

# Macro Prudential Policies to Mitigate Financial Vulnerabilities in Emerging Markets

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## Introduction

This chapter analyzes the use of macro prudential policies (MaPPs) aimed at reducing vulnerabilities in banking systems, with a special focus on their use in and for emerging markets (EMs). Recent events have highlighted the high costs of financial crises. More generally, the potential for instability arising from the financial system—whether from excessiveness in cycles or from spillovers through interconnectedness—is increasingly being recognized. Accordingly, there is a growing interest in the potential for MaPPs to complement micro prudential regulations and traditional macroeconomic management policies, notably monetary policy and fiscal policy, to help contain (the buildup of) systemic risks and achieve greater financial stability, and in this way reduce adverse consequences of financial volatility—including from crises—for the real economy.

Whereas many analyses have been motivated by the (ongoing) crisis in advanced countries (ACs), EMs have had much greater experience with MaPPs in recent years, in part because they have had more pronounced business and financial cycles, partly because of their greater exposures to volatile international capital flows, commodity price shocks, and other risks. In this context, there is much for ACs to learn from EMs about the effectiveness of MaPPs. And there are, of course, lessons for EMs themselves.

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The chapter, therefore, asks the following questions. What are the specific market failures and externalities that can motivate the use of MaPPs to reduce systemic risks? What are the key MaPPs available to countries to reduce systemic risks? Which MaPPs have countries actually used and what is the evidence to date on the effectiveness of different MaPPs to reduce financial system vulnerabilities?

Most studies on the use and effectiveness of MaPPs take an aggregate perspective, that is, they investigate the effects of MaPPs either at the overall economic or at the financial sector level, for example, on leverage or credit growth or the occurrence of a financial crisis, or at the level of a subsector, such as real estate. We review empirical evidence on the role of MaPPs in limiting vulnerabilities in individual banks (and thereby overall banking systems) over the past decade. Because this work uses a large sample of countries, it allows for analysis of differences in country circumstances and conditions, including between ACs and EMs, and between relatively open and closed capital account economies. It is able to differentiate by type of MaPP and by the phase of the financial cycle—upswings or downswings.

This work finds that macro prudential policies aimed at the borrowers—caps on debt-to-income (DTI) and loan-to-value (LTV) ratios—are quite effective in (indirectly) reducing banking system vulnerabilities. Also, limits on foreign currency lending are effective in reducing vulnerabilities in boom times. Although countercyclical buffers (such as reserve requirements, restrictions on profit distribution, and dynamic provisioning) also help mitigate increases in bank leverage and asset growth (dimensions of financial sector vulnerability), few macro prudential tools help stop declines in these bank variables in adverse times.

We interpret the fact that demand-oriented measures aimed at the real estate markets are consistently effective in addressing financial-sector vulnerabilities as indicative of two facts: one, real estate cycles are an important aspect of overall financial cycles that often trigger major concerns about systemic banking risks, thus making these measures important; and two, addressing demand for credit directly can be effective in reducing banking system vulnerabilities because it faces fewer problems of implementation, including circumventions.

The results suggest that macro prudential tools are best used as *ex ante* tools, that is, for reducing the buildup in bank risks in boom periods, rather than for mitigating declines when the cycle turns. Although macro prudential policies can help lessen a systemic crunch by providing buffers so that banks do not (need to) reduce leverage, assets, and noncore liabilities as much during bad times, in practice these effects are absent, or not very strong. We also conjecture that some macro prudential policies aimed at mitigating the buildup of financial vulnerabilities (including caps on LTV and DTI) can work perversely during financial downturns if not sufficiently lowered because they make adjustments more difficult. As such, macro prudential policies need to be properly calibrated and adjusted.

We conclude that MaPPs can be important elements of the policy toolkit aimed at overall systemic risk mitigation, especially for EMs exposed to international shocks. However, we note that in as much as MaPPs affect resource

allocations, they can also entail costs. Poorly designed or wrongly implemented, MaPP tools can be circumvented and imply further distortions. We therefore argue that to provide their full benefits, MaPPs need to be properly chosen and carefully calibrated depending on country and financial system characteristics, including capital account openness, and adjusted as circumstances change.

This chapter is structured as follows. Motivated by the case of EMs, the first section discusses the conceptual rationale for MaPPs in general, as well as the various MaPPs that can be used to deal with specific risks and shocks, depending on a country's structural features and macroeconomic and financial sector conditions. The next section reviews empirical evidence on the use of MaPPs and the effectiveness of different instruments in reducing banking system vulnerabilities. The final section concludes, with reference to EMs' current situations, prospects and vulnerabilities, on whether and how MaPPs can best be used.

### **Why Macro Prudential Regulations May Be Needed and the Actual Toolkit**

The global financial crisis has highlighted that, even with macroeconomic stability, using a judicious mix of micro prudential regulation, supervision, and market discipline to address potential risks at the level of individual financial institutions—even if well-designed and implemented—does not ensure financial stability. Because of externalities, private costs and benefits of the actions of individual financial institutions and agents can diverge from their social values. Measures that focus on individuals' actions and institutions' stability alone do not suffice to limit a buildup of systemic risk. Furthermore, some policies, including micro prudential regulations, although important for public policy objectives at the individual institution's level, can lead to behavior that creates systemic risks. Neither is traditional macroeconomic management, notably monetary policy and fiscal policy, necessarily able nor the most effective to contain (the buildup of) systemic risks, especially not for EMs (see Ghosh 2010; Claessens and Ghosh forthcoming).

Although the benefits of a broader approach has been recognized by some, notably at the Bank for International Settlements (BIS),<sup>1</sup> it is only recently that policy makers and academics have started to acknowledge the need to use policy instruments that target the soundness of the financial system as a whole. In this context, MaPPs are promising in principle, as academic research has also highlighted (for an early analytical review of the need for MaPPs, see Brunnermeier and others 2009; see also Hanson, Kayshap, and Stein 2011, and De Nicolò, Favara, and Ratnovski 2012).

Their use, however, requires a clear identification of the aspects of systemic risks that need to be addressed and their fundamental causes. Systemic risk can be cyclical—whereby financial institutions and markets overexpose themselves to risks in the upswing of the financial cycle and then become overly risk averse in the downswing, rendering the entire financial system and economy vulnerable to booms and busts. Or it can be cross sectional—whereby the actions and problems of individuals or financial institutions can have spillover effects on the

overall financial system. Although both types of risks can arise from externalities and market failures, the appropriate policy tools differ between the two (Allen and Carletti 2011; Bank of England 2011; De Nicolò, Favara, and Ratnovski 2012; and Schoenmaker and Wierts 2011 provide similar classifications of sources of systemic risks and related policy measures).

