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A Perspective from Latin America

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POLICY BRIEF N°  
IDB-PB-250

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## A Perspective from Latin America

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February 2016



Cataloging-in-Publication data provided by the  
Inter-American Development Bank  
Felipe Herrera Library

Agénor, Pierre-Richard.

Reserve requirements and loan loss provisions as countercyclical macroprudential instruments: a perspective from Latin America / Pierre-Richard Agénor, Luiz A. Pereira da Silva.

p. cm. — (IDB Policy Brief ; 250)

Includes bibliographic references.

1. Bank reserves—Latin America. 2. Monetary policy. 3. Macroeconomics I. Inter-American Development Bank. Department of Research and Chief Economist. II. Silva, Luiz A. Pereira da. III. Title. IV. Series.

IDB-PB-250

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## Abstract\*

This paper discusses, from an analytical and operational perspective, the use of reserve requirements and loan loss provisions as countercyclical macroprudential instruments. In recent years both of these instruments have been used extensively in Latin America and elsewhere in the world. The first part of the paper sets the stage with a discussion of the rationale, in the presence of financial frictions, for using macroprudential regulation to mitigate financial system procyclicality. The second part reviews the general arguments, as well as the recent empirical evidence for Latin America, associated with the use of reserve requirements and loan loss provisions. The third part provides a normative analysis of the ways through which countercyclical reserve requirements and cyclically adjusted (or, more commonly called, dynamic) provisioning rules should be formulated, independently and jointly, to address concerns arising from procyclicality and financial volatility. Optimal countercyclical rules are discussed from the perspective of how these rules can either minimize a composite measure of economic volatility (combining measures of both macroeconomic and financial volatility) or maximize social welfare. The last part brings together the lessons for policymakers that can be drawn from the analysis.

**JEL classifications:** E51, E58, G28

**Keywords:** Macroprudential regulation, Reserve requirements, Loan loss provisions, Procyclicality, Countercyclicality

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## 1. Introduction

The global financial crisis led to a renewed debate about the nature and effectiveness of financial regulation. The consensus that emerged is that, to contain systemic risks and preserve macroeconomic and financial stability, it is essential to go beyond a microprudential approach focused solely on the regulation of individual institutions. At the same time, the greater focus on systemic risk has stirred up a broad debate in academic and policy circles on how macroprudential regulation (in its time series dimension) can help to mitigate the procyclicality of the financial system, most notably by preventing unsustainable credit booms and the build-up of asset price bubbles.<sup>1</sup>

It is now common to distinguish among three types of macroprudential measures: capital-related, liquidity-related and credit-related measures.<sup>2</sup> Capital-related measures aim primarily at addressing excessive procyclicality and at making the financial system more resilient. They include strengthening the eligibility of financial instruments as capital, raising the minimum required amount (in proportion of risk-weighted assets), implementing countercyclical or time-varying capital requirements, adopting time-varying loan loss provisioning requirements, and imposing restrictions on profit distribution. Liquidity-related measures aim primarily at addressing the resilience of the financial system during periods of stress. They include limits on net open currency positions and currency mismatches, limits on maturity mismatch, and reserve requirements on private deposits. Credit-related measures aim primarily at preventing excessive leverage and various balance-sheet mismatches in the financial system. They include loan-to-value and loan-to-income ratios, caps on foreign currency lending, and ceilings on credit or credit growth. Even though no consensus has yet emerged on which of these instruments are most appropriate under what circumstances, some of them (such as countercyclical capital requirements and so-called dynamic loan loss provisions, as well as leverage and liquidity ratios)

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<sup>1</sup> See Caruana and Cohen (2014) for a discussion of the key elements of macroprudential policy. It is worth noting that some countries took an entirely different path. Iceland for instance, with a banking system that grew to more than seven times the size of the economy in 2007 and was hit hard by the global financial crisis, recently announced that, to reform its monetary system, its central bank would assume exclusive powers to create money (see Sigurjonsson, 2015). It would not just set interest rates, but also control the quantity of credit; commercial banks would be allowed to lend within a maximum range, reviewed each month. However, past experience has shown that this type of centralized approach may overly constrain credit (with potentially adverse effects on growth), in addition to being very difficult to implement in an open economy. See Independent Commission on Banking (2011).

<sup>2</sup> See Bank of England (2011), Committee on the Global Financial System (2012), and Galati and Moessner (2013) for a general discussion of macroprudential policy tools.

have already been made part of the new Basel III regime for banking regulation (see Basel Committee on Banking Supervision, 2011, 2013) and have been implemented in a number of countries.<sup>3</sup>

The new capital framework, in particular, not only strengthens the definition of bank capital but also recommends the implementation of both a capital conservation buffer and a countercyclical capital buffer (capital in excess of regulatory capital), with the latter ranging from 0 to 2.5 percent of risk-weighted assets.<sup>4</sup> According to the proposed rule for these buffers, bank capital should be adjusted in response to excess growth in credit to the private sector (deviations in actual credit growth from a trend value), which is viewed as a reliable indicator of systemic risk.<sup>5</sup> The evidence suggests indeed that systemic risk is typically built in the upswing of the financial cycle, when credit, asset prices, leverage and maturity mismatches, all rise in a mutually reinforcing manner. In an upturn, expanding credit puts upward pressure on asset prices, thereby strengthening balance sheets and collateral values, and prompting further credit growth. Credit growth is often further magnified by a weakening of lending standards and reduced screening intensity. To the extent that decisions of individual financial institutions ignore these self-reinforcing effects the upswing is characterized by an excessive expansion of credit and leverage. The opposite happens (often more abruptly) in the downswing, during which a vicious circle arises among asset sales, deteriorating lending portfolios, and deleveraging. Capital buffers can therefore help to mitigate the amplitude of these movements. In addition, Basel III backstops the capital requirements with a new leverage ratio and requires financial

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<sup>3</sup> Claessens, Kose and Terrones (2013), Giese et al. (2013), Akinci and Olmstead-Rumsey (2015), Bruno, Shim and Shin (2015), and Cerutti, Claessens and Laeven (2015) offer empirical evidence on the performance of macroprudential tools. Basel III actually does not promote a clear framework for dynamic provisioning, beyond supporting the concept in general terms—not least, as discussed later, due to the ongoing debate on the reform of international accounting standards.

<sup>4</sup> Several countries have chosen to go beyond the Basel III recommendations and have considered higher capital requirements. In addition to requiring additional capital, authorities in some countries have also considered measures to restrict the activities that banks can undertake. For instance, the Vickers Report in the United Kingdom proposes ring-fencing traditional retail banking business activities. The Volcker Rule in the United States incorporates restrictions on proprietary trading by banks and limits on owning and investing in hedge funds. Similarly, the Liikanen Report for the European Union looks to ring-fence risky activities in a bank's subsidiaries.

<sup>5</sup> In 2011, Peru introduced a countercyclical capital rule linked instead to GDP growth. See Drehmann, Borio and Tsatsaronis (2011), Repullo and Saurina (2011), Kauko (2012), and Gersbach and Rochet (2014) for a more detailed discussion of alternative rules for setting countercyclical capital buffers. Repullo and Saurina (2011), in particular, suggest a rule based on GDP growth, consistent with the Peruvian approach.

institutions to increase their ability to withstand liquidity shocks in a downturn, based on two new instruments, a Liquidity Coverage Ratio (LCR) and a Net Stable Funding Ratio (NSFR).<sup>6</sup>

In academic and policy-oriented research, capital buffers have attracted the most interest among studies aimed at assessing the performance of countercyclical macroprudential instruments.<sup>7</sup> By contrast, there has been more limited research on the use of other instruments, despite the fact that (as noted earlier) Basel III incorporates a range of potential tools and the fact that several countries already use a wide range of them. These instruments include reserve requirements—which are part of the Basel III liquidity requirement—and so-called dynamic provisioning schemes, which have been implemented in a number of countries in Latin America (initially in Uruguay, and more recently in Bolivia, Colombia, and Peru) as well as in other regions in the developing world.<sup>8</sup>

The purpose of this paper is to discuss, based on recent academic and policy-oriented research, how reserve requirements and dynamic provisioning (as opposed to capital requirements) can help to mitigate the procyclicality of the financial system and financial volatility. To conduct this analysis, and in contrast to much of the existing literature, we focus on the larger middle-income countries (MICs) of Latin America. We do so for several reasons, which are discussed later on.

The remainder of the paper is organized as follows. Section 2 sets the stage with a brief discussion of the rationale for using macroprudential regulation to mitigate procyclicality and financial volatility, in the presence of financial frictions. Section 3 reviews the general arguments, as well as the empirical evidence, associated with the use of reserve requirements and loan loss provisions. Section 4 provides a more normative analysis of the ways through which countercyclical reserve requirements and time-varying provisioning rules should be formulated, independently and jointly, to address concerns arising from procyclicality and financial

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<sup>6</sup> See Basel Committee on Banking Supervision (2013, 2014).

<sup>7</sup> Recent contributions that have studied the performance of countercyclical capital rules in New Keynesian dynamic stochastic general equilibrium (DSGE) models include, among many others, Suh (2011), Agénor, Alper and Pereira da Silva (2013, 2014), de Resende et al. (2013), Angelini, Neri and Panetta (2014), Rubio and Carrasco-Gallego (2014), and Clancy and Merola (2015). Some of these studies, as well as others, have also considered the combination of countercyclical capital rules with other macroprudential instruments.

<sup>8</sup> See Montoro and Moreno (2011), Galindo, Izquierdo and Rojas-Suárez (2013), Cordella et al. (2014), Dassatti and Peydró (2014) and Hoffmann and Löffler (2014). In Asia, a number of countries adopted discretionary measures to increase provisioning in good times in response to rising levels of risk associated with rapid credit growth. See

volatility. Optimal countercyclical rules are discussed from the perspective of how these rules can either minimize a composite measure of volatility, combining measures of macroeconomic and financial volatility, or maximize social welfare. The last section draws together the lessons that can be inferred from the analytical and empirical literature for policymakers in Latin America and, more generally, middle-income countries.<sup>9</sup>

## **2. Procyclicality, Financial Frictions, and Macroprudential Regulation**

Procyclicality refers to the amplification of economic fluctuations during an otherwise normal business cycle. The banking system is often viewed as the main amplifying factor, during both upturns and downturns; rather than compensating for swings in the economic activity over the cycle, it often makes them more intense.

The literature has identified a variety of causes of procyclicality in banking.<sup>10</sup> Key among them is the fact that, because borrowers have higher net worth and tend to be perceived as less risky during economic expansions than during downturns, the financial system is prone to having a more lax assessment of risk in good times than in bad times. In addition, monitoring costs tend to fall during upswings. As a result, access to credit is facilitated in good times. The financial accelerator formalized by Bernanke, Gertler and Gilchrist (2000) and extended in numerous contributions since then captures the fact that even relatively small shocks to the economy can be magnified by endogenous changes in credit market conditions and lead to the propagation and amplification of the business cycle. These amplification effects also tend to be exacerbated by financial market frictions and the presence of implicit or explicit government guarantees.

It has also been argued that banking regulation may not be capable of mitigating significantly financial exuberance and may even amplify the procyclical behavior of the banking system. Risk-based capital requirement rules in Basel II, in particular, have often been criticized as a possible source of amplification of economic shocks (see Saurina, 2008), even though some research in a general equilibrium setting has provided a more nuanced answer (see Zhu, 2008,

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Angklomkiew, George and Packer (2009), Packer and Zhu (2012), Darbar and Wu (2015), and Zhang and Zoli (2016) for a discussion.

<sup>9</sup> An important issue that we do not address here is how monetary and macroprudential policies interact to shape macroeconomic outcomes and mitigate procyclicality and financial volatility. See Agénor and Pereira da Silva (2012, 2013) for a discussion of this issue in the context of middle-income countries.

