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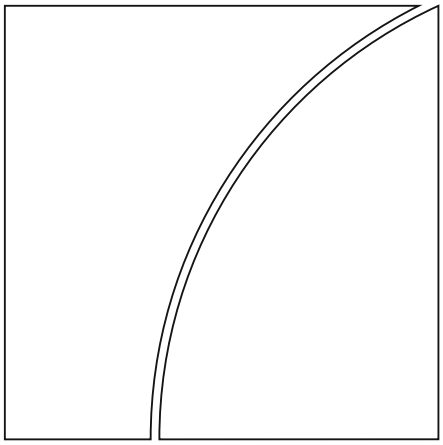

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Macroprudential policy

A joint CBRT/BIS/IMF conference on "Macroprudential policy: effectiveness and implementation challenges" which was held in Istanbul, Turkey, on 26-27 October 2015.

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Foreword

Erdem Basçi[1]

There are two major types of problems in the area of finance. These are "I don't know" type of problems and "I don't care" type of problems. The former perhaps can be addressed by "financial education." But the latter is better addressed by "financial regulation."

Economic agents cannot easily assess the results of their financial activities. The main reason behind the "I don't know" type of problem is the difficulty in handling dynamic optimization. This difficulty exists even in fully deterministic dynamic optimization problems. The degree of difficulty is more pronounced for dynamic stochastic optimization problems. It is much more pronounced for problems that involve further complications, such as presence of an unusually high degree of uncertainty or uncertainty arising from interactive decision making and, perhaps, multiple equilibria.

To mitigate this first type of problem, financial education would be useful. For example, Bernheim et al (2001)[2] and Lusardi (2008)[3] show that financial education leads to increase in saving rates and asset accumulation via better informed decisions.

The second type of problem – "I don't care," – arises from the insensitivity of agents to the results of their financial decisions on the well-being of others. Well-known examples are the so-called agency problems, such as moral hazard and adverse selection. These two problems arise when the flow of information is asymmetric between a principal and its agent. Such informational asymmetries are pervasive in financial decision-making. A banker is much better informed than the depositor and the shareholder. A debtor typically is much better informed than the creditor. Financial regulation is typically introduced to mitigate this type of problem. "Microprudential regulation" is the typical term used for such financial precautionary policies.

If the negative externalities of our actions are rather indirect and hence are less visible, then a "I don't care" problem of a different nature arises. Some examples of terminology, also used frequently in this volume, are: systemic risks; risks in the financial system as a whole; aggregate demand externalities; and macro-financial linkages. The mitigation of problems of such nature are considered under the heading of "macroprudential regulation" or "macroprudential policy."

The Central Bank of Republic of Turkey (CBRT) recently placed more emphasis on financial education and its relation to financial stability. The organization of the "International Conference on Financial Education and Financial Awareness: Challenges, Opportunities and Strategies" on 9-11 March 2011 in Istanbul jointly with the Capital Markets Board of Turkey and the publication of the booklet "Access to

[1] Former Governor, Central Bank of Republic of Turkey.

[2] Bernheim, B D, J Skinner and S Weinberg (2001): "What accounts for the variation in retirement wealth among US households", *American Economic Review*, vol 91, September, pp 832–857.

[3] Lusardi, A (2008): "Financial literacy: an essential tool for informal consumer choice?", Dartmouth College, mimeo.

Financial Services and Financial Education in the World and Turkey", were two steps to contribute financial education in Turkey.

The emphasis on macroprudential policy is also rather new. The global approach to the financial system before the global financial crisis of 2008 can perhaps be summarized in one word: "deregulation." The trend at that time was towards less and less government intervention, including financial markets and institutions. This led to a concentration of a significant amount systemic risk in an under-regulated financial system. The result was an unstable and fragile global economy.

"Reregulation" of the financial sector has then become a keyword. It has been repeated many times at national and international forums after the global financial crisis. While the Basel I and Basel II frameworks were mainly microprudential frameworks, the Financial Stability Board came up with proposals including macroprudential policy measures to contain the risk of contagion. The G20 leaders called on the FSB, IMF and BIS to focus on macroprudential policy framework in their Seoul Summit in November 2010. A joint FSB/IMF/BIS Conference on macroprudential policy framework was held in 2011. The three organisations responded to this call with a progress report which set out a comprehensive framework for discussion. This was an important call to the authorities and to academia to do work further on macroprudential policies.

After the global financial crisis, the awareness of the need to use macroprudential policies increased dramatically because of two reasons. Firstly, macroprudential policy tools were deemed necessary to mitigate macro-financial externalities, like pecuniary externalities related to real exchange rates or aggregate demand externalities related to leverage or liquidity.

Secondly, price stability and financial stability trade-offs became more evident. Using the short-term interest rate as the only monetary policy tool was clearly not the optimal solution to deal with such trade-offs. Moreover, short-term interest rates proved to be too blunt for specific financial stability purposes. In this respect, both advanced and developing country central banks employed very diverse sets of macroprudential tools and policies.

Research shows that monetary policy rules that feature responses to financial variables such as credit spreads and the real exchange rate produce better results in coping with external financial shocks. These benefits, however, might be reaped at the expense of sacrificing price stability. Furthermore, using solely short-term policy rates might be counterproductive if hitting multiple targets necessitates different trajectories for the single policy tool. Overall, it seems that macroprudential policies are better suited for the financial stability purposes and their effective use may provide enough room for interest rate policy to target price stability more effectively. Nonetheless, these areas are still open for discussion. More research is needed and a consensus is yet to emerge.

The CBRT/BIS/IMF Joint Conference on "Macroprudential Policy: Effectiveness and Implementation Challenges" which was held on 26-27 October 2015 in Istanbul was a successful event and a good opportunity to discuss and exchange opinions. This volume is a collection of research and speeches presented at the conference. It contributes to the literature and to the better understanding of the issue not only by academicians but also by decision-makers. I therefore would like express my gratitude to all the participants of this conference and to all the contributors to this useful volume.

Macroprudential policies and integrated inflation targeting

Luiz Awazu Pereira da Silva[1]

The Turkish presidency of the G20 during 2015 deserves great credit for sponsoring a number of fruitful meetings in order to deepen the analysis of macroprudential policies. The BIS was pleased on several occasions to collaborate with the CBRT in such endeavours. Economists from the BIS and the CBRT have worked closely and productively together on a number of topics.

This joint CBRT/BIS/IMF conference, instigated by then-Governor Başçı, gave much food for thought. Allow me to record a special word of thanks to him not only for encouraging such collaboration but also for his most thoughtful contributions over many years. He was always rigorous and imaginative constantly challenging conventional thinking. For this he earned wide respect. Thanks are also due to the staff of the IMF for their dedication to our joint project.

Central banks, especially in the post-global financial crisis world, have to grapple with two policy objectives – macroeconomic stability and financial stability. They have to analyse the many, and changing, links between the macroeconomy and financial markets. Tinbergen suggested that with two policy objectives, we need two instruments – in this case, the policy interest rate and a macroprudential tool. But we cannot assume that a one-for-one assignment of each instrument to a specific objective (eg the policy interest rate only to the macroeconomic objective) would necessarily work best. This is because each instrument is likely to affect more than one objective (eg low interest rates can encourage excessive leverage, and so undermine financial stability). Many of the papers in this volume address some of the complexities of this assignment problem.

During the conference, we debated about the likely effectiveness of potential macroprudential tools that have not been widely tried. Learning from experience abroad can help assess how an instrument that is new to one country – but has been tried in other countries – might work. Putting too much reliance only on those instruments we have used in the past can actually be counterproductive because there may be diminishing marginal returns to using any particular instrument.

Macroprudential tools have proved to be effective not only in moderating booms, but also in building up buffers which serve to limit the fall-out from busts. There are of course caveats to this positive assessment. If over-used, such policies create distortions. In addition, they can be circumvented: careful design and good international co-operation can reduce this risk. Monetary policy can be a key component, especially when experimenting with new macroprudential tools. There is, in short, a need for what I have termed elsewhere **integrated inflation targeting** (IIT).[2] Monetary and macroprudential policies need to be calibrated jointly to achieve macroeconomic and financial stability. Many of the papers in this volume seek to take

[1] Deputy General Manager, Bank for International Settlements.

[2] Agénor, P-R and L A Pereira da Silva (2013): *Inflation targeting and financial stability*, Inter-American Development Bank and CEMLA.

account of how macroprudential regimes can alter the monetary transmission mechanism, and better understanding such links is a big priority.

Further efforts will be needed to continue examining the issues posed by achieving both macroeconomic and financial stability in a world of globalised financial flows, interconnected economies and monetary policy spill-overs. This conference constitutes a step in building knowledge and sharing experiences towards that common goal.

Analysing the effectiveness of macroprudential tools

José Viñals[1]

Let me begin by extending a warm thank you to the Central Bank of the Republic of Turkey for their generosity in hosting the event and to former Governor Basçi who had the idea of this conference. Over 120 academics, central bankers and staff of international financial institutions descended by the blue waters of the Bosphorus for a very lively conference on how macroprudential policies could be made more effective. By the time they left, two days later, they had collectively learnt a lot. This conference volume is intended to enable others to participate in that intellectual journey, by bringing together some of the key contributions for a wider audience.

The conference, co-organised by the Central Bank of the Republic of Turkey, BIS and IMF, explored some of the most important and vexing questions that continue to occupy policymakers' minds: What do we know about the transmission and effectiveness of macroprudential policy tools in achieving their objectives? How does macroprudential policy interact with other policies, notably monetary policy, and how might this differ across advanced and emerging markets? Are there potential unintended consequences of macroprudential policy? How important are the cross-border effects of macroprudential policies, and how should these be addressed?

The conference showed that a growing body of research has been able to make important progress in answering these questions. It featured cross-country studies that make use of newly created international databases of macroprudential policy actions, such as the IMF's global macroprudential instruments (GMPI) database, to examine the effects of macroprudential policy for a large number of countries. This was complemented by a range of studies on individual countries that assessed the effects using novel approaches and datasets, for both advanced and emerging markets. New theoretical analysis also showed light, such as on the unintended effects of macroprudential policy through the cycle, where empirical research has not yet been able to reach.

To be sure, not all questions were settled, and much further work remains. For instance, debate will surely continue on how best to address cross-border effects of macroprudential policy, and whether that is even necessary. That said, by the end of the conference, many participants came away encouraged: We appear to have learned a lot already about how macroprudential policy works, compared to only a few years ago, when the global financial crisis led countries to start developing their macroprudential toolkits, and researchers began more seriously investigating the effects of macroprudential tools. What is more, the growing experience confirms that macroprudential policy can be successful in both emerging and advanced economies when properly designed and implemented.

At the IMF, we think that this should give policymakers confidence: countries should develop the courage to make appropriate use of macroprudential policies in their pursuit of financial stability, and guided by the experience of others. And as more countries use macroprudential policy tools, this will lead further experience to

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accumulate, enabling us collectively to further refine our knowledge about how to use these tools effectively. We at the IMF will continue draw on that experience also in our bilateral advice, in the context of our Financial Stability Assessment Programs (FSAP) and Article IVs.

Abstract

This volume contains 17 papers presented at the joint Central Bank of the Republic of Turkey (CBRT) – Bank for International Settlements (BIS) – International Monetary Fund (IMF) conference on "Macroprudential policy: effectiveness and implementation challenges" held in Istanbul, Turkey, during Turkey's presidency of the G20. They address the history, the theory and the practical implementation of macroprudential policies.

They analyse, inter alia: the nature of interactions with other policies (notably monetary policy and microprudential regulation); how macroprudential policies can cope with external shocks and what cross-border spillover effects arise; and the effectiveness of various macroprudential policy tools. Several country case studies are presented.

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Keywords: macroprudential policy, capital flows, interest rate policy, bank regulation

Contents

Session 5: "Effectiveness of macroprudential policy tools"

Session 6: "Country experiences with macroprudential policies (II)"

Session 7: "Microprudential and macroprudential links and policy frameworks"

Macroprudential regulation: history, theory and policy

Turalay Kenç[1]

1. Introduction

The great depression of 1929 led to the emergence of macroeconomics as a separate branch of economics, to better understand how the whole economy functions. This time, in the wake of the global financial crisis (GFC) of 2008-9 the macroprudential regulation approach to financial regulation, in a similar fashion, has emerged – or, more accurately perhaps, re-emerged – as a new discipline, aiming at mitigating the risk of the financial system as a whole (or "systemic risk"). In its Washington "Declaration of the summit on financial markets and the world economy" on 15 November 2008, the G20 initiated overhauling "reforms that [have] strengthened financial markets and regulatory regimes so as to avoid future crises" and underscored the importance of macroprudential policies in this regard.

Macroprudential policy has thus become an overarching public policy in achieving financial stability across the world. This new perspective has generated profound changes and impacts on our understanding of how the whole economy functions when the effects of financial policies and actions are taken into account, the role of monetary policy in the presence of macroprudential policies and the institutional framework for an optimal policy coordination and cooperation between monetary, fiscal and prudential policies. The macroprudential perspective revolutionised the establishment of the Financial Stability Board (FSB) and the reorientation of the existing IOs to extend their surveillance functions to include global and national financial stability, and the construction of aggregated financial stability indicators on systemic risk, stress-testing and etc. The latter resembles the formation of aggregated indicators such as GDP, unemployment rates, national income and price indices, some of which regarded as the great inventions of the twentieth century.

Since the inception of the GFC, there have been a lot of new works that improve our understanding macroprudential regulation with respect to indicators of systemic risk including the time dimension of risk and the cross-sectional dimension of risk, institutional underpinnings and international policy coordination, the effectiveness of macroprudential policy tools. Numerous reports, policy papers, discussion papers and academic papers on macroprudential regulation have been produced and their findings and conclusions have been discussed in many conferences and meetings across the world. However, macroprudential regulation is still very much work in progress. With this in mind, on 26-27 October 2015 the Central Bank of the Republic of Turkey (CBRT) together with the International Monetary Fund (IMF) and the Bank for International Settlements (BIS) organised a joint conference with the title of "Macroprudential Policy: Effectiveness and Implementation Challenges." As the title

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suggests participants from different parts of the world and with different institutional affiliations including academia, central banks and international organisations discussed the factors affecting the implementation of macroprudential policies across both advanced economies (AEs) and emerging market economies (EMEs). The factors covered in the conference included macroprudential policy's interaction with monetary and fiscal policies, its links with microprudential regulation, external shocks such capital flows, spillover effects of macroprudential policy tools and institutional frameworks. Sessions on "country experiences with macroprudential policies" in turn provided the practical solutions adopted by both AEs and EMEs in designing and implementing effective macroprudential policies in the presence of these factors and other factors.

This short paper provides an introduction to the historical and theoretical aspects of macroprudential regulation in order to shed insight on effective macroprudentional policies. The section on macroprudential policies attempts to use this insight in the discussion of the state of play in macroprudential policy tools.

2. The history of macroprudential regulation

Although the term 'macroprudential' dates from the 1970s, and the global adoption of the macroprudential policies is more recent, the underlying approach has a long history. It began decades ago in the advanced economies and later in the emerging market economics faced with excessive capital inflows. The United States was probably the first country that implemented macroprudential policies to control credit growth in aggregate or in a major economic sector such as housing.[2] This history is of interest, especially given the neglect by major central banks of the advanced economies in subsequent decades of credit aggregates.

The objectives of these early US macroprudential policies included not only achieving financial stability but also achieving smoother economic and financial cycles, price stability as well as specific industrial policies. Table 1 reports the policies implemented by the Federal Reserve and other agencies under the classification of tools that operate on the demand for credit, such as limits on loan-to-value ratios and loan maturities, and those that operate on the supply of credit, such as limits on deposit rates (and therefore the supply of funds to lend), limits on lending rates, restrictions on banks portfolios, reserve requirements, capital requirements, and supervisory pressure. Among these measures the reserve requirement policy is worth noting as it is used to control not only general credit growth through required reserves on liabilities but also selective credit through changing the credit portfolio allocation of the banking sector at the expense of consumer credit with asset based required reserves. In addition, they are even extended to money markets funds.

Over almost a century until the 1990s, the United States utilised the measures reported in Table 1 to ease as well as tighten credit conditions over numerous episodes. The US experience suggests that tightening policies were effective to a great extent contrary to largely ineffective easing macroprudential policy measures. However, the effectiveness of macroprudential policy in general has over time greatly

[2] The US history of macroprudential policies is largely based on the work of Elliott, Feldberg and Andreas Lehnert (2013).

diminished in line with the fundamentally changed US financial system with results of credit activity tending to shift to unregulated lenders, the administration of controls demanding a substantial bureaucracy, rule-making authority and enforcement mechanisms, and distortions in resource allocation and inefficiencies. Their efficiency too wilted as the costs have become quite sizable to the extent that they were implemented over a long period of time.

The history of cyclical macroprudential policy in the United States: tools to control credit growth

Table 1

Tools affecting demand for credit	Tools affecting supply of credit
Loan-to-value ratios	Lending rate ceilings
Margin requirements	Interest rate ceilings
Loan maturities	Reserve requirements
Tax policy and incentives	Capital requirements
	Portfolio restrictions
	Supervisory pressure

Note: This Table is taken from Elliott, Feldberg, and Andreas Lehnert (2013).

Country experiences with macroprudential policy are not limited to the United States.[3] Large numbers of European economies in post-World War II era also resorted to macroprudential policy measures as they were mostly in economic boom regimes and interest rate policies were constrained by capital inflows and fiscal policy pressures associated with higher public debt levels. EMEs too had a great deal of macroprudential policy experiences in the wake of their financial crises in the 1990s. Most EMEs implemented numerous macroprudential policy measures to mitigate the systemic risks caused by the excessive capital inflows to their countries in the 2000s. The macroprudential policies implemented in Europe fall into three main categories: credit control instruments, liquidity and reserve requirements, and recommendations to the banking sector. Discretionary as well as broad-based rediscount ceilings and constraints on credit expansion were used not only to prevent financial bubbles but also to fine tune economies in stabilising inflationary pressures. The direct limits on credit expansion was the most contentious policy across Europe. The policy lasted from the 1950s towards end of the 1970s. The only country never to make use of it was the Federal Republic of Germany. Regulating the liquidity ratios of banks were designed to channel resources towards specific sectors of the economy and encourage the issuance of medium and long term loans. In the 1960s European countries increasingly moved to reserve requirements at the back of the successful case of the Bundesbank in the 1950s. European central banks also made recommendations such as liquidity and solvency ratios to banks by exploiting their supervisory and lender of the last resort roles. In some cases such as France and Italy there were specifically established institutions in the form of national credit councils to make the recommendations.

[3] Brunnermeier and Schnabel (2015) provides a detailed historical perspectives on the policies, including macroprudential measures, implemented by central banks across the world while Monnet (2014) and Kelber, Monnet, et al (2014) focus specially on the European experience with macroprudential policies.

Germany followed a different path and implemented capital flow management (CFM) measures including capital controls as well as macroprudential policies such as credit controls to limit the credit extension of German banks. This policy mix was Germany's response to large speculative capital inflows during the 1960s and early 1970s with an aim to preserve the foreign exchange value of the mark. The CFM toolkit includes several measures including a non-interest-bearing reserve requirement ratio of 100% on foreign currency denominated deposits and constraining the issuances of DM obligations in external bond and international money markets by domestic residents as well as by foreigners in German capital markets. In addition, there were strict regulations on bond issuances with a complete prohibition of floating rate, zero-coupon and FX-linked bond issuances. In this respect, to avoid leakages in the system even interest rate swaps were prohibited.[4]

In response to their respective financial crises in the 1980s and the 1990s, EMEs constructed numerous macroprudential policy and CFM measures as they faced excessive capital inflows during the great moderation era.[5] During both episodes, many EMEs experienced capital flows fuelled by rapid credit growth and sizeable real effective exchange rate misalignments. And their problems were exacerbated by strong domestic demand for credit. Several EMEs are currently in a comparable situation to that of Germany in the 1960s and early 1970s, in particular in terms of the state of development of their financial markets.

The origin of the term macroprudential can be traced back to unpublished documents prepared in the late 1970s by the BIS and the Bank of England. During this period, the term generally denoted a systemic orientation of regulation and supervision linked to the macroeconomy. Public references to macroprudential policy surfaced only in the 1980s. In 1986 the BIS discussed it as a policy aimed at supporting the safety and soundness of the financial system as a whole, as well as payments mechanism. In the early 2000s, following the widespread use of macroprudential policies in the EM world and growing concerns about financial stability in AEs the notion of a macroprudential approach to regulation and supervision received new impetus in BIS meetings and speeches (Clement 2010). The use of the term macroprudential has become much more common in the wake of the GFC and the establishment of effective macroprudential policy framework has become one of the prime objectives of the G20, EU, IMF and other structures.[6]

[4] German monetary history in the second half of the Twentieth Century provides an excellent case on the appropriate policies to capital flow shocks. See the works of Hetzel (2002a, 2002b) as well as Neumann (1986) for a comprehensive account of German monetary policy and its interactions with macroprudential regulation.

[5] Of course, EMEs again lately experienced excessive capital inflows during the Fed's quantitative easing episode of 2010-2013 and still suffer from the volatile impacts of the unconventional monetary policies in AEs and the ongoing quantitative easing by the ECB and Bank of Japan.

[6] See the FSB, IMF and BIS prepared 2011 Macroprudential Policy Tools and Frameworks Progress Report to G20 for an early but a comprehensive assessment of the state of play in macroprudential regulation.

3. The theoretical foundations of macroprudential regulation

The rationale for macroprudential regulation stems from the negative externalities from limited liability, limited enforcement and asymmetric information. Agents endowed with limited liability, limited enforcement and asymmetric information find it in their private interest to propagate risks through increasing leverage, expanding balance sheets and relying on short-term liquidity. Operating in an interconnected system the financial system further propagates the systemic risk. Because of strategic complementarities – where an action chosen by an agent strengthens the incentives of other agents act in the same way – financial intermediaries also choose to correlate their risk. Furthermore, fire-sales by some financial firms spillover, and adversely affect the balance sheet of others. These externalities are respectively called interconnectedness externalities, strategic complementarities and pecuniary externalities.[7] Agents do not internalise these externalities on other agents and the economy as a whole. Macroprudential regulation is then justified to the extent that the social, and overall, costs of market failures (such as a financial crisis) due to these externalities exceed both the private costs of failure and the extra costs of regulation.[8]

A pecuniary externality is related to fire sales which typically arise in down-turns. They occur when the sale of an asset by a troubled financial institution reduces the price of similar assets because of the also troubled nature of potential buyers in times of heightened financial volatility. The sale price of this asset falls below its fundamental value, causing losses to the seller. Similarly, fire sales also may depress the prices of similar assets held by other agents. In a frictionless world, such losses affect the distribution of wealth among agents, but entail no welfare losses. However, when markets are incomplete, pecuniary externalities can have real welfare effects. The existence of the fundamental market inefficiencies such as limited liability, asymmetric information and limited enforcement is the source of endogenous risk. In this case, asymmetric information or limited enforcement induces lenders to demand collateral from borrowers, which limits the amount of debt to the value of their collateral. A shock that causes agents to sell assets can lead to a deterioration of collateral values. As a consequence, borrowers become more credit constrained and some profitable investments will not be carried out; the real economy suffers a loss.

Fire sales related externality can be quite acute for banks because of their business model of liquidity, maturity and credit transformation. In downturn, given their mostly liquid liabilities as opposed to illiquid assets banks are exposed to the risk of having to liquidate assets prematurely in case of a sudden withdrawal of deposits or whole sale funding. Excessive reliance on short-term and mostly noncore

[7] In addition, recent papers on macroprudential regulation also identify another source of externality which does not rely on the existence of incomplete market: aggregate demand externalities [Farhi and Werning (2013) and Korinek and Simsek (2014)]. Relying on the situations with nominal price and wage rigidities and macroeconomic stabilisation constraints in the form of a zero lower bound for monetary policy they justify financial market interventions to correct aggregate demand externality due to household deleveraging.

[8] This section is largely depends on the excellent work by De Nicoló, Favara, and Ratnovski (2012). I have also utilised Borchgrevink, Ellingsrud and Hansen (2014) and (Brunnermeier, Crockett, Goodhart, Persaud, and Shin 2009) to a great extent in writing this section.

(wholesale) debt often exacerbates this fire sale problem. The heart of the matter is that banks fail to internalise the fire sale related general equilibrium effects of their liquid and short-term funding while they enjoy the benefits from cheap debt financing. On the other hand, this ex-post fire sale problem that the financial sector in particular and the economy in general face in downturns is mostly the result of over-borrowing taking place in booms which is again related to the fact that agents do not internalise the adverse general equilibrium effects of their borrowings. As a result, the economy faces too much debt compared to the social optimum.

The second type of externality is interconnectedness externalities which stem from the interconnected nature of the financial sector business, especially the banking sector. The banking business, for example, makes banks portfolios correlated and balance sheets interlinked. Even an idiosyncratic shock hitting just a single bank is then likely to hit the whole banking sector. In particular, interbank exposures of banks aggravate this interconnectedness externality. Of course, shocks hitting to systemically important financial institutions (SIFIs) will likely to generate much larger externalities, since they are complex, operate internationally, and play a role as backbones of the financial infrastructure. Again, to the extent that financial intermediaries do not take into account the effects of their actions on the risk in other institutions and the financial system as a whole, interconnectedness externalities can lead to financial instabilities by excessively exposing the financial system to shocks and contagion.

Externalities related to strategic complementarities, that arise from the strategic interactions of banks and other financial institutions and agents, cause the build-up of vulnerabilities during the boom phase of a financial cycle and the magnification of vulnerabilities in downturns. Strategic complementarities are present when the agents mutually reinforce one another. There are several sources of strategic complementarities. The classic one is bank runs of the Diamond-Dybvig banking model. Depositors withdraw cash from their bank accounts in expectation of deposit withdrawals by other depositors. In the presence of interconnected externalities even a bank run on one troubled bank have the potential to lead to a complete shut-down of the financial system because of similar runs on other banks if depositors expect the other banks to be in similar difficulties. There are various sources of complementarities such as increased competition in boom times among banks, implicit government guaranties provided to banks and etc. They can generate excessive risk taking through asset communality. Having exposed to the same type of risk and the same quality of portfolios financial intermediaries also find these vulnerabilities deepened and leading to the downside of a financial cycle.

4. Macroprudential policies

In the lights of the recent developments, financial stability has become one of the key policy objectives and its policy instrument is macroprudential policy along with microprudential regulation. However, developing macroprudential policies is a work in progress since there are number of issues related to the use of macroprudential

policies.[9] It starts with developing metrics for financial stability or systemic risk. Such metrics should incorporate: (i) the growth in total credit and macroeconomic drivers of imbalances; (ii) financial between each sector and the rest of the world; and (iii) the structure of the financial system and linkages within and across key classes of intermediaries and market infrastructures. The scope of systemic risk necessitates several measures as opposed to a single metric[10] and requires the use of market intelligence and soft supervisory information on trends and market developments as well as supervisory and statistical data. In this regard, it is worth noting that this underscores the significance of the G20 Data Gaps initiative with a set of 20 recommendations on the enhancement of economics and financial statistics in closing data and information gaps.

Once metrics of systemic risk have been established, there are other points need to be taken account in order to identify effective macroprudential policy measures to mitigate systemic risk and financial vulnerabilities. They include the goals and scope of macroprudential policy, the existence of a strong supervisory and enforcement system, the support of appropriate monetary, fiscal and other financial sector policies, a well-constructed macroprudential toolkit and the strong institutional and governance frameworks.[11] This process of identifying measures and constructing a policy and institutional framework for a successful implementation of macroprudential policy is also a difficult task to accomplish as macroprudential policies interact strongly with other economic policies including macroeconomic policies and CFM measures. In this process, policy makers also have to pay attention to the spillover effects of macroprudential policies in foreign jurisdictions on their domestic economies. The recent research finds that the level of financial market development is a key determinant for an effective macroprudential policy framework. Indeed, the successful implementation of macroprudential policies for the world as a whole needs to take into account cross-border implications of macroprudential policies as well. This calls for international coordination.

To introduce economic rationale into the discussion of macroprudential policy and to assess the effectiveness of macroprudential policies, one can view macroprudential policy as a tool to correct externalities that create systemic risk or financial instability. Specifically, this approach maps externalities related to strategic complementarities, fire sales and interconnectedness with the following macroprudential policy proposals: capital instruments, liquidity instruments and credit instruments, taxation and resolution procedures. Capital-related instruments

[9] On the one hand, academic papers are making progresses in their analysis of macroprudential regulation issues. On the other hand, international organisations, namely the IMF, BIS, FSB, WB and OECD have produced several official and staff written papers on the topic. For example, as part of its surveillance function the IMF has produced policy papers on macroprudential regulation: see (IMF 2013).

[10] The Macroeconomic Imbalance Procedure of the European Union is an exemplary mechanism with a scoreboard of indicators to identify potential risks early on. See "European Parliament, 2011a. Regulation (EU) no 1174/2011 of the European Parliament and of the Council of 16 November 2011" and "European Parliament. 2011b. Regulations (EU) no 1173-1177/2011 and Council Directive 2011/85/EU."

