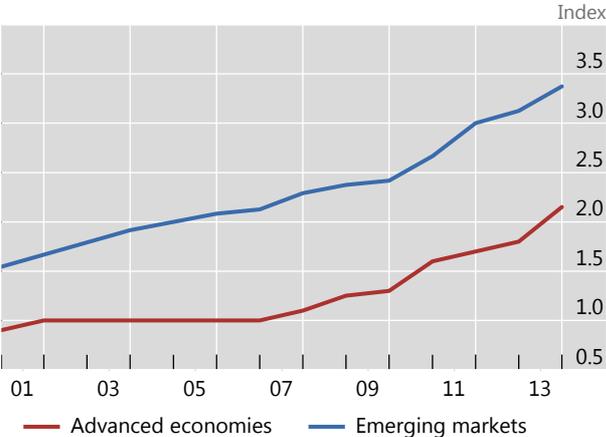
<sup>1</sup> The box is authored by Carlos Cantu. Matthias Lörch and Diego Urbina and provided excellent research assistance.

The macroprudential approach to financial regulation and supervision has been a topic of policy discussions since the start of this century.<sup>2</sup> But it took the Great Financial Crisis (GFC) to underline that a microprudential approach, even when combined with stable output and inflation, will not suffice to ensure financial stability. As a result, the use of macroprudential instruments has become more widespread, in advanced economies (AEs) as well as emerging market economies (EMEs). To be sure, many EMEs had already been using macroprudential instruments, even if not so identified, probably owing to their previous experience with financial crises (Graph 1, left-hand panel). That said, such instruments have been used more extensively post-crisis in both AEs and EMEs (Graph 1, right-hand panel).

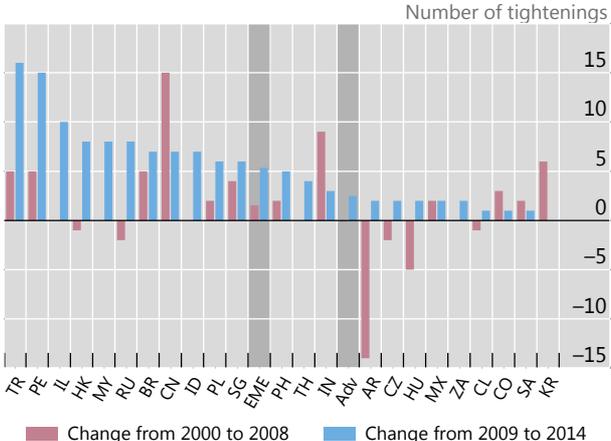
Trends in macroprudential instrument deployment

Graph 1

The number of instruments has been increasing



Macroprudential instruments have been tightened more after the GFC



The left-hand panel plots an index of macroprudential instruments. The index is a cumulative measure of 12 instruments. Each instrument takes value 1 if it is utilised in a country and takes value 0 otherwise. The right-hand panel plots the changes in “cum\_PruC2” developed in Cerutti et al (2017). It is a cumulative measure of nine macroprudential instruments. Each instrument takes value 1 if tightened, -1 if loosened and 0 if there is no change. See Cerutti et al (2017) for details. AE = United Arab Emirates; AR = Argentina; BR = Brazil; CL = Chile; CN = China; CO = Colombia; CZ = the Czech Republic; HK = Hong Kong SAR; HU = Hungary; ID = Indonesia; IL=Israel; IN = India; KR = Korea; MX = Mexico; MY = Malaysia; PE = Peru; PH = the Philippines; PL = Poland; RU = Russia; SA = Saudi Arabia; SG = Singapore; TH = Thailand; TR = Turkey; ZA = South Africa. Shaded areas in the right-hand panel are the averages for EMEs and AEs.

Sources: Cerutti et al (2016) and Cerutti et al (2017).

While some efforts have been made to analyse the use of macroprudential tools, our understanding of how they operate is still rather limited. This note will use questionnaire responses as well as new data sets to assess their deployment and effectiveness.<sup>3</sup>

<sup>2</sup> See Crockett (2000) and Borio (2003) for early examples.  
<sup>3</sup> The note uses macroprudential databases developed and analysed in Cerutti et al (2016), Cerutti et al (2017) and Reinhardt and Sowerbutts (2016).

## Deployment

### Measurement

Although macroprudential frameworks are intended to bolster financial stability and mitigate systemic risk, there is no reliable direct method for measuring how far these objectives are met (see Villar (2017) for a discussion of macroprudential objectives). Even more challenging is to measure the likelihood and cost of financial distress with a sufficient lead and confidence to be able to take preventive action. At the same time, ex post measurement can at least help ensure the accountability of the responsible authorities (Borio and Drehmann (2010)).

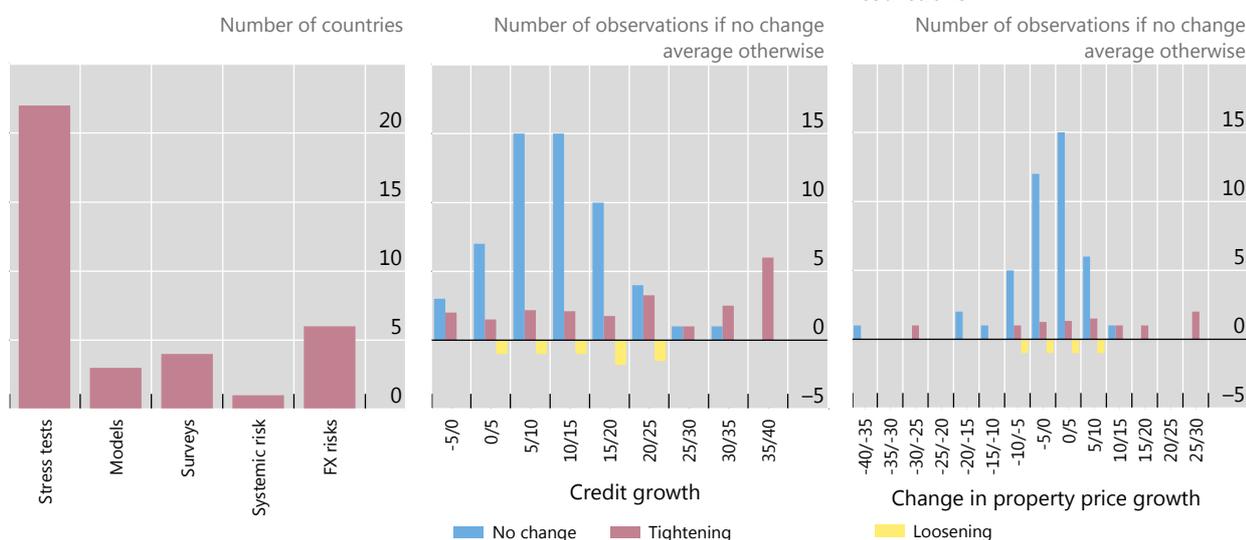
Risk measures and macroprudential instrument deployment

Graph 2

How do countries measure vulnerabilities?

Total credit growth (lagged) and changes in the cumulative measure

Changes in property price growth (lagged) and changes in LTV restrictions



The left-hand panel is constructed from the questionnaire responses by counting the countries that mention specific measures of vulnerability (see Table 1 Appendices). The total credit growth is the change in credit stock between two years (in percentage points). The change in property price growth is the change between the year-on-year growth rates from two subsequent years (in percentage points). In the centre and right-hand panels, blue bars show the number of inactive periods while red bars show average change in the cumulative measure conditional on tightening, and yellow bars show average loosening in the cumulative measure conditional on loosening.

Source: Author's calculations based on data from Cerutti et al (2017), national sources and questionnaire responses.

The questionnaire responses reveal that all jurisdictions use contemporaneous financial variables as proxies for systemic risk (Graph 2 left-hand panel and Appendix Table A1). Indeed, except for Thailand, no country monitors a direct measure of systemic risk, citing the lack of a reliable indicator. Only two countries explicitly mention that they use early warning indicators to gauge financial risks. Most jurisdictions follow various measures of credit, house prices and bank balance sheets (eg capitalisation, profitability, maturity and currency mismatches). Several countries (eg Brazil and China) monitor the financial health of borrowers using detailed firm- or consumer-level data. Russia and China monitor the riskiness of non-banks as well. The HKMA uses housing price and asset-pricing models as well as a statistical method

to assess overvaluation in the housing market. Most of the questionnaire respondents see the various measures as complementary.

