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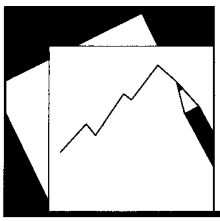

IMF Working Paper

Macroprudential Policy: What Instruments and How to Use Them?

Lessons from Country Experiences

C. Lim, F. Columba, A. Costa, P. Kongsamut,

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Monetary and Capital Markets Department

Macroprudential Policy: What Instruments and How to Use Them?

Lessons from Country Experiences[1]

Prepared by C. Lim, F. Columba, A. Costa, P. Kongsamut, A. Otani,

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Authorized for distribution by Jan Brockmeijer

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Abstract

This paper provides the most comprehensive empirical study of the effectiveness of macroprudential instruments to date. Using data from 49 countries, the paper evaluates the effectiveness of macroprudential instruments in reducing systemic risk over time and across institutions and markets. The analysis suggests that many of the most frequently used instruments are effective in reducing pro-cyclicality and the effectiveness is sensitive to the type of shock facing the financial sector. Based on these findings, the paper identifies conditions under which macroprudential policy is most likely to be effective, as well as conditions under which it may have little impact.

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EXECUTIVE SUMMARY

This paper aims to contribute to the international debate on how to make macroprudential policy operational. In the wake of the 2008 financial crisis, there has been burgeoning interest in macroprudential policy as an overarching framework to address the stability of the financial system *as a whole rather than only its individual components.* However, incorporating systemic oversight in the financial stability framework poses considerable analytical and operational challenges for most countries given that there is relatively limited experience in testing the effectiveness of macroprudential policies. In response to a request by the IMF Board, the paper provides a review of the cross-country experience in choosing and applying macroprudential instruments and draws lessons on which instruments—and under what conditions—appear to have been most effective.

Macroprudential instruments are typically introduced with the objective of reducing systemic risk, either over time or across institutions and markets. Countries use a variety of tools, including credit-related, liquidity-related, and capital-related measures to address such risks, and the choice of instruments often depends on countries' degree of economic and financial development, exchange rate regime, and vulnerability to certain shocks. Countries often use these instruments in combination rather than singly, use them to complement other macroeconomic policies, and adjust them countercyclically so that they act in much the same way as "automatic stabilizers."

Many of the macroprudential instruments are found to be effective in mitigating systemic risk. A cross-country regression analysis, using data from a group of 49 countries, suggests that the following instruments may help dampen procyclicality: caps on the loan-to-value ratio, caps on the debt-to-income ratio, ceilings on credit or credit growth, reserve requirements, countercyclical capital requirements and time-varying/dynamic provisioning. In addition, limits on net open currency positions/currency mismatch and limits on maturity mismatch may help reduce common exposures across institutions and markets. The effectiveness of the instruments does not appear to depend on the exchange rate regime nor the size of the financial sector, but the analysis does suggest that the type of shocks do matter. Different types of risks call for the use of different instruments.

Policymakers face a menu of options in using macroprudential instruments. While no one size fits all, some approaches may have advantages. Figure 1 summarizes the situations that are more likely to lead to success and those that should be avoided:

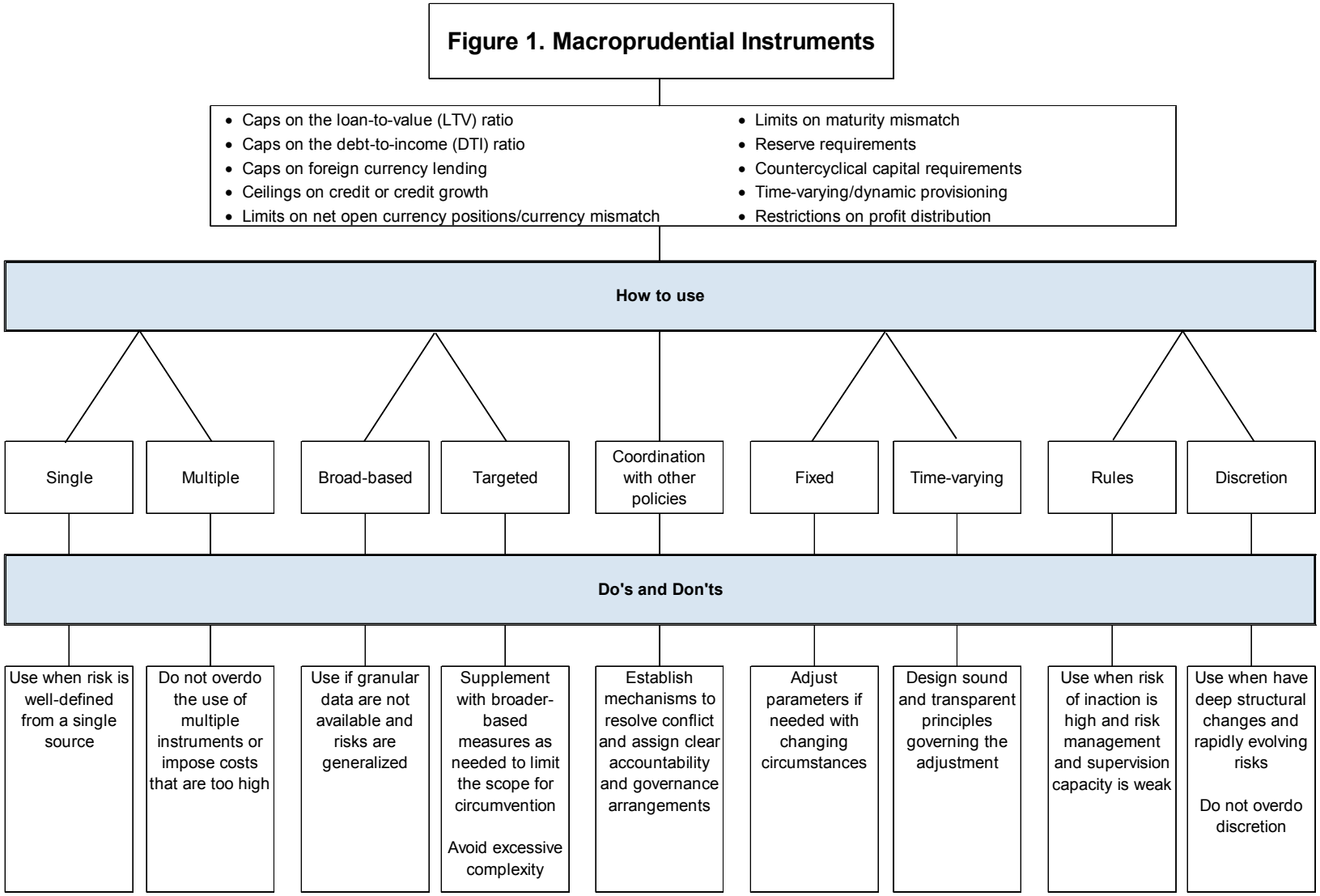
- *Single versus multiple.* The use of multiple instruments has the advantage of tackling different aspects of the same risk, reducing the scope for circumvention and providing a greater assurance of effectiveness.
- *Broad-based versus targeted.* The ability to target specific risks by differentiating types of transactions makes the instruments more precise and potentially more effective.

- *Fixed versus time-varying.* Adjusting the instruments at different phases of the cycle makes them more effective in smoothing out the financial cycle.
- *Rules versus discretion.* Rules-based adjustments such as dynamic provisioning have clear advantages and are effective. Yet, rules can be difficult to design, especially for some instruments, and policymakers need to retain discretion to adjust the stance of macroprudential polices. Clear public communication is essential when making discretionary adjustments.
- *Coordination with other policies.* The instruments tend to be more effective when used in conjunction with monetary or fiscal policy tools as they can be mutually reinforcing in achieving the same macroprudential objectives. Stand-alone policies tend to be inferior to those that are well coordinated with other policies.

Important caveats apply to these conclusions, however. There are costs involved in using macroprudential instruments, as is the case with regulation more generally, and the benefits of macroprudential policy should be weighed against these costs. In addition, calibrating the instruments may be difficult, which could lower growth unnecessarily or generate unintended distortions if not done appropriately. The empirical analysis presented here does not address these issues. Additional work with better quality, more granular and longer time series data is needed to corroborate the initial assessment and confirm the causal relationships identified. Moreover, certain pre-conditions should be in place for the successful implementation of macroprudential policy. A strong regulatory framework is essential, along with high-quality supervision, and good macroeconomic policies. An appropriate institutional framework for macroprudential policy is also vital.

In addition to these caveats, important questions remain to be answered. These include the issues posed by regulatory or cross-border arbitrage, data gaps that prevent a more careful analysis of the cross-sectional dimension of systemic risk, and the side-effects of applying macroprudential instruments. The relationship between macroprudential policy and microprudential regulation also needs to be further clarified in order to ensure close coordination between the oversight of the *whole* financial system and that of *its individual components* in order to adequately capture systemic risk.

Figure 1. Macroprudential Instruments



Source: IMF staff analysis.

I. INTRODUCTION

This paper is prepared at the request of the IMF Board. Macroprudential policy is quickly gaining traction in international circles as a useful tool to address system-wide risks in the financial sector.[2] Yet, the analytical and operational underpinnings of a macroprudential framework are not fully understood and the effectiveness of the instruments is uncertain. In April 2011, the Board initiated a discussion of these issues in the context of the paper "Macroprudential Policy: An Organizing Framework" (SM/11/54). In concluding, the Board asked for further work on several fronts.[3] This paper responds to the specific request for a review of country experiences to better understand the design and calibration of macroprudential instruments, their interaction with other policies, and their effectiveness.

While macroprudential policy is widely seen as a useful policy response to changes in the global financial environment, views on the contours of macroprudential policy can vary substantially among policymakers. The IMF—in conjunction with the Bank for International Settlements and the Financial Stability Board—has characterized macroprudential policy with reference to three defining elements:[4]

- Its *objective*: to limit the risk of widespread disruptions to the provision of financial services and thereby minimize the impact of such disruptions on the economy as a whole. Systemic risk is largely driven by fluctuations in economic and financial cycles over time, and the degree of interconnectedness of financial institutions and markets.

- Its *analytical scope:* the focus is on the financial system as a whole (including the interactions between the financial and real sectors) as opposed to individual components.

- Its *instruments and associated governance*: it primarily uses prudential tools that have been designed and calibrated to target systemic risk. Any non-prudential tools that are part of the framework need to be specifically designated to target systemic risk through their governance arrangements.

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[2]See, for example, Borio (2010), Galati and Moessner (2011), and Viñals (2010 and 2011).

[3]The IMF Board asked for four strands of work: (i) identifying indicators of systemic risk; (ii) reviewing country experiences on the use and effectiveness of macroprudential instruments; (iii) assessing the effectiveness of different institutional setups for macroprudential policy; and (iv) assessing the multilateral aspects of macroprudential policy. The first issue is addressed in IMF (2011h); the second issue in this paper; the third issue in IMF (2011c); and work on the fourth issue is currently underway.

[4]See IMF (2011a).

Against this organizing framework, the objective of the paper is to identify conditions under which macroprudential policy is most effective. The assessment uses data provided by the 2010 IMF Survey on financial stability and macroprudential policy, as well as an internal survey of desk economists.[5] Relative to previous studies, this approach has the advantage of examining a much broader range of instruments,[6] risks, and countries, taking greater account of the implications of cyclical disturbances and interconnectedness. The goal is to help policymakers make more informed decisions about macroprudential policy and to guide the Fund's policy advice and technical assistance in this area.

The paper is structured as follows. Section II reviews country experiences with macroprudential policy, focusing on the objectives, types of instruments and how they have been chosen and applied. Section III presents the empirical analysis based on case studies and panel regressions. Section IV draws common lessons and policy messages, noting the conditions under which the instruments appear to have been most effective. Section V concludes with next steps for further research and analysis.

II. Country Experiences with Macroprudential Instruments

A. What Instruments Are Used?

Country authorities have used a variety of policy tools to address systemic risks in the financial sector. The toolkit contains mostly prudential instruments, but also a few instruments typically considered to belong to other public policies, including fiscal, monetary, foreign exchange and even administrative measures. The IMF survey identified 10 instruments that have been most frequently applied to achieve macroprudential objectives. There are three types of measures:

- *Credit-related*, i.e., caps on the loan-to-value (LTV) ratio, caps on the debt-to-income (DTI) ratio, caps on foreign currency lending and ceilings on credit or credit growth;
- *Liquidity-related*, i.e., limits on net open currency positions/currency mismatch (NOP), limits on maturity mismatch and reserve requirements;[7]
- *Capital-related*, i.e., countercyclical/time-varying capital requirements, time-varying/dynamic provisioning, and restrictions on profit distribution.

[5]See IMF (2011b) for details of the survey.

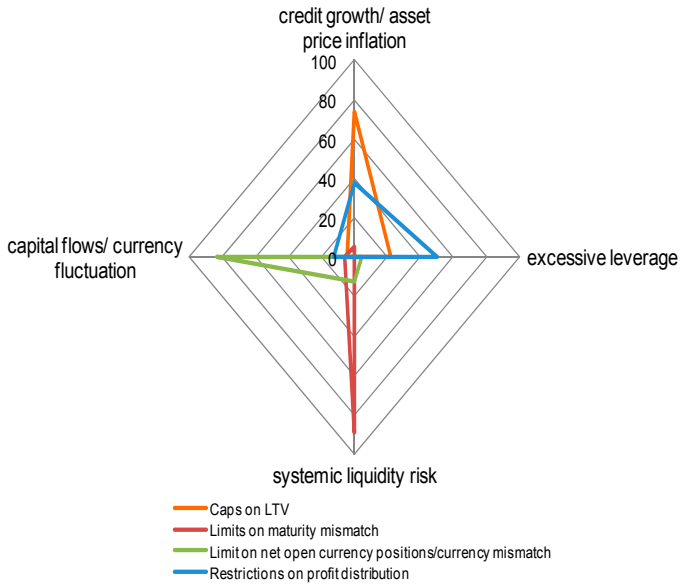
[6]For the purpose of this paper, policy tools capable of addressing systemic risk are considered macroprudential instruments. Appendix V describes details of some of the instruments. Appendix VI provides the conceptual basis underpinning the instruments as macroprudential tools and Appendix VII shows the instruments that countries have been using.

[7]Reserve requirements can also serve to build up buffers.

There is usually a clearly stated policy objective when the instruments are applied. Specifically, the instruments have been used to mitigate four broad categories of systemic risk (Figure 2):[8]

- Risks generated by strong credit growth and credit-driven asset price inflation;
- Risks arising from excessive leverage and the consequent de-leveraging;
- Systemic liquidity risk; and
- Risks related to large and volatile capital flows, including foreign currency lending.

Figure 2. Objectives of Macroprudential Policy Instruments



Source: IMF Financial Stability and Macroprudential Policy Survey, 2010.

The recent financial crisis has prompted an increasing number of countries to use the instruments, and with greater frequency. According to the IMF survey, two-thirds of the respondents have used various instruments for macroprudential objectives since 2008. Emerging market economies have used the instruments more extensively than advanced economies, both before and after the recent financial crisis. Elements of a macroprudential framework existed in some emerging market economies in the past, when they started to use some of the instruments to address systemic risk following their own financial crises during the 1990s. For these countries, the instruments are part of a broader "macro-financial" stability framework that also includes the exchange rate and capital account management.[9] The recent crisis has also led to an increase in the number of advanced countries that deploy the instruments within a more formal macroprudential framework. The work of the European Systemic Risk Board is an example (Box 1).

[8]Systemic liquidity risk arises when the financial system has an aggregate shortage of liquidity and financial institutions and other market players are not able to obtain short-term funding. Leverage is the amount of debt borrowed to acquire assets, defined as assets/equity. The amount of leverage more than one standard deviation from its historical trend is generally considered excessive.

[9]Appendix I shows some macroprudential instruments that may also be considered capital flow measures (CFMs). In these "hybrid cases," clarity of the primary objective of the macroprudential instrument is important to ensure the policy is used appropriately to target systemic risk, and not the exchange rate or capital flows. Macroprudential instruments should not be confused with capital controls.

Box 1. Macroprudential Instruments in the European Union[10]

Work on selecting and applying macroprudential instruments is a priority in the European Union (EU), both at a national and at a Union level. The European Systemic Risk Board (ESRB) was established as of January 1, 2011, in order to provide warnings of macroprudential risks and to foster the application of macroprudential instruments.

Macroprudential instruments have a particular relevance in the EU context, given the constraints on macroeconomic and microprudential policies and their coordination, including the absence of national monetary policies and policies to harmonize capital standards. The ESRB has an additional role to foster "reciprocity" through its "comply or explain" powers amongst the national authorities, so that all banks conducting a particular activity in a country will be subject to the same macroprudential instrument irrespective of the bank's home country.

The European Commission has been focusing on countercyclical capital as the main macroprudential instrument. Other agencies, as well as some national authorities, propose casting the net much wider, to take account of regional, national, sub-national, or sectoral conditions. For instance, with real estate lending having been central to past financial crises, there is likely to be a focus on instruments such as the loan-to-value ratio.

B. Why Use Macroprudential Policy and What Affects the Choice of Instruments?

Macroprudential policy has several advantages compared with other public policies to address systemic risk in the financial sector. In their survey responses, country authorities indicate that macroprudential instruments are less blunt than monetary tools, and are more flexible (with smaller implementation lags) than most fiscal tools. Many instruments (e.g., caps on the LTV, DTI, foreign currency lending, and capital risk weights) can be tailored to risks of specific sectors or loan portfolios without causing a generalized reduction of economic activity, thus limiting the cost of policy intervention. Some countries have imposed caps on foreign currency lending, for example, because these target excessive lending in foreign currency directly in a way that no other policies can. These instruments are especially useful when a tightening of monetary policy is not desirable (e.g., when inflation is below target).

Country authorities indicate that they choose instruments that are simple, effective, and easy to implement with minimal market distortions. They consider it necessary that the choice of macroprudential instruments be consistent with other public policy objectives (fiscal, monetary, and prudential).

[10]See IMF (2011d).

They also believe it important to choose macroprudential instruments that minimize regulatory arbitrage, particularly in advanced economies with large nonbank financial sectors and complex and highly interconnected financial systems.

A number of factors seem to influence the choice of instruments. The stage of economic and financial development is one such factor (Figure 3). In general, emerging market economies have used macroprudential instruments more extensively than advanced economies. This may reflect a greater need to address market failures where financial markets are less developed and banks usually dominate relatively small financial sectors. Emerging market economies are more concerned about systemic liquidity risk and tend to use liquidity-related measures more often. Advanced economies tend to favor credit-related measures, although more of them are beginning to use liquidity-related measures after the recent crisis.[11]

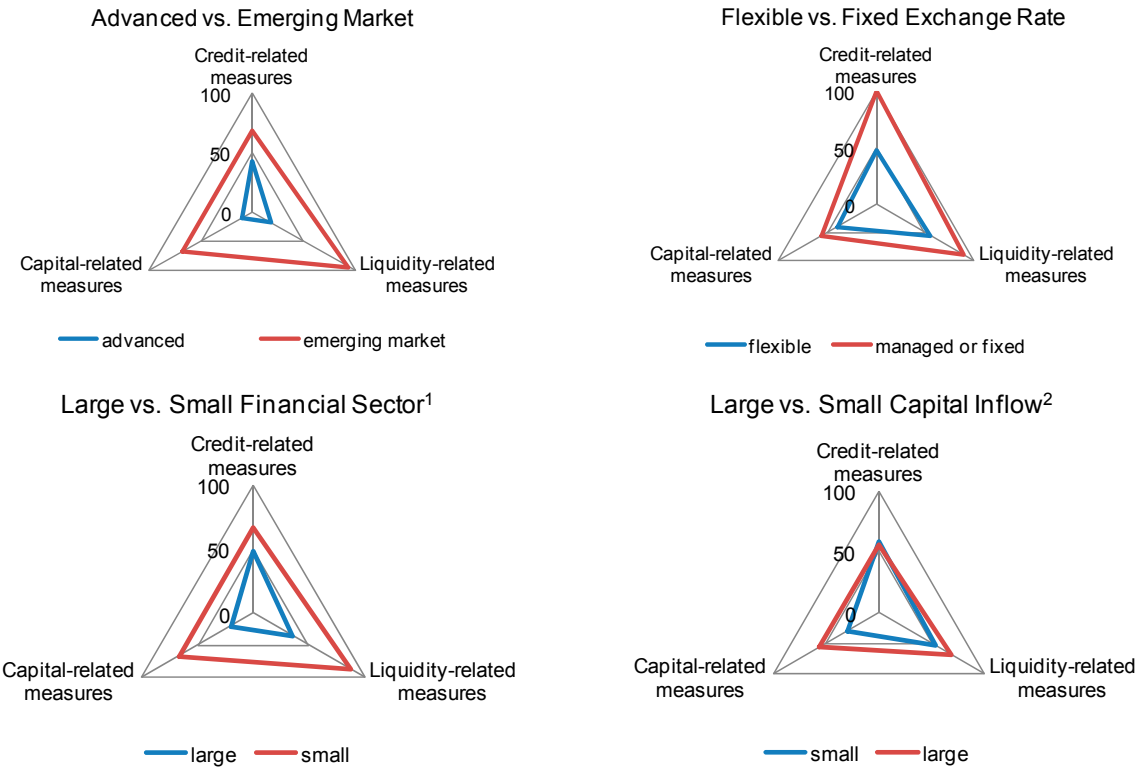
The exchange rate regime appears to play a role in the choice of instruments. Countries with fixed or managed exchange rates tend to use macroprudential instruments more since the exchange rate arrangement limits the room for interest rate policy. In these countries, credit growth tends to be associated with capital inflows as the implicit guarantee of the fixed exchange rate provides an incentive for financial institutions to expand credit through external funding.[12] Credit-related measures (e.g., caps on the LTV and ceilings on credit growth) are often used by these countries to manage credit growth when the use of interest rates is constrained. They also tend to use liquidity-related measures (e.g., limits on NOP) to manage external funding risks.

The type of shocks is another factor that may influence the choice of instruments. Capital inflows are considered by many emerging market economies to be a shock with a large impact on the financial sector, given the small size of their domestic economy and their degree of openness. Some Eastern European countries have used credit-related measures (e.g., caps on foreign currency lending) to address excessive credit growth resulting from capital inflows. In Latin America, several countries (e.g., Argentina, Brazil, Colombia, Peru, and Uruguay) have also used liquidity-related measures (e.g., limits on NOP) to limit the impact of capital inflows. In the Middle East, some oil exporters with fixed exchange rates have also used credit-related measures to deal with the impact of volatile oil revenue on credit growth. Unlike other policy tools aimed at the volume or composition of the flows (e.g., taxes, minimum holding periods, etc.), macroprudential instruments are more directly aimed at the negative consequences of inflows, i.e., excessive leverage, credit growth and exchange rate induced credit risks that are systemic.

[11]Advanced countries may prefer capital-related measures but are waiting for Basel III rules to be finalized, as these measures are price-based and tend to be less "distortionary" for financial institutions.

[12]See Magud, Reinhart and Vesperoni (2011).

Figure 3. Use of Macroprudential Policy Instruments
(% of countries in each group using each type of instruments)



1/ The ratio of credit/financial claims to GDP. Countries with the ratio at or above the medium are classified as "large," otherwise "small."
2/ The ratio of net capital inflow to GDP. Countries with the ratio at or above the medium are classified as "large," otherwise "small."

Sources: IMF Financial Stability and Macroprudential Policy Survey, 2010.

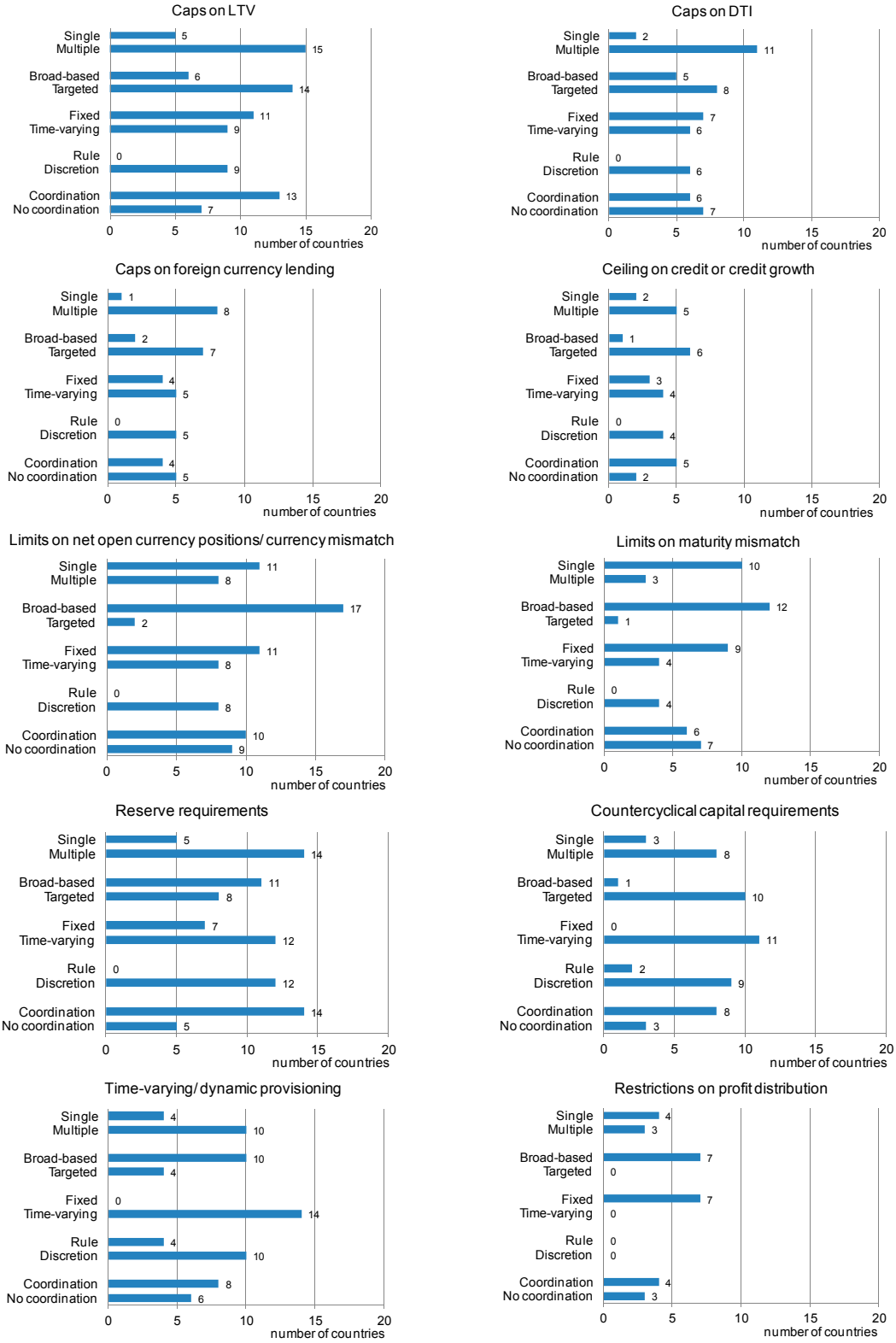
C. How Are Instruments Applied?[13]

Country experiences show that a combination of several instruments is often used to address the same risk. Caps on the LTV and DTI, for instance, are frequently applied together by country authorities to curb rapid credit growth in the real estate sector. Sometimes a range of measures are implemented (Figure 4). On the other hand, using a single instrument to address systemic risk is rare.[14] The rationale for using multiple instruments seems simple—to provide a greater assurance of effectiveness by tackling a risk from various angles. While this may be true, there may be a higher regulatory and administrative burden of enforcing multiple instruments.

[13]Appendix II contains case studies of countries using the instruments.

[14]The survey reports only two countries that use single instruments, and for one of them (Canada), the objective of using the LTV is microprudential.

Figure 4. How Instruments Are Used



Sources: IMF Financial Stability and Macroprudential Policy Survey, 2010.

Many instruments, particularly credit-related, are calibrated to target specific risks. Macroprudential instruments are generally more targeted than monetary and fiscal policy tools, and they are frequently further differentiated for specific types of transactions. Caps on the LTV and DTI, for example, have been applied according to the loan size, the location and the value of the property (Hong Kong SAR and Korea). Reserve requirements used for macroprudential purposes have been differentiated by currency, types of liabilities, and applied within a band or on a marginal basis, or if credit growth exceeds the official limit (Argentina, Chile, China, Indonesia, Peru, Russia, Serbia, and Turkey). Sometimes social and other developmental aspects are taken into account when the instruments are calibrated (Canada). Many countries apparently find it useful to take full advantage of the targeted nature of macroprudential instruments, but others also apply the instruments broadly with no further differentiation.