[11] For a book level discussion of these topics see Freixas, Laeven, and Peydro (2015). For an article level but still comprehensive treatment of macroprudential policy tools see (Claessens 2014).

include countercyclical capital requirements including dynamic provisioning, leverage ratios, and restrictions on profit distribution.[12]

Liquidity instruments include limits on maturity mismatch and reserve requirements. Credit instruments include restrictions on bank activities, assets and liabilities such as caps on loan-to-value (LTV) ratios, caps on debt-to-income (DTI) ratios, and ceilings on credit or credit growth.

Externalities and macroprudential policies Table 2

Externalities due to	*Can be addressed by*				
	Capital instruments	Liquidity instruments	Capital instruments	Liquidity instruments	Resolution mechanism
Strategic complementarities	X		X		
Fire sales	X	X		X	
Interconnectedness	X		X	X	X

Note: This Table is a slightly modified version of Table 1 in De Nicolo´, Favara, and Ratnovski (2012).

As depicted in Table 2 there are two types of policies used to correct externalities related to strategic complementarities: countercyclical capital requirements (surcharges) and restrictions on bank asset allocation. The Basel III accords capital surcharges on excessive aggregate loan growth are introduced to mitigate excessive risk-taking during credit expansions, inducing banks to internalise more of the cost of engaging in risky lending. Basel III also introduced sector specific capital requirements in order to control exposures to specific assets, such as real estate loans. On top of capital requirement tools which target supply of credit several countries have also introduced tools targeting demand for credit. They include caps to loan-to-value (LTV) and debt-to-income (DTI) ratios and are meant to address undesirable procyclicality in lending standards: lax during boom times and tight during downturns. These quantity restrictions together with sector specific capital requirements are aimed at preventing banks from taking large risk exposures. To the extent that these tools limit asset growth in the upturn of the credit cycle the cost associated with adjustments in downturns will be lower than otherwise.

Countercyclical capital buffers of Basel III are also corrective measures for pecuniary externalities, ie externalities related to fire sales as they aim at inducing banks to internalise the ex-post general equilibrium effects of their excessive and/or risky lending in normal times. Setting higher time-varying capital requirements in upturns lessens these externalities, by reducing the incentives for risk-taking in booms. In addition, having higher levels of capital serves as a buffer to offset losses and hence reduces the risk of selling assets at fire sale prices in downturns. Likewise, Basel III uses liquidity requirements (such as the liquidity coverage ratio and the net stable funding ratio) to ensure banks have adequate liquidity buffers when bank funding markets are disrupted. A related way to limit the use of noncore funding is to rely on taxes (a levy) calibrated to the cost difference between core and non-core funding as well as long- and short-term funding.

[12] Broader interpretations of macroprudential policy measures also consider the traditional flat capital requirement as policy instruments. The claim is that higher flat capital requirements weaken the problems caused by limited liability, thus decreasing the likelihood of fire sales, credit crunches, flights to quality, and asset commonalities [Basso and Costain (2016)].

As for corrective measures for interconnectedness externalities, there are four regulatory tools reported in Table 2. Resolution procedures for global systemically important banks (GSIBs) are a more obvious and specific measure. For example, the G20 instigated total loss-absorbing capacity (TLAC) standard is designed so that failing GSIBs will have sufficient loss-absorbing and recapitalisation capacity available in resolution for authorities to implement an orderly resolution that minimises impacts on financial stability, maintains the continuity of critical functions, and avoids exposing public funds to loss. With this better and faster resolution of banking crises the ultimate aim is to mitigate potential spillovers through the banking network. In this regard, capital surcharges linked to a measure of systemic importance introduced in 2011 by the BIS aim to require the firms themselves to bear the costs that their failure would impose on others. Interconnectedness is intrinsic to payments and securities systems and therefore a framework to oversee these markets systems is needed to decrease systemic risk.

In addition, there are also restrictions on the asset composition of GSIBs imposed in some countries. These restrictions are intended to reduce GSIBs' risky activities by limiting their proprietary trading activities. As for taxes, Pigouvian taxes, based on a measure of systemic risk externalities, can be also used to reduce systemic risk by forcing GSIBs to internalise the systemic risk they create.

5. The "Macroprudential policy: effectiveness and implementation challenges" conference

The first session of the conference was on "Macroprudential Policy and its Interactions with Other Policies" and all the three papers presented in this session appear in the conference volume. Luc Laeven's presentation on "Policies for Macrofinancial Stability: How to Deal with Credit Booms?" empirically examines the triggers of credit booms and importantly explores the types of credit booms ending up busts. In particular, the paper considers the role of monetary, macroprudential, and other policies in curbing credit growth and mitigating associated risks, including the fallout on the real economy from credit busts. The paper concludes that credit booms are associated with financial liberalization, buoyant economic growth, fixed exchange rate regimes, weak banking supervision and loose macroeconomic policies. His findings also establish that not all credit booms are bad, with only one-in-three booms ending up in crises, and that it is difficult to identify bad booms as they emerge. Unlike monetary and fiscal policies, he argues, macroprudential policies can be effective in containing booms and in limiting the consequences of busts. But circumvention of these macroprudential policies can undermine their effectiveness. In addition, monetary policy should act first and foremost when credit booms coincide with periods of a general overheating in the economy,

In a similar vein, the paper on "Credit cycles and capital flows: effectiveness of macroprudential policy framework in emerging countries" by Ahmet Faruk Aysan, Salih Fendoğlu, Mustafa Kılınç and Sümeyye Yıldız construct macroprudential policy index for a variety of macroprudential tools in order to evaluate the effectiveness of macroprudential tools from the perspective of emerging countries. Their identify empirically effective macroprudential policies that help cushion the economy from volatile capital flows. They also consider interactions among the tools and their unintended consequences. Overall, the findings of the paper support the use of

macroprudential policy measures in supporting macrofinancial stability in emerging countries: macroprudential tools targeting demand for credit (borrower-based measures) and domestic measures are successful in containing real credit growth where tools affecting supply of credit (financial-institutions-based measures) are effective in reducing sensitivity of credit growth to cross-border capital flows.

The recent experience with macroprudential policy measures across the world has coincided with the implementation of unconventional monetary policies in advanced economies and unorthodox policies in emerging economies. Exploring interactions between monetary policy and macroprudential regulation is therefore important. Erlend Nier's paper on "Monetary and macroprudential policies: exploring interactions" provides a concise analytical discussion and empirical examination of this issue. The Nier work identifies three areas in which monetary and macroprudential policies interact: (i) the impact of a range of "side effects" of monetary policy on financial stability; (ii) dampening "side effects" of macroprudential policy on output; and (iii) macroprudential policy can build buffers that can be relaxed in periods of financial stress. He then, based on his empirical analysis, correspondingly provides factors and conditions on: (i) how macroprudential policy contain monetary side effects effectively; (ii) how strong the side effects of macroprudential policy on output are; and (iii) how effective can be a relaxation of buffers in periods of stress. His final interest is to offer implications for the institutional set-up.

Spillover effects of macroprudential policy tools were covered in Session 2 and there were three presentations which will all appear in the conference volume. The paper by Bálint Horváth and Wolf Wagner on "Macroprudential policies and the Lucas Critique" reminds us that there may be unintended consequences of the implementation of new policies such as the recent macroprudential regulation. Their result is rooted in the Lucas Critique and accordingly highlights the importance of financial intermediaries' reactions to this new modified financial architecture. The paper discusses several areas in which such adjustment behaviour is likely and derive suggestions for how macroprudential policies can be improved to limit such problems. They recommend that regulators should pay more attention to the dynamic implications of new macroprudential instruments.

The second paper of this session was "Cross-border spillovers from macroprudential policy in the euro area" by Luca Nocciola and Dawid Zóchowski. Their study aims at uncovering and measuring cross-border effects of macroprudential regulation in the euro area using a large global banking data set on cross-border banking flows. Their results underscore the importance of cross-border spillovers on loan growth but also highlight that the sign and the magnitude of the spillovers depend on the ownership structure of the bank; the type of instrument; how the policy stance is measured; the timing of implementation; and the bank balance sheet and country characteristics. They conclude that their findings speak for stronger reciprocity arrangements in order to mitigate leakages.

The work of Kristin Forbes, Dennis Reinhardt and Tomasz Wieladek on "The spillovers, interactions, and (un)intended consequences of monetary and regulatory policies" takes an advanced, financial centre economy (the United Kingdom) perspective on regulation in the presence of unconventional monetary policy and tries to answer whether their possible interactions have been a factor behind the recent "deglobalisation" in cross-border bank lending or not. Their result suggest that the use of microprudential capital requirements tend to reduce international bank lending. Also, the Funding for Lending Scheme to revive domestic credit growth

significantly amplified the effects of increased capital requirements on external lending. This paper highlights the unintended consequences of domestic policies as it finds that unconventional monetary policy designed to support domestic lending can have an adverse impact on the foreign lending of banks in the United Kingdom.

In the third session, presenters discussed the impact of external shocks on macroprudential policies. Philip Turner chaired the session and afterwards extended his introductory remarks to a short paper under the title "External shocks, the exchange rate and macroprudential policy" for the conference volume. The paper discusses the exchange rate and the interest rate on local currency bonds and stresses that they are key endogenous variables in the transmission of external shocks (financial and real) to small open economies. He concludes that analyses of macroprudential policy choices need to have a convincing "story" for both variables.

The paper "Capital flows, credit cycle and investment: the role of macroprudential policy" by Yusuf Soner Başkaya, Julian di Giovanni, Sebne Kalemli-Özcan, José-Luis Peydró and Mehmet Fatih Ulu analyse the impact of external factors such as capital flows and changes in global risk premia on loan growth in Turkey by taking into account all firm-time and bank-time factors. The paper considers loans in different currencies and borrowers as exporters versus non-exporters. In this large framework, the main question is the effectiveness of macroprudential policies on loan growth in different currencies and the impact of capital flows on firm-level real outcomes such as investment. The richness of the paper allows a better analysis of the transmission channels of capital flows and policies. Their main finding is that macroprudential policies decrease the sensitivity of domestic loan growth to capital flow cycle, both total loans and FX loans.

The second presentation of the session by José-Luis Peydró focussed on a comprehensive analysis of macroprudential policies during credit and asset cycles by providing evidence from some countries. He explained the theory and practice of credit and asset cycles and corresponding macroprudential policies as covered in his co-authored book (Freixas, Laeven and Peydró, 2015). His joint work on Spanish dynamic provisioning experiments highlights the role countercyclical bank capital buffers on credit supply (Jiménez, Ongena, Peydró and Saurina Salas, 2012). He also examines macroprudential regulation by modelling credit supply by banks together with their securities trades (Abbassi, Iyer, Peydró and Tous 2016).

The session's last presentation was by Franz Hamann on "Monetary and macroprudential policies in an oil-exporting economy". Hamann discussed monetary and macroprudential policies in an oil-exporting economy like Columbia which is subject to large, sudden and persistent commodity price swings. Using a small open DSGE framework, it is argued that efficient credit allocation between tradable and nontradable sectors is disturbed by sectoral financial frictions. The paper points out an interesting result: general purpose macro- prudential policy, ie policies targeting aggregate credit, may amplify these inefficiencies.

On the first "country experiences" session, the Governor of the Central Bank Croatia, Boris Vujčić, provided an authoritative account of "managing systemic risk in the Croatian economy". Croatia experienced excessive capital inflows in the pre-GFC period which coincided with financial liberalisation and investors' exuberance. These developments fuelled strong credit growth in foreign currency as well as domestic currency and led to a rapid accumulation of external imbalances. The authorities in Croatia respond decisively and timely to this sharp deterioration in the two robust crisis predictors, namely domestic credit growth and real currency appreciation by

introducing the then very unconventional set of policies including macroprudential regulation and marginal reserve requirements with significant successes in moderating banks' credit growth and curbing banks' foreign indebtedness. Accumulated buffers during the pre-crisis period were also effectively used to support the Croatian Economy during the downturn after the GFC in a countercyclical fashion.

Santiago García-Verdú presented his joint paper titled "Macroprudential policy regulation: continuing challenges" with Manuel Ramos-Francia which analyses the externalities created by global asset management companies due to run-like dynamics in their investment decisions. It is potentially a systemic risk mainly affecting emerging market economies and as such a continuing macroprudential policy regulation challenge. They find evidence of the presence of run-like dynamics in bond flows to and from EMEs. They also find that changes in US monetary policy affect such dynamics, and that the strength of such effects could have increased since 2013.

Session five focused on the interaction between cyclical and prudential risks. The pressing matter with macroprudential regulation is to understand and improve the effectiveness of macroprudential policy tools. Empirical work on macroprudential policy is still at early stage and often relies on aggregate data to draw policy conclusions. In this regard, the paper by Eugenio Cerutti, Stijn Claessens and Luc Laeven attempts to provide new evidence on the use and effectiveness of macroprudential policies. They investigate the effects of macroprudential policies on procyclicality. In particular, their paper tries to answer the question 'how do macroprudential policies affect credit growth and house prices?' and identity effective instruments. Claessens claimed that microprudential rules (eg higher capital requirements) can create some procyclicality, and that macroprudential policies could correct these. He also highlighted the pattern observed in several country cases that quantitative macroprudential measures tend to become less effective as real incomes rise.

The work of Yusuf Soner Başkaya, Turalay Kenç, Ilhyock Shim and Philip Turner takes the effectiveness analysis to financial development and analyses the impact of different levels of financial development on the effectiveness of macroprudential policies more precisely in terms of quantity-based and price-based macroprudential policy measures. They show that the stage of financial development is a key determinant in the choice between quantity and price based macroprudential policy measures. Given the coimplementation of capital flow management measures and macroprudential policy measures (especially by emerging market economies) and the potential interactions between them, their work also examine their interactions and impacts on the effectiveness of price-based and quantity-based macroprudential measures.

The second "country experiences" session is chaired by Erlend Nier. In the paper titled "housing market dynamics and macroprudential policy tools: the UK's recent experience" David Aikman elaborates the design and implementation of sectoral macroprudential policy tools on the UK housing market in the presence of strong and rising house price inflation. Such case studies are important as real estate lending booms are typically followed by deeper recessions and slower recoveries. In the UK case, the authorities use the capital-based tools (affecting supply of credit) – countercyclical buffer and sectoral risk weights – and the product-based tools (affecting demand for credit) – LTV and DTI ratios to slow down house price inflation. The paper provides some early evidence on the effectiveness of this policy initiated in 2014 and finds that the share of lending with LTI > 4.5 was 1% point lower by

end-2014. The paper by Dong He, Erlend Nier, and Heedon Kang also looks into the effectiveness of macroprudential policy measures in addressing housing sector risks.

With a similar purpose to the Başkaya, di Giovanni, Kalemli-Özcan, Peydró and Ulu paper discussed above (but using a different approach), Hara Kara also discusses the effectiveness of the macroprudential policies implemented in Turkey in the wake of GFC on curbing rapid loan growth in general and consumer loan growth in particular. Based on economic and financial developments he concludes that macroprudential policies in Turkey have brought about a soft landing and improved sustained growth prospects by lowering the sensitivity of economic activity to capital flow volatility considerably.

David Hargreaves provided an empirical analysis of the macroprudential policy experiment of New Zealand over the last five years. His reflections on the role of macroprudential policy based on New Zealand experience include: (i) that cyclical macroprudential policy is complicated, and is no substitute for striving for the appropriate permanent policy settings; (ii) that the potential relationship between monetary and macroprudential policy in recent years is complicated; and (iii) that very low interest rates in major advanced economies can be detrimental to financial stability in both advanced and emerging market economies.

In the penultimate session on "Microprudential and macroprudential links and policy frameworks", Jean-Pierre Landau provided an ex-policymaker's account of macroprudential policy effectiveness. His presentation raised several questions on this issue. Focusing on maturity transformation he highlighted areas where macroprudential policy measures may lead to ineffective outcomes. In her presentation on "key elements of an institutional framework for macroprudential policy", Inci Ötker-Robe underscores the risks of macroprudential policy inaction and too much action due to the lack of clear assignment of power mandate responsibilities. A strong and effective institutional framework is there- fore essential to reduce these two risks by clarifying the objectives and assigning the macroprudential policy mandate to ensure timely/forceful/appropriate policy action. In particular, it is essential is to guard against political/industry pressures to delay action, to provide legal foundation for using macroprudential policy and to help ensure macroprudential policy is not used beyond its call of duty. The existence of several different institutional frameworks indicates the case of no one-size-fits-all as they mostly reflect specific circumstances of the countries in terms of their history, legal environment, resources, size/complexity of financial systems. But there are some common desirable elements including a major role for the central bank and the importance of government participation.

The concluding session was a policy panel, chaired by Luiz Pereira da Silva, Deputy General Manager of the BIS. Otaviano Canuto said that the effectiveness of macroprudential policies depended on specific circumstances (Agénor and da Silva (2014)). He echoed the view expressed by some speakers that macroprudential policies tended to work better in booms, but in recessions monetary policy had to be used. For emerging markets, capital flows/commodity price swings played key roles. Because there is no one-size-fits-all, we are unlikely to develop a framework for macroprudential policy as standardised as that which had emerged for monetary policy.

Athanasios Orphanides worried about the uncertainty (which model? what transmission mechanism?) which bedevilled macroprudential policy. He did not agree that such uncertainty justified greater discretion in policy because the "temptation to

find the optimal decision at every single step" as economic conditions evolved ran the risk of dynamic inconsistency. As with monetary policy, he said, the need is for simple rules that can be explained to Ministers or the public. But most others did not believe simple standardisation would be either feasible or desirable. Uniform prudential standards set too high could lead to serious welfare losses – targeted policies are more efficient.

Turalay Kenç reminded everybody that what we now call macroprudential policies (eg reserve requirements) had been used also in the United States and other advanced economies before the 1980s. The subsequent neglect by advanced economy central banks of credit aggregates had been a mistake. One participant asked the panel whether central banks were not converging to a new world of very low interest rates if most of them chose to tighten macroprudential policy rather than monetary policy because of fear of exchange rate appreciation/volatility.

He Dong (IMF) said the IMF encouraged members to experiment with different macroprudential tools, and adapt policy pragmatically. He wondered whether there was a case for relaxing macroprudential policies in EMEs facing heavy capital outflows. The IMF would analyse the boundaries of such policies, notably considering how to apply them to asset management companies.

Luiz Pereira da Silva warned that macroprudential tools were not silver bullets that would solve complex financial stability issues – but had to be complemented by aggregate demand policies. Capital flows had an impact on the domestic cycle, influenced local financial conditions and created forex risks. He said that policy response to large and persistent movements in capital flows and exchange rates was high on the BIS agenda. Recent BIS research had identified a risk-taking channel of currency appreciation (Hofmann et al, 2016). With national boundaries no longer defining the decision-making unit or the currency area, the analytical frameworks underlying open economy macroeconomics need rethinking.

6. Conclusion

The GFC has led to the revival of macroprudential regulation and the birth of many new instruments. Experience with these measures is still at an early stage. The fine-tuning of existing macroprudential policy tools and its institutional framework continues. There are still a number of issues to be ironed out: effective macroprudential policy tools; rule-based versus discretionary policies, its interactions with other macroeconomic policies especially monetary policy, effective institutional frameworks, international policy coordination and so on.

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Credit cycles and macroprudential policy framework in emerging countries[1]

Salih Fendoğlu[2]

Introduction

Due to large and unprecedented quantitative easing policies and the prevailing policy uncertainty in advanced economies, many emerging countries have faced large and excessively volatile short-term capital flows during the recent era. If not managed properly and timely, such flows can give rise to an amplified cycle of steady appreciation of the currency, a strong rise in asset prices, looser credit market conditions, and build-up of balance sheet risks. This fragility may eventually trigger a sudden reversal of such flows (often called "sudden stop"), leading to a sharp currency depreciation and a large contraction in credit and output.[3] In turn, to reduce the build-up of financial stability risks and contain 'excessive' cycles in credit market conditions, emerging countries have increasingly utilised macroprudential policy tools.[4]

In this paper, we assess how macroprudential policy tools perform in major emerging countries in containing 'excessive' credit cycles. In particular, we first compile an index of policy stance for widely used macroprudential tools, using existing databases on macroprudential policy actions and national sources.[5] We then study whether changes in the policy stance contain 'excessive' cycles in domestic

[1] We would like to participants at various conferences and workshops for helpful suggestions. The views expressed here are those of the authors and should not be interpreted as reflecting the views of the Central Bank of the Republic of Turkey.

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[3] There is a large literature on the effect of sudden stops on emerging country business cycles. Among many, see Calvo (1998), Caballero and Krishnamurty (2004), Calvo et al (2008), Mendoza (2006, 2010), Bianchi (2011), and for a review of the literature, Korinek and Mendoza (2013). For empirical evidence at a micro-level, see Altunok et al. (2016).

[4] This goes without emphasising that various countercyclical financial regulatory practices in the spirit of, as now known, macroprudential policies have been implemented in early decades (eg, see Elliott et al (2013) and Brunnermeier and Schnabel (2015) for advanced economies). What makes the recent era unique is much frequent and systematic use of such tools and the strong emphasis on (and better understanding of) the soundness of the whole financial system (beyond that of individual institutions) in a highly interconnected financial system within and across national borders. See Crockett (2000), Borio (2003) and Clement (2010) for early discussions on "macroprudential" policy, and Lim et al (2011), Galati and Moessner (2013), Claessens (2014) and Bruno et al (2015) for a thorough review of the recent literature.

[5] We use the databases on macroprudential policy actions presented in Lim et al (2011, 2013), Shim et al (2013) and Cerutti et al (2015). The country set is a panel of 18 major emerging countries (Brazil, Bulgaria, Chile, Colombia, Croatia, the Czech Republic, Hungary, Indonesia, Korea, Malaysia, Mexico, the Philippines, Poland, Romania, Russia, South Africa, Thailand and Turkey) for the period of 2000Q1–2013Q2. Our choice for the country set and time span is mainly based on the availability of data on macroprudential policy actions and domestic credit.

credit, and particularly from the perspective of emerging countries, whether they help contain excessive credit cycles due to fluctuations in capital inflows.

Assessing the performance of a macroprudential policy framework at a multiple-instrument multi-country level is challenging. First, there are many macro-financial targets against which the effectiveness of macroprudential tools can be evaluated. Even if one focuses on a single aggregate target, most notably credit growth, as a potential measure of risk-taking and build-up of financial imbalances, an important concern prevails: more credit might very well mean financial deepening and better access to financial services, and therefore, foster investment and output. Moreover, while 'excessive' fluctuations in credit (eg cyclical credit growth or credit-to-GDP gap) can be taken as a proper target variable, misjudging what might be an 'excessive' level may eventually yield misleading results. Second, the type and intensity of macroprudential policy actions differ significantly across countries and over time.[6] A simplification, therefore, is often made in multi-country analyses by using the number of tools in place to infer the macroprudential policy stance. This approach, however, can be quite restrictive for frequently used tools. Last, macroprudential policies in emerging countries should in principle help make the economy more resilient to adverse external factors, and therefore, a crucial additional dimension, often missing in this very literature, is whether macroprudential policies, particularly those that are tailored to tame the effect of capital flows on domestic cycles, can moderate 'excessive' credit cycles due to swings in capital inflows.

In this paper, we take a step forward to address these challenges. We consider several measures of 'excessive' credit against which we assess how macroprudential tools perform.[7] Since credit creation necessarily involves risk taking, an excessive growth in credit may indicate significant risk taking and pose a significant threat to real economic activity. Indeed, a historically high level of credit (beyond its long-run trend level) is widely recognised as a robust indicator for the build-up of financial imbalances.[8] Along these lines, we use a credit-to-GDP gap using a recursive (one-sided) long-run trend as our main target credit variable. For reasons discussed in Fendoglu (2016) in detail, we also consider the credit-to-GDP gap using a recursive medium-run trend, change in credit-to-GDP ratio and an indicator variable for 'credit boom' as defined by Dell'Ariccia et al (2012) as alternative measures of excessive credit.

[6] In essence, macroprudential policy tools can be `desirable' only if they mitigate certain externalities within the economy. While examples of heterogeneity in the use of macroprudential tools are numerous, an example could be the use of LTV cap (which can be regarded a priori as easier to quantify and compare across the economies). An LTV cap might be implemented for specific segments of property market (residential versus commercial real estate), for specific regions (tighter policy for speculative metropolitan areas) and for different assets (real estate versus vehicles), which differs widely across countries and over time.

[7] On theoretical grounds, recent papers have contributed significantly to our understanding of the externalities that justify the use of macroprudential tools (eg externalities due to strategic complementarities, fire sales or interconnectedness). Among others, see Allen and Gale (2000), Caballero and Krishnamurthy (2003), Lorenzoni (2008), Fostel and Geanakoplos (2008), Korinek (2011), Bianchi (2011), Brunnermeier and Sannikov (2014), Korinek and Sandri (2015), Bianchi and Mendoza (2015). For an early review of this literature, see De Nicolo et al (2012).

[8] See, eg, Borio and Lowe (2004), Mendoza and Terrones (2008, 2012), Drehmann et al (2011), Dell'Ariccia et al (2012), Schularick and Taylor (2012), Drehmann and Tsatsaronis (2014), BCBS (2010) and IMF (2011a, 2011b).

Second, the index of macroprudential policy stance that we have compiled takes into account potential heterogeneity in the use of tools as well as the intended policy direction (easing or tightening). In particular, we consider policy actions regarding widely used macroprudential tools: caps on loan-to-value (LTV) and debt-service-to-income (DSTI) ratios, countercyclical capital requirements, time-varying/dynamic loan-loss provisioning, restrictions on foreign currency lending, and limits on net open currency position. For each tool, the macroprudential policy stance index takes successively higher values for tightening and successively lower values for easing actions. By reflecting the policy direction (tightening or easing) in the index, we provide a more complete picture on the actual use of macroprudential tools at a multi-country level.

We further take into account whether the policy action regarding a specific tool is geared towards general domestic purposes or towards capital flow management (CFM) purposes (eg higher risk weights on foreign-currency (FX) loans as a currency-based CFM tool), which is particularly relevant for emerging countries. We then aggregate these individual indices into major categories: an index of policy stance regarding (i) borrower-based tools (MaPP-Bw); (ii) financial institutions-based tools (MaPP-FI); (iii) domestic-currency measures (MaPP-D); and (iv) FX-related measures (MaPP-FX).[9] Finally, we supplement the analyses with domestic or foreign currency-based reserve requirement policy actions (RR-D and RR-FX, respectively).

Figures 1 through 3 present the use of macroprudential and reserve requirement policies in emerging countries. They show that (i) borrower-based measures and countercyclical capital requirements on financial institutions are used much more frequently than the other tools; (ii) macroprudential policy actions, particularly financial institutions-based ones, have been undertaken increasingly more over time, where most actions are after the global financial crisis; (iii) FX-related macroprudential tightening actions have been undertaken much more frequently after the global financial crisis; and (v) domestic and foreign currency reserve requirements are used more frequently than the macroprudential measures, where the former is used mostly for cyclical purposes and the latter is tilted towards tightening.

To this end, we estimate the effectiveness of macroprudential policy actions in a dynamic panel framework.[10] Our set of control variables include monetary policy

[9] Similar classifications can be found in FSB/IMF/BIS (2011), Claessens et al (2013) and Cerutti et al (2015). We do not consider measures related to cross-sectional risks (eg limits on interbank exposures, capital surcharges on systemically important financial institutions or concentration limits) due to lack of available data. Moreover, regarding capital flow management tools, we confined our interest to FX-related macroprudential measures (which can also be labelled as currency-based capital flow measures). We did not include capital control measures since they are residency-based, only indirectly targeting macro-financial aggregates, and generally not taken as `macroprudential' policy actions.