Among many other indicators, stress tests stand out, as all countries either use or intend to use them as a systemic risk indicator. Stress tests may be particularly helpful, as they are forward-looking and various extreme scenarios can be consistently studied. However, stress tests too have some shortcomings, such as the difficulties in meaningfully modelling the dynamics of financial distress (Borio et al (2014)). This is underlined by the fact that macro stress tests carried out prior to the GFC did not point to any significant risk in the banking sector.

Measuring not only the objectives but also the “macroprudential policy stance” has proved challenging. Indeed, the survey responses indicate that no consensus exists about the definition of a “macroprudential policy stance”. On the one hand, it is possible to view such a stance as the values taken by macroprudential instruments, irrespective of current financial conditions (unconditional definition). In (conventional) monetary policy, this would correspond to the level of interest rates. But one can also define the stance as conditional on financial developments, ie how binding the instruments are at a given time (conditional definition). An analogue in monetary policy would be deviations from a neutral interest rate.

The lack of a consensus over the definition of a macroprudential policy stance also extends to the methods used to measure it. Of course, knowing whether and how intensively macroprudential instruments have been used gives some indication about the stance, but this information has significant limitations even under the first, unconditional, definition of what such a stance actually constitutes. Most importantly, it is difficult to aggregate different instruments with potentially very different effects on financial risks. An alternative measure falling squarely under the second, conditional, definition of the macroprudential stance involves tracking financial risks as a proxy. For example, Korea calibrates its macroprudential stance according to a systemic risk survey, while Hungary and South Africa use some indices of financial conditions for the same purpose. Finally, the majority of the countries mention that they do not measure the macroprudential stance at all.

### Infrequent instrument activation

Authorities not only track financial variables as proxies for systemic risk but may also use them as intermediate objectives for setting policy (see the notes by Malaysia, Russia and South Africa). All questionnaire respondents set intermediate objectives such as limiting credit growth, currency volatility or housing prices (Appendix Table A1). However, due to varying sources of financial stability risks, there is no fixed set of intermediate objectives for all jurisdictions and they may change along with the sources of financial risks.

But even if authorities use intermediary objectives, these do not mechanically feed into policy actions. For example, while most central banks say they track and aim to limit credit growth, they only rarely react to periods of high credit growth by tightening macroprudential measures. Similarly, only in a few cases have episodes of large house prices increases been followed by reductions in loan-to-value (LTV) caps, which survey participants identify as the most common response to excessive house

price growth.<sup>4</sup> However, authorities appear to become more active when credit or house price growth accelerates even further. Graph 2 also illustrates the prevalence of inactivity. Blue bars in the centre and right-hand panels represent the number of periods in which countries did not react when credit or house price growth was in a given interval. Inactivity is clearly by far the most common choice. Not surprisingly, inactivity lessens, and tightening becomes more likely (red bars) once credit or house prices start to grow more rapidly. A more formal analysis yields a similar result: regressing macroprudential policy changes on lagged changes in credit growth, and LTV caps on house price growth gives statistically significant results, but with low explanatory power. These findings underline the key role of judgment, as confirmed in the survey responses, but are also consistent with the existence of an inaction bias.

There are several possible reasons for an inaction bias. First, serious political economy constraints arise due to the fact that the costs of the measures are immediate and visible while the benefits are harder to identify, even *ex post*, and accrue over time (see ESRB (2014) and the note by Poland for further arguments). Second, any co-movement of the risk measure with some possible fundamental makes it very difficult to make a convincing case for costly action. Third, action may be delayed by the low frequency of the decision points. In their survey responses, many central banks mentioned that there is no fixed calendar for taking decisions. Many decision-making bodies meet twice a year or quarterly, although they can meet more frequently if required. Other than for the HKMA, the responses suggest that policy adjustments are very infrequent. That said, there may be less need to meet frequently and take decisions since systemic risk builds up slowly and the relevant horizon is longer than for monetary policy.

The tendency towards inaction may be asymmetrical. For example, political opposition towards tighter policy is often stronger than one for a more accommodative stance. This could bias policies aimed at managing the financial cycle, especially if policy decisions are not insulated from the political cycle. For measures primarily targeted at building resilience, the bias may go into the opposite direction, as easing buffers tends to be more difficult than building them up in the first place. The reason is that, in periods of distress, any easing measures, eg reducing the countercyclical capital buffer, could be seen as adding to systemic risk. Again, the nature and size of the bias could depend on who is in charge of setting policy. Supervisory authorities that attach a greater value to the stability of individual institutions may be more reluctant to cut buffers than a central bank that tends to take a more systemic perspective.

Inaction bias may be mitigated by a rule-based approach. However, shifting substantially in this direction, while very helpful in principle, would require both reliable indicators and a good understanding of the workings of the instruments (ESRB (2014)). It is unclear how much scope there is at present (Borio (2011)).

Most policymakers appear to have a wide array of macroprudential instruments at their disposal (see Villar (2017) and Tables A2 and A3 in the Appendix).<sup>5</sup> In theory, a broad range of tools should allow very targeted actions and thus help maintain

<sup>4</sup> There are several other instruments, such as PTI (interest rate plus principal payment) and DTI (debt-to-income), that authorities use to dampen house prices growth. However, they are used less frequently across countries and over time.

<sup>5</sup> Even if a particular tool is not in the policymaker's toolkit at a given point in time, this could easily be remedied.

financial stability. However, in practice, only a small subset of the available tools have been used in any given country. For example, only a handful of countries report deploying debt service-to-income ratios, liquidity requirements, credit growth limits or exposure limits (see also data by Shim et al (2013), Cerutti et al (2016, 2017), Reinhardt and Sowerbutts (2016)).

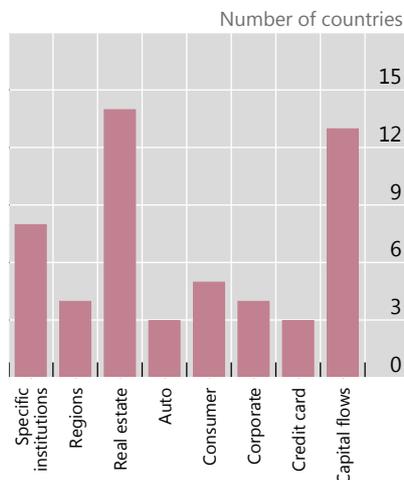
A possible reason could be practical problems posed by using multiple tools. These would make calibration even harder, given the sizeable uncertainty regarding the effects of single instruments and, above all, the interaction of different tools. And the use of multiple tools may further complicate communication (Patel (2017)).

### Targeting specific sectors, regions, institutions and capital flows

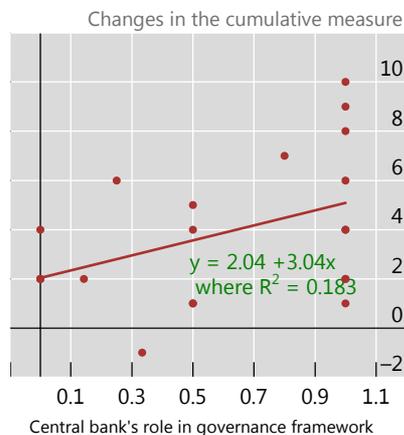
Macroprudential tools are tailored for specific sectors, regions and institutions (Graph 3, left-hand panel, and Appendix Table A2). LTV restrictions are the most commonly used for containing property market risks, limiting excessive household borrowing, strengthening banks' buffers and improving asset quality. Some central banks (eg the HKMA, PBC and Bank of Thailand) adjust LTV requirements for different segments of the housing market or higher-risk borrowers. The central bank of the Philippines limits lending to the real estate sector to not more than 20% of an individual bank's total loan portfolio. Turkey and Brazil apply LTV limits not only to housing loans but also to auto loans. Russia and Turkey use higher capital risk weights for unsecured consumer lending. The survey responses also reveal that some authorities target specific institutions. For example, the Czech Republic, the Philippines and Poland require additional buffers for systemically important ones. Mexico regulates pension funds and adjusts VaRs to limit potential spillovers to the financial sector. Overall, the responses suggest that authorities tailor the instruments to the source of the risk.