Making countercyclical adjustments of macroprudential instruments is a common practice. Instruments aimed at credit growth, such as caps on the LTV, the DTI and reserve requirements, are adjusted most frequently. The adjustments are usually made to give the instruments a progressively larger countercyclical impact, but in some cases they also reflect the need to proceed cautiously on a trial and error basis. Capital-related measures, such as countercyclical capital requirements and dynamic provisioning, are designed to work through the cycle by providing a buffer, but some countries have adjusted them at different phases of the cycle to give them a more potent countercyclical impact.[15]

The design and calibration of the instruments are usually based on discretion and judgment, as opposed to rules. The use of rules-based instruments has the advantage of less regulatory uncertainty, preventing political economy pressures and overcoming policy inertia when systemic risk is building up.[16] However, most countries that participated in the IMF survey have used judgment almost entirely when designing and calibrating the instruments. The implementation of the instruments is a learning-by-doing process, in which judgment on how to calibrate an instrument is often formed by trial and error, depending on the type of shock the system is facing. A few exceptions include dynamic provisioning as used in Spain and several Latin American countries, where the amount of provisioning is based on a formula and varies with the economic cycle.

Macroprudential instruments are sometimes applied in conjunction with other macroeconomic policies. Some Asian and Latin American country authorities have used macroprudential instruments such as caps on the LTV with other policies, for example, monetary and fiscal policies.[17] Some Eastern European countries have kept fiscal policy

[15]Brazil has used a formula tied to cyclicality for the adjustment in capital requirements (see Sinha (2011)), and India has made countercyclical adjustments in risk weights and in provisioning.

[16]See Borio and Shim (2007) and CGFS (2010).

[17]China, Hong Kong SAR and Singapore also imposed taxes on real estate transactions when lowering the LTV to curb rapid credit growth and asset price inflation in the real estate sector.

loose, but tightened monetary policy and attempted to contain banks' foreign currency lending through various macroprudential measures. The combined use of policy tools typically occurs when the credit cycle coincides with the business cycle and there is a generalized risk of excessive credit growth and economic overheating. In such cases, macroprudential instruments are implemented as part of a larger policy action to curb excess demand and the build-up of systemic risk, so they play a complementary role to macroeconomic policies.[18] Figure 5 summarizes the intensity of use of the instruments.

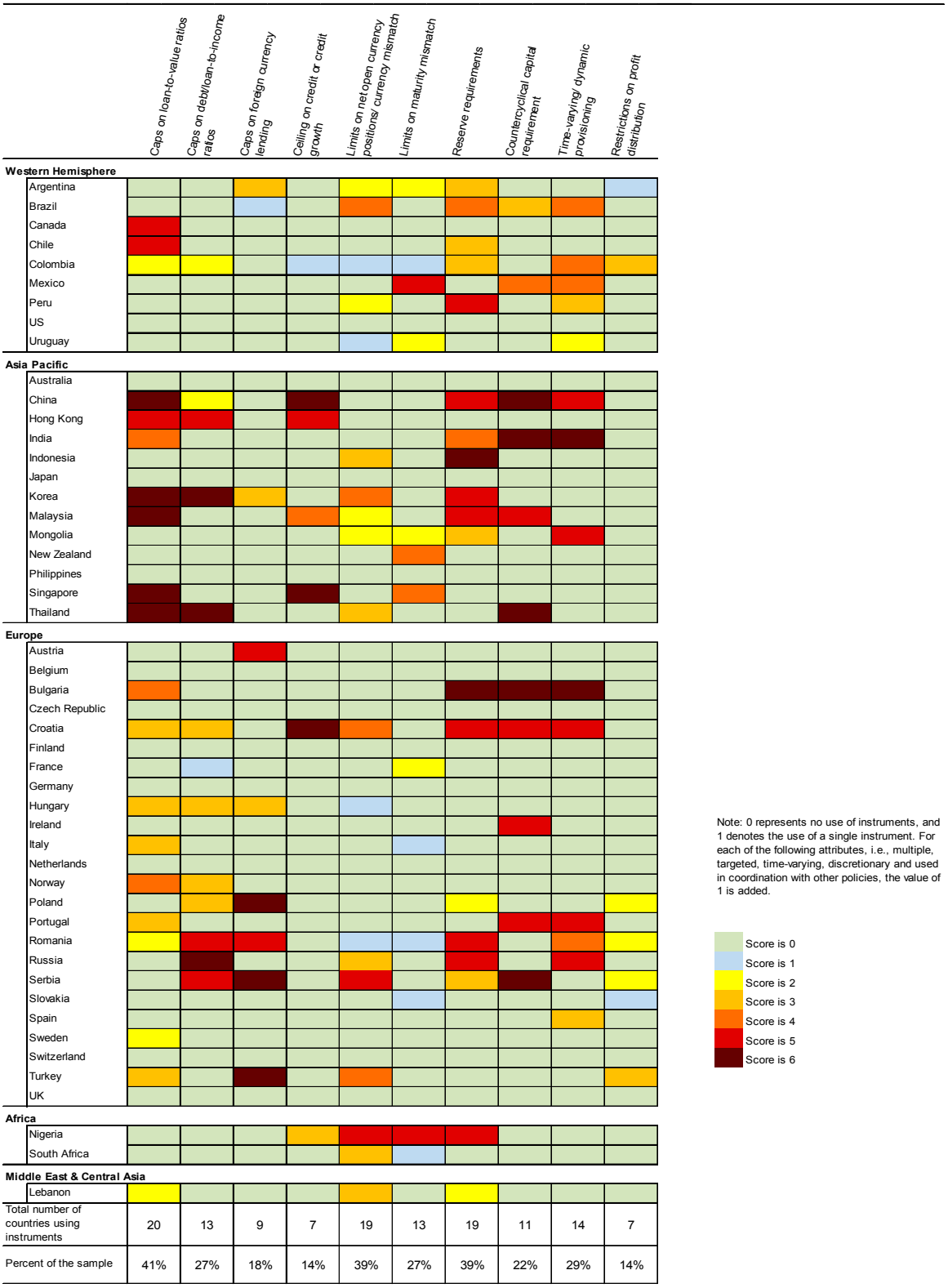
III. Effectiveness of Macroprudential Instruments

Macroprudential instruments may be effectively applied to address specific risks if used appropriately. According to the IMF survey, most country authorities who have used macroprudential instruments believe that they are effective. To assess the effectiveness of macroprudential instruments more thoroughly, this paper uses three different approaches. The first is a case study, involving an examination of the use of instruments in a small number of countries to see if they have achieved the intended objectives. The second is a simple approach, involving an examination of the performance of the target (risk) variables before and after an instrument is introduced. The third is a more sophisticated approach, which uses panel regression to assess the effect of macroprudential instruments on various target risk variables by comparing the introduction of an instrument with a "counterfactual" scenario where no macroprudential instrument is implemented.

The usual caveats, of course, apply to the evaluation. First, data availability and quality present challenges. Firm level data are preferable since many of the macroprudential instruments are aimed at the balance sheet of financial institutions, but these are not readily available or consistent over time or across countries. Moreover, the number of countries that have used macroprudential instruments in a systematic way is small since macroprudential policy frameworks have been put in place only recently, limiting the degree of confidence in any statistical analysis. In addition, establishing causality is not straightforward, or even feasible in some cases, with a selection bias that favors high risk countries where policies are implemented in reaction to adverse economic or market developments. The empirical analysis also does not take into account issues such as costs and distortions, important factors to consider when using the instruments. These caveats notwithstanding, the evaluation still provides valuable insights into the effectiveness of macroprudential instruments.

[18]There are few examples where macroprudential policy is widely seen as a substitute rather than a complement to macroeconomic policies. Two cases that are commonly cited are Turkey and some Eastern European countries where macroprudential instruments were used in place of a tight fiscal policy.

Figure 5. Intensity of Use



Sources: IMF Financial Stability and Macroprudential Policy Survey, 2010.

A. The Case Study

Experiences of a few countries suggest some success in using the instruments to achieve their intended objectives. The case study covers a small but diverse group of countries, including China, Colombia, Korea, New Zealand, Spain, the United States and some Eastern European countries. While small, the sample seems representative. Some countries use the instruments singly while others in combination (and in coordination with other policies); instruments are both broad-based and targeted; some keep the instruments fixed while others make adjustment (both rules-based and discretionary). Their experience suggests that, to various degrees, the instruments may be considered effective in their respective country-specific circumstances, regardless of the size of their financial sector or exchange rate regime. Appendix II presents the case studies, which are summarized briefly below.

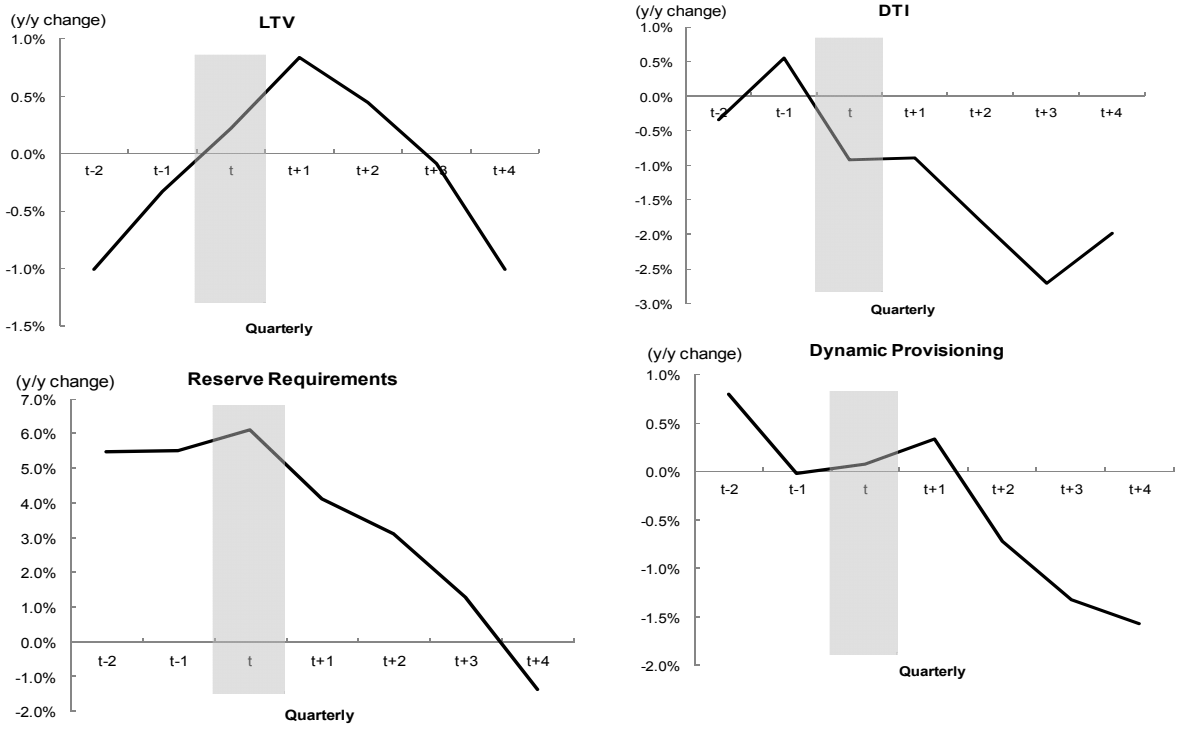
- *In China,* the authorities managed to lower credit growth and housing price inflation by taking a series of steps in 2010 that also included fiscal and monetary measures.
- *In Colombia,* the authorities took measures in 1999 to limit banks' exposure to default risk. The measures seem to have been effective. Non-performing loans declined and remained low while credit to the private sector recovered after an initial reduction.
- *In Eastern Europe,* the authorities adopted several measures to curb bank lending in foreign currency. The instruments appear to have been effective in slowing credit growth and building capital and liquidity buffers, although they were circumvented partly as lending activity migrated to nonbanks (leasing companies) and to direct cross-border lending by parent banks.
- *In Spain,* the authorities introduced dynamic provisioning as a macroprudential tool in 2000. The instrument appears to have been effective in helping to cover rising credit losses during the global financial crisis, but the coverage was less than full because of the severity of the actual losses.
- *In Korea,* the authorities adopted measures after the financial crisis to deal with the build-up of vulnerabilities associated with capital flows. They appear effective in curbing banks' short-term external borrowing, which remained some 30 percent below its pre-crisis levels as of 2010.
- *In New Zealand*, the authorities introduced two liquidity mismatch ratios and a core funding ratio in 2010 to limit banks' liquidity risk. The ratios had an effect even before they were formally implemented—banks began to lengthen their wholesale funding structure after the ratios' announcement.
- *In the United States*, the authorities adopted a minimum leverage ratio for banks in 1991. The requirement was not adjusted over time in response to changing circumstances, but a key weakness was the fact that it did not apply to investment banks after 2004. As result of the divergence in regulatory requirements, leverage rose noticeably at investment banks but remained lower at commercial banks.

B. The Simple Approach

Some targeted risk variables show a change of course after the instruments are introduced. An examination of the performance of the target risk variables during the periods before and after the implementation of an instrument indicates that a number of them may have had the intended effect. Some instruments, e.g., caps on the LTV, caps on the DTI, dynamic provisioning, and reserve requirements, seem to have an impact on credit growth (Figures 6), but the effect of other instruments is less obvious.[19] Specifically,

- ***Caps on the LTV:*** credit growth and asset price inflation decline after its implementation in more than half of the countries in the sample.
- ***Caps on the DTI:*** credit growth decline but asset price inflation does not.
- ***Dynamic provisioning:*** credit growth and asset price inflation, and to a lesser extent, leverage growth, decline.
- ***Reserve requirements:*** both credit growth and asset price inflation decline.

Figure 6. Change in Credit Growth After the Introduction of Instruments



Notes:
1/ Average of sample countries' y/y growth in credit (detrended).
2/ t denotes the time of the introduction of instruments.
3/ For details, see charts in Appendix III.

Source: International Financial Statistics.

[19]See Appendix III for a complete set of charts.

Macroprudential instruments seem to have been effective in reducing the correlation between credit and GDP growth. In countries that have introduced caps on the LTV, DTI and reserve requirements, the correlation is positive but much smaller than in countries without them, as shown by the flattening of the curve in Figure 7. In countries that have introduced ceilings on credit growth or dynamic provisioning, the correlation between credit growth and GDP growth becomes negative as shown by an inverted curve. The difference in the correlations is also statistically significant, except in the case of caps on foreign currency lending and restrictions on profit distribution. A more sophisticated analysis is described below to try to demonstrate causality and to disentangle the effects of other macroeconomic policies.[20]

C. The Panel Regression

A panel regression analysis suggests that macroprudential instruments may have an impact on four measures of systemic risk—credit growth, systemic liquidity, leverage, and capital flows.[21] Specifically, eight instruments[22] are estimated to see if they limit the procyclicality of credit and leverage—their tendency to amplify the business cycle. Procyclicality is captured in this case by the respective correlation of growth in credit and leverage with GDP growth. This specification has the advantage of showing the effect of the instruments in both the expansionary and recessionary phases of the cycle without "timing" the cycle. In addition, the effects of the other two instruments[23] on common exposure are estimated, using proxies for risks related to liquidity and capital flows, although the scope is limited by data availability. Dummy variables for factors such as the degree of economic development, the type of exchange regimes and the size of the financial sector are used to see if the instruments are effective across countries. The regressions use data from 49 countries during a 10-year period from 2000 to 2010 collected in the IMF survey.

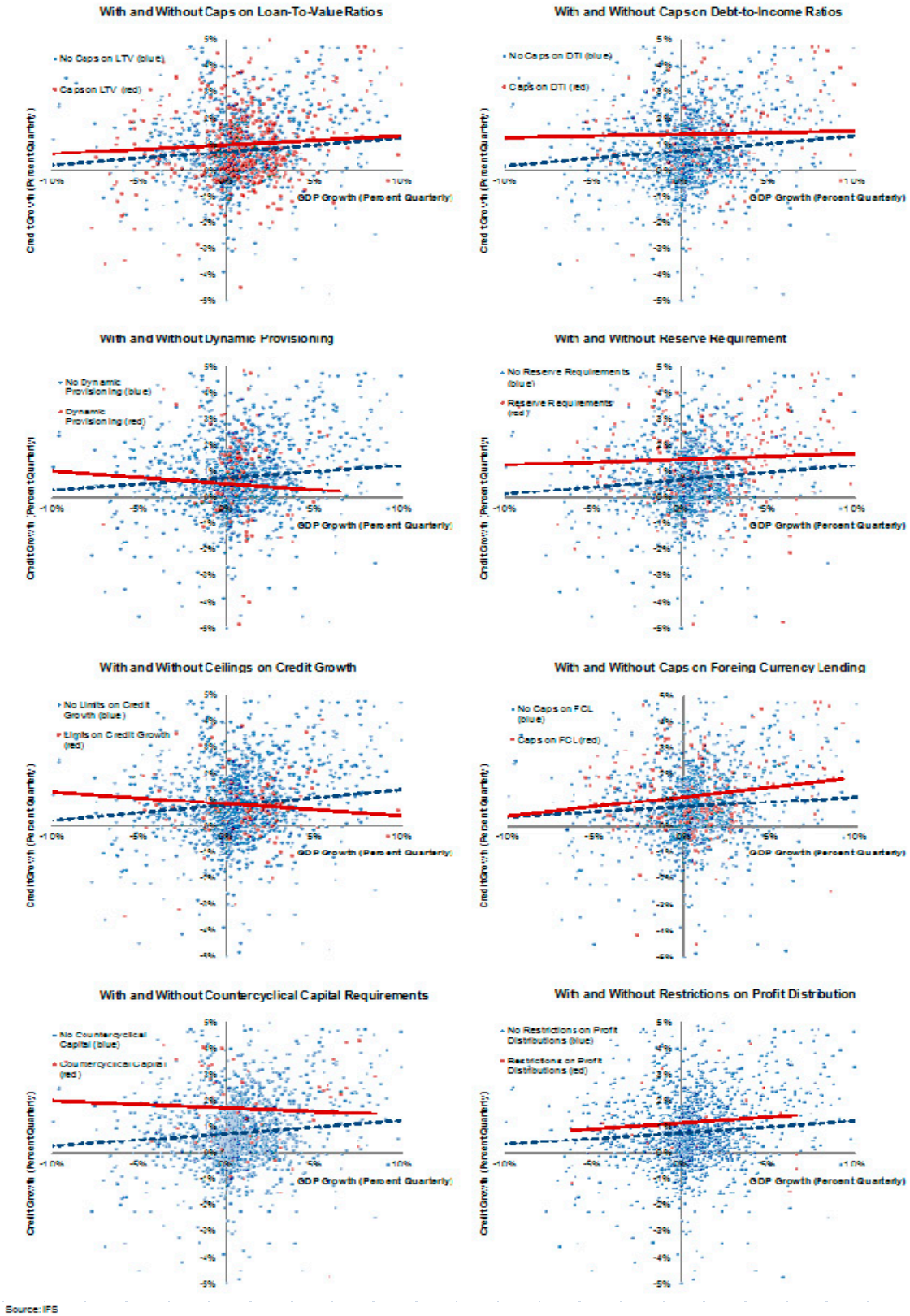
[20]The change in credit growth in a small number of countries partially coincided with the financial crisis, so Figure 6 may exaggerate the correlation between the instruments and credit growth. The change in most of the countries in the sample did not coincide with the crisis.

[21]In this section, *credit growth* is measured as the logarithm change of claims on the private sector from both banks and non-bank financial institutions (source: IFS); *Systemic liquidity* is approximated by banks' credit as a fraction of total deposits to capture non-core funding (source: IFS); *Leverage* is defined as assets over equity for both banks and non-bank financial institutions (source: IMF and FSIs); *Capital flows* are represented by the ratio of liabilities to non-residents to claims on non-residents, which is meant to capture the banking sector's dependence on external funding (source: IFS).

[22]These are caps on the LTV, caps on the DTI, caps on foreign currency lending, ceilings on credit or credit growth, reserve requirements, countercyclical/time-varying capital requirements, time-varying/dynamic provisioning and restrictions on profit distribution.

[23]Limits on NOP and limits on maturity mismatch.

Figure 7. Credit Growth and GDP Growth



Source: IFS

The specification of the panel regressions addresses several challenging issues, including:

- *How to disentangle the effect of macroprudential instruments from that of other policies.* For monetary policy, an interest rate variable is introduced, and for fiscal policy, GDP growth is used as a proxy. Using fiscal deficit has the disadvantage of introducing multicollinearity given its high correlation with GDP growth, and there seems no direct linkage between fiscal policy and procyclicality of credit or leverage. Any indirect linkage would be captured by interest rates and GDP growth.[24]
- *How to infer the general effect of macroprudential instruments in the context of country-specific characteristics.* This is addressed by introducing dummy variables to control for the type of exchange rate regime, the size of the financial sector and the degree of economic development. The panel regressions' fixed effect takes into account other unobserved country-specific characteristics.
- *How to avoid estimation biases to ensure a correct quantification of the effect of macroprudential instruments.*[25] This is addressed by using the System Generalized Method of Moments,[26] widely used to deal with panel data with endogenous explanatory variables.

Results of the panel regressions suggest that the majority of the 10 instruments may be effective. The empirical analysis finds no evidence to suggest that the degree of economic development, the type of exchange rate regimes or the size of the financial sector affects the effectiveness of the instruments—the estimated coefficients of their dummy variables are all statistically insignificant—even though these factors may influence their choice. The results also show that the instruments remain effective after controlling for macroeconomic policies. As indicated by an impulse response analysis of an open economy DSGE model, a combination of policies may have lower welfare costs than monetary or macroprudential policy used alone (Box 2). In addition, instruments that are rules-based have a larger effect, although there is not enough evidence to indicate whether individual or multiple instruments are more effective due to the lack of granular data. Results of the regressions are summarized as follows:

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[24]In DSGE models with financial frictions and a role for fiscal policy, fiscal shocks are transmitted through both demand (GDP) and risk premia in the lending rate, the two control variables used in the panel regression. See, for instance, Fernández-Villaverde (2010).

[25]Biases may arise from a spurious correlation or endogeneity among the instruments, control variables and risk variables. Three forms of endogeneity are possible. First, countries with a high degree of procyclicality may be more likely to use the instruments, potentially overstating their effectiveness. Second, the risk variables may be correlated with the control variables for macroeconomic policies. Third, the dynamic specification (with lagged terms of the dependent variable) may result in autocorrelation.

[26]Developed by Arellano and Bover (1995).

- *On credit growth (yoy change in inflation-adjusted claims on the private sector)*, the coefficients of five of the 10 instrument dummy variables (caps on the LTV, DTI, ceilings on credit growth, reserve requirements and time-varying/dynamic provisioning) are statistically significant (Table 1).[27] This indicates that these instruments may reduce the correlation between credit growth and GDP growth. Caps on the LTV, for example, reduce the procyclicality of credit growth by 80 percent.[28] This is in line with findings of previous studies that associate higher LTV ratios with higher house price and credit growth over time.[29] The coefficient of the dummy variable for a subgroup of countries that have adjusted the LTV caps over time is also significant.

- *On systemic liquidity,* credit expansion funded from sources other than deposits (credit/deposit) is used as a proxy for wholesale funding in the estimation of the effectiveness of limits on maturity mismatch. The estimation is intended to see if this instrument limits wholesale funding, considered a source of systemic risk with a cross-sectional dimension. The coefficient of the dummy variable for limits on maturity mismatch is statistically significant, and the credit/deposit ratio is 5 percent lower in countries with the instrument than in countries without it.

- *On leverage (assets/equity),* the coefficients of six of the 10 instrument dummy variables (caps on the DTI, ceilings on credit growth, reserve requirements, caps on foreign currency lending, countercyclical/time-varying capital requirements[30] and time-varying/dynamic provisioning) are statistically significant (Table 2). This indicates that, while capital-related measures are expected to reduce the procyclicality of leverage, other instruments aimed at limiting credit growth may also have an impact on leverage growth. Dynamic provisioning appears to reduce the procyclicality of both credit growth and leverage. The effect of other capital-related measures is not obvious probably because the number of observations available is limited as only a few countries have implemented them in the last two years.

- *On capital flows and currency fluctuation,* external indebtedness (foreign liabilities/foreign assets) is used as a proxy for common exposure to risks associated

[27]See Appendix IV for a complete description of the model specification and an analysis of the results.

[28]The coefficient of GDP growth is 0.0791 and the coefficient of LTV caps is -0.0634 (first column, Table 1). For every 1 percent increase in GDP growth, credit growth increases by 0.08 percent, but it is offset by 0.06 percent when LTV caps are introduced, leaving an overall net effect of 0.02 percent.

[29]See IMF (2011e).

[30]This instrument, as used by countries in the sample, is not the countercyclical capital buffer proposed under Basel III. These countries typically adjust capital requirements by changing capital risk weights countercyclically as opposed to the adjustment in common equity or other loss absorbing capital based on a threshold of credit to GDP under Basel III.

with them. The only dummy variable that has a statistically significant coefficient is limits on NOP. The results suggest that for every dollar of foreign assets held, the foreign liabilities of countries with this instrument are 15 percent lower than those without it (Table 3).

The regression results are independently confirmed by other studies. A separate study that focuses more on the structural determinants of credit growth corroborates the initial findings of the panel analysis. This study uses a different model and assumption on endogeneity, and the coefficients of caps on the DTI, caps on foreign currency lending, reserve requirements and time-varying/dynamic provisioning have a negative sign on credit to GDP and are statistically significant.[31]

This paper's finding that the effectiveness of the instruments does not depend on the type of exchange rate regime is also independently confirmed by a structural model used in IMF (2011h), which shows that the impact of macroprudential instruments is virtually identical in economies with either fixed or floating exchange rates. The regression results need to be interpreted with caution. Statistically, the coefficients of the dummy variables for the instruments are averages of country performances. Their magnitude is affected by the number of countries in the sample that have used the instruments as well as the effectiveness in individual countries, and their statistical significance is not an indication that the instruments are equally effective in all countries. Country-specific circumstances, such as the quality of supervision, the phase of the credit cycle in which the instruments are implemented, the extent to which circumvention and arbitrage are possible, the ability of the authorities to take coordinated policy actions to limit circumvention and their responsiveness to changed conditions are among factors that determine whether an instrument is effective when applied in a particular country.

While the panel regression yields promising results, more work is needed to confirm its findings. The use of macroprudential instruments is still relatively new. The short experience with macroprudential policy limits the number of observations available for a more comprehensive evaluation of its effectiveness. Further research with longer time series and better quality data is therefore necessary to corroborate the initial assessment and to evaluate an instrument's effectiveness in country-specific contexts. Factors such as the costs involved in using macroprudential instruments, the degree of calibration, and the potential for regulatory and cross-border arbitrage, which can easily circumscribe the effectiveness of macroprudential policy, should be taken into account in future analysis.

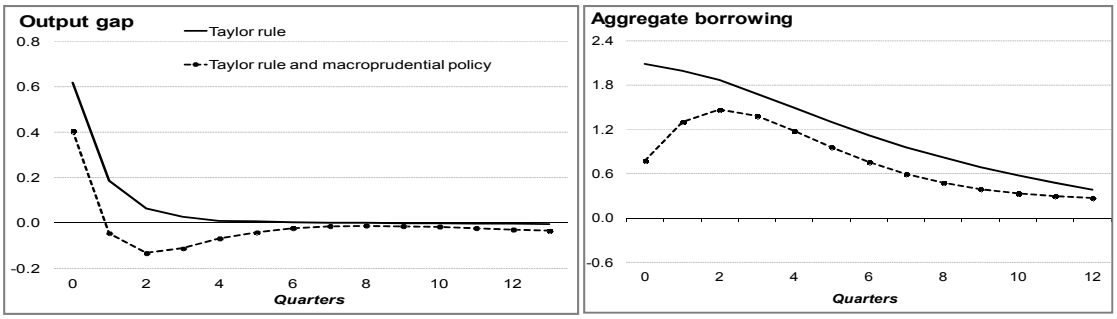
[31]See IMF (2011g).

Box 2. Monetary and Macroprudential Policy: Are They Mutually Reinforcing?[1/]

Should macroprudential measures be used in conjunction with monetary policy to mitigate risks associated with large capital inflows? To address this question, an open-economy, New Keynesian DSGE model is used to assess whether a combination of the two policies is superior to stand-alone policies.

In the model, firms can finance their investment through retained earnings or borrowing from domestic or foreign sources. Macroprudential policy is assumed to impose a higher cost of borrowing for firms, defined as an additional "regulation premium" to the cost of borrowing. Monetary policy is assumed to follow a Taylor rule, with the central bank reacting to changes in inflation and output gaps. An initial shock, modeled as a decline in investors' perception of risk, triggers capital inflows, leading to a decline in financing costs; firms borrow and invest more. Eventually, higher leverage triggers an increase in risk premium, and financial conditions normalize. But both monetary and macroprudential policies have a nontrivial role in mitigating the impact of the shock.