[10] By macroprudential policy action, we specifically mean one-quarter change in the respective index. The results are by and large robust to using 2-,3-, or 4-quarter change in the index. Given the dynamic structure, we use Arellano and Bond (1991) GMM estimator that addresses the Nickell (1981) bias and ensures that the lagged endogenous variable is orthogonal to the residual. Moreover, the GMM estimator, by using lagged levels as instruments, mitigates potential endogeneity of macroprudential measures. We also would like to note that any remaining endogeneity would create an attenuation bias in our framework, ie a tighter MaPP is likely to reduce credit gap, whereas higher expected credit gap may lead to a tighter MaPP today. Therefore, our results should be read as a lower bound on the effectiveness of MaPP. In other words, a significant negative coefficient should be interpreted as a lower bound for the (absolute value) of the `true' coefficient. Moreover, quantifying the `true' intensity

stance, aggregate demand conditions (real GDP growth), a proxy for balance sheet conditions (annual change in the real exchange rate) and portfolio inflows (cross-border banking inflows-to-GDP ratio, following Bruno and Shin (2014)).[11]

Figures 4 and 5 present the summary of main results in Fendoglu (2016). Figure 4 provides the results for whether macroprudential and reserve requirement policy actions help contain the target credit variables we consider, and Figure 5 whether they help contain the sensitivity of the target credit variables to portfolio inflows.[12] In a nutshell:

- a tightening in macroprudential policy stance, most notably MaPP-Bw or MaPP-D, helps contain credit-to-GDP gap (both under long-run and medium-run recursive trends). While it is hard to draw a conclusion, borrower-based measures might be harder to circumvent or tightening actions on borrower-related measures might be finely calibrated and in turn such policy actions might be binding for a wider set of credit transaction counterparties.
- Financial institutions-based measures may also appear effective (eg, by reducing changes in the credit-to-GDP ratio). Our take is that while MaPP-FI class of tools can affect credit as it arises, the evidence is rather limited on whether the reduction in the credit per se can be comfortably regarded as desirable/appropriate.
- Financial institutions-related measures appear significantly effective, perhaps as expected, in reducing the sensitivity of credit gap to cross-border banking inflows (though for only the recent period and only mildly significantly). Yet, if we take a broader definition for portfolio inflows (eg net or gross portfolio inflows or net portfolio debt flows), a tightening in MaPP-FI appears counterproductive, pointing out potentially strong spillovers to unregulated segments of the financial system. On the other hand, MaPP-Bw and MaPP-D appear significantly effective in reducing the sensitivity.
- Domestic-currency reserve requirement tightening actions appear not significant in containing the target credit variables per se, but are strongly robust and significant in reducing the sensitivity of target credit variables to portfolio inflows. Foreign-currency reserve requirement tightening actions, on the other hand, appear by and large ineffective in containing excessive credit cycles.

In sum, regarding the question, "Can macroprudential policy tools help contain excessive credit cycles in emerging countries?" our answer is a broad yes, depending on the category of macroprudential policy tools considered. The evidence is rather strong for borrower-based and domestic currency-related macroprudential policy actions in containing the credit gap, financial institutions-based policy actions in

of macroprudential policy actions is challenging especially at a multi-instrument multi-country level. Thus, we would especially be encouraged if we find macroprudential measures significant in affecting the target variables.

[11] We gauge monetary policy stance by estimating a Taylor-type rule gap. In particular, we estimate unexpected movements in the short-term policy rate above and beyond what inflation and output would imply. The results are robust to including change in the real exchange rate in the policy rule. The results are also robust to using change in the policy rate or change in the M2-to-GDP ratio. For portfolio inflows, as we present shortly below, we also study gross portfolio flows, net portfolio flows, or net portfolio debt flows.

[12] In Figures 4 and 5, we consider the whole sample period as well as the recent period where most macroprudential policy actions are undertaken. The whole period corresponds to 2000Q1−2013Q2, and the recent period corresponds to 2008Q1 onwards.

reducing credit as it arises, and domestic reserve requirement policy tightening actions in reducing the sensitivity of target credit variables to portfolio inflows. The results are by and large stronger for the recent period.

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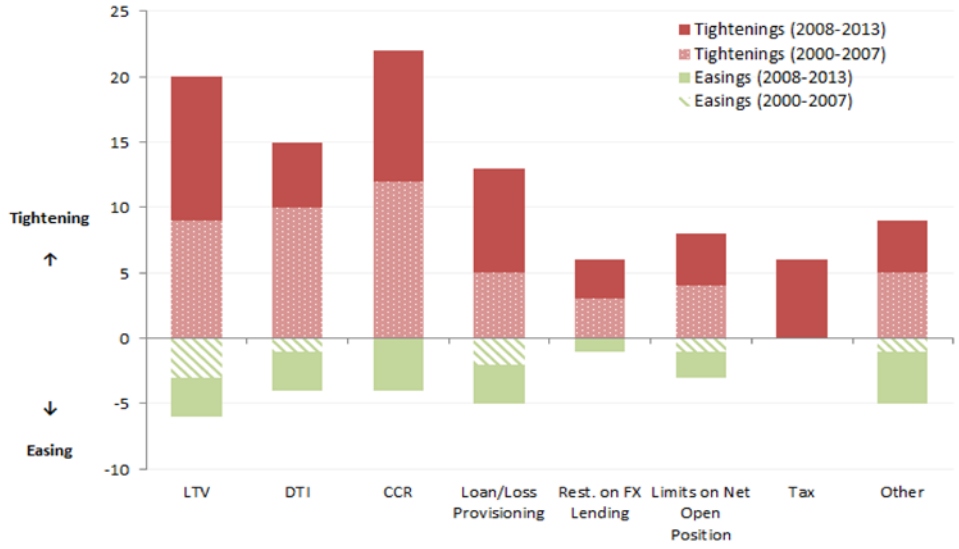


FIGURE 1. Use of Macroprudential Policy Tools (Aggregate number of tightenings versus easings in emerging countries). Sources: Authors' calculations based on Lim *et al.* (2011, 2013), Shim *et al.* (2013), IMF (2014), Cerutti *et al.* (2015), and country sources.

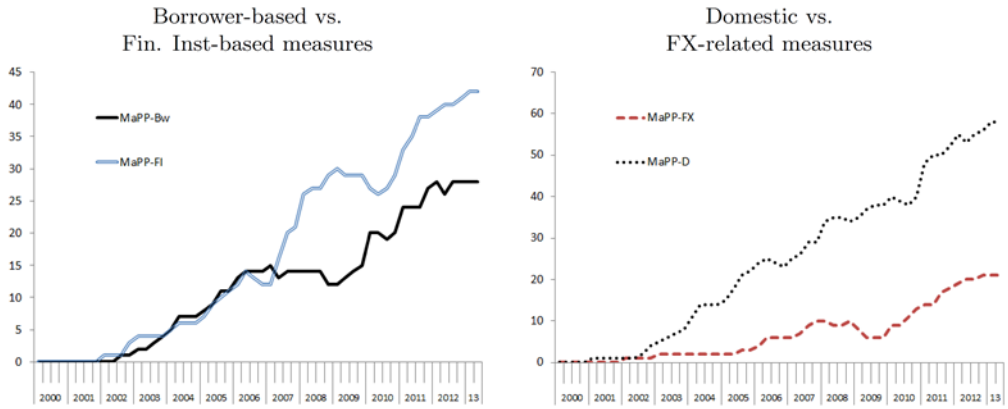


FIGURE 2. Macroprudential policy stance for emerging countries over time. MaPP-Bw denotes borrower-related measures, MaPP-FI denotes financial-institutions-related measures, MaPP-D reflects domestic macroprudential policy actions and MaPP-FX reflects FX-related macroprudential actions. Policy stance is measured as tightenings net of easings.

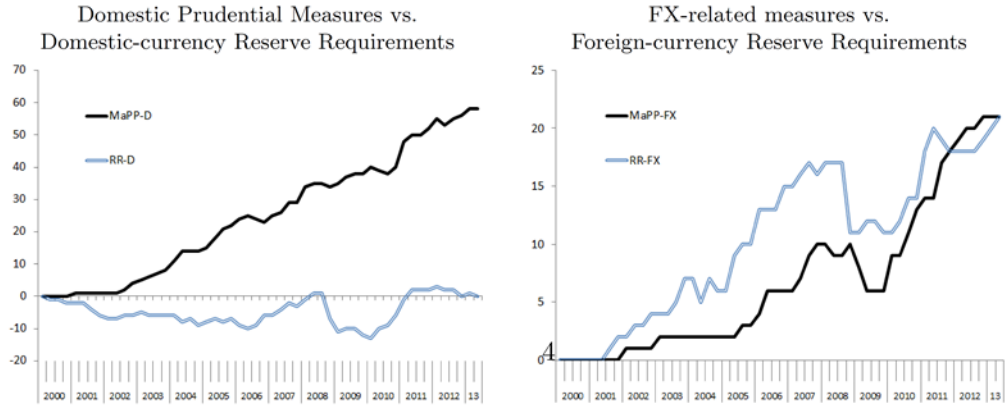
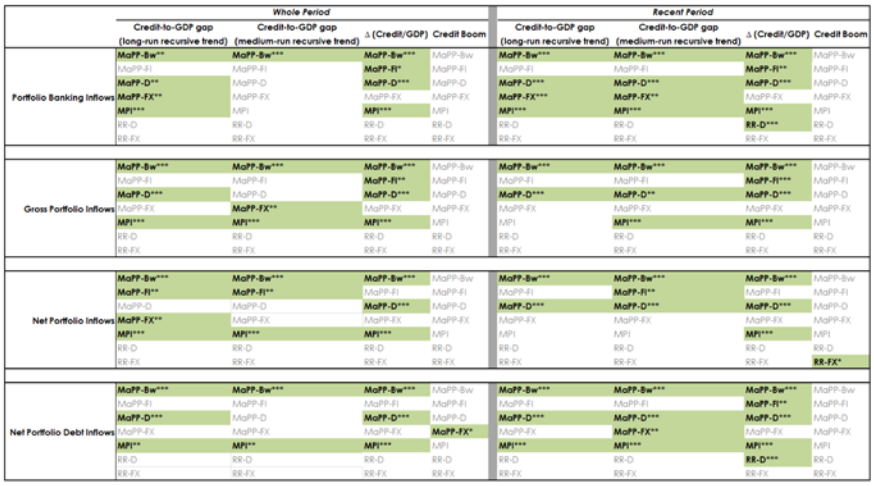


FIGURE 3. Reserve requirements and macroprudential policy stance over time.

FIGURE 4: CAN MACROPRUDENTIAL POLICY ACTIONS HELP CONTAIN EXCESSIVE CREDIT CYCLES?



	Whole Period				Recent Period			
	Credit-to-GDP gap (long-run recursive trend)	Credit-to-GDP gap (medium-run recursive trend)	Δ (Credit/GDP)	Credit Boom	Credit-to-GDP gap (long-run recursive trend)	Credit-to-GDP gap (medium-run recursive trend)	Δ (Credit/GDP)	Credit Boom
Portfolio Banking Inflows	MaPP-Bw**	MaPP-Bw***	MaPP-Bw***	MaPP-Bw	MaPP-Bw***	MaPP-Bw***	MaPP-Bw***	MaPP-Bw
	MaPP-FI	MaPP-FI	MaPP-FI*	MaPP-FI	MaPP-FI	MaPP-FI	MaPP-FI**	MaPP-FI
	MaPP-D**	MaPP-D	MaPP-D***	MaPP-D	MaPP-D***	MaPP-D***	MaPP-D***	MaPP-D
	MaPP-FX**	MaPP-FX	MaPP-FX	MaPP-FX	MaPP-FX***	MaPP-FX**	MaPP-FX	MaPP-FX
	MPI***	MPI	MPI***	MPI	MPI***	MPI***	MPI***	MPI
	RR-D	RR-D	RR-D	RR-D	RR-D	RR-D	RR-D***	RR-D
	RR-FX	RR-FX	RR-FX	RR-FX	RR-FX	RR-FX	RR-FX	RR-FX
Gross Portfolio Inflows	MaPP-Bw***	MaPP-Bw***	MaPP-Bw***	MaPP-Bw	MaPP-Bw***	MaPP-Bw***	MaPP-Bw***	MaPP-Bw
	MaPP-FI	MaPP-FI	MaPP-FI**	MaPP-FI	MaPP-FI	MaPP-FI	MaPP-FI***	MaPP-FI
	MaPP-D***	MaPP-D	MaPP-D***	MaPP-D	MaPP-D***	MaPP-D**	MaPP-D***	MaPP-D
	MaPP-FX	MaPP-FX**	MaPP-FX	MaPP-FX	MaPP-FX	MaPP-FX	MaPP-FX	MaPP-FX
	MPI***	MPI***	MPI***	MPI	MPI	MPI***	MPI***	MPI
	RR-D	RR-D	RR-D	RR-D	RR-D	RR-D	RR-D	RR-D
	RR-FX	RR-FX	RR-FX	RR-FX	RR-FX	RR-FX	RR-FX	RR-FX
Net Portfolio Inflows	MaPP-Bw***	MaPP-Bw***	MaPP-Bw***	MaPP-Bw	MaPP-Bw***	MaPP-Bw***	MaPP-Bw***	MaPP-Bw
	MaPP-FI**	MaPP-FI**	MaPP-FI	MaPP-FI	MaPP-FI	MaPP-FI**	MaPP-FI	MaPP-FI
	MaPP-D	MaPP-D	MaPP-D***	MaPP-D	MaPP-D***	MaPP-D***	MaPP-D***	MaPP-D
	MaPP-FX**	MaPP-FX	MaPP-FX	MaPP-FX	MaPP-FX	MaPP-FX	MaPP-FX	MaPP-FX
	MPI***	MPI***	MPI***	MPI	MPI	MPI	MPI***	MPI
	RR-D	RR-D	RR-D	RR-D	RR-D	RR-D	RR-D	RR-FX*
	RR-FX	RR-FX	RR-FX	RR-FX	RR-FX	RR-FX	RR-FX	
Net Portfolio Debt Inflows	MaPP-Bw***	MaPP-Bw***	MaPP-Bw***	MaPP-Bw	MaPP-Bw***	MaPP-Bw***	MaPP-Bw***	MaPP-Bw
	MaPP-FI	MaPP-FI	MaPP-FI	MaPP-FI	MaPP-FI	MaPP-FI	MaPP-FI**	MaPP-FI
	MaPP-D***	MaPP-D	MaPP-D***	MaPP-D	MaPP-D***	MaPP-D***	MaPP-D***	MaPP-D
	MaPP-FX	MaPP-FX	MaPP-FX	MaPP-FX*	MaPP-FX	MaPP-FX**	MaPP-FX	MaPP-FX
	MPI**	MPI**	MPI***	MPI	MPI***	MPI***	MPI***	MPI
	RR-D	RR-D	RR-D	RR-D	RR-D	RR-D	RR-D***	RR-D
	RR-FX	RR-FX	RR-FX	RR-FX	RR-FX	RR-FX	RR-FX	RR-FX

Notes. The category of tools are MaPP-Bw (borrower-based), MaPP-FI (financial-institutions-based), MaPP-D (domestic), MaPP-FX (FX-related), MPI (overall), RR-D (domestic-currency reserve requirement), and RR-FX (FX reserve requirement). ***, **, and * denote significance levels at 1%, 5%, and 10%, respectively, based on robust standard errors. A negative and statistically significant coefficient estimate (that is the respective category of tool appear helpful in containing the target credit variable) is highlighted with a light green background.

FIGURE 5: CAN MACROPRUDENTIAL POLICY ACTIONS HELP CONTAIN EXCESSIVE CREDIT CYCLES *due to portfolio flows*?

	Whole Period				Recent Period			
	Credit-to-GDP gap (long-run recursive trend)	Credit-to-GDP gap (medium-run recursive trend)	Δ (Credit/GDP)	Credit Boom	Credit-to-GDP gap (long-run recursive trend)	Credit-to-GDP gap (medium-run recursive trend)	Δ (Credit/GDP)	Credit Boom
Portfolio Banking Inflows	MaPP-Bw	MaPP-Bw	MaPP-Bw	MaPP-Bw	MaPP-Bw	MaPP-Bw***	MaPP-Bw***	MaPP-Bw***
	MaPP-FI	MaPP-FI	MaPP-FI	MaPP-FI*	MaPP-FI*	MaPP-FI	MaPP-FI*	MaPP-FI
	MaPP-D	MaPP-D	MaPP-D	MaPP-D	MaPP-D	MaPP-D*	MaPP-D	MaPP-D***
	MaPP-FX	MaPP-FX	MaPP-FX	MaPP-FX	MaPP-FX	MaPP-FX	MaPP-FX	MaPP-FX***
	MPI	MPI	MPI	MPI	MPI	MPI*	MPI***	MPI***
	RR-D**	RR-D**	RR-D	RR-D**	RR-D**	RR-D	RR-D	RR-D***
	RR-FX	RR-FX	RR-FX	RR-FX***	RR-FX	RR-FX	RR-FX	RR-FX***
Gross Portfolio Inflows	MaPP-Bw*	MaPP-Bw**	MaPP-Bw***	MaPP-Bw	MaPP-Bw***	MaPP-Bw***	MaPP-Bw***	MaPP-Bw
	MaPP-FI***	MaPP-FI***	MaPP-FI**	MaPP-FI	MaPP-FI***	MaPP-FI*	MaPP-FI**	MaPP-FI
	MaPP-D***	MaPP-D	MaPP-D***	MaPP-D	MaPP-D***	MaPP-D**	MaPP-D***	MaPP-D
	MaPP-FX	MaPP-FX*	MaPP-FX*	MaPP-FX	MaPP-FX	MaPP-FX	MaPP-FX	MaPP-FX
	MPI***	MPI*	MPI***	MPI	MPI	MPI**	MPI***	MPI
	RR-D***	RR-D***	RR-D***	RR-D***	RR-D***	RR-D***	RR-D***	RR-D***
	RR-FX	RR-FX	RR-FX	RR-FX*	RR-FX	RR-FX	RR-FX	RR-FX***
Net Portfolio Inflows	MaPP-Bw***	MaPP-Bw***	MaPP-Bw***	MaPP-Bw	MaPP-Bw***	MaPP-Bw***	MaPP-Bw***	MaPP-Bw
	MaPP-FI***	MaPP-FI***	MaPP-FI***	MaPP-FI	MaPP-FI	MaPP-FI*	MaPP-FI**	MaPP-FI
	MaPP-D***	MaPP-D***	MaPP-D***	MaPP-D	MaPP-D***	MaPP-D**	MaPP-D***	MaPP-D
	MaPP-FX	MaPP-FX	MaPP-FX	MaPP-FX	MaPP-FX	MaPP-FX	MaPP-FX	MaPP-FX
	MPI***	MPI***	MPI***	MPI	MPI**	MPI***	MPI***	MPI
	RR-D***	RR-D***	RR-D***	RR-D**	RR-D***	RR-D***	RR-D***	RR-D***
	RR-FX*	RR-FX**	RR-FX	RR-FX***	RR-FX	RR-FX*	RR-FX	RR-FX***
Net Portfolio Debt Inflows	MaPP-Bw*	MaPP-Bw	MaPP-Bw***	MaPP-Bw	MaPP-Bw***	MaPP-Bw***	MaPP-Bw***	MaPP-Bw
	MaPP-FI	MaPP-FI	MaPP-FI	MaPP-FI	MaPP-FI	MaPP-FI	MaPP-FI	MaPP-FI
	MaPP-D	MaPP-D	MaPP-D***	MaPP-D	MaPP-D*	MaPP-D**	MaPP-D***	MaPP-D
	MaPP-FX	MaPP-FX	MaPP-FX	MaPP-FX*	MaPP-FX	MaPP-FX	MaPP-FX	MaPP-FX
	MPI	MPI*	MPI***	MPI	MPI**	MPI	MPI***	MPI
	RR-D***	RR-D	RR-D*	RR-D	RR-D	RR-D	RR-D	RR-D
	RR-FX	RR-FX	RR-FX	RR-FX	RR-FX**	RR-FX	RR-FX**	RR-FX

Notes. The category of tools are MaPP-Bw (borrower-based), MaPP-FI (financial-institutions-based), MaPP-D (domestic), MaPP-FX (FX-related), MPI (overall), RR-D (domestic-currency reserve requirement), and RR-FX (FX reserve requirement). ***, **, and * denote significance levels at 1%, 5%, and 10%, respectively, based on robust standard errors. A negative and statistically significant coefficient estimate (that is the respective category of tool appear helpful in containing the sensitivity of target credit variable to portfolio flows) is highlighted with a light green background. A positive and statistically significant coefficient estimate is highlighted with a dark red background.

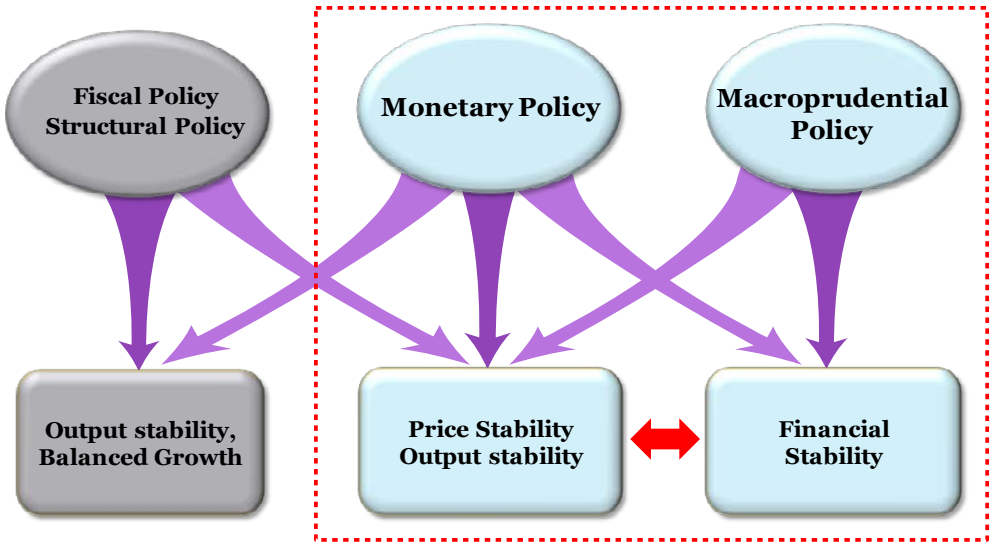
Monetary and macroprudential policies – exploring interactions[1]

Erlend Nier[2] and Heedon Kang[3]

1. Introduction

This article explores the interactions between monetary policy and macroprudential policy. The starting point is that monetary policy and macroprudential policy pursue different primary objectives – price (and output) stability for monetary policy, and financial stability for macroprudential policy. Nonetheless, the conduct of each policy can have "side effects" on the objectives of the other (Figure 1). We argue that, in the presence of such side effects, effective monetary and macroprudential policies complement each other, yielding superior outcomes to a world where monetary policy – or macroprudential policy – is pursued on its own and in the absence of the other policy. In particular, we explore the following three arguments.

Interactions among policies and objectives — Figure 1



- First, monetary policy can have a range of "side effects" on financial stability. However, macroprudential policy can attenuate these side effects, providing more room for maneuver for monetary policy to pursue its primary objective.

[1] The usual disclaimer applies: this article reflects the views of the authors and should not be represented as stating the views of the International Monetary Fund, its Management or its Executive Board.

[2] International Monetary Fund.

[3] International Monetary Fund.

- Second, the tightening of macroprudential policy tools can have dampening "side effects" on output. However, monetary policy can counter these effects, by adding accommodation at the margin, as long as monetary policy is effective.
- Third, macroprudential policy can build buffers that can be relaxed in periods of financial stress. Such a policy can help keep open the transmission of monetary policy, preserving the effectiveness of monetary policy in the event of such stress.

For each of these three "interactions", we also explore important empirical questions. Can macroprudential policy contain monetary side effects on financial stability effectively? How strong are the side effects of macroprudential policy on output? How effective is a relaxation of macroprudential buffers in periods of stress? This article draws on the results first reported in IMF (2013a) and IMF (2013b), and on further analysis conducted for this article on the effects of macroprudential measures for the sample of 36 countries over the period 2000–11 that was used in IMF (2013b).[4]

2. Side effects of monetary policy for financial stability

It is widely recognised that monetary policy can have side effects on financial stability. Most often, these days commentators focus on the potential for policy rates that are "low for too long" to result in a build-up of financial imbalances. What is sometimes less well recognised is that there can be multiple effects of policy rates on financial stability, with the sign and size of the net effects uncertain and depending on the stage of the financial cycle and capital account openness.

This section therefore starts by offering a brief taxonomy of the side effects that monetary policy can have on financial stability. We then argue that where the effects of monetary policy on financial stability are undesirable, macroprudential policy can attenuate them. Several effects can be identified that work through the behavior of borrowers, the risk-seeking behavior of banks and asset prices and exchange rates (Table 1).

Borrower balance sheets channel. As is well-known, monetary easing stimulates the demand for credit. Since lower interest rates may increase both debt affordability and the prices of assets offered as collateral, low interest rates can induce borrowers to take on more leverage, an effect sometimes termed the "borrower balance sheet channel" of monetary policy. A sizable empirical literature has found that lower interest rates lead borrowers to take on more debt (eg Bernanke, Gertler and Gilchrist, 1996; Jiménez et al, 2012) while a contractionary monetary policy lowers the value of collateral and thus reduces the availability of new loans to borrowers (eg Ciccarelli et al, 2010).

Default channel. A tightening of interest rates can adversely affect borrowers' credit quality, leading to higher default rates that can precipitate a crisis (Allen and Gale, 2000; Illing, 2007; Goodhart et al, 2009). This "default channel" of tighter monetary policy works through several mechanisms. Tighter interest rate policy increases debt repayment burdens, especially for variable-rate borrowers. By affecting economic activity, rate increases also reduce income flows and loan repayment capacity more generally. Increases in rates can finally lower borrower net worth, thereby curtailing

[4] A more extensive discussion is forthcoming in an IMF Working Paper by the same authors.

access to short-term credit and increasing the risk of default on existing debt (Gertler and Gilchrist, 1994).

Monetary policy effects on financial stability and tools to address the effects Table 1

Source of financial instability	Channel	Predicted effect when ↑ r (↑ improves stability)	Tools to contain side effects
Borrowing constraints	Balance sheet	↑	Caps on LTI or DSTI ratio
	Default	↓	
Risky behaviour of financial institutions	Risk-taking	↑	Capital buffers,leverage ratio
	Risk-shifting	↓	Net stable funding ratio, capital buffers
Externalities through aggregate prices	Asset price	↑	Limits on LTV ratio
	Exchange rate	↓	FX reserve requirements, limits on FX lending, Levy on FX non-core liabilities

Source: IMF staff.

Risk-taking channel. Low interest rates can boost banks' capital ratios, leading intermediaries to expand their balance sheets, increase leverage and reduce efforts in screening borrowers (Borio and Zhu, 2008; Dell'Ariccia et al, 2015; Jiménez et al, 2014). Since low interest rates also reduce the likelihood of borrower defaults, this can lead measured risks to go down and risk-weighted capital to go up, in turn creating incentives to take more risk (Adrian and Shin, 2012). These effects are often argued to be worse if monetary policy is (too) accommodative for too long.

Risk-shifting channel. Since banks' funding is short-term but their lending is long-term, increases in policy rates can reduce intermediation margins, and lead lenders, especially poorly capitalised intermediaries, to seek more risk (Bhattacharya, 1982). This channel may be stronger just ahead of a crisis, when intermediary leverage is already high and competition limits the pass-through of policy rates to lending rates (Dell'Ariccia et al, 2015). More generally, where increases in short-term rates lead to a flattening of the yield curve, this can lead banks to seek risk in order to maintain profits (Merrouche and Nier, 2010).

Asset price channel. Low interest rates can increase asset prices, including real estate prices, which can trigger further increases in leverage and asset prices. This exposes the system to financial stress when asset prices fall; an effect known as the "financial accelerator mechanism" (Bernanke and Gertler, 1989). However, evidence is mixed on whether low rates cause asset price booms, and the effects, if any, are often found to be quite small. For instance, Del Negro and Otrok (2007) and Bean et al (2010) find the impact of accommodative monetary policy on house prices to be small relative to the overall increase ahead of the global financial crisis in the United States.

Exchange rate channel. In emerging markets, and small open economies more generally, interest rate increases can lead to policy rate differentials with advanced economies, which can lead to carry trades and attract capital inflows, thereby appreciating the currency (Hahm et al, 2012). An appreciating exchange rate can in turn create incentives for excessive leverage and borrowing in foreign currency and

lay the ground for exchange rate externalities during the depreciation phase (Bruno and Shin 2012; Hahm et al, 2012).[5]

The intensity of these effects can vary with the financial cycle. As financial imbalances build up, low policy rates reduce current defaults, but can induce banks to make riskier loans and increase leverage. When policy rates are increased close to the peak of the financial cycle, this can induce risk-shifting and borrower defaults. The strength of the effects can also depend on financial structure and capital account openness. For instance, in small open economies, domestic monetary policy may have a weaker influence over domestic long-term rates and asset prices when these are driven strongly by capital flows, but exchange rate externalities become more important (Rey, 2013).

Where the effects of monetary policy on financial stability are expected to be undesirable, this can create conflicts between financial and price stability objectives. Appropriate macroprudential policies can attenuate these side effects, thereby reducing policy dilemmas and creating additional "room for maneuver" for monetary policy.

For most of the channels discussed above, a range of specific macroprudential instruments may reduce the effect when brought in ex ante (see Table 1 and also IMF (2013b)). For instance, where loose monetary policy contributes to a build-up of household debt and asset prices, loan-to-value (LTV), loan-to-income (LTI) or debt-service-to-income (DSTI) limits can contain these dynamics, and stressed DSTI limits can reduce the impact of increases in interest rates on household default rates. In open economies where interest differentials lead to borrowing and lending in foreign currency, macroprudential tools such as the macroprudential levy introduced in Korea or constraints on FX lending can aim to contain the resulting risks for systemic stability.

Conceptually, therefore, it appears feasible for macroprudential policy to attenuate the side effects of monetary policy. However, there is an empirical question as to whether macroprudential policy is able to contain side effects successfully when the monetary policy stance gives rise to side effects for financial stability that are very strong. In particular, when monetary policy is very accommodative, this may give rise to incentives to borrow at low rates that are difficult for macroprudential policy to fully contain, since attempts to control credit can be circumvented.