Capital flows can influence financial stability, especially in EMEs. For instance, banks' wholesale funding often takes the form of foreign currency-denominated cross-border borrowing. The increased availability of such borrowing will, in turn, affect lending conditions and, therefore, financial stability. Aware of the potential risks, more than half of the survey respondents have used capital flow management tools for macroprudential purposes (Graph 3 left-hand panel, and Appendix Table A2). To prevent short-term speculative inflows, Peru increased required reserves on non-resident deposits and short-term external borrowings by financial institutions. Russia differentiated reserve requirements by applying a higher ratio on foreign currency liabilities to mitigate liquidity risk in addition to setting limits to banks' net open foreign exchange positions. To deal with capital reversals, Argentina imposed a 120-day minimum holding period for non-resident inflows. China established its macroprudential framework for cross-border capital flows in 2015. Israel limited non-resident investment in short-term treasury bills and futures transactions. Eight countries mention that they do not use capital flow management measures for macroprudential ends. Overall, policy actions suggest that such measures remain in the "grey area" of macroprudential frameworks.

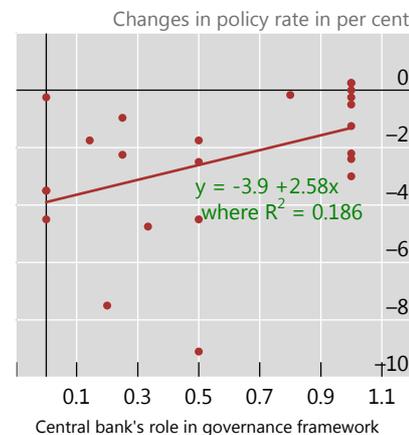
Targeting specific sectors, regions, institutions and capital flows



Greater CB role in macroprudential frameworks is associated with more tightening of macroprudential instruments



Greater CB role in macroprudential frameworks is associated with tighter monetary policy



The left-hand panel is constructed from the questionnaire responses and shows the number of countries that mention specific institutions, sectors and capital flows. In the centre and right-hand panels, for the central bank's role, we use the measure developed by Cerutti et al (2016) as the share of tools that the central banks implement or supervise among 13 macroprudential instruments. Changes in policy rates are calculated by differencing the values at 2008 from 2016. For macroprudential measures, the value of the cumulative measure in Q1 2008 is subtracted from the value in Q4 2014. For the description of the cumulative measure, see the footnote of Graph 1. Significance: CB role in MAP and MP: 5%; CB role in MAP and change in MP: 10%.

Source: Author's calculations based on data from Cerutti et al (2016), Cerutti et al (2017), national sources and questionnaire responses.

## Governance and implementation

In contrast to monetary policy, there is still no consensus on appropriate governance for macroprudential policies; frameworks differ considerably across countries, as outlined in Villar (2017). However, governance frameworks may be highly relevant for both implementation and outcomes. For example, a central bank with a greater role<sup>6</sup> in the macroprudential framework may be able to act more quickly, decisively and effectively. Indeed, there is some, albeit weak, evidence that central banks with a larger number of macroprudential tools under their control deployed them more frequently than did others post-crisis (Graph 3, right-hand panel).<sup>7</sup>

<sup>6</sup> For the purposes of this note, that responsibility is proxied by the share of macroprudential instruments under the central bank's control, as indicated in the survey responses. The indicator rests on the assumption that governments equip central banks with instruments commensurate with their responsibilities.

<sup>7</sup> The relationship is complicated by the possibility that central banks with a limited number of macroprudential instruments available may use them quite intensively. For example, the central banks of Turkey and Peru have a very small toolbox by international standards, comprising only reserve requirements and a few other tools, but they have used them very actively since 2008. Nevertheless, if Peru and Turkey are excluded from the analysis, the relationship still holds. Controlling for inflation and credit growth increases the statistical significance of the results.

Central banks with a greater responsibility for financial stability may also use interest rates more actively to safeguard it. The left-hand panel of Graph 3 plots the degree of central bank responsibility for macroprudential policy, again proxied by the share of tools available to them, against policy rates. It shows that, in countries where the central bank plays a greater role in the macroprudential framework, policy rates have declined by less than elsewhere. Of course, this finding is only a correlation; more research would be required to establish an explicit causal relationship. That said, it is not easy to come up with alternative convincing explanations.

Given that central banks have more expertise in economic analysis and are more likely to deploy macroprudential tools, why don't governments provide a larger role for them? One reason may simply be institutional inertia. In some countries, historically microprudential tools may have been under the control of institutions other than the central bank (most commonly the banking regulator). As many macroprudential instruments have evolved from their microprudential counterparts, their governance may have stayed in that institution (see the note by Poland). Another possibility is that governments may wish to retain control over macroprudential instruments and hence do not wish to give up all responsibility to an independent institution, which might also become too powerful.

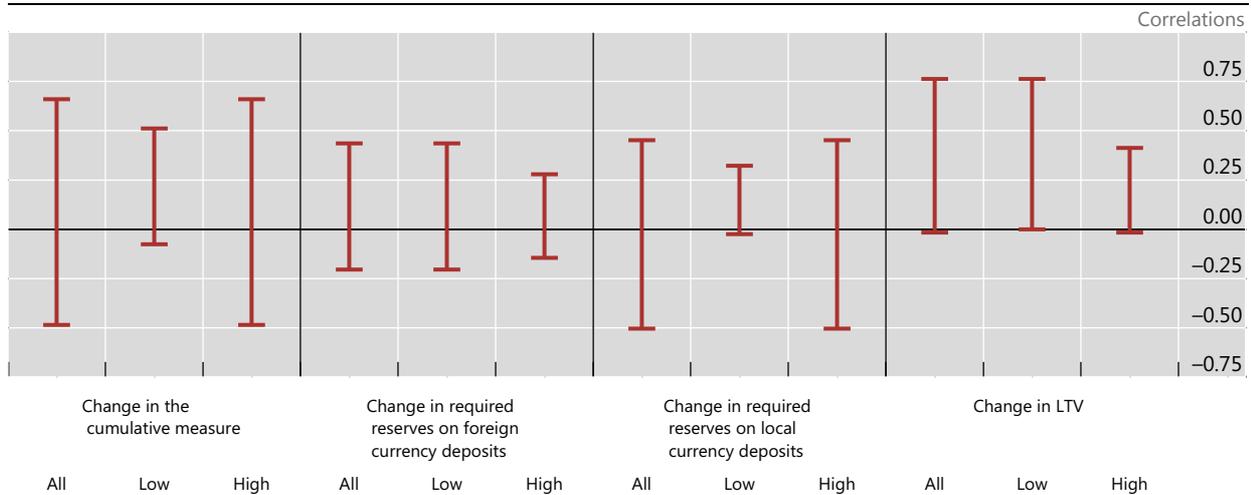
Monetary policy and macroprudential instruments may have spillover effects on each other's objectives. When used in the same direction, tighter monetary policy, for example, can restrict bank credit, thereby further reinforcing resilience. Indeed, this is one of the results of the projects that use credit registry data described in the box below. How are the two policies used in practice? Graph 4 shows the correlation ranges between changes in monetary policy stance and those in macroprudential measures for different governance frameworks. The graph shows a large degree of variation across countries. Only the LTV measure is positively correlated with monetary policy in all countries that have used it. Indeed, some aggregated measures for macroprudential tools actually have a negative correlation with monetary policy in some countries.<sup>8</sup> This contrasts with a finding in Bruno et al (2016) that in Asia macroprudential instruments and monetary policy were more successful when used in the same direction.

<sup>8</sup> We use aggregated measures, as changes in individual measures are infrequent.

## Correlation of changes in macroprudential measures and policy interest rates

All countries and countries grouped by low and high central bank role; data since 2000, annual

Graph 4



The graph plots the range of correlations of annual changes in policy rates and macroprudential instruments. “Low” means only countries where the fraction of instruments under the central bank’s control is smaller than 0.5 are included, “high” that it is greater. The classification is based on data from the Cerutti et al (2016) database. The data comes from Cerutti et al (2017).

Source: Author’s calculations based on data from Cerutti et al (2016) and Cerutti et al (2017).

## The effects of macroprudential instruments

Macroprudential actions are effective if they ensure that the financial system remains stable and fulfils its main purposes (to allocate capital, manage risks etc). But this definition is probably too general to be useful when assessing the effectiveness of individual tools. Narrower measures of effectiveness could focus on whether a specific action has been able to increase the resilience against shocks of a particular set of market participants, for instance households or banks, or to restrain a financial boom.