The use of MaPPs will also depend on the availability and efficacy of other policy instruments—notably monetary, fiscal, micro prudential and capital flow management (CFM) policies (“capital controls”) that can help address these risks.

Research has made less progress in developing robust advice to help choose the proper MaPP and calibrate its design (for example, the level of a capital surcharge or loan-to-value limit). Whereas recent work on capital account liberalization (IMF 2011b; Ostry and others 2011) has helped clarify in which types of countries and circumstances CFM tools can be useful, equivalent analysis and framing are yet to happen for MaPPs.

### ***Procyclicality***

The financial sector is inherently procyclical, that is, it amplifies the business cycle.<sup>2</sup> The two-way interactions between the financial sector and real sector “causing” this procyclicality largely operate through changes in the values of assets and leverage. A positive shock (such as a productivity shock) increases the value of a bank’s assets (for example, loans and securities), and if the bank targets a desired leverage ratio, it will increase its asset holdings in response to the increase in asset value. Faced with a common shock, if all financial institutions do the same thing, the increased demand for assets raises their prices, further fueling the cycle and leading to a generalized expansion of credit.

In the process, banks’ balance sheet structure can become more vulnerable to shocks (or a downturn in the economy) through a range of balance sheet mismatches and weaknesses. These mismatches include rising leverage ratios, maturity mismatches and, especially in the case of EMs and developing countries, foreign exchange (FX) mismatches. On the liability side, the ratio of noncore-to-core funding tends to rise. As banks seek to expand their balance sheets, they generally turn to noncore funding since the more stable core (mainly deposits) liabilities tend to be more sluggish (see Hahm, Shin, and Shin 2012 for a model and empirical analysis of how an increase in noncore-to-core funding is often a precursor to financial crises).

Once the financial system as a whole becomes more leveraged, it becomes vulnerable to shocks such as sudden withdrawals of funds, stops in capital inflows, or changes in asset prices. Indeed, even small shocks such as slight increases in borrower defaults or small declines in collateral values during a downturn can trigger systemwide problems. If equity buffers are insufficient to absorb losses, for example, banks may be forced to deleverage, in turn creating systemwide declines in the supply of external financing. Or a negative shock that shakes depositors’ confidence can expose banks to the risk of runs, forcing them to hoard liquidity or sell assets at depressed market prices to meet withdrawals, if the systemwide maturity transformation (lending long and borrowing short) or

reliance on wholesale funds is high. Negative externalities related to fire sales can then come into play because a generalized sell off of financial assets causes a decline in asset prices, which in turn further impairs the balance sheets of intermediaries amplifying the contractionary phase of the cycle.

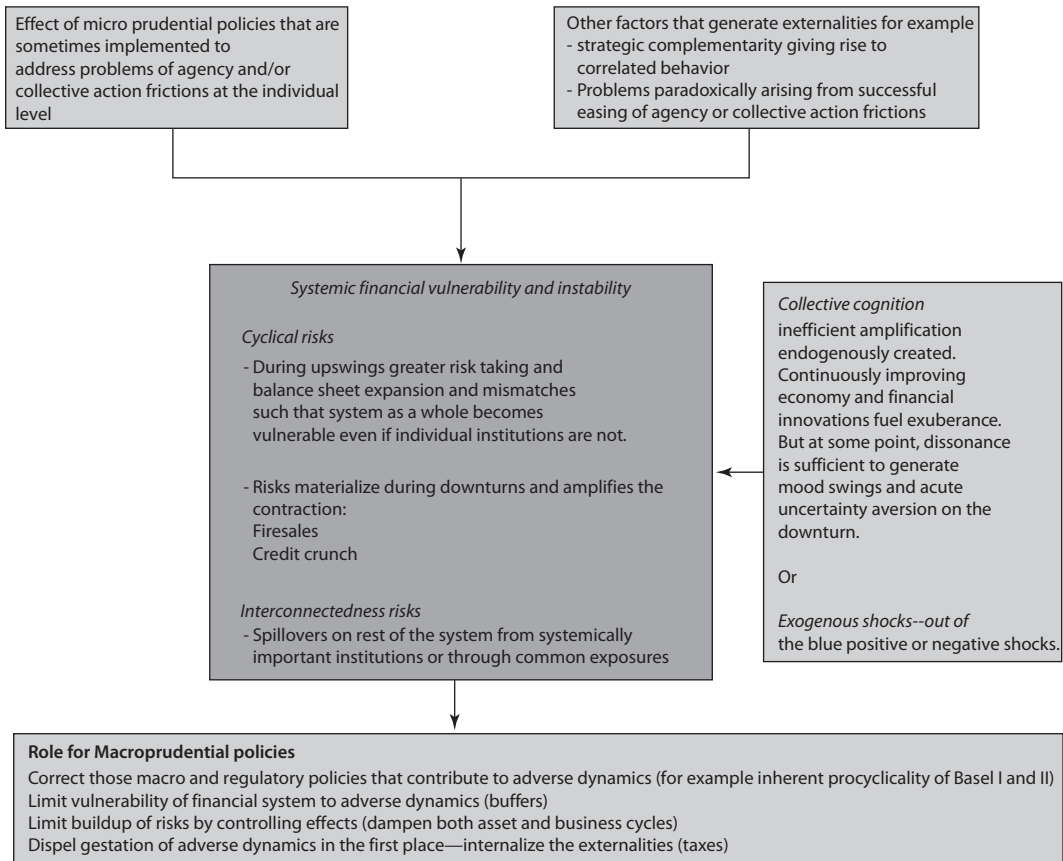
It is also possible that instead of, or in addition to, selling financial assets to regain liquidity and improve capital ratios, banks may reduce new credit extension, ration credit via higher margins/haircuts or raise interest rates or other costs to borrowers (externalities related to credit crunches). Such deleveraging via reduced credit extension will have general effects because the economic slowdown adversely affects borrowers by lowering output and prices. This situation raises the probability of default for all other borrowers and can set off a cycle of adverse effects on the real economy, again further amplifying banking-sector losses.

Positive (negative) exogenous shocks, which can be one trigger of a financial sector upturn (or downturn), can then get amplified through financial-sector frictions and the factors discussed earlier. There is also increasing recognition in the literature of the possible role of collective cognition, in which the dynamics are endogenous to the financial development process itself and get amplified by experience-based expectations. Thus, faced with the new and unknown (say, following a financial innovation and improving economy), market participants can be subject to waves of optimism and exuberance. At some point, however, a significant dissonance initiates a mood swing fueled on the downturn by acute uncertainty aversion (de la Torre, Ize, and Schmukler 2012).