Dynamic Responses to a Positive Financial Shock ***(percent deviations from steady state)***



Source: IMF staff analysis.

The simulations suggest that macroprudential measures could be a useful complement to monetary policy in stabilizing the economy after the initial shock. When policymakers adopt macroprudential measures that directly counteract the increase in leverage and the easing of underwriting standards, the responses of domestic and foreign debt to the shock become more muted. Output and inflation therefore respond less, and the welfare loss, computed as the sum of inflation and output volatilities in percent of steady state consumption, decreases by almost half (1.3) compared with the simple Taylor rule (2.5), where only monetary policy is implemented. In the scenario where macroprudential measures alone are implemented and the policy interest rate is kept unchanged, output and inflation become more volatile, and the welfare loss is large (31.5).

In conclusion, the combination of monetary and macroprudential policies are superior to stand-alone policies.

1/ See Unsal (2011).

Table 1. Effectiveness of Macroprudential Instruments in Reducing the Pro-cyclicality of Credit

Indep. Variables	Dependent Variable[1]: Quarterly Credit Growth Rate$_t$							
Quarterly Credit Growth Rate$_{t-1}$	0.0819	0.0909	0.1034	0.0817	0.0855	0.0825	0.0855	0.0779
	(8.19)***	(15.16)***	(30.07)***	(33.60)***	(2.81)***	(17.95)***	(20.02)***	(17.08)***
GDP Growth$_t$	0.0791	0.0889	0.0667	0.0869	0.0729	0.0436	0.0487	0.0454
	(5.89)***	(10.44)***	(9.39)***	(6.17)***	(5.47)***	(4.50)***	(5.46)***	(5.59)***
Interest Rate$_t$	-0.0777	-0.0804	N/A[2]	-0.0839	-0.0618	-0.0779	-0.0843	-0.0804
	(-11.35)***	(-10.48)***		(-19.74)***	(-10.07)***	(-18.38)***	(-17.84)***	(-17.04)***
Caps on Loan-to-Value[3] × GDP Growth$_t$	-0.0634							
	(-3.01)**							
Caps on Debt-to-Income[3] × GDP Growth$_t$		-0.0976						
		(-4.96)***						
Limits on Credit Growth[3] × GDP Growth$_t$			-0.1227					
			(-4.17)***					
Reserve Requirements[3] × GDP Growth$_t$				-0.0800				
				(-4.27)***				
Dynamic Provisioning[3] × GDP Growth$_t$					-0.1776			
					(-2.12)**			
Limits on Forex Lending[3] × GDP Growth$_t$						0.0055		
						(0.21)		
Countercyclical Cap. Req. [3] × GDP Growth$_t$							0.0438	
							(0.63)	
Restrictions on Profit Dist.[3] × GDP Growth$_t$								0.0664
								(4.21)

***, **, * indicate statistical significance at 1%, 5%, and 10% (two-tail) test levels, respectively.

1/ The dependent variable is credit growth, the log change in the real level of credit. Credit is measured as claims on private sector from both bank and non-bank financial institutions (source: IFS). The interest rate is the nominal long-term interest rate on prime lending, from the IMF's International Financial Statistics. The estimation period is 2000–2010. The sample is composed of 48 countries. The regression includes dummy variables to correct for different degrees of flexibility in the exchange rate regime, individual (country) effects, a time trend (year effect) and a dummy variable for the use of other MPP instruments. Instrumental variables for the policy instrument and the GMM Arellano-Bond estimator are used to address selection bias and endogeneity.

2/ Non-Significant Results when Interest Rate included.

3/ The coefficient corresponds to the interaction term between GDP growth and a dummy for the respective macroprudential instrument.

Source: IMF staff estimates.

Table 2. Effectiveness of Macroprudential Instruments in Reducing the Pro-cyclicality of Leverage

Indep. Variables	Dependent Variable[1]: Quarterly Leverage Growth Rate$_t$							
Quarterly Leverage Growth Rate$_{t-1}$	0.0012	-0.0116	-0.0095	-0.0170	-0.0167	-0.0102	-0.0120	-0.0142
	(0.12)	(-2.88)***	(-1.62)	(-5.35)***	(-0.73)	(-1.69)***	(-2.03)**	(-4.71)***
GDP Growth$_t$	0.0346	0.0418	0.0394	0.0880	0.0323	0.0376	0.0429	0.0224
	(2.58)**	(5.43)***	(7.15)***	(4.81)***	(4.36)***	(10.90)	(7.71)***	(4.64)***
Interest Rate$_t$	0.0591	0.1121	0.1429	0.1362	0.0956	0.1031	0.1724	0.1181
	(0.94)	(3.22)***	(5.43)	(4.31)***	(3.09)**	(1.78)*	(3.74)	(4.95)***
Caps on Loan-to-Value[2] × GDP Growth$_t$	-0.0121							
	(-0.44)							
Caps on Debt-to-Income[2] × GDP Growth$_t$		-0.0406						
		(-3.35)***						
Limits on Credit Growth[2] × GDP Growth$_t$			-0.0317					
			(-1.82)*					
Reserve Requirements[2] × GDP Growth$_t$				-0.0959				
				(-3.44)***				
Dynamic Provisioning[2] × GDP Growth$_t$					-0.2744			
					(-4.78)***			
Limits on Forex Lending[2] × GDP Growth$_t$						-0.0207		
						(-1.91)*		
Countercyclical Cap. Req.[2] × GDP Growth$_t$							-0.1286	
							(-2.72)***	
Restrictions on Profit Dist.[2] × GDP Growth$_t$								0.0942
								(2.57)**

***, **, * indicate statistical significance at 1%, 5%, and 10% (two-tail) test levels, respectively.

1/ The dependent variable is leverage growth, the log change in the level of leverage. Leverage is measured as assets over capital (source: IMF FSIs). The interest rate is the nominal long-term interest rate on prime lending, from the IMF's International Financial Statistics. The estimation period is 2000–2010. The sample is composed of 48 countries. The regression includes dummy variables to correct for different degrees of flexibility in the exchange rate regime, individual (country) effects, a time trend (year effect) and a dummy variable for the use of other MPP instruments. Instrumental variables for the policy instrument and the GMM Arellano-Bond estimator are used to address selection bias and endogeneity.

2/ The coefficient corresponds to the interaction term between GDP growth and a dummy for the respective macroprudential instrument.

Source: IMF staff estimates.

Table 3. Effectiveness of Macroprudential Instruments in Reducing Cross-Sectional Risks

Indep. Variables	Dependent Variable[1]:	
	Foreign Liabilities / Foreign Assets$_t$	Credit / Deposits$_t$
Foreign Liabilities / Foreign Assets$_{t-1}$	0.8041	
	(1089.88)***	
Credit / Deposits$_{t-1}$		0.7129
		(16.91)***
GDP Growth$_t$	-0.3651	-0.0208
	(-37.40)***	(-4.55)***
Interest Rate$_t$	-0.3340	-0.0169
	(-3.17)**	(-0.70)
Limits on Net Open Positions in Foreign Currency[2]	-0.1485	
	(-7.87)***	
Limits on Maturity Mismatch[3]		-0.0526
		(-2.50)**

***, **, * indicate statistical significance at 1%, 5%, and 10% (two-tail) test levels, respectively.

1/ The dependent variables are the ratio of financial system liabilities with foreign residents to claims on foreign residents (1) and the ratio of banking institutions claims to deposits (2), obtained from the IMF's International Financial Statistics. The interest rate is the nominal long-term interest rate on prime lending, also from IFS. The estimation period is 2000–2010. The sample is composed of 48 countries. The regression includes dummy variables to correct for different degrees of flexibility in the exchange rate regime, individual (country) effects, a time trend (year effect) and a dummy variable for the use of other MPP instruments. Instrumental variables for the policy instrument and the GMM Arellano-Bond estimator are used to address selection bias and endogeneity.

2/ The coefficient corresponds to a dummy variable with a value of 1 for countries with limits on net open positions in foreign currency, and zero otherwise.

3/ The coefficient corresponds to a dummy variable with a value of 1 for countries with limits on maturity mismatches, and zero otherwise.

Source: IMF's staff estimates.

IV. Lessons and Policy Messages

A number of instruments may be effective in addressing systemic risks in the financial sector. The effectiveness does not seem to depend on the stage of economic development or type of exchange rate regime. Emerging market economies with fixed or managed exchange rates, where room for interest rate policy is limited, facing large capital inflows or having thin financial markets and a bank dominated financial system tend to use macroprudential instruments more extensively, but the instruments seem equally effective when used by countries with flexible exchange rate regimes and by advanced economies. However, there are costs involved in using macroprudential instruments, as is the case with regulation more generally, and the benefits of macroprudential policy should be weighed against these costs. Moreover, calibrating the instruments may be difficult, which could lower growth unnecessarily or generate unintended distortions if not done appropriately. These issues are not addressed in the paper but are important considerations to take into account when using macroprudential instruments.

Underpinning the assessment of effectiveness is the assumption of a sound regulatory framework and high quality supervision. These are the foundation for the effective application of macroprudential instruments.[32] In addition, institutional arrangements for

[32]The objective of microprudential policy is to improve the resilience of individual institutions while macroprudential policy aims to improve the resilience of the financial system as a whole. Both share instruments that have the same root. There is also growing recognition that microprudential regulations—unless carefully designed—can encourage procyclical behavior (See Viñals et al (2010)).

macroprudential policy need to ensure a policymaker's ability and willingness to act—including clear mandates; control over instruments that are commensurate with those mandates; arrangements that safeguard operational independence; and provisions to ensure accountability, supported by transparency and clear communication of decisions and decision-making processes.[33]

While care is needed to avoid one-size-fits-all approaches, there are common lessons on what instruments should be used to address specific risks that are considered systemic:

- *To address systemic risks generated by credit growth or asset price inflation*, *credit-related instruments may be useful*. Of these, LTV and DTI caps can be kept in place, adjusted counter cyclically or targeted at specific sources of risk. They may be supplemented by reserve requirements or capital-related instruments, such as dynamic provisioning, should the credit boom become more generalized; these in turn can be targeted by currency if foreign currency lending proves to be the source of risk.

- *To address systemic liquidity risk, liquidity-related instruments such as limits on liquidity mismatch may be used, or limits on the net foreign currency position if the liquidity risk stems from foreign currency funding.* A core (or stable) funding ratio, or a levy on non-core liabilities, which are not examined by this paper, could also be good candidates if wholesale funding is a significant funding source. The ratio or levy can be kept in place to prevent the buildup of systemic liquidity risk, or adjusted in response to a sudden liquidity shock.

- *To address risks arising from excessive leverage, capital-related instruments may be a good choice.* These measures provide a buffer that can be made countercyclical through adjustments in the capital requirement, the risk weights of assets or the provisioning requirement, and can thus help curtail excessive growth in leverage. If leverage growth stems from banks' drive to expand credit, capital-related measures can be supplemented by credit-related instruments to go to the source of the risk.

- *If the above mentioned risks arise due to capital flows, all three types of instruments can be used.* Liquidity-related instruments, like limits on net open positions in foreign currency, are shown to be effective in limiting the financial sector's dependence on foreign sources of funding. These instruments can be supported by credit-related instruments if excessive credit growth is what drives banks to borrow abroad. In this context, capital-related instruments may also be useful by limiting credit growth and providing a buffer.

Several considerations are relevant for the successful design and calibration of instruments. Countries have tailored the design and calibration of the instruments to their

[33]This is discussed in IMF (2000c).

specific circumstances, taking into account the type and source of risk, the ability of the financial system to circumvent the measure, or bear the cost of additional regulation, the quality of supervision and enforcement, and the governance and accountability arrangements regarding macroprudential policy.[34] The following five considerations are important (Table 4):

- Single versus multiple
- Broad-based versus targeted[35]
- Fixed versus time-varying
- Rules versus discretion
- Coordination with other policies

The use of multiple instruments has the advantage of tackling the same risk from various angles. A combination of instruments also reduces the scope for circumvention and provides a greater assurance of effectiveness by addressing different sources of the risk. Caps on the LTV and the DTI, for example, complement each other in dampening the cyclicality of collateralized lending, with the LTV addressing the wealth aspect, and the DTI the income aspect, of the same risk.[36] In general, when credit-related instruments are used to address risks generated by excessive credit growth, it may also be useful to limit funding risks with liquidity-related instruments and to provide a cushion by using capital-related instruments. Nevertheless, the use of multiple instruments may impose a higher cost on banks and are harder to calibrate and communicate, so it is important to choose instruments that minimize the cost and plan the implementation carefully to avoid an unnecessary burden on the financial sector.

Some instruments can be used to target specific risks, although the targeted approach has its limits. Macroprudential policy is already more targeted than monetary policy, and the ability of macroprudential instruments to target specific types of activities is another advantage that makes them more precise and potentially more effective. A lower LTV cap on more expensive houses helps limit the risk to banks since such exposure tends to be riskier while a higher LTV cap on less expensive houses may be desirable from a social perspective as well. However, the targeted approach requires more granular data, has a higher administrative cost and may be more susceptible to circumvention.

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[34]It should be noted, however, that there is insufficient evidence to shed light on whether macroprudential policy should aim at correcting imbalances as a preventative measure, rather than building buffers to improve resilience in the event of a crisis; or how effectiveness would be affected by countries that use macroprudential policy to pursue multiple objectives.

[35]When an instrument is differentiated according to transactions, e.g., caps on the LTV based on the value of properties, it is targeted; otherwise, and it is broad-based.

[36]The LTV is a wealth constraint (through the down payment) while the DTI is an income constraint. At least one of the constraints should be binding when used together.

Excessive targeting may also result in micromanagement, which would increase the cost of policy actions. The additional benefit of targeting should be weighed against its cost.

It is useful to adjust macroprudential instruments at different phases of the cycle to smooth out cyclicality. Some macroprudential instruments counter the cyclicality in the financial system as an "automatic stabilizer." Dynamic provisioning and the capital conservation buffer under Basel III fall into this category, whose buildup during the upturn and depletion during the downturn help limit the severity of the cycle. However, other instruments, such as caps on the DTI, ceilings on credit growth and reserve requirements, may need to be adjusted during different phases of the cycle to minimize cyclicality. In addition, adjustments in the LTV cap and capital requirements can make them more potent in smoothing out the cycle, as indicated in Section III. While necessary, the adjustments should be based on sound and transparent principles and ad hoc and frequent changes that are disruptive to financial activities should be avoided.

Instruments that vary through the cycle based on rules have clear advantages and should be used to the extent possible. Dynamic provisioning and the capital conservation buffer are two examples of such instruments. The use of rules-based instruments helps overcome policy inertia and provides greater predictability in the regulatory environment. However, these two instruments may be rare exceptions, most other instruments, such as caps on the LTV, DTI, ceilings on credit growth and reserve requirements, may need to be adjusted at the discretion of the policymaker because designing rules for their adjustment may be difficult or even impossible, especially when it is necessary to use multiple instruments in combination. When discretion is necessary, it is useful to make the adjustment on a trial and error basis in a learning-by-doing process. Still, even when discretionary action is necessary, macroprudential policymakers should base their decisions on formal methods of analysis, and explain the rationale behind their actions publicly to enhance policy transparency and effectiveness.

The need for the discretionary use of the instruments calls for a framework to guide the conduct of macroprudential policy. This framework should include a mechanism to identify and monitor systemic risk, procedures for using macroprudential instruments, and careful choice of specific objectives macroprudential policy actions are to achieve. The criteria for the choice of instruments and methodology for the evaluation of their effectiveness should also be important elements in the framework. In addition, since many fiscal and monetary tools may be used to address systemic risk, a clear communication strategy and a set of principles and rules regarding the use of other public policy tools for macroprudential objectives are essential for transparency and the credibility of the macroprudential authority.

Well coordinated policy actions are a necessary condition for a successful response to systemic risk. The combined use of macroprudential instruments with monetary and fiscal policy tools in addressing systemic risk tends to be more effective when financial sector risks intertwine with those in other sectors or the financial cycle coincides with the business cycle. In general, macroeconomic policies should always be the primary tool to use when the source

of systemic risk is domestic demand imbalances. In particular, macroprudential policy should be used only as a complement to monetary policy, which is more blunt and potent in addressing excess demand. On the other hand, macroprudential policy is better suited to target specific sectors, and should be used primarily to increase the resilience of the financial system. In any event, mechanisms should be established to address coordination challenges and limit any potential policy conflicts.

Table 4. Use of Macroprudential Instruments
Some Considerations

Instrument	How to use	Pros	Cons	Do's and Don'ts
Single vs. Multiple	Single	Easier to calibrate, communicate, administer and assess effectiveness	Insufficient for multiple sources of risk or higher probability of circumvention	Use when risk is well-defined from a single source
	Multiple	Help tackle a risk from various angles More effective for multiple sources of risk	Impose a higher cost on regulated institutions	Do not overdo the use of multiple instruments and impose costs that are too high
Targeted vs. Broad-based	Broad-based	Wider impact Smaller scope for circumvention	May have a higher cost or larger distortions	Use if granular data are not available and risks are generalized
	Targeted	Achieve objective while minimizing cost or potential distortions; avoid bluntness of other policies	Granular data requirement Higher administrative cost Higher probability of circumvention	Be ready to adjust fine-tuning; anticipate channels for evasion Supplement with broader-based measures to limit the scope for circumvention Avoid excessive complexity
Fixed vs. Time-varying	Fixed	Provide a minimum buffer Low administrative cost Avoid timing the cycle	May be ineffective in rapidly changing circumstances	Adjust parameters with changing circumstances
	Time-varying	Lean against the wind, countercyclical	Ad hoc and frequent changes may be disruptive Hard to time the cycle	Design sound and transparent principles governing the adjustment
Rules vs. Discretion	Rules-based	Transparent, lower risk of inaction Provide regulatory certainty	Susceptible to circumvention Changes to calibration may be necessary	Use when risk of inaction is high and risk management and supervision capacity is weak. Re-assess calibration periodically
	Discretionary	Flexible, take into account different situations, types of risks and structural changes	Less transparent No regulatory predictability: subject to regulatory capture	Use when have deep structural changes and rapidly evolving risks Do not overdo, use constrained discretion
Coordination with other policies	Fiscal, Monetary and Prudential	Signals willingness to tackle the challenges Enhances policy effectiveness	Coordination challenges if multiple agencies are involved; slows decision making process; accountability may not be clear	Establish mechanisms to resolve conflict and clear accountability and governance arrangements

Source: IMF Staff Analysis.

V. NEXT STEPS

This paper has examined the use of macroprudential instruments to mitigate systemic risk in the financial system. The analysis focuses on the factors affecting the choice of the instruments, the circumstances in which the instruments are used, and the effectiveness of the instruments in achieving their intended objectives by drawing on the experience of a sample of 49 countries that have actively applied macroprudential instruments in the past 10 years. Several common lessons and policy messages, on conditions for macroprudential policy to be effective and situations to avoid, are derived from country experiences and econometric analysis. The broad guidelines set out in this paper should contribute to the international debate on how to make macroprudential policy operational and help guide the Fund's policy advice in surveillance and technical assistance.

The findings are preliminary and more work is needed in several areas. The paper has assessed mostly the time dimension of systemic risk, and largely with experiences from emerging market economies. The analysis of the cross-sectional dimension of systemic risk has been more limited, and data availability has been the main constraining factor. In analyzing the interconnectedness of global systemically important institutions, more granular data would be required. Filling the data gaps would also help to develop mechanisms to identify and monitor systemic risk, which is essential to make macroprudential policy operational.

A deeper understanding of design and calibration issues and how they shape effectiveness is needed. The paper has shown that some approaches have advantages over others, but whether instruments would be more effectively used strictly as a form of insurance against future crisis or as a tool to correct imbalances is unclear. Another issue not addressed in this paper but may warrant further research is whether price-based or quantity-based instruments are more effective. Effectiveness may also vary with the degree of complexity (e.g., as instruments become more targeted), or if the instrument is used to pursue more than one objective.

The cost of implementing macroprudential instruments is another issue that needs further exploration. Although these issues are beyond the scope of this paper, it will be important to consider costs related to the regulatory burden, distortions, or other unintended consequences when making macroprudential policy operational. Most notably, macroprudential instruments may cause a migration of systemic risk to other parts of the financial system, and care is needed to mitigate such "leakages."

The relationship between macroprudential policy and microprudential regulation also needs to be further clarified. Many of the macroprudential instruments cited in this paper are traditional prudential regulation tools. These instruments are assumed to be "readily" available for use as macroprudential instruments. However, it is important to clarify when the prudential tools begin to serve macroprudential purposes so that the implementation of macroprudential policy can be well coordinated with microprudential objectives.

APPENDIX I. MACROPRUDENTIAL OR CAPITAL FLOW MEASURES?

Many countries have recently undertaken measures which can be considered both macroprudential—in the sense that they seek to respond to rising systemic risk in the financial system—and capital flow management measures (CFMs)—in the sense that they are designed to affect capital inflows and hence the exchange rate. This box describes recent examples of such measures in Brazil, Korea, and Turkey. These measures are further described in IMF (2011f), *Recent Experiences in Managing Capital Inflows—Cross-Cutting Themes and Possible Policy Framework.* A common theme from these cases is that concerns of preserving financial stability and macroeconomic stability (exchange rate appreciation, overheating, etc.) are often intertwined.

Brazil. Managing large capital inflows has been one of the main policy issues in Brazil since the global financial crisis. In January 2011, Brazil imposed a 60 percent unremunerated reserve requirement on banks' short foreign exchange (FX) positions in the spot market exceeding $3 billion or Tier 1 capital (whichever is lower). The measure was motivated by concerns that banks or the local currency market could face disruptions following a large shock to the exchange rate, given the banks' large short FX spot positions. At the same time, the measure also complemented Brazil's IOF (Imposto sobre Operações Financeiras) tax on bond and equity inflows as it was expected to reduce the attractiveness of non-residents' long local currency positions. These forward positions in the onshore and offshore markets, a form of carry trade, were typically facilitated by local banks which took the other side of non-resident investors' positions and hedged themselves by borrowing FX. By raising the cost of such short FX positions, the measure was expected to affect an important channel for carry trades that was left open in the original design of the IOF while reducing potential vulnerabilities in the banking sector.

Korea. In the aftermath of the global financial crisis, Korea experienced a pronounced sudden stop of short-term external bank debt. Such debt had grown rapidly prior to the crisis driven in part by demand for currency forward contracts by the corporate sector on expectations of won appreciation. In June 2010, and following other measures, Korea introduced ceilings on banks' foreign derivatives positions to reduce the short-term external debt that resulted from banks' provision of forward contracts to corporates. The ceilings were expressed as a ratio to bank capital and set at 50 percent for resident banks' and 250 percent for foreign banks branches (due to the much smaller capital for foreign bank branches). In late 2010, the authorities announced a macroprudential stability levy on banks' non-deposit foreign currency liabilities, with increasingly penal rates on shorter maturities. This measure, which became effective on August 1, 2011, is a CFM since it is designed to affect capital inflows.

Turkey. Facing rapidly rising capital inflows, the Central Bank of Turkey (CBT) implemented from the fourth quarter of 2010 a new policy mix intended to preserve macroeconomic and financial stability. Unremunerated required reserve ratios on all Turkish lira and FX liabilities of banks were raised in several steps to an average of 14 percent and 11.5 percent respectively (from their 5 percent and 9 percent troughs during the global crisis). Moreover, higher rates were applied to shorter-duration bank liabilities. In addition, the CBT's interest rate corridor was widened significantly to facilitate increased volatility of short-term market interest rates. The use of reserve requirements served both macroprudential and capital flow management purposes by aiming to moderate inflows and lengthen their duration.

While the above are selected examples of recent measures that can be considered both CFMs and macroprudential, not all macroprudential measures are CFMs (and vice versa). In particular, macroprudential measures that are not designed to influence capital inflows—a matter of careful judgment based on the totality of circumstances, including whether the measures were introduced or intensified during an inflow surge—would not be considered CFMs. Examples could include capital adequacy requirements, loan-to-value ratios, limits on net open FX positions, and limits on foreign currency mortgages.

APPENDIX II. SELECTED CASE STUDIES

Selected European Countries (Bulgaria, Croatia, Poland, Romania, and Serbia)

Background

Macroeconomic conditions in a number of Eastern European countries were buoyant in the mid-2000s. Optimism about the region's prospects stemmed from its closer integration with the European Union (EU), with EU accession by Poland in 2004, and Bulgaria and Romania in 2007. GDP growth between 2003 and 2008 was strong, and current account balances showed large deficits (except Poland), financed by even larger net capital inflows (Table II.1). Credit growth boomed during this pre-crisis period, with credit/GDP increasing by 19 percentage points in Croatia and as much as 45 percentage points in Bulgaria. At the same time, the large capital inflows led to strong asset price growth and increasing household and corporate indebtedness.

Such external imbalances called for fiscal restraint to avoid overheating and ensure sustainability. However, only Bulgaria accumulated fiscal surpluses during this period, in line with maintaining its currency board arrangement.

Table II.1 Macroeconomic Indicators, average 2003–08 (in percent)

	GDP growth	CAB/GDP	Fiscal deficit/GDP	Public debt/GDP	External debt/GDP	Net capital flows/GDP	FX regime	FX liab./Total liabilities, 2007
Bulgaria	6.3	-15.7	2.2	28.7	79.0	24.3	CB	58.6
Romania	6.6	-9.7	-2.6	20.5	42.3	13.5	Floating	42.5
Croatia	4.3	-6.6	-2.9	35.1	73.9	13.1	Stabilized	73.6
Serbia	5.7	-12.5	-1.0	51.7	64.3	19.0	Floating	67.8
Poland	5.2	-3.3	-4.1	46.6	49.2	5.6	Floating	21.9

Sources: WEO database, various central banks, and MCM exchange rate classification.

The other countries maintained fiscal deficits, and only Bulgaria and Serbia reduced their public debt to GDP ratios substantially during the pre-crisis period. Foreign banks dominate the financial systems in all these countries.

Action

The primary risk that needed to be addressed was systemic risk arising from currency-induced credit risk. Specifically, with the rapid expansion in credit (a significant portion of which was offered in foreign currency), rising asset prices, and increasing private indebtedness, the ability of unhedged borrowers to repay would be undermined in the event of a large depreciation.

How Instruments Were Used

All countries used multiple instruments as a package to tackle the systemic risk (Table II.2).

Table II.2 Prudential Measures Imposed During the Boom Period, 2003-early 2008

	Bulgaria	Croatia	Romania	Serbia
Conditions set				
By currency		x	x	x
By maturity			x	x
By source of funding				
Deposits	x		x	x
incl. FX indexed				x
by type e.g., retail				x
External liabilities		new foreign borrowing	x	x
Local currency securities		Special RR		
FX subordinated				x
FX assets of leasing companies				x
Speed bumps on credit growth and bank liabilities	x	x		

Sources: Central bank websites.

- In Poland, measures were taken in 2006 to try to contain the risks of foreign currency (FX) lending, particularly for mortgages, and in 2008 higher risk weights for FX residential loans were introduced. In 2010, Poland adopted further measures aimed at FX mortgage and retail lending, including tighter LTV (e.g., based on loan maturity) and debt service to income ratios.

- Croatia, Romania, and Serbia adopted several measures to curb FX lending. Romania focused on lending criteria and provisioning, and introduced a gross exposure limit, while Croatia and Serbia implemented higher risk weights; these reached 125 percent (Serbia) and 150 percent (Croatia) on lending to unhedged borrowers. Serbia also introduced an exposure limit for retail lending relative to Tier I capital.

- Bulgaria targeted measures on overall credit growth and asset price growth, such as credit ceilings, differential risk weights based on LTV, and countercyclical provisioning requirements.

- All countries imposed LTV ratios and all but Croatia restricted profit distribution, and several put in place debt service to income limits.

- High reserve requirements (RR) were used extensively in all cases except Poland, in which a unified low reserve requirement was maintained, in line with EU practices. The RR were differentiated by currency, maturity and source of funding (Table II.3).

- In Bulgaria and Croatia, marginal RR (MRR) were imposed on credit growth exceeding a threshold rate and additional external borrowing by banks. The required marginal rate was set very high in Bulgaria (200 percent in 2005).

Table II.3 Reserve Requirement Features During the Boom Period, 2003-early 2008

	Bulgaria	Croatia	Poland	Romania	Serbia
Measures on FX exposures					
FX liquidity requirement		x			x
Net open position		x		x	x
Gross exposure limits				on unhedged	
Differential lending criteria				x	
Differential provisioning				x	
Differential risk weights on FX		x	x		x
Differential buffers for FX moves			x[1]		
Real estate exposures					
Loan to value limits	x	x	x	until EU accession	x
Differential risk weights on LTV	x				
Consumer lending					
Debt to income				x	x
Other					
Countercyclical provisioning	x	x			x
Countercyclical capital		x			for HH
Restriction on profit distribution or treatment of profits in regulatory capital	x		x	x	x
Memorandum item; (in percent)					
Higher minimum capital requirement	12	10		until EU accession	12 from 2008

[1]Taking into consideration adverse scenarios (significant devaluation of local currency) when assessing the creditworthiness of borrowers.