The questionnaire suggests that central banks appear to be broadly satisfied with the effectiveness of the macroprudential tools they have used (Appendix Table A3). Of course, there is a selection bias in the responses: central banks tend to use the tools they regard as most effective. Moreover, the authorities’ evaluation is mostly judgmental, as formal quantification is limited. That said, some instruments are mentioned consistently across countries. For example, LTV restrictions are found both to dampen risks in the property market and to safeguard bank asset quality (see the note by the HKMA for a detailed discussion). Similarly, authorities consider reserve requirements as effective in managing the credit cycle and mitigating foreign currency risks (in the case of required reserves on foreign currency funding). By contrast, capital and liquidity requirements are not frequently mentioned among the main tools used.

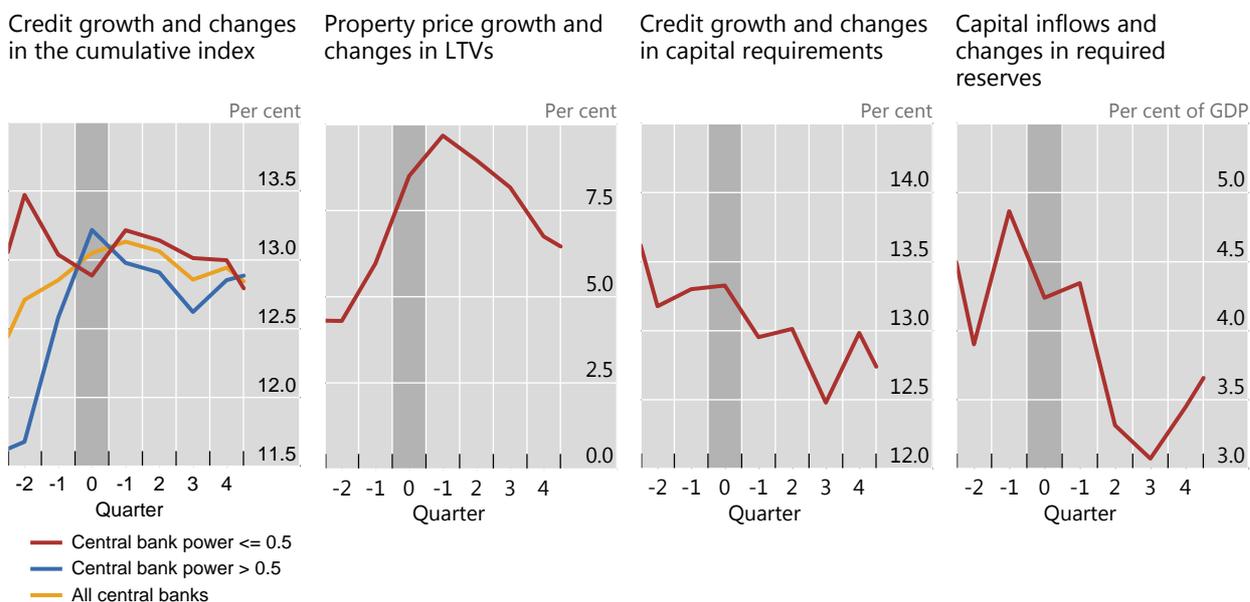
Empirical research finds that macroprudential measures have an impact on a number of financial risk indicators (see Galati and Moessner (2014) and Claessens (2015) for literature reviews). Cross-country studies find that some, but not all, tools dampen credit and house price growth (Claessens et al (2016), Kuttner and Shim (2013), Lim et al (2011), Akinci and Olmstead-Rumsey (2015), Fendoglu (2015), Dumičić (2017)). Bank-level analysis leads to a similar conclusion (Aiyar et al (2014) and Claessens et al (2013)). At the micro level too, studies using credit registry data

find a significant impact (see Camors and Peydro (2014), Jiménez et al (2017), Saurina (2009) and the box below). Kim and Mehrotra (2017) find that the instruments not only affect the financial risk but also output and inflation. In general, caps on LTVs or DTIs tend to have the strongest effects on credit growth and house prices, while the evidence for capital ratios and other measures primarily aimed at enhancing resilience is more mixed. By contrast, a simple event analysis does not show major differences. Graph 5 shows the evolution of various intermediate objectives before and after activation of specific macroprudential instruments. For example, credit growth tends to fall after an increase in capital requirements (third panel). Similarly, house price growth declines after a tightening in LTV limits (second panel). Finally, higher required reserves tend to be followed by a fall in net capital inflows (fourth panel).

### Impact of changes in macroprudential measures

t=0 is the period of a change in the macroprudential measure; quarterly data since 2000; averages across countries.

Graph 5



The graphs plot the dynamics of several risk economic variables before and after the activation of instruments. The first and third panels plot total credit growth after the change in the cumulative macroprudential index (see the footnote of Graph 1) and capital requirements. The second panel plots house price growth before and after changes in LTV restrictions. The fourth panel plots net capital inflows before and after a change in required reserves. All figures plot averages across countries.

Sources: Author's calculations based on data from Cerutti et al (2016, 2017); national sources.

The empirical work also suggests that the impact of many macroprudential instruments may not be symmetrical. For example, both Kuttner and Shim (2013) and Cerruti et al (2016) find that instruments such as LTV or DTI caps tend to be more effective in the boom than in the bust phase.

Macroprudential measures can mitigate individual bank risks as well as macro risks. A recent study based on bank-level data covering more than two decades (Altunbas et al (2017)) finds that the default risk of banks that are small, less well capitalised and with a higher share of wholesale funding react more to changes in macroprudential tools aggregated into an MP index (Table 1). Tools that primarily aim at enhancing resilience (MP resilience index) tend to have stronger effects than tools that focus above all on taming financial booms and busts (MP\_cyclical index),

as one would expect.<sup>9</sup> That said, even the asset-based tools, reserve requirements and currency instruments covered by the cyclical index appear to reduce bank risk.

### Tighter macroprudential policy reduces banks' expected default frequency

Table 1

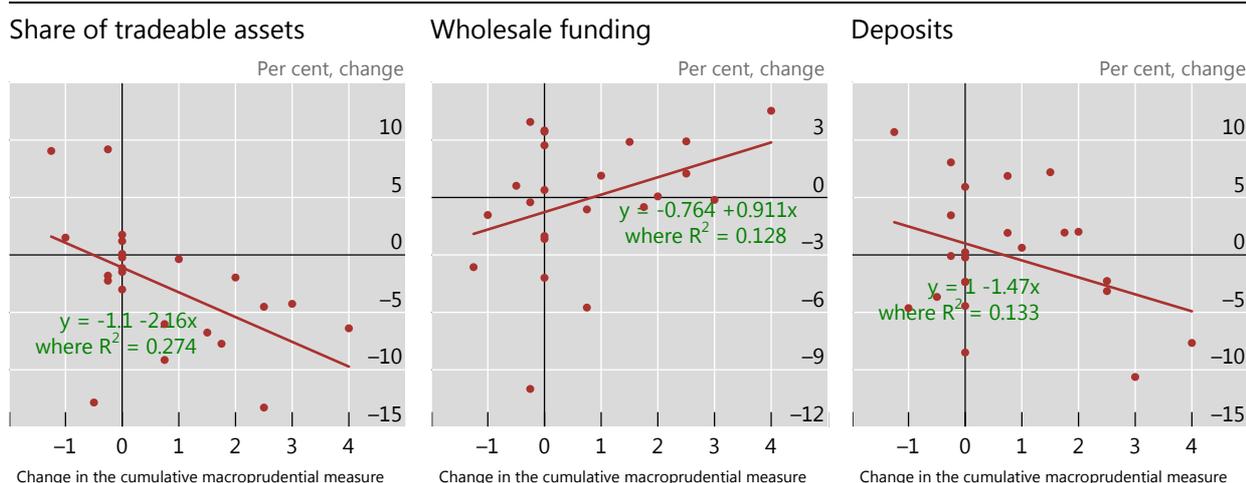
		Dependent variable: annual change of expected default frequency over a one-year horizon					
		(I)			(II)		
		Coeff	Std Err		Coeff	Std Err	
<i>Dependent variable</i> <sub>t-1</sub>		0.067 ***	0.003		0.0225 ***	0.0053	
<i>MP_index</i> <sub>t</sub>		-0.058 ***	0.017				
<i>MP_cyclical index</i> <sub>t</sub>					-0.2715 ***	0.0279	
<i>MP_resilience index</i> <sub>t</sub>					-0.0129 **	0.0052	
<i>Controls</i>		Yes			Yes		
Sample period		1990–2012			1990–2012		
Observations		5,756			5,756		

Notes: The results are taken from Altunbas et al (2017). *MP\_index*, *MP\_cyclical index*, *MP\_resilience index*, takes value 1 if tightened, -1 if loosened, and 0 otherwise. These indices are constructed by aggregating several instruments. See the paper for more details. Standard errors (clustered at the bank level) are reported. The symbols \*, \*\*, and \*\*\* represent significance levels of 10%, 5%, and 1% respectively. The coefficient for the banking crisis dummy is not reported.