Although the financial sector, thus, naturally exhibits procyclicality, several factors can amplify the buildup and heighten vulnerability by accentuating procyclical behavior, encouraging greater risk taking, or inducing correlated behavior (figure 5.1).<sup>3</sup>

Some aspects of micro prudential regulation, although intended to enhance stability at the level of the individual financial institutions, can actually increase the system's procyclicality. This situation is the case, for instance, with the Basel capital requirements and other micro prudential regulations designed to ease agency problems or frictions by providing some "skin in the game" (and buffers against unexpected shocks).<sup>4</sup> Even under the essentially flat capital requirements of Basel I, bank capital regulation had the potential to be procyclical because bank profits may turn negative during recessions, impairing banks' lending capacity. Additionally, the internal ratings-based approach of Basel II makes capital requirements an increasing function of banks' estimates of their loans' probability of default and loss given default, which are both likely to decrease (increase) during upturns (downturns). This approach thus creates procyclicality, especially in downturns when the rules can substantially exacerbate the negative impact of recessions on banks' supply of credit and, thereby, on the economy as whole. Hence, there are many concerns about the procyclicality introduced by rules such as Basel II.<sup>5</sup> Micro prudential regulations may also encourage correlated asset choices across financial institutions—since these regulations assigned similar risk-weights to certain asset classes, thereby favoring preferences of some asset classes over others and encouraging financial institutions to make the same asset choices.

**Figure 5.1 Factors That Can Lead to Systemic Risks and the Need for MaPPs**



Some (nonprudential) policies or practices aimed at reducing agency and/or participation frictions can also increase risk-taking and procyclicality.<sup>6</sup> For instance, remuneration contracts of managers commonly include a variable, performance-related component to better align the incentives between managers (agents) and shareholders (principals). However, the asymmetry of such schemes—whereby managers are highly paid if they make profits, but are not penalized for losses—can result in greater risk-taking on their part. Similarly, limited liability, which applies to bank shareholders, as it does for any other corporate shareholder, and is designed to foster entrepreneurship (and in the case of the financial sector, participation in financial markets) can encourage greater risk-taking. In particular, limited liability can encourage the use of value-at-risk (VaR) models. Shareholders do not care about tail risks—for an equity holder protected by limited liability, it does not matter whether the firm goes bust marginally or whether it goes bust spectacularly (Shin 2008).<sup>7</sup> Since empirically measured risk (for example, volatility, which directly influences VaR) is low during booms and high during busts, banks expand their balance sheets and increase

leverage during upturns and contract their balance sheets and reduce leverage during downturns. Thus adopting VaR encourages procyclical behavior.

Similarly, margins or haircuts that adjust over the cycle can also lead to greater procyclicality, especially in down cycles when margin/haircut spirals can occur.<sup>8</sup>

Some of these practices or policies generate strategic complementarities that lead to or actively encourage correlated behavior among financial institutions and markets and hence increase systemic vulnerability.<sup>9</sup> For instance, correlated behavior can arise as a result of reputational concerns and the incentive structures for bank managers. When bank managers care about market perceptions of their ability, their credit policies are influenced by those of other banks (Rajan 1994). Peer benchmarking can also give rise to correlated behavior because a bank reporting poor performance due to losses will be evaluated harshly unless many other banks suffer losses at the same time. Banks therefore have incentives to roll over bad loans to hide the loans until the buildup of bad loans forces them to coordinate a strategy of loss recognition and credit contraction. The prospect of a government bailout in the event of financial distress can also lead banks to engage in correlated asset choice *ex ante*. As financial institutions try to mimic each other's strategy—knowing there is safety in numbers—there is an increase in the systemic vulnerabilities of the financial system (De Nicolò, Favara, and Ratnovski 2012).

Attempts at reducing agency, collective action, or participation frictions that, on the one hand, are associated with successful financial development can, on the other hand, paradoxically, exacerbate systemic vulnerability. An example from de La Torre, Ize, and Schmukler (2012) relates to the availability of public information. More public information can reduce the ability to appropriate rents from private information, which eases agency frictions. At the same time, though, it can encourage investors to free ride (leading to a collective action problem). Rather than investing in analysis and monitoring, and staying committed investors may invest short and rely on market liquidity to exit at the first sign of trouble.

### ***Risks from Interconnectedness***

The cross sectional dimension of systemic risk arises from the interconnectedness of financial institutions and markets. This interconnectedness can result in a specific shock to an institution or market at a point in time being amplified as it is propagated throughout the system (see Allen and Gale 2007; Diamond and Rajan 2001; Bebchuk and Goldstein 2011). The shock may spread through the network of interconnected balance sheets of financial institutions when one systemically important financial institutions (SIFI) is hit, or it can spread because of direct actual or anticipated common exposures of financial institutions to a particular asset class (for example, commercial real estate, or foreign exchange risks) through financial markets and asset prices. Spillovers can also arise because of feedback from the real economy.

Financial institutions can reduce but not entirely eliminate these externalities since the shape of interconnectedness in the financial system is beyond the individual bank's control. Externalities stemming from interconnectedness are

particularly strong for SIFIs. Unlike smaller institutions, distressed SIFIs cannot be easily wound down, since they are large and complex, operate internationally, and play a role as backbones of the financial infrastructure. These institutions can then become too important to fail or too big to fail, leading to government subsidies *ex ante* (because they can attract financing at lower costs) and *ex post* (because they get bailed out when they run into distress).

Cyclical and interconnectedness risks can interact to exacerbate vulnerabilities. Although links among financial institutions can help them manage risk and distribute funds to where they can be deployed effectively, intrafinancial system activity can also increase the tendency for lending to become excessive during the upswing of a business cycle as discussed earlier. For instance, the dispersion of risks and the increased complexity in the financial system associated with securitization before the financial crisis reduced incentives to screen and monitor lending. This impairment in underwriting standards, in turn, exacerbated the extent of overborrowing in the real economy. Also, funding chains between banks and other financial intermediaries can mean that systemwide maturity transformation may be high, even though maturity transformation at any individual level may appear small.

Linkages within financial systems can also tend to exhibit procyclicality and contribute to time-varying risk in its own right by increasing the potential for contagion during exuberant periods, and increased risk aversion during times of financial turmoil. In particular, for a given level of lending to the real economy, a system that has longer, larger, or more opaque chains of intrafinancial system claims is more prone to amplifying shocks through counterparty risk. Excessive intrafinancial system activity also poses liquidity risks. Because of greater sensitivity to individual firm characteristics and marketwide sentiment, wholesale funding may be particularly flighty and shocks to one or more institutions can propagate withdrawals of funding in interbank and other wholesale markets during times of stress. Most of these risks appear in all types of countries, but with some variation. For ACs, besides domestic financial cycles often related to real estate booms and busts, interconnections among large SIFIs and through financial markets are important drivers of systemic risks. For EMs, with still less developed financial systems with smaller, less systemic banks and fewer interconnections, cyclical risks often related to global financial cycles and capital flows (especially in the form of bank flows) are important drivers of overall risk (see also Shin 2012). For further differences between EMs and ACs in terms of the typical behavior of business and financial cycles, refer to Claessens, Kose, and Terrones (2011a, 2011b).