The existing evidence on this issue is still scarce. Aiyar, Calomiris, and Wieladek (2014) find that tightening monetary policy and increasing banks' capital requirements both have negative effects on bank credit supply, and that there is no interaction between changes in monetary policy and changes in capital requirements. That is, the marginal effect of changes in capital requirements on credit supply is independent of the monetary policy stance. On the other hand, Tressel and Zhang (2016) find that LTV constraints tend to be *more* effective in containing credit growth and house price appreciation when monetary policy is loose.

[5] Given low policy rates in advanced economies, a number of emerging market economies (eg Brazil, Peru and Turkey) have recently been struggling with this policy dilemma. However, this channel was also relevant ahead of the crisis. In Iceland, high interest rate differentials fuelled capital inflows via the banking sector and led to a sharp appreciation and overheating of the economy. As the inflation targeting central bank raised policy rates in response, it attracted even more capital inflows, generating an adverse feedback loop (Jonsson, 2009). Many central and eastern European economies also faced this dilemma before the crisis (IMF, 2013b).

We examine the issue using a dataset of macroprudential measures that is based on the 2010 IMF survey (Lim et al, 2011) and expanded to include measures taken over the 2000–11 period by 36 countries. We run panel regressions on quarterly data to examine the effect of three types of macroprudential measures (capital buffers, LTV/ DSTI limits and reserve requirements) on credit growth and asset (house) price growth.

We find that a tightening of any of the three macroprudential measures has measurable effects on credit growth, and that capital and LTV constraints in particular have statistically significant effects on house price growth (Table 2). We then interact the variable for macroprudential measures with a dummy variable for the monetary policy stance that indicates whether monetary policy is tight or loose when compared with the country-specific median. We find that the interaction terms are statistically insignificant (Table 2). In other words, the marginal effect of tightening these macroprudential instruments on credit growth or asset prices is unaffected by whether the prevailing monetary policy stance is tight or loose, which is consistent with the results for capital requirements reported by Aiyar, Calomiris and Wieladek (2014).

Effects of macroprudential tools and interaction with monetary policy[1, 2] Table 2

Tightening stance	Capital Requirement (CR)	Limits on LTV Ratio (LTV)	Reserve Requirement (RR)	Interaction terms		
				MP*CR	MP*LTV	MP*RR
Credit Growth						
House Price Growth						

[1] The table summarises the results from a panel regression analysis with either credit growth rate (y-o-y) or house price inflation (y-o-y) as a dependent variable and the following variables as independent variables: macroprudential instrument indices, an interaction term between the macroprudential indices and monetary policy stance, and other control variables (ie lagged GDP growth rate and nominal interest rates). Time- and country-fixed effects dummies are included. Quarterly data of 36 economies are used, including 21 emerging market economies and 15 advanced economies. [2] Green, orange, and yellow colours in each cell indicate significance at 1%, 5%, and 10% level, respectively.

Source: IMF staff estimates.

In sum, in its transmission, monetary policy can have a range of side effects on financial stability. Several channels may be at work, operating simultaneously and with their strength varying with the stage of the financial cycle and capital account openness. Where these side effects are expected to be undesirably strong, well targeted macroprudential policies can attenuate these effects in principle. While the evidence is still scarce, our preliminary results suggest that the marginal effect of macroprudential policy tools is not affected materially by whether they operate in an environment in which the monetary policy stance is tight, or loose.

3. Effects of macroprudential policies on output – in financial upturns

When macroprudential policies are tightened, the intended effect is to increase the resilience of the financial system and to contain procyclical feedback between asset prices and credit that can result in unsustainable increases in leverage, debt burdens and volatile funding (IMF, 2013c). However, tightening macroprudential policy tools can also have some dampening effects on output. A priori, the strength of the effects should depend on the specific macroprudential tool being used, as well as financial and economic conditions.

Existing research suggests that tools that work on intermediary balance sheets, such as tighter capital and provisioning requirements, increase resilience but will often have only weak effects on loan rates and the volume of credit (IMF, 2013b; BIS, 2010). The effects on credit and output can be greater when an aggressive tightening forces intermediaries to cut lending, or when tightening occurs in periods of financial stress, so that it is more difficult for intermediaries to find equity capital.[6] For LTV and DSTI constraints, in contrast, the effects on output should be expected to be greater, since these tools are designed to have a more direct effect on the amount of credit received by households.

Evidence first reported in IMF (2013b) confirms that the short-run effects of macroprudential policies depend on the tool considered (Table 3). There is strong evidence that adjustable LTV ratios do affect both the composition of output as well as overall output growth in a measurable way. By contrast, we find that the effects of capital and reserve requirements on output are not statistically significant, suggesting only mild effects on aggregate demand. Overall, this suggests that the effect of a tightening of macroprudential policy tools on output depends on the type of tool considered, with LTV ratios exerting stronger effects than other macroprudential tools.

Effects of macroprudential tools on ouput[1, 2] Table 3

	Capital Requirement	Limits on LTV Ratio	Reserve Requirement
Credit Growth			
House Price Growth			
Output Growth			

Notes: The table summarises the results from panel regression analyses with credit growth rate (y-o-y), house price inflation (y-o-y), and GDP growth rate (y-o-y) as a dependent variable and the following variables as independent variables: macroprudential instrument indices, and lagged terms of GDP growth rate and nominal interest rates. Time- and country-fixed effects dummies are included. Quarterly data of 36 economies are used, including 21 emerging market economies and 15 advanced economies.

Source: IMF staff estimates.

[6] For reserve requirements, the available existing evidence suggests that their effects on credit can be sizable, but the output effects are still measured to be small, and have been argued to be ambiguous in theory (Glocker and Towbin, 2012).

As long as monetary policy is effective, any undesirable effect on output can be offset by more accommodative monetary policy to reach the price stability objective. Complications may arise, however, when monetary policy is constrained and unable to counter the effects on output. This can happen when capital requirements are tightened in financial downturns – that is, when the imposition of the macroprudential measures is ill-timed – or when monetary policy has already reached its lower bound, and thus may be unable to counter effectively the deleveraging effects set off by increases in capital requirements. Trade-offs can also arise in currency unions and under pegs, where, more generally, monetary policy is unable to respond to the imposition of macroprudential policy tools in a manner that would cushion their effects on output. In these cases of constraints on monetary policy, it will be particularly important for tools such as LTV, LTI and DSTI constraints to be tightened gradually, and in a manner that tries to avoid large effects on output.

4. Effects of macroprudential policy – in financial downturns

Macroprudential policy buffers can be helpful for the conduct of monetary policy in financial downturns. When macroprudential buffers are available in times of financial stress, they can be released in order to maintain the provision of credit to the economy, thereby reducing the effects of financial shocks on output, and complementing monetary easing that would typically occur in such stressed conditions. In particular, macroprudential buffers can help keep monetary transmission open under such conditions, especially when buffers can be relaxed.

For instance, in times of financial stress, monetary easing may not transmit to increased bank lending when banks are weighed down by non-performing loans that deplete voluntary capital buffers over and above the microprudential minimum. Banks may then be reluctant to expand their balance sheets in response to monetary accommodation since this will further reduce capital ratios, potentially leading banks to hit the microprudential minimum ratios that trigger supervisory corrective action. By contrast, where macroprudential capital buffers have been built up, they can be released in periods of stress, and thereby made available to absorb losses from increases in non-performing loans. This makes it less likely that banks will pull back on credit, and can lend greater potency to the transmission of monetary policy accommodation that seeks to stimulate the provision of credit in order to boost output.

Similarly, after a fall in house prices, high-LTV borrowers may be unable to refinance their loans since the principal loan amount exceeds their property value. These borrowers can then not take advantage of lower mortgage rates that an easing of monetary policy may help bring about (Geanakoplos, 2010). A more stringent LTV constraint prior to going into the bust may mitigate this and help strengthen the transmission of monetary policy after prices correct. The transmission of accommodative monetary policy to housing markets can be further enhanced when macroprudential policymakers relax LTV constraints for new loans and refinancing by removing the tightening that occurred ahead of the bust, since this means that a greater share of potential borrowers is able to take advantage of the low mortgage rates that monetary policy easing may bring about.

By helping monetary policy transmission, such active use of macroprudential policy can reduce the need for monetary policy to respond aggressively to adverse financial shocks. It can thereby reduce the risk that monetary policy runs into the lower bound on nominal interest rates and has to resort to unconventional policy measures, such as quantitative easing or negative policy rates.

The benefits of a relaxation of macroprudential policy buffers in stressed times raise the issue as to whether such a relaxation of buffers can be effective. Conceptually, and in general, the effect of a variation of a macroprudential constraint on credit will be the stronger the more its prevailing setting acts as a binding constraint on the provision of credit.

- For capital tools, constraints may be more likely to be binding in bad times, when earnings are subdued and raising new equity is difficult. On the other hand, market discipline may impose a tighter constraint in stressed conditions when buffers are not regarded as sufficient to ensure resilience, thereby reducing the effect on credit of a relaxation of capital tools.
- For LTV and DSTI tools, the effects on mortgage credit from a relaxation will depend on the share of existing borrowers that is constrained by the effect of falling house prices on their ability to refinance at prevailing LTV ratios, and on the new demand for houses that can be unlocked by a relaxation of LTV and DSTI caps. It will also depend on the extent that banks will pass on the relaxation of the regulatory caps to their borrowers.
- In the presence of liquidity stress, liquidity tools are likely to become binding and a relaxation of liquidity tools should then help sustain credit provision and avoid fire sales in such periods. A relaxation of requirements for banks to hold liquid assets can make these assets available to meet withdrawals. Requirements for long-term funding may also become difficult to meet during stressed conditions, and a relaxation can then help avoid fire-sales.

The existing empirical literature on the effect of a relaxation of macroprudential policy tools is scarce, in part due to the fact that instances of the relaxation of macroprudential policy measures are still rare. Jiménez et al (2013) find that episodes of a relaxation of the dynamic provisioning requirements in Spain had a greater effect on credit and output than the tightening of the provisioning regime. Igan and Kang (2011) show that the response of house prices was less visible when LTV and DSTI caps were loosened in Korea, but that a loosening and tightening of DSTI limits had symmetric effects on mortgage loans.

We examine whether the effects of macroprudential policy instruments are symmetric – that is, the strength of effects of tightening on credit growth is similar to that of loosening – or asymmetric – that is, there are differences in the strength of these effects, using our cross-country panel.

We find that the effect of tightening and loosening capital requirements on credit growth and house price growth is largely symmetric (Table 4). The size of the effects on credit from a tightening and a loosening of LTV constraints are similar in magnitude, even though the effect of a tightening of LTV limits on house prices appears somewhat stronger than that of a loosening. Conversely, we find that a loosening of reserve requirements has a stronger effect on credit growth than a tightening of these requirements. Overall, therefore, the evidence is not inconsistent with the assumption of largely symmetric effects of a loosening and a tightening of

macroprudential tools on credit growth, even if the effects are hard to quantify with confidence given the relative scarcity of loosening episodes to date.

Effects of macroprudential tools: symmetric or asymmetric[1, 2] Table 4

	Capital Requirement (CR)	Limits on LTV Ratio (LTV)	Reserve Requirement (RR)	Difference: Loosening - Tightening		
				CR	LTV	RR
Credit Growth						
House Price Growth						

[1] The table summarises the results from a panel regression analysis with either credit growth rate (y-o-y) or house price inflation (y-o-y) as a dependent variable and the following variables as independent variables: macroprudential instrument indices, an interaction term between the macroprudential indices and a dummy of macroprudential policy stance (tightening or loosening), and other control variables (ie lagged terms of GDP growth rate and nominal interest rates). Time- and country-fixed effects dummies are included. Quarterly data on thirty six economies are used, including 21 emerging market economies and 15 advanced economies. [2] Green, orange, and yellow colors in each cell indicate significance at 1%, 5%, and 10% level, respectively.

Source: IMF staff estimates.

In sum, well-calibrated macroprudential policies can contain systemic risks ex-ante and help buffer shocks, thereby easing the conduct of monetary policy in times of financial stress. A loosening of macroprudential policy constraints is likely to be the more effective, the more binding is their prevailing setting on the provision of credit to the economy. Empirically, we find that the effects of relaxation on credit have been no less strong than the effects of a tightening of tools, supporting the idea that macroprudential policy can be a useful complement to monetary policy easing in times of financial stress. Ultimately, however, when a crisis strikes both monetary and macroprudential policies need to be complemented by lender of last resort policies, to cushion the impact of liquidity shocks, and resolution policy, to ensure the repair of financial sector balance sheets.

5. Conclusions

Overall, we find that there are strong complementarities between monetary and macroprudential policies, such that where both monetary and macroprudential policies are used actively, overall policy effectiveness is enhanced relative to a world in which any one policy acts without the support of the other. Specifically, we argue that three such interaction effects are important in practice.

- First, monetary policy can have a range of "side effects" on financial stability. However, macroprudential policy can attenuate these side effects, providing more room for maneuver for monetary policy to pursue its primary objective.
- Second, the tightening of macroprudential policy tools can have dampening "side effects" on output. However, monetary policy can counter these effects, by adding accommodation at the margin, as long as monetary policy is effective.

- Third, macroprudential policy can build buffers that can be relaxed in periods of financial stress. Such a policy can help keep open the transmission of monetary policy, preserving the effectiveness of monetary policy in the event of such stress.

These interactions strengthen the case for a leading role of central banks in the emerging macroprudential policy frameworks (see eg Nier (2011), IMF (2013a) and IMF (2013c)). In particular, they imply that central banks have strong incentives to ensure macroprudential policy is pursued effectively. However, and as discussed further in IMF (2013a), safeguards are also needed to ensure that each policy function remains focused on its own primary objective.

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Macroprudential Policies and the Lucas Critique[1]

Bálint Horváth[2] and Wolf Wagner[3]

The experience of recent years has reinforced the view that the financial system tends to amplify shocks over the cycle, leading to excessive lending in boom times and sharp contractions when economic conditions deteriorate. Common explanations for this are based on the fact that the players in the financial system are typically subject to constraints that tend to exacerbate shocks, such as borrowing constraints that fluctuate with asset prices, risk-sensitive capital requirements or remuneration schemes based on relative performance.

Importantly, research has also identified several externalities that are at play. In particular, individual agents subject to borrowing constraints do not internalise that forced liquidations can impose negative effects on other players in the system. This can cause them to take more risk than is warranted for the social point of view, and lead to excessive fluctuations in the economy (eg Korinek, 2011). The presence of this, and other externalities, implies that a financial system that is not governed by appropriate systemic policies will not operate efficiently. There is hence a strong rationale for macroprudential policies.

Based on the experience of violent crises in the past years and the strong theoretical backing, there has been a significant interest in designing macroprudential policies that limit fluctuations in the financial system:

- The new Basel Accord incorporates capital buffers that are built up in good times and can be run down when economic conditions deteriorate.
- The liquidity coverage ratio of Basel III – which aims at safeguarding banks against short-term outflows – contains a countercyclical element to the extent that such liquidity buffers are released in bad times.
- On the accounting side, there is a discussion about whether mark-to-market accounting – which has the potential to amplify the impact of asset price changes – should be suspended when prices are depressed.

There is also a growing debate about whether monetary policy should "lean against the wind" with respect to the financial cycle, that is, whether the central bank should raise interest rates when the economy experiences excessive credit expansion and asset price inflation, but lower interest rates in times of significant contraction in lending or general stress in the financial system.

However, it is also well known that the financial system tends to react to new policies in surprising – and often undesirable – ways. This insight is essentially an application of the Lucas critique in economics; in banking circles referred to as

[1] We thank participants at the CBRT-BIS-IMF Conference on "Macroprudential Policy: Effectiveness and Implementation Challenges" for comments and suggestions. This paper draws heavily on the chapter "Unintended consequences of macroprudential policies" published in the VoxEU book on "Macroprudentionalism".

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Goodhart's Law. The Lucas Critique provides a cautionary background for the implementation of new policies. Rational agents tend to anticipate the consequences of new policies and may adopt their behaviour in ways that affect the effectiveness of policies. New financial regulation, which is moving from a microprudential to a macroprudential view of the world, is based on our experiences with past crisis episodes and is in essence backward-looking. It may hence lead to unexpected outcomes when financial intermediaries change their behaviour in response to a modified financial architecture.

The typical regulatory cycle looks as follows. An unwanted behaviour in the financial system is observed and this is attributed to a market failure. Policymakers devise a policy that specifically targets this failure. Upon implementation it is then discovered that the policy does not work. This is because financial institutions circumvent the spirit of the policy by shifting into economically equivalent activities that are not affected by regulation. In addition, the responses of market participants often lead to undesirable outcomes in other parts of the financial system.[4] The apparent failure of regulation in turn leads to a series of new and increasingly complex measures, which by themselves bring about further unintended consequences.

The lessons from the past, however, seem to have been largely forgotten when it comes to the design of new policies. So far little thought has been given as to how the financial system will react to these new measures. The experiences with previous policies should make us very cautious in this regard. On the face of it, we would expect the potential for adverse side effects to be significantly larger for system-based regulation. This is because such regulation is inherently more complex than traditional regulation that was focused on individual institutions only. The difficulty of properly predicting the impact of a policy rises with its complexity. High complexity also provides ample opportunities for financial institutions to sidestep new regulation.

In this paper we will discuss three areas in which countercyclical policies are likely to have effects outside their intended realm.

1. Systemic risk-taking

Countercyclical policies cannot be separated from a second dimension of the systemic risk: the extent to which institutions in the financial system are correlated with each other. Such correlation can arise through various channels: herding in investment activities, the use of common funding sources, interconnectedness through interbank linkages, but also because of convergence of risk management practices and trading strategies.

In particular, Horváth and Wagner (2015) have shown that countercyclical policies have the potential to increase cross-sectional risk. The intuition is simple. Under countercyclical capital requirements, banks are subjected to relatively higher requirements when the economy is doing well but to lower requirements in bad times. Such requirements hence insulate banks from economy-wide fluctuations as

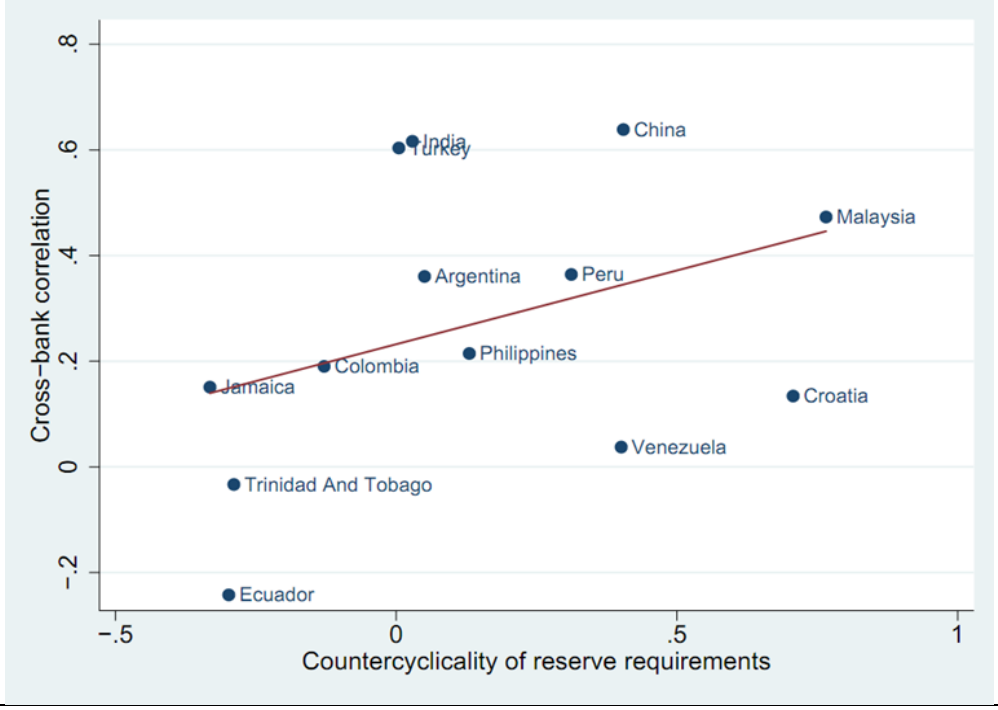
[4] For instance, tight regulation in the core banking system can cause a build-up of risk in the less regulated shadow banking system.

they require more capital only when capital is generally abundant and less capital when it is costly to raise it. However, they do not insulate banks from fluctuations in bank-specific, idiosyncratic, conditions. In particular, a bank that focuses more on idiosyncratic exposures runs the risk that it will experience stress at a time when other banks are doing well. In this case the bank would be subject to high capital requirements when it is most costly. The consequence is that countercyclical policies increase the incentives for banks to correlate with each other. Systemic risk may thus increase, rather than fall.

There is some evidence for this mechanism being at play coming from developing countries. While, with the exception of Spain, capital requirements have not been consistently used for macroprudential purposes, Frederico et al (2012) show that developing countries have made active use of reserve requirements over the business cycle. Defining countercyclicality as the correlation of reserve requirements with GDP, Frederico et al (2012) find that the majority of these countries used reserve requirements in a countercyclical fashion.

Figure 1 plots their measure of countercyclicality against the average pair-wise correlation of banks in the respective countries. This figure shows a positive relationship between countercyclicality and bank correlation:

Countercyclicality of reserve requirements and cross-bank correlation — Figure 1



Note: Countercyclicality of reserve requirements is the correlation between the cyclical component of reserve requirements and real GDP. Cross-bank correlation is the average pair-wise correlation of banks using weekly stock returns from September 2011 to September 2012.

Source: Federico et al (2012).

How could regulation respond to this problem? An alternative to countercyclical buffers is to incentivise banks to become less correlated. For example, regulators can

impose higher capital requirements for systemic banks.[5] The analysis in Horváth and Wagner (2015) shows that such a policy would dominate countercyclical buffers in the presence of incentive problems. This is because it addresses two dimensions of systemic risk at the same time. First, it discourages correlation among banks. Second, by doing so it makes the system less procyclical as more heterogeneous institutions will respond less strongly to aggregate shocks. In contrast – as argued before – countercyclical policies improve systemic risk along one dimension at the potential cost of worsening it along another.

2. Incentives of regulators

It is well known that financial regulation suffers from a time inconsistency problem, similar to the one arising for monetary policy. Ex-ante, regulators have an interest to be tough in order to limit risk-taking in the financial system. However, ex-post regulators are likely to bail out financial institutions in order to safeguard the stability of the financial system. This time inconsistency problem is arguably a major source of risk-taking in the financial system.[6]

Microprudential capital regulation was not prone to this problem because it was rule-based. Regulators could not easily deviate from the Basel standards in a discretionary fashion and hence there was little pressure to adjust capital requirements in the advent of shocks. This will all change with Basel III, which introduces an important discretionary element. Basel III contains guidelines for when countercyclical buffers should be invoked, but the ultimate decision is left to the regulators. To be sure, they are good reasons for this. In contrast to monetary cycles, it is more difficult to quantify credit cycles. It is hence important to leave significant room to regulators as to when to implement countercyclical policies.

However, this discretion introduces a significant time inconsistency problem. Ex-post, regulators will always have incentives to reduce the impact of negative shocks on the financial system. They are thus likely to allow banks to run down capital buffers in downturns. The opposite is not likely to happen following positive shocks. Pressure from the financial industry and politicians will make it difficult for regulators to impose additional capital when excesses start to materialise. The problem is compounded by the fact that it is nearly impossible to accurately measure when a boom becomes excessive. It will hence be difficult to hold regulators accountable for their decisions.

Ex-post, regulators will thus have a tendency to be lenient in their countercyclical policies. This is likely to create ex-ante moral hazard, in a way similar to bail-out expectations. Because of this, endowing regulators with a countercyclical tool can easily reduce welfare in the financial system (Wagner, 2015).

[5] For this, systemic risk can be quantified using measures such as the CoVar (Adrian and Brunnermeier, 2011) or the Systemic Expected Shortfall (Acharya et al, 2012).

[6] See Acharya and Yorulmazer (2007) and Farhi and Tirole (2012) for analyses of time inconsistency leading to systemic risk on the asset and liability side, respectively.

3. Endogenous booms

This area is, in our view, the most important one but also the one least understood.

Basel III views booms and busts as discrete and exogenous events. Buffers are implemented when an excessive boom (by some measure) materialises, while buffers can be released if there is a sufficiently severe downturn.

Cycles, however, develop over time. The response to a shock can initially be small but may be amplified later on. More importantly, cycles are to a large extent endogenous – they are not simply driven by a series of fundamental shocks. In particular, the literature on the nexus between finance and macroeconomics has emphasised that there are various feedback and amplification mechanisms that can lead to the endogenous build-up of a boom.[7]

The endogenous nature of booms has immediate consequences for macroprudential policies. First, anticipation of higher capital requirements if a boom turns excessive may prevent the boom from ever reaching the excessive stage in the first place. Many feedback mechanisms rely on intertemporal amplification, that is, on the knowledge that the impact of a shock is magnified over time. From theoretical studies on bubbles, for example, it is known that in order for bubbles to exist, it is crucial that there is the possibility that the bubble can go on forever. The presence of a regulator who is committed to pricking the bubble when it reaches a certain size may prevent the formation of bubbles. Capital surcharges imposed in boom times will hence have implications for bank behavior in normal times, which in turn will affect the likelihood and severity of booms.

Second, policies in pre-boom times matter as well. For instance, a policy that gradually increases capital requirements as the boom forms may stop the boom from ever becoming excessive. Discrete buffers akin to Basel III may then never have to be invoked.

Conclusions

Current regulatory initiatives are making important strides towards reducing fluctuations arising from systemic risk in the financial system. Based on a static backward-looking view of the economy, these policies address clear externalities that have been identified in prior research and hence should lead to higher welfare. However, agents in the financial system are likely to adapt to new regulation, and sometimes in ways that render the original policies ineffective. To avoid this, regulators should pay more attention to the dynamic implications of new macroprudential instruments.

[7] See, for instance, Kiyotaki and Moore (1997).

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Cross-border spillovers from macroprudential policy in the euro area

Luca Nocciola[1] and Dawid Żochowski[2]

In the context of the International Banking Research Network (IBRN) project for 2015 (see Buch and Goldberg, 2016), our study aims at understanding and measuring cross-border effects of macroprudential regulation in euro area. Understanding such cross-border spillovers is important for at least three reasons. First, cross-border spillovers may reduce (negative spillovers) or increase (positive spillovers) the efficacy of macro-prudential policy in containing systemic risk. Second, while achieving the same objectives, various macroprudential instruments may differ in the size of cross-border spillovers, calling for the use of the instrument that exerts less cross-border effect, as the European Systemic Risk Board recommends in the European context. Third, cross-border spillovers may increase in magnitude as financial markets and sectors become more integrated, which gradually took place in the euro area after the introduction of the common currency and is likely to be reinforced after the introduction of the banking union, in particular the Single Supervisory Mechanism. Accordingly, understanding and measuring the cross-border impact of macroprudential policy could shed some light on the need for coordination, in particular in the form of reciprocity arrangements, among macroprudential authorities in order to limit negative spillovers and reap the benefits from positive ones.

In this study (see Nocciola and Żochowski (2016) for details), we focus on inward cross-border spillovers, namely on the reaction of banks located in the domestic economy to changes of macroprudential policy abroad.[3] In particular, we consider two different channels of propagation: first, the transmission of foreign macroprudential policy to the lending of domestic banks (see Figure 1, left-hand panel); and second, the transmission of the home countries (the countries where the parent banks reside) macroprudential regulation to the lending of foreign-owned banks located in the domestic economy (see Figure 1, right-hand panel).

For the first channel, we characterize the strength of linkages in the European Union (EU) network using country-level lender exposure weights, while for the second channel, we construct a database with the information on the ownership structure of each Monetary Financial Institution (MFI) in order to identify the home countries and the respective regulations.