Implementation and effectiveness also tend to depend on governance frameworks. There is some evidence that in countries where central banks have more instruments (or more responsibility), macroprudential tools are tightened earlier and credit growth is lower on average (Graph 5, first panel).

### Macroprudential measures and bank business models

Graph 6



The graph plots the changes in the cumulative macroprudential measures after the crisis (between 2007 and 2008) against several bank variables. The changes in bank variables are the differences between the 2012–15 and 2005–10 averages. A longer window is chosen for the initial period to limit data availability problems. Trade: trading assets plus liabilities; wholesale funding: other deposits plus short-term borrowing plus long-term funding. Significance: trade: 1%; wholesale funding: 10%; deposits: 10%.

Source: Author's calculations based on data from Bankscope and Cerutti et al (2017).

<sup>9</sup> The resilience index covers capital and liquidity based instruments, whereas the cyclical index focuses on asset side instruments, reserve requirements and currency instruments.

Macroprudential measures also appear to influence bank business models, although not necessarily making banks safer. For example, banks in countries that tightened measures more between 2007 and 2008 reduced the share of tradable assets in their balance sheet by more than banks elsewhere (Graph 6, left-hand panel). On the other hand, banks in these countries also reduced the share of deposit funding and increased that of wholesale debt (Graph 6, centre and right-hand panels). While the impact of changes in the share of tradable assets on risk is unclear, the shift towards wholesale funding is generally regarded as pointing to higher risk.

Box 1

### The impact of macroprudential measures in Latin America and their interaction with monetary policy: An empirical analysis using credit registry data.

Only very few studies on the effectiveness of macroprudential measures use loan-level data from credit registries. In part, this is because such data tend to be highly confidential. This box presents the results of a joint BIS-coordinated project by a group of Latin American central banks (Argentina, Brazil, Colombia, Mexico and Peru) on the impact of macroprudential measures and their interaction with monetary policy using micro data at the bank-client level.<sup>①</sup> To ensure comparability, the five central banks used a common methodology even though the confidentiality of the data precluded the construction of a common database. The analysis was complemented with work for three more countries (Canada, Chile and the United States) on the effects of specific measures using alternative approaches.<sup>②</sup> Table B1 shows the macroprudential measures analysed by the each country group and summarises the findings.<sup>③</sup>

The preliminary results are, first, that macroprudential measures adopted by the sample of countries have helped dampen credit cycles and reduce banking sector risk. In particular, measures used for countercyclical purposes, such as reserve requirements and dynamic provisioning, restrained credit growth. Bank-specific characteristics influenced the impact of macroprudential measures on credit. For example, the supply of credit originated by banks with more stable funding (eg with higher ratios of deposits to other liabilities) was less affected by the introduction or tightening of the measures. The effects of the measures were more pronounced for less stable financial institutions (Colombia), less strongly capitalised banks (United States and Brazil), and less liquid intermediaries (Brazil).

Second, the measures tend to be more effective in dampening credit cycles when they are accompanied by countercyclical monetary policy (Brazil and Colombia).

Third, the measures have helped reduce the procyclicality of credit and stabilise the economy. In particular, a cumulative index of the measures for Colombia was negatively related to GDP growth. In Mexico, provisions set by banks on the basis of their internal models were negatively correlated with GDP growth.

Finally, prudential measures directed at increasing the resilience of the banking sector, such as higher provisions and capital requirements, were effective in reducing the growth of non-performing loans (Argentina and Colombia), and of credit to riskier borrowers (Colombia). In contrast, measures designed to dampen credit growth, such as limits on external borrowing position and deposit requirements on external loans, had a more limited impact on the volume of loans, but not on the overall accumulation of banking sector risk. However, the imposition of reserve requirements in Brazil affected access to credit for riskier borrowers.

<sup>①</sup> The research network was set up under the financial stability group (CGDFS) of the Consultative Council of the Americas (CCA), comprising representatives of the eight BIS shareholders in the Americas region. <sup>②</sup> Callem et al (2016) evaluate recent changes introduced by the Comprehensive Capital Analysis and Review, the Dodd-Frank stress tests, and the Leveraged Lending Guidance in the United States. Allen et al (2016), using information at the borrower level, focus on the evaluation of measures in the housing market related to changes in LTV ratios in Canada. Finally, Alegría et al (2016) estimate the effect of loan-to-value in the housing loan market originating from an unexpected Chilean central bank statement concerning housing price dynamics. Gambacorta and Murcia (2016) describe the joint project in detail, using meta-analysis techniques to summarise the results obtained at the country level. <sup>③</sup> Measures are sorted into two categories depending on the specific aim targeted (see main text). For measures that work towards both aims (eg countercyclical capital ratios) the introduction of the policy was classified as reinforcing resilience and the tightening of the policy as cyclical.

## Macroprudential measures by country group

Table B1

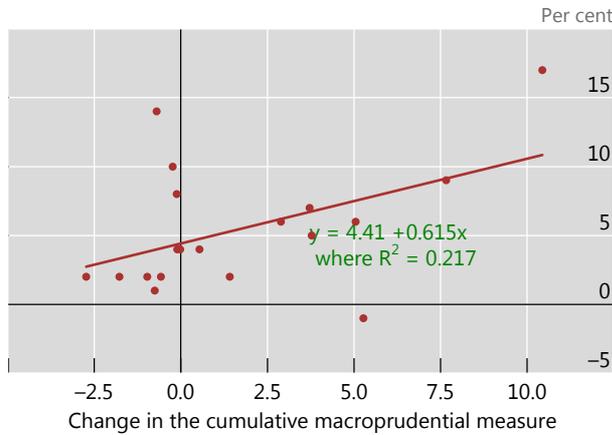
Country	Type of measure	Specific measures	Main results
Argentina (Aguirre and Repetto (2016))	Resilience/cyclical	(i) Introduction and tightening of a capital buffer.	Dampened credit cycles, particularly strong effect on effect on non-performing loans.
	Cyclical	(ii) Tightening in foreign currency net global position.	
Brazil (Godoy de Araujo et al (2016))	Cyclical	(i) Introduction of loan-to-value limits for certain subsidised loans.	Led to higher down-payments for borrowers constrained by the new regulation.
Brazil (Barroso et al (2016))	Cyclical	(i) Reserve requirements.	Slowed credit growth, especially riskier loans.
Colombia (Gómez et al (2016))	Resilience	(i) Dynamic provisioning (DP).	DP and RR had a negative effect on credit growth. ER did not have a statistically significant effect. DP had a negative effect on the growth of non-performing loans.
	Cyclical	(ii) Countercyclical reserve requirement (RR).	
	Cyclical	(iii) External borrowing reserve (ER).	
Mexico (Levin et al (2016))	Resilience	(i) Banking provisions based on expected losses.	Lowered credit growth, with larger on local currency loans than on dollar credit.
Peru (Cabello et al (2016))	Resilience	(i) Dynamic provisioning (DP).	DP had a significant effect on credit growth. CR had a significant effect on the share of loans denominated in foreign currency.
	Cyclical	(ii) Conditional reserve requirement on deposits in foreign currency (CR).	

Source: Gambacorta and Murcia (2016).