<sup>10</sup> See Andritzky et al. (2009) and Athanasoglou, Daniilidis and Delis (2014) for an overview of the literature on the causes and consequences of procyclicality in banking.



and Agénor, Alper and Pereira da Silva, 2012). Indeed, when an economy falls into recession, banks' profits decline and their balance sheets weaken; if a capital increase by issuing new shares is not feasible, then banks may have no choice but to reduce their lending in order to maintain capital adequacy ratios. This drop in lending may lead to a further decline in economic activity.<sup>11</sup> The introduction of capital buffers in Basel III (as noted earlier) was viewed as a way to mitigate significantly Basel II's procyclicality. However, it has also been argued that the introduction of countercyclical capital buffers may create significant operational and institutional challenges, especially in developing countries where the supervisory environment is weak to begin with, or because the timing (for instance, a mandatory announcement 12 months in advance) would create challenges for predicting the exact phase of the financial cycle when these measures would come into effect. In particular, defining the variables to which buffers should be related to during the buildup and release phases remains a matter of significant debate.<sup>12</sup>

More directly related to our purpose here is the debate on provisioning regimes. Indeed, it has also been argued that so-called "incurred loss" (or specific) loan loss provisioning rules, which do not recognize the build-up of credit risks during expansions, tend to facilitate credit expansion and excessive risk-taking. Provisioning tends therefore to be procyclical: following a period of high credit growth and lax lending standards, a downturn triggers a rise in nonperforming loans (as documented for Brazil, for instance, by Vazquez, Takak and Souto, 2012) and, hence, higher specific loan loss provisions that may exacerbate the contraction in credit. Empirical evidence shows indeed that while credit risks build up during expansions (as discussed above), banks tend to postpone provisioning during upswings until lending conditions deteriorate. The belated recognition of potential loan losses may lead to a tightening of lending policies and possibly a credit crunch—thereby exacerbating the downturn. Thus, because the incurred loss model, with its backward-looking provisioning requirements, does not adequately recognize the weakening of lending standards and the build-up of credit risks that occur

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<sup>11</sup> Interestingly enough, as documented by Fonseca, Gonzalez and Pereira da Silva (2010), before Basel III banks tended to have capital buffers well above those required by regulators in order to protect themselves from abrupt swings in business cycles and asset valuation that would otherwise lead to either immediate penalties or balance sheet adjustments.

<sup>12</sup> See Behn et al. (2013), Alessi and Detken (2014), Bank of England (2014), Buncic and Melecky (2014), Drehman and Tsatsaronis (2014) and Jokivuolle, Pesola and Viren (2015) for a discussion.

during expansionary phases, it fails to provide adequate incentives for lenders to engage in prudent loan origination.

### **3. Reserve Requirements and Loan Loss Provisions in Latin America**

As mentioned above, the purpose of this paper is to examine how two types of macroprudential instruments, reserve requirements and dynamic provisions can help to mitigate the procyclicality of the financial system, that is, credit booms and busts that exacerbate the inherent cyclicality of lending. To conduct this analysis, we focus on the larger middle-income countries of Latin America. The main reason for doing so has to do with the characteristics of financial systems in these countries, and we therefore begin by reviewing them.

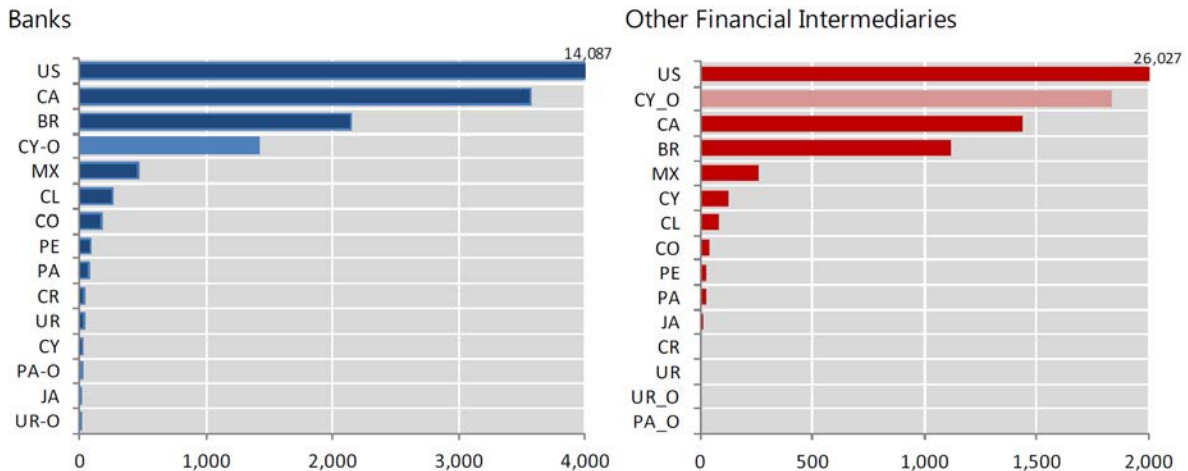
#### ***3.1 Features of Financial Systems in Latin America***

From the perspective of this paper, there are four features of financial systems in the major Latin American economies that are important. First, commercial banks in most of these countries continue to dominate the financial system. Indeed, apart from a few of them, nonbank financial intermediaries are not highly developed. Data compiled by the Regional Consultative Group for the Americas (2014), for instance, show that in Latin America shadow banking—comprising money market funds, credit investment funds, exchange-traded funds, credit hedge funds, private equity funds, securities broker-dealers, securitization entities, credit insurance providers or financial guarantors, finance companies, and trust companies—is large only in Brazil, with banks still accounting for about 40 percent of total assets (Figure 1).<sup>13</sup>

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<sup>13</sup> In general, shadow banking comprises a set of activities, markets, contracts, and institutions that operate partially (or fully) outside the traditional commercial banking sector, and, as such, are either lightly regulated or not regulated at all (see Pozsar et al., 2010, and Institute of International Finance 2012). In industrial countries, alternatives to conventional bank finance include invoice factoring or discounting (where a business borrows money against its invoices), asset-based financing (where money is borrowed against assets such as a plant or machinery), peer-to-peer and consumer-to-business lending (in which individuals agree to lend money to each other or to businesses through an online money exchange). New lending models also involve providing cash advances to businesses (e.g., restaurants and hotels) that derive much of their income from credit card sales. However, most of these new lending models have not reached a mass of borrowers that is critical enough to be considered serious alternatives to bank finance.

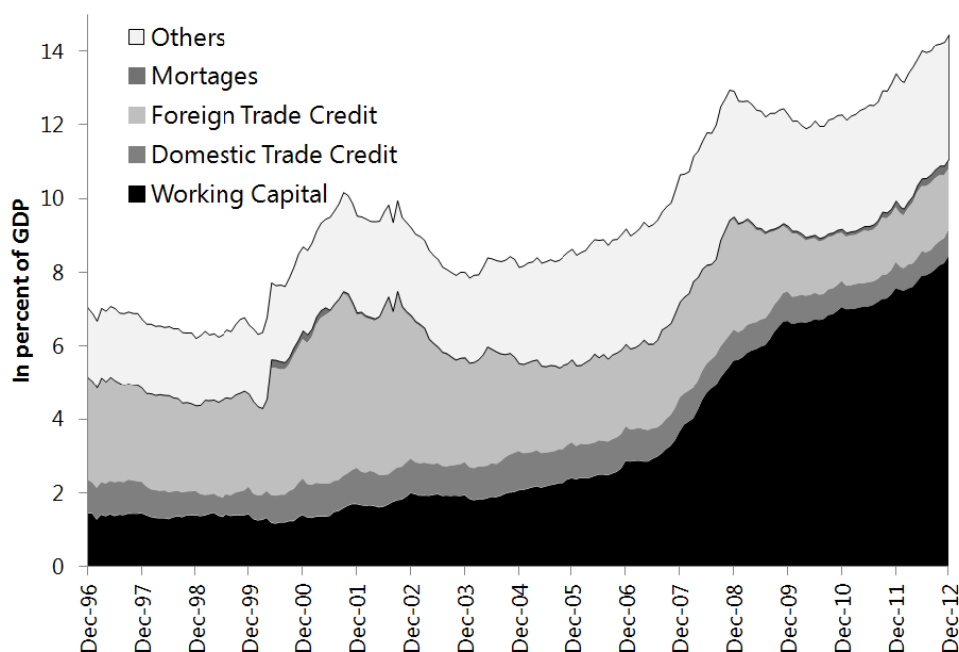
**Figure 1. Size of Financial Intermediaries, 12 Jurisdictions, 2012, in Billions of US Dollars**



*Note:* Domestic and offshore assets included.  
*Source:* Regional Consultative Group for the Americas (2014).

Second, and related to the lack of financial diversification, bank credit has an important impact on the supply side of the economy. Firms borrow short term to finance their working capital needs (such as labor inputs and raw materials) prior to the sale of output. Figure 2, for instance, shows that in Brazil, loans aimed at financing working capital needs increased (as a share of GDP) dramatically between 1996 and 2012, from below 2 percent to more than 7 percent. For most countries in Latin America, as shown in Table 1, the share of working capital financed by bank credit increased significantly between 2006 and 2010, especially in Colombia (almost as much as in Brazil), Peru, Argentina, and Uruguay.

**Figure 2. Brazil: Distribution of Credit to Firms, 1996-2012, in Percent of GDP**



Source: Cabezón (2014).

**Table 1. Latin America: Share of Working Capital Financed by Bank Credit, 2006 and 2010, in Percent of Total)**

| Country   | 2006 | 2010 | Diff. |
|-----------|------|------|-------|
| Brazil    | 43.7 | 54.4 | 10.7  |
| Colombia  | 46.8 | 57.3 | 10.5  |
| Peru      | 46.2 | 55.5 | 9.4   |
| Argentina | 30.6 | 40.0 | 9.3   |
| Uruguay   | 24.0 | 32.6 | 8.6   |
| Bolivia   | 31.0 | 37.3 | 6.2   |
| Paraguay  | 34.7 | 36.7 | 2.1   |
| Ecuador   | 45.5 | 46.6 | 1.1   |
| Chile     | 41.5 | 42.5 | 1.0   |
| Venezuela | 14.3 | 13.4 | -0.9  |

Source: Cabezón (2014).

In addition to important implications for the impact of monetary policy (namely, the role of the cost channel and the possibility of a “price puzzle”), the relationship between short-term credit and output—with credit often preceding output at turning points—means that the business cycle and the financial cycle tend to be more closely synchronized than in industrial countries, as documented by Amador et al. (2014), Calderón and Fuentes (2014), and Gonzalez, Lima and Marinho (2015). In particular, Amador et al. (2014) found that, even though on average credit cycles are longer in duration and larger in amplitude than output cycles, middle-income countries in Latin America (including Brazil, Chile, Colombia, Mexico, and Peru) tend to have cycles that are shorter (albeit deeper) than those exhibited by high-income countries. For Brazil alone, Gonzalez, Lima and Marinho (2015) estimated the periodicity of the financial cycle at about six years, close to the mean frequency of the business cycle. This is an important fact to consider when calibrating countercyclical macroprudential instruments aimed at mitigating not only financial volatility but also more generally at promoting economic stability.

Third, financial systems in Latin America are often highly vulnerable to external shocks, including terms-of-trade shocks, changes in world interest rates, and global risk factors. These shocks may lead to abrupt reversals in short-term capital movements, which may in turn exacerbate domestic financial volatility. A number of studies have indeed documented a positive relation between increasing international capital flows due to greater integration with world financial markets and vulnerability to sudden reversals in capital flows.<sup>14</sup>

In such conditions, monetary policy may need to be conducted with caution because of potentially undesirable side effects. This is what occurs when a country is confronted with a *sudden flood* of private capital, that is, large inflows induced by changes in external market conditions (Agénor, Alper and Pereira da Silva, 2014). Indeed, sudden floods have been on numerous occasions a source of macroeconomic instability in Latin America, having led to rapid credit and monetary expansion (due to the difficulty of pursuing sterilization policies), inflationary pressures, asset price bubbles, real exchange rate appreciation, and widening current account deficits—often contributing to financial fragility and financial crises. As documented by

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<sup>14</sup> Forbes and Warnock (2012), for instance, found that global factors play an important role in explaining “waves” of international capital flows. The more open and integrated a country is to global financial markets, the deeper are the channels through which reversals in capital flows will impact both the real economy and the financial system—and the more critical the policy response becomes to ensure macroeconomic and financial stability. See Agénor (2012) and Agénor and Pereira da Silva (2013) for a broader discussion.