Sources: Survey responses, central bank websites.

Countercyclical adjustments were made in several instruments. Although RRs were tightened in the period leading up to the crisis, RR rates were subsequently lowered and in some cases removed altogether (Bulgaria and Croatia). In addition, FX liquidity requirements were relaxed (Croatia and Serbia), as well as some provisioning and capital rules.

In all cases, the instrument use can be characterized as discretionary, due to the relative frequency of adjustment. The authorities in many cases found that adjustments needed to be made, either because the measures were not as effective as expected or because of circumvention. For example, several countries first set higher reserve requirements for liabilities at shorter maturities, only to find that banks exceeded those maturities by small margins to get around the regulation, and the requirement had to be extended to all maturities. In Croatia and Serbia, frequent adjustments were needed to expand the RR base, mainly to deal with circumvention. Similarly, FX indexed loans had to be brought into the same umbrella as FX loans in Serbia.

The degree of cooperation with other policies (macroeconomic and microprudential) was mixed. On macroeconomic policies, monetary policy in all five countries was applied in the same direction as macroprudential policy. However, as noted in the IMF's Article IV consultations, fiscal policy was insufficiently tight except for Bulgaria.[37] With respect to microprudential policies, the consistency with macroprudential policy improved over time. Early on, banks evaded the measures by channeling funding through non-bank subsidiaries (including leasing companies), or through asset sales to avoid the macroprudential measures (Bulgaria, Croatia). In Poland, some banks took advantage of the EU "single passport rule" which enabled them to establish branches which were not subject to stricter prudential regulations. As these circumvention tactics became known, the authorities widened the perimeter of regulation and harmonized prudential rules, and this channel for regulatory arbitrage was closed.

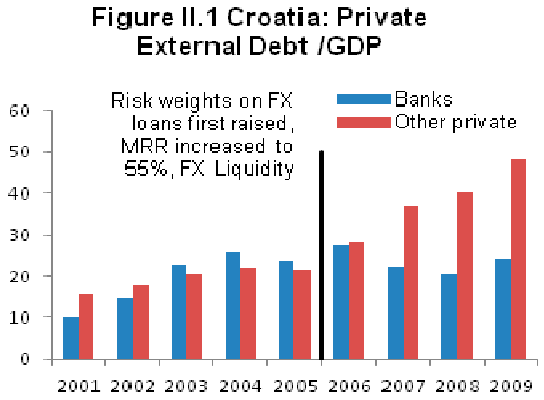
Outcome

The instruments had been effective in slowing credit growth and building capital and liquidity buffers in these countries. The combination of measures created capital and liquidity buffers that helped most of these countries' banking systems withstand the financial crisis fairly well even as credit quality deteriorated (except Romania).[38] Together, the instruments appear to have altered the composition of external debt in some countries, as banks' FX liabilities stopped growing in Croatia and Serbia (Figures II.1 and II.2).[39]

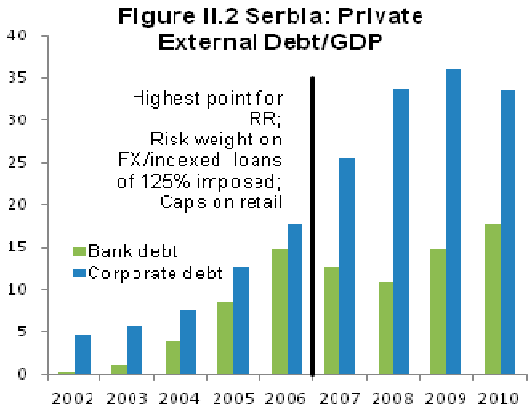
[37]Although, as noted in the 2008 Article IV report noted, fiscal policy was not as tight as suggested by the headline numbers and the augmented structural balance (which takes into account the effects of both the output and the absorption gap), declined from 1.5 to 0.2 percent of GDP during 2005–2008.

[38]The Vienna Initiative, in which parent banks committed to maintain their exposures, also helped. It should be noted though that some parent banks, particularly in Austria, had to be re-capitalized and in some cases nationalized.

[39]In Croatia, the data on FX-indexed lending is available only beginning in 2009, so the effect cannot be gauged.



Sources: Galac 2010 and Croatia National Bank.



Source: National Bank of Serbia.

However, the measures were partly circumvented through direct cross-border borrowing by corporate borrowers, so indebtedness was still being built up.

Fine-tuning can be helpful, but may have been taken too far for RR. It appears that simpler RR were sufficient to create liquidity buffers in Bulgaria, without the need to resort to more complex measures with very high rates that are more difficult to administer and require frequent adjustments to address circumvention (e.g., in Croatia, Serbia and Romania).

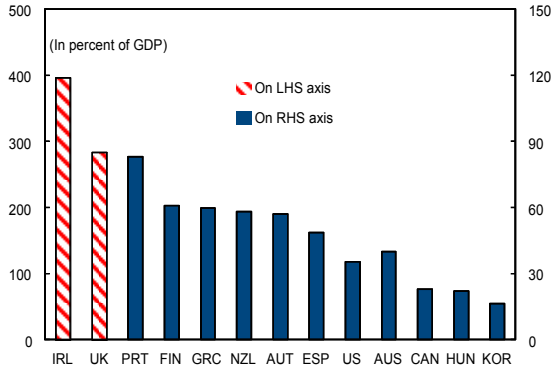
Finally, a macroprudential approach consistent with the macroeconomic policy mix appears to have worked better. This was seen in Bulgaria, where fiscal policy was countercyclical and worked in concert with macroprudential policy. In the other cases, fiscal policy was too loose, and shifted the burden of adjustment to monetary and macroprudential policy.

New Zealand[40]

Background

New Zealand banks depend on short-term offshore funding to provide credit. Given low national saving, they have relied on external debt to fund private sector credit. Gross external debt exceeded 130 percent of GDP in 2009, and while New Zealand's short-term external debt declined during 2009, it remained high at almost 60 percent of GDP at end-2009 (Figures II.3).

Figure II.3 Total Short-term External Debt, 2009

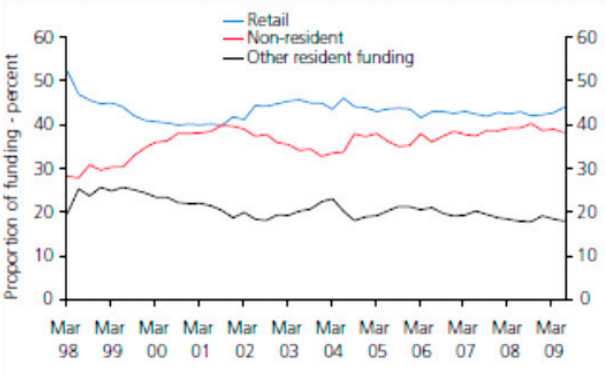


Source: IMF Staff estimates.

[40]Based on IMF (2011i).

Before the introduction of the liquidity rules, the share of non-resident funding had grown to 40 percent of total funding. The corresponding core funding as a share of bank loans was thus lower than in most other advanced countries (Figure II.4). At the onset of the financial crisis in 2007, about 60 percent of the non-resident funding had residual maturities of up to three months (Figure II.5).

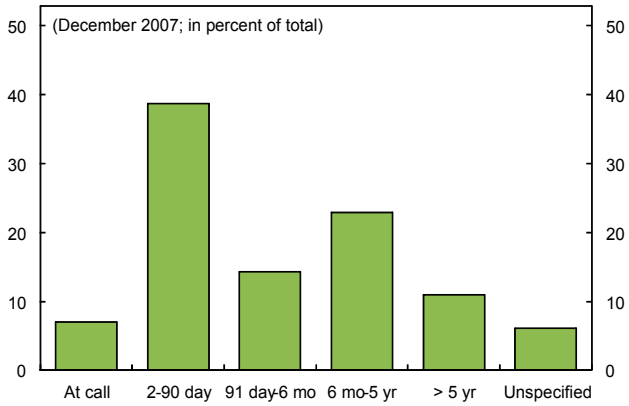
Figure II.4 Shares of Domestic and Non-resident Funding by New Zealand Banks



Source: Reserve Bank of New Zealand Standard Statistical Return and RBNZ calculations.

Note: Other resident funding includes interbank funding.

Figure II.5 New Zealand Banks' Non-resident Funding by Residual Maturity

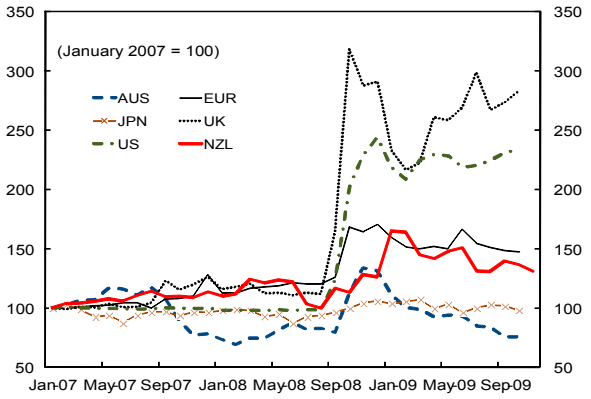


Source: Statistics New Zealand and RBNZ calculations.

Note: Based on data from December 2007.

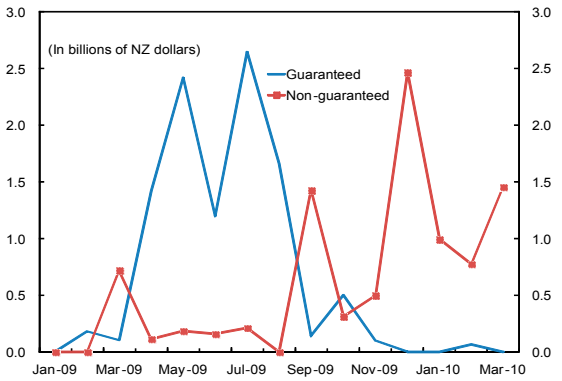
In late 2008, New Zealand banks experienced some difficulty rolling over their short-term debt when international markets were impaired after the collapse of Lehman Brothers. Banks came to the Reserve Bank of New Zealand (RBNZ) for liquidity support and used the government's wholesale funding guarantee to gain access to international markets (Figures II.6 and II.7). Parent banks in Australia also provided funding to their subsidiaries in New Zealand. The four largest banks in New Zealand are Australian banks' subsidiaries.

Figure II.6 Central Bank Balance Sheet Sizes



Source: IMF Staff estimates.

Figure II.7 New Zealand Banks' Bond Issuance



Source: IMF staff estimates.

The RBNZ was concerned that liquidity risk was becoming systemic. Also, in the absence of strict liquidity coverage rules, the RBNZ felt that banks may rely excessively on central bank financing instead of managing their own liquidity more prudently.

Action

In October 2009 the RBNZ introduced new quantitative requirements to increase banks' liquidity and reduce reliance on short-term offshore funding. The requirements became effective from April 2010. This step was preceded by a consultation process with banks that sought to refine the proposed ratios to ensure that the definitions were consistent with the stated objectives of the proposal. The RBNZ is the sole institution responsible for monitoring and enforcing the liquidity rules.

How the Instruments Were Used

The minimum liquidity and funding requirements in New Zealand were conceptually aligned with the respective Basel III's new liquidity standards ratios:

- Liquidity mismatch ratios set minimum 'zero' requirements for one-week and one-month mismatch ratios each business day. The mismatch ratios compare a bank's liquid assets and likely cash inflows with its likely cash outflows, expressing the difference as a ratio of total funding.

- A minimum core funding ratio (CFR) that requires banks to hold sufficient retail and longer-dated wholesale funding. The minimum CFR has been set at 65 percent of total loans and advances from April 2010, increasing to 70 percent from July 2011 and 75 percent from July 2012.

The required liquidity ratios and underlying assumptions have been fine-tuned over time. The ratios are based on a generic set of assumptions that provide a standard metric for the amount of required liquid assets. Assumptions about the share of funding withdrawn consider the financial sophistication of the providers and the size of their deposit, whereby larger deposits are subject to higher run-off rates. For committed lending facilities, the assumed drawdown rate (15 percent) is based on historical figures across a range of products. Similarly, the *core funding ratio* is based on assumptions about retention rates in determining available stable funding. The initial minimum rate of 65 percent was set with discretion in April 2010 and, (as of late 2009); all locally-incorporated banks were expected to meet that target.

The liquidity regulation can be considered a rules-based system. It comprises differentiated rates for assumed cash inflows and outflows that may not require discretionary adjustment along the cycle. Moreover,it specifies maximum exposures to individual providers of liquidity to avoid excessive concentration and defines eligible liquid securities to preserve quality holdings. The rates are not expected to change once the new system has been fully phased in.

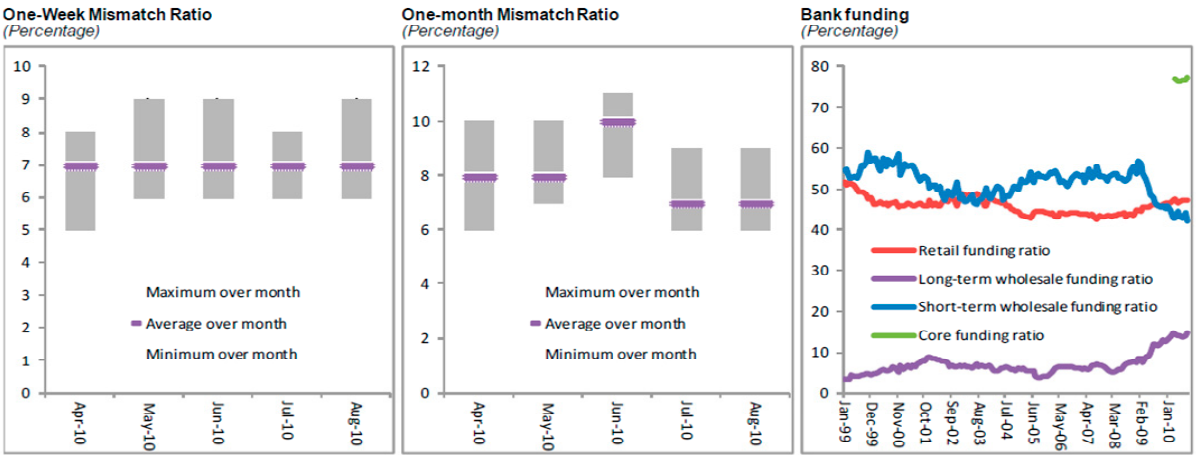
In New Zealand, the instruments are stand-alone measures that are not used in conjunction with other policies. In fact, monetary and fiscal policies were not aligned with the

instruments at the time of their introduction, but they were not seen to have had any adverse consequences on the usefulness of the instruments.

Outcome

The liquidity instruments had an effect even before they were formally implemented. In late 2008—upon publication of a consultation paper outlining the proposed measures—banks began to change the maturity structure of wholesale funding in favor of long-term funding. Other important reasons for banks to change include pressures from financial markets such as rating agencies and banks' own funding difficulties experienced during the global crisis. As a result, New Zealand's short-term debt dropped from 64 percent of GDP in December 2008 to 50 percent in December 2010. This shift corresponded to a 20 percentage point drop in New Zealand's short-term external debt ratio to 50 percent of GDP. In the run-up to implementation, banks also started competing more strongly for retail deposits, which raised bank funding costs (estimated to correspond to a hike in the policy rate of 100-150 basis points) and led to an increase in lending rates. In the months following implementation, all banks met the liquidity and funding standards, with ratios at the system level in excess of the required minima by 7-10 percentage points (Figure II.8).

Figure II.8 Liquidity Mismatch Ratios



Source: RBZN.
1/Once-week and one-month liquidity mismatch ratios are defined as the mismatch dollar amount to total funding.

The instruments were arguably effective in achieving the stated goals. The consultation process ensured that banks were informed about the impending policy changes and able to comply with them by the time of their implementation.

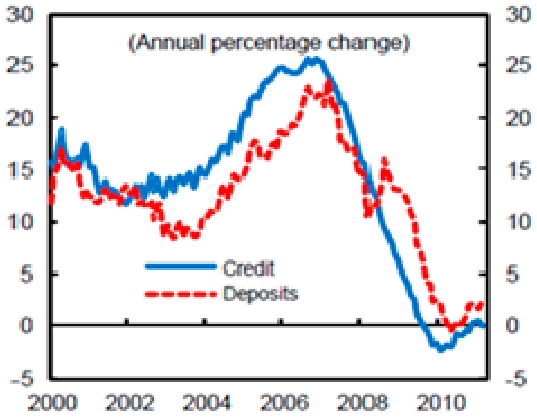
Careful calibration of parameters—values of eligible assets, run-off rates, and the minimum core funding ratio—contributed to the relatively smooth transition. It appears, however, that the impact on average funding costs was higher than anticipated.

Spain

Background

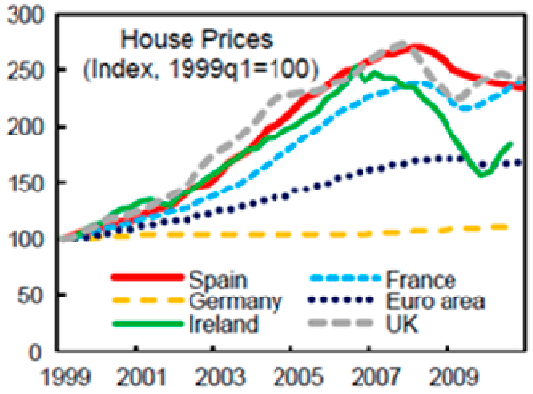
Spain introduced dynamic provisioning (DP) as a macroprudential tool in 2000. This required banks to build reserves for eventual loan losses. Previously, banks would provision against loan portfolios in two ways. First, they would set aside 1 percent of their total lending as a "generic" provision in case of loan losses. Second, they would set aside a "specific" provision for potential losses on loans in the current period that would match realized loan losses in the most recent period. The new requirement was for banks to constitute a reserve fund periodically according to a formula that took account of average loan losses over a full economic cycle, average specific provisions, as well as specific provisions in the most recent period. This approach was called "dynamic" provisioning as the contribution to the countercyclical fund varied with the economic cycle. DP was introduced soon after Spain joined the euro zone in 1999. During the 1990s, the nation's convergence to the euro zone entailed a focus on reducing the inflation differential with Germany and tightening fiscal policy. Following convergence, the nation's banks benefited from a significant reduction in inflation, currency, and credit risk premia, and from significant declines in long-term interest rates to near zero (from levels near 4-5 percent in the mid-1990s), allowing access to much cheaper funding than before. These developments allowed banks to lend more freely to households and companies, resulting in rapid credit growth (Figure II.9.)

Figure II.9 Credit and Deposit



Source: Banco de España.

Figure II.10 House Prices



Sources: National Authorities, Eurostat, Bloomberg, and IMF Staff Estimates.

Much of the lending was directed towards the acquisition or development of real estate, causing home prices to rise sharply at a rate of more than 10 percent per year in the first few years after euro zone entry and eventually reaching an annual rate of 20 percent by 2004–2005 (Figure II.10).

Action

The primary objective behind the introduction of DP was to cope with a sharp increase in credit risk on Spanish banks' balance sheets following a period of significant credit growth during the late-1990s. A secondary objective was to give banks an incentive for more prudent loan origination that would curb credit growth, as moral suasion had proved to be ineffective and heightened competition among banks had resulted in some types of loans being too cheap (i.e., risk premia were perceived to be too low for certain operations). In addition, there had been a significant reduction in non-performing loans in the second half of the 1990s, which meant that specific provisions were quite low.[41]

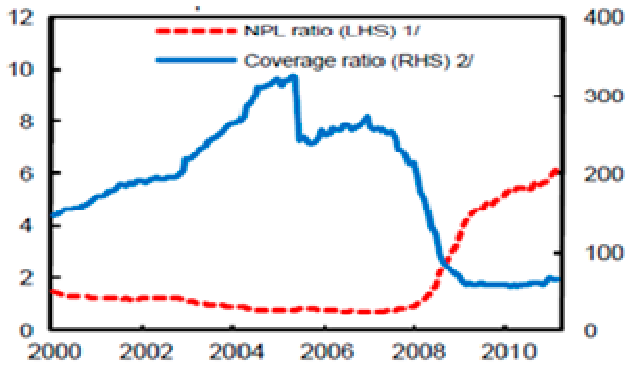
How the Instrument Was Used

The instrument was used as a stand-alone measure, as the authorities did not apply other macroprudential tools to meet the objective of protecting against credit losses. The authorities viewed dynamic provisions as being less volatile compared with "normal" provisions comprised of generic and specific provisions. The latter typically rise sharply in a credit cycle downturn when non-performing loans (NPLs) and corresponding loan losses are on the upswing. With dynamic provisions expected to reduce the amplitude of swings in "normal" provisions, the authorities believed that it could help reduce earnings volatility.

Fine-tuning of DP: Dynamic provisions were applied across several categories of loans including mortgages (differentiated by high/low LTV), corporates, automobiles and credit cards. The formula calibrated on the basis of historical experience prior to 2000 suggested expected loss estimates ranging from 0.6 percent to 2.5 percent on these categories of loans, while average specific provisions varied from 0.1 percent to 1.6 percent.

There was a one-off adjustment of DP rates: the authorities lowered the provisioning rates in 2005, as the coverage of bad loans had risen above 300 percent in the wake of low NPLs and strong credit growth. This step resulted in a significant drop in provision coverage (Figure II.11). The liberated provisions were kept as "other reserves" in banks' balance sheets.

Figure II.11 Coverage Ratio



Source: Banco de España.

[41]See Saurina (2009), "Loan Loss Provisions: A Working Prudential Tool", p. 13.

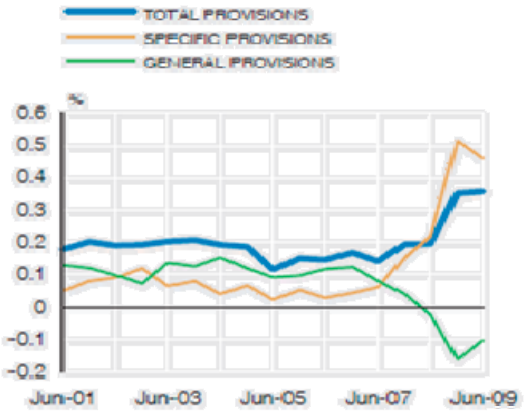
The use of the instrument can be characterized as rules-based. The contribution to the fund of dynamic reserves was predicated on the difference between the average provision through the cycle and the current specific provision. Thus, dynamic provisions varied with the cycle, as specific provisions were low in the upswing and high in the subsequent downturn. While the authorities changed the DP rates once, this adjustment was not countercyclical.

The degree of cooperation with other policies was low. Monetary conditions set by the European Central Bank turned out to be too loose for Spain. Only in 2008, when the downturn had already begun, did Spain introduce more stringent treatment for commercial and residential real estate exposures than that envisaged in the Capital Requirements Directive of the EU. This was done in order to penalize non-traditional riskier mortgages requiring higher capital requirements.

Outcome

The instrument was largely effective in covering rising credit losses in Spain during the financial crisis. As credit growth declined sharply and house prices fell, banks experienced a significant pickup in NPLs, particularly in real estate exposures. These credit losses were partially absorbed by dynamic provisions. The increase in total provisioning cost (in percent of total loans) was lower than that of specific provisions as banks tapped into their dynamic reserve buffers (Figure II.12).

Figure II.12 Total Provisions



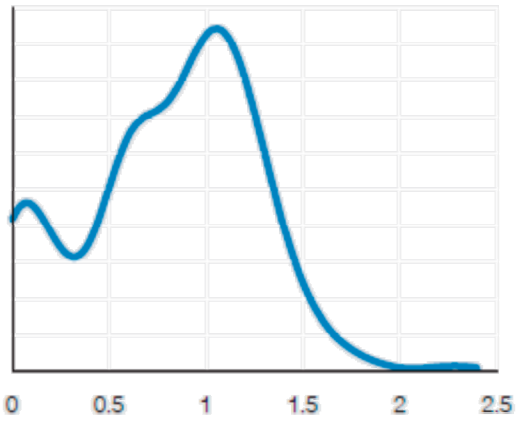
Source: Banco de España.

The coverage was less than full because the loan losses turned out to be much higher than expected losses at the time when the DP formula was calibrated. This conforms to the notion that loan loss reserves should cover expected losses, whereas bank capital should cover unexpected losses. It is probable that, with the benign adjustment in 2005, DP rates no longer reflected a prudent estimate of expected loan losses. On the other hand, market dynamics are inherently difficult to gauge in terms of their impact on the build-up of credit risk. It is clear, though, that capital needs would have been much higher still in the absence of dynamic provisions.

In addition, some banks were not fully covered, because DP rates were not differentiated enough. Figure II.13 shows the distribution of buffer size across banks (DP funds as a percentage of total loans as of June 2009). By this date, a significant share of banks had already run down their buffers, while fewer banks retained larger cushions. This skewed distribution is the result of the DP formula not fully capturing banks' individual risk profiles. While the formula distinguishes between high and low risk loan segments for allbanks alike, it does not reflect that loan portfolios in a given segment differ in risk (i.e., the consumer loan

portfolio of one bank has a higher expected loss than that of others). The banks that exhausted their buffers early on likely had riskier loan portfolios. To guard against this underprovisioning, rates could be differentiated by loan category and by bank.

Figure II.13 Size of DP Funds (% of loans)



Source: Banco de España.

DP was arguably less effective with regard to the secondary objective of curbing credit growth. After the introduction of DP in 2000, credit growth declined briefly, but it is difficult to disassociate this from the credit contraction that took place following the collapse of the tech stock bubble in 2000. Thereafter, credit grew by as much as 25 percent annually. It could be that credit would have been even more dynamic without DP, but the growth rates were high in absolute terms.

China

Background

The massive stimulus in 2008 and a delay in its exit helped fuel a domestic credit boom in 2009 and 2010. Credit growth was driven in part by lending to local government financing platforms (LGFPs), vehicles set up to make infrastructure investment, and to the real estate sector, including loans to developers and residential mortgages. Signs of overheating in the real estate sector began to emerge after mid-2009, and housing prices were rising at an annual rate of 15-20 percent by early 2010.

Action

The authorities have adopted a series of measures to curb credit growth and housing price inflation since 2010. The measures have been introduced in packages, fine-tuned with a differentiation between mortgages on first and second homes, adjusted over time at the discretion of policymakers, and include fiscal, interest rate, and administrative measures.

- Caps on the LTV were lowered from 80 percent to 70 percent for primary homes and to 50 percent for second homes (April 2010); mortgages for third homes were suspended (September 2010); the LTV cap on second home mortgages was subsequently lowered to 40 percent (January 2011);

- Interest rates on mortgages for second homes were raised to 1.1 times the officially administered benchmark lending rate (April 2010);

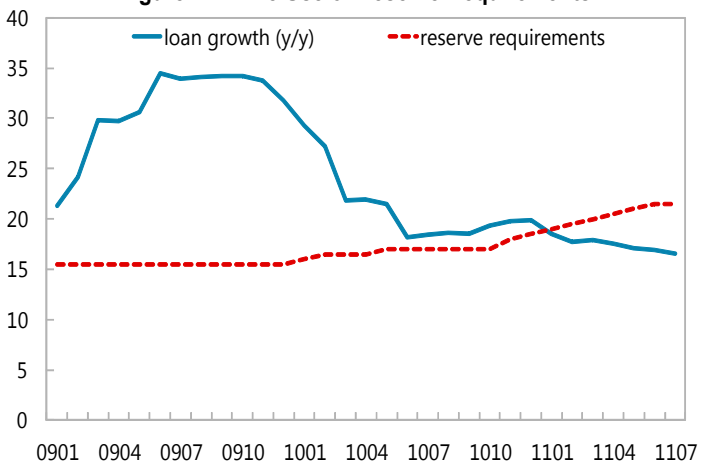
- A capital conservation buffer, a countercyclical buffer, and a systemic capital buffer were introduced, raising the minimum capital adequacy ratio to 11.5 percent from 8 percent for large banks (2010); the provision coverage ratio was raised from 100 percent to 150 percent, and provisions were required to cover the higher of 150 percent of NPLs or 2.5 percent of total loans (2010);

- Taxes were increased on the resale of properties within five years of purchase (January 2010); the exemptions of home purchases from stamp duties and of home sales from income taxes were abolished for all transactions except for cases involving a family's only home (September 2010);

- In cities with high house prices, rapid price increases, and low housing supply, local governments would limit the number of houses each family could buy, and non-local mortgage applicants were required to present proof of local tax payments for at least a year (September 2010); and

- The official benchmark lending rate was raised five times between October 2010 and July 2011 for a total of 125 basis points, and the reserve requirement nine times for a total of 450 basis points (Figure II.14).