The first channel, operating via the adjustment of the balance sheet of domestic banks to changes in the foreign macroprudential environment, is shown conceptually in the left-hand panel of Figure 1. Each blue circle represents a country, while the orange one represents a bank. As an example, in country A (left-hand panel) four

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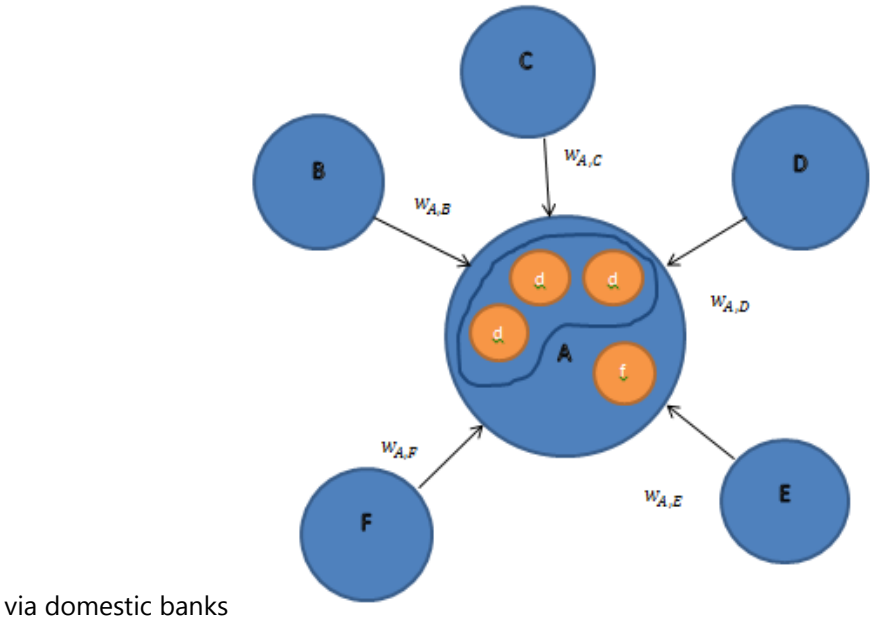
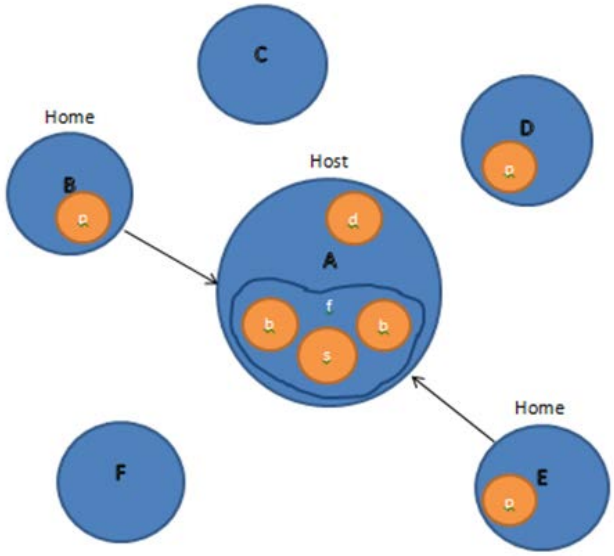
[3] For a comprehensive description of channels of cross-border propagation from macroprudential policy, see Fahr and Żochowski (2015).

Channels of propagation of inward cross-border spillovers from macroprudential policy

Figure 1



via domestic banks



via foreign affiliates

Note: The left-hand panel depicts a stylised inward spillover from exposure-weighted foreign regulation through domestic banks. Each blue circle represents a country, while each orange circle a bank. *d* and *f* stand for domestic and foreign, respectively. w_{ij} is the cross-border lender-exposure weight of country *i* lending to country *j*. Arrows represent the impact of changes in macroprudential policy abroad on country A. The right-hand panel shows a stylised inward spillover from home-country regulation through foreign-owned banks. *b* and *s* inside the set of foreign affiliates *f* stand for branches and subsidiaries, respectively. *p* stands for the ultimate parents of *f*. Arrows represent the impact of changes in macroprudential policy in the home countries on lending activity of *b* located in country A.

banks operate, three domestic (d) and one foreign (f), which in turn could be either a branch or a subsidiary. In this example, we consider as an inward spillover the effect that foreign regulation activated in country B, C, D, E and F has (arrows) on loan growth by the three domestic banks in country A. The impact of the respective regulations on domestic banks operating in A is weighted by country A's cross-border

loan exposures to other countries. This weighing concept is extended to other countries. In effect we build a two-layer network of banks and countries.

The second potential channel of propagation through which regulation may have cross-border impact is an inward transmission through foreign affiliates. This channel is shown conceptually in the right-hand panel of Figure 1. In country A (right-hand panel) there are four banks: one domestic (d) and three foreign (f), of which one is a subsidiary (s) and the remaining two are branches (b). The domestic bank and foreign subsidiary are considered as subject to the regulation of the host country A, while the foreign branches (b) would be, according to the legal status of a branch in the European context, subject to the regulation of the countries (B and E) where the respective parent banks (p) reside. The inward externality via the second channel arises when the macroprudential regulations applied in countries B and E influence the lending of foreign branches (b) in country A. As indicated in the right panel, the overall effect of regulation on the subset of foreign affiliates placed in country A now depends on both the host (A) and the home countries' (the countries of the parent banks, B and E) regulations.

To assess these two channels, we employ a panel dataset composed of individual MFIs covering 248 banks from 16 EA countries over the period from 2007Q3 to 2014Q4 along with information from the IBRN database on macroprudential policy changes in home and host countries, involving most of EU countries plus some additional countries in which the parent banks of some foreign affiliates reside. Using the panel of euro area banks, we estimate panel regressions and find evidence for inward cross-border spillovers from capital regulation (*capital requirements* and *sector-specific capital buffers*), liquidity measures (*reserve requirements*) and borrower-based measures (*loan-to-value limits*), along the two channels of transmission.

Concerning the first domestic channel, we find that following the exposure-weighted tightening of *capital buffers* in the EU countries, euro area domestic banks reduce lending on average by 5.8%. In contrast, when *loan-to-value limits* or *reserve requirements* are tighten, EU banks tend to, on average, increase their lending, by 7.2% and 5.5%, respectively. This evidence may suggest that domestic banks react to tightened foreign macroprudential policy by reducing lending possibly in reaction to an increase in lending by foreign banks residing in the domestic economy associated with a transfer of resources from domestic banks placed in the foreign economies where the regulation has become harsher or by rebalancing their cross-border portfolios in response to the tighter environment abroad on their foreign affiliates (balance sheet adjustments). This is because capital tightening abroad affects also the capital requirements of the bank on the consolidated level. Instead, when macroprudential instruments that operate locally are used, they seem to encourage banks to increase lending in other jurisdictions, possibly by rebalancing their lending portfolio in view of the changes in the relative price of lending among them. When considering a more comprehensive specification with interaction terms the *sector-specific capital buffers* also tend to lead to an increase in lending, similarly as in the case of other instruments that operate locally. In addition, we also find that banks in countries in the expansionary phase of the financial cycle increase lending to a larger extent when *sector-specific capital requirements* in other EU countries are tighter on average.

Turning to the second channel, which operates via the lending behavior of foreign affiliates, we also find that the tightening of *sector-specific capital buffers* leads

to an increase in lending by 1.7% and 3.7% after the first and the second quarter, respectively. This also seems to be confirmed by the joint test of significance of the sum of the contemporaneous term and two lags' coefficients, which suggests that the cut-cumulative index is significant at the 10% level. However, this finding is not confirmed by the comprehensive specification with interaction terms. The two other instruments considered in the second channel (*capital requirements* and *local reserve requirements*) do not seem to play a role in this transmission.

Taken together, our findings suggest that the sign of cross-border spillovers, ie whether the tightening of the instrument in the home country leads to an increase or decrease in lending by foreign affiliates is instrument-specific. It seems that instruments that are directed toward specific borrowers or sectors, such as *loan-to-value limits* or *sector-specific capital buffers* are prone to cross-border leakages, as EA banks seem to shift their foreign lending to other jurisdictions, while tightening of *capital requirements* leads to a decrease in lending also abroad.

Moreover, we find that bank characteristics play a role in the propagation of cross-border spillovers of macroprudential policy from the home countries on lending of euro area foreign banks: When looking at the first channel, we find that less liquid EA banks reduce lending by less when the exposure weighted capital requirements are tightened; we also find that better capitalized banks increase lending by more when sector-specific capital buffers in host countries are tightened. If loan-to-value limits in the host countries are tightened, larger (as measured by total assets) EA banks are also found, to increase lending more than other banks.

All in all, our results seem to confirm that cross-border spillovers play a role in affecting lending in the euro area. The sign and the magnitude of the spillovers seem to depend on several factors: the ownership structure of the bank (domestic or foreign; subsidiary or branch); the type of instrument, which determines which banks are affected and influences their incentives for adjusting cross-border lending; how the policy stance is measured (in changes or cumulatively); the timing of implementation (contemporaneous or lagged), the bank balance sheet and country characteristics. All these factors should be taken into account by the macroprudential policy maker when designing and implementing the policies. Our findings also speak for stronger reciprocity arrangements in order to mitigate leakages.

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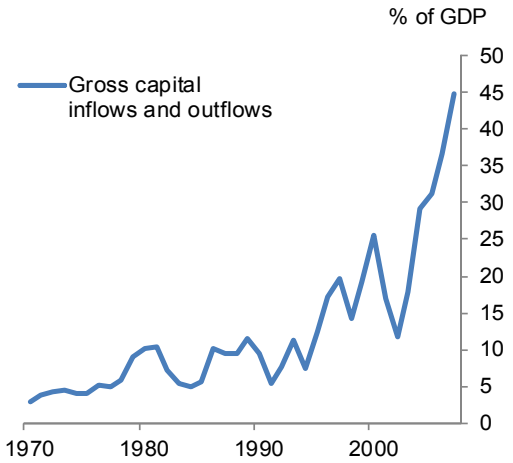
Banking de-globalisation: a consequence of monetary and regulatory policies?[1]

Kristin Forbes[2], Dennis Reinhardt[3] and Tomasz Wieladek[4]

Introduction: financial globalisation – or banking de-globalisation?

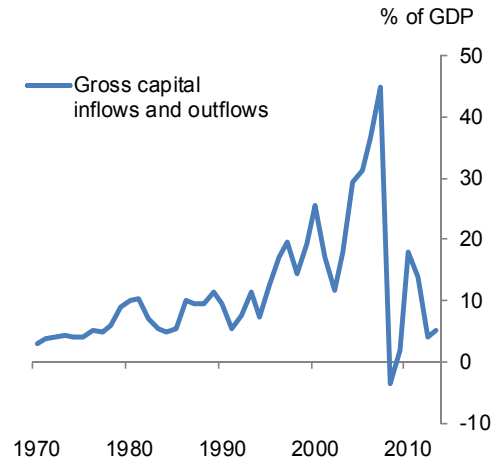
Countries around the world have tended to become more closely linked through the movement of goods, capital and people over time. It is often argued that this globalisation is a seemingly irreversible trend that can only move in one direction, especially in international finance. For example, Figure 1a shows one measure of cross-border financial integration – the sum of capital flowing in and out of a country

Figure 1a: Gross capital inflows and outflows for selected advanced economies[(a)] 1970-2007



(a) Sample of countries: Australia, Austria, France, Israel, Italy, Netherlands, Sweden, United Kingdom, United States.
Source: IMF International Financial Statistics, OECD

Figure 1b: Gross capital inflows and outflows for selected advanced economies[(a)] 1970-2013



(a) Sample of countries: Australia, Austria, France, Israel, Italy, Netherlands, Sweden, United Kingdom, United States.
Source: IMF International Financial Statistics, OECD

1 We would like to thank James Benford, Enrica Detragiache, Jas Ellis, Phil Evans, Glenn Hoggarth, Sujit Kapadia, Luc Laeven, Lyndon Nelson and participants at the CBRT-BIS-IMF conference on "Macroprudential Policy: Effectiveness and Implementation Challenges", at the IMF's 16th Jacques-Polak Annual Research Conference, and the One Bank Research Steering Committee for useful comments. We thank John Lowes for excellent assistance and advice with regard to the data. All remaining errors are our own. The views expressed in this paper are those of the authors, and not necessarily those of the Bank of England or the Monetary Policy Committee. Wieladek's contribution to this paper was completed while he was employed by the Bank of England and does not represent the views of Barclays.

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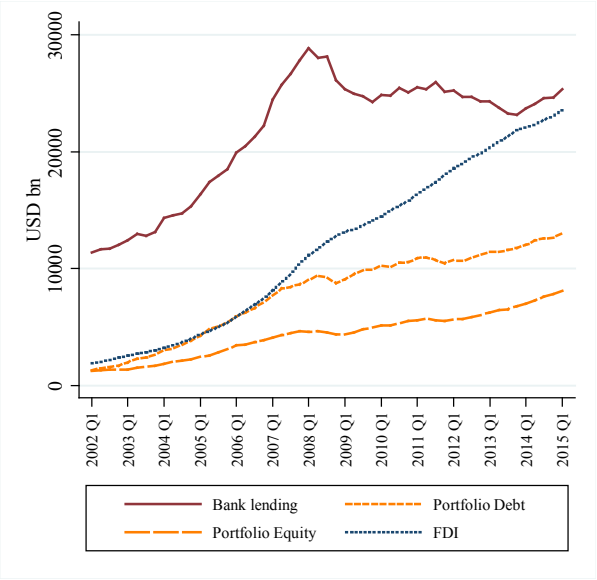
4 Senior International Economist at Barclays, and CEPR Research Affiliate.

by foreigners and domestic residents each year (scaled as a share of global GDP) for a group of advanced economies with data back to 1970.[5] These capital flows increased sharply over the 15 year window starting in 1990 – a trend which many believed would continue (albeit with some ups and downs around this longer term trend as had traditionally occurred).

During the global financial crisis, however, this trend of ever increasing cross-border financial flows reversed. Figure 1b extends Figure 1a with post-crisis data and shows the subsequent sharp decline in international capital flows.

To better understand what has caused this decline, Figure 2a breaks these capital flows into four broad categories: banking flows, portfolio equity and debt flows and foreign direct investment. This figure shows that although portfolio equity and bond flows slowed slightly during the crisis, these types of capital flows have since stabilised and continued to increase. Capital flows in the form of FDI have continued to increase – both during and after the crisis. Figure 2b divides these international banking flows further into international bank-to-bank lending and bank-to-nonbank lending. The main decline in cross-border bank flows – especially since 2012 – was caused by a decline in international bank-to-bank (but not bank-to-nonbank) lending.

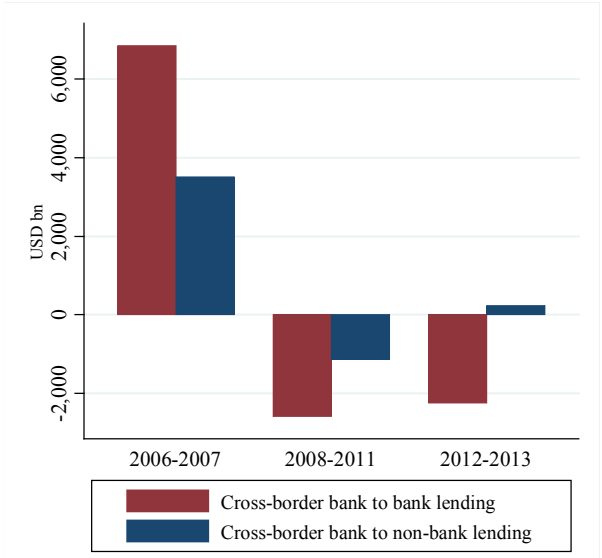
Figure 2a: Gross capital flows disaggregated



Notes: Gross lending in different types of assets is the cumulated USD bn flow in cross-border lending since 2002 Q1 summed across the BIS reporters for which data was available and then added to 2001 Q4 stocks. Flows in the BIS data refer to estimated exchange-rate adjusted changes in stocks.

Sources: IMF *International Financial Statistics*; BIS international banking statistics.

Figure 2b: Bank-to-bank and bank-to-non-bank flows



Note: The chart shows, over the specified time period, the cumulated (exchange-rate adjusted) cross-border bank-to-bank and bank-to-non-bank lending summed across the BIS reporters for which data was available.

Sources: IMF *International Financial Statistics*; BIS international banking statistics.

This persistent contraction in cross-border bank lending has been described with terms such as "financial de-globalisation" (Forbes, 2014) and "the great cross-border bank deleveraging" (Cerutti and Claessens, 2014). A number of papers have proposed

[5] This is gross capital flows into each country, expressed as a percent of the total GDP of all countries in the sample. "Gross" capital inflows is asset purchases by foreigners – capital flows from foreigners into the country – net of their sales (outflows). Gross capital outflows is defined symmetrically for domestics.

and tested explanations for this contraction. For example, Rose and Wieladek (2014) explore the role of government intervention in the banking system, while Giannetti and Laeven (2012) consider the impact of increased home bias. Cerutti and Claessens (2014) and Forbes (2014) weigh a wide set of factors, including the above as well as a reduced demand for loans, and reduced availability of wholesale funding for banks.

A closer inspection of Figures 2a and 2b suggests that the recent evolution of international bank lending can be divided into two stages: the sharp initial contraction that occurred during the crisis, and a more recent decline that began in 2012 – what we refer to as the "second phase of banking de-globalisation". This most recent decline in international lending is in stark contrast to greater stability in other types of capital flows and domestic bank lending. Indeed, at a time of substantial monetary easing in most advanced economies, one would expect at least part of the intermediation to take place via the global banking system. The academic literature has not yet focused on this second phase of banking deglobalisation, or whether regulatory and/or unconventional monetary policy could be behind these trends in global banking. The paper summarised in this article, Forbes, Reinhardt and Wieladek (2016), attempts to fill these gaps.

An unexplored explanation: bank regulation combined with unconventional monetary policy?

Many countries meaningfully adjusted their economic policies during and since the global financial crisis in ways that could affect international bank lending. For example, bank regulations were significantly tightened to strengthen the resilience of financial systems. Typically this would lead banks to reduce domestic and international lending to the same degree – as shown in several studies.[6] At the same time, many central banks pursued unconventional monetary policies (such as quantitative easing and targeted lending policies) aimed at stimulating aggregate demand. Even though these policies were not directly aimed at international bank intermediation, they may have had substantive effects by changing the relative risk weights attached to international relative to domestic lending. More specifically, assume unconventional monetary policy lowers interest rates at home or improves the domestic economic outlook. This will reduce the associated risk weight, thereby skewing an individual bank's incentive to reduce international lending significantly more than domestic lending in response to higher capital requirements. Conceptually, this is how policies such as quantitative easing or other programs aimed to support economic activity at home may interact with changes in microprudential requirements to generate a large contraction in international lending.

While these policies could play an important role in explaining the contraction in cross-border bank lending, it has been difficult to evaluate their effects empirically for several reasons. First, distinguishing between cross-border loan supply and

[6] For example, after a 100 basis point increase in capital requirements, Aiyar, Calomiris and Wieladek (2014) find a contraction of 5.6% in domestic private non-financial corporate (PNFC) lending, while Aiyar, Calomiris, Hooley, Korniyenko and Wieladek (2014) find a contraction of about 5.4% in cross-border loan supply. Bridges et al (2014) also find a quantitatively similar impact on domestic lending.

demand is difficult. Second, the temporal clustering of these different policies, in direct response to the financial crisis in most countries, makes disentangling their individual effects challenging. Finally, it is difficult (if not impossible) to obtain the necessary data on all the relevant policies in most countries.

The United Kingdom as an ideal case study with global implications

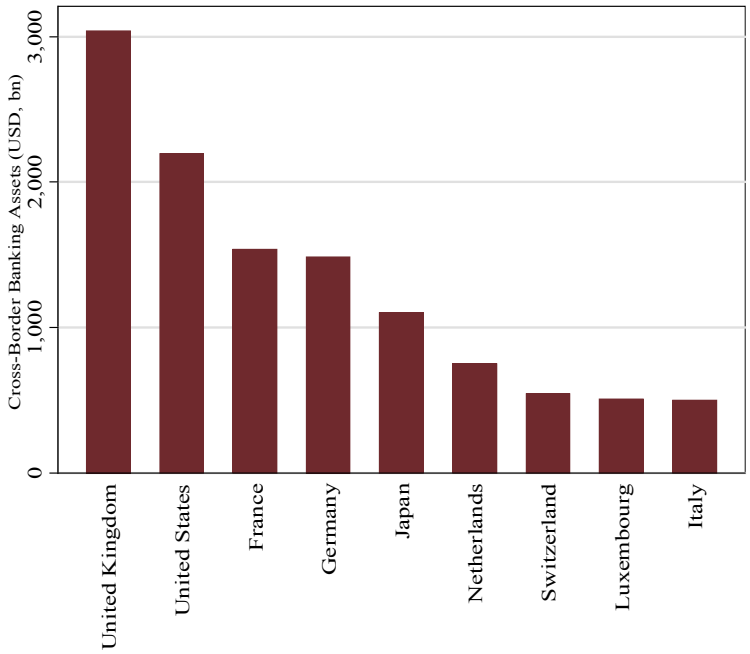
A unique UK data set, combined with the policy decisions and structure of the British banking system, however, allows us to address these challenges and provide the first evaluation of whether changes in regulatory and monetary policy were a significant factor in the second phase of banking de-globalisation. Our dataset includes external bank lending by country, which we have merged with detailed regulatory data on microprudential capital requirements (merged across three regulatory forms), as well as with information on bank balance sheets and different forms of unconventional monetary policy. The resulting bank-country-time panel allows us to separate country-specific loan demand from supply via country-time effects (as in Aiyar et al, 2014).

The United Kingdom is also an ideal case study to test how regulatory and unconventional monetary policy may have affected international bank lending due to its structure and recent policy actions. UK-resident banks are at the heart of the global financial system and have played a major role in the de-globalisation of bank flows. As shown in Figure 3, UK banks provide more international loans (bank-to-bank assets) than any other country in the world, with around 15% of international interbank activity booked in the United Kingdom and the average UK bank lending to 53 countries. The United Kingdom actively used different regulatory and unconventional monetary policies after the peak of the financial crisis: UK quantitative easing was conducted from 2009 onwards; microprudential regulatory requirements were adjusted throughout; and the Funding for Lending Scheme (FLS), a policy designed to stimulate domestic lending, was introduced in July 2012.

The FLS plays a key role in our analysis, so merits a brief explanation. The program was announced in June 2012, and coordinated between the Bank of England and Her Majesty's Treasury (HMT). It was designed to increase bank lending by ensuring that high bank funding costs and capital constraints within the British banking system did not impede lending to the United Kingdom's real economy. This scheme consisted of several components. First, it provided funding to participating institutions for an extended period at below market rates. This likely led to lower interbank funding costs and hence lower effective interest rates on mortgage and private non-financial corporate (PNFC) loans in the United Kingdom. Second, it provided preferential capital treatment for specific FLS-eligible lending in order to stimulate domestic lending. The program was also modified on 1 January 2014, when support for household lending was removed (due to the improvement in household credit conditions and renewed momentum in house price inflation), while the subsidy for non-financial corporate lending remained.

The largest cross-border banking centres at the onset of the 2nd phase of banking de-globalisation

Figure 3



Note: Data refer to 2012 Q2 and cross-border bank-to-bank lending.

Source: BIS international banking statistics.

Key results

The results from our analysis suggest that changes in capital requirements, and their interactions with certain types of monetary policy, have led to significant reductions in international bank lending. We find that an increase in a bank's capital requirement of 100 basis points leads to a contraction in external lending growth of about 3.4%. For banks which specialised in FLS-eligible lending (before the introduction of this policy), the effects of increased capital requirements were amplified by a significant amount. In particular, the same increase in a bank's capital requirement led to a larger contraction in external lending under the FLS – with estimates suggesting this amplification effect was substantial for the average bank. The main findings are robust to different data cleaning techniques and the inclusion of various control variables in our econometric model. These results are also robust to an alternative estimation framework aimed at addressing any potential endogeneity between capital requirements and international bank lending.

While these results suggest that certain forms of unconventional monetary policy – namely the FLS – can have important effects on international bank lending when combined with changes in bank regulations, other types of unconventional monetary policy may or may not have the same impact. Indeed, a similar analysis for quantitative easing suggests that while this policy may also have magnified the impact of increased capital regulations on external lending, any such amplification

effects were insignificant, smaller in magnitude, and not robust to perturbations of our baseline empirical model.

A more detailed analysis of the different components of the FLS program supports these main findings and provides additional details on precisely how this form of unconventional monetary policy interacted with and amplified the impact of capital regulations. This significant interaction between the FLS and increased capital regulations only occurred when the full FLS program – aimed at supporting both household and PNFC lending – was in place. The interactions are less powerful during the second phase of the FLS – aimed at supporting only the much smaller component of PNFC lending. This is not surprising, since household mortgage lending is a much larger fraction of overall UK bank lending than PNFC lending.[7] Moreover, we document that this effect is only present for international bank-to-bank (but not bank-to-nonbank) lending, which is the type of lending behind the recent decline in cross-border banking flows since 2012 (as shown in Figure 2b). These results support the thesis that the interaction of increased capital requirements with the FLS (which began in 2012) may have played a significant role in the 'second phase of banking de-globalisation'.

To assess if the regression estimates based on UK microeconomic data can explain a meaningful amount of the aggregate data, we assess the overall impact based on a number of conservative assumptions. More specifically, we calculate how cross-border bank-to-bank lending would have evolved in the absence of increased capital requirements and their interaction with the FLS. This counterfactual exercise suggests that external bank-to-bank lending would have been higher in the absence of tighter capital requirements, and substantially higher in the absence of their interaction with the FLS. A simple back-of-the-envelope calculation suggests that the level of external UK (global) bank-to-bank lending at the end of the first phase of the FLS in 2013 was approximately 30% (10%) lower as a result of these policies. The size of this effect is striking, since our calculation is only based on the estimated effects of these policies in one country. Yet many other countries were simultaneously increasing bank regulations and adopting various programmes aimed at supporting domestic lending and the real economy. The combined effects of these policies and their interactions across countries could explain a significantly larger share of the reduction in international lending that occurred not only in the United Kingdom, but also in many other countries.

Conclusions

This series of results suggests that certain types of unconventional monetary policy, and their interactions with regulatory policy, can have important global spillovers. Policies designed to support domestic lending, such as the UK's Funding for Lending scheme, might have the unintended consequence of amplifying the impact of microprudential capital requirements on external lending. We do not explicitly test for the domestic effects of these policies, but instead focus on the spillover effects to other countries. Nor do we consider the welfare implications of these effects. But we do find that the magnitude of these types of spillovers can be substantial – even for

[7] Bridges et al (2014) note that mortgages make up 65% of total UK domestic real sector lending, with PNFC lending making up the remaining 35%.

a single country that is a relatively small share of global GDP. This suggests that the global implications could be substantially bigger – especially as many countries undertook similar policies to the United Kingdom over this period.

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External shocks, the exchange rate and macroprudential policy

Philip Turner[1]

In this session, we shall have presentations on capital flows, on credit cycles and on policies in an oil-exporting economy. By way of introduction to how these topics are linked, I would like to underline the key role of the exchange rate and explain what Bruno and Shin (2015) have called the risk-taking channel of currency appreciation. The debate on the policy response to external shocks in emerging market economies (EMEs) is often coloured by the perception that the exchange rate is not a very reliable stabilising mechanism. Events over the 2014–16 period seem to have reinforced this perception.

Very many episodes in developing countries over the past 50 years have called into question the simple macroeconomic view that exchange rate movements serve to stabilise an economy hit by external shocks. Recall the debate in the 1970s and the 1980s about **contractionary devaluations**: the main culprit was adverse balance sheet effects because of excessive foreign currency debt. And in more recent years we have discovered that, in EMEs, currency appreciation and booms have often gone together: **expansionary appreciations**.

Why should this be so? The simplest answer is the converse of the 1970s and 1980s story: currency appreciation improves the balance sheet position – real or perceived – of households or firms. More than 30 years ago, Obstfeld (1982) highlighted the importance of looking beyond simple income-expenditure models. He argued that balance sheet effects also shape macroeconomic responses to currency appreciation. He showed that a permanent appreciation increases real wealth and so reduces real savings. (In contrast, a temporary appreciation which raises only current income should increase savings.) Such wealth effects will be greater in economies where households have sizable foreign currency debts. And taking account of endogenous changes in the supply of credit reinforces this conclusion.

Is this relevant to the situation of EMEs in 2016? The short answer is "yes". Very low dollar interest rates and, in some cases, the prospect of an appreciating domestic currency induced non-financial companies in the emerging markets to borrow heavily in dollars. The consequent increase in currency mismatches in many medium-sized EMEs since 2010 means that negative balance sheet effects from currency depreciation have grown in importance. It is true that EMEs as a whole still have a positive aggregate net foreign currency position (that is, assets minus liabilities). So national balance sheets strengthen when the exchange rate falls. Other things equal, this reinforces the expenditure-switching stimulus to aggregate demand from any currency depreciation. Devaluations are expansionary.