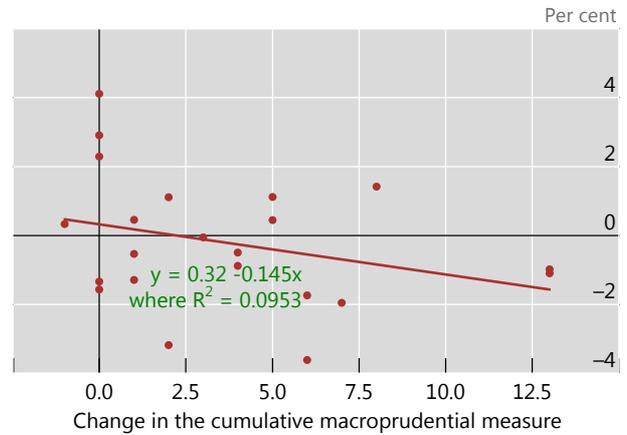
## Avoidance

Central banks mention several ways in which market participants may work around macroprudential measures. An obvious example would be firms issuing bonds abroad or borrowing directly from foreign banks. The left-hand panel of Graph 7 shows that, indeed, there is a strong positive relationship between the increase in the activation of instruments and the international debt issuance of non-financial firms. But only one country mentions this avoidance mechanism in the survey, arguing that it is likely to have a limited significance as only large firms have access to international markets.

The rise of international debt issuance



Fiscal policy stance



The left-hand panel plots changes in international debt issuance against changes in the cumulative macroprudential policy index. Both variables are changes during the 2008–14 period. The right-hand panel plots changes in the cyclically adjusted primary balance as a share of GDP against changes in the cumulative macroprudential policy index. For primary balance, the average for the 2007–11 period is subtracted from the average for 2012–16. For the cumulative macroprudential index, the differences between 2011 and 2007 are used. Significance: debt issuance: 5%; fiscal and MAP: no significance (excluding Argentina makes it significant at 10%).

Source: Author’s calculations based on data from IMF, *Fiscal Monitor*; Cerutti et al (2017); BIS data.

Macroprudential measures applied to the banking sector may shift risks to unregulated entities. In the Philippines, real estate developers have extended in-house financing to buyers through contract-to-sell agreements. The HKMA points to a similar avoidance scheme. In Malaysia, following the November 2010 introduction of an LTV ratio limit of 70% for the third or subsequent outstanding housing loan for individuals, there was an increase in housing loans taken out by non-retail clients – possibly an attempt to circumvent the measure by borrowing in a corporate name. Therefore, in December 2011, the Central Bank of Malaysia extended the maximum LTV ratio limit to all housing loans by non-individuals. The note by the Bank of Korea mentions a similar avoidance mechanism. After the introduction of LTV and DTI measures, there was a continuous increase of household loans not subject to the regulations, such as loans by non-bank institutions or secured by other collateral.

## Unintended consequences

One potential unintended consequence of macroprudential measures might be to limit the access to finance for those parties who need it most. That said, an analysis of the World Bank Financial Inclusion database shows that there is no significant relationship between macroprudential measures and changes in the percentage of the population with financial accounts. Still, a more detailed analysis would be needed to reach a more robust conclusion. By contrast, Ayyagari et al (2017) find that macroprudential measures tend to lower SMEs’ access to financing.

The relationship between the fiscal policy stance and the activation of macroprudential measures is a priori unclear. On the one hand, as governments typically have some control over both fiscal policy and macroprudential instruments, one might expect that fiscal policy would become more prudent in the regions where

macroprudential instruments were tightened more, with both policies working in the same direction. On the other hand, the government might take advantage of a tighter macroprudential stance to loosen policy or even compensate for it if it were deemed too restrictive on output. The evidence appears to support this second hypothesis (Graph 7, right-hand panel). After 2008, the fiscal policy stance loosened more in countries that had tightened their macroprudential measures to a greater extent.<sup>10</sup> Whatever the underlying reason for this relationship, it is likely to reduce the overall effectiveness of macroprudential measures.

<sup>10</sup> The possibility of reverse causality, ie loose fiscal policy leading to financial imbalances and then macroprudential tightening, is not likely: the changes in macroprudential instruments lead the changes in fiscal stance by several years (see the notes in Graph 7).

## Appendices

### How do authorities measure vulnerabilities?

Table A1

Tools used to measure vulnerabilities	
Argentina	(1) Banking system indicators: aggregate intermediation, asset and liability structure, credit portfolio quality, currency and interest rate mismatches, solvency and liquidity positions, leverage levels, profitability, among other aspects. (2) Fixed income and equity markets, yields, volatilities, financing flows, sovereign debt. (3) The financial conditions of the corporate and household sectors. (4) Credit conditions, market expectations surveys. (5) Asset prices, leverage, liability dollarisation of the corporate sector, developments in the payment system. (6) Stress tests. (7) Financial risk dashboard.
Brazil	(1) Credit, liquidity and market risks. (2) Earnings, funding and capital developments. (3) System-wide stress tests. (4) Credit growth, performance, pricing and maturity indicators are produced by size, ownership (government-owned vs private sector) and business model. (5) Solvency, liquidity and profitability indicators. (6) Changes in real housing prices. (7) Credit risk indicators for households and enterprises respectively, including non-bank debt. (8) Consumer credit growth and household disposable income. (9) Non-performing loans (NPLs). (10) Debt service-to-income ratio (DSTI).
Chile	(1) Stress tests for the banking system. (2) Indebtedness of the household sector. (3) Evolution of real estate prices. (4) Indebtedness and currency mismatches in the corporate sector. (5) Evolution of risks in the banking sector, including stress test results.
China	(1) Amount and rate of NPLs, capital adequacy ratio, profit growth etc. (2) The business performance of listed companies, profit and asset indicators of securities, futures companies and funds etc. (3) Structural configuration of assets, insurance premium growth, asset liability matching etc in the insurance sector. Exploring quantitative methods such as stress tests in recent years to improve the effectiveness of assessments.
Colombia	(1) Financial stability map. (2) Index of financial stability. (3) Indicators of credit booms and financial fragility. (4) Further early warning tools and a stress-testing framework are under development.
Czech Republic	(1) Stress tests. (2) Comprehensive financial cycle indicator. (3) Credit-to-GDP gap. (4) Credit growth. (5) Real estate price gap. (6) External vulnerability indicators. (7) Concentration indicators.
Hong Kong SAR	(1) Credit-to-GDP gap and property price-rent gap. (2) Property price and transaction volume indicators; indicators of speculative activities, such as confirmer transactions and short-term resale activities; affordability indicators, including price-to-income ratio and income-gearing ratio, and buy-rent gap as a user cost measure. (3) Macro stress testing of retail banks' credit exposure. (4) A housing price model and an asset pricing model. (5) A statistical method to detect any property price bubbles.
Hungary	(1) System-wide financial stress index. (2) Credit-to-GDP gap. (3) Cyclical systemic risk map with additional early warning indicators. (4) Credit growth. (5) Value of collaterals (real estate and vehicles). (6) Repayment capacity of borrowers. (7) Household indebtedness. (8) Stress test based on the Liquidity Coverage Ratio (LCR) and its components reported by banks at a monthly frequency. (9) Solvency stress tests.
India	(1) Systemic risk survey. (2) Single-factor sensitivity analysis. (3) Banking stability maps and indicators. (4) Estimation of expected loss, unexpected loss and expected shortfalls of banks. (5) Macro stress testing. (6) Stress testing of the derivatives portfolio of banks. (7) Financial network analysis. (8) Major global and domestic economy indicators. (9) Banking stability indicators: asset quality, capital adequacy, profitability, liquidity and efficiency. (10) Interconnectedness. (11) Aggregate and sectoral credit growth. (12) Loan-to-deposit ratios. (13) Credit-to-GDP gap from long-term trends. (14) Growth of non-performing assets. (15) Interest coverage ratio.
Indonesia	(1) Financial System Stability Index, financial distress indicators, network analysis and risk profile analysis. (2) Interbank stress test, systemic impact analysis and transmission map of any identified shock. (3) Banking stress test (top-down approach), Systemic Risk Assessment Model (forthcoming), liquidity stress testing (forthcoming), granular individual bank stress testing and other sensitivity analysis. (4) Qualitative methods.
Israel	(1) Leading indicators. (2) Stress tests. (3) Subjective assessment of all variables to assess the vulnerability of the financial system.
Korea	(1) Financial stability index and map. (2) Private credit-to-nominal GDP ratio and gap. (3) Financial market price volatility. (4) Soundness/profitability/interconnectedness of financial institutions. (5) Housing prices etc to grasp the signal of sectoral financial risks. (6) Micro data of households and corporates, additionally, to seize potential (or tail) risks in advance.
Malaysia	(1) Leading and key financial soundness indicators on credit, market and liquidity risks, capitalisation and profitability. (2) Macro and micro stress tests. (3) Standalone sensitivity tests. (4) Indices on banking sector vulnerabilities, financial market volatility, and consumer and business sentiment. (5) Probability-of-default model for large corporate borrowers. (6) Financial leverage and house price cycles.
Mexico	(1) Risk analyses and stress testing. (2) Banking sector performance: profitability, liquidity and leverage, periodically. (3) Individual credit portfolios.
Peru	(1) Indicators of credit cycles (eg credit-to-GDP gap, credit growth). (2) Degree of financial dollarisation of credit and deposits. (3) Indicators of currency mismatches (eg banks' net FX position).
Philippines	(1) Macro and micro prudential indicators. (2) Rating systems. (3) Early warning systems. (4) Various periodic reports/publications.
Poland	(1) Financial cycle indicators. (2) Credit gap. (3) Early warning indicators. (4) Detailed analysis of various segments of the credit market. (5) Stress tests. (6) Individual-level data (ie household level) to assess the degree of risk taken by particular sector.