### ***The Macro Prudential Toolkit***

To mitigate these causes of systemic risk, a number of MaPP instruments have been proposed and some have been used, even before the global financial crisis.<sup>10</sup> Table 5.1 categorizes these measures in a matrix (for other classifications of MaPPs, see Bank of England 2011 and IMF 2011a). The matrix's columns show the goals of five groups of MaPP policies and the rows show whether the instruments are



**Table 5.1 The Macro Prudential Toolkit**

	Policy tool group				
	1	2	3	4	5
	<i>Capital requirements, provisioning, surcharges</i>	<i>Restrictions on financial sector balance sheet (assets, liabilities)</i>	<i>Restrictions related to borrower, instrument, or activity</i>	<i>Taxation, levies</i>	<i>Other measures (including institutional infrastructure)</i>
<b>Expansionary phase</b>	Countercyclical capital requirements, leverage restrictions, general (dynamic) provisioning	Time varying caps/limits on: - mismatches (FX, interest rate) - reserve requirements	Time varying caps/rules on: - DTI, LTI, LTV - margins, haircuts - lending to sectors - credit growth	<b>Levy/tax on specific assets and/or liabilities</b>	- Accounting (for example, varying rules on mark to market) - Changes to compensation, market discipline, governance
<b>Contractionary phase: fire sales, credit crunch</b>	Countercyclical capital requirements, general (dynamic) provisioning	Liquidity limits (for examples, Net stable funding ratio, Liquidity coverage ratio)	Adjustment to specific loan-loss provisioning, margins or haircuts (for example, through the cycle, dynamic)	<b>Levy/tax (for example, on noncore liabilities)</b>	- Standardized products - OTC vs. on exchange - Safety net (central bank/ treasury liquidity, fiscal support)
<b>Contagion, or shock propagation from SIFIs or networks</b>	Capital surcharges linked to systemic risk	Institution- specific limits on (bilateral) financial exposures, other balance sheet measures	Varying restrictions on asset composition, activities (e.g., Volcker, Vickers)	Tax/levy varying by externality (size, network)	- Institutional infrastructure (for example, CCPs) - Resolution (for example, living wills) - Varying information, disclosure

	Enhancing resilience
	Dampening the cycle
	Dispelling gestation of cycle

applied to address cyclical systemic risks (and if so whether on the expansionary or contractionary phase) or systemic risks arising from interconnectedness.

Table 5.1 classifies macro prudential policies by intended target and method in five groups: (1) capital and provisioning requirements; (2) quantitative restrictions on financial institutions’ balance sheets; (3) quantitative restrictions on borrowers, instruments, or activities; (4) taxation/levies on activities or balance sheet composition; and (5) other, more institutionally oriented measures, such as accounting changes and changes to compensation. Categories 1, 2, 4, and 5 can be seen as affecting the supply side of financing, whereas category 3 aims to affect the demand for financing. Although this overlap is less precise, tools shaded in dark grey are more aimed at enhancing resilience, those in light grey are more aimed at dampening the cycle, and those in the striped cells are aimed at dispelling the gestation of the cycle

Specific measures under each of the 15 combinations include those correcting or compensating for fundamental factors that can give rise to externalities and market failures and those that compensate for policy factors that can contribute to adverse financial dynamics (such as the procyclicality introduced by micro prudential capital requirements).

The measures in the first four columns are meant to be time-, institution-, or state-varying, while the ones in the fifth column are meant to be more structural. Some measures fall into more than one combination depending on how they are used. As noted, many of the measures are tools traditionally used for micro prudential objectives; however, by making them vary by time, institution, or state of the world, they can be used to achieve macro prudential objectives, such as dampening the amplitude of the cycle. We will discuss the more important ones.

*Capital requirements, provisioning, surcharges.* Capital and provisioning requirements, in the first column, can have an impact on reducing the amplitude of the upswing of the cycle (first row), but are primarily considered tools for building more resilience in the financial sector (second row). Under Basel III, for example, a countercyclical capital buffer ranging between 0–2.5 percent of risk-weighted capital is to be introduced on top of the capital conservation buffer, when aggregate credit and other indicators are judged to signal a buildup of systemic risk.<sup>11</sup> General dynamic provisioning is also a countercyclical tool that builds up a cushion against expected losses in boom times (first row) that can be reversed during the downswing (second row).<sup>12</sup> Both countercyclical requirements could help dampen the effects of externalities associated with strategic complementarities in the upswing as well as with externalities related to fire sales and credit contraction in the downswing. A few countries have already used some variant of these measures, allowing for analyses of their effectiveness (see Jimenez and others 2012, for the case of Spain). A capital surcharge on SIFIs (too big to fail) (third row), also proposed under Basel III, is geared toward mitigating the externalities associated with financial institutions' interconnectedness.

*Restrictions on financial sector balance sheet.* Restrictions on banks' balance sheets, in the second column, are often considered for micro prudential purposes. They can also be used to achieve macro prudential objectives such as dampening the amplitude of the cycle (first and second rows). Measures range from (time varying) restrictions on balance sheet mismatches, such as on foreign exchange mismatches, and maturity mismatches. Reserve requirements that require banking institutions to hold a fraction of their deposits/liabilities as liquid reserves normally held at the central bank in the form of cash or other forms such as government securities, have been used as a liquidity and credit policy tool, that is, as a monetary policy tool. They can, however, also be used as a macro prudential tool to affect asset composition and dampen procyclicality.<sup>13</sup> Reserve requirements appear to be used that way in EMs and developing countries. Federico, Vegh, and Vuletin (2012), for example, found that in a sample of 52 developing countries 74 percent have used reserve requirements countercyclically. RRs can be applied on liabilities and on assets (the latter would entail holding reserves

against different asset classes, with the regulator setting adjustable reserve requirements on the basis of its concern with each asset class, Palley, 2004).

Given the potential risks arising from a liquidity shortage during the contractionary phase, as evidenced during the global financial crisis, the Basel III discussion includes a proposed set of liquidity requirements (second row): the liquidity coverage ratio (LCR) and the net stable funding ratio (NSFR).<sup>14</sup> To reduce buildup of systemic risks and externalities that can arise during the contractionary phase, restrictions on balance sheets can also include countercyclical requirements on noncore-to-core funding, leverage, or other ratios.