But for the non-government sector (and this is mainly non-financial corporations), foreign currency debts far exceed foreign currency liabilities in most medium-sized EMEs (see Graph 1). By end-2015, net foreign currency liabilities of these countries have risen to 37% of exports. The consequence of this is that the

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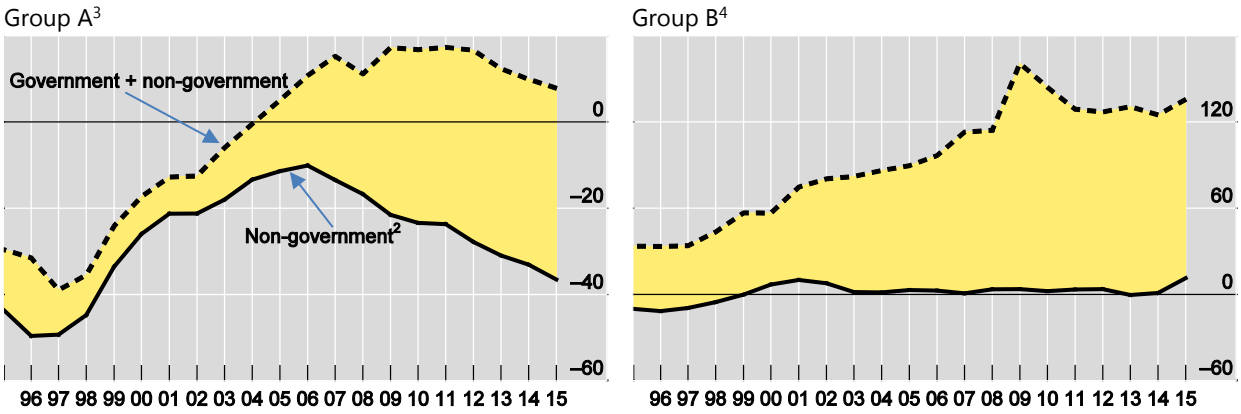
balance sheets of EM firms worsen when the currency depreciates. Because of this, they tend to switch from dollar borrowing or increase forex hedging when they see their dollar revenues fall. Such firms may also decide to cut or delay investment. With currency mismatches, therefore, depreciation could induce balance-sheet-related reactions that are contractionary.

Net foreign currency assets of EMEs[1]

As a percentage of exports Graph 1



[1] For net foreign currency assets, outstanding positions of year-end. Calculated with aggregates of the economies listed in footnotes 3-4. [2] Excluding the central bank and general government assets/liabilities where these can be identified separately. [3] Brazil, Chile, Colombia, the Czech Republic, Hungary, Indonesia, Malaysia, Mexico, Peru, the Philippines, Poland, South Africa, Thailand and Turkey. [4] China, Chinese Taipei, India, Korea and Russia.

Source: M Chui, E Kuruc and P Turner: "A new dimension to currency mismatches in the emerging markets - non-financial companies", *BIS Working Paper,* no 550, March 2016.

The strong rise in the dollar against other major reserve currencies from 2014 means that the balance sheet effect of currency depreciation has risen strongly (because debt is largely denominated in dollars) relative to the trade effect (because the currencies of many major export markets and of their competitors have also fallen). The recent BIS Annual Report (p 54, BIS 2016) provides tentative evidence that, for emerging economies, an equal depreciation of the debt-weighted exchange rate and the trade-weighted exchange rate may be initially contractionary. Hence the financial effects of currency depreciation related to currency mismatches can at first be stronger than the (expansionary) real economy effects.

The Bernanke-Blinder model

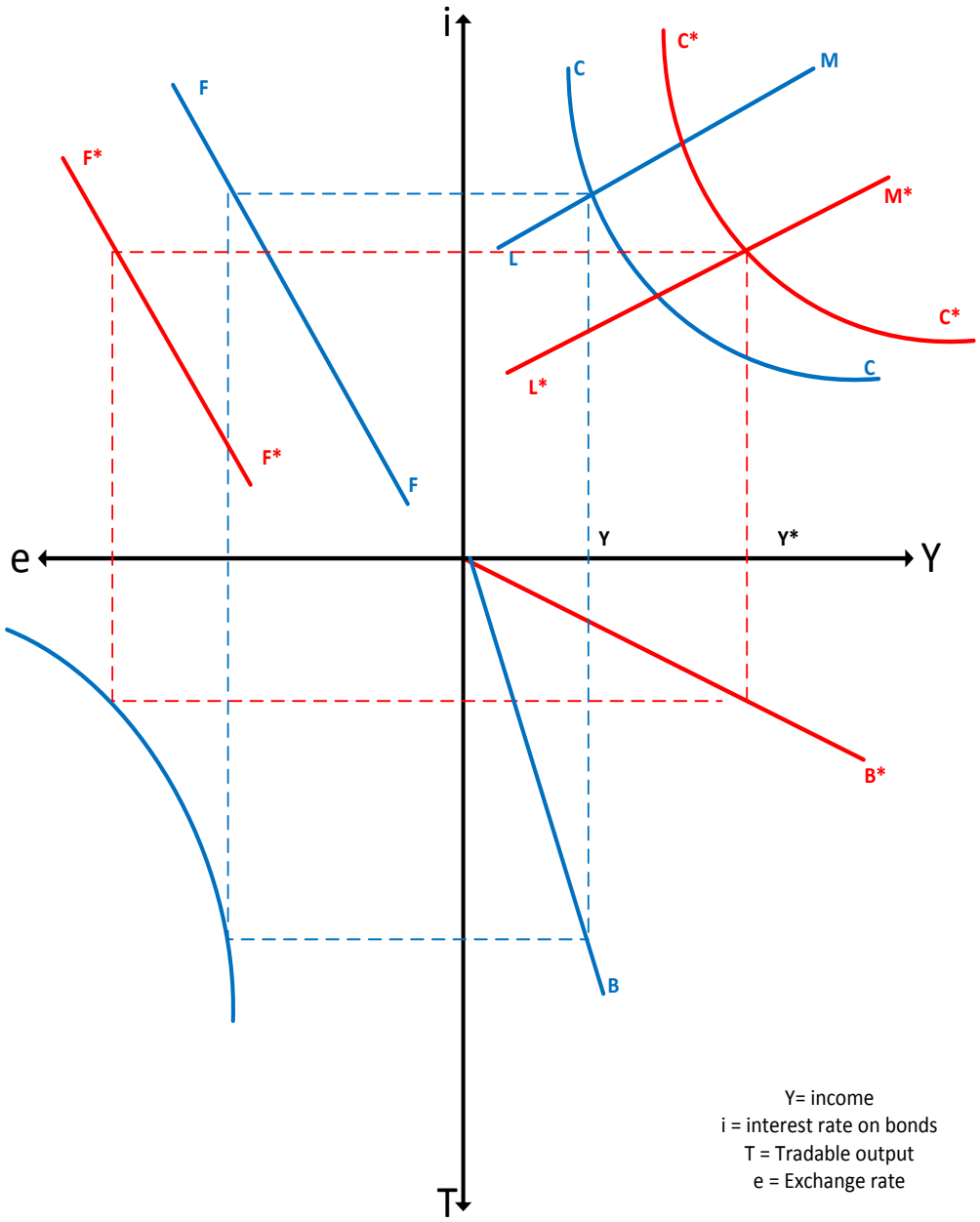
The nature of the shock driving real currency appreciation matters. The most recent shock – which Franz Hamann is analysing in this session (see Gonzalez et al (2015)) – is the large and prolonged real terms-of-trade gains for exporters of commodities (and, since 2013, its reversal). This typically leads to nominal currency appreciation, which stimulates the supply of credit through several possible channels.

This channels are illustrated in Graph 2, which is based on Bernanke-Blinder's graph in their AER bank lending channel paper (this is in the top right quadrant), extended in a simple Mundell-Fleming framework linking the interest rate on

domestic bonds (i) to the exchange rate (e). This seminal paper replaced the IS curve by a CC curve – "commodities and credit". They did this to allow for the impact on aggregate demand of changes in the willingness of banks to lend. They motivated this by changes in "the perceived riskiness of loans" – not a change in monetary policy. Their analysis indeed **holds monetary policy constant** (defined by constant money supply in their IS-LM framework). Hence the interest rate on bonds in their model is a market interest rate. It is not a simple function of the policy rate – but instead changes as the risk taking/risk assessments of banks change.

The Bernanke-Blinder diagram: the monetary and financial channels of terms-of-trade gains

Graph 2



This **endogeneity of the interest rate** on bonds is an essential assumption of the Bernanke-Blinder framework – allowing market rates to rise as risk-taking increases. This link between interest rates and risk-taking is crucial – but many macroeconomic analyses ignore it. The recent article of Blanchard et al (2015), for instance, made the opposite assumption. They assumed that monetary policy fixes the interest rate on bonds, which becomes an **exogenous policy variable**. Given the strong forces towards the convergence of real long-term rates in different currencies, this is a strong assumption. It is also unorthodox: normally central banks are thought to be able to control the short-term interest rate in their own currencies but not a market-determined rate such as the long-term rate.

In any event, their assumption means that capital inflows into local currency bonds do not drive down domestic long-term interest rates (which would have boosted domestic demand) but do lead to an appreciation of the real exchange rate (which is contractionary). Their conclusion that inflows into bonds are contractionary – reversing the standard Mundell-Flemming presumption for a country facing highly elastic capital flows – depends on the assumption that the local central bank faced with capital inflows can prevent the interest rate on domestic bonds from falling.

The risk-taking channel of currency appreciation

Returning to the analysis of the most recent shock, there are at least 3 possible channels through which a large and prolonged terms-of-trade gain can increase aggregate demand.

1. *Increased domestic bank lending*. As their real incomes rise, households (especially those with foreign currency debts, common in EMEs) become better credit risks. This is represented by an outward shift in the CC curve (which is just the IS curve augmented for bank lending). Income (Y) and the interest rate on bonds (i) both rise along a given LM curve if money is held constant. In an open economy, a higher rate of interest on bonds induces capital inflows and leads to currency appreciation. This link is shown by the FF schedule.

2. *A decline in the country's risk premium*. The higher real value of expected future exports in effect gives the country increased collateral, making foreigners more willing to lend. Hofmann, Shim and Shin (2016) have shown how currency appreciation in EMEs is indeed associated with a decline in the country's risk premium (ie lower sovereign credit default swap spreads). A lower country risk premium moves the FF schedule leftwards, capital inflows rise and the exchange rate appreciates. The notion that the exchange rate and capital flows respond to return differentials, which goes back to Fleming, does not of course allow for the impact of slow-moving balance sheet effects (eg mounting debts) which ultimately reverse the appreciation.

3. *Monetary expansion*, in practice so often associated with increased foreign exchange intervention. In this diagram, the central bank is assumed to follow quite a restrictive policy by allowing the exchange rate to rise to keep the current account in balance (ie along the rays B and B* from the origin) as the terms of trade improve. The only expansionary aspect assumed is that the central bank intervenes to purchase foreign exchange as capital flows increase. Unless the central bank fully sterilises purchases by selling bonds, bank reserves will usually

rise and – without changes in reserve requirements or other policies – the banking system becomes more liquid. The LM curve shifts to the right. (In practice, even greater holdings of government bonds – not just reserves – make banks' balance sheets more liquid. Gadanecz et al (2014) find evidence that increased bank holdings of government bonds in EMEs has led to an expansion in bank credit to the private sector.)

The net result of these three channels is that income is higher but the interest rate of bonds is lower. Because of the terms-of-trade gain, the current account remains in balance at a higher level of real GDP. In a closed economy, by contrast, only the first channel is operative – increased bank lending as the perceived riskiness of loans decreases. This increases income – but it raises the interest rate on bonds.

It is of course possible that a strong competitiveness impact of real currency appreciation on net exports (moving the CC curve towards the origin) would reverse this result. Such competitiveness effects, however, take years to build up and may be weak in countries dependent on commodity exports.

In addition, do not forget that real currency appreciation (especially in a commodities boom) increases gross fixed capital formation. This would move the CC curve outwards – and reinforce the impact of credit expansion. For many commodity producers, this effect of increased fixed investment seems to dominate at least for a few years the demand-depressing effect of lower competitiveness. So capital inflows, the supply of credit and the exchange rate can all rise together – and interest rates fall – when the real terms of trade improve.

This process will ultimately reverse once the terms of trade declines. The spurt of new investment will in any case run out of steam. If this analysis is correct, policy makers have to cope for several years with expansionary appreciation. Then at some unknown point in the future they will grapple with a contractionary devaluation and terms-of-trade loss. As the exchange rate overshoots in a downward direction, consumers can become much too pessimistic about their future income. Banks overtighten lending standards and risk premia on domestic assets widen alarmingly.

Left to itself, the financial system accentuates these expansions and contractions. Hence there is a role for macroprudential policies. Several speakers have indeed addressed how macroprudential policies with an exchange rate dimension (such as limiting foreign currency borrowing, increasing reserve requirements, capital flow management policies etc) can support (and perhaps reduce reliance on) foreign exchange intervention because they limit credit expansion and put downward pressure on the exchange rate (Pereira da Silva and Harris (2012)).

This analysis also applies to industrial countries receiving large capital inflows (with a current account deficit) and facing unwanted currency appreciation pressures. A rise in house prices is the classic ingredient of such credit-financed booms. But raising short-term interest rates will do little to counter this. But higher rates will usually attract capital inflows and add to currency appreciation. This can further fuel credit growth. To cool housing market pressures, the Reserve Bank of New Zealand (see Hargreaves (2016) in this volume) recently introduced macroprudential measures which allowed the central bank "to delay the tightening of interest rates, thereby reducing the incentive for any additional capital inflows into the New Zealand dollar" (Wheeler (2014)).

To conclude, the exchange rate and the interest rate on local currency bonds are key **endogenous** variables in the transmission of external shocks (financial and real)

to small open economies. Assuming either is exogenous can lead to incorrect conclusions. Analyses of macroprudential policy choices need to have a convincing "story" for both variables.

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Capital flows, credit cycles and macroprudential policy[1]

Yusuf Soner Baskaya[2] Julian di Giovanni[3] Sebnem Kalemli-Ozcan[4] Jose-Luis Peydro[5] Mehmet Fatih Ulu[6]

In the wake of the Global Financial Crisis (GFC), a considerable number of countries have adopted major changes in their policy frameworks geared towards enhancing financial stability. It is now conventional wisdom that part of the surge in capital flows into emerging market economies (EMEs) was in part a side effect from unconventional policies such as quantitative easing and negative interest rates, which generated a huge amount of global liquidity, as well as low interest rates in advanced economies. These inflows, mostly in the form of portfolio inflows, have in turn led to risks associated with a massive domestic credit expansion in EMEs. These phenomena have raised concerns over potential external imbalances, as well as maturity and currency mismatches between assets and liabilities in the household and corporate sectors.

For EMEs, the major policy challenge has become how to look for the ways of decreasing the sensitivity of credit and the exchange rates to capital inflows. Given the existing global economic and financial environment, using conventional monetary policies would be associated with increased risks to financial stability, since these policies could amplify credit and exchange rate swings. In particular, raising domestic interest rates in emerging markets – aimed at slowing down domestic credit growth – could in fact lead to high capital inflows, which in turn would fuel rapid credit growth. Furthermore, high interest rates would also lead to a smaller monetary policy space needed for stabilising inflation and output. In other words, the reliance on conventional monetary policy actions in such an environment may also sharpen the trade-off between the price and financial stability.

Given these challenges, the policy framework in Turkey in the post-GFC period has mainly entailed redefining the policy objectives, devising new policy tools, and introducing new mechanisms for coordinating the policy actions across different institutions responsible for different aspects of financial stability. On the monetary policy front, the financial stability objective has been incorporated into the monetary policy framework as a secondary objective, while keeping price stability as the primary objective. This approach has also entailed enriching the policy toolkit to alleviate the trade-offs arising from having high interest rates for price stability reasons in an environment of massive and volatile capital flows. On the macroprudential policy front, the toolkit has been composed of various traditional policies, such as the use

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of loan to value ratios, risk weights on different components on credit implemented by Banking Regulation and Supervision Agency (BRSA); as well as the interest rate corridors to discourage the inflow of short-term capital and to decrease the sensitivity of the domestic credit cycle to the global liquidity cycle.

The set of policies taken for maintaining the financial stability also led to the Central Bank of the Republic of Turkey (CBRT)'s new monetary policy framework, which was adopted at the end of 2010. With this change in the policy framework, the CBRT continued to focus primarily on price stability, while incorporating financial stability as a side objective. The latter entailed decreasing the sensitivity of both the economic activity in the financial and non-financial sectors to global capital flows and risk perceptions, and reducing the risks due to maturity and currency mismatches. With the multiple policy objectives, the policy toolkit has also been revised accordingly. While the key policy tool in the setup with only price stability objective was the policy rate, the new setup has utilised a much broader set of tools such as the interest rate corridor, the liquidity policy, the policy rate and finally the reserve requirement ratio (RRR), differentiated both across maturity and the currency denomination of liabilities.

In theory, such policies work both on the upside and downside of the capital flow cycle, ie the policies can reduce systemic risk and can also mitigate the effects of a credit crunch as a result of a reversal of capital flows. To date, there has been no causal evidence on the impact of such policies on the joint response of credit supply, credit demand and investment. To put it differently, we do not know whether macroprudential policies are successful in curbing credit growth and at the same time in diminishing risk taking by firms and banks without hampering investment and growth. In fact, the empirical evidence that is based on country-level aggregate data from emerging markets show inconclusive results in terms of the effects of macroprudential policies on credit supply, output and investment (see Forbes (2014) and Forbes and Klein (2013)).

There are several identification challenges in this literature. First and foremost, any macroprudential policy that aims at curbing domestic credit growth, which is linked to foreign capital inflows, will be correlated with capital inflows since the policy is taken in response to these flows. Second, when a country imposes capital controls or macroprudential policies to curb the domestic credit growth, it also imposes other macroprudential measures. Therefore, it is hard to tease out the effect of one policy from another, and especially at the annual frequency, which is the focus of many cross-country empirical studies. Third, both capital flows and macroprudential policy (or policies) are correlated with macroeconomic and microeconomic fundamentals. Therefore, even if one finds a negative effect of a capital control policy or a loan-to-value ratio cap policy on capital flows and domestic credit growth, this does not imply causality given omitted country fundamentals, firm and bank characteristics and trends. Fourth, theoretical models point to rich micro-level heterogeneity arising from pecuniary or aggregate demand externalities. In particular, these models highlight how certain agents' risk-taking behavior will have aggregate effects (eg see Farhi and Werning (2014) and Korinek (2015)). In fact, such models' predicted design for the optimal macroprudential policy rests on this heterogeneous risk-taking. Aggregate data do not have the rich firm-, bank- and loan-level heterogeneity needed to test for heterogeneous impacts of policy. And last but not least, given country heterogeneity, one policy may work differently in different countries, and hence trying to infer the causal impact of policy from the diverse experiences of many EMEs might bias the results to finding nothing. As a result, it has thus far proved elusive to tease

out the direction of causality, and hence gauge the effectiveness of macroprudential policies on credit growth and real growth during capital inflow and outflow episodes for EMEs.

In our work, we overcome these identification challenges by using a unique administrative data set from a typical emerging market, Turkey, combined with a unique policy experiment. Turkey received capital flows on a consistent basis since 2003, with a current account deficit to GDP ratio of 8 percent on average. There have also been several macroprudential policies implemented since 2009 onward to curb domestic credit growth. We focus on certain policies that took place after June 2009. Our dataset covers the period 2003−13, and is at the loan-firm-bank-quarter level. We match loan-level data from a credit registry to firm and bank balance sheets collected by the CBRT. We work with quarterly frequencies to understand the effect of capital flows and macroprudential policy on financial outcomes such as loan growth, and then turn to the annual frequency to tease out the effects of flows and policy on firm-level investment.

Our identification strategy is composed of several building blocks. We want to identify the causal effect of capital inflows on domestic credit expansion, and then test for the effect of macroprudential policy in mitigating the risks of such an expansion. Given our loan-bank-firm-quarter level data set, we examine how global financial conditions and macroprudential policy impact credit conditions in Turkey by regressing loans and interest rates on these variables using the credit registry data. We are able to saturate all our regressions with firm-quarter fixed effects, which fully control for the direct effects of unobserved time-varying firm fundamentals (including the firm demand for credit), and also with bank-quarter fixed effects to control for the direct effects of all bank-specific factors that vary over time and affect banks' credit supply. We next run a difference-in-difference analysis before and after the macroprudential policy episode, which started in the third quarter of 2009, to see the difference in loan provision in terms of domestic currency and foreign currency loans for risky and non-risky borrowers.

Our results are as follows. First, we establish the link from global liquidity and capital flows to an increase in domestic credit provision in Turkey. Although there are several existing papers that establish this link using macro data, we are not aware of any work that links variables such as VIX and emerging market capital flows to loan growth directly using detailed micro data. Second, we show that during periods of such capital flow surges, loans in foreign currency also expand together with loans in domestic currency as part of the credit boom. Finally, we investigate the effects of the macroprudential policies on loan provision in terms of the differences between foreign and domestic currency loans before and after the policies take place in a difference-in-difference setting. We show that foreign currency borrowing declines after the policies, but not if there is a capital flow surge taking place across EMEs.

Our paper is related to several strands of the literature. Ours relates to papers that show a link between global conditions and emerging market capital flows such Forbes and Warnock (2012), Rey (2013), Bruno and Shin (2013a, 2013b, 2015), Miranda-Agrippino and Rey (2014) and McCauley et al (2015). This literature focuses on the global financial conditions that are significantly influenced by the stance of US monetary policy. Both credit booms and busts in EMEs can be driven by global capital flows which, in turn, are affected by global liquidity and US interest rates. In the light of a possible monetary policy normalisation in advanced countries, a possible tightening in the financial conditions in the international markets can create

spillover effects, according to this literature, where capital leaves the EMEs and/or cost of borrowing increases substantially for these economies (eg, see Fratzscher et al (2013), Chen et al (2015) and Sobrun and Turner (2015)). At the same time, a dollar appreciation will increase the value of dollar debt and the real burden of dollar-denominated debt will increase in EMEs in such a case (See Shin (2013) and BIS (2015)).

Finally, our paper contributes to the literature on the real effects of the credit supply and demand shocks by investigating the firms' investment outcomes. There are only very few papers that analyse the real effects of credit supply and/or credit demand shocks by matching credit register data with precise firm-level information. For example, in a very recent paper using Italian credit registry data, Cingano, Manaresi and Sette (2013) exploit the dramatic liquidity drought in the interbank markets following the 2007 financial crisis and find important effects of credit shocks to banks on firm investments through the bank lending channel. Paravisini, Rappoport, Schnabl and Wolfenzon (2014) use Peruvian credit register data to show how the banking crisis negatively affects trade via a credit supply reduction, while Chodorow-Reich (2014) exploits US syndicated loan-level data to show that the financial crisis negatively affected employment of firms via a reduction of credit availability through their banks – he finds large effects. However, for Spain, Jimenez, Mian, Peydro and Saurina (2015) and Jimenez, Ongena, Peydro and Saurina (2015) use Spanish credit registry data and find insignificant real effects of credit supply booms in terms of employment.

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Macroprudential policies in a commodity exporting economy[1]

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Colombia, like other Emerging Market economies, is a small open and commodity exporter economy. The predominant type of the commodity exported has varied, from coffee in the past century to oil in the current one. Nonetheless the importance of the commodity exporting sectors for the Colombian business cycle is prominent. In the last 40 years, empirical evidence shows a strong and positive association between the cyclical component of the real price of Colombian exports and the cyclical component of real GDP. Periods of high export prices coincide with economic booms, while periods of lower than usual prices are associated with recessions. In addition, besides contributing significantly to the GDP cycle volatility, the effects of these shocks are widespread as they affect real variables, such as consumption and investment, as well as other financial variables, such as credit.

In this study we perform an oil price shock identification analysis in which we analyse how a key set of macroeconomic variables behave around oil price shocks. We are interested in studying large increases in international oil prices. Once we identify the shocks, we observe how country risk, output, private consumption, domestic credit, trade balance and the real exchange rate evolve during the commodity price surge as well as during its collapse.

Our sample runs from 1988 to 2012. The event analysis is carried out at quarterly frequency. However, neither all variables are available for the full sample nor observed at the same frequency. In particular, we take monthly data for the oil price and the country risk measured by JPMorgan EMBI-Colombia index. Our measure of oil prices is the Europe Brent Spot Price FOB (in US dollars per barrel) adjusted by using the United States' CPI. This series is available from January 1988 to December 2012. The remaining variables are at quarterly frequency, and taken from the national accounts and the balance of payments statistics. The data for these last variables are available from 1999Q2 to 2012Q4.

We follow Hamilton (2003) to find the quarters during which there were oil price shocks. Hamilton defines an oil shock as a large increase in the oil price. Specifically, an oil shock is the maximum value of the oil price during the last 36 months. An oil shock event occurs when the oil shock is larger than two standard deviations. At quarterly frequency, there is an event if at least one monthly shock event occurs.

Our main findings are that before the peak of a large and steady oil price hikes, country risk falls, output rises, private consumption increases, domestic credit increases, trade balance improves and the real exchange rate appreciates. In general,

[1] This article was completed while Andres Gonzalez was at the Central Bank of Colombia. The views expressed in this paper are those of the author(s) and do not necessarily represent those of the IMF or IMF policy.

[2] International Monetary Fund.

[3] Banco de la República.

[4] Banco de la República.

after the sudden oil price reversal all these patterns shift back in the opposite direction.

These findings are consistent with the intuition shared by many economists, who study small open economies in which resource sectors are important. As the oil price grows, income from the resource sector increases and risk premium falls with the improved overall creditworthiness, creating a surge in demand for tradable and nontradable goods, inducing a real exchange rate appreciation and a shift of economic resources from the tradable sector to the nontradable sector. Credit expands, especially in those sectors that benefit from the real exchange rate appreciation. Overall economic activity and demand rise in tandem with asset prices. However, sharp oil price reversals truncate this process and a rapid reallocation of resources occurs together with a collapse in asset prices and the currency.

To explain these facts, we develop a New-Keynesian DSGE model for financial policy analysis that takes into account these key empirically relevant features of the Colombian economy. Our baseline model is a three-sector economy (commodity, tradable and nontradable sectors) populated by households, entrepreneurs, retailers, capital producers, private banks, the government and the central bank. Households receive the revenues from the resource sector, supply labour to firms, consume final goods and save in the form of bank deposits. Output is produced in several stages, including a monopolistically competitive nontradable sector with nominal rigidities. Entrepreneurs, both in the tradable and nontradable sectors, face financial frictions and their external financing cost is decreasing in their net worth, as in Bernanke, Gertler and Girlchrist (1996).

In the baseline specification of the model, the central bank sets the nominal interest rate using a monetary policy rule. We also enhanced further the model to consider exchange rate and credit policies. We model the first as the sales/purchases of international reserves, which adjust in response to real exchange rate misalignment, and the second as any financial regulation instrument, which responds to aggregate credit dynamics by enlarging or compressing the external financing premium in the economy.[5]

In sum, we construct a setup with a commodity-driven transfer problem, in which high oil prices increase export revenues and cause higher demand for tradable and nontradable goods. The model includes three productive sectors: commodity, nontradable and tradable sectors and uses the Bernanke-Gertler-Girlchrist setup to introduce an external financing premium relating net worth of entrepreneurs in the tradable and nontradable sectors to their financing costs. It also models separately the central bank and commercial banks.

The economy's long-run net foreign assets is pinned down by assuming that the external interest rate is an exogenous, increasing function of the ratio of external debt to the stock of oil. We interpret this as representing a form of collateral for credit provided by foreign lenders. The model allows us to show that the dynamics of the proposed transfer problem can be the efficient response of the economy to exogenous terms-of-trade shocks.

However, the adjustment is inefficient because the equilibrium is distorted by financial frictions. In the commodity boom phase, credit growth and real appreciation transfer net worth from the tradable to the nontradable sector, which enhances

[5] The complete set of equations are available upon request.

borrowing capacity in the latter, and then a sudden reversal in commodity prices causes a reallocation back to the tradable sector and causes the nontradable sector to experience a credit crunch.

Moreover, a pecuniary externality is also at work in this process, because in the Bernanke-Gertler-Girlchrist financing premium the value of net worth depends on equilibrium sectoral relative price movements that individual agents do not internalise when they make borrowing decisions.

We enhance the model to account for the role of macroprudential policy. Our model introduces policy rules governing central bank foreign exchange intervention and a regulatory premium incorporated as a multiplicative factor of the external financing premium banks charge to entrepreneurs. These rules are ad-hoc, but they make an interesting contribution because they are formulated as functions of the deviations of the real exchange rate from its long-run target (for the foreign exchange intervention rule) or the private sector credit from its steady state value (for the regulatory premium). Hence, these rules try to approximate the prudential nature of the policy because by construction they induce larger adjustments in the policy instruments in boom times (ie when the real exchange rate and/or credit exceed their long-run levels), and converge to turning off both instruments in the long run, when their driving variables settle at their steady state values.

We use the estimated model (by Bayesian techniques) to perform several quantitative exercises. First, we perform a shock decomposition analysis. We quantify the historical importance of external and domestic shocks in the Colombian data. Although our focus is commodity export shocks, we also study the relative importance of the remaining ones. Second, we compute the Bayesian impulse-response functions. The objective is to visualise in more detail the macroeconomic impact of one-off commodity shocks and the policy response of the central bank. The third exercise is a counterfactual experiment to assess the effects of an unexpected reversal of a commodity shock. There, agents take decisions based on the idea that the value of commodity production will increase persistently for several quarters. However, they do not anticipate the possibility of a sudden reversal. Our interest is to use the model to analyse the role of conventional monetary policy and macroprudential policies when the sudden commodity collapse takes agents by surprise.