## How do authorities measure vulnerabilities?

Table A1  
(cont)

Tools used to measure vulnerabilities	
Russia	(1) Domestic and global macroeconomic outlooks. (2) Financial soundness of banks, non-bank financial institutions and significant non-financial corporates. (3) Financial market developments. (4) Credit and liquidity risks of the banking system. (5) Systemic risk dashboard. (6) Risks in the rouble money market, FX money market, foreign exchange market, equity market, state and corporate debt market and also in global markets. (7) Risks of large-scale withdrawal of deposits, large-scale conversion of roubles into foreign currency and collateral deficit, funding volatility, and also indicators of interest rate risk and credit risk of the banking sector.
Saudi Arabia	(1) Solvency and liquidity stress tests. (2) Early warning indicators. (3) Macroprudential dashboard.
Singapore	(1) Property prices and transactions. (2) Property valuation metrics. (3) Banks' exposure to the property sector and the risk profile of housing loans, including LTVs and debt servicing ratios. (4) Credit-to-GDP gap, real economy, banking sector and asset market indicators. (5) Annual industry-wide stress test.
South Africa	(1) Risks in institutions identified as systemically important, shadow banks, asset markets and the non-financial sector. (2) Level of leverage, and general credit market conditions. (3) Maturity and currency mismatches. (4) Changes to lending standards. (5) Stress tests. (6) House prices, commercial property prices and asset valuations in equity markets. (7) Government and corporate bond spreads, credit default swap spreads and measures of risk premia. (8) Underwriting standards, and asset quality and credit conditions.
Thailand	(1) Heat map. (2) "Ms Muffet Spidergram". (3) Systemic risk (network model, CoVaR). (4) Risk build-up over time (financial cycle, heat map). (5) Micro stress tests. (6) Macro stress-testing framework under development.
Turkey	(1) Heat map. (2) Credit developments. (3) Credit risk, liquidity risk, FX net position and deposits. (4) Vintage analyses and interest rate risk scenarios. (5) DuPont analysis. (6) Studies on the impact of macroprudential tools.

Source: Replies to questionnaires by central banks, comprising a succinct summary of replies to question 6. Replies are enumerated to improve readability.

## Macprudential tools used and their aims and effectiveness

Table A2

	Tools	Aims	Effective-ness
Argentina	Limits on currency mismatches.	Address banks' and banks' clients' financial mismatches.	1
	Limits on financing to individual customers (private, public and financial sector).	Reduce individual exposure to both private and public debtors.	1
	Cash reserve requirements.	Reduce the probability and intensity of a run scenario.	1
Brazil	LTV.	Enhance auto-loan underwriting practices.	1
	Reserve requirements.	Manage credit cycles and ease liquidity constraints.	1
	Consumer loans.	Focused on personal credits, payroll-deducted loans and vehicle financing, involving longer maturities or higher LTV.	1
	FX swaps.	Reduce volatility in FX markets; offer FX hedge to market agents and provide more liquidity.	2
	Capital flow management.	Stem volatile carry trades, lengthen maturities of the inflows, and ease persistent appreciation pressures on the currency.	2
Chile	Warning messages through the FSR.	Raise concerns to mortgage lenders re their credit standards.	1
China	Macroprudential assessment system.	Make the macroprudential policy framework resilient and sufficiently complete to prevent systematic risk.	1
	Provisions for forward sale of foreign currency.	Eliminate speculative trading and adjust foreign currency liquidity.	1
	All cross-border management pilot programmes.	Control leverage and currency mismatch risk.	1
	Application of legal deposit reserve ratio.	Improve the deposit provisions regime and adjust cross-border renminbi flow in the long run.	1
	LTV limits.	Control the housing market through countercyclical adjustment.	1
Colombia	Marginal reserve requirement.	Limit credit growth.	2
	Limits on FX positions.	Limit currency risk.	2
	LTV limits.	Limit household leverage and financial institutions' exposure to house price movements.	1
	Dynamic provisioning.	Stabilise credit growth.	2
Czech Republic	Capital controls.	Reduce currency mismatches and discourage speculative flows.	3
	CCyB rate.	Increase resilience.	
	D-SIB buffer rate.	Increase resilience.	
Hong Kong SAR	LTV limits.	Decrease excess leverage.	
	LTV limits for mortgages.	Provide equity buffers for banks against default.	1
	DSR limit and stressed DSR limit for mortgages.	Reduce overindebtedness and risk of default.	1
	Risk weight floor of 15% for residential mortgage portfolio of banks using IRB for calculating the capital charge for their credit risk.	Ensure that IRB banks maintain a higher level of regulatory capital as a cushion.	1
	SFR.	Ensure that banks maintain sufficiently stable funds to support their lending business.	1
Hungary	CCyB.	Build additional capital during periods of high credit growth.	1
	PTI and LTV limits.	Avoid excessive household lending.	1
	Mortgage funding adequacy ratio.	Reduce maturity mismatch and lower interest rate risks.	1
	Systemic risk buffer.	Enhance the resilience of institutions with large stocks of problem project loans, and incentivise banks to wind down their problem portfolios.	1
	FFAR, FECR.	Mitigate maturity and currency mismatches.	2
India	CCyB.	Absorb negative impacts of a potential financial crisis.	2
	Countercyclical provisioning and capital requirements.	Increase the resilience of banks and limit credit growth.	1
	Prudential tools to deal with interbank exposures.	Reduce interconnectedness in the banking system.	2
	Prudential limits to reduce bank exposures to capital markets.	Reduce bank exposures to the equity market and mutual funds.	2
	Buffers for SIBs.	Address moral hazard for systemically important banks.	2
Israel	Capital and provisioning requirements for bank exposures to entities with large foreign currency exposures.	Signal to the real sector not to have excessive foreign currency exposure.	1
	LTV limit.	Reduce the risk to banks derived from high-LTV mortgages.	2
	Limiting the proportion of new mortgages at variable rates.	Minimise the interest rate risk to households and banks.	2
	PTI limitation on new mortgages, term to repayment limit.	Reduce the risk to banks derived from high-PTI mortgages.	2
Indonesia	Additional capital allocation requirements for housing credit.	Increase the capital buffer for mortgages.	2
	RR based on LFR.	Manage liquidity risk for excessive LFR.	2
	LTV limits on mortgages.	Limit the build-up of systemic risks that may arise from high mortgage loan growth and increasing property prices.	1
	CCyB.	Prevent systemic risk arising from excessive credit growth.	