Additional measures aim at enhancing the resilience of banking system to reduce risks of spillovers (third row). Here measures can be micro prudential in nature as well, like restrictions on financial institutions' bilateral exposures or other balance sheet limits, but be designed and used with the macro prudential objectives of reducing interconnectedness.

*Restrictions related to borrower, instrument, or activity.* Measures related to borrowers (third column) in the expansionary phase of the cycle (first row) are typically designed to limit the leverage of borrowers to manage financial institutions' credit risk and include (time varying) caps on LTV ratios (which can also be applied differentially to loans of different characteristics (such as mortgages or central versus peripheral locations) and (time varying) caps on debt-to-income ratios. And caps on credit growth directly address asset growth and the potential risks during the upswing of the financial cycle. These measures can act as a brake on banks' asset growth, but also help to reduce leverage and the impact of declines in asset prices and economic prospects during downturns (second row). Structural measures limiting banks' activities (third row), such as the Volcker rule in the United States and the Vickers rule in the United Kingdom, can limit the risks of spillovers due to interconnections.

*Taxation, levies.* As proposed by Shin (2010) among others and discussed by IMF (2010), a tax or levy (fourth column) applied to some balance sheets concept can serve to mitigate the externalities that lead to excessive asset growth during the upswing, for example, by limiting risky funding (first and second row). For bank and nonbank financial institutions engaged in market-based activities, macro prudential regulations can take the form of procyclical margin requirements (see, for example, Geanakoplos 2009; Gorton 2009; and Gorton and Metrick 2010). Requiring through-the-cycle margins or haircuts can help mitigate the externalities arising during the expansionary and contractionary phase because it would mean margins remain higher (lower) during upswings (downswings). Also levies on noncore liabilities can help reduce the probability that financial institutions would run into aggregate funding problems in the first instance. Similar to a capital surcharge, a tax can be levied on SIFIs to encourage them to reduce their externalities (third row).

*Other measures (including institutional infrastructure).* Finally, a wide set of institutional infrastructure changes can serve a macro prudential role (fifth column) as either they limit the frictions or deeper distortions that give rise to

financial cycles in the first place (first and second) row or they help reduce the spillovers by building stronger protections (third row). For further discussion of these more institutionally oriented measures, refer to Andritzky et al. (2009).

### **What MaPPs Have Countries Used and How Effective Have They Been?**

The previous two sections discussed the analytical reasons for MaPPs and the specific tools countries can use in principle. The preferred use will vary depending on the country's exposure to shocks and risks, and its structural, institutional, and financial market characteristics that affect the amplification of financial and real sector cycles. The country's financial structure, that is the importance of banks versus capital markets in external financing, is likely to be an important factor in the choice of policy. For example, financial institution-based measures are likely to be of greater importance when much of the external financing comes from the regulated financial system. Such financial structures can differ vastly across countries.

The use and effectiveness of policies could also vary depending on the availability and effectiveness of fiscal, monetary, and micro prudential policies. For example, some countries can use monetary policy to affect the financial cycle, but for others, such as those in a currency union with a pegged exchange rate, this policy is not available (even when available, the effectiveness of monetary policy is not clear). Others may have less room to conduct countercyclical fiscal policy. The degree of financial openness will matter for the choice of policies because it affects the degree to which some policies can be implemented and, more generally, because it determines exposures (for instance, there are strong links between the behavior of capital flows and bank vulnerabilities, as outlined by Hahm, Shin, and Shin 2012 Claessens and Ghosh 2013). Institutional environment constraints (for example, lack of data or expertise), political economy, and other factors may lead countries to adopt MaPPs in ways different from what is preferable. A major issue is that little is known about the actual effectiveness of various MaPPs, thus their use has proceeded on an experimental basis.

This section first reviews the use of MaPPs in a large sample of countries, and then reviews studies on their effectiveness, examining in detail the tools and approaches used to reduce financial vulnerabilities in banking systems.

#### ***Use of MaPPs***

Data on the use of macro prudential policies in recent years were collected through a survey of country authorities as well as from an internal IMF survey of country desk economists for 48 countries, both ACs and EMs (see Lim and others 2011 for the exact coverage and definitions). Based on these data, 35 countries (10 ACs and 25 EMs) have implemented at least one MaPP instrument during the period 2000–10. The eight specific instruments used were categorized as: caps on loan-to-value (LTV) and debt-to-income (DTI), limits on credit growth (CG), limits on foreign currency (FC), that is, lending limits; reserve requirements (RR), dynamic provisioning (DP), countercyclical requirements (CTC), limits on profit redistribution (PRD), and a residual category (other).<sup>15</sup>

**Table 5.2 Overall Use of Macro Prudential Instruments**

Type of instrument	Frequency		Emerging markets	Advanced economies	Closed capital account	Open capital account	Frequency	
	Total countries	of use (percent)					Frequency of EMs-year (5)	of ACs-year (percent)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Loan-to-value limits (LTV)	24	44	15	9	11	13	35	74
Debt-to-income limits (DTI)	7	9	5	2	4	3	8	11
Credit growth limits (CG)	6	8	5	1	4	2	10	1
Limits on foreign currency lending (FC)	8	8	7	1	4	4	10	3
Reserve requirements (RR)	5	5	5	0	5	0	7	0
Dynamic provisioning (DP)	9	9	8	1	5	4	9	11
Countercyclical capital requirements (CTC)	2	1	2	0	2	0	2	0
Regulations on profit redistribution (PRD)	6	3	6	0	4	2	4	0
Other	13	12	12	1	6	7	15	1
Total by classification	35	100	25	10	15	20	100	100

Note: There were 35 countries using a macro prudential policy at any point during the period 2000–10. Countries are classified into emerging versus advanced economies (IMF 2013) and open versus closed capital account countries (Chin and Ito 2008). A country was defined as an open capital account country if its Chinn-Ito index was larger than the global mean in 2005 and a closed capital account country if its Chinn-Ito index was smaller than the global mean in 2005. The frequency of use is the ratio of country pairs using a particular instrument to the total number of country-year pairs using a macro prudential policy (for example, during 2000–10, 44 percent of the time, countries used caps on LTV ratios compared with only 9 percent of the time using DTI ceilings).

Overall, countries used LTVs the most (table 5.2, column 1): 24 countries used them in at least one year during this period. Next was DPs (9 countries), FCs (8 countries), DTIs (7 countries), and CG caps and PRDs (6 countries); RRs (5 countries); and CTCs (2 countries).

Weighting by the length of time over which the macro prudential policies are used (column 2 in table 5.2), the most often-used policy in the sample of countries was by far the LTV, which was used in about 44 percent of the country-year combinations when a policy was used. Next, besides “other,” were four categories used about equally frequently (in about 8 percent of the cases each): DTI, CG caps, FC lending limits, and DP. These policies were followed by RRs (5 percent), PDRs (3 percent), and finally CTCs (1 percent). Note that some countries used more than one policy at a time, making these comparisons relative to the overall use of macro prudential policies.