Furceri, Guichard and Rusticelli (2011), for instance, in the two years following the beginning of a capital inflow shock, the credit-to-GDP ratio increases by about 2 percentage points. In a more recent study, Igan and Tan (2015) found that non-FDI capital inflows boost credit growth and increase the likelihood of credit booms in both household and corporate sectors.<sup>15</sup>

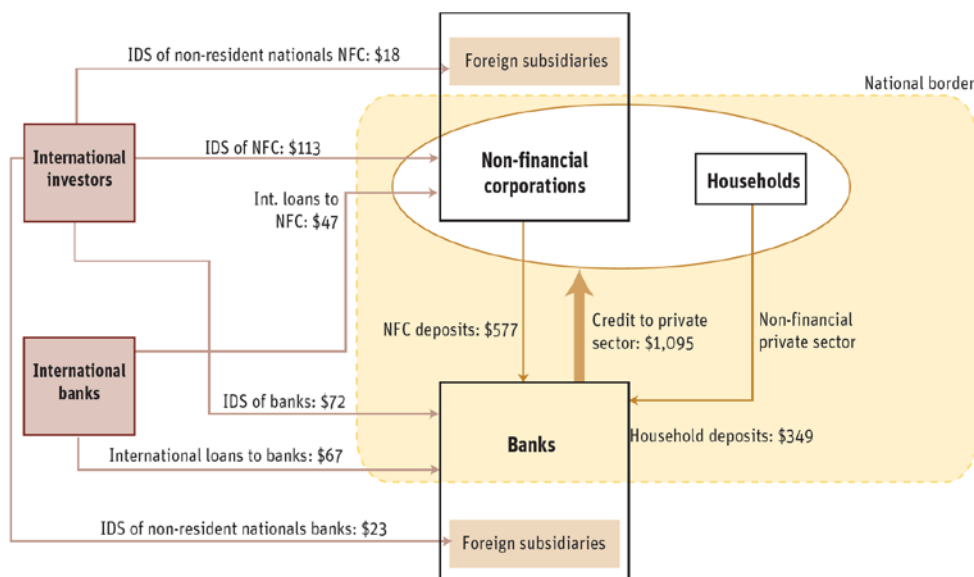
Figure 3, based on data compiled by the Inter-American Development Bank (2014, Appendix D), presents a flow of funds analysis to explore the links between external borrowing and credit growth in the four largest economies in Latin America (Brazil, Chile, Colombia and Mexico). As shown in the figure, the change in the stock of credit in these four countries between end-2008 and June-2013 was US \$1.1 trillion.<sup>16</sup> Total deposits rose by US \$935 billion during the same period, with deposits of nonfinancial corporations increasing relatively more (US \$577 billion) versus an increase of US \$349 billion in household deposits. In addition, banks received direct financing by issuing international debt securities and acquiring international loans for a total of US \$162 billion over the same period. Nonfinancial firms financed their increase in deposits in part by issuing foreign debt and contracting international loans for about US\$180 billion, with the rest financed through changes in domestic debt, equity, and retained profits. The figures clearly suggest that banks' direct issuance of foreign liabilities plays a significant role in financing credit expansion, as does the increase in household deposits. Indeed, in a more general econometric study of 18 countries over the period 2002-12, the Inter-American Development Bank (2014) found that international loans to domestic financial institutions have a significant effect on domestic credit growth.

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<sup>15</sup> The Appendix, based largely on Agénor and Pereira da Silva (2013), provides a more detailed discussion of the links between external shocks, capital flows, and financial instability in Latin America.

<sup>16</sup> As pointed out in the report, the chart does not aim to offer an exhaustive representation of all funding sources of banks, or of all interlinkages of banks and nonfinancial entities with the broad economy. The diagram omits important actors in the global and domestic economies, such as governments and domestic investors, and interlinkages between international investors or banks with foreign subsidiaries of domestic firms. As such, the sums of all funding of banks represented in the figure do not necessarily equal the size of credit. It is also worth noting that, as documented in the report, measures of liabilities taking into account national non-residents are significantly higher for several countries in the region relative to liabilities measured on the basis of residency.

**Figure 3. Latin America: Changes in Stocks of Credit, Deposits, and International Debt, 2008-13, in Billions of U.S. Dollars**



Source: Inter-American Development Bank (2014, Appendix D).

Finally, all the major countries in Latin America have suffered many costly crises in recent decades, with large drops in output, persistent credit crunches, and sharp increases in unemployment and poverty. Although the exact trigger to these crises has often seemed to be in the past some random event (including political turmoil, a real estate crash, a sharp decline in the terms of trade, or contagion from other economies), making it hard to predict their exact timing in the future, they are often preceded by sustained imbalances. Thus, any policy response that can help to identify sources of weaknesses, prevent these imbalances from emerging—by relying in particular on countercyclical macroprudential instruments—and to minimize the chances of a financial crisis occurring, may generate large welfare benefits. It is with these features in mind that we now turn to a discussion of the performance of reserve requirements and loan loss provisioning regimes.

### 3.2 Reserve Requirements

In Latin America, Brazil, Colombia and Peru have all used reserve requirements actively over the past few years. Prior to the global crisis, Brazil, for instance, managed reserve requirements as a prudential tool to contain pressures on credit growth resulting from large capital inflows.

The country lowered reserve requirement rates during the Lehman crisis and increased them again in the period of large capital inflows that emerged in 2010 to mid-2011 (Figure 4). It also used average reserve requirements as a mechanism to prevent disruptions in the interbank market following the Lehman Brothers' episode.<sup>17</sup> In Colombia, authorities increased reserve requirement ratios significantly between early 2007 and late 2009 (Figure 5). In Peru, marginal reserve requirements were imposed on both domestic- and foreign-currency deposits. More generally, there is evidence suggesting that central banks in many middle-income countries have often raised reserve requirements in response to capital inflows (Hoffmann and Löffler, 2014). In addition, and of direct relation to our purpose in this paper, there is evidence that some countries used reserve requirements linked to system-wide measures of credit expansion (Lim et al., 2011). Bulgaria in particular introduced a marginal reserve requirement for banks exceeding average credit growth.

As noted by Gray (2011), reserve requirements usually serve three purposes, depending on circumstances: a microprudential function, a monetary control role (to affect market interest rates and monetary aggregates), and a liquidity management function (especially to sterilize excess reserves). The microprudential function relates to protection against liquidity and solvency risks; from that perspective, reserve requirements help to ensure adequate liquidity insurance in the event of funding outflows. This role is particularly important in countries where the lack of development of financial markets leaves an undersupply of effectively liquid assets.

Regarding the monetary control and liquidity management functions, the evidence suggests that (in middle-income countries in general) reserve requirements have proved to be particularly useful during episodes of strong capital inflows associated with changes in world interest rates and risk perceptions.<sup>18</sup> As documented in a number of studies, these episodes have often been accompanied by an expansion in credit, an increase in aggregate demand, and high inflationary pressures. In such conditions, although interest rate hikes could restrain inflation, they may also attract more capital, which in turn can fuel further credit expansion.

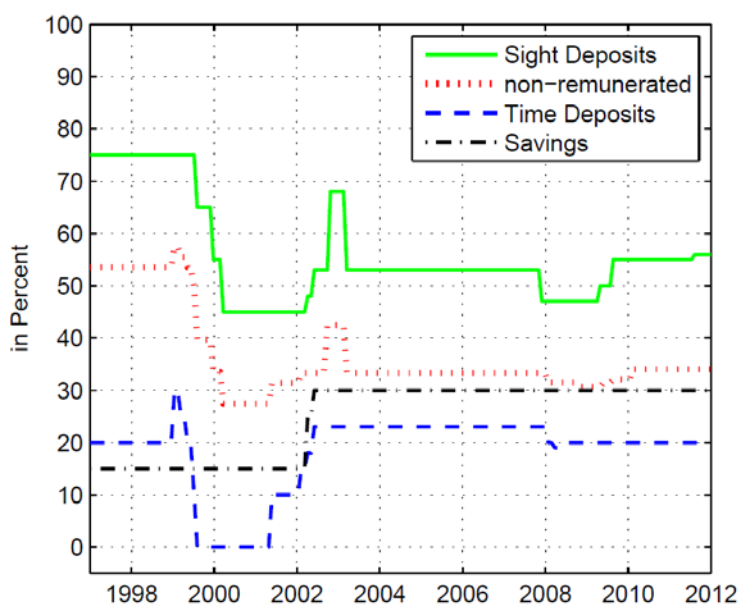
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<sup>17</sup> Specifically, average reserve requirements imposed on large and liquid banks were lowered if they extended credit to small and illiquid banks. As discussed by Robitaille (2011), in Brazil, despite the country's high reserve ratios, reserve requirements have been seen as an important tool for managing liquidity risk. See also Mimir, Sunel and Taskin (2012) for Turkey.

<sup>18</sup> Ahmed and Zlate (2014) provided evidence that interest rate differentials and global risk aversion are important determinants of net private capital inflows to middle-income countries, especially (for portfolio flows) in the aftermath of the global financial crisis.



**Figure 4. Brazil: Reserve Requirements by Type of Deposits, 1996-2012, in Percent**



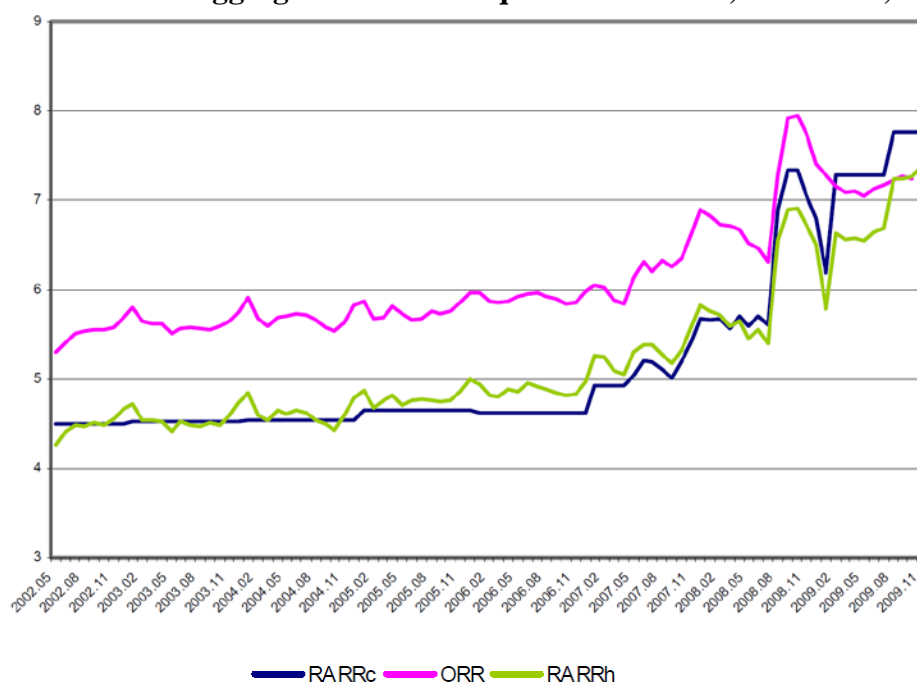
Source: Cordella et al. (2014).