Our first quantitative experiment is a shock decomposition analysis. The model considers 12 shocks. We label four of them as external and the rest as domestic. The external shocks are: one to the foreign interest rate spread that the economy faces when borrowing abroad, another is a foreign inflation shock and the third is a shock to commodity exports. It can be either commodity prices or quantities. The domestic ones are shocks to productivity, investment and interest rate spreads all to both sectors (tradable and nontradable), markup as well as a monetary policy shock. Our aim is to gauge the estimated contribution of the considered shocks on the observed movements of tradable and nontradable output and credit, aggregate consumption, inflation, the real exchange rate and nominal interest rates.

The shock decomposition of these time series confirms a conventional finding in many of the models used in the international macro literature. The role of foreign interest rate spread shocks appear to be small. Also the role of foreign inflation shocks is negligible. Most of the importance of foreign shocks in the Colombian macro series stems from commodity export movements, as we suspected from the documented evidence in the first part of the paper.

Despite these large real effects on sectoral output and relative prices, commodity export shocks have a smaller contribution to tradable and nontradable credit and consumption. Credit fluctuations are mostly dominated by investment specific shocks, especially in the case of nontradable credit. The inter-sectoral effects of specific shocks go from nontradable credit to tradable credit, but not the other way around. More precisely, tradable investment shocks have no impact on nontradable credit, while nontradable investment shocks spillover to tradable credit. This type of credit is much more responsive to interest rate credit spread shocks than nontradable credit. Thus, based on these findings, we are inclined to conclude that the importance of commodity export shocks appears to lie more on its sectoral effects than on its impact on aggregate activity. GDP fluctuations may mask the reallocation effects that commodity export shocks entail. Preference shocks appear to be an important source of macroeconomic fluctuations, as they affect GDP through nontradable output, consumption, inflation and the policy rate. However, they do not affect both types of credit. Their contribution to real exchange rate and tradable output fluctuations has also been small. Put together, these results suggest that credit cycles in Colombia does not appear to be driven by aggregate domestic shocks nor by foreign shocks, but mostly by sectoral specific shocks and their interaction.

The mechanism that we have in mind to explain the response of the economy to commodity booms, approximated by the model's impulse responses, is as follows: besides the standard channels in the tradable and nontradable small open economy models, a key mechanism works through the external interest rate risk premium. This premium has an endogenous component, which depends not only on net external debt but also on the stock of the real commodity resource. A commodity price shock raises the value of this real asset lowering the risk premium that the economy faces in international financial markets. Thus, the income effect on the households' budget constraint may be small but the wealth effect may be large, especially since overall the economy has a negative net foreign asset position. Without this mechanism, the effects of a commodity boom on the real exchange rate in a three sector model would be smaller.

There is an additional channel in our model induced by the presence of the sectoral financial accelerator. The appreciation of the exchange rate also leads to a fall in the value of the assets of the tradable sector, lowering the value of its collateral and consequently, rising the external financing premium that tradable firms pay to commercial banks. This increase in financing costs coupled with the lower demand of domestically produced tradable goods drives further down employment in this sector. In contrast, the nontradable sectors benefit from an exchange rate appreciation. This channel is present in the model but it is quantitatively small in the Colombian data, as the shock decomposition also reveals.

Finally, the effectiveness of the macroprudential policy is evaluated by studying how the response of the economy to an oil price hike lasting six quarters, followed by an unexpected reversal, differs with and without the macroprudential policy rules. In the case without the rules, the only policy rule at play is the standard Taylor rule in New-Keynesian DGSE models.

The results show only small differences with or without the policy rules governing currency intervention and the regulatory premium. These results could be interpreted as indicating that the model's financial frictions are not the empirically relevant ones, but they may also suggest again that the perturbation approach to smooth the convex borrowing costs implied by the financial frictions is weakening their real

effects. The results also suggest that it would be useful to explore the implications of varying the values of the parameters that characterise the elasticities of the macroprudential policy instruments to their corresponding determinants. Intuitively, it seems that in the limit if the elasticities were very high, the financial sector should have strong real effects because of large changes in financing costs via the regulatory premium, and large adjustments in the central bank's balance sheet via the foreign exchange interventions.

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Managing systemic risks in the Croatian economy

Boris Vujčić[1] and Mirna Dumičić[2]

1. Introduction

The recent world financial and economic crisis revealed the need for a macroprudential approach to financial system analysis, since it has become obvious that a significant share of risks arises from the system itself, independently of the risks related to individual financial institutions. The previous regulatory framework has shown to be pro-cyclical, which, combined with liberalised financial systems and technological advancement, increased the speed and the intensity of shock propagation. Real output costs of extreme financial crises amount from 3% to 5% of world GDP (Kapp and Vega (2012)), while the social costs considerably exceed those amounts. All of this emphasises the necessity of identifying and monitoring systemic risks in order to better understand the processes of their accumulation and enable the preventive reaction of policy makers, which was partly missing in the "standard" supervision framework.

Up to the escalation of the recent financial crisis, macroprudential policy has been conducted primarily by emerging market countries, while developed countries intensified its use after 2008. Croatia stands out as one of the countries with the most intensive use of macroprudential measures and instruments in the pre-crisis period (Lim et al (2011), Lim et al (2013)). This makes Croatia one of the rare countries with relevant experience in conducting macroprudential policy both in the boom and the bust stages of the cycle. The main goal of this paper is to describe Croatian experience in managing systemic risks from early 2000s to the recent period, with the focus on the post-crisis period when the new regulatory landscape aimed at enhancing systemic risk prevention and building up the resilience of the financial system has been created.

The paper is divided into four sections. After the introduction, the main factors that encouraged the use of macroprudential policy in the pre-crisis period and the most important macroprudential measures are described, while the third section presents the main institutional and regulatory changes introduced since the onset of the crisis. The paper ends with the main conclusions based on the Croatian experience in managing systemic risk.

2. Croatian pre-crisis experience in macroprudential policy

The active use of macroprudential policy in Croatia in the pre-crisis period has been encouraged by inherent characteristics of domestic economy such as size, openness, extremely high and persistent deposit and credit euroisation and the insufficient level of domestic deposits for financing credit growth; as well as by global developments

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such as financial liberalisation, convergence process, high global liquidity, low risk aversion and yield hunt in low yield environment, which stimulated strong capital inflows in emerging market countries (Dumičić and Šošić (2014)).

Strong credit growth in some periods prior to the onset of the crisis has been several times faster than the GDP growth, and a non-negligible share of it was financed by foreign borrowing, mainly from parent institutions of domestic banks (Figures 1 and 4). The flipside of strong capital inflows were widening current account deficit and rapidly growing external debt, as increased aggregated demand exceeded short-term domestic supply and encouraged imports (Figure 3). Growing imports at the same time kept inflation relatively stable, but strong pressures on the prices of financial assets such as shares and currencies, as well as of the non-tradable goods, resulted in bubbles in the real estate and stock markets and put significant appreciation pressures on domestic currency (Rohatinski (2009); Figures 5–8).

In addition to high euroisation (Figure 2), manoeuvring space for monetary policy has also been limited by the "Tošovský dilemma", according to which in situations of strong capital inflows an increase in interest rates would just stimulate them additionally. These limitations combined with the described macroeconomic and financial developments encouraged the Croatian National Bank (CNB) to combine classical monetary policy with measures of the macroprudential characteristics. These measures were targeted at slowing down the accumulation of external imbalances and reducing credit growth rates, as well as on creating buffers against potential shocks.

CNB has started using countercyclical macroprudential policy already in 2003[3] (Figures 11 and 12). The most important pre-crisis measures included:

- a high level of the general reserve requirement ratio which increased overall resilience of the banking sector (23.5% in early 2000 and 12.0% at the end of 2015);
- foreign currency interventions primarily aimed at alleviating strong appreciation pressures;
- quantitative restrictions on lending (annual credit growth ceiling set at 16% in 2003 and at 12% from 2007 to 2009) which obliged banks whose annual placement growth exceeded the limit to purchase compulsory CNB bills;
- the minimum required foreign currency claims which served as the foreign exchange liquidity buffer (introduced in 2003 with the initial rate of 32%, afterwards gradually reduced to 17%);
- the marginal reserve requirement ratio (from August 2004 to July 2006, it has been gradually increasing from 24% to 55%) aimed at slowing down the accumulation of external imbalances and strong loan growth by making foreign borrowing more costly;
- the special reserve requirement ratio (set at 55% in March 2006) that served as additional reserve requirements on banks' liabilities arising from issued securities;

[3] For more details about the macroprudential policy of the CNB in the pre-crisis and crisis period please see Dumičić (2015) and Dumičić and Šošić (2014).

- increased risk weights for foreign currency and foreign currency-indexed loans to unhedged borrowers from 50% to 75% and from 100% to 125% in June 2006, respectively, and from 75% to 100% and from 125% to 150% in March 2008, respectively[4]; and
- increased capital adequacy requirement from 10% to 12% in March 2010, which partially substituted the removal of higher risk weights for currency-induced credit risk due to harmonisation of domestic legislation with Basel II.

The main results of these measures were slower accumulation of systemic risk and strengthened resilience of the financial system through more prudent risk management and increased liquidity and capital buffers of the banking sector as they encouraged banks' recapitalisation (Figure 9) and ensured the adequate level of both domestic and foreign currency reserves against potential shocks. Nevertheless, it should be noted that the efficiency of macroprudential measures was partially reduced due to their circumvention through the less regulated parts of financial system or by transferring operations from daughter banks to parent banks.

After the onset of the crisis and a significant deterioration in financing conditions in international markets, CNB started gradually releasing the system reserves accumulated in the preceding period by removing the marginal and special reserve requirements, lowering the general reserve requirement ratio, reducing the minimum required foreign currency claims and abolishing credit growth limit (Rohatinski (2010)). By the end of 2012, CNB released EUR 6.1 billion, or more than 14% of GDP. Such measures significantly improved the liquidity of the banking system, ensured smooth servicing of the government's liabilities to foreign creditors and preserved the stability of domestic currency against euro, which has been the key prerequisite for maintaining the overall financial stability (Dumičić (2015)).

3. New institutional and regulatory changes in the macroprudential landscape

The post-crisis period has been marked by several important changes on the national and global levels that have created a new landscape for approaching and managing systemic risks. The most important ones were the introduction of the Basel III and the establishment of the European Systemic Risk Board (ESRB) responsible for the macroprudential oversight of the EU financial system. With its recommendations the ESRB supports the development of institutions and instruments for the implementation of macroprudential policy. Most important recommendations from the Croatian perspective refer to establishing the national macroprudential mandate, mitigating systemic risks related to foreign currency lending and intermediate macroprudential objectives. Apart from these global developments, in July 2013 Croatia entered the EU, which also induced some regulatory modifications.

[4] The direct impact of this measure was the decrease of the capital adequacy ratio by more than 3.0 percentage points, which spurred capital raising by the banks and made it more costly to the banks, in terms of the needed capital, to extend loans denominated in the foreign currency and helped to modestly reduce the euroisation level of the banking system.

3.1 Institutional changes

Despite the fact that the CNB has continuously focused on preserving financial stability, this task has not been formally allocated to the central bank. This encouraged the amendment of the Act on the Croatian National Bank in 2013 with an explicit task of contributing to the stability of the financial system.

Apart from that, the recent financial crisis clearly pointed to the negative effects caused by the lack of coordination among the regulatory institutions. The ESRB therefore initiated the formation of macroprudential bodies whose primary task is to coordinate macroprudential supervision among different regulators within the country and on the EU level. Stimulated by this, but also by practical experience with problems arising from the insufficient coordination between institutions that might affect financial stability in the pre-crisis period, in January 2014 the Financial Stability Council (FSC) has been established. This inter-institutional body comprises representatives of the CNB, the Croatian Financial Services Supervisory Agency, the Ministry of Finance and the State Agency for Deposit Insurance and Bank Rehabilitation. Its main tasks are to identify, assess and address systemic risks, and to ensure cooperation and exchange of information between the competent authorities.

This Act also defines the main and intermediate goals of macroprudential policy, which are in line with the *ESRB Recommendation on intermediate objectives and instruments of macroprudential policy*. Concurrent examination of the relation between systemic risks, intermediate objectives and the appropriate response of macroprudential instruments in practice has been ensured by newly developed framework for monitoring financial stability which supplements the regular CNB analysis. This macro-level approach is based on a simplified standardisation of systemic risk indicators and the relation between structural vulnerabilities and short-term developments in the financial and non-financial sectors (CNB (2015)). The chosen indicators are in line with the identified main and intermediate objectives of macroprudential policy, but they also include the specific indicators, vulnerabilities and measures based on monetary, macroeconomic and financial characteristics of domestic economy.

3.2 New policies and measures

New capital requirements

The introduction of Basel III presented new and stricter international standards for capital and liquidity risk management. Until then, regulators have used measures of macroprudential characteristics in discretionary ways without specifically defined rules or frameworks, while the new regulation harmonises and to a certain degree pre-defines the use and the calibration of some instruments.

For most of the EU countries, Basel III implied policy tightening and an increase in the required capital ratio, but Croatia and some other CEE countries have used them mostly to preserve the existing capital buffers and substitute previously used comparable measures. The main change was the definition of the obligation to maintain the required capital buffers. Up to 2014, the minimum required capital adequacy ratio in Croatia was set at 12%, which was higher than in other EU countries. At the end of 2015, the minimum capital adequacy ratio for small banks was set at 12.0%, while for banks designated as systemically important, it amounted to 13.5%

According to the new regulation, the minimum proscribed capital adequacy ratio is 8% and comprises common equity Tier 1 capital (4.5%), additional Tier 1 capital (1.5%) and Tier 2 capital (2%), while capital conservation buffer was set at 2.5% of the total amount of risk exposure in the form of the common equity Tier 1.

As of April 2014, credit institutions are obliged to maintain structural systemic risk buffer in the amount of 1.5% of the total amount of risk exposure in the form of the common equity Tier 1 for all banks, and additional 1.5% for large banks, depending on the size and complexity of their operations. Decision on the application of this buffer was based on the following systemic risk indicators:

- elevated structural macroeconomic imbalances that define the probability and intensity of a potential shock to the financial system;
- a high level of market concentration that increases the vulnerability of the financial system;
- low liquidity of real estate markets, complicating a fast and efficient exercise of collateral; and
- the operation of domestic systemically important financial institutions.

Structural systemic risk buffer of additional 1.5% for large banks was used as a temporal substitute for the buffer for other systemically important institutions (O-SII).

As of 2015, the CNB also formally traces cyclical risk related to credit activity. Due to the ongoing deleveraging of the households and corporate sector, the buffer rate is currently set at 0%.

Measures aimed at risks related to lending in foreign currencies

Beside many actions taken in order to mitigate risks related to high credit euroisation and aimed at informing and warning bank clients about potential risks, as well as at enhancing the management of these risks in banks by defining specific procedures and by increasing the costs of such lending for banks, in 2015 the CNB expanded the existing toolkit for dealing with these risks in the area of consumer information and obliged banks to illustrate the impact of potential currency and interest rate shocks to monthly annuity or instalments. For loans denominated in foreign currency, banks should also provide the comparable offer for domestic currency loans or refer the customer to an informative list of banks offering such loans.

Tightened provisioning standards

In order to deal with seizure of collateral and procedures which present obstacles to efficient unwinding of non-performing loans, in 2013 the CNB tightened provisioning standards (Figure 10). According to the new rules, if a bank does not adequately tackle the loan resolution process, regardless of collateral it has to increase the provisioning level progressively over time. They should account provisions, even if the loan is fully collateralised for at least 30% of loan value two years after delinquency, and then 5% subsequently every six months (Vujčić (2015)). This should work as an incentive to clean up the balance sheet in order to dispose of non-performing loans.

Special rules for risk weights for residential real estate

In 2014, the CNB extended the use of stricter criteria for application of risk weight of 35% to the exposures fully and completely secured by mortgages on residential property.

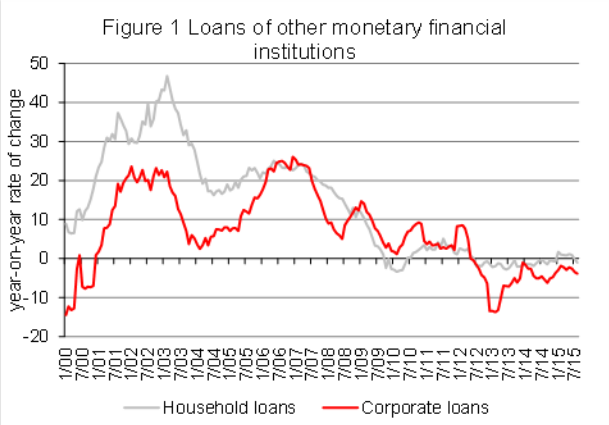
Recommendation related to the risk weights for commercial real estate

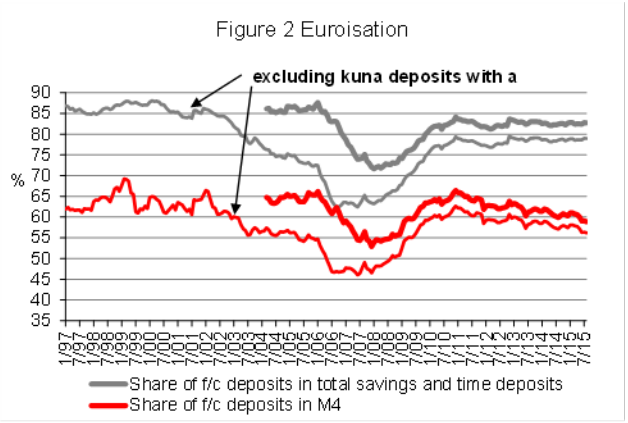
Considering the fact that the commercial real estate market in Croatia has been rather illiquid, the CNB recommended in 2014 that credit institutions should not apply a 50% risk weight to exposures secured by commercial real estate, until the market becomes more liquid and the effectiveness of the process of forced collection is satisfactorily improved.

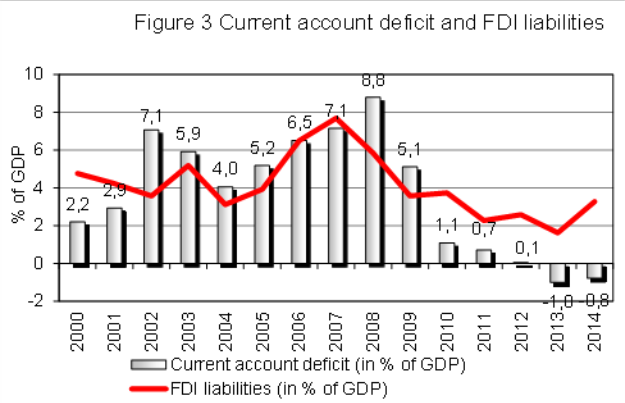
4. Conclusion

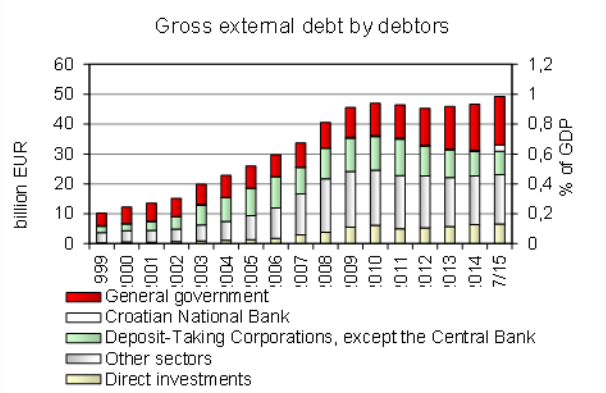
The recognised need for establishing an effective framework for managing macroprudential policy that will enable the prevention, mitigation and avoidance of systemic risks and the strengthening of system resilience to financial shocks has resulted in many regulatory and institutional changes on the global level. Prior to these reforms, the CNB was in the forefront even in global terms in the timely creation of adequate systemic risk buffers and the countercyclical conduct of macroprudential policy. The new regulation has provided a new set of instruments at its disposal, which should enable a more effective implementation of macroprudential policy. Nevertheless, despite the efforts to make handbooks for managing different types of systemic risks, Croatian experience shows that the policymakers should not focus only on "prescribed" tools and policy options but should also keep their eyes and minds open, as it is the only way to increase the chances of successfully managing systemic risks.

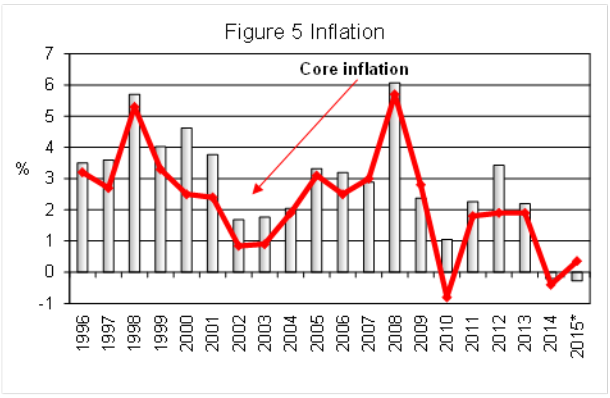
Figures

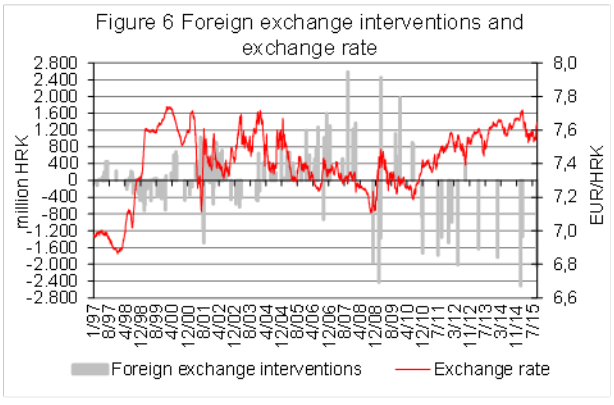


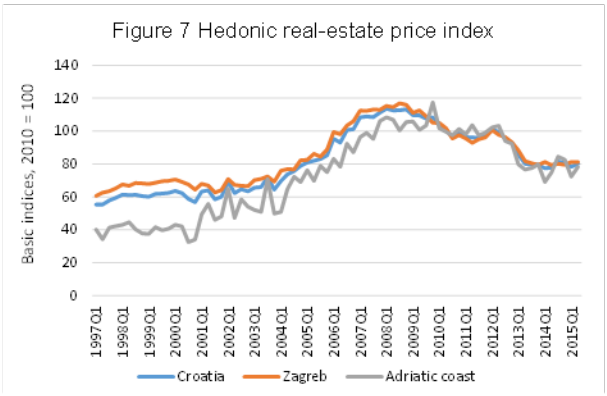


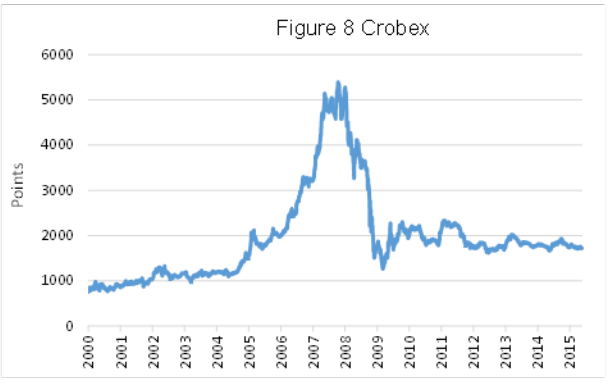




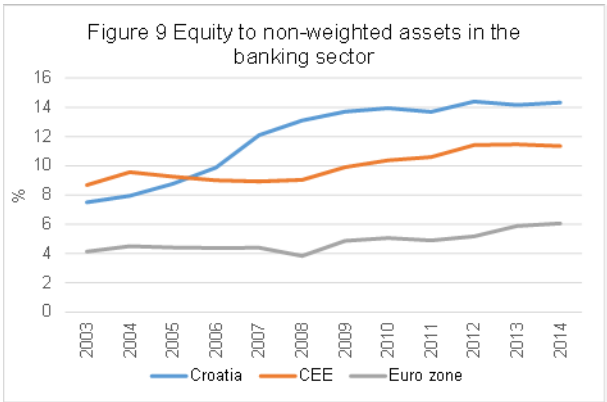


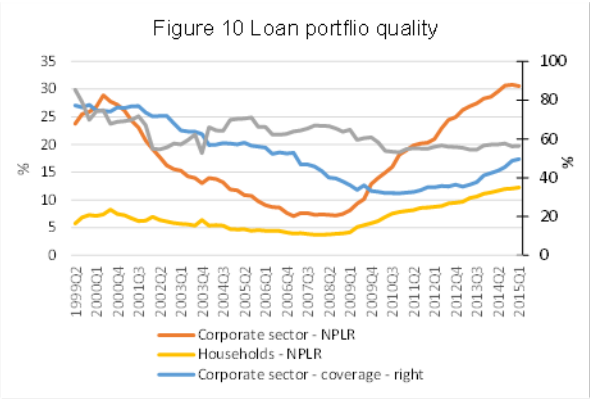






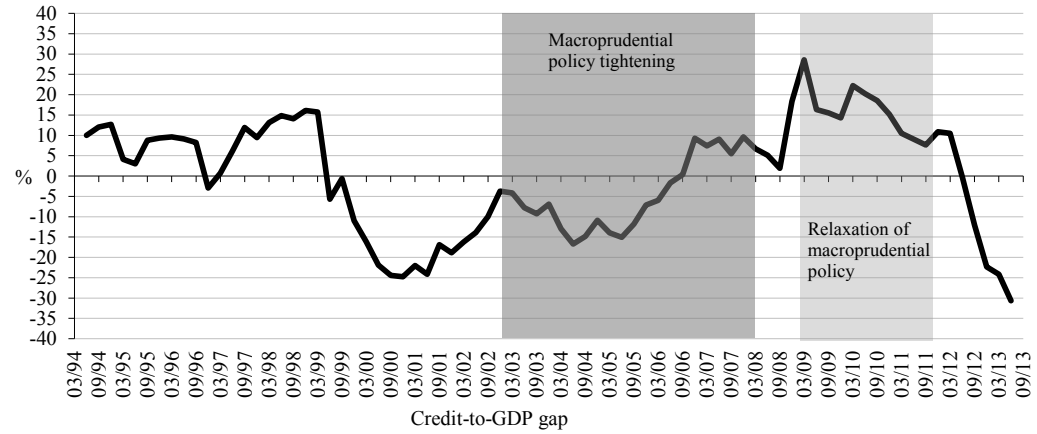
Sources: Croatian National Bank; Zagreb Stock Exchange.





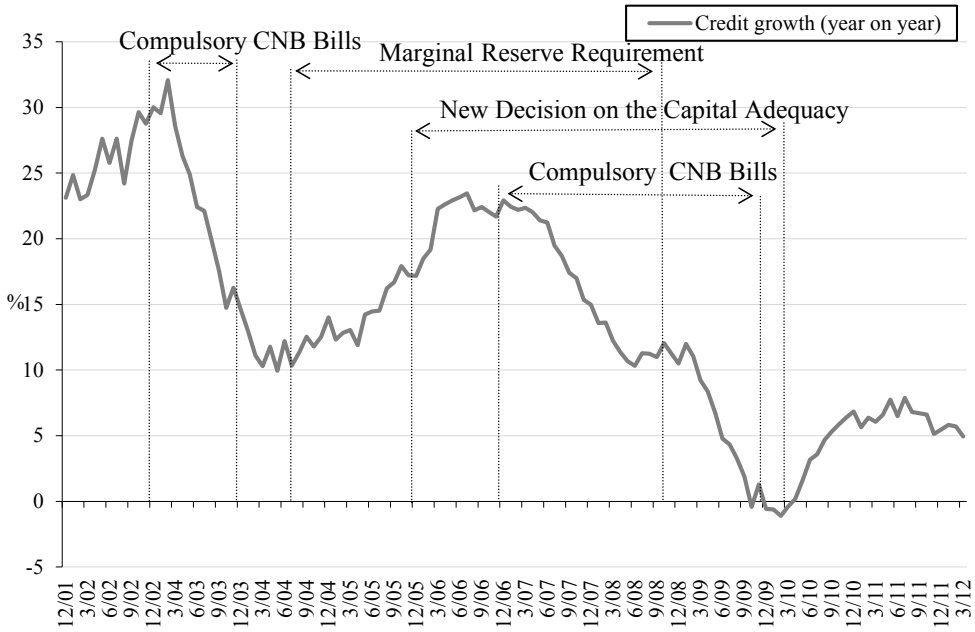
Source: Croatian National Bank; European Central Bank.