Use of a specific policy can be expected to vary between advanced countries and emerging markets and between open versus closed capital account countries in part due to the variation in source of systemic risks. In advanced countries, LTVs are used the most (table 5.2, columns 3 and 4). Advanced countries using LTVs over this period were Canada, France, Hong Kong SAR, Italy, the Republic of Korea, Norway, Singapore, Spain, and Sweden. Use of other macro prudential policies by advanced countries is rarer: only Hong Kong SAR and Korea use DTIs; Singapore uses CG limits; Austria, FCs; Spain, DPs; and Norway and

Korea, “other” tools. Whereas LTV caps and foreign currency limits are used almost equally in both open and closed economies, reserve requirements were only used in relatively closed capital account countries (table 5.2, columns 5 and 6). This use of policy tools likely reflects differences in both risk exposures and financial system structures, and possibly the degree of financial liberalization. Otherwise, the differences in use between open and closed economies are not as stark as those between emerging markets and advanced countries.

Differences between emerging markets’ and advanced countries’ use of specific policies are starker when considering the length of time over which the policies were used (columns 7 and 8 of table 5.2, which report usage percentages by country-year observations for each group). Emerging markets used a much broader set of policies over a longer period than advanced countries did. Perhaps because emerging markets tend to be more concerned with large and volatile capital inflows and with related systemic liquidity risk, they tended to favor capital flow- and liquidity-related policies (FC and RR). But they also used limits on credit growth more often, possibly in part because they tend to have less liberalized financial systems. They also tend to place more limits on profit distributions. Conversely, as noted, advanced countries tend to prefer LTVs (74 percent of their usage by country-year observations). They also used DTI and dynamic provisioning relatively more than emerging markets. This usage suggests that advanced countries are relatively more concerned with risks arising from excessive leverage, and the consequent deleveraging.

### ***Effectiveness of MaPPs***

A number of papers have analyzed the effects of MaPPs on various measures of financial vulnerability and stability and documented the effectiveness of some MaPPs. Lim and others (2011) using cross-country regressions, found MaPPs to be effective in reducing the procyclicality of credit and leverage. Specifically, tools, such as LTV and DTI caps, ceilings on credit growth, reserve requirements, and dynamic provisioning rules, can mitigate the “procyclicality” of credit. Crowe and others (2011) found that MaPPs linked to the real estate cycle, such as maximum LTV, appear to have the best chance to curb a real estate boom. They argue that the narrower focus of such tools reduces their costs. Regarding measures aimed at strengthening the banking system (such as dynamic provisioning), they argue that such tools may help to cope with a bust, even if they fail to stop a boom. Vandenbussche, Vogel, and Detragiache (2012), covering countries in Central, Eastern, and southeastern Europe, find that measures like capital ratio requirements and nonstandard liquidity measures (marginal reserve requirements on foreign funding or marginal reserve requirements linked to credit growth) helped slow down housing price inflation.

Dell’Ariccia and others (2012) found that MaPPs can reduce the incidence of general credit booms and decrease the probability that booms end up badly.<sup>16</sup> Consistent with MaPPs’ focus on financial vulnerabilities, they found a lower probability of a bad boom, primarily for booms that end in a crisis, with the effect on the probability of economic underperformance not very different. They

concluded that MaPPs can reduce the risk of a bust while simultaneously reducing the vulnerability of the rest of the economy to troubles in the financial system.

Some case studies focused on specific risks or market segments. Jiménez and others (2012) found that in Spain countercyclical macro prudential policies, such as dynamic provisioning, were useful in taming credit supply cycles. More importantly, during bad times, dynamic provisioning helps smooth the downturn, upholding firm credit availability and performance during recessions. Igan and Kang (2011) found evidence of LTV and DTI limiting mortgage credit growth in Korea.

Most of these studies investigated the effects of MaPPs either at the macroeconomic or overall financial sector level, such as leverage or credit growth or the occurrence of a financial crisis, or at the level of subsector, such as real estate.

Our recent analysis (Claessens, Ghosh, and Mihet 2013) investigates how MaPPs may affect certain channels by which vulnerabilities and externalities can arise at the *microeconomic* level. Specifically, we explore the role of MaPPs in limiting vulnerabilities in individual banks (and thereby banking systems) in 48 ACs and EMs. Using data for 2,800 banks, three vulnerability measures were calculated: increase in leverage, growth in assets, and increase in noncore-to-core liabilities. These measures differ across countries. The typical expansionary phase is stronger in EMs than in ACs, and entails much larger leverage, asset, and noncore-to-core liabilities growth than in ACs, while the typical contractionary phase is deeper in EMs than in ACs. Similarly, open capital account countries have more volatility than closed capital account countries. Importantly, these measures of vulnerability also differ across countries that have adopted MaPPs and those that have not, with the median change in risk variables being higher for those that adopted some MaPPs.

Using the panel data, the various MaPPs were related to the vulnerabilities measures. Regressions controlled for whether the country was in an expansionary or contractionary phase of the business cycle, and whether other macroeconomic policies were used that complemented MaPPs in limiting vulnerabilities. The work also explored differences between ACs and EMs and between closed and open capital account countries.

The regression results, summarized stylistically through different shadings in table 5.3, suggest that many MaPPs can help in controlling banking system vulnerabilities, with at times complementary relationships among MaPPs. Thus, those instruments shaded in black were found to be statistically significant in limiting the increase in vulnerability (as measured by an increase in leverage ratio, asset growth, or noncore-to-core liabilities) through the cycle. Specifically:

- *Measures aimed at borrowers*: Loan-to-value and debt-to-income caps can reduce bank leverage growth, asset booms, and noncore-to-core liabilities growth, especially when there is more procyclicality in these variables (that is, when the cycles are more intense).
- *Measures aimed at financial institutions (addressing asset side)*: Limits on credit growth help reduce asset growth. Foreign currency lending limits are also effective, with (statistically) significant coefficients for all three bank vulnerability indicators.

- *Measures aimed at financial institutions (addressing liabilities side):* Reserve requirements reduce asset growth. They are not found to affect the leverage cycle. Neither do they reduce the noncore-to-core liabilities growth, rather the opposite, perhaps because higher reserve requirements induce the banks to seek additional funds to finance the reserve requirements, which at the margin means more noncore liabilities (see chapter 1).
- *Measures addressing bank buffers:* Dynamic provisioning appears to be a robust instrument in reducing growth in all three measures. Countercyclical capital requirements are effective in reducing growth in leverage and assets. Restrictions on profit distribution seem to be effective in reducing leverage and asset growth but not in reducing growth in noncore-to-core liabilities.