By contrast, an increase in reserve requirements would induce banks to *lower* deposit rates. Indeed, in response to large capital inflows, central banks often intervene to buy foreign exchange and prevent an appreciation of the exchange rate. Concurrently, to avoid an expansion in the money supply and maintain price stability, they engage not only in open-market operations (sales of government bonds) but also in increases in reserve requirements.<sup>19</sup> In an open economy the incentive to do so is particularly strong if the use of open-market operations to sterilize capital flows is costly, due to large differentials between the interest rate on assets used for these operations and the interest earned on foreign reserves. Because reserve requirements represent a tax on financial intermediation, they drive a wedge between the rate that a bank pays its depositors and its cost of funding. If bank deposits offer special transaction and liquidity services to households, the cost of higher reserve requirements would normally be passed on in full to depositors in the form of lower deposit rates. A similar outcome, albeit with a less than complete

<sup>19</sup> Higher reserve requirements on bank deposits have been used to sterilize the effects of capital inflows not just on the monetary base but also on the broader money supply, as occurred, for instance, in China, India, and Morocco,

pass-through, would occur if banks can only partly substitute reservable liabilities with other funding sources as a result for instance of information frictions or a less than perfectly elastic supply of liquidity from the central bank. In either case, the policy may lead to an increase in bank intermediation spreads through lower deposit rates, higher lending rates, or both.

**Figure 5. Colombia: Aggregate Reserve Requirement Ratios, 2002-2009, in Percent**



Notes:

ORR: Observed required reserves/Total deposits subject to reserve requirements.  
RARRc: Remuneration-adjusted reserve requirement ratio (fixed composition of deposits).  
RARRh: Remuneration-adjusted reserve requirement (variable composition of deposits).  
Source: Vargas et al. (2010).

In an early contribution, Reinhart and Reinhart (1999) found indeed that increases in reserve requirements in developing countries tend to raise lending rates and reduce deposit rates, whereas Gelos (2009) found that high reserve requirements are a key determinant of the comparatively high intermediation spreads observed in Latin America. In subsequent studies Montoro and Moreno (2011), Tovar, García-Escribano and Vera Martin (2012), Izquierdo, Loo-Kung and Rojas-Suárez (2013), Armas et al. (2014), Cordella et al. (2014), Dassatti and Peydró

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among others, in recent years. See for instance Ma, Xiandong and Xi et al. (2013) for a discussion of China's experience.

(2014), Federico, Végh and Vuletin (2014), and Glocker and Towbin (2015), all found that increases in reserve requirements tend to mitigate the expansion of credit in Latin America. In effect, during the recent global financial crisis, reserve requirements were used as a substitute for monetary policy, not only to curb lending growth but also to dampen inflationary pressures.<sup>20</sup> At the same time, by contributing to smoothing the credit cycle, reserve requirements also helped to contain system-wide risks to the financial system.

Much recent thinking on bank reserve requirements has focused precisely on their role as a non-capital based, systematic—as opposed to a capital-based, sporadic—countercyclical macroprudential instrument, aimed at smoothing financial cycles and mitigating systemic risks to the financial system, rather than a substitute for monetary policy or as a pure liquidity management tool. By requiring banking institutions to hold a fraction of their deposits (in the form of either cash or deposits at the monetary authority remunerated at below-market rates), mandatory reserves act as an implicit tax on financial intermediation; and by altering the cost of funding, they may be useful to reduce the volatility of credit. Increasing reserve requirements can restrain credit growth during expansions, while reducing them during downturns can provide additional resources to limit credit contractions. Thus, reserve requirements may have a significant impact on the credit channel and the business cycle.<sup>21</sup>

Recent analytical contributions on the macroprudential role of reserve requirements, in both closed and open economies, include Prada (2008), Bianchi (2011), Montoro (2011), Glocker and Towbin (2012), Kashyap and Stein (2012), Mimir, Sunel and Taskin (2012), Alper et al. (2014), Escudero, González and Sola (2014), and Medina and Roldós (2014).<sup>22</sup> An increase in required reserves turns deposits into a more expensive source of funding, so that the interest rate on deposits falls. In Prada's model, this fall leads not only to a drop in the demand for deposits but also to a reduction in credit as well, because deposits and credit are complements. Thus, the policy is countercyclical. Bianchi (2011) showed that, for a generic bank balance sheet, capital and reserve requirements have similar effects and may therefore be thought of *ex ante*

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<sup>20</sup> See, for instance, Vargas et al. (2010) for a discussion of the impact of reserve requirements on credit growth in Colombia. Mora (2014) also found evidence that increases in reserve requirements were contractionary for Lebanon.

<sup>21</sup> In dollarized economies, differentiated reserve requirement rates are also used as instruments to mitigate the risks associated with financial dollarization, most notably by building foreign exchange liquidity buffers. See, for instance, Armas, Castillo and Vega for a discussion of the Peruvian case.

<sup>22</sup> The contribution by Agénor, Alper and Pereira da Silva (2015) is discussed in the next section.

(although not *ex post*) as substitutes from a macroprudential perspective. Glocker and Towbin (2012) considered required reserves as an additional policy instrument and variations in loans as an additional target into an open-economy model with nominal rigidities and financial frictions. Their results suggest that reserve requirements favor the price stability objective only if financial frictions are nontrivial and are more effective if there is a financial stability objective and debt is denominated in foreign currency. However, because they obtain opposite impact effects on consumption and investment, the overall effect on aggregate demand and inflation is ambiguous. Kashyap and Stein (2012) showed that the central bank can exploit a nonzero and time-varying scarcity value of reserves to tax the negative systemic externality from credit booms.

In sum, much recent thinking has focused on the use of reserve requirements as a countercyclical macroprudential tool, aimed at mitigating systemic financial risk by dampening procyclicality. This may appear as a significant change in perspective compared to the “traditional” view of reserve requirements as a key tool to constrain the degree to which banks can use liquid liabilities to finance illiquid assets. However, what we want to emphasize here is that there is no conflict necessarily between these two goals; *liquidity risk and systemic risk may be closely correlated*, because during financial crises, there is often a liquidity shortage as well. Indeed, liquidity crises (bank runs) are often the defining event of a financial crisis. Thus, by using reserve requirements to mitigate financial risks, a countercyclical reserve requirement rule also helps to mitigate liquidity risk.

### ***3.3 Loan Loss Provisioning Regimes***

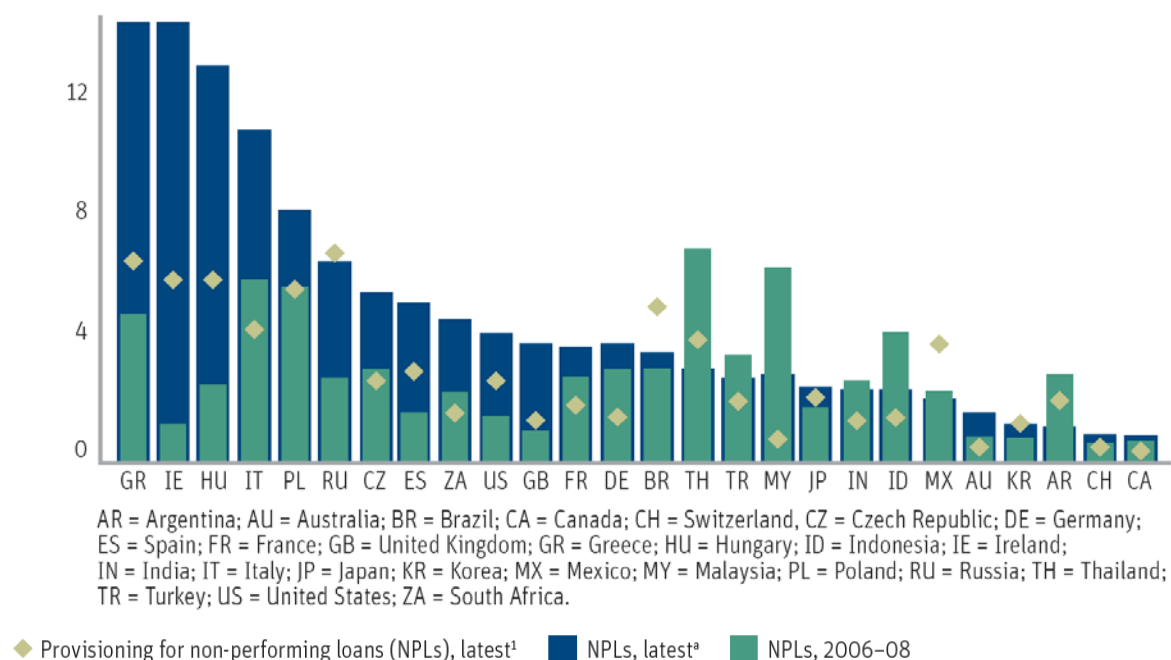
Loan loss provisions represent an accounting item used to recognize credit risk and credit losses along the lending cycle. In general, loan loss provisions can be classified into two main categories: i) specific provisions, which depend on expected losses on loans that have been identified as impaired or nonperforming, that is, if they have not been repaid a certain number of days (usually 90 days) past the due date; and ii) general provisions, which depend on expected losses on loans that are not necessarily impaired but are likely to be in the future.<sup>23</sup> As shown in

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<sup>23</sup> In the United Kingdom for instance, general provisions are subjective but banks are expected to take into account past experience and current economic conditions. Pérez, Salas-Fumás and Saurina (2008) note that general provisions usually rise during an upturn, as banks give out more loans and the demand for credit is high during these periods. During a downturn, loans to riskier companies would incur larger loan losses as risks materialize, therefore implying higher specific loan-loss provisions.

Figure 6, while some countries in Latin America (such as Brazil and Mexico) have banks that are well provisioned, others (including Argentina and Chile) are not.

**Figure 6. Selected Countries: Bank Provisioning and Non-Performing Loans as a Percentage of Total Loans**



Source: Bank for International Settlements, *Annual Report* (June 2012).

Specific provisions are governed by International Accounting Standards (IAS) 39, which require domestic banks to adopt an incurred loss method of loan loss provisioning; this implies (as noted earlier) that provisions are set when a loan is partly or wholly uncollectible, that is, only once a loss has been incurred. Many observers have argued that IAS 39 accounting guidelines have been a predominant source of procyclicality in lending standards because loan loss provisions tend to be essentially *ex post*.<sup>24</sup> Indeed, with the incurred loss approach, the recognition of loan losses is delayed until borrowers actually default. Moreover, there are often

<sup>24</sup> In the United States, under the guidelines of the Generally Accepted Accounting Standards (GAAP), loan loss provisions should be established at a level that is adequate (but not excessive) to cover expected losses related to identified impaired loans and probable credit losses that have been incurred as of the balance sheet date. Thus, they are also essentially *ex post* in nature. Evidence that provisioning may amplify credit cycles is provided by Bikker and Metzmakers (2005), Davis and Zhu (2009), Nkusu (2011) and Pool, de Haan and Jacobs (2015). However, as far as we know there is no formal evidence for Latin America.

restrictions on the tax deductibility of provisioning expenses,<sup>25</sup> which tend to affect the cyclicity of bank profits, market valuations, and their funding costs. The result is that it can be difficult for a bank to increase provisions in an economic boom—even if it correctly assesses that the *future* ability of its borrowers to repay has significantly deteriorated. A possible consequence is that banks may reduce lending in recessions, thereby magnifying the impact of negative shocks (Beatty and Liao, 2011, and Balla et al., 2012). This raises therefore the broader question of redesigning accounting principles (that is, switching from an incurred loss approach to an expected loss approach) to mitigate procyclicality and systemic risk.