Figure II.14 The Use of Reserve Requirements



Source: People's Bank of China.

Outcome

Overall, the measures have been effective in lowering credit growth and housing price inflation. Bank lending growth slowed to 16.9 percent (yoy) in June 2011 from 31.7 percent in December 2009. Home sales rose only 6 percent (yoy) in the first four months of 2011 compared with 30 percent (yoy) in the same period of 2010, and sales declined sharply in major cities. Home prices are leveling off, but a much anticipated house price correction has not materialized.

Colombia

Background

A combination of unsustainable fiscal positions and external shocks tipped the economy into recession in the late-1990s. The peso came under heavy pressure and was allowed to float. Currency depreciation, high unemployment and a rising current account deficit put considerable stress on the financial sector. Mortgage write-offs increased along with rising non-performing loans.

Action

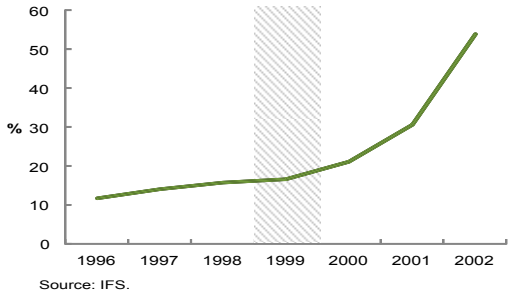
The authorities implemented three prudential measures during the final months of 1999 to limit banks' exposure to households' default risk. The measures were introduced in a package, were broad-based, not adjusted subsequently, and not accompanied by fiscal or monetary policy actions.

- A loan-to-value ratio limiting the loan amount to 70 percent of the value of the collateral,
- A debt-to-income ratio limiting the borrower's monthly debt service payments to 30 percent of disposable income,
- A requirement limiting a bank's global net open position in foreign currency to 20 percent of its capital; and a rule limiting the spot net open position to 50 percent of its capital.

Outcome

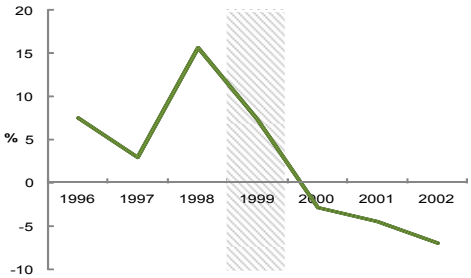
The implementation of the instruments was followed by a reduction in non-performing loans in subsequent years. Banks' foreign liabilities also declined slowly while their foreign assets expanded. Credit to the private sector decreased initially and then recovered over the next few years, but non-performing loans remained subdued for some time (Figures II.15 & 16).

Figure II.15 Non-Resident Assets/Liabilities



Source: IFS.

Figure II.16 NPL Growth



Source: IFS.

Korea

Background

In the years leading up to the financial crisis in 2008, the Korean banking sector experienced a large buildup in short-term external debt. The external borrowing was associated with foreign exchange forward transactions, in which banks (mostly branches of foreign banks) bought dollar forwards from exporters wishing to hedge future export receipts. Banks covered their long dollar positions by borrowing from offshore banks, converting the proceeds into won and investing in local currency securities to offset the maturity and currency mismatch emerging from forward contracts with exporters. As the financial crisis hit, Korean banks were unable to roll over their maturing short-term external liabilities as global liquidity conditions worsened.

Action

The Korean authorities introduced a series of measures in the aftermath of the financial crisis to deal with large and volatile capital flows. These measures have been introduced in packages, fine-tuned with a differentiation between domestic banks and foreign bank branches, adjusted over time at the discretion of policymakers, and include fiscal policy tools.

- Banks were required to raise their long-term foreign currency borrowing from 80 percent to 90 percent of their long-term lending, and hold at least 2 percent of their foreign assets in liquid investments rated A or higher (November 2009);

- The value of banks' foreign exchange forward transactions was limited to 125 percent of exporters' future export revenues (November 2009); the limit was subsequently lowered to 100 percent (June 2010);

- Foreign exchange derivative positions were limited to 50 percent of capital for domestic banks and 250 percent for foreign bank branches (June 2010); the limits were subsequently lowered to 40 percent and 200 percent, respectively (June 2011);

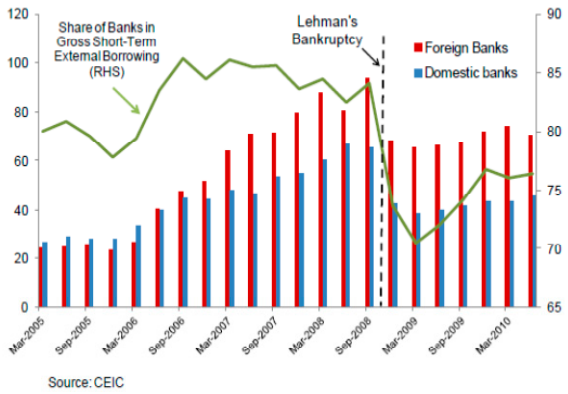
- A withholding tax was reinstated on foreign purchases of domestic bonds, bringing it back in line with purchases by residents (January 2011); and

- A macro-prudential levy is planned on banks' non-deposit foreign currency liabilities (August 2011).

Outcome

The measures appear to have limited growth in banks' external liabilities, with banks' short-term external borrowing remaining some 30 percent below its pre-crisis levels as of 2010 (Figure II.17). However, the measures have not stemmed portfolio inflows into both debt and equity markets. The impact of the withholding tax has also been limited by existing double-taxation agreements.

Figure II.17 Banks' Short-Term External Borrowing (in US$ billion)



Source: CEIC

United States

Background

There were no prior formal interagency capital standards prior to the 1980s, and supervision in this area was governed by state laws or federal policies. During the 1980s, a surge in the number of bank failures, combined with a steady increase in the leverage position of some large banks, prompted the U.S. authorities to re-examine their regulatory and supervisory standards in order to ensure the safety and soundness of banks.

As part of this effort, and under the Federal Deposit Insurance Corporation Improvement Act of 1991, the authorities introduced a leverage ratio that would be applied on a consolidated basis (at the level of the bank holding company) as well as at the level of individual banks. The leverage ratio is a simple capital-to-assets ratio used to monitor a bank's overall risk. It is intended to be used as a supplement to the risk based capital ratio. Its principal objective is to place a constraint on the maximum degree to which a bank can leverage its equity.

Although the U.S. authorities did not have macroprudential objectives in mind when the leverage ratio was introduced, it served the purpose of a macroprudential tool by containing the risk of excessive leverage building up in the financial system.

Action

How the instrument was used

The leverage ratio is expressed as a minimum ratio of Tier 1 capital to total average adjusted assets, where the latter is defined as the quarterly average total assets less deductions that include goodwill, investments deducted from Tier 1 capital, and deferred taxes.

The leverage ratio is set at 3 percent for banks rated "strong" (those that present no supervisory, operational, and managerial weaknesses and are therefore rated highly under the supervisory rating system) and at 4 percent for all other banks.[42] Banks' actual leverage ratios are typically higher than the minimum. A higher ratio may be required for any institution if warranted by its risk profile or circumstances.[43]

The main advantages of the leverage ratio are its simplicity and ease of application. It can be adopted quickly and monitored effectively without leading to high administrative costs. It also serves as a "back-up" against the possible failure of model-dependent, risk-based capital ratios by ensuring a minimum amount of capital. The disadvantage is that, as a balance-sheet measure, it does not take into account off-balance-sheet exposures.

The new standards were implemented by each of the Federal banking agencies[44] according to their supervisory responsibilities. The leverage ratio was introduced with a broad-based application, and was not adjusted over time or accompanied by any other policy.

In 2004, a change in SEC regulation allowed investment banks to raise their leverage from 15:1 (6.7 percent) to 40:1 (2.5 percent).[45]

Outcome

Leverage of U.S. investment banks rose significantly after 2004 while leverage at U.S. commercial banks remained relatively low. The divergence reflected in large part the

[42]US banks are also subject to prompt corrective action rules requiring them to maintain a minimum leverage ratio of 5 percent in order to be considered well capitalized.

[43]In Canada the leverage ratio is set as a multiple of "assets to capital." Under this requirement total adjusted assets should be no greater than 20 times capital. This is more conservative than the U.S. leverage ratio—and the inclusion of off-balance-sheet items strengthens the ratio.

[44]Federal Deposit Insurance Corporation (FDIC), Office of the Comptroller of Currency (OCC), Office of Thrift Supervision (OTS) and Federal Reserve Board (FRB).

[45]U.S. broker-dealers were subject to supervisory rules limiting the debt to net equity ratio to 15:1 until 2004, when investment banks opted for consolidated oversight (requiring that capital and risks be computed on a group-wide basis) that allowed them to increase leverage to 40:1 in some cases.

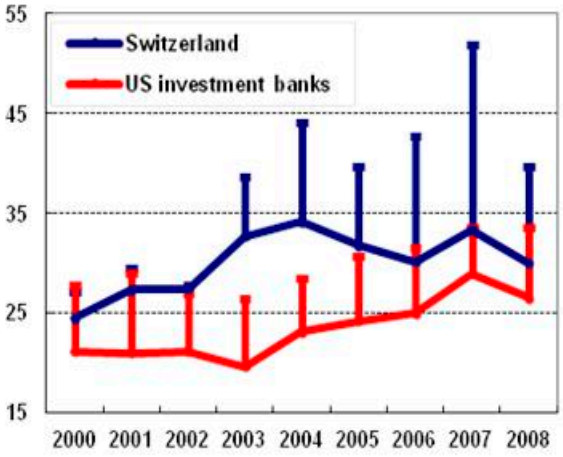
different regulatory provisions on leverage for commercial banks and investment banks. While the leverage ratio was intended to limit risk at individual banks, it appears to have helped prevent the buildup of excessive leverage in the commercial banking sector, even though the degree of effectiveness was limited. This observation is corroborated by the evidence seen in other countries, where leverage caps constrained excessive risk-taking in financial institutions.[46]

This said, the leverage ratio can be circumvented by financial institutions assuming leverage through off-balance sheet exposures. Its coverage should be sufficiently comprehensive, and the ratio adjusted counter-cyclically to adequately reflect rising systemic risk.

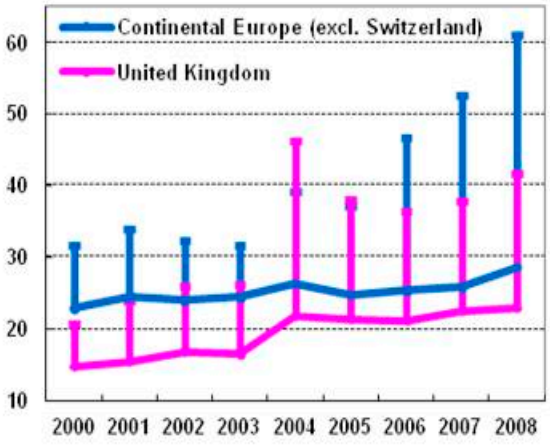
[46]Caps were imposed since the early eighties on banks and other deposit-taking institutions in Canada. Similar limits have been adopted in Switzerland in 2008 and are being considered in the U.K. Armstrong et al. (2009); commenting on the Canadian experience, argue that the ceiling has moderated pro-cyclical pressures, contributing to the resiliency of Canadian banks to the effects of the crisis. Hildebrand (2008) notes that the two major Swiss banks were among the best capitalized in the world in terms of risk-based measures, but among the worst capitalized in terms of simple leverage. He argues that, with the benefit of hindsight, more emphasis should have been put on the risks of excessive leverage.

Figure II.18 Leverage of Large International Banks and Hedge Funds*

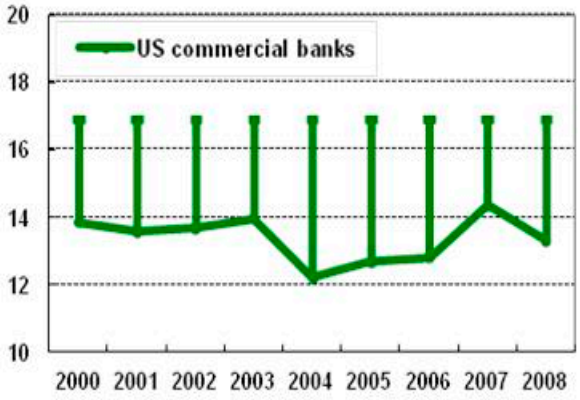
Panel A: Large Swiss Commercial Banks and US Investment Banks /1



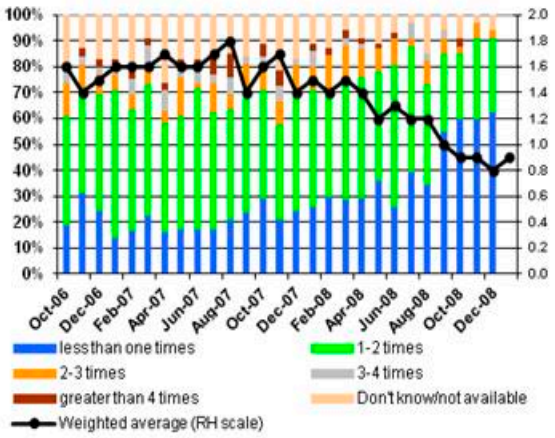
Panel B: Large Continental European and UK Banks /1



Panel C: Large US Commercial Banks /1



Panel D: Hedge Funds /2



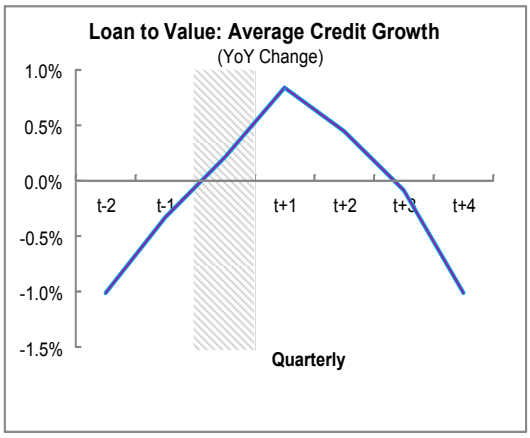
/1 Source: Fitch-Ibca. Leverage is defined as total assets over capital. The data points linked by a continuous line represent the weighted average of the leverage of the sample of banks in turn considered; the top of the vertical segments corresponds to the maximum value of leverage of the sample of banks considered. Continental Europe: 10 major commercial banks; Switzerland: three major banks; U.K.: five major commercial banks; US: five major commercial banks and five major investment banks. Data are as of June 2008.

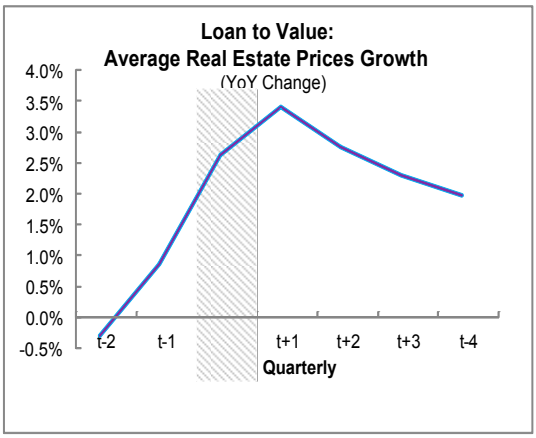
/2 Source: Merrill Lynch, Global Fund Managers Survey. Based on a monthly survey of about 30-40 hedge funds.

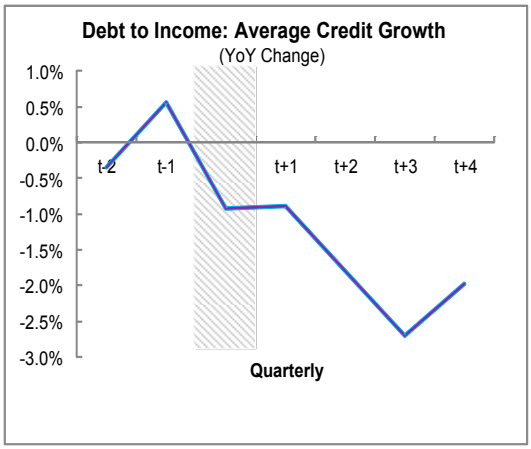
*Figure from Panetta, F. and P. Angelini—coordinators-and U. Albertazzi, F. Columba, W. Cornacchia, A. Di Cesare, A. Pilati, C. Salleo and G. Santini (2009) "Financial Sector Pro-cyclicality: Lessons from the Crisis," Bank of Italy Occasional Papers. No.44.

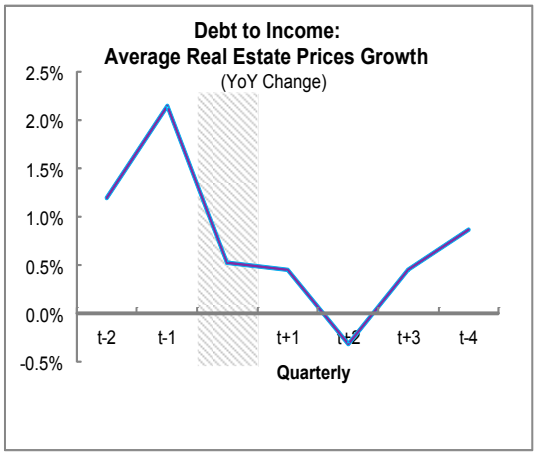
APPENDIX III. THE SIMPLE APPROACH

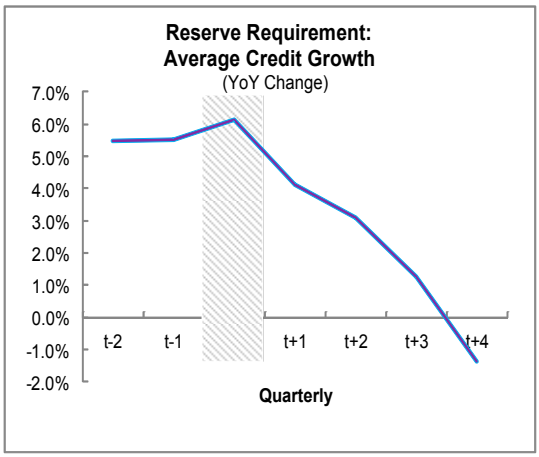
Figure III.1 Change in Risk Variables after the Implementation of Instruments[47]

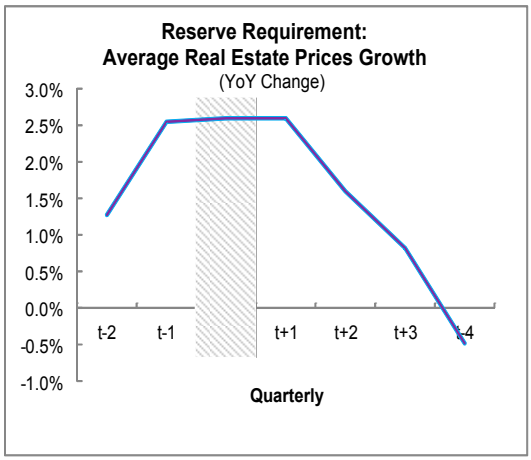






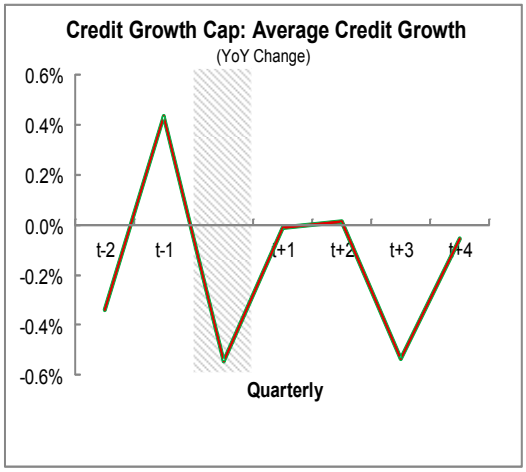


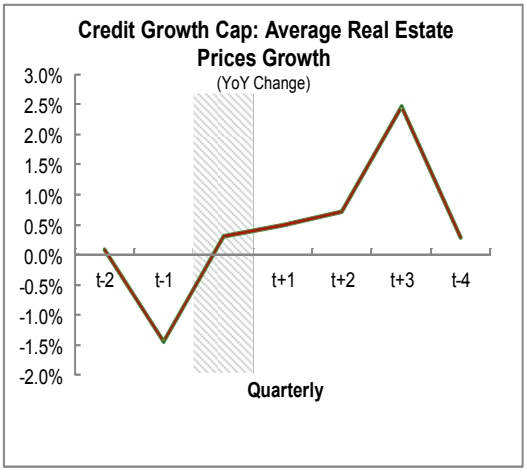


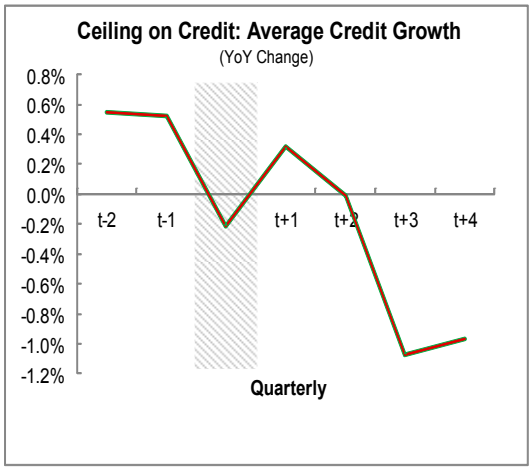


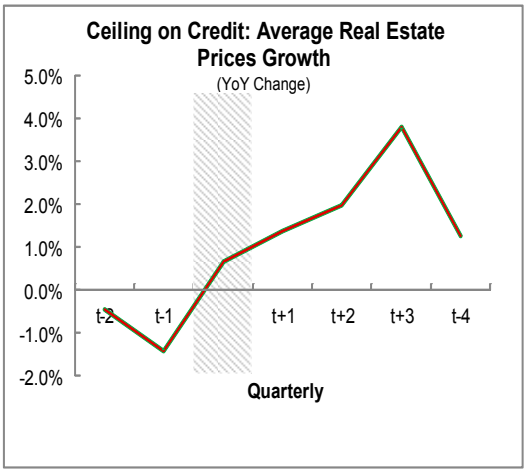
[47]The simple average of changes in the risk variables of all countries in the sample.

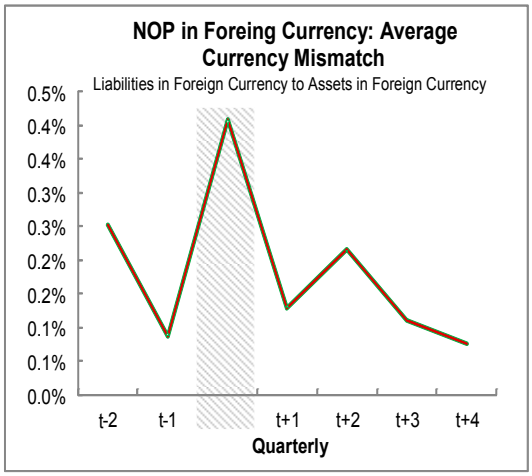
Figure III.1 Change in Risk Variables after the Implementation of Instruments (Continued)











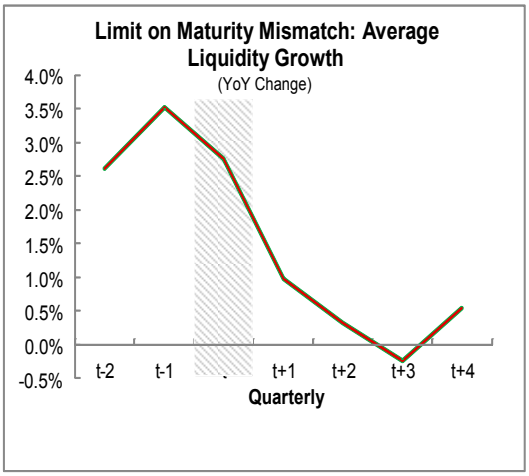
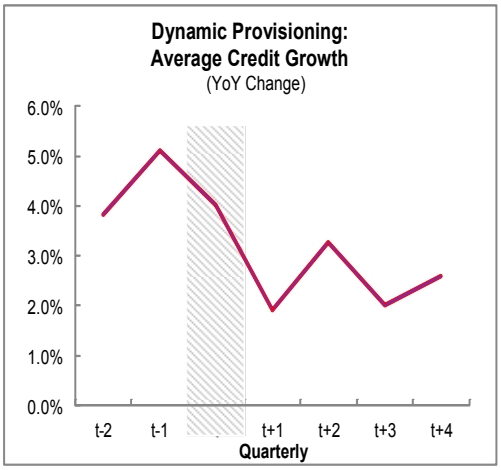
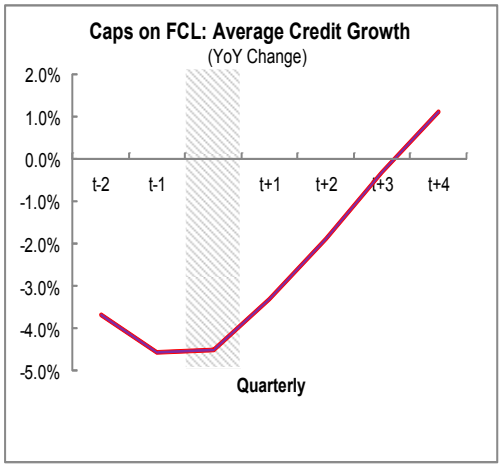
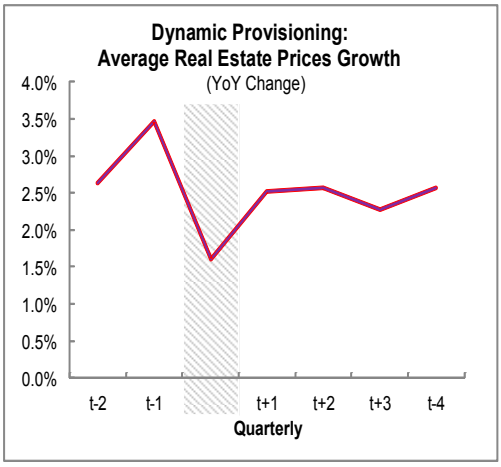
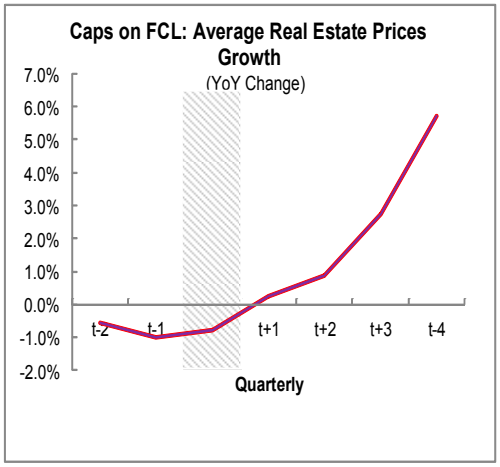


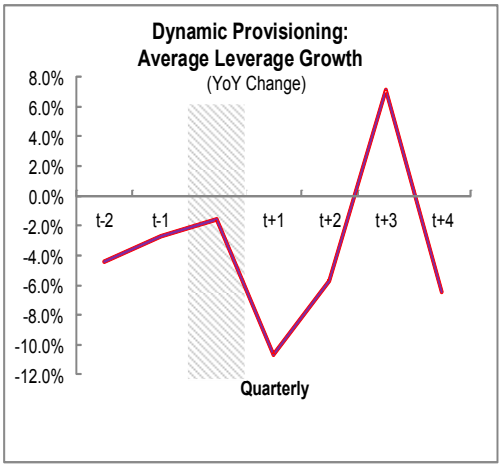
Figure III.1 Change in Risk Variables after the Implementation of Instruments (Continued)

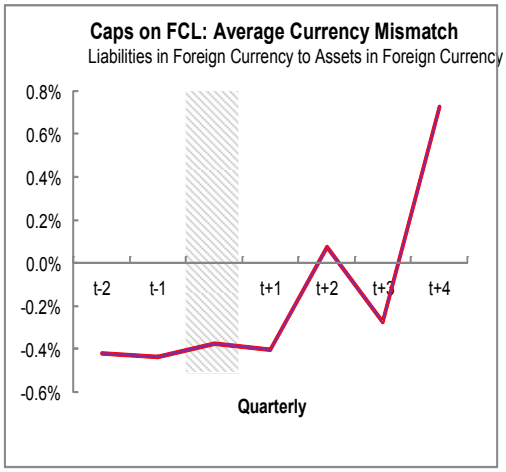












Source: IMF Staff Estimates.