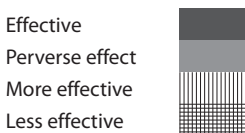
When the analysis was conducted differentiating upswings from downswings, the results show that macro prudential policies are much more effective in booms than in busts, with many coefficients statistically significant in expansionary periods and many fewer coefficients significant in contractionary periods. Again, the instruments that were shown to have a statistically significant effect (and of the correct sign) are shown shaded in black (table 5.3). Specifically we found that in booms, caps on loan-to-value and debt-to-income ratios, limits on foreign currency lending, dynamic provisioning, and limits on profit redistribution helped limit leverage growth; all macro prudential policies except for limits on credit growth and limits on profit redistribution helped limit asset growth;

**Table 5.3 Summary of Effectiveness of Macro Prudential Policies in Reducing Leverage, Asset, and Noncore-to-Core Ratios**

	Through the cycle			Upturns			Downturns			Open economies relative to Closed economies			Emerging markets relative to Advanced countries		
	Lev	Asset	NCC	Lev	Asset	NCC	Lev	Asset	NCC	Lev	Asset	NCC	Lev	Asset	NCC
	LTV	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective
DTI	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective
CG	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective
FC	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective
RR	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective
DP	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective
CTC	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective
PRD	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective	Effective

Source: Claessens and others 2013.

Note: Lev = leverage growth; NCC = noncore-to-core liabilities. A country is defined as an open capital account country if its Chinn-Ito index is larger than the global mean in 2005 and a closed capital account country if its Chinn-Ito index is smaller than the global mean in 2005.





and limits on foreign currency lending and dynamic provisioning helped limit noncore-to-core liabilities growth.

In principle, tools such as reserve requirements could provide liquidity cushions, while dynamic provisioning could help build capital buffers during upturns, supporting lending during downturns. Other tools such as limits on profit redistribution could also have countercyclical, buffer effects, helping banks' willingness to maintain (or at least reduce less) balance sheets in bad times. In our regressions, however, very few policies affect in a statistically significant way the speed of decline when the credit cycle reverses. The only ones that are significant and positive are DTI ratios, which help maintain overall leverage growth during downturns, limits on foreign currency lending, and "other," which help maintain overall bank asset growth. DTI ratios also help limit the decline in noncore-to-core liabilities. Some negative signs, that is, policies that actually worsen the declines, were seen. These perverse effects are shaded in light grey in table 5.3. Specifically, caps on LTV ratios and caps on credit growth appear to lower asset growth during downturns, and caps on LTV ratios and limits on foreign currency borrowing seem to worsen declines in noncore-to-core liabilities.

That macro prudential policies are mostly effective in the expansionary times only may not be surprising because most macro prudential policies are not designed to mitigate contractionary periods as such. It could even be that tools like LTV limits actually act perversely during periods of credit contractions and asset price declines. As borrowers' net worth and income decline, for example, strict LTV limits make it even harder for lenders to extend loans, possibly leading to further declines in house prices and setting of a perverse cycle of even tighter LTV ratios. Unless the limits are adjusted quickly in a rightly calibrated manner—that is, without unduly increasing systemic risks—their effects may be perverse.

To investigate whether there are differences between the effectiveness of macro prudential policies depending on country characteristics, we also ran regressions interacting macro prudential policies with group dummies, where emerging markets and open economies are the dummies (coefficients without interactions, therefore, refer to the general effects and coefficients for the interactions refer to the additional effects for emerging markets and open economies). The results show that only a few policies affect risks in the groups differently as only a limited number of interaction coefficients are found to be statistically significant. This finding is largely because macro prudential policies tend to be used more by emerging markets and closed economies, making direct comparisons limited (no results are then reported).

Policies found to be more effective (statistically significant) for open economies (relative to close capital account economies) and for emerging markets (relative to advanced countries) are shown in vertically striped cells in table 5.3. Policies found to be less effective in the same contexts are shown as gridded cells. The results suggest that caps on LTV ratios are less effective in reducing asset growth in open economies and caps on DTI ratios are less effective in reducing leverage growth in emerging markets and open economies. Caps on

credit growth affect asset growth more for closed than open economies and limits on foreign currency borrowing help reduce asset growth somewhat more in emerging markets and open economies, and noncore-to-core growth in open economies. Dynamic provisioning seem to work better in closed economies for controlling leverage and asset growth and “other” limits seem of more value in emerging markets and closed economies for reducing leverage and asset growth. Otherwise, regression results suggest no statistically significant differences between instruments in limiting some of the risk buildups in emerging markets’ (or closed countries’) banking systems versus those in advanced countries’ (or open countries’) systems.

## Conclusions

Recent theoretical advances support a role for macro prudential policies in safeguarding financial stability. Such policies can reduce the buildup of vulnerabilities and can help mitigate the impact of adverse cycles by encouraging a greater buildup of buffers. Indeed, empirical analyses confirm that countries stand to benefit from greater use of MaPPs to reduce systemic risk.

Some macro prudential policies are better suited to reducing the buildup of vulnerabilities, whereas others are geared toward building up buffers. Macro prudential policies thought to be more effective in reducing vulnerabilities help reduce risks during upswings. In contraction phases, though, some of these tools seem to prevent a rebound in financial variables, suggesting that they may be ineffective in fostering a restoration of financial intermediation during adverse conditions. However, tools that help build buffers in good times generally not only reduce the level and the growth of bank risk measures during upswings, but also help provide cushions that alleviate more severe crunches during downswings. As such, these tools may be more promising.

There are large differences across countries in the use of macro prudential policies, with emerging markets and countries with closed capital accounts using them more than advanced countries and open capital account countries. We find evidence that some of the macro prudential policies are more effective in reducing banking sector vulnerabilities (as measured by increase in leverage, growth in assets, and increase in noncore-to-core liabilities) in emerging markets than in advanced economies.

This is not surprising, given both their more frequent use in these countries and the fact that these countries’ financial systems are often simpler, making it more likely that macro prudential policies are effective. We also find the effects of macro prudential policies to be quantitatively greater in open capital account countries, even though they are used relatively less in these economies.