Much of the recent debate on the macroeconomic effects of loan loss provisioning regimes has centered on so-called “dynamic” provisioning, whose goal indeed is not only to enhance bank soundness but also to mitigate procyclicality in lending (see Burroni et al., 2009, and Schwarz et al., 2014). The goal of dynamic provisioning is to deliberately build loan loss reserves during good times, which are then used to absorb losses in bad times. During an economic upswing, the stock of dynamic provisions grows rapidly as loan origination is high and loan losses are typically low. The reverse is true during economic downturns, and additional provisions for actual loan losses are then covered by drawing on the stock of dynamic provisions.<sup>26</sup> Specifically, in this provisioning regime banks have to build dynamic provisions in line with the estimate of long-run expected (through-the-cycle) loan losses rather than incurred losses. This is because (as noted earlier) incurred losses do not capture additional costs from future loan defaults caused by a probable deterioration in economic variables. In this context, it is not primarily the *level* of provisioning that matters but the *timing* of provisioning, as a sufficiently large stock of loan loss reserves reduces the likelihood of failure from capital deficiency (Balla and McKenna, 2009). In addition, dynamic provisioning gives incentives for banks to extend loans more carefully due to these mandatory provisions on performing loans.

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<sup>25</sup> In some countries fiscal authorities authorize tax deduction from provisions that affect eventually profits and thus bank capital only under its own specific rules. However, Deferred Tax Assets (DTAs) can be accumulated and the main issue is to incorporate them into bank capital levels to evaluate their degree of contingency. During discussions on the implementation of Basel III, many jurisdictions had to ensure the full guarantee of these assets (and rules for their usage) in order to comply with Basel III.

<sup>26</sup> As suggested by some observers, because banks have diverging risk profiles in lending operations, differing exposures could be accommodated to allow for bank-specific dynamic provisioning rates. This would help to address the problem of uniform rates penalizing the more efficient banks, those with above-average loan growth (Panetta and Angelini, 2009). However, a bank-specific system would require a highly accurate estimate of through-

Thus, in this regime, both flows and stocks of total provisions (comprising specific and dynamic provisions) become less procyclical and possibly countercyclical. This is because of the explicit interaction between specific and dynamic provisions, with dynamic provisions growing when specific provisions and loan losses are lower than the through-the-cycle average, and vice versa.<sup>27</sup>

Spain was the first country to adopt (in 2000, with subsequent modifications in 2005) a dynamic provisioning regime. In line with the foregoing discussion, the goal was to take into account more credit information and anticipate and quantify better the expected losses—using historical information on banks’ loan loss experience—associated with a loan portfolio, in order to provide additional buffers and better incentives to mitigate procyclicality.<sup>28</sup> The rule implicitly allows substitution between dynamic and specific provisions so as to ensure an overall level of provisions commensurate with risks averaged over the cycle. Specifically, the Spanish system requires higher provisions when credit grows more than the historical average, thus linking provisioning to the credit and business cycle. This both discourages (although does not eliminate) excessive lending in booms and strengthens the banks for bad times.

Studies that have attempted to evaluate the performance of Spain’s dynamic loan provisioning system include Saurina (2009), Caprio (2010), Jiménez et al. (2012), and Fernández de Lis and García-Herrero (2013); all concluded that although the provisioning scheme allowed banks to enter the downswing associated with the global financial crisis in more robust shape than they would have been otherwise, it is less clear that it had any material effect on the credit cycle or that it helped in any significant way to contain Spain’s real estate bubble over the previous decade. Put differently, even though these systems may succeed in making banks more resilient—by increasing their capacity to absorb expected losses, in contrast to capital

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the-cycle loan losses for *each* financial institution as well as recalibrations whenever the associated risk profile noticeably changes.

<sup>27</sup> With a dynamic provisioning regime countercyclical bank behavior may lead to a positive correlation between profitability and provisions. Under the income smoothing hypothesis for instance, a bank’s management may wish to avoid major changes in profitability levels and, therefore, may choose to increase provisions in times of higher profitability to avoid significant variations from year to year in the bank’s net income. Alternatively, according to the so-called capital management hypothesis, banks with a low capital adequacy ratio may choose to make higher provisions to improve that ratio, whereas according to the so-called tax shield hypothesis, the tax deductibility of provisions from taxable income may be an incentive for banks to increase provisions.

<sup>28</sup> The introduction of countercyclical provisions in Spain was facilitated by the fact that the design of accounting rules fell under the authority of the Central Bank of Spain.

requirements—they appear to have limited effectiveness when it comes to restraining credit growth. As noted by Alberola, Trucharete and Vega (2011: 24):

Dynamic provisioning is not the macro-prudential panacea, since the lending cycle is too complicated to be dealt with using only loan loss provision policies. Indeed the Spanish experience shows that even well targeted and calibrated instruments cannot cope perfectly with the narrow objective for which they are designed, among other things because the required size to fully achieve its goals would have inhibited and distorted financial and banking activity.

Following Spain, several countries in Latin America have introduced dynamic loan provisioning systems in recent years. Uruguay was the first to do so in September 2001, whereas Bolivia (in December 2008), Colombia (with two major steps in July 2007 and July 2008), and Peru (in November 2008) introduced dynamic loan loss provisioning systems in the midst of the global financial crisis.<sup>29</sup> These systems differ significantly in terms of their design. However, as shown by Wezel (2010) and Wezel, Chan-Lau and Columba (2012), when properly calibrated, it appears that they can all help to absorb rising loan losses in a downturn. Furthermore, López, Tenjo and Zárate (2014), in a study of Colombia over the period 2003-2011, found that countercyclical loan provisions were negatively related with the amplitude of credit cycles. Cross-country studies also help to support that assessment. Lim et al. (2011) and Jiménez et al. (2012) found that dynamic provisioning rules have indeed been associated with reductions in the procyclicality of credit. Bushman and Williams (2012) found evidence for a cross-country panel of banks that explicit dynamic provisions that capture the extent to which current provisioning anticipates future loan losses appear to enhance discipline of bank risk-taking and thus to mitigate one of the sources of procyclicality. Cerutti, Claessens and Laeven (2015) studied the impact of a broad set of macroprudential policies in a large set of 119 countries over the period 2000-13, while also distinguishing the effects of these policies on different segments of credit

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<sup>29</sup> Ecuador also adopted a dynamic provisioning regime in June 2012. In Brazil, the central bank introduced as early as December 1999 a Resolution (No. 2682) that incorporates some cyclical sensitivity in setting provisions. According to that resolution, the classification of loans for the purpose of calculating provisions takes into account the characteristics and the liquidity of the collateral as well as the borrower's economic situation, degree of indebtedness, ability to generate income, cash flow, administration and quality of controls, contingencies, punctuality or delay in previous payments, sector of activity, and credit limit.



markets (household versus corporate credit). They found that dynamic provisioning (used almost exclusively in middle-income countries, especially in Latin America) was especially effective.<sup>30</sup> Another study by Akinci and Olmstead-Rumsey (2015), based on a sample of 57 countries, also provides some supporting evidence that loan loss provisions contributed to mitigate bank credit growth.

Nevertheless, despite this favorable evidence, the question arises as to whether, to mitigate procyclicality in lending and enhance financial stability, it may be necessary or desirable to use a *combination* of macroprudential instruments. A key argument in favor of combining instruments is that each of them taken individually may be subject to diminishing marginal returns: using a single instrument very aggressively may help to mitigate the volatility of some variables—but at the cost of higher volatility elsewhere, in both the real and financial sectors. If stability concerns are sufficiently broad (involving both real and financial considerations), exploiting complementarities between instruments becomes essential. For instance, it has been argued that dynamic provisioning should be complemented with countercyclical capital buffers, to the extent that provisioning focuses on strengthening the banking sector against *expected* losses, whereas capital measures focus on *unexpected* losses.

In what follows we will consider from a normative perspective the optimal design of countercyclical macroprudential instruments and possible complementarity (or substitutability) between three types of instruments: reserve requirements, dynamic provisions, and capital controls. We focus on these three instruments because all of them (in contrast to countercyclical capital buffers) have been used extensively in Latin America. A key issue therefore is to what extent this combination of instruments represents (at least from a normative standpoint) an “optimal mix” from the perspective of mitigating procyclicality and promoting macroeconomic and financial stability.

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<sup>30</sup> By contrast, in a simulation exercise applied to the Chilean banking sector, Chan-Lau (2012) found that while dynamic provisioning increases the resilience of banks, it may not dampen procyclicality.

#### **4. Countercyclical Macroprudential Rules, Stability, and Welfare**

In most countries, adjustments in macroprudential instruments are based on judgment and discretion rather than on rules. However, discretionary macroprudential regulation raises all of the issues associated with the debate of rules versus discretion; as noted by Cecchetti (2015: 135), in that case, there are information and recognition lags (in terms of understanding when the financial system is vulnerable and in what dimensions), response and decision lags (in terms of being able to take prompt and timely decisions, most notably with respect to which instrument(s) are most appropriate), as well as implementation and transmission lags (in terms of enacting changes in the policy instruments that have been selected and evaluating their impact on lending, asset prices, and ultimately the business and financial cycles). In normal times, rules may have significant advantages in several of these dimensions, most notably by helping to increase transparency, reducing regulatory uncertainty, and overcoming policy inertia. Understanding how macroprudential rules perform in mitigating procyclicality is thus important.

In what follows, we discuss some of the recent literature on the performance of countercyclical reserve requirements and provisioning rules. Our discussion is normative in nature, given that few countries have implemented the type of rules that we have in mind. We also focus on policy responses to financial shocks, both domestic and external.<sup>31</sup> As noted earlier, middle-income countries are highly vulnerable to external financial shocks. In such conditions, the scope for responding to the risk of macroeconomic and financial instability through monetary policy is limited because higher domestic interest rates vis-à-vis interest rates in advanced economies may simply exacerbate the flood of private capital. Other instruments must therefore be used to manage capital flows and mitigate their destabilizing effects on the domestic economy. Indeed, if financial imbalances are related to excessive credit growth, and if credit growth is fueled by capital inflows, a comprehensive policy response could involve the use of both macroprudential tools and—at least temporarily—capital controls. In fact, in the aftermath of the recent global financial crisis, several countries in Latin America imposed or intensified these controls; Brazil for instance implemented a direct tax on fixed income and equity inflows (see Pereira da Silva, Sales and Gaglianone, 2012). Colombia and Peru also imposed taxes on

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<sup>31</sup> Experiments with real (supply and demand) shocks show that, in line with much of the literature, macroprudential rules are not very effective in terms of mitigating procyclicality and volatility.

capital inflows. It is therefore useful to also consider capital controls as a possible countercyclical macroprudential tool and examine whether they are complements or substitutes to reserve requirements or loan loss provisioning rules.<sup>32</sup>

#### ***4.1 Reserve Requirement Rules***

As noted earlier, there have been a number of recent analytical contributions on the macroprudential role of reserve requirements, in both closed and open economies. Few of them, however, have focused on the performance of countercyclical reserve requirements rules and the determination of an “optimal” rule. Agénor, Alper and Pereira da Silva (2015) provide a thorough analysis of these issues. They do so in an open-economy model that accounts for imperfect capital mobility, a two-level financial intermediation system, exchange rate smoothing, and sterilized intervention.<sup>33</sup>

As noted earlier, establishing a rationale for the effectiveness (or lack thereof) of reserve requirements as a countercyclical instrument is not straightforward. In models where monetary policy targets a short-term interest rate, bank funding sources (deposits and central bank liquidity) are perfect substitutes, and there are no stigma effects associated with accessing central bank facilities, an increase in reserve requirements has no impact on lending rates despite making deposits more expensive; banks simply borrow more from the central bank at the prevailing rate. Without a change in the loan rate, it is difficult to generate a countercyclical role for reserve requirements; if anything, the opposite may occur—if intertemporal substitution effects are strong, the drop in the deposit rate tends to reduce savings and to increase current consumption. This therefore generates a procyclical movement in private spending and thus possibly aggregate demand (see, for instance, Evandro and Takeda, 2013, Agénor and Pereira da Silva, 2014, and Escudero, González-Rosada and Sola, 2014). By contrast, in Agénor, Alper and Pereira da Silva (2015) deposits and borrowing from the central bank are imperfect substitutes;

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<sup>32</sup> The empirical evidence on the benefits of capital controls remains largely ambiguous. For recent contributions and reviews of the evidence on the impact of capital controls, see Binici, Hutchison and Schindler (2010), Magud, Reinhart and Rogoff (2011), Agénor (2012), Agénor and Pereira da Silva (2013), Forbes, Fratzscher and Straub (2015), and Eichengreen and Rose (2014). It is important to note, however, that few, if any, of these contributions have explicitly analyzed the impact of capital controls on financial stability—measured, in particular, in terms of second-order moments.