APPENDIX IV. GMM METHODOLOGY FOR PANEL REGRESSION

This appendix describes the methodology used to evaluate the effectiveness of macroprudential instruments and the full results of the panel regression.[48]

The goal of the exercise is to answer two simple questions:

- What is the effect of an instrument in countries where it has been introduced?[49]
- And, what would have been its effect in countries that have not actually used it?

To answer these questions, a dummy variable I is introduced with a value of 1 for countries and periods in which a particular instrument is used, and a value of zero otherwise. The dummy variable captures an average "treatment effect" of the instrument across countries, with countries and periods in which the instrument is not used as counterfactuals.

Specification

A fixed-effect dynamic panel specification is used here since a general theoretical framework for using macroprudential instruments is not yet available. The model is specified as follows:

$$\Delta Y_{i,t} = a_{i,1} + b_1 I_{i,t} + c_1 \Delta Y_{i,t-1} + d_1 X_{i,t} + e_1 I X_{i,t} + \varepsilon_{i,t}^{I} \quad (2)$$

For each country *I*, matrix *I* is the time-series of the value of a particular instrument (for example: the maximum LTV ratio) or a set of dummy variables that take a value of 1 during periods in which the instrument is used. Dummy variables representing a combination of instruments are also considered to capture the effect of multiple instruments used in the same period.

Matrix X represents macroeconomic variables used to control for GDP growth, the interest rate or other policy instruments already in place. *IX* is a matrix that captures the interaction between the macro-control variables and the instrument used. The coefficient of this matrix, e_1, measures the change in the correlation between the risk variable and the control variable after an instrument is adopted. Countries that do not use the instrument are included as a counterfactual, where the value of the instrument is set to zero. Matrix Y represents the change in systemic risk after the introduction of an instrument.

[48]The alternative of estimating individual regressions is not feasible given the lack of a sufficiently long time-series data, which narrows the time span for analysis after the instrument is introduced, and the difficulty in pinning down the exact time frame where the instruments have an impact.

[49]A different approach, also common in the literature, identifies a shock and calculates the impact of the shock with and without the instrument. This approach requires the identification of common shocks to all countries in a panel VAR framework, as well as indentifying assumptions (e.g., a Cholesky decomposition) for these shocks, introducing difficulties beyond the scope of this paper.

For this specification, a total of 40 regressions are needed to show the interaction between four risk variables and 10 instruments. The coefficients of the interaction terms, e_1, and the constant dummies, b_1, are expected to be negative.

Most of the instruments are estimated for their effect on procyclicality, which is defined as the correlation between growth of GDP and growth of the risk variable on the left hand side. Some instruments may be used to reduce common exposure across institutions. These are estimated for their effect on the level of exposure to non-core funding (measured as credit to deposits of the banking sector) and foreign assets to foreign liabilities (a proxy for capital flow reversal risk).

Estimation challenges

Ordinary least squares (OLS) estimation of average treatment effects may be subject to biases. For instance, countries that adopt an instrument may need it the most (the so called endogeneity problem). Thus, if countries that introduce the instrument are those that would have had, for example, excessively high credit growth, the coefficient estimated with ordinary least squares are biased upwards. Instrumental variables are needed to address endogeneity.

The use of a dynamic panel—required to fully capture the time-series component of the effectiveness of the instruments—adds difficulties. The estimation of a dynamic panel by OLS with fixed-effects will be biased, since by construction there is a positive correlation between the lagged dependent variable and the unobserved individual-level effects.

The Generalized Method of Moments (GMM) addresses this problem, and is a standard choice for the estimation of panel data models with endogenous regressors. The GMM system estimator ensures orthogonality between the lagged endogenous variables, in both levels and differences, and the residual term. The lagged variables are used as instruments, appropriately weighted.

Data

The sample covers 49 countries for a period of ten years, from 2000 to 2010. The information required on the use of macroprudential instruments is obtained from a recent IMF survey on country authorities, as well as an internal IMF survey on country desk economists.[50] Four risk variables, as identified by country authorities, are chosen: excessive credit growth risk, excessive leverage risk, liquidity risk and the risk of capital flows reversals.

[50]See IMF (2011b) for details of the survey.

Credit growth is measured as claims on the private sector from both banks and non-banking financial institutions (source: IFS). Leverage is measured as assets over equity, obtained from the IMF FSIs. Liquidity risk is proxied by non-core funding, measured as bank credit to deposits. Capital flow reversals risk is proxied by the ratio of foreign assets to foreign liabilities, for both bank and non-bank financial institutions. The source for these variables is IFS.

GDP growth and the prime lending rate are control variables for fiscal and monetary policies, respectively, both obtained from the IFS. The lending rate is used to capture the change in the price of credit, either due to changes in demand or supply in response to, for example, changes in monetary policy.

Other variables such as the policy rate or fiscal imbalances are also tested as control variables but not used. The policy rate has the disadvantage of being identical for all euro-area countries, reducing the variability across countries. In addition, the pass-through mechanism in some emerging economies is rather weak, making the interpretation difficult. Similar results are obtained when the policy rate is used instead of the lending rate and are not reported. The high correlation of fiscal imbalances with GDP (and interest rates) would result in biased estimates. In addition, the theory on fiscal policy and financial frictions suggests that fiscal policy shocks are transmitted through GDP (in the form of higher demand) and the lending rates (through risk premia).[51] Since the right hand variables already capture these effects, fiscal imbalances are not used.

All variables are tested and found to be covariance stationary. Interaction terms are also tested for significance, with no further significant results. Variables in the form of dummies are used to control for the exchange rate regime, the degree of financial development and the use of other macroprudential policies.[52] Possible interactions between these dummies and the instruments are also tested, without significant results.

Results

The regression results are summarized as follows. The regressions passed the Arellano-Bond for autocorrelation. However, due to the rather small number of countries in the sample, the large number of instruments used by Arellano-Bover causes the Sargan test to be weak. To further check the robustness of the results under GMM, the equation is estimated under

[51]See, for instance, Fernández-Villaverde (2010) "Fiscal Policy in a Model with Financial Frictions."

[52]Three dummy variables are used to identify exchange rate regimes, differentiating across fully flexible (no dummy), crawling pegs, managed floats and pegs or currency boards. The degree of financial development is determined by the ratio of financial system assets to GDP, and a dummy with a value of 1 is assigned to countries above a threshold. The dummy for other macroprudential policy assigns a value of one when other instruments were actively used at the same time.

restrictions on the lags used as instruments, as well as under ordinary least squares with fixed effects. The results are consistent, with significant coefficients of very similar magnitudes to the ones shown in the main text and the appendix.

The most significant coefficients are found on the interaction term between GDP growth and five instruments: caps on LTV, caps on DTI, ceilings on credit growth, reserve requirements and dynamic provisioning. As expected, the effect of an instrument differs in different phases of the cycle. Indeed, Table IV.1 provides the results obtained when no differentiation of the cycle is made, and the instrument is included on the right hand side as a dummy affecting the constant term and hence the level of the risk variable. Most coefficients have non-significant results.

However, when the instruments are analyzed during economic expansions alone (Table IV.2), the coefficients on the dummies become negative and even significant in some cases. This confirms the need to take account of different phases of the economic cycle, and in turn the rationale for focusing on procyclicality. Tables IV.3 and IV.4 provide the results under this framework.

Table IV. 1 Effectiveness of Macroprudential Instruments in Reducing Credit and Leverage Growth

Indep. Variables	Dependent Variable [1]: Quarterly Credit Growth Rate $_t$							
Quarterly Credit Growth Rate $_{t-1}$	0.0832	0.0796	0.0767	0.0705	0.0678	0.0794	0.0800	0.0772
	(16.24)***	(16.49)***	(15.89)***	(9.96)***	(2.40)**	(18.60)***	(21.90)***	(17.22)***
GDP Growth $_t$	0.0292	0.0478	0.0537	0.0556	0.0416	0.0560	0.0506	0.0461
	(2.37)**	(6.60)***	(9.00)***	(6.14)***	(2.46)**	(8.43)***	(6.31)***	(5.53)***
Interest Rate $_t$	-0.0712	-0.0745	-0.0810	-0.0791	-0.0546	-0.0662	-0.0767	-0.0789
	(-14.73)***	(-18.46)***	(-16.55)***	(-9.90)***	(-6.13)***	(-15.34)***	(-16.54)***	(-16.75)***
Constant Term								
Caps on Loan-to-Value [3]	0.0823							
	(2.65)***							
Caps on Debt-to-Income [3]		0.0286						
		(1.29)						
Limits on Credit Growth [3]			0.0290					
			(1.01)					
Reserve Requirements [3]				-0.0013				
				(-0.06)				
Dynamic Provisioning [3]					-0.0062			
					(-0.20)			
Limits on Forex Lending [3]						0.0280		
						(1.27)		
Countercyclical Cap. Req. [3]							0.0302	
							(1.24)	
Restrictions on Profit Dist. [3]								-0.0260
								(-3.96)***
Indep. Variables	Dependent Variable [1]: Quarterly Leverage Growth Rate $_t$							
Quarterly Leverage Growth Rate $_{t-1}$	-0.0133	-0.0097	-0.0121	-0.0190	-0.0442	-0.0237	-0.0138	-0.0073
	(-2.77)**	(-1.23)	(-5.21)***	(-16.32)***	(-4.31)***	(-3.00)***	(-8.50)**	(-0.74)
GDP Growth $_t$	0.0325	0.0331	0.0318	0.0293	0.0327	0.0307	0.0321	0.0339
	(7.01)***	(9.03)***	(9.47)***	(9.67)***	(13.94)***	(7.87)	(16.19)***	(9.78)***
Interest Rate $_t$	0.1246	0.1421	0.1067	0.1069	0.1792	0.1953	0.1603	0.2440
	(2.45)**	(4.77)***	(1.31)	(3.23)***	(4.17)***	(4.52)***	(3.99)	(2.96)***
Constant Term								
Caps on Loan-to-Value [3]	-0.0153							
	(-1.54)							
Caps on Debt-to-Income [3]		0.0032						
		(0.43)						
Limits on Credit Growth [3]			0.0076					
			(1.13)					
Reserve Requirements [3]				-0.0076				
				(-1.43)***				
Dynamic Provisioning [3]					0.0128			
					(1.09)			
Limits on Forex Lending [3]						-0.0340		
						(-7.03)***		
Countercyclical Cap. Req. [3]							0.0059	
							(0.47)	
Restrictions on Profit Dist. [3]								-0.0156
								(-3.37)***

***, **, * indicate statistical significance at 1%, 5%, and 10% (two-tail) test levels, respectively.

1/ The dependent variable is credit growth (top) or leverage growth (bottom), the log change in the real level of credit or leverage. Credit is measured as claims on private sector from both bank and non-bank financial institutions (source: IFS) and leverage is measured as assets over capital (source: IMF FSIs). The interest rate is the nominal long-term interest rate on prime lending, from the IMF's International Financial Statistics. The estimation period is 2000–2010. The sample is composed of 48 countries. The regression includes dummy variables to correct for different degrees of flexibility in the exchange rate regime, individual (country) effects, a time trend (year effect) and a dummy variable for the use of other MPP instruments. Instrumental variables for the policy instrument and the GMM Arellano-Bond estimator are used to address selection bias and endogeneity.

2/ Non-Significant Results when Interest Rate included.

3/ The coefficient corresponds to a dummy for the respective macroprudential instrument.

Source: IMF's staff estimates.

Table IV.2 Effectiveness of Macroprudential Instruments in Reducing Credit and Leverage Growth during Booms

Indep. Variables	Dependent Variable[1]: Quarterly Credit Growth Rate$_t$						
Quarterly Credit Growth Rate$_{t-1}$	0.0883	0.0828	0.0807	0.0801	0.0217	0.0775	0.0803
	(9.12)***	(18.12)***	(14.02)***	(16.77)***	(0.79)	(11.15)***	(3.91)***
GDP Growth$_t$	0.0534	0.0388	0.0598	0.0469	0.0510	0.0431	0.0459
	(3.50)***	(3.56)***	(5.62)***	(5.92)***	(6.27)***	(4.92)***	(3.44)***
Interest Rate$_t$	-0.0746	-0.0780	-0.0787	-0.0830	-0.0645	-0.0781	-0.0781
	(-14.45)***	(-18.87)***	(-15.12)***	(-14.89)***	(-8.34)***	(-18.98)***	(-17.18)***
Caps on Loan-to-Value[3]	-0.0081						
	(-0.62)						
Caps on Debt-to-Income[3]		0.0180					
		(0.94)					
Limits on Credit Growth[3]			-0.0691				
			(-1.34)				
Reserve Requirements[3]				-0.0076			
				(-2.23)**			
Dynamic Provisioning[3]					-0.1466		
					(-22.57)***		
Limits on Forex Lending[3]						0.0157	
						(1.02)	
Countercyclical Cap. Req. [3]							-0.1005
							(-0.23)
Restrictions on Profit Dist.[3]							

Indep. Variables	Dependent Variable[1]: Quarterly Leverage Growth Rate$_t$						
Quarterly Leverage Growth Rate$_{t-1}$	-0.0213	-0.0264	-0.0243	-0.0064		-0.0254	
	(-3.06)***	(-3.31)***	(-3.37)***	(-0.52)		(-3.39)***	
GDP Growth$_t$	0.0330	0.0331	0.0301	0.0277		0.0311	
	(7.18)***	(3.41)***	(4.85)***	(7.28)***		(4.58)***	
Interest Rate$_t$	0.1633	0.1273	0.1215	0.2089		0.1217	
	(3.09)***	(2.68)***	(2.29)**	(3.01)***		(2.39)**	
Caps on Loan-to-Value[3]	-0.0032						
	(-0.40)						
Caps on Debt-to-Income[3]		-0.1570					
		(-0.30)					
Limits on Credit Growth[3]			0.0011				
			(0.03)				
Reserve Requirements[3]				0.0210			
				(1.98)*			
Dynamic Provisioning[3]					N/A[2]		
Limits on Forex Lending[3]						-0.0068	
						(-0.13)	
Countercyclical Cap. Req. [3]							N/A[2]
Restrictions on Profit Dist.[3]							

***, **, * indicate statistical significance at 1%, 5%, and 10% (two-tail) test levels, respectively.

1/ The dependent variable is credit growth (top) or leverage growth (bottom), the log change in the real level of credit or leverage. Credit is measured as claims on private sector from both bank and non-bank financial institutions (source: IFS) and leverage is measured as assets over capital (source: IMF FSIs). The interest rate is the nominal long-term interest rate on prime lending, from the IMF's International Financial Statistics. The estimation period is 2000–2010. The sample is composed of 48 countries. The regression includes dummy variables to correct for different degrees of flexibility in the exchange rate regime, individual (country) effects, a time trend (year effect) and a dummy variable for the use of other MPP instruments. Instrumental variables for the policy instrument and the GMM Arellano-Bond estimator are used to address selection bias and endogeneity.

2/ Not enough observations during booms

3/ The coefficient corresponds to a dummy for the respective macroprudential instrument.

Source: IMF staff estimates.

Table IV.3. Effectiveness of Macroprudential Instruments in Reducing Credit Growth (both Level and Pro-cyclicality)

Indep. Variables	Dependent Variable[1]: Quarterly Credit Growth Rate$_t$							
Quarterly Credit Growth Rate$_{t-1}$	0.0991	0.0888	0.0858	0.0764	0.0483	0.0591	0.0869	0.0810
	(4.76)***	(14.48)***	(13.69)***	(13.44)***	(1.78)*	(3.70)***	(12.20)***	(15.28)***
GDP Growth$_t$	0.0745	0.0710	0.0643	0.0707	0.0614	0.0397	0.0807	0.0273
	(6.48)***	(6.30)***	(5.00)***	(6.70)***	(4.58)***	(2.55)**	(5.88)***	(1.86)*
Interest Rate$_t$	-0.0668	-0.0771	-0.0729	-0.0774	-0.0535	-0.0615	-0.0813	-0.0787
	(-10.39)***	(-6.14)***	(-9.59)***	(-11.61)***	(-7.29)***	(-9.44)***	(-14.11)***	(-14.50)***
Caps on Loan-to-Value[3]	0.0755							
	(1.92)**							
Caps on Debt-to-Income[3]		0.0333						
		(0.39)						
Limits on Credit Growth[3]			0.0172					
			(0.44)					
Reserve Requirements[3]				-0.0157				
				(-1.93)*				
Dynamic Provisioning[3]					-0.0365			
					(-2.81)**			
Limits on Forex Lending[3]						0.0822		
						(2.81)		
Countercyclical Cap. Req. [3]							0.1424	
							(3.17)	
Restrictions on Profit Dist.[3]								-0.0284
								(-1.03)
Caps on Loan-to-Value[2] × GDP Growth$_t$	-0.0615							
	(-2.59)**							
Caps on Debt-to-Income[2] × GDP Growth$_t$		-0.0637						
		(-2.44)**						
Limits on Credit Growth[2] × GDP Growth$_t$			-0.0703					
			(-1.05)					
Reserve Requirements[2] × GDP Growth$_t$				-0.0448				
				(-2.18)***				
Dynamic Provisioning[2] × GDP Growth$_t$					-0.1463			
					(-0.90)			
Limits on Forex Lending[2] × GDP Growth$_t$						0.0295		
						(0.53)		
Countercyclical Cap. Req.[2] × GDP Growth$_t$							-0.1563	
							(-2.57)***	
Restrictions on Profit Dist.[2] × GDP Growth$_t$								0.0213
								(0.41)

***, **, * indicate statistical significance at 1%, 5%, and 10% (two-tail) test levels, respectively.

1/ The dependent variable is credit growth (top) or leverage growth (bottom), the log change in the real level of credit or leverage. Credit is measured as claims on private sector from both bank and non-bank financial institutions (source: IFS) and leverage is measured as assets over capital (source: IMF FSIs). The interest rate is the nominal long-term interest rate on prime lending, from the IMF's International Financial Statistics. The estimation period is 2000–2010. The sample is composed of 48 countries. The regression includes dummy variables to correct for different degrees of flexibility in the exchange rate regime, individual (country) effects, a time trend (year effect) and a dummy variable for the use of other MPP instruments. Instrumental variables for the policy instrument and the GMM Arellano-Bond estimator are used to address selection bias and endogeneity.

2/ The coefficient corresponds to the interaction term between GDP growth and a dummy for the respective macroprudential instrument.

3/ The coefficient corresponds to a dummy for the respective macroprudential instrument.

Source: IMF staff estimates.

Table IV.4. Effectiveness of Macroprudential Instruments in Reducing Leverage Growth (both Level and Pro-cyclicality)

Indep. Variables	Dependent Variable[1]: Quarterly Leverage Growth Rate$_t$							
Quarterly Leverage Growth Rate$_{t-1}$	-0.0131	-0.0086	-0.0084	-0.0169	-0.0166	-0.0237	-0.0095	-0.0155
	(-1.31)	(-0.63)	(-1.16)***	(-2.95)***	(-0.58)	(-2.99)***	(-0.83)	(-3.74)***
GDP Growth$_t$	0.0288	0.0449	0.0432	0.0834	0.0324	0.0297	0.0432	0.0248
	(3.89)***	(5.42)***	(5.17)***	(5.26)***	(4.30)***	(6.69)***	(11.18)***	(7.49)***
Interest Rate$_t$	0.1278	0.1130	0.1612	0.1363	0.0963	0.2002	0.1279	0.1672
	(2.45)**	(1.83)*	(2.17)**	(2.09)**	(1.45)	(3.73)***	(4.73)***	(3.95)***
Caps on Loan-to-Value[3]	-0.0140							
	(-1.61)							
Caps on Debt-to-Income[3]		0.0009						
		(0.09)						
Limits on Credit Growth[3]			0.0117					
			(0.70)					
Reserve Requirements[3]				0.0030				
				(0.63)				
Dynamic Provisioning[3]					0.0010			
					(0.15)			
Limits on Forex Lending[3]						-0.0334		
						(-5.48)***		
Countercyclical Cap. Req. [3]							0.0132	
							(0.71)	
Restrictions on Profit Dist.[3]								-0.0127
								(-2.39)**
Caps on Loan-to-Value[2] × GDP Growth$_t$	0.0036							
	(0.16)							
Caps on Debt-to-Income[2] × GDP Growth$_t$		-0.0526						
		(-2.69)***						
Limits on Credit Growth[2] × GDP Growth$_t$			-0.0417					
			(-1.56)					
Reserve Requirements[2] × GDP Growth$_t$				-0.0937				
				(-4.39)***				
Dynamic Provisioning[2] × GDP Growth$_t$					-0.2765			
					(-3.75)***			
Limits on Forex Lending[2] × GDP Growth$_t$						0.0058		
						(0.39)		
Countercyclical Cap. Req.[2] × GDP Growth$_t$							-0.1076	
							(-1.74)*	
Restrictions on Profit Dist.[2] × GDP Growth$_t$								0.0823
								(2.83)***

***, **, * indicate statistical significance at 1%, 5%, and 10% (two-tail) test levels, respectively.

1/ The dependent variable is leverage growth, the log change in the level of leverage. Leverage is measured as assets over capital (source: IMF FSIs). The interest rate is the nominal long-term interest rate on prime lending, from the IMF's International Financial Statistics. The estimation period is 2000–2010. The sample is composed of 48 countries. The regression includes dummy variables to correct for different degrees of flexibility in the exchange rate regime, individual (country) effects, a time trend (year effect) and a dummy variable for the use of other MPP instruments. Instrumental variables for the policy instrument and the GMM Arellano-Bond estimator are used to address selection bias and endogeneity.

2/ The coefficient corresponds to the interaction term between GDP growth and a dummy for the respective macroprudential instrument.

3/ The coefficient corresponds to a dummy for the respective macroprudential instrument.

Source: IMF staff estimates.

APPENDIX V. MANAGING RISK WITH SELECT MACROPRUDENTIAL INSTRUMENTS

Loan-to-Value Ratios

Limits on Loan-to-Value (LTV) ratios have increasingly been applied to reduce systemic risk arising from boom-bust episodes, notably in real estate markets. LTV limits are particularly popular in Asian and European countries, where they have been introduced in two stages: (i) during the boom phase of the mid-2000s (especially in Asia) and (ii) in the wake of the global financial crisis (especially in Europe).

Design and calibration. By limiting the loan amount to well below the current value of the property, LTV limits can help rein in house price increases by putting the brakes on household leverage, commonly known as reducing the financial accelerator effect.[53] In some cases, the instrument is also designed to meet social objectives, such as ensuring that lower-income households have access to financing. Implementation of the tool in the early part of the credit cycle is important to ensure that it has a preemptive effect and provides a minimum buffer.

Single vs. multiple. Most countries use LTV limits by combining them with other macroprudential tools. LTV limits are usually used in conjunction with either

DTI/debt service-to-income limits or with reserve requirements. Countries using

LTV limits as a single instrument adjust the maximum rates on a regular basis (Canada, Hong Kong, Singapore, and Thailand). Others have kept the maximum rates unchanged, because they have only recently been set (Norway and Sweden).

Targeted vs. broad-based. About half of the countries differentiate LTV limits on mortgage loans based on the purpose or value of the property. They do so to limit financing for commercial investors (Canada, Turkey, and Singapore) and for luxury or speculative investments (Hong Kong, Malaysia, and Singapore). Some Asian countries have adopted more granular features: Hong Kong relates the maximum LTV negatively to the value of residential properties, while rates in Korea are based on whether or not a property is located in a speculative zone. A number of countries have carve-outs for social housing projects, or require mortgage insurance for high-LTV loans, thereby ensuring that lower-income households or first-time homebuyers have access to financing (Canada, Chile, Hong Kong, and the United States). A few European countries (Poland, Hungary, and Serbia) differentiate loan limits according to the currency in which the loan is denominated such as FX mortgage loans.

[53] Almeida, H., M. Campello and C. Liu (2006) "The Financial Accelerator: Evidence from International Housing Markets," Review of Finance 10: 1-32.

Fixed vs. time-varying. Some countries have kept LTV rates constant to provide a minimum buffer against an unsustainable increase in house prices (Colombia, Lebanon, Malaysia, and Sweden). In other countries, LTV limits are adjusted in line with the cyclical position, with a tightening occurring during housing booms and a relaxation during downturns (China, Hong Kong, and Korea). In some cases, the adjustments are made in a reactive, and not necessarily countercyclical, manner.

Rules vs. discretion. All countries use discretion when adjusting LTV limits. While there is no direct evidence of rules-based applications, a number of countries tighten the limits in a measured way, ostensibly in response to house price developments (Canada, Hong Kong, Korea, and Singapore).

Effectiveness. Statistical evidence shows LTV limits to have a clear effect on credit growth and property prices. However, as this effect may wear off in dynamic markets, limits need to be tightened successively (e.g., Hong Kong[54] and Singapore). In some countries, such as Korea, LTV rates are targeted to a particular market segment, but the statistical evidence on its effectiveness is inconclusive.

Pros	Cons and side effects
◦ Allows targeting of specific risks in housing markets.	◦ Requires debtor-level data on property values.
◦ Likely to have an immediate effect.	◦ May have to be recalibrated if market dynamics subsequently render limits non-binding.

Dynamic Loan-Loss Provisioning

Spain became a pioneer in this field in 2000, when it introduced dynamic loan-loss provisioning (DP); subsequently, rules-based DP systems have been applied in Latin America. There are four main DP systems. The first system requires banks to continuously make provisions against a benchmark rate, where the benchmark rate is the average flow of provisions through the credit cycle (Spain and Uruguay). The second system does not require continuous DP, but it rather includes an activation mechanism that triggers the accumulation of dynamic provisions during an economic upswing and the drawdown of these provisions during a downturn (Colombia and Peru). A third form of DP, recently introduced in Chile and Mexico, sets provisioning rates directly according to debtors' classification or risk profile in terms of expected loss (Chilean banks are allowed to build additional countercyclical provisions to cover "unexpected losses"). Finally, some other countries have introduced countercyclical provisioning with discretionary rate adjustments (Bulgaria, Croatia, India, Mongolia, and Russia).

[54]Wong E., T. Fong, K. Li and H. Choi (2011) "Loan-to-Value Ratio as a Macro-Prudential Tool – Hong Kong's Experience and Cross-Country Evidence", Hong Kong Monetary Authority Working Paper 01/2011.

Design and calibration. DP is aimed at distributing loan losses more evenly over the credit cycle. This is based on the notion that provisions should account for expected loss rather than incurred loss. By requiring banks to build reserve buffers during an upswing, DP counterbalances the tendency of specific loan reserves to be low when credit quality is high. As a result, the marginal cost of loan-loss provisioning is smoothed significantly over the credit cycle. DP is best introduced at the beginning of the credit cycle to build a sufficiently large reserve cushion, but policymakers need to be wary of changing circumstances that may require a recalibration of rates.

Single vs. multiple. The instrument was introduced as part of a wider set of macroprudential measures in Colombia, Mexico, Peru and Uruguay. By contrast, Spain has used it as a stand-alone policy tool. Clearly, the application of DP in conjunction with other macroprudential tools may lead to lower-than-expected loan losses and thus produce a large buffer of reserves.

Targeted vs. broad-based. All DP systems apply a spectrum of fixed rates differentiated by individual loan categories (e.g., commercial vs. consumer loans). The first two types of DP systems classes apply such differentiated rates to all banks alike, while Chile and Mexico calibrate rates directly to debtors' risk profiles.

Fixed vs. time-varying. With the exception of Spain in 2004, the provisioning rates of DP systems have not been changed in any of the countries.

Rules vs. discretion. The countries using DP in its strict form apply it as a rules-based system. By contrast a few countries in other regions have adjusted provisioning rates countercyclically with discretion (of these countries, India has adjusted rates gradually and also differentiated by type of loan). However, these discretionary approaches are less likely to bring about an adequate buffer because they are not calibrated to cover expected loss and appear to be applied in a reactive manner.

Effectiveness. The statistical evidence shows rules-based DP system to be effective as opposed to discretion-based systems. Still, DP is not designed to cover large unexpected loan losses (for which there is bank capital) nor rein in rapid credit growth. For example, in Spain[55] the buffer of dynamic provisions was large enough to offset about half of the loan losses that occurred during 2008–09 but not all delinquencies, since eventual loan losses turned out to exceed expected losses. By contrast, the reserves coverage in Uruguay has ballooned as the expected loan delinquencies on which the model was calibrated have not materialized. In other countries, the history of this tool is too short to come to conclusive results.

[55]See Saurina (2009), "Loan Loss Provisions: A Working Prudential Tool", p. 13.

Pros	Cons and side effects
○ Countercyclical reserves buffer covers rising loan losses and helps sustain credit in downturn.	○ Requires data on provisioning flows or expected loss.
○ Smoothes provisioning costs over the credit cycle.	○ May lead to overprovisioning if calibration is incorrect and incurred loss turns out to be much lower than expected loss.