Macroprudential tools used and their aims and effectiveness

Table A2  
(cont)

	Tools	Aims	Effectiveness
Korea	LTV and DTI limits.	Hold down mortgage loan size and house prices.	1
	Loan/deposit ratio regulation.	Instil sound management practices in financial institutions.	1
	Foreign exchange soundness regulation.	Reduce the volatilities in foreign capital flows.	1
Malaysia	LTV limit, capital risk weights.	Curb speculative activities and promote a sustainable property market.	2
	Maximum loan tenure.	Ensure prudent expansion of credit to households.	1
	DSR limit.	Promote responsible financial behaviour among borrowers and credit providers.	1
Mexico	Limits on foreign currency operations.	Limit the possible effects of changes in FX on banks.	1
	Capital requirements.	Prevent possible contagion of problems.	1
	CCyB		–
Peru	Asset transfer authorisation for banks and related counterparties.	Ensure that these operations take place under market conditions.	1
	Higher RRs for foreign currency.	Mitigate the liquidity risk created by dollarisation.	1
	Additional RRs for dollar-denominated loans.	Speed up the reduction of credit dollarisation.	1
Philippines	Cyclical adjustment of RRs.	Smooth the domestic credit cycle, particularly in FX.	1
	RR on banks' short-term external liabilities.	Limit banks' exposure to sudden reversals.	1
	LTV ratios.	Manage bank lending.	1
Poland	Limits on lending to specific sectors.	Manage risks concentration.	1
	Limits on single borrower and related parties.	Strengthen arm's length transactions.	1
	Limits on net open currency positions.	Manage FX funding risks.	1
Russia	Limits on currency mismatches.	Manage FX funding risks.	1
	FX lending restrictions.	Stop new FX lending.	1
	LTV limit.	Limit excessive credit growth and enhance the resilience.	1
Saudi Arabia	DSTI limit.	Limit excessive credit growth, enhance the resilience of financial institutions and limit overindebtedness.	2
	OSII buffer.	Limit risk related to OSII banks.	1
	CCyB.	Counteract cyclical risk.	1
Singapore	Reserve requirements.	Limit foreign currency risks.	2
	Provisioning, capital risk weights.	Limit systemic risk in the unsecured consumer lending segment. Stimulate the provision of mortgage loans with a reduced level of risk. Limit the risk of high-risk mortgages.	2
	Measures to support the de-dollarisation of the economy.	Reduce dollarisation.	2
Thailand	LDR.	Liquidity risk.	1
	LCR, NSFR.	Liquidity risk.	1
	LTV.	Credit risk.	1
Turkey	LTI.	Credit risk.	1
	CCyB.	Credit risk.	1
	LTV	Encourage financial prudence among borrowers. Mitigate loss exposures of financial institutions from loan defaults.	1
Singapore	Loan tenure limits	Encourage financial prudence among borrowers.	1
	Total debt servicing ratio framework	Encourages financial prudence among borrowers.	1
	Seller's stamp duty	Strengthens credit underwriting practices.	1
Thailand	Additional buyer's stamp duty	Curbs speculative property investments.	1
	LTV limit.	Mitigates excessive investment demand, through additional duty on second or more property purchases.	1
	Dynamic provisioning (through possible impaired loans).	Prevent speculation and mitigate the build-up of risk in the real estate loan market.	2
Turkey	Maximum credit line on credit cards and personal loans.	To build up extra cushion in good times.	2
	Minimum salary/payment on credit card requirement.	Dampen concern about household debt.	2
	LTV limit and consumer loan restrictions (risk weights, provisioning, maturity restrictions).	Contain credit growth and household debt.	1
Turkey	Reserve requirements.	Improve the quality of the liability side.	1
	Credit card restrictions (limits on credit balances, instalments, maturities, minimum payments, risk weights).	Mitigate and prevent excess credit growth, maturity transformation and leverage.	1
	Higher capital requirements for D-SIBs.	Create capital buffer for systemically important banks.	1

CCyB: countercyclical capital buffer; D-SIB: domestic systemically important banks; DSR: debt service ratio; DSTI: debt service-to-income ratio; DTI: debt to income; FFAR: foreign exchange funding adequacy ratio; FECR: foreign exchange coverage ratio; IRB: internal ratings-based; LCR: liquidity coverage ratio; LDR: loan-to-deposit ratio; LFR: loan-to-funding ratio; LTI: loan to income; LTV: loan to value; NSFR: Net stable funding ratio; OSII: other systemically important banks; PTI: interest rate payment plus principal payment; RR: required reserves. Effectiveness indicators: (1) very effective; (2) moderately effective; (3) not effective; (4) counterproductive. Source: Replies to questionnaires by central banks, comprising a succinct summary of replies to question 8.

## Tools that target specific sectors, regions or institutions and foreign capital flows

Table A3

	Tools that target specific sectors, regions or institutions	Tools that target foreign capital flows
Argentina	None.	Minimum holding period for non-residents' capital inflows. Reserve requirement for non-residents' inflows. Limits on banks' General Exchange Position.
Brazil	Higher regulatory capital requirement for auto loans with long maturities and high LTVs. Eliminated required reserves for the banks that were most affected by liquidity shortage. Reduced reserve requirements for large banks under certain conditions. Special conditions for foreign and domestic currency liquidity.	Tax on foreign purchases of domestic bonds and equities.
Chile	The tool used was aimed at the real estate sector.	RR on foreign capital flows (mid-1990s).
China	None.	Provisions for forward sale of foreign currency. All cross-border management pilot programmes. Legal deposit reserve ratio applied to offshore financial institutions.
Colombia	LTV applies only to mortgage loans. Liquidity risk Indicator: specific formula that differentiates between credit establishments, stock brokers and mutual funds. Dynamic provisions for commercial and consumer loans.	Limits on FX positions and FX lending. Reserve requirements for short-term external borrowing. Limit on exchange rate derivatives exposure. Deposit for foreign portfolio investment. A minimum permanence period for foreign direct investment.
Czech Republic	D-SIB buffer rate.	None.
Hong Kong SAR	Property mortgage lending.	Lower LTV caps for borrowers whose income is mainly derived from outside Hong Kong.
Hungary	Systemic Risk Buffer (SRB) targets financial institutions. The mortgage funding adequacy ratio sets a minimum required level of mortgage-backed funding relative to the amount of household mortgage loans. LTV and PTI target household loans.	None.
India	Sector-specific prudential tools for certain sectors. Prudential measures to reduce interconnectedness. Prudential measures to reduce excessive foreign currency borrowing by corporates.	Caps for various sectors receiving foreign investment. Sector- and company-specific caps for external borrowing.
Indonesia	LTV requirement for mortgage loans.	Minimum holding period for Bank Indonesia Certificate (SBI). Hedging ratio. Credit rating requirement.
Israel	Additional capital requirements for mortgage credit.	Limits on investments by non-residents in short-term treasury bills and MAKAM and in short-term futures transactions.
Korea	LTV and DTI target real estate sector and specific regions. Additional capital requirement for SIBs.	Regulations on derivative position in foreign currency. Tools to strengthen the management of foreign currency. Macroprudential instability levies and taxation on non-deposit liabilities in foreign currency.
Malaysia	LTV and capital risk weights target property market. Maximum loan tenure for consumer and mortgage loans.	In 1994: limits on non-trade-related external liabilities of banks; prohibition of forwards (bid side) and non-trade-related swaps; requirement to place ringgit-denominated funds of foreign banks held in non-interest bearing vostro accounts with the central bank. Currently: none.
Mexico	Loan loss provisions (calculated by expected losses) for non-revolving consumer and mortgage lending, for federal and local governments and for commercial lending. Higher limits on VaRs for retirement funds (in 2009 and 2010). Limited authorisation to banks to use internal models for the estimation of their expected losses.	None.
Peru	RR differentiated by currency. Additional RR depending on the performance of mortgage and auto loans in dollars.	RR on FX short-term foreign funding.
Philippines	Banks' loans to the real estate sector must not exceed 20% of their loan portfolio. Larger buffers for D-SIBs.	Limits on banks' total gross exposures to all forms of peso NDF transactions.
Poland	Buffer for "other systemically important institutions".	None.
Russia	Additional provisioning requirements and higher capital risk weights for unsecured consumer lending. Differing capital risk weights based on the level of effective lending rates on loans.	Tools to support the effort to de-dollarise the economy. Reserve requirements on liabilities in foreign currency.
Saudi Arabia	LTV ratio (70%) targets the real estate sector. LTI ratio (33%) targets households.	Imposing ownership limits and minimum qualifications for international institutions for "gradually" opening up the market.
Singapore	LTV limits, loan tenure limits, TDSR framework and stamp duties are targeted at the property market.	None
South Africa	None.	None.
Thailand	LTV ratio was segmented into high-rise and low-rise properties and also by value of the property (whether more or less than THB 10 million). Credit card and personal loan requirement for low-income individuals.	None.
Turkey	Tools on consumer loans (risk weights, provisioning, and maturity restrictions). Tools on credit cards (higher provisions, number of instalments). Caps on LTV ratios on housing, commercial real estate loans and auto loans. Higher risk weights on general purpose loans, credit card receivables and auto loans. Lower general provisions for SME and export loans.	None.

D-SIB: domestic systemically important bank; DTI: debt to income; LTV: loan to value; RR: required reserves; MAKAM: short-term securities issued by the Bank of Israel; NDF: non-deliverable forward; PTI: interest rate payment plus principal payment. Source: Replies to questionnaires by central banks, comprising a succinct summary of replies to questions 9 and 10.

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