<sup>33</sup> Sterilized intervention was also used extensively in Latin America (as well as in other major middle-income economies) in the past decade as an instrument to manage capital flows; however, its effectiveness remains a matter of debate. See Agénor and Pereira da Silva (2013) for a discussion.

this is captured by making a distinction between a “base” policy rate (determined through a standard Taylor rule) and the actual cost of borrowing from the central bank for commercial banks. In turn, the latter incorporates a penalty rate that depends on the ratio of loans from the central bank to deposits, due to a *stigma* effect, that is, the fact that borrowing too much from the monetary authority (in relation to the bank’s deposit base) may signal to markets that the bank’s balance sheet is weak and may therefore raise its funding costs on these markets. Put differently, even though the central bank operates a standing facility, its supply of liquidity is not perfectly elastic at the base policy rate.<sup>34</sup>

Another key feature of the model is the focus on bank-related short-term capital flows. Such flows have been an important component of cross-border capital flows in recent years. According to recent data by the Institute of International Finance, for instance, since 2010 net inflows of private capital associated with commercial bank lending have consistently accounted for a larger fraction of total flows than portfolio equity flows to Latin America. In 2014 alone, bank-related capital inflows represented 11.4 percent of nonresident capital inflows, compared to 7.4 percent for portfolio investment flows.<sup>35</sup> In Brazil alone, domestic banks’ foreign credit exposures increased substantially in the past decade, despite the international deleveraging process that followed the global financial crisis (see Cerutti, Claessens and Laeven, 2015).<sup>36</sup>

After calibrating their model for a “typical” middle-income country, using mostly parameter estimates for Latin America, Agénor, Alper and Pereira da Silva (2015) studied the effects of a temporary drop in the world risk-free interest rate, with constant reserve requirements. Consistent with the stylized facts discussed earlier and in the Appendix, their simulations showed that this shock triggers an expansion in domestic credit and activity, asset price pressures, a real exchange rate appreciation, and a current account deficit.

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<sup>34</sup> A conceptually similar idea is developed in Alper et al. (2014), although in a very different setting. They also provide evidence for Turkey which suggests that central bank liquidity and household deposits are imperfect substitutes. In practice, central bank loans may also fail to provide a good substitute for deposits if, as is usually the case, the maturity of central bank loans is shorter than that of bank deposits, or if future monetary policy—and hence the cost or availability of central bank liquidity—is subject to a high degree of uncertainty. These features are, however, more difficult to capture in standard stochastic macroeconomic models.

<sup>35</sup> See <https://www.iif.com/file/10583/download?token=SsHBKQ5j>.

<sup>36</sup> See Hoggarth, Mahadeva and Martin (2010), Committee on International Economic Policy and Reform (2012), Herrmann and Mihaljek (2013), Reinhardt and Riddiough (2014), and Bruno and Shin (2015) for a discussion of the

They then define a simple, implementable reserve requirement rule that relates changes in required reserves to fluctuations in domestic credit. They showed that, in response to the same shock, the rule helps to mitigate both macroeconomic and financial volatility, with the latter defined both in terms of a narrow measure based on the credit-to-output ratio, the ratio of capital flows to output, and interest rate spreads, and a broader measure that includes also real asset prices. They also derive an “optimal” rule, based on minimizing a composite measure of economic volatility, defined in terms of a composite measure of macroeconomic and financial volatility. The fundamental reason why an optimal value exists in the model is because the relationship between the degree of aggressiveness of the countercyclical reserve requirement rule (the reaction parameter to changes in credit) and economic volatility is non-monotonic. At first, as the policy becomes more aggressive, financial volatility falls because it stabilizes credit, investment and domestic absorption. However, as the policy becomes more aggressive, it magnifies volatility in market interest rates and bank deposits; in turn, higher volatility in domestic interest rates induces more volatility in capital flows, and therefore tends to increase financial volatility once again—so much so that it eventually dominates the gains in terms of reduced volatility in credit growth and aggregate demand. The optimal reaction parameter in the countercyclical rule is the point at which the composite index of financial volatility reaches its minimum value.

A variety of sensitivity tests, related to the intensity of sterilization, the degree of exchange rate smoothing, and the rule used by the central bank to set the cost of bank borrowing, were also performed, and their impact analyzed both in terms of the transmission process of the world interest rate shock and the determination of the optimal rule. Among other results, Agénor, Alper and Pereira da Silva (2015) showed that the stronger the exchange rate smoothing policy is, the stronger should be the optimal response to credit growth in the countercyclical reserve rule.

An important issue that is not addressed in this analysis is the fact that reserve requirements represent a tax on banking activity, which may have an adverse effect on the financial condition and credit of depository institutions relative to that of other financial

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importance of cross-border bank flows in international capital movements (especially changes in the external liabilities of resident banks) during the run up to, and the immediate aftermath of, the global financial crisis.

institutions<sup>37</sup> and could therefore create an incentive for banks to reduce the tax-like impact of (unremunerated) reserve requirements by evading them. If changes in reserve requirements lead to disintermediation away from the banking sector and toward less-regulated channels, the consequence may be to distort markets and weaken financial stability. This may entail long-run costs, which may exceed the short-run stabilization benefits that the policy may generate. However, it is also important to keep in mind that the issue at stake is not *permanent* changes in reserve requirements, but rather *temporary* changes in the course of the business cycle. Moreover, to the extent that these changes are not too large, they are unlikely to create strong incentives to engage in financial disintermediation.

Another issue that is not discussed in Agénor, Alper and Pereira da Silva (2015) is whether reserve requirements are complements to or substitutes for other macroprudential instruments, and in the first case, whether the optimal values of the parameters characterizing the policy rules can (and should) be determined jointly. Agénor and Jia (2015) took a step in that direction by analyzing (in a setting similar to Agénor, Alper and Pereira da Silva, 2015) the interactions between a reserve requirements rule (which responds to the credit-output ratio, as defined earlier) and a countercyclical capital controls rule based on changes in cross-border bank borrowing (a non-reservable source of funding). Because its goal is to mitigate the volatility of bank-related capital flows, and thus indirectly financial volatility, the capital controls rule is fundamentally macroprudential in nature. Agénor and Jia establish numerically the existence of an optimal, welfare-maximizing rule, defined once again in terms of the degree of aggressiveness of the rule. More importantly, they also solve jointly for the optimal countercyclical reserve requirements and capital controls rules and find that the two instruments are in general complements in maximizing welfare. Put differently, if reserve requirements are viewed as an implicit tax on financial intermediation, it is optimal to tax banks on *both* components of their market funding sources at a business cycle frequency. In addition, a more aggressive reserve requirement rule induces less reliance on capital controls; thus, at the margin, the two instruments are *partial substitutes* from the perspective of welfare maximization. These results remain qualitatively unchanged when the countercyclical capital controls rule displays a high

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<sup>37</sup> Robitaille (2011) discusses how reserve requirement policy in Brazil taxes large banks to subsidize small banks that are exempt, but that over time banks have shifted from demand deposits with a high reserve requirement to other funding sources such as certificates of deposits.

degree of persistence or responds instead to cyclical output.<sup>38</sup> The results remain also essentially the same if, instead of focusing on welfare maximization, the analysis centers instead on the type of composite measures of financial volatility discussed earlier—in terms, in particular, of the volatility of the credit-to-GDP ratio and the volatility of real estate prices.

#### ***4.2 Cyclically Adjusted Provisioning Rules***

Only few studies have focused on the countercyclical properties of dynamic (or, more appropriately, cyclically adjusted) provisions using general equilibrium models. These studies include Goodhart et al. (2013), Agénor and Zilberman (2015), and Agénor and Pereira da Silva (2015). In Goodhart et al. (2013), dynamic provisioning is formalized as a requirement for the bank to keep cash on its balance sheet throughout the good state of the world when the growth of real estate-related credit exceeds a certain threshold. Consistent with the core ideas discussed earlier, provisioning involves banks setting aside a portion of today's profits to cover future (expected) losses. However, the form of provisions defined in the model is more akin to a reserve ratio, that is, a form of liquidity regulation: when loan growth is high, banks are required to hold an increasing proportion of their assets in cash. The effects of requiring banks to build up provisions ahead of a downturn cannot be analyzed in that setting.

Agénor and Zilberman (2015), drawing in part on the partial equilibrium framework of Bouvatier and Lepetit (2012), do capture this feature in a dynamic stochastic general equilibrium (DSGE) model with credit market imperfections. They define two alternative loan loss provisioning regimes: a specific provisioning system, in which provisions are triggered by past due payments, and a dynamic provisioning system, in which both past due payments and expected losses over the whole business cycle are accounted for, and provisions are smoothed over the cycle. More specifically, commercial banks' loan pricing in their model is directly

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<sup>38</sup> A limitation of that study is that it does not address the role of distortions associated with leakages in implementing capital controls. By and large, the evidence suggests that incentives to evade restrictions on capital flows become stronger over time when they take a permanent form. The capital controls rule studied in this paper operates at a business cycle frequency; it is therefore less likely to induce this type of distortions. Nevertheless, it is possible that even in the short term tighter restrictions on bank foreign borrowing (as discussed here) may lead to a shift in the behavior of the nonfinancial private sector which is such that it weakens the performance of these controls. A related issue is the possibility that, as documented by Bruno, Shim and Shin (2015), controls on some types of inflows may lead over time to substitution or spillover effects. A key question then is whether there are important gains from capital controls despite the existence of leakages or cross-flow effects, and more generally given the ability of the financial system to circumvent regulatory and prudential standards.

linked to loan loss provisions through two main transmission channels: a risk premium channel and a provisioning cost channel. The first channel is related to the fact that loan loss provisions can either increase or lower the share of nonperforming loans, which in turn impacts the risk premium over the cost of borrowing from the central bank (the refinance rate). This is consistent with the analysis of a number of previous contributions, including Agénor, Alper and Pereira da Silva (2012, 2013). The second channel is linked to the characteristics of loan loss provisions reserves being invested in a safe asset (therefore entering positively each bank's profit function) and the direct cost of holding provisions, which reduce bank profits and result in a higher loan rate.<sup>39</sup>

Their numerical experiments showed that, in response to a shock to nonperforming loans, a dynamic provisioning regime can be highly effective in mitigating procyclicality of the financial system—regardless of the presence, or direction, of the risk premium channel. Their results also indicate that a credit gap-augmented Taylor rule, coupled with a forward-looking provisioning system, may be a more effective way—in terms of minimizing a central bank policy loss function that depends not only on output and inflation but also the credit-to-GDP ratio—to mitigate real and financial volatility, compared to a specific provisioning regime only, coupled or not with an augmented Taylor rule. Moreover, a standard Taylor rule coupled with dynamic provisions performs better than a credit-augmented rule combined with specific provisions only. These results are important in the context of the debate regarding whether monetary policy should explicitly adopt a financial stability objective, in addition to its standard objectives of stabilizing output and inflation.