As documented, emerging markets have been at the forefront of using macro prudential policies. Advanced countries’ ongoing financial crises and weak economic performance in contrast to emerging markets’ stable financial systems and continued solid performance, however, leads one to question the view that emerging markets are more exposed to risks and in need of macro prudential policies. In principle, all types of countries can experience the externalities and market failures that macro prudential policies aim to address. In practice, the choice of which macro prudential policies, if any, to use will be country and circumstance specific. Indeed, our findings suggest that the use and effects of macro prudential policies depend on country-specific circumstances. Although in some respects, concerns in

emerging markets about systemic risks are becoming similar to those of advanced countries, emerging markets are likely to need a different and broad set of policies, including macro prudential policy tools in addition to fiscal and micro prudential policies. At the same time, their pragmatic approaches to date in using these tools can benefit from further research regarding which approaches are the most effective and efficient given country- and circumstance-specific conditions (see also Acharya 2013, and Shin 2011 for suggestions on how to adapt macro prudential policies to emerging markets and developing countries).

## Notes

1. In particular, the many works by Borio and White, including Borio and White (2003) and White (2006), highlighted the boom and bust patterns in financial markets and the need for broader tools. See Clement (2010) on the origins of the term “macro prudential,” whose first recorded use at the BIS was in 1979.
2. Procyclicality can arise from the behavior of financial intermediaries (supply side) and from changes in borrowers’ balance sheets and income statements. The latter amplification mechanisms, collectively known as “the financial accelerator,” operate through the demand side of financial transactions. Models show how small shocks, real or financial, can be propagated and amplified across the real economy as they lead to changes in access to finance for corporations and households. Here the financial system is less a cause of procyclicality, but rather accommodates it. Obviously, there are many interactions between the demand and supply side causes of procyclicality. See Brunnermeier, Eisenbach, and Sannikov (2012) for a review of models of macro financial linkages and Angelini and others (2009) for a general review of financial sector procyclicality.
3. These factors all result in externalities of one form or other. In the case of factors that exacerbate procyclicality, this externality takes place through the impact of individual financial institutions’ actions on asset prices, which indirectly leads to correlated outcomes (expansion of balance sheets and balance sheet vulnerabilities). In the case of factors that give rise to strategic complementarity, the externality arises directly through correlated behavior.
4. Agency frictions refer to frictions that limit the capacity of individuals to delegate and contract bilaterally—and hence hinder financial development—due to (1) asymmetric information frictions (which lead to a misalignment of incentives between the principal (for example, depositors) and the agent (for example, the banker), because the agent, who has more information on his or her actions, can use this informational advantage to act in ways that are not in the interests of the principal; or (2) contract enforcement costs.
5. However, for capital requirements to have contractionary effects, some banks must find it difficult to respond to the accumulation of losses or higher capital requirements by issuing new equity and the borrowers of the constrained banks must be unable to switch to other sources of finance.
6. Participation frictions or collective frictions refer to frictions that constrain economic agents’ participation in financial markets or financial inclusion broadly defined. Much of the gains from financial activity relate to a reduction in transactions costs, and the increase in liquidity and risk diversification benefits that come with greater participation

in financial markets. Hence, limited participation can constrain financial development (de la Torre, Ize, and Schmukler 2012).

7. Moreover, during the upswing, in a situation in which the best borrowers may already have access to the loans they want/or the list of sound projects are limited, banks' drive to expand their balance sheets may be associated with their moving down the quality ladder to lend to increasingly riskier borrowers/projects.
8. When cash lent on repo trades (short-term borrowed money) is lower than the market value of the collateral security, the applicable discount is referred to as a "haircut." In securities lending, the market value of the collateral to be posted always has to be higher than that of the securities, and the overcollateralization is referred to as the margin. The spiral arises because many institutions finance their asset positions with (short-term) borrowed money (repos) and have to put up margins in cash or are imposed a haircut (discount) on the assets they provide as collateral to assure the lender that the loan can be recovered in case the borrower defaults. As margins/haircuts increase in times of price declines—as lenders want more protection—a general tightening of lending results (margins and haircuts implicitly determine the maximum leverage a financial institution can adopt). The margin/haircut spiral then reinforces the capital adequacy and VaR channels in making institutions reduce their leverage. See further Brunnermeier and Pedersen (2009); Adrian and Shin (2010), and Geanakoplos (2009).
9. Strategic complementarity arises when the payoff to a certain strategy rises with the number of financial institutions adopting the same strategy (De Nicolò, Favara, and Ratnovski 2012).
10. Note that many of these instruments can also serve some other policy objectives, including, besides micro prudential objectives, consumer protection, and competition policy.
11. According to the original guidance document (BCBS 2010), intentions to raise the level of the capital buffer would be preannounced by up to one year, but a decision to decrease the buffer would take place immediately.
12. Most of the dynamic provisioning measures are a variation on the following rule:  $DP = \text{through-the-cycle loss ratio} \times \text{flow of new loans} - \text{flow of specific provisions}$  (where specific provisions correspond to realized losses). Thus, the formula implies that during boom times dynamic provisions are positive and contribute to the increase in loss provisions as realized losses are below the-through-the cycle loss ratio. The requirement for extra buildup of loan-loss provisioning could act as a brake during boom times. The reverse is true during downswings, with the drawdown serving as an additional cushion.
13. When applied to deposits, regulations usually specify the level of the requirement according to deposit type (for example, demand or time) and its currency denomination (domestic or foreign). Regulations also set a holding period relative to the reserve statement period for which the reserve requirement (RR) is computed and whether they *are* remunerated or nonremunerated. When they apply only to new deposits they are referred to as marginal RRs. In addition RRs can apply to domestic or foreign nondeposit liabilities of banks' balance sheets.
14. The LCR goal is to ensure that banks have liquidity to survive one month of stressed funding conditions. Therefore, the LCR identifies the amount of unencumbered (that is, not pledged and not held as a hedge for any other exposure) high-quality liquid assets that can be employed to offset expected cash outflows over a 30-day horizon. The NSFR is a complement to the LCR with a goal of addressing longer-term

structural maturity liquidity mismatches in banks' balance sheets. It sets a minimum acceptable amount of stable funding based on liquidity characteristics of a bank's assets over one-year horizon. The NSFR is defined as the ratio between available stable funding and required stable funding. Stable funding includes those types and amounts of equity and liability financing expected to be reliable sources of funding over a one-year horizon under stress scenarios. Stable funding is defined as the total amount of capital; preferred stock with maturity greater than one year; and secured and unsecured borrowing and liabilities (including deposits with effective maturities of one year or greater; proportion of stable wholesale funding, nonmaturity deposits, and/or term deposits of less than one year expected to stay with the institution for an extended period of idiosyncratic stress).

15. A dummy variable for each instrument takes the value of 1 for countries and years in which that instrument is used or zero otherwise. Only for some of the MaPP do we also know the level: caps on loan-to-value and debt-to-income ratios, which vary from 0 to 1 and 0 to 0.5, respectively.
16. When estimating regressions using the subcomponents of their macro prudential index, they find that credit and interest controls and open foreign exchange position limits enter significantly in most regressions, although their significance is sensitive to the specific combination of variables included.

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