Reserve Requirements

Many emerging market countries use reserve requirements (RR) as a macroprudential tool to (i) protect against liquidity risks and (ii) address risks associated with excess credit growth, fueled in some cases by capital inflows. As a monetary policy tool, RR are often reduced to minimum prudential levels, are imposed uniformly, and are often replaced by more indirect monetary policy tools. By contrast, RR as a macroprudential tool are usually targeted and can be raised to very high rates.[56]

Design and calibration. As a macroprudential tool, the objective of the RR should be clearly defined. If slowing down credit growth is the main objective, and if banks form a large part of a country's financial system, then RR should be widely applied and based on a relatively simple design—with rates set well below prohibitive levels—so as to minimize distortions and limit the administrative burden of ensuring compliance. If the objective is more limited—for example, encouraging more stable funding—then more targeted RR can be imposed on short-term foreign borrowing by banks (e.g., Peru).

Targeted vs. broad-based. Compared to the traditional formulation of a single rate applied to the full base, RR for macroprudential purposes usually are more targeted. For example, different rates can be imposed according to maturity, currency, and base (Table V.1).

Fixed vs. time-varying. RR for macroprudential purposes are used in a countercyclical way: they are raised during the boom and lowered, or lifted altogether, during the downturn. During the boom, some rates can be imposed at extraordinarily high levels, particularly in the case of marginal RR.[57]

Rules vs. discretion. RR are adjusted in a discretionary manner, based on a trial-and-error approach—both the rate and base can be adjusted depending on circumstances.

[56]For a recent survey of country experiences with reserve requirements more generally, see Gray (2011).

[57]Average RR apply to the particular base evenly. Marginal RR apply to new flows on top of a base: for example, in Bulgaria, prior to EU accession, banks that exceeded the existing 6 percent per quarter credit growth limit by 2 percent per quarter (relative to a specific base period) had to set aside reserves of 400 percent.

Effectiveness. Statistical evidence suggests that RR are effective in reducing the procyclicality of credit growth. It cannot be robustly confirmed through econometric analysis whether these effects last beyond a certain time horizon. Country-specific evidence suggests the need for RR to be recalibrated periodically to preserve their effectiveness.

Pros	Cons and side effects
○ Builds up a useful liquidity buffer.	○ Easy to circumvent; effectiveness wears off.
○ Immediately effective.	○ Possible migration of risk.
○ Can work well with other macroprudential tools.	○ Burdensome to enforce if too complex.
○ Easy to apply and adjust.	○ Restricts credit to small/medium enterprises.

Measures Targeted at Foreign Currency Lending

Many countries in which banks are heavily engaged in foreign currency-denominated (FX) lending have justifiable concerns about currency-induced credit risk. Such risk arises when borrowers who do not earn foreign exchange are unable to repay their FX loans in the event of sharp and sustained exchange rate depreciation. This mismatch triggered significant systemic effects during past crises. Several countries use macroprudential measures to mitigate this risk. These include (i) measures to limit exposures, such as direct caps on exposures, debt-to-income caps by currency, more targeted restrictions on FX lending, and in extreme cases, outright bans) and (ii) measures to build buffers, such as LTV set by loan currency, higher risk weights or capital requirements, and higher provisions against FX lending.

Design and calibration. These measures designed to restrain growth in FX lending to un-hedged borrowers, and building buffers against a downturn. The degree of targeting may depend on data availability, and the understanding of the potential impact of a depreciation on different types of borrowers. Despite little or no detailed data, such measures are adopted in many countries. Ideally, the measures should be adopted *before* the build-up of significant exposures. During the recent crisis, several countries adopted measures to curb new exposures, but they still have a large outstanding stock of FX loans that remains to be addressed (e.g., Hungary and Ukraine).

Single vs. multiple instruments. Countries take a variety of approaches when implementing FX lending measures:

- Many countries adopt FX lending measures in conjunction with RR, to address more than one objective. RR are used to address liquidity risk, while FX lending measures either to limit exposures or build buffers.

- Some countries use a single measure to limit exposure. For example, some countries ban FX lending altogether, either on a temporary (Austria between 2008 and 2010) or a permanent basis (Brazil since the mid 2000s).

- Some countries use multiple measures to build buffers. These include measures affecting capital, such as higher risk weights on FX loans (up to 150 percent in the case of Croatia), limits on FX exposures relative to capital or capital add-ons for such lending (Peru and Romania), sometimes combined with higher provisioning requirements (Peru, Romania, and Uruguay)

Targeted vs. broad-based. Countries use varying degrees of targeting, including measures that apply to all FX loans or total FX exposures (Lebanon and Peru), those targeted at unhedged borrowers (Argentina, Croatia, Serbia, and Uruguay), and those that are more specifically targeted at FX mortgage lending (e.g., Poland). Some countries impose outright bans on specific FX lending: Argentina, Hungary, Turkey and Ukraine have banned specific kinds of FX or FX-indexed lending (e.g., on household mortgages, or household lending in general, to unhedged borrowers).[58]

Fixed vs. time-varying. The measures on FX lending are applied with fixed parameters (such as higher-risk weights on FX loans). While most countries tighten limits on FX lending during the upswing, they do not usually relax them during the downturn.[59]

Rules vs. discretion. Measures to address currency-induced credit risk usually have been applied through fixed formulas. These were sometimes adjusted after a certain period in a discretionary way, taking into account the effects of such measures on banks' behavior.

Effectiveness. Statistical evidence suggests mixed evidence that measures on FX lending restrain credit growth tested by itself, such measures are effective, but this effect weakens when other measures are included. One measure that is effective is net open position limits on FX exposures, which reduce the external indebtedness of the financial system.

Pros	Cons and side effects
○ Generally formula-based, which provides greater predictability in the regulatory environment.	○ May observe migration of risk to non banks or to other areas (or to FX indexed loans).
○ Can help to build buffers.	○ May contribute to disintermediation or introduce distortions.
○ May encourage more lending in local currency.	
○ Can be implemented relatively easily.	

[58]Note that in Hungary, the actual measure was a ban on entering such properties into the property registry, which in effect made them useless as collateral.

[59]Croatia in 2010 reduced risk weights on FX lending to unhedged borrowers to 100 percent in the context of Basel II adoption, but to compensate increased the capital adequacy requirement to 12 percent from 10 percent.

Table V.1 Summary of Use of Reserve Requirements as a Macroprudential Tool in Selected Countries

	Argentina	Bulgaria	China	Colombia	Croatia	Indonesia	Lebanon	Romania	Serbia	Peru	Turkey	Uruguay
Conditions set												
By bank size			x			x						
By currency		x	x	x	x	x	x	x	x	x	x	x
By maturity	x			x	x			x	x	x	x	x
By source of funding												
Deposits		x	x		x		x	x	x	x	x	x
FX indexed					x				x			
By type	Average RR on non-resident portfolio investment			Average and marginal RR on checking/sight, saving, and CDs	Special RR on local currency securities purchased by non-residents				Average RR on household deposits	Average RR on non- resident deposits; marginal RR on both domestic and FX deposits	Average RR on short-term deposits and accounts; and on deposits/participation accounts by maturity	Separate average RR on non resident deposits
External liabilities				URR on < 18 mo. non-trade finance foreign borrowing (not only of banks)	Marginal RR on banks' new foreign borrowing			x	Banks' external liabilities	Banks' external liabilities	Banks' FX liabilities by maturity	
Other assets or liabilities									Banks' FX subordinated obligations; FX assets of leasing companies			
Speed bumps: on credit growth exceeding a threshold rate		Marginal RR if (i) bank expands credit by > 6%/qtr and (ii) loans + risk-weighted OBS converted into assets - own funds > 60% of attracted funds (excl. interbank).	Bank by bank credit growth target; if exceeded, banks subject to dynamic differentiated RR and/or must hold low-yielding central bank paper		Credit growth reserve: hold low yielding central bank paper against growth in credit exceeding 4% per quarter							
Minimum holding period	1 year			varied; 6-12 mos; early w/d incurred penalty								
Other conditions						Link to loan-to-deposit ratio, in bands. Later also linked to CAR threshold: high LDR but higher CAR, zero RR	Exemptions to LC RR to spur lending and reduce FX lending to unhedged borrowers		Exemptions provided for certain types of lending during the 2008-09 crisis period			
Range of rates (in percent)	0-100	4-400	6-21.5	0-140	13-55	1-8	15-25	0-40	5-100	0-120	5-16	25-35

Sources: Central bank websites and survey results; (see reference list).

Table V.2 Measures to Address Credit Risk Arising from Foreign Currency Lending

	Argentina	Austria	Croatia	Hungary	Lebanon	Peru	Poland	Romania	Serbia	Uruguay
Measures to limit exposure										
DTI on mortgages, by currency				x			x			
Direct caps on exposures					60 percent of FX deposits (to 2006)					
Including outright bans on:										
Lending to unhedged borrowers	x	Austrian banks in emerging Europe were asked to discontinue non-euro FX loans								
FX mortgages				x						
FX and indexed loans to households		Moral suasion to refrain from new such loans in 2008; allowed in 2010 with strict criteria adopted								
Measures to build buffers										
LTV on mortgages, by currency				x			x			
Additional capital on FX exposures						2.5 percent of total FX exposure				
Higher risk weights on FX loans (max)			150 percent for unhedged borrowers				75 percent for fully secured HH mortgages		125 percent for unhedged borrowers	125 percent for unhedged borrowers
Limits on FX exposures to capital (excluding net open FX position limits)	Additional market risk capital charge depends on value at risk from FX volatility		Maximum allowed FX exposure = 20 percent of regulatory capital		Various measures (net, global, structural) as share of bank's equity			FX loans to unhedged borrowers to own funds, 300 percent. Lifted in 2007.		
Higher provisioning on FX loans						If guaranteed, less provisioning; If meet risk assessment practices, less provisioning		Unhedged borrowers are downgraded and require higher provisioning		Commecial loans: by ability to repay after FX shocks of different thresholds; Consumer loans: by debt service to income
Other										
Risk management improvements		x	x	x		x	x	x	x	
FX credit to total private sector credit			73	52		52	30	63	68	52

Sources: Survey results and central bank websites; (see references).

APPENDIX VI. THE CONCEPTUAL BASIS FOR MACROPRUDENTIAL INSTRUMENTS

Instruments	Conceptual Basis
Caps on the LTV	The LTV imposes a down payment constraint on households' capacity to borrow. In theory, the constraint limits the procyclicality of collateralized lending since housing prices and households' capacity to borrow based on the collateralized value of the house interact in a procyclical manner. Set at an appropriate level, the LTV addresses systemic risk whether or not it is frequently adjusted. However, the adjustment of the LTV makes it a more potent counter-cyclical policy instrument.
Caps on the DTI	The DTI represents prudential regulation aimed at ensuring banks' asset quality when used alone. When used in conjunction with the LTV, however, the DTI can help further dampen the cyclicality of collateralized lending by adding another constraint on households' capacity to borrow. Like in the LTV, adjustments in the DTI can be made in a counter-cyclical manner to address the time dimension of systemic risk.
Caps on foreign currency lending	Loans in foreign currency expose the un-hedged borrower to foreign exchange risks which, in turn, subject the lender to credit risks. The risks can become systemic if the common exposure is large. Caps (or higher risk weights, deposit requirements, etc.) on foreign currency lending may be used to address this foreign-exchange-induced systemic risk.
Ceilings on credit or credit growth	A ceiling may be imposed on either total bank lending or credit to a specific sector. The ceiling on aggregate credit or credit growth may be used to dampen the credit/asset price cycle—the time dimension of systemic risk. The ceiling on credit to a specific sector, such as real estate, may be used to contain a specific type of asset price inflation or limit common exposure to a specific risk—the cross-sectional dimension of systemic risk.
Limits on net open currency positions/currency mismatch	Such prudential regulation tools limit banks' common exposure to foreign currency risks. In addition, the limits may be used to address an externality—sharp exchange rate fluctuations caused by a convergence of purchases/sales of foreign exchange by banks. This externality increases the credit risk of un-hedged borrowers with heavy foreign currency debt.
Limits on maturity mismatch	These prudential regulation tools may be used to address systemic risk since the choice of asset/liability maturity creates an externality—fire sales of assets. In a crisis, the inability of a financial institution to meet its short-term obligations due to maturity mismatches may force it to liquidate assets, thus imposing a fire sale cost on the rest of the financial system. The funding shortages of a few institutions could also result in a systemic liquidity crisis due to the contagion effect.
Reserve requirements	This monetary policy tool may be used to address systemic risk in two senses. First, the reserve requirement has a direct impact on credit growth, so it may be used to dampen the credit/asset price cycle—the time dimension of systemic risk; second, the required reserves provide a liquidity cushion that may be used to alleviate a systemic liquidity crunch when the situation warrants.
Countercyclical capital requirement:	The requirement can take the form of a ratio or risk weights raised during an upturn as a restraint on credit expansion and reduced during a downturn to provide a cushion so that banks do not reduce assets to meet the capital requirement. A permanent capital buffer, which is built up during an upturn and deleted during a downturn, serves the same purpose. Both can address the cyclicality in risk weights under Basel II based on external ratings that are procyclical.
Time-varying/ Dynamic provisioning	Traditional dynamic provisioning is calibrated on historical bank-specific losses, but it can also be used to dampen the cyclicality in the financial system. The provisioning requirement can be raised during an upturn to build a buffer and limit credit expansion and lowered during a downturn to support bank lending. It may be adjusted either according to a fixed formula or at the discretion of the policymaker to affect banks' lending behavior in a counter-cyclical manner.
Restrictions on profit distribution	These prudential regulation requirements are intended to ensure the capital adequacy of banks. Since undistributed profits are added to bank capital, the restrictions tend to have a counter-cyclical effect on bank lending if used in a downturn. The capital conservation buffer of Basel III has a similar role.

APPENDIX VII. MACROPRUDENTIAL INSTRUMENTS: COUNTRY EXPERIENCE

Country	Year	Background and Motivation	Action – Macroprudential Tools Used
Argentina	**2010**	The economy grew very rapidly in 2010, owing to the strong demand for exports and favorable terms of trade as well as the recovery in domestic consumption. The improvement in international liquidity conditions and low interest rates in the advanced economies increased capital flows to Emerging Market Economies. Historically, the Argentine banking sector saw high volatility and close correlation between its profitability and business cycles. Under these circumstances, the BCRA (Central Bank of Argentina) has recently decided to implement a capital conservation requirement in order to: • shield the local credit market from external shocks • strengthen financial entities' solvency and reduce procyclicality	• **Restrictions on profit distribution**: introduction of a restriction on profit distribution (May 2010) Note: in the first half of 2000s, the authorities introduced a 30% unremunerated reserve requirement on capital inflows to address capital flow related risk, a limit on net open currency position and a foreign currency lending capacity requirement to contain currency mismatch.
Austria	**2003-2010**	In 2003, the ratio of foreign currency denominated loans in Austria was high, and not only the banking sector but also borrowers were exposed to exchange rate risks. The authorities introduced measures to: • reduce the volume of foreign currency lending • address the funding risks for banks created by foreign currency lending	While the authorities initially introduced measures to reduce foreign currency lending in 2003, they tightened them further in 2006, 2008, and 2010. These measures involved: • 2003 – introducing minimum standards governing foreign currency loans and loans with repayment vehicles • 2006 – increasing the risk awareness of foreign currency borrowers • 2008 – suspending the granting of foreign currency loans • 2010 – improving the risk-bearing capacities of individual banks
Brazil	**2005-2007**	There were signs of overheating in economic and financial activities partly due to increasing capital inflows. Under these circumstances, the Brazilian authorities introduced several measures to: • dampen the build-up of potential imbalances by introducing countercyclical measures • reduce foreign currency risk	• **Time-varying/ dynamic provisioning**: introduction of forward looking provisioning • **Currency mismatch:** decrease in limits on currency mismatch from 60% to 30% of regulatory capital (2007)
	2008-2010	The economy grew rapidly with strong credit expansion and an increase in speculative capital inflows. The authorities introduced several policy measures to: • reduce credit growth • curtail speculative inflows	• **Reserve requirements**: reserve requirements were raised to reduce credit growth (2010). In addition, the central bank introduced a 60 percent unremunerated reserve requirement on banks' short foreign exchange positions in the spot market exceeding US$3 billion or Tier I capital (whichever is lower). • **Capital**: the central bank increased capital requirements for some consumer loan operations with long maturities and high LTV ratios (including car loans) (2010).
Bulgaria	**2004-2007**	As in many other countries in Eastern Europe, credit to households grew rapidly during the transition to EU accession. A credit boom was accompanied by a house price boom in the early 2000s. In 2004, rapid growth of 49 percent in bank lending led to concerns about banks' ability to manage the credit and operational risk associated with such rapid credit growth. The authorities introduced measures to: • limit the build-up of risk for the banking sector • cut lending growth and minimize systemic risk	• **Capital**: more stringent rules for classifying claims and determining banks' capital adequacy by excluding current profit from the capital base (2004 and 2005) • **Provisions**: higher specific provisions for loans to households introduced (2005) and tightened several times since then • **LTV**: introduction of a 70 percent LTV ratio for mortgages risk-weighted at 50 percent • **Reserve requirements**: tighter reserve requirements by reducing the share of vault cash in eligible assets and broadening the liability base to deposits and securities with longer maturity and repos (2004); introduction of a marginal reserve requirement for banks exceeding average credit growth (2006); and a rise in the reserve requirement ratio (2007)
	2008-2010	Due to the financial crisis, economic growth was stagnant. The authorities took action to promote credit growth.	• **Reserve requirements**: reductions in reserve requirements (2008 and 2009) • **Risk weight: a** reduction in risk weights for loans to households and mortgage loans (2010) Note: the authorities introduced differentiated reserve requirements for funds attracted by banks from abroad and for funds attracted from the domestic market (2009). The reserve requirement ratio on funds attracted from abroad was set at a lower level than that on funds attracted domestically.

Country	Year	Background and Motivation	Action – Macroprudential Tools Used
Canada	**2008-2011**	Canada experienced rapid mortgage growth in 2008 and high household debt in 2010 and 2011. Under these circumstances, the ministry of finance introduced several policy measures to protect and strengthen the Canadian housing market and support its long-term stability.	• **LTV**: in July 2008, the maximum term for mortgages was decreased from 40 to 35 years. In February 2010, the government selectively tightened the LTV ceilings on cash-out refinancing transactions and investment property loans. In April 2011, the maximum amortization period for new government-backed insured mortgages with LTV ratios of more than 80% was reduced to 30 years from 35 years.
Chile	**2008-2009**	Chile's economic activity declined as a fall-out from the global financial crisis. In response, the authorities enacted measures to restore the flow of credit, especially to low-income households and small and medium-sized enterprises.	• **LTV:** the maximum LTV ratio for covered bond-type mortgages raised from 75% to 100% for debtors with higher credit ratings (2009) • **Differentiated reserve requirements**: introduction of differentiated reserve requirements for foreign currency (2008) Note: Chile has in place a systemic capital surcharge. The surcharge is required when a merger or acquisition result in a bank with a market share higher than 15 percent. The resulting banking institution must maintain a higher capital adequacy ratio (from 10 to 14 percent) for a minimum period (of not less than a year).
China	**2010-2011**	The authorities implemented a massive stimulus package in 2008 to counter the effect of the financial crisis. The stimulus worked quickly to stem the contraction in output, but it was not withdrawn immediately. The delay in the policy exit helped fuel a domestic credit boom. From late-2009, housing prices began to rise at an average annual rate of 15-20%. The authorities introduced several measures to curb credit growth and housing price inflation.	• **LTV**: the LTV ratio on primary homes was lowered from 80% to 70% and to 50% on second homes (2010). The LTV ratio on purchases of second homes was subsequently lowered further to 40% (2011). • **Lending ceiling**: caps on credit growth were introduced for major banks. In addition, the authorities issues "verbal" guidance to banks to temporarily stop lending. • **Reserve requirements**: reserve requirements have been increased 8 times since Jan 2010. • **Countercyclical capital requirement**: large banks were required to have a countercyclical and systemic capital buffer (2010). • **Provisions:** the provision coverage ratio was raised from 100% to 150%.
Colombia	**Late 1990s**	Colombia experienced excessive leverage from mortgage borrowers and suffered a mortgage crisis. Based on such experience, the authorities introduced several measures to: • limit the exposure of households to debt • reduce excessive leverage from mortgage borrowers	• **LTV**: introduction of caps on LTV ratios at 70% (1999) • **DTI**: introduction of caps on debt-to-income ratio, by imposing a monthly debt service limit of no more than 30% of disposable income (1999) • **NOP**: limit on financial institutions' net open foreign currency positions set at 20 percent of their capital (1999)
	2007- 2009	In 2007, the economic growth rate reached over 7 percent and there were signs of overheating. But the economy then started to slow down due to the global financial crisis. Under these circumstances, the authorities introduced measures to: • dampen credit growth • reduce procyclicality	• **Maturity mismatch**: limit on maturity mismatch was introduced (2009). • **Reserve requirements**: marginal reserve requirements were used (2007 and 2008). • **Time-varying/ dynamic provisioning**: dynamic provisioning was introduced (2007). • **Restrictions on profit distribution**: restrictions on profit distribution were introduced (2008). This tool was used only one time.
Croatia	**2003- 2008**	Croatia's economic growth over the period 2003-2008 was strong, with the country experiencing a period of boom fueled by capital inflows and domestic consumption. Also, from 2001 to 2003, bank credit to the private sector had increased by 20-30% a year, already from a relatively high base. Furthermore, mortgage credit grew rapidly at an annual rate of 31% between 2003 and 2007. House prices surged by a cumulative rate of 30 percent over the same period. Systemic risk rose from bank lending in foreign currency, particularly to unhedged borrowers and from weaker underwriting standards. Banks were exposed to rollover/liquidity risks and contagion risk from a sudden shift in investor sentiment in the region, especially given significant bank borrowing from abroad. The authorities took action to: • slow down very rapid credit growth • reduce procyclicality • slow down foreign borrowing and encourage banks to apply prudent business policies in their foreign borrowing	• **LTV**: introduction of LTV ratio for housing loans at 75% (2006) • **DTI**: approval of new loans prohibited if a debtor's average monthly income did not cover the total repayment obligations of the debtor (2006) • **Lending ceiling**: lower credit ceilings (2003 and 2007-2008). Banks with growth in credit exceeding a certain threshold were required to hold low-yielding central bank bills. • **Liquidity**: an additional liquidity requirement increased the ratio of foreign liquid assets to foreign borrowing to 24% (2003) and 35% (February 2005), but it was soon cut to 32% (March 2005). • **Reserve requirements**: unremunerated reserve requirement on additional foreign borrowings by banks during 2004-2008 and on newly issued securities by banks during 2006-2008 • **Time-varying/ dynamic provisioning:** banks were required to set up extra provisions for excessive credit growth (2004-2006).

Country	Year	Background and Motivation	Action – Macroprudential Tools Used
			• **Countercyclical capital requirement**: countercyclical capital requirement was used (2008). • **Risk weight**: 25% increase in risk weight on loans to debtors with currency mismatch (2005)
France	**2010**	Due to the global financial crisis, the functioning of the European interbank market deteriorated and many banks faced liquidity problems. The authorities took action to reduce liquidity risk.	• **Liquidity:** imposition of one-month liquidity ratio of 100% (2010) • **Exposure limits**: banks' exposures to individual clients or a group of connected clients limited to no more than 25% of the bank's capital (2010)
Greece	**1999-2005**	Stimulated by the favorable economic conditions on the way to euro adoption, household credit growth accelerated, rising by 30 percent in 1998 and pushing the ratio for outstanding household debt to disposable income from 27% in 2000 to 52% in 2004. Mortgage loans, in particular, grew fast, bringing the mortgage debt to GDP ratio from a mere 4 percent in 1995 to 23% in 2004. Real house price appreciation reached 67% over the same period. The authorities took measures to: • contain credit expansion and mitigate endogenous inflation pressure • address the risks associated with a boom in consumer lending	• **Lending ceiling**: introduction of unremunerated reserves for an amount equivalent to the growth of credit above specified rates (1999-2000) • **DTI**: imposition of an indicative limit of 40% on the household debt service-to-income ratio (2005) • **Provisions**: increases in the regulatory provisioning ratios for doubtful consumer loans from 84% to 100% (2005)
Hong Kong	**1990s**	With naturally limited land supply and one of the world's largest public housing sectors, Hong Kong real estate markets have been historically volatile. In the run-up to the Asian crisis, real estate prices started inflating in the late 1980s and accelerated in 1993. Mortgage loans as a percentage of GDP also grew rapidly. The authorities took action to moderate mortgage growth and property price inflation in order to ensure the safety and soundness of the banking system in light of the property boom.	• **LTV**: reduction in LTV ratio from 80-90% to 70% (1991), and a further reduction of the LTV ratio to 60% for luxury residences (1997) • **Lending ceiling**: ceiling on the growth of mortgage lending set at 15% per annum (1994), and banks' exposure to property limited to 40% (1994-1998)
	2009-2010	Following the boom-bust between 1995 and 2003, prices increased modestly until the second half of 2007, but then accelerated. Not counting the brief but sharp downturn around the global financial crisis in the second half of 2009, as of 2010Q3, house prices have increased 45% since 2007Q2. The housing boom put bank balance sheets at risk. The authorities took action to limit risks posed by the housing market boom.	• **LTV**: reduction in LTV ratio for properties valued at or above HK$20 million to 60% from 70% (2009). Extension of 60% LTV limit to properties valued at or above HK$12 million and non-primary-residence loans (August 2010). Further reduction in LTV ratio for (i) residential properties valued at or above HK$12 million from 60% to 50%, (ii) residential properties valued at or above HK$8 million and below HK$12 million from 70% to 60%, and (iii) all non-owner-occupied residential properties, properties held by a company and industrial and commercial properties to 50%, regardless of property value (November 2010). • **DTI**: standardization of the limit on DTI at 50% from the previous range of 50-60% (2010) • **Lending ceiling:** introduction of loan cap of HK$7.2 million on mortgages subject to 70% LTV limit (August 2010). Reduction of cap to HK$4.8 million (November 2010)
Hungary	**2010**	The economy had considerable vulnerabilities in the form of high external debt as well as currency mismatch. A large share of mortgage loans was provided in foreign currency, making unhedged borrowers, especially the household sector, vulnerable to exchange rate volatility. The main motivation to take action was to address the excessive foreign exchange lending to households.	• **LTV**: introduction of LTV limit for FX mortgages (2010) • **DTI**: introduction of DTI limit for FX mortgages (2010) • **FX lending ceiling:** ban on foreign exchange mortgage lending (2010)
India	**2004-2010**	Financial institutions generally tend to behave in a procyclical manner in their operations. Up until the global financial crisis, strong economic growth and urbanization started a real estate boom and credit to the private sector, including loans to households for housing and consumer credit. After the global crisis, credit started to decline. The authorities' main objective was to reduce procyclicality.	• **LTV**: introduction of 80% of LTVs for residential real estate (2010) • **Reserve requirements**: increase in cash reserve requirements from 4.5% to 5% (2004), 5.5% (2006), and then to 6% (2007) • **Risk weight**: increase in risk weight on housing loans from 50% to 75% (2005) and for commercial real estate exposure from 100% to 125% (2005), 150% (2006), and then to 100% (2008) • **Provisions**: an increase in general provisions from 0.25% to 0.4% (2005), 1% (2006), and then to 2% (2007)