In studying optimal policy, Agénor and Zilberman (2015) focus mainly on the case of an integrated mandate for the central bank and a dynamic provisioning regime with full smoothing—in the sense that any deviation in the share of nonperforming loans from its steady-state value is fully reflected in the calculation of total provisions. However, the possibility of “over provisioning” (a more than proportional response to deviations in the fraction of nonperforming loans, or any other measure of cyclical fluctuations) with independent mandates for monetary policy and macroprudential regulation is not discussed. Moreover, they do not

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<sup>39</sup> Put differently, the increase in the cost of holding provisions—just like the cost of increasing capital requirements, as documented by Gavalas (2015) for instance—translates into an increase in banks' marginal cost of funding, thereby leading to higher lending rates and a contraction in credit.



consider the extent to which dynamic provisioning should be (optimally) combined with other macroprudential instruments to promote financial stability.

Both issues are addressed in Agénor and Pereira da Silva (2015), using a more general model with financial frictions (namely, balance sheet and collateral effects, and costly production of loans and deposits) and a housing market. They consider two types of financial shocks, one associated with borrowers' default risk and the other with asset prices and collateral values. Their numerical experiments also showed that cyclically adjusted provisioning can be highly effective in mitigating procyclicality and financial volatility (defined in terms of a weighted average of the credit-output ratio and the volatility of real house prices) in response to financial shocks. However, the relationship between the parameter that characterizes the response of provisions to cyclical movements in default risk and financial volatility follows a U-shaped pattern. At first, a more aggressive policy mitigates financial volatility—measured in terms of a weighted average of the volatility of the credit-to-GDP ratio and the volatility of real house prices—because the policy stabilizes credit, investment and activity. But beyond a certain point, market interest rates become more volatile, and so do lending and aggregate demand; financial volatility therefore begins to increase again. The optimal policy is obtained at the point where the volatility index is minimized. In fact, the optimal policy involves “excess smoothing,” in the sense that it entails a more than proportional reaction to cyclical movements in the share of nonperforming loans.<sup>40</sup>

In addition, Agénor and Pereira da Silva studied the optimal combination of cyclically adjusted provisioning and a countercyclical reserve requirements rule, in which the reserve requirement rate is adjusted (as discussed earlier) in response to changes in the loan-output ratio. They showed that the simultaneous use of these instruments does *not* improve the ability of either one of them to mitigate financial volatility. At the same time, taken independently, the optimal provisioning rule performs significantly better than the optimal reserve requirement rule. In that sense, the two instruments are partial substitutes. Finally, they also found that although an optimal cyclically adjusted provisioning regime may be defined in terms of reaction to an aggregate macroeconomic variable, cyclical output (in the spirit of the Peruvian regime, which

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<sup>40</sup> In practice cyclically adjusted provisioning rules often include upper and lower limits to the stock of general provisions. The upper limit helps to prevent the accumulation of disproportionately large (and costly) resources,

uses output growth), responding to that variable does *not* perform as well as responding to changes in nonperforming loans in terms of mitigating volatility.<sup>41</sup>

The foregoing analysis is useful to understand the performance of loan loss provisioning regimes and their complementarity with other macroprudential tools. However, much further research is needed in order to strengthen the policy conclusions that existing models provide. One important issue is to better account for the potential costs of provisioning regimes. Bushman and Williams (2012), for instance, in a study of bank behavior across 27 countries, found that (discretionary) dynamic provisioning can also be used to smooth or disguise earnings; a bank's management may indeed wish to avoid major changes in profitability levels and therefore may choose to increase provisions in times of higher profitability so that the bank's net income does not vary significantly from year to year. This could weaken market discipline, as transparency and comparability of financial statements may then be reduced. As a result, the cost of banking activity may increase and this would affect market interest rates—and, by implication, the behavior of output, prices, and financial variables, as well as macroeconomic and financial stability. Accounting for the potential costs of provisioning regimes (and thus decreasing marginal returns associated with a more aggressive use of their use) may also restore some degree of complementarity between countercyclical reserve requirement rules and cyclically adjusted provisioning rules.

Another important issue is to study the performance of, and interactions between, countercyclical capital rules (a core proposal of the new Basel arrangement, as mentioned earlier) and the type of cyclically adjusted provisioning rules discussed earlier. The new Basel capital regime allows loan loss reserves to be included in regulatory capital, up to certain limits. It is therefore possible that higher provisioning charges on new loans may cause a decline in banks' capital, which for a given or desired leverage will restrain credit growth and mitigate systemic risk. Understanding this type of substitution effects is important for the optimal design of countercyclical financial regulation.

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whereas the lower limit helps to avoid these resources from being entirely depleted. These limits, however, are not explicitly imposed in the formal analysis referred to above.

<sup>41</sup> Moreover, because there are lags in observing GDP, and given that preliminary estimates may be substantially revised, in practice it may be preferable to use a credit variable, for which data are usually available in a timely fashion and hardly subject to revisions.

## 5. Policy Lessons

Among the challenges that many countries in Latin America and elsewhere faced in the aftermath of the global financial crisis, the issue of how to smooth financial cycles and ensure the robustness of the financial system through, in particular, macroprudential financial regulation took center stage. With its greater focus on the financial cycle and systemic risk, macroprudential regulation came to be seen as essential, as it was supposed to prevent unsustainable credit booms and the build-up of asset price bubbles, as well as more generally mitigate the excessive procyclicality of the financial system. Among the various instruments and policies that have been considered to that effect, the most prominent have been i) higher levels of capital, with a countercyclical layer calibrated over a measure of “excessive” credit growth; ii) higher provisions, especially during booms to be used against losses during busts; and iii) higher levels of liquid assets (reserves) first to prevent the damaging effect of sudden asset price reversals. As noted in the introduction, in the framework of Basel III regulators rapidly put rapidly in place i) a new capital framework, in particular with buffers (e.g., a capital conservation buffer and a countercyclical capital buffer); and ii) two new liquidity requirements through a Liquidity Coverage Ratio (LCR) and a Net Stable Funding Ratio (NSFR).

Much academic and policy-oriented research has focused on higher capital requirements and capital buffers as the main instrument to strengthen the financial system and smooth financial sector procyclicality. While the transmission of additional capital requirements into market borrowing costs may indeed have a countercyclical effect, the fact that higher requirements must be communicated in advance to markets raises the possibility that changes in agents’ expectations may prevent that effect from occurring—even generating adverse effects (for instance, a sooner than anticipated contraction in credit).

By contrast, little attention has been paid by regulators and researchers, to the potential countercyclical properties of reserve requirements and (cyclically adjusted) provisions, or to the capacity of these instruments to mitigate financial volatility. Yet, in many countries in Latin America combinations of these tools have been used extensively, especially during periods of sudden floods of capital induced by changes in interest rates in advanced economies or in risk appetite on world capital markets, to contain credit growth and unsustainable pressures on asset prices. Assessing the performance of reserve requirements and provisioning regimes with respect to these objectives, through both empirical studies and normative (model-based) analysis is thus

critical for policymakers. A key objective of this paper was to “take stock” with respect to both aspects.

The broad lesson of our review of model-based, general equilibrium analyses of the performance of reserve requirements and cyclically adjusted provisioning rules—formulated independently or jointly with other macroprudential instruments—is that in responding to financial shocks simple, implementable and optimal countercyclical rules can be designed, so as to either minimize a composite measure of economic instability (combining measures of macroeconomic and financial instability) or to maximize social welfare. Moreover, while these instruments can be complements (in the sense that they must be combined to maximize welfare for instance), they may also be partial substitutes at the margin. This appears indeed to be the case in studies that have focused on the effects of countercyclical reserve requirements and capital controls on bank-related capital flows.

In practice, of course, it is often difficult for policymakers to determine at which stage of the financial cycle the economy is; an accurate calibration of countercyclical macroprudential rules of the type discussed in this paper is thus not necessarily an easy task. In addition, as noted earlier, more research is needed to assess the robustness of some of the results associated with the use and performance of these rules. Nevertheless, the existing body of evidence (however imperfect) does provide some broad lessons from a policy perspective. Instead of having available only one, capital-based countercyclical instrument to attempt to smooth financial cycles, policymakers have in fact two additional tools that, in many countries, are implementable with more discretion by the monetary authority and/or the regulator, depending on the institutional arrangement. These instruments can be calibrated with a great deal of flexibility according to local circumstances and timing, and may therefore better reflect the dynamics of the specific financial cycle at hand. That is less the case with the Basel III countercyclical capital rule. Indeed, under that arrangement, the only discretion that local authorities have is to decide whether or not to activate the capital buffer with 12 months’ prior notice. Response, decision and implementation lags may significantly weaken the benefits of countercyclical capital buffers.

Beyond the general analytical and policy insights discussed in this paper, the challenge for central banks and regulators in Latin America is to extend their operational macroeconomic models to explicitly account for countercyclical reserve requirements and provisioning rules and study, in the context of their own economic environment and calibration procedures, the

performance of these instruments. Because smoothing financial cycles is a common problem, addressing this challenge will benefit a wide range of countries. At the same time, it is important to keep in mind that, as documented by Bruno, Shim and Shin (2015), macroprudential policies tend to be more successful when they complement monetary policy (by reinforcing monetary tightening) than when they act in opposite direction. Thus, the issue of coordinating monetary and macroprudential policies, possibly in the context of an integrated inflation targeting regime (as discussed by Agénor and Pereira da Silva, 2013), must also be addressed.

## Appendix: External Shocks, Capital Flows, and Financial Instability

In the past two decades many countries in Latin America have continued to open their capital account, and greater integration with world capital markets has been accompanied by a substantial rise in private capital flows to these countries. The conventional distinction in terms of what drives capital flows to developing countries is between “push” factors (macroeconomic and structural reforms that attract capital from abroad as a result of changes in regulation and improvements in the risk-return characteristics of assets issued by MICs) and “pull” factors (cyclical and structural factors that affect the risk-return characteristics of assets issued by advanced economies).<sup>42</sup> While foreign direct investment has often been driven by longer-term prospects (push factors), short-term, cross-border capital flows are highly responsive to changes in relative rates of return, including movements in interest rates in advanced economies and changes in risk perception among global investors (pull factors).

Although there are substantial potential benefits associated with capital flows (especially foreign direct investment, as documented in a number of studies), the risk of volatility and abrupt reversals in short-term capital movements may represent a substantial cost. A wave of currency and banking crises during the past two decades, including most recently the global financial crisis (and the liquidity policies that were followed in its aftermath), have heightened concerns associated with such reversals.<sup>43</sup> From the perspective of financial stability, the main source of concern is *gross*, rather than *net* capital flows, because of the risk that capital flows, intermediated directly or indirectly through the banking system, may lead to the formation of credit-fueled bubbles. Forbes and Warnock (2012) found that in recent years the size and volatility of gross flows in many countries have increased, while net capital flows have been more stable. Broner et al. (2013) also found that gross capital flows are very large and volatile,

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<sup>42</sup> In addition to the growing trend toward integration of world capital markets and changes in policies and prospects in the recipient countries, global cyclical factors have also played an important role in explaining fluctuations in capital flows, especially short-term flows. See Agénor and Montiel (2015, Chapter 13) for a review of the evidence on the determinants of capital flows, Forbes and Warnock (2012), Herrmann and Mihaljek (2013), Okada (2013), Ahmed and Zlate (2014), and Ghosh et al. (2014) for an analysis of the role of global and domestic factors in explaining “waves” of international capital flows over large samples, and Fratzscher (2012) for a more specific study of the importance of push and pull factors before and after the global financial crisis.

<sup>43</sup> Using panel data covering the period 1975-97, Hutchison and Noy (2006), for instance, found that currency crises lead to reductions in output of about 5-8 percent over a two-to-four year period, whereas banking crises lead to output reductions on the order of 8-10 percent over the same period. Joyce and Nabar (2009) found that banking crises have a significant negative effect on domestic investment.

relative to net capital flows. In addition, they found that gross capital flows are procyclical: during expansions, foreigners invest more domestically and domestic agents invest more abroad; during crises, total gross flows collapse and there is a retrenchment in both inflows by foreigners and outflows by domestic agents.

Among gross flows, bank-related flows are especially important because of their potential direct impact on credit expansion (as noted earlier) and their role in transmitting international shocks: for instance, deteriorations in the balance sheet of domestic banks can push them to sell external assets or to recall external loans to comply with internal rules or with prudential regulations such as capital requirements or maximum leverage ratios.<sup>44</sup> In the recent wave of capital flows, bank-related flows have been particularly large.<sup>45</sup>

The volatility associated with short-term capital flows is a major concern because the evidence shows that the financial system in Latin America is often highly vulnerable to small domestic or external disturbances—even more so now to global financial cycles, as a result of increased international financial integration. Bank-related and portfolio debt flows have been especially volatile in recent years. Abrupt reversals in short-term capital movements tend to exacerbate financial volatility—particularly in countries with relatively fragile financial systems, weak regulatory and supervision structures, and policy regimes that lack flexibility. A number of studies have indeed documented a positive relation between the increasing international capital flows due to greater integration with world financial markets and vulnerability to sudden reversals in capital flows. For instance, Broto, Díaz-Cassou and Erce (2011) found that, since 2000, global factors have become increasingly significant relative to country-specific drivers in determining the volatility of capital inflows, whereas Dufrénot, Mignon and Péguin-Feissolle (2011) found that stress indicators in US financial markets in the aftermath of the subprime crisis caused abrupt changes in stock market volatility in several Latin American countries. Agosin and Huaita (2012) defined a sudden flood (or capital boom, in their terminology) as an episode where

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<sup>44</sup> Krugman (2008) refers to such international financial contagion as the “International Finance Multiplier;” changes in asset prices are transmitted internationally through their effects on the balance sheets of banks and other highly leveraged financial institutions. See Herrmann and Mihaljek (2013) for some formal evidence on the role of bank lending flows in transmitting financial shocks across borders.

<sup>45</sup> See also Hoggarth, Mahdeva and Martin (2010). As argued by Bruno and Shin (2015), these capital flows reflect the interaction of the supply and demand for wholesale funding between global and local banks. When local and global banks interact in the market for wholesale bank funding, the liabilities of local banks serve as the assets of the

(gross) capital inflows are larger than one standard deviation above the historical mean and represent at least five percentage points of GDP.<sup>46</sup> Sudden stops are defined in symmetric fashion. Using a sample of mostly middle-income countries, over the period 1976-2003, they found that sudden floods are good predictors of subsequent sudden stops. Moreover, the probability of a sudden stop increases dramatically the longer the preceding capital boom. Thus, sudden stops may not be due to a (current or expected) deterioration in domestic macro fundamentals, but rather could represent downward overreactions to previous periods of positive “overreaction” in capital flows.<sup>47</sup> Galindo et al. (2010), using a cross-country dataset covering 17 countries in Latin America between 1996 and 2008, found that financial integration, despite contributing to a deepening of domestic credit markets, amplifies the impact of international financial shocks on domestic aggregate credit and interest rate fluctuations.

What this evidence suggests is that the volatility associated with large capital inflows is the consequence of the rapid increases in liquidity, aggregate demand pressures, real exchange rate appreciation, and growing external imbalances that these flows generate.

The more recent surge in capital flows to Latin America—caused in part by the post-crisis global excess liquidity generated by the expansionary monetary policies of advanced reserve currency-issuing countries—has also induced booms in credit and equity markets, real appreciation, and inflationary pressures in many of these countries and raised concerns about asset price bubbles and financial fragility. Between March 2009 and August 2011 for instance, Brazil and Colombia recorded real appreciations of 39 percent and 24 percent, respectively. Balakrishnan et al. (2012) also provide also evidence of sustained credit growth and pressures on property prices in Asian MICs during the recent inflow episode.

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global banks, and the lending by global banks is the supply of wholesale funding, while the borrowing by local banks is its demand.

<sup>46</sup>This is a rather stringent definition. In International Monetary Fund (2011) for instance, a sudden flood (or capital inflow surge) is identified as a period when net inflows exceed the historical trend by one standard deviation and are larger than 1.5 percent of GDP only. In Balakrishnan et al. (2012), an episode of large net private capital flows is defined as a period of two or more quarters during which these flows (as a share of GDP) are larger (by 1 standard deviation) than their historical trend—taken to be an eight-quarter moving average—or above the 75th percentile of their distribution over the whole sample.

<sup>47</sup> A possible explanation for this effect is that large capital inflows bring about some adverse endogenous changes in macroeconomic fundamentals in some dimension (such as a deterioration of the current account deficit, an appreciation of the real exchange rate, an excessive rise in bank credit to the private sector, or a progressive mismatch in the balance sheets of firms and banks that borrow in foreign currency) that eventually triggers a massive withdrawal of capital. Put differently, booms create the seeds of their own destruction.



The evidence also suggests that the more open and integrated a country is to global financial markets, the deeper are the channels through which reversals in capital flows will impact both the real economy and the financial system—and the more critical the policy response becomes to ensure macroeconomic and financial stability. In addition, cross-border banking capital flows can be a potential source of instability, not so much because of their size but rather because they may amplify cyclical movements in domestic financial conditions and exacerbate domestic imbalances. Increased exposure to adverse shocks magnifies the possibility of default and the risk of bankruptcy by borrowers and lenders alike. The former also tends to foster collateralized lending.

Developing countries have suffered many costly crises over the past decades, with large drops in output, persistent credit crunches, and sharp increases in unemployment and poverty.<sup>48</sup> Less extreme events of financial instability also tend to be costly in terms of activity. Cardarelli, Elekdag and Lall (2009), for instance, found that when a slowdown or recession is preceded by financial stress—based on an index related to banking, securities, and foreign exchange markets—typically it is substantially more severe than during episodes that are not preceded by financial stress. In particular, slowdowns or recessions preceded by banking-related stress tend to involve two to three times greater cumulative output losses and tend to endure two to four times as long. In the same vein, Claessens, Kose and Terrones (2011) found that recessions in MICs are longer and deeper when accompanied by financial disruptions—the average output decline in a recession rises from 5.0 percent if there is no concomitant credit crunch to 8.5 percent if there is a credit crunch. Likewise, recessions associated with equity price busts result in a 6.8 percent decline in output, on average, versus a milder 3.3 percent fall in the absence of equity price busts. Other studies have found that recessions whose origin is the collapse of credit-fueled bubbles—periods during which banks make loans that appear to have abnormally low expected returns—also tend to be more severe and longer lasting than those generated by “normal” monetary policy contractions aimed at curbing inflationary pressures.

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<sup>48</sup>See Agénor and Montiel (2015) for a review of the evidence on the determinants of, and costs associated with, financial crises in developing countries. It is also worth noting that the real cost of financial volatility is not necessarily limited to the risk of crises. As discussed by Bloom et al. (2014) for instance, firms may become more cautious in investing and hiring when financial uncertainty increases. It may also hamper the economy’s ability to reallocate resources following shocks. This, in turn, may have adverse effects on growth and employment.

In addition, although credit and asset price cycles often exacerbate each other, several studies have found that credit growth is also a useful leading indicator of asset price busts. By contrast, there is no strong evidence that asset prices (in particular, equity prices) are good out-of-sample predictors (International Monetary Fund, 2009). More generally, rapid credit growth—often associated with episodes of large capital inflows in MICs, as documented earlier—is often a warning sign of financial instability; even though not all episodes of credit booms end up in crises, almost invariably crises are preceded by episodes of credit booms.

There is indeed robust evidence that credit booms raise significantly the likelihood of an asset price bust or a financial crisis in developing countries. Mendoza and Terrones (2012), for instance, in a study of 61 developing and industrial countries over the 1960-2010 period, found a systematic relationship between credit booms and a boom-bust cycle in production and absorption, asset prices, real exchange rates, capital inflows, and external deficits. Banking crises, currency crises or sudden stops often follow credit booms, and they do so at similar frequencies in industrial and developing economies.<sup>49</sup> In the same vein, Dell’Ariccia et al. (2012) found that credit booms—which are often triggered by financial reform, capital inflow surges associated with capital account liberalizations, and periods of strong economic growth, and tend to be more frequent in fixed exchange rate regimes, when banking supervision is weak, and when macroeconomic policies are loose—tend to be larger and last longer when they are “bad.” In their sample, roughly half of the booms lasting longer than six years end up in a crisis.

Financial variables other than credit growth have also been associated with financial crises (International Monetary Fund, 2009). The nominal year-on-year rate of credit growth tends to be quite high in the periods leading up to a crisis. In addition, the change in the credit-to-GDP ratio also tends to be high before distress episodes. Both facts are consistent with other studies mentioned earlier. In addition, credit-to-deposit ratios (a measure of bank leverage) higher than 120 percent appear to be associated with financial crises within the next year. Foreign liabilities of the private sector typically accelerate rapidly as well before a crisis, whereas external borrowing by banks and the nonbank private sector grows from around 10 percent to 25 percent in the run-up to a crisis. Following a crisis episode, these liabilities fall dramatically during the

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<sup>49</sup> Mendoza and Terrones (2012) also found that credit booms often follow surges in capital inflows, gains in total factor productivity and financial reforms, and they are far more common with managed than flexible exchange rates.

next 12 months. Finally, banks' foreign liabilities as a share of domestic deposits increase from about 32 percent to 38 percent two years before a crisis.

A more formal analysis of the impact of foreign liabilities on financial crises is provided by Ahrend, Goujar and Schweltnus (2012), who found that the structure of a country's external liabilities, more than the overall level, is a key determinant of vulnerability to financial crises. Specifically, a bias in gross external liabilities towards debt (in particular short-term *bank* debt) raises crisis risk. The same holds in the presence of currency mismatch, that is, a situation where a country's foreign currency-denominated liabilities are large compared to its foreign-currency denominated assets.<sup>50</sup>

Another variable that has proved to be associated with financial crises is the real exchange rate. In an empirical study using data from 1973 to 2010 for both high- and middle-income economies, Gourinchas and Obstfeld (2012) found that the two factors emerge consistently as the most robust and significant predictors of financial crises are a rapid increase in leverage and a sharp real appreciation of the currency.

Finally, it is worth noting that the recent evidence also stresses the role of credit booms as determinants of financial crises in industrial countries as well. Reinhart and Rogoff (2008), for instance, found that systemic banking crises are typically preceded by asset price bubbles, large capital inflows and credit booms in rich and poor countries alike. Schularick and Taylor (2012) provide evidence for 14 industrial countries for the period 1870-2008; they found that lagged credit growth turns out to be highly significant as a predictor of financial crises, but the addition of other variables adds very little explanatory power. Similar results are obtained by Aikman, Haldane and Nelson (2015). At the same time, however, it is also possible that the link between credit growth and financial crises is weaker in countries with more developed financial markets.<sup>51</sup>

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<sup>50</sup> They also found no evidence that the share of overall short-term debt (maturity less than one year) in total external liabilities directly influences the risk of banking crises—a result that may reflect the fact that a substantial part of that debt takes the form of trade credit.

<sup>51</sup> Gerdesmeier, Reimers and Roffia (2010) found that credit aggregates also play a significant role in predicting asset price busts in industrial countries. By contrast, Assenmacher-Wesche and Gerlach (2010) found that for these countries deviations of credit and asset prices from trend (viewed as measures of financial imbalances) contain little useful information for forecasting future economic conditions. This is consistent with the view that the link between credit growth and financial instability is weaker in countries with deep financial markets.

The key point that can be drawn from the foregoing discussion is that, although the exact trigger to financial crises in developing countries can be almost any event (including political turmoil, a real estate crash, a sharp decline in the terms of trade, or contagion from other economies), making it hard to predict their exact timing, they are often preceded by sustained imbalances—especially high rates of credit growth. Thus, measures that can help to prevent these imbalances (especially countercyclical macroprudential rules, as discussed in the text) from emerging or developing, and to minimize the chances of a crisis occurring, may have large welfare benefits.

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