Country	Year	Background and Motivation	Action – Macroprudential Tools Used
Indonesia	**2010-2011**	The Indonesian economy experienced rapid growth with rising inflationary pressure, partly due to massive capital inflows from advanced economies. So the authorities took action to: • contain inflationary pressure • reduce vulnerability from capital inflows	• **Reserve requirements:** the reserve requirement for local currency deposits was raised from 5% to 8% (2010) and, for foreign currency deposits, it was raised from 1% to 5% (2011) and then to 8% (later in 2011). The authorities introduced additional reserve requirement for banks with loan to deposit ratios below 78 percent or above 100 percent (March, 2011).
Ireland	**2006**	Ireland experienced rapid mortgage growth between 2000 and 2006. Financial deregulation, a positive macroeconomic outlook, and immigration flows had set the stage for a rapid escalation of real estate prices and credit. Also, capital gains taxes on non-owner-occupied property were cut in half, and residential property taxes were fully removed, slashing the user cost of housing. Mortgage debt to GDP grew by an astonishing 159 percent between 1996 and 2005, while house prices rose by 217 percent. The authorities took action to: • dampen credit growth • strengthen banks against the backdrop of rapid mortgage growth	• **Risk weight**: increase in risk weight for mortgages from 50% to 100% of the loan value, on the portion of each loan exceeding 80% of the value of the property (2006)
Italy	**2007**	Italian bank lending accelerated owing to strong corporate demand for funds fuelled by the recovery in activity; bank lending to households continued to grow fast. The proportion of loans associated directly or indirectly with real estate activity increased further. Motivation to take action was to reduce lending cyclicality.	• **LTV**: introduction of caps on LTV (2007). Mortgages secured by residential real estate are discouraged when they are beyond 80% loan to value. Tighter capital requirements are requested for loans above 80% loan to value.
Korea	**2002-2011**	The Korean banking system was vulnerable to housing market booms. In the aftermath of the Asian crisis, expansive policies to stimulate the economy created a credit boom (in particular, credit cards), the bust of which came in 2003 and left policymakers with a desire for tougher regulation. Real house prices increased by 26 percent from 2001Q1 to 2003Q3. After stalling in 2004, price appreciation resumed in 2005 and recorded an increase of 14 percent between 2005Q1 and 2007Q1. But prices declined again due to the negative effect of the global financial crisis. Given the systemic impact of housing policies, both on consumer confidence and overall macroeconomic management, as well as the social welfare purposes, the Korean authorities tightly regulate the housing market. The main aims are to: • maintain positive but limited house price appreciation • maintain consumer confidence through housing market policies • support construction sector • provide for the housing needs • more recently limit household debt	• **LTV**: introduction of caps on LTV ratios in 2002. Since then, tightened 4 times and loosened once in accordance with property price fluctuations. • **DTI**: introduction of caps on debt-to-loan ratio in 2005. Since then, tightened 4 times and loosened 2 times in accordance with property price fluctuations. • **Loan-to-deposit ratio**: reduction in banks' loan-to-deposit ratio to 100% starting in 2014 (November 2009, the deadline was shortened to end-June 2012, in June 2011). • **Reserve requirements**: increase in reserve requirements from 5% to 7% for demand deposits, money market deposit accounts, and other non-savings deposits (2006). Reduction in reserve requirement from 1% to 0% for long-term savings deposits (2006). The overall reserve requirements increased from 3% to 3.8% (November 2006). Also, the reserve requirement on demand deposits in foreign currency increased from 5% to 7% (2006). • **Other instruments**: tax incentives, subsidized financing, government construction and purchases of unsold houses, direct support for the construction sector, and moral suasion on lenders.
	2009-2011	In the years leading up to the financial crisis, the Korean banking sector experienced a large build-up in short-term external debt. The main motivations to take action were to: • reduce short-term external debt and reduce capital flow volatility • to reduce wholesale financing • strengthen foreign currency liquidity standards in order to reduce maturity mismatches and improve the quality of liquid assets • prevent excessive foreign currency bank loans from turning into systemic risks	• **Off-balance-sheet limits**: introduction of a ceiling on banks' foreign exchange forward positions (2010) and tightened further in 2011 • **Lending ceiling**: limits set on foreign currency loans (2010) • **Liquidity**: use of stronger foreign currency liquidity standards (2009) • **Tax**: reintroduction of a withholding tax on foreign purchases of treasury and money stabilization bonds and of a macroprudential levy on banks' non-deposit foreign currency liabilities (2011) • **Restriction on investment in foreign currency denominated bonds**: introduction of restriction on domestic banks and other institutional investors onshore from investing in Kimchi bonds (foreign currency denominated bonds issued by Korean banks and corporate) that are intended to be converted into Korean won for domestic use (2011)
Lebanon	**1997-2009**	Lebanon banks carried a substantial maturity mismatch from funding their lending operations largely from short-term deposits and a significant foreign currency exposure from foreign exchange lending to unhedged clients. The central bank introduced measures to reduce open currency positions and the resulting risk from foreign exchange fluctuations.	• **NOP**: introduction of foreign currency exposure limits as a share of bank's Tier I capital (1997) and a foreign currency liquidity ratio (2009)

Country	Year	Background and Motivation	Action – Macroprudential Tools Used
	2008-2009	The global financial crisis and the slowdown in the Gulf negatively affected capital flow and economic activity in Lebanon. Under these circumstances, the central bank introduced measures to promote credit growth.	• **LTV**: discontinuation of LTV ratio in real estate (for housing loans for a first house and loans granted under special programs including housing to military personnel) (2008) • **Reserve requirements**: introduction of reserve requirement exemptions on local currency deposits in order to promote in local currency (2009)
Malaysia	**1990s**	After increasing at a modest 3 percent per year in 1993-94, house prices accelerated to an annual growth rate of 13 percent in 1995-96. More striking, however, was the boom in the commercial real estate segment. Office rents rose by 50 percent between 1990 and 1996. Related, the growth in bank loans for non-residential property purchases far exceeded that in loans for residential property purchases. The authorities took action to: • limit banks' exposure to real estate to contain any deterioration in portfolio quality • prevent an asset price bubble	• **LTV**: introduction of a maximum LTV ratio of 60% on real estate loans in 1995 (discontinued in 1998). • **Lending ceiling**: introduction of a limit on property lending equal to 20% of a bank's portfolio in 1997 (discontinued in 1998) • **Reserve requirements**: increase in the statutory reserve requirement from 8.5% to 11.5% in 1994, and again to 13.5% in 1996 (reversed to 8% in 1998)
	2005	The boom-bust in the 1990s left the market with a significant supply hangover, in particular at the high-end condo segment. There have also been considerable additions to supply at the lower-end as a consequence of mass building of housing units by government agencies. Residential mortgage credit growth gained speed starting in 2001, and house prices recorded an increase of 4 percent in 2004, after an increase of about 1.6 percent per annum during 2000-03. The authorities took action to reduce the mortgage growth rate and property prices.	• **Risk weight**: increase in risk weight for non-performing loans from 50% to 100% (2005)
	2010	Malaysia has emerged from the world recession with strong forward momentum. Forceful countercyclical policies, sound balance sheets, and intra-regional trade have primed the recovery. Under these circumstances, credit growth started accelerating due to strong demand for consumer loans and mortgages. The authorities took action to moderate the excessive investment and speculative activity in the residential property market.	• **LTV**: introduction of 70% of LTV for the third house loan (2010)
Mexico	**Late 1990s and early 2000s**	The 1994-1995 crisis had a strong impact on the economy and the banking sector. The government provided significant liquidity support to banking system to avoid a collapse. Following the crisis, the sector was open to foreign investment, and after a few years foreign subsidiaries played a dominant role in the Mexican financial system. The authorities also introduced measures to limit the exposure to liquidity risks both in domestic and foreign currency.	• **Maturity mismatch in foreign currency**: significant refinement of limits on maturity mismatch in foreign currency (1997) • **Exposure limits**: limits on interbank exposure set at 100% of a bank's Tier I capital (2001)
	2010	The Mexican financial system weathered the spillovers from the financial crisis relatively well, reflecting improvements in bank risk management and prudential oversight since the mid-1990s, and the strong profitability, reserve and capital buffers of banks coming into the crisis. The authorities introduced measures to increase buffers of banks and reduce procyclicality of the banking system.	• **Provisions**: introduction of forward-looking loan loss provisioning
Mongolia	**2010-2011**	The country's economy was hit hard by the global economic crisis. The banking sector also experienced the crisis of 2008-2009 , which highlighted the increased vulnerabilities of banks' balance sheets. However, the rising global prices of minerals and strong investment in mining have contributed to a return to economic growth in 2010. The main motivations for the authorities' recent actions were to: • address procyclicality • address exchange rate risk from cross-border exposure • address leverage and maturity mismatch • address credit growth and asset price risk	• **NOP**: introduction of limits on net open currency positions (the amount of a single foreign exchange open position shall not exceed 15% of the bank's equity capital) (2010) • **Maturity mismatch**: introduction of limits on maturity mismatch (the difference between average durations of asset and liability shall not exceed 30% of total assets' average duration) • **Reserve requirements**: increase in reserve requirement from 5% to 9% (2011) • **Time-varying/ dynamic provisioning**: change in the rate of provisioning in response to the economic downturn (2010)

Country	Year	Background and Motivation	Action – Macroprudential Tools Used
New Zealand	**2010-2011**	The New Zealand banks are highly dependent on short-term offshore funding. Under this backdrop, the global financial crisis highlighted the need for banks to have adequate liquidity to safeguard them from future financial crises. The authorities took actions to: • ensure sufficient liquid assets to meet short-term liabilities • ensure more stable funding sources	• **Maturity mismatch**: introduction of a liquidity mismatch ratio and a core funding ratio (2010). The liquidity mismatch ratio compares a bank's likely cash inflow and outflow. The core funding ratio aims to ensure that banks hold sufficient retail and longer-dated wholesale funding. The minimum ratio of core funds to loans and advances was set at 65% and raised to 70% in July 2011. In 2011Q3, the authorities will review the likely impact of the further increase in the minimum ratio of core funds to 75% from July 2012.
Nigeria	**2008-2010**	At the end of 2008, Nigerian banks held large exposures to the stock market and the oil industry. The stock crash in early 2008 and subsequent oil price collapse led to concerns over banks' liquidity, and the quality of banks' assets deteriorated sharply. The cutoff of foreign credit lines and capital flight exacerbated these problems. The authorities took action to: • mitigate liquidity risk • reduce loan concentration	• **Lending ceiling**: limiting capital market lending to a set proportion of a bank's balance sheet **(**2010) • **Liquidity**: reduction of the liquidity ratio from 40% to 25% between September 2008 and April 2009 • **NOP**: reduction of foreign exchange open positions from 20% to 1% (2009) • **Reserve requirements**: reduction of the cash reserve requirement for commercial banks from 4% to 1% (2008-2009)
Norway	**1998**	After rebounding from the systemic banking crisis in 1991, both house prices and credit grew modestly from 1993 to 1996. Credit to households picked up in mid-1996 and house prices posted double-digit annual growth rates in 1997. The main motivation to take action was to curb credit growth and property price inflation.	• **Risk weight**: an increase in risk weights on loans with LTV above 60% from 50% to 100% (discontinued in 2001)
	2010	Household debt (mainly mortgages) reached a high level and was a key risk in Norway. The drivers behind the build-up of risk in the banking sector were a combination of demand and supply factors. On the demand side, low unemployment and wealth effects from increases in oil prices helped to boost the accumulation of household debt. On the supply of credit side, lax lending standards and aggressive mortgage lending practices also played a role. The main motivations to take action were to address the problems of high housing debt.	• **LTV**: 90% cap on LTV for housing loans and 75% cap on LTV for home equity loans • **DTI**: introduction of caps on DTI Note: These limits are guidelines rather than hard caps-e.g., the LTV limit can be exceeded if the lender makes a special soundness evaluation.
Peru	**2001-2010**	Peru's economic performance over the last decade has been outstanding. Credit growth recorded a double-digit increase for several years and the economy saw massive capital inflows. The motivations to take actions are to: • dampen lending cyclicality • mitigate foreign exchange risk in banks' balance sheets • mitigate short-term capital flows and exchange rate volatility	• **NOP**: introduction of limits on NOP (2010) • **Differentiated reserve requirements**: use of differentiated reserve requirement for residents/non-residents, and domestic currency/foreign currency. The authorities also apply 60 percent of reserve requirements to external liabilities with maturity of less than two years. • **Time-varying/ dynamic provisioning**: introduction of dynamic provisioning (2008)
Poland	**2006-2011**	The credit boom which took place in the 2006-2008 period raised concerns about weaker credit underwriting standards promoted by banks. Moreover, increasing volumes of FX lending to non-hedged borrowers, which were supported by interest-rate differentials and widespread expectations of zloty appreciation signaled the buildup of potential systemic risk. During the crisis, access by banks to foreign currency liquidity was a concern since banks usually hedge the direct FX risk through short-term FX swaps. The measures undertaken aimed at: • mitigating the credit and FX risk associated with lending (in particular mortgage lending) to households; • strengthening capital and liquidity buffers in order to increase their ability to cope with shocks	• **DTI**: 50%-65% caps under stressed scenarios for loans to households starting in 2010. Lower cap of 42% for FX loans to households with banks having until end 2011 to adjust. • **FX mortgage lending ceilings and tighter criteria:** FX mortgage lending ceiling set at 50% of total mortgage lending introduced in 2010; haircuts in collateral for FX loans and stricter eligibility criteria for FX mortgages introduced in 2006. • **Risk weights**: Differentiated risk weights for mortgage in Polish zloty (PLN) and FX, with FX weight of 75% and 35% for PLN lending in 2008 (LTV for FX lending was reduced in 2010). The risk weight for all FX loans will be raised at 100% starting in 2012. • **Reserve requirements**: decrease in reserve requirements from 3.5% to 3% to increase banking sector liquidity (2009) • **Capital**: restrictions on profit distribution (2009)
Portugal	**1999**	From 1996 to 2000, house prices rose by a rather modest 17 percent. By comparison, growth in mortgage credit was remarkable as the mortgage debt to GDP ratio doubled from 21% to 41%, mostly driven by the marked fall in bank interest rates. Motivations were to: • moderate cycles in specific sectors by limiting loan growth and leaning on asset demand • safeguard the soundness of the banking system	• **Capital**: tighter capital requirements for housing loans with an LTV ratio exceeding 75% • **Provisions**: tighter provisioning requirements for consumer loans (provisions for general consumer credit risks were raised to 1.5%)

Country	Year	Background and Motivation	Action – Macroprudential Tools Used
Romania	**2000s**	In first half of the 2000s, credit to the non-government sector grew rapidly, including over 40% in 2003 partly due to sustained economic growth and favorable economic conditions. FX loans to unhedged borrowers such as mortgages also grew rapidly. Under these circumstances, the authorities took action to: • slow down the credit growth rate • limit individuals' indebtedness • limit the currency risk	• **LTV**: caps on LTV of 75% during 2004-2007 • **DTI**: caps on DIT of 30% for consumer loans and 35% for mortgages (2004-2007). Introduction of a cap on DIT for total household debt of 40% (2005) • **FX Lending Ceiling**: aggregate exposure from FX loans to unhedged borrowers limited to 300% of the credit institution's own funds during 2004-2007 • **Reserve requirements**: increases in reserve requirements on deposits in foreign currency from 25% to 30% in 2004, from 30% to 40% in 2006 (the reserve requirement on deposits in domestic currency was reduced slightly from 18% to 16% in 2005) • **Provisions**: stricter loan provisioning and loan classification rules taking into account the currency risk of the borrowers (2002 and 2005)
Russia	**2008-2010**	The Russian economy was severely damaged by the global financial crisis; the economy contracted by 7.9 percent in 2009 and saw capital outflows. The banking sector suffered from bad loans and credit growth remained stagnant. The motivations to take actions were to: • stimulate credit growth • mitigate liquidity constraints • limit currency risk and manage capital flows	• **DTI**: easing of DTI (2008-2009) • **NOP**: limits on net open currency positions (2008-2009) • **Reserve requirements**: decrease in mandatory reserve requirements (2008) • **Provisions**: The Bank of Russia eased the requirements for the evaluation of debt servicing on loans in connection with the formation of loan loss. Note: Russia has used differentiated reserve requirements by residency.
Serbia	**2004-2011**	Rapid credit growth was accompanied by a rapid increase in foreign debt liability eurorization. Systemic risk rose from bank lending in foreign currency, particularly to unhedged borrowers and from weaker underwriting standards. Action taken was aimed at: • constraining high credit growth • limiting currency risk	• **DTI (for households)**: introduction of caps on DTI in 2004 and recalibrated several times since then. • **FX lending ceiling**: introduction of 20% of minimum deposit on FX denominated non-mortgage loans to households in 2007 (it was raised once to 30% but reduced to 0% in 2008). • **Differentiated reserve requirements for FX**: introduction of differentiated reserve requirement for FX and Serbian Dinar (RSD) funds in 2005 to reduce FX loans. • **NOP**: tightening of maximum net open currency positions relative to capital from 30% to 10% in 2007 but with the onset of the financial crisis it was raised to 20% (end 2008). • **Capital**: introduction of 200% ceiling on the ratio of household loan portfolio to Tier I capital in 2006 (reduced to 150% in 2007). • **Restrictions on profit distribution**: dividend and bonus payments forbidden if the bank was under provisioned in 2008 – remains in place to this day. • **Mandatory shortening of cash loans to maximum of 2 years duration:** in order to slow down household lending, preempt large credit risks and prevent excessive leverage of the poorest households.
Singapore	**2009-2011**	Real estate cycles have been strong with an increase of 45 percent in real house prices from 2004Q2 to 2008Q1. During the global financial crisis, private property price index declined almost 25 percent between its peak in 2008Q2 and its trough in 2009Q2, but it rebounded sharply since 2009Q3. Since 2009, there has been a risk of excessive house prices, including potential bubbles, and risks of increasing speculative demand. The main motivations to apply measures during the recovery after the global financial crisis were to: • ensure a stable and sustainable property market • reduce further speculative demand	• **LTV**: reduction of caps on LTV from 90% to 80% for all borrowers (2010) This was lowered to 70% for borrowers who have one or more outstanding housing loans at the point of applying for the new housing loan (later in 2010), and reduced further to 60% for borrowers who have one or more outstanding housing loans and to 50% for non-individuals (2011). • **Lending Ceiling:** introduction of caps on banks' loan exposures to the property sector (excluding residential mortgages for owner occupation) at 35 % of total non-bank exposure in 2009. Disallowance of the Interest Absorption Scheme and interest-only loans for residential mortgages in 2009. • **Maturity mismatch**: revisions of regulation in 2008 to improve liquidity condition during the financial crisis (such as expansion of the range of eligible liquid assets).

Country	Year	Background and Motivation	Action – Macroprudential Tools Used
Slovakia	**2008-2009**	Slovakia is a small and open economy, relying mainly on exports. In 2008, the economy was in good condition. However, the impact of the global recession started in 2008Q4. There was also a concern about the risk of liquidity outflows during the financial crisis. Hence, the main motivations to take action were to: • strengthen the short-term liquidity position of banks • increase the capital base • prevent liquidity outflows of liquid assets	• **Maturity mismatch**: introduction of a new short-term liquidity indicator (2008) • **Restrictions on profit distribution**: issuance of the central bank's recommendation that banks would not distribute their entire profit from 2008 but use it to increase own funds (2009)
South Africa	**2008**	As in most emerging markets, the global financial crisis led to large capital outflows that resulted in lower stock prices and a weaker currency. The impact on the financial sector, however, was low because exposure to market risks was limited by existing macroprudential regulations and prudent risk management. Basel II had entered into effect on January 2008, setting capital requirements for exchange rate risk. The motivations to take actions were to strengthen the resilience of financial system.	• **Capital surcharges**: introduction of capital surcharges for systemically important institutions (2008) Note: the authorities have used minimum liquid asset ratios (banking sector has been required to hold a minimum of 5 percent of its liability as liquid assets) since 1996 and limits on net open currency position (the net open position of foreign currency of each bank has been limited to 10 percent of its net qualifying capital and reserve funds) since the 1990s.
Spain	**2000-2008**	Several factors together created the longest recorded boom that ran from 1996 to 2007. Waves of immigrants and foreign property investors started flowing in while demographic changes pushed household formation rates up. A multiplier effect came from the effects of financial liberalization and convergence with the rest of the EU, pressing down real interest rates and making both traditional and new forms of mortgage loans more readily available to potential buyers. This was combined with a tight rental market where the quality and quantity of rental property does not measure up. As a result, house prices skyrocketed, going up 121 percent from trough to peak. The main motivations to take measures were to : • reduce the procyclicality of loan loss provisions and stem credit growth • build up a buffer in good times to be used in bad times	• **Time-varying/ dynamic provisioning**: introduction of dynamic provisioning in 2000 (revised in 2004). Note that dynamic provisioning was not applied universally across the banking sector, with the Cajas (saving banks) being omitted. • **Risk weight**: introduction of sector-dependent asset risk weights in 2008 (establishing higher risk weight for mortgages that exceed an LTV of 95% for residential property and 80% for others)
Sweden	**2010**	There was a sign of excessive indebtedness, which would make borrowers vulnerable to a situation in which real estate prices decline. The motivations were to: • stem an unsound trend in the credit market • protect consumers	• **LTV**: LTV cap of 85% for mortgages (2010)
Switzerland	**2008**	The general economic and financial conditions for the Swiss banking sector deteriorated in 2008 due to the global financial crisis. Many financial institutions were faced with increasing refinancing difficulties and declining credit growth, and posted losses. The motivations to take actions were to: • reduce procyclicality • strengthen the resilience of the financial system	• **Leverage ratio**: introduction of leverage ratio for systemically important banks (2008) • **Capital surcharges**: introduction of capital surcharges for systemically important institutions (2008)
Thailand	**2002-2011**	The country saw rapid credit growth, double-digit rises in housing prices, and massive capital inflows in the first half of the 2000s. House prices have been declining since 2006, with the speed of decline accelerating in 2008. Yet, in 2010Q2, prices spiked, posting a 10 percent quarter-on-quarter increase and commercial bank loans grew strongly over the summer. The motivation to take actions were to: • reduce the cyclicality of the real estate sector • reduce currency risk	• **LTV**: introduction of a cap of 70% on the LTV ratio (2003); increase in the LTV ratio for high value mortgages (above 10 million baht) from 70% to 80% (2009) • **DTI**: introduction of caps on DTI (2004) • **NOP**: introduction of limits on net open currency positions (2002) • **Risk weight**: imposition of higher risk weight for high value mortgages (above 10 million baht) with LTV above 80% (2009); and higher risk weight for residential mortgages (less than 10 million baht) with LTV above 90% (2011)
Turkey	**2008-2009**	The impact of the global financial crisis manifested itself in Turkey through an FX liquidity squeeze. Banks responded to the liquidity squeeze by reducing their FX loans and holdings of Eurobonds. Important motivations for the authorities to take action were to: • strengthen and preserve the financial position of banks • address the negative effect of the global financial crisis	• **Caps on foreign currency lending:** moderation of FX lending by allowing non-FX earnings companies to obtain FX loans (2009) • **FX liquidity**: change in FX liquidity ratio by allowing banks to temporarily classify FX loans as FX liquidity to help them meet FX liquidity adequacy ratios (2008) • **Restriction of profit distribution**: introduction of restrictions on profit distribution (2008)

Country	Year	Background and Motivation	Action – Macroprudential Tools Used
	2009-2010	Turkey rebounded rapidly after the global financial crisis. The country saw a rapid increase in domestic demand, rapid credit growth, and increased foreign currency borrowing by banks. The motivations to take actions were to slow credit growth and improve credit quality.	• **LTV**: introduction of caps on the LTV ratio for real estate loans (2010)
Uruguay	**most of 1990s**	Uruguay experienced relatively high economic growth during almost the entire 1990s. At the same time, important vulnerabilities emerged, including financial dollarization and a sharp increase in non-resident deposits. The main motivations were to reduce currency risk and liquidity mismatch.	• **NOP**: introduction of limits on net open currency positions (NOP should not exceed 150% capital) • **Maturity mismatch**: introduction of limits on maturity mismatch • **Core funding ratio**: introduction of a core funding ratio
	2001	The devaluation of the Brazilian real and the recession in Argentina depressed Uruguay's economy. Sustained deposit outflows prevented banks from lending. The motivation to take action was to build up adequate buffers and limit cyclicality.	• **Time-varying/ dynamic provisioning**: introduction of dynamic provisioning (2001).
	2005	After the crisis in the early 2000s, financial vulnerability still remained, including high dollarization. The motivation to take action was to reduce currency risk.	• **Risk weight**: introduction of higher risk weights for FX loans (2005).

REFERENCES

Almeida, H., M. Campello, and C. Liu, 2006, "The Financial Accelerator: Evidence from International Housing Markets," *Review of Finance,* 10 (3), pp. 321-352.

Arellano, M. and O. Bover, 1995, "Another Look at the Instrumental Variable Estimation of Error-Components Models," *Journal of Econometrics*, 68 (1), pp. 29-51.

Armstrong, J., E. Bordeleau–Labrecque, A. Crawford, and C. Graham, 2009, "The Role of Regulatory Limits on Leverage: The Canadian Experience," Bank of Canada, *mimeo*.

Barajas, A., G. Dell'Ariccia, and A. Levchenko, 2007, "Credit Booms: The Good, the Bad, and the Ugly," *Unpublished manuscript*, International Monetary Fund.

Berger, A. and G. Udell, 2004, "The Institutional Memory Hypothesis and the Procyclicality of Bank Lending Behavior," *Journal of Financial Intermediation,* 13 (4), pp. 458-495.

Borio, C., 2010, "Implementing a Macroprudential Framework: Blending Boldness and Realism," Bank for International Settlements.

Borio, C. and I. Shim, 2007, "What Can (Macro-) Prudential Policy Do to Support Monetary Policy?," BIS Working Papers No. 242.

Committee on the Global Financial System, 2010, "Macroprudential Instruments and Frameworks: A Stocktaking of Issues and Experiences," CGFS Papers No. 38.

Dell'Ariccia, G., D. Igan, L. Laeven, and H. Tong, 2011, "Policies for Macrofinancial Stability: Options to Deal with Credit Booms," IMF SDN, *forthcoming*.

_____ and R. Marquez, 2006, "Lending Booms and Lending Standards," *Journal of Finance*, 61 (5), pp. 2511-2546

Fernández-Villaverde, J., 2010, "Fiscal Policy in a Model with Financial Frictions," *American Economic Review: Papers & Proceedings*, 100 (2), pp. 35-40.

Galac, T., 2010, "The Central Bank as Crisis-Manager in Croatia—A Counterfactual Analysis," Croatian National Bank Working Paper No. 27.

Galati, G. and R. Moessner, 2011, "Macroprudential Policy—A Literature Review," BIS Working Papers No. 337.

Gray, S., 2011, "Central Bank Balances and Reserve Requirements," IMF Working Paper No. 11/36 (Washington: International Monetary Fund).

Hildebrand, P., 2008, "Is Basel II Enough? The Benefits of a Leverage Ratio," Speech at the Financial Markets Group Lecture, London School of Economics.

International Monetary Fund, 2011a, "Macroprudential Policy: An Organizing Framework."

_____, 2011b, "Macroprudential Policy: An Organizing Framework – Background Paper."

_____, 2011c, "Towards Effective Macroprudential Policy Frameworks: An Assessment of Stylized Institutional Models" (companion board paper), *forthcoming*.

_____, 2011d, "Lessons from the European Financial Stability Framework Exercise."

_____, 2011e, "Housing Finance and Financial Stability: Back to Basics?," Chapter 3 in Global Financial Stability Report, April 2011.

_____, 2011f, "Recent Experiences in Managing Capital Inflows—Cross-Cutting Themes and Possible Policy Framework," IMF Policy Paper.

_____, 2011g, "Policies for Macrofinancial Stability: Options to Deal with Credit Booms," IMF Staff Discussion Note, forthcoming.

_____, 2011h, "Towards Operationalizing Macroprudential Policies: When to Act?," Chapter 3 in Global Financial Stability Report, September 2011.

_____, 2011i, "New Liquidity Rules: Will it Work as a Macroprudential Policy Tool?," Appendix 1 in New Zealand Staff Report for the 2011 Article IV Consultation.

Magud, N, C. Reinhart, and E. Vesperoni, 2011, "Capital Flows, Exchange Rate Flexibility, and Domestic Credit," IMF Working Paper, *forthcoming*.

Panetta, F. and P. Angelini –coordinators- and U. Albertazzi, F. Columba, W. Cornacchia, A. Di Cesare, A. Pilati, C. Salleo, and G. Santini, 2009, "Financial Sector Pro-cyclicality: Lessons from the Crisis," Bank of Italy Occasional Papers No. 44.

Rajan, R., "Why Bank Credit Policies Fluctuate: A Theory and Some Evidence," *Quarterly Journal of Economics*, 109 (2), pp. 399-441.

Ruckes, M., 2004, "Bank Competition and Credit Standards," *Review of Financial Studies*, 17 (4), pp. 1073-1102.

Saurina, J. 2009, "Loan Loss Provisions in Spain: A Working Prudential Tool," *Bank of Spain Financial Stability Journal*, 17, pp. 11-26.

Sinha, A., 2011, "Macroprudentail Policies-Indian Experience," Speech delivered at the 11th Annual International Seminar on Policy Challenges for the Financial Sector on "Seeing both the Forest and the Trees-Supervising Systemic Risk," Washington D.C.

Viñals, J., 2010, "Towards a Safer Global Financial System," presented at London School of Economics.

_____, 2011, "The Do's and Don'ts of Macroprudential Policy," presented at European Commission and ECB Conference on Financial Integration and Stability in Brussels.

_____, Fiechter, J., Pazarbasioglu, C., Kodres, L., Narain, A., and Moretti, M., 2010, "Shaping the New Financial System," IMF Staff Position Note No. 10/15.

Unsal, F, D., 2011, "Capital Flows and Financial Stability: Monetary Policy and Macroprudential Responses," IMF Working Paper No. 11/189 (Washington: International Monetary Fund).

Wong, E., T. Fong, K. Li, and H. Choi, 2011, "Loan-to-Value Ratio as a Macro-prudential Tool- Hong Kong's Experience and Cross-Country Evidence," Hong Kong Monetary Authority Working Paper No. 01/2011.