Figure 11 Credit-to-GDP gap and the countercyclical implementation of CNB's macroprudential policy



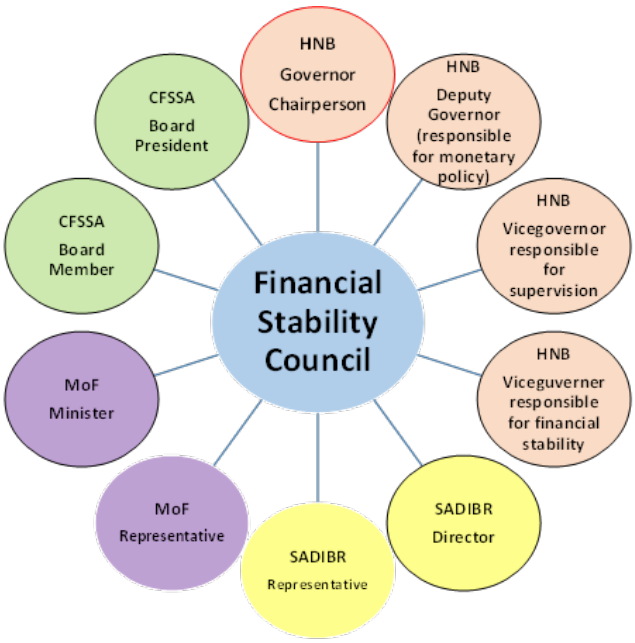
Source: Croatian National Bank.

Figure 12 Selected macroprudential measures and credit growth



Source: Croatian National Bank.

Figure 13 Members of the Financial Stability Council



Note: The line around a circle denotes a voting right.

Source: Financial Stability Council.

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Macroprudential policy regulation: some continuing challenges[1]

Manuel Ramos-Francia[2] and Santiago García-Verdú[3]

Introduction

The unprecedented monetary policy stances in advanced economies (AEs) have had considerable implications on the global economy and, in particular, on most emerging market economies (EMEs). One such implication has been the significant bond flows that have entered and exited EMEs.

A byproduct of the global financial crisis has been the financial stability policy discussion on the degree of leverage in financial institutions. In effect, financial leverage has been underscored as a fundamental factor leading to the global financial crisis. Accordingly, many financial sector reforms have been designed with the goal, *inter alia*, of providing better incentives for financial institutions to attain levels of leverage that are closer to a social optimal.

Nonetheless, it has been argued that, given the bond flows' magnitude involved, and the incentives faced by many asset management companies, a low degree of leverage in the financial institutions concerned will not necessarily ensure a smooth financial ride through the US policy rate tightening.

In this context, based on Feroli et al (2014), we seek evidence on the existence of run-like dynamics in bond flows in a set of EMEs. We also explore some of the implications changes in US monetary policy could have on the bond flows. Such dynamics can be explained by the presence of delegated investment between capital owners and fund investors, and a concern for relative performance between investors. Evidently, other mechanisms could be contributing to this type of dynamics, but we do not explore them here.

Of course, AEs' monetary authorities are pursuing their legal mandates. Yet, given the monetary policy stances' unprecedented characteristics, their implications are not necessarily fully understood. Thus, we are interested in understanding some of their economic repercussions for EMEs. More generally, our concern is about the run-like dynamics that could potentially take place in the near future. We hypothesis that hitherto we have only seen a handful of episodes of run-like dynamics, and the possibility that we observe more is latent.

[1] This note contains the main ideas and results of our working paper "Is trouble brewing for EMEs?" on which the presentation "Macroprudential policy regulation: some continuing challenges" was based. The referred presentation was delivered at the conference, "Macroprudential Policy: Effectiveness and Implementation Challenges" jointly organised by the CBRT, the BIS and the IMF on 26–27 October 2015 in Istanbul, Turkey. The opinions in this note and the associated presentation are those of the authors, and do not necessarily reflect those of Banco de México.

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Preliminary analysis

To set the stage, we summarise some of the characteristics EMEs' bond flows and their associated indices have presented in recent periods (January 2009–August 2014). From the cumulative bond flows to EMEs in our database, we document first that they maintain noticeable correlations. Second, it seems that the longer inflows have been accruing in an economy, the greater the outflow tends to be, once such an episode takes place. In effect, the pace of inflows is more likely to be slower than that of outflows. Third, some changes in the flows' direction are associated with key announcements of US monetary policy.

In particular, we find the following regarding correlations. First, aggregated bond flows associated with EMEs and the JPMorgan EMBI Global spread tend to co-move negatively, ie bond flows and their prices co-move positively. Second, the correlation of the EMBI Global spread with changes in bond flows seems to have increased after 3Q 2011; that is, variations in the EMBI spread have led to greater changes in bond flows after 3Q 2011. Third, the bond flows' variance has increased since around 3Q 2011.

Overall, high correlations among bond flows, their negative co-movement with the EMBI Global spread, and sharp bond outflows are, jointly, evidence suggesting the presence of run-like dynamics in this type of flows. This stands in contrast with the classic case in which an increase in the risk premium (ie a lower price) eventually prompts an upsurge in capital inflows, as some investors jump in to seize the opportunity.

Main features of the model

We use the model posited in Feroli et al (2014) as a framework to analyse our data, and to organise part of our discussion. Next, we explain some of its most salient features. It has two types of investors:

1. *Passive investors* are risk-averse. Each one chooses between holding one unit of the risky asset and having her resources in a money market account, which offers a floating rate. This rate is associated with the monetary policy rate. Everything else being constant, the floating rate is the safest return.
2. *Active investors* are risk-neutral. Similarly, each one selects between holding a risky asset and having her capital in the money market account. However, they are *delegated* investors. Thus, although they care about long-term fundamentals, they are also concerned about their *relative performance* vis-à-vis their peers. One can rationalise such a concern in several ways.

Each of the active investors keeps an eye on their peers' performance. In practice, investors measure their performance against a benchmark index. Thus, active investors play a game in which the effort one exerts will affect the effort of others.[4]

[4] As pointed out by Feroli et al (2014), the delegated relationship is typically a sizeable chain of relationships. Thus, although one can think of a principal and an agent, in practice it would probably

Next, we describe the model´s intuition. We omit many of the details to keep technicalities to a minimum, and refer the interested reader Feroli et al (2014) for further details.

Active investors care about the risky asset's fundamental value. Yet, they have a relative ranking concern in the short run, materialised by a penalty taken by the active investor that ranks last. Each one decides where to invest her capital depending on the expected return of the risky asset, the money market account return, and the penalty for being last. Importantly, the risky asset market's size is small so that changes in the active investors' positions affect prices.[5]

Accordingly, their portfolio allocation decisions can lead to unexpected changes in active investors' positions, exacerbated by the relative ranking concern. As a few active investors change their portfolio's allocation towards the money market account, those active investors who have not done so, based on their short-run ranking concern, sell their positions in the risky assets, possibly bringing about a run-like episode.

In our estimations, active investors' positions in the risky assets are captured by the bond flows. The risky asset's price is captured by the EMBI spreads. In the model, prices and spreads have a negative correlation. In addition, we use the Wu and Xia (2016) rate to measure the US monetary policy stance, which captures monetary accommodation beyond the zero lower bound.

Overall, the main predictions of the model on the relationship between bond flows, risk premiums and the monetary policy rate are as follows.

- Because of the interaction of the two types of investor, and the relative performance concern, there is a positive feedback between bond flows and prices (ie a negative feedback between bond flows and risk premiums).
- Sharp bond outflows are more likely than smooth ones since the relative performance concern is heightened in such cases, increasing the risk premium (ie reducing bond prices).
- A rise in the policy rate of the core country is likely to set off bond outflow episodes. In short, a rise in the policy rate leads to active investors' demand for risky assets to fall. (As its price falls, its risk premium increases).[6]

After briefly describing the data, we empirically explore these predictions.

Data

Our database has the respective time series for Brazil, Chile, China, Colombia, Hungary, Indonesia, Malaysia, Mexico, Peru, the Philippines, Poland, Russia, South

involve several principal agent relationships in a series, positioning the initial principal from the last agent farther apart. In this context, relative ranking could be interpreted as an effective monitoring device.

[5] This is particularly relevant given the size of capital outflows and inflows that some EMEs have faced, in particular, compared to the size of their financial (especially bond) markets.

[6] The risk-taking channel of monetary policy operates in the context of a global monetary policy game.

Africa and Turkey. We use the JPMorgan EMBI spreads as proxies to the risk premiums in the model. The EMBI spread measures the risk premium of EMEs bonds denominated in US dollars, which satisfy minimum liquidity requirements.[7]

We use EPFR bond flows data to measure changes in the active investors' position in the risky asset in the model. EPFR Global tracks both traditional and alternative funds domiciled globally. One could have some concerns about the characteristics of the EPFR bond flows database. We contend that none of these should be a significant concern for our aims.

In addition, bond flows might have some measuring issues. As pointed out in Feroli et al (2014), funds can merge, be liquidated, or be created. To mitigate this issue, in most estimations, we have taken a weighted average of the bond flows of the past four weeks.

It is also important to consider the asset gathering capabilities of investment management companies. They have comparative advantages in information gathering and analysis. Operationally, these companies tend to use similar risk management tools. Moreover, a few investment institutions take the lions' share of the assets under management. We believe that these elements increase the likelihood of observing co-movements in bond portfolio allocations.

Bond flows and risk premiums

We estimate a bivariate VAR having as variables the EPFR bond flows and the EMBI spreads, using a weekly frequency over the period of the week including 1 July 2009 to the week including 9 March 2014. Using a higher frequency is more favourable to a causality hypothesis.[8,9]

First, we present evidence on a possible negative feedback between bond flows and risk premiums. Consider the cumulative responses of bond flows to shocks to the EMBI spreads (Figure 1). Only three out of 14 economies in our sample do not present a statistically significant response: China, Hungary and Malaysia.[10]

Individual responses vary across EMEs. For instance, in terms of its duration, Brazil, Colombia, Indonesia, Mexico and South Africa all have statistically significant cumulative responses for 20+ weeks. For the 11 EMEs that have statistically significant responses, their signs are in line with what is predicted by the model: a positive shock to the risk premium (ie the EMBI spread) reverses the bond flows. A rise in the risk premium is indicative of active investors leaving their position in the risky asset. An

[7] The index's denomination is appropriate, since investors do the comparison against the US policy rate.

[8] Using time series with a lower frequency would probably entail other effects.

[9] The identification procedure for the impulse-response functions is based on the Cholesky decomposition of the VAR's variance-covariance matrix. In addition, a lag of two periods is used in the VAR, broadly in line with the tests used to determine an optimal lag (FPE, AIC, HQIC, and SBIC), and emphasising comparison among the EMEs. We always estimate the optimal lag based on the full samples.

[10] The Philippines and Russia present marginally significant responses.

unexpected significant increment in the EMBI spread will likely make active investors join a potential run-like episode, captured by the bond outflows' rise.

Cumulative impulse-response functions Figure 1

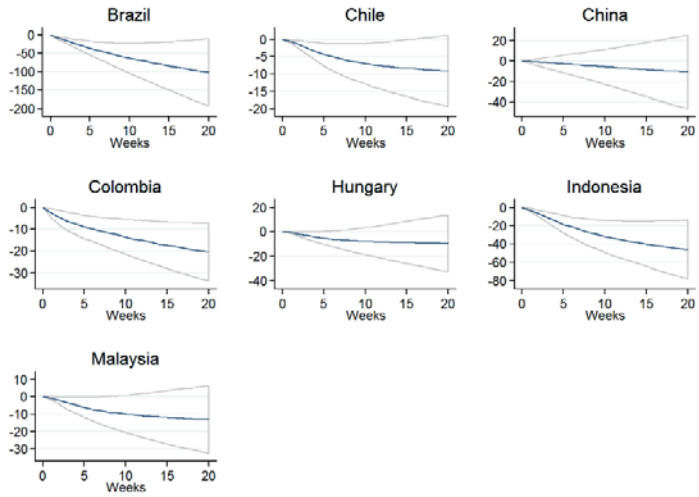

Exhibit A: EMBI spreads → bond flows

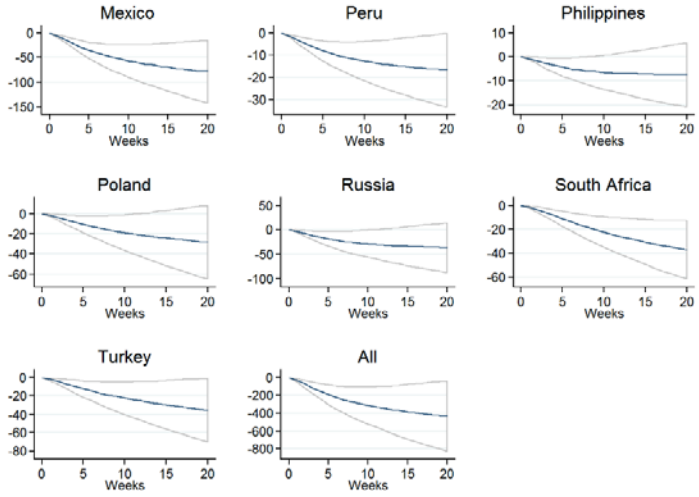

Exhibit B: EMBI spreads → bond flows

Notes: Cumulative impulse-response functions (CIRFs) are based on the bivariate VARs. The aggregated time series are obtained by adding the bond flows, and by taking the average of the EMBI spreads of all the EMEs in our database. The confidence level is 90%. The sample period for estimation is from the week including 1 July 2009 to the week including 9 March 2014.

Consider the cumulative responses of the EMBI spreads to bond flows' shocks (Figure 2). Only two economies do not present significant responses. In terms of size, Indonesia and Turkey have notable responses. Moreover, Hungary, Indonesia, Peru, Poland, Russia, South Africa and Turkey have responses that last for 20+ weeks.

Cumulative Impulse Response Functions Figure 2

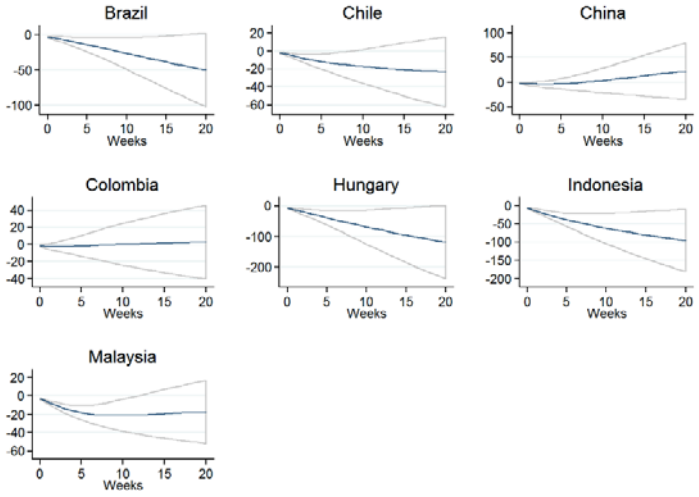

Exhibit A: Bond flows → EMBI spreads

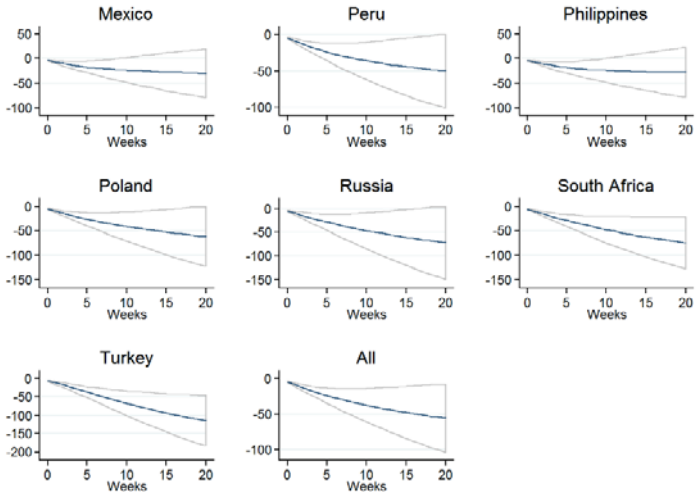

Exhibit B: Bond flows → EMBI spreads

Notes: Cumulative impulse-response functions (CIRFs) are based on the bivariate VARs. The aggregated time series are obtained by adding the bond flows and taking the average of the EMBI spreads of all EMEs in our database. The confidence level is 90%. The sample period for estimation is from the week including 1 July 2009 to the week including 9 March 2014.

In all 12 cases in which the responses are statistically significant, as predicted by the model, a positive shock to bond flows is associated with a reduction in the risk premium.[11] In effect, as more active investors take their position in the risky asset (ie inflows increase), they do so with the expectation that the risk premium will be greater than the floating rate. So, as the number of active investors with a position in the risky asset increases, the risk premium decreases (ie the price increases). Conversely, as more active investors leave their position in the risky asset, the risk premium increases (ie the price decreases), and the concern for relative ranking

[11] This result holds for the aggregated time series as well.

heightens. As it does, those active investors who still have a position in the risky asset have a greater incentive to leave it. Thus, given Given the agency friction at the heart of the model, one should then observe evidence of run-like dynamics. Overall, we find evidence favourable to the first and second predictions of the model in most of these EMEs.[12]

Bond flows, risk premiums and US monetary policy

Here we explore the third implication of the model. First, we estimate a tri-variate VAR.[13] The variables included in this model are the first principal component (PC) of the EPFR bond flows, the first PC of EMBI spreads and the Wu-Xia rate. The sample period is from January 2009 to August 2014, and the data are with a monthly frequency.

We obtain from all bond flows and, separately, from all EMBI spreads, their first principal component.[14] Based on the results above, we have excluded China from our data set for this exercise, as it lacks significant responses in its associated CIRFs.[15]

The main predictions are the following. First, a positive shock to the policy rate is associated with an increase in bond outflows. As the active investors' threshold is surpassed, they seek to invest in the safe asset, ie the money market account. Second, in tandem a positive shock to the bond flows is associated with a decrease in the risk premium, as more active investors gain a position in the risky asset.

We find that both predictions hold: in effect, the PC of bond flows' response to a Wu-Xia rate's shock and the PC of EMBI spreads' response to a PC of bond flows' shock are both statistically significant. Interestingly, if we estimate the same VAR model but for the subperiod of January 2013 to August 2014, the PC of bond flows' response to a shock in the Wu-Xia rate increases.

In sum, we conclude that there is evidence that as a group, EMEs are vulnerable to changes in the US monetary policy rate through channels akin to the one we are exploring, and that there is evidence of the existence of mechanisms in which financial stability might be jeopardised.

A natural set of exercises that serves as a control is to estimate these same models but with the equivalent data from AEs. In contrast with the EMEs' results, we find little evidence favouring the presence of run-like dynamics in AEs. While there is

[12] In a VAR, by assumption, the response' magnitude to a shock is symmetrical regardless of its direction. Yet, the model predicts that outflows would tend to move at a swifter speed, as the run-like mechanism can be set off. In short, and as we have documented in the initial analysis, bond outflows tend to be acute. Thus, as an extension to the model, we introduce a regime-switching model into the variance-covariance matrix of a bivariate VAR model with aggregated time series. For the most part, these are broadly in line with the model, in particular the second implication.

[13] To make the bivariate VAR using the EPFR data with a weekly frequency and the tri-variate VAR comparable, we transform the EPFR data with a weekly frequency to a monthly frequency and estimate the tri-variate VAR.

[14] The first principal component summarises in one variable the most information possible from the original time series set.

[15] The shock identification is based on the Cholesky decomposition. We assume that the Wu-Xia rate is the slowest moving variable, followed by the bond flows, and the EMBI spread being the fastest. In effect, the quantities are faster than the rate, but slower than the prices.

some heterogeneity among the AEs we consider, such results can be explained by the depth of their financial markets, macroeconomic policies and generally higher economic development. The referred estimations as well as an extensive battery of complementary exercises are included in Ramos-Francia and García-Verdú (2015).

Policy implications and concluding remarks

The degree of leverage in financial institutions is a characteristic that has brought attention regarding its implications for financial stability. Yet, other mechanisms, unrelated to the degree of leverage, could play a significant role for financial stability. The type of mechanisms we have explored could be associated with the ability EMEs have to deal with the tightening of the US policy rate.

As the data we have analysed strongly suggest, the possible effects of run-like behaviour in the bond market are latent. However, some EMEs should be more concerned than others in terms of its implications.

The externality is two-fold; it affects AEs and EMEs alike. In the short term, there might be little policy-makers could do about this. This is so because the current economic policy tools cannot necessarily effectively target much of the run-like dynamics. As a result of the global financial reform efforts in the last few years, this type of mechanism would be particularly relevant to the extent to which they are generated by non-banking institutions.

Yet, Stein (2014) has emphasised that this depends on the level on which the run behaviour might take place: at the ultimate investors' or at the fund managers' level. If it is at the ultimate investors' level, financial authorities might be able to impose a fee on those investors that decide to withdraw their funds in order to internalise the externality they would impose on those left behind.

If, however, it is at the fund managers' level, it is not obvious what financial authorities could do. Evidently, in practice the previous measure could be difficult to implement and could lead to an increase in policy uncertainty.

In sum, we have explored an economic phenomenon that underscores that there are continuing challenges for macroprudential policy regulation, and some of its possible responses could probably entail to an important extent some level of international cooperation.[16]

[16] In a general context, the FSB (2016) has recently published a consultative document in which it puts forwards policy recommendations to address structural vulnerabilities from asset management activities. It, for example, highlights the importance of recognizing structural issues of asset managers such as the fact that they usually act as *agents*, as we have assumed active investors do in this paper. On a related note, it mentions that the criteria to classify an asset management company as a global systemically important financial institution (G-SIFI) have been under discussion. If an asset management company were determined to be a G-SIFI, it would be subject to significantly different regulations and oversight.

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The use and effectiveness of macroprudential policies

Eugenio Cerutti[1], Stijn Claessens[2] and Luc Laeven[3]

Introduction

Macroprudential policies – such as caps on loan-to-value and debt-to-income ratios, limits on credit growth and other balance sheet restrictions, (countercyclical) capital and reserve requirements and surcharges, and Pigouvian levies – have become part of the policy paradigm in emerging markets and advanced countries alike. A growing literature has documented the use of macroprudential policies across countries and analysed their effects (eg Brunnermeier, Goodhart, Crocket, Persaud and Shin (2009), CGFS (2012), IMF (2013), ESRB (2014), Galati and Moessner (2014), Freixas, Laeven and Peydró (2015) and Claessens (2015)).

Taken together, the empirical evidence on the effectiveness of macroprudential policies in influencing credit flows and asset prices is, however, still preliminary and sometimes inconclusive. This is partly driven by the still limited experiences, but possibly also by the incomplete data on the use of policies, leading to differences across studies. While macroprudential policies are being increasingly used, notably so since the global financial crisis, information on what policies are actually used across a large set of countries and over a longer period of time is still quite lacking. As a consequence, relatively few comprehensive studies exist, that cover many countries and longer periods, on what policies are most effective in reducing procyclicality in financial markets and associated systemic risks.

This chapter summarises a recent paper by Cerutti, Claessens and Laeven (2016) that documents the use of macroprudential policies for a large number of countries, 119, over an extended period, 2000–13, and covering many instruments.[4] It reviews which countries have used what policies most frequently. Using this data, it analyses which policies are most effective in terms of reducing the growth of credit, covering both household and corporate sector credit. It also explores differences among types of countries, advanced vs emerging, and financially more open and more closed economies, as well as whether usage comes with greater cross-border borrowing, a form of avoidance, and if policies work better in booms or in busts.

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[4] The data used in Cerutti, Claessens and Laeven (2016) are available from http://www.imf.org/external/pubs/ft/wp/2015/Data/wp1561.zip.

The (evolving) tool-kit

Many macroprudential tools have been proposed, and some were in use even before the recent crisis. The toolkit available includes existing microprudential and other regulatory tools, taxes and levies, and new instruments. Most tools considered to date apply to the banking system, mainly given the presence of microprudential tools more easily adaptable to macroprudential objectives and the related more extensive theory and knowledge of these tools. But there are also tools applicable to nonbanks and capital markets.

The macroprudential data in this paper come from a recent and comprehensive IMF survey, called Global Macroprudential Policy Instruments (GMPI), carried out by the IMF's Monetary and Capital Department during 2013–14 with responses received directly from country authorities, which was cross-checked with other surveys (eg Kuttner and Shim (2013) and Crowe et al (2011)) and material published to ensure a high quality dataset.[5] The 12 specific tools covered here are: general countercyclical capital buffer/requirement (CTC); leverage ratio for banks (LEV); time-varying/dynamic loan-loss provisioning (DP); loan-to-value ratio (LTV); debt-to-income ratio (DTI); limits on domestic currency loans (CG); limits on foreign currency loans (FC); reserve requirement ratios (RR); and levy/tax on financial institutions (TAX); capital surcharges on SIFIs (SIFI); limits on interbank exposures (INTER); and concentration limits (CONC).

Instruments are each coded for the period actually in place, ie, as simple binary measures whether or not in place.[6] An overall macroprudential policy index (MPI) is the simple sum of the scores on all 12 policies. While tools can be grouped in many ways, one commonly used two-way classification is borrowers – (LTV and DTI ratios), and financial institutions – oriented tools (DP, CTC, LEV, SIFI, INTER, CONC, FC, RR, CG, and TAX). Similarly to MPI, indexes are created for these two groupings. In the final sample, 119 countries – of which 31 are advanced, 64 emerging, and 24 developing – are analysed.

The policies are related to developments in aggregate and sectoral credit growth, distinguishing credit to households and the corporate sector (non-financial corporations), and house price growth. The sectoral breakdown and house price data are available for fewer countries. All credit and house prices are deflated using the country's CPI deflator. We also study the degree of reliance on cross-border financing, defined as the share of cross-border claims to total claims to the non-financial sector.

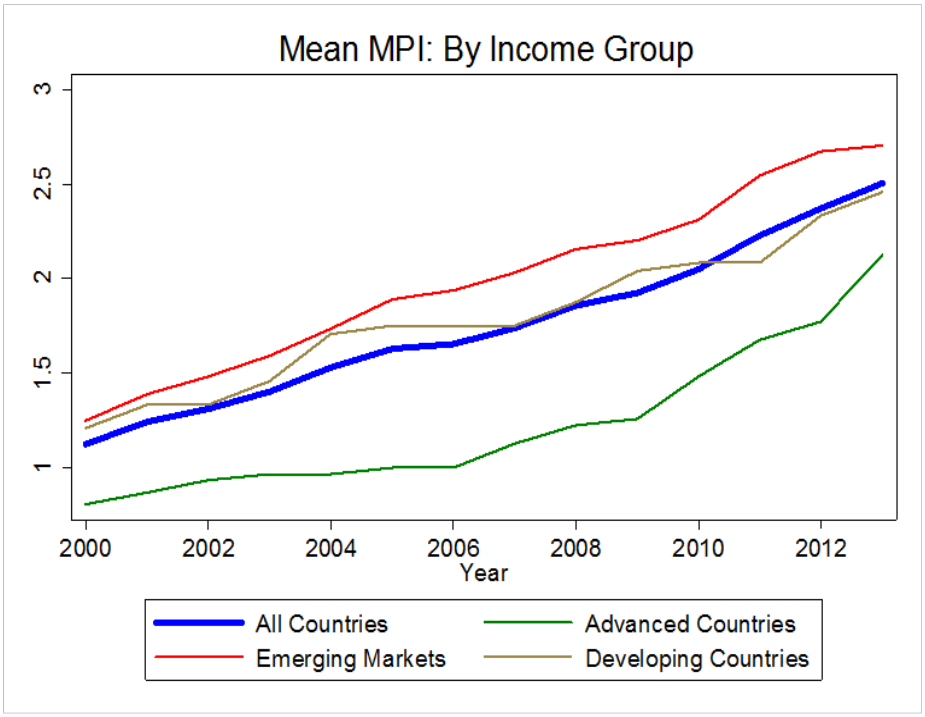
[5] The survey includes detailed information on the timing and use of different macroprudential policies and, to the best of our knowledge, is the most comprehensive cross-country database on policies to date.

[6] We do not attempt to capture the intensity of the measures and any changes in intensity over time, nor whether and when instruments are actually binding. At the cost of a reduced coverage of countries (64 countries) and instruments (nine macroprudential indices), see Cerutti, Correa, Fiorentino and Segalla (2016) for a dataset covering changes in the usage intensity over time.

Actual use of policies

Over the period of 2000–13, countries generally increased their usage of macroprudential measures. As depicted in Figure 1, the average MPI starts at just above one in 2000 and ends at almost 2½ in 2013. In terms of tools, most countries have used concentration limits (CONC): in about 75% of the country-year combinations and evenly across country groups (Figure 2). This is followed by INTER (29%), RR_REV (21%), LTV_CAP (21%), DTI (15%), LEV (15%), TAX (14%), FC (14%), CG (12%), DP (9%), CTC (2%), and SIFI (1%).[7]

The macroprudential policy index by income level Figure 1



There are large differences across countries. Usage is the most frequent among emerging markets (see Figure 1), consistent with their higher exposure to external shocks, including from volatile capital flows. Developing countries come in second and advanced countries last, despite their recent increase in usage. CONC, INTER, and LEV, however, are consistently used by all countries alike. In terms of relative use (see Figure 2), LTVs are used relatively more by advanced countries, maybe due to their concerns about housing sector related vulnerabilities, typically larger as mortgage markets are more developed. RR and FC are used more by emerging countries, maybe due to their concerns with large and volatile capital flows and related systemic risks; and DP and CG are used more by developing countries, which also rely relatively more on RR and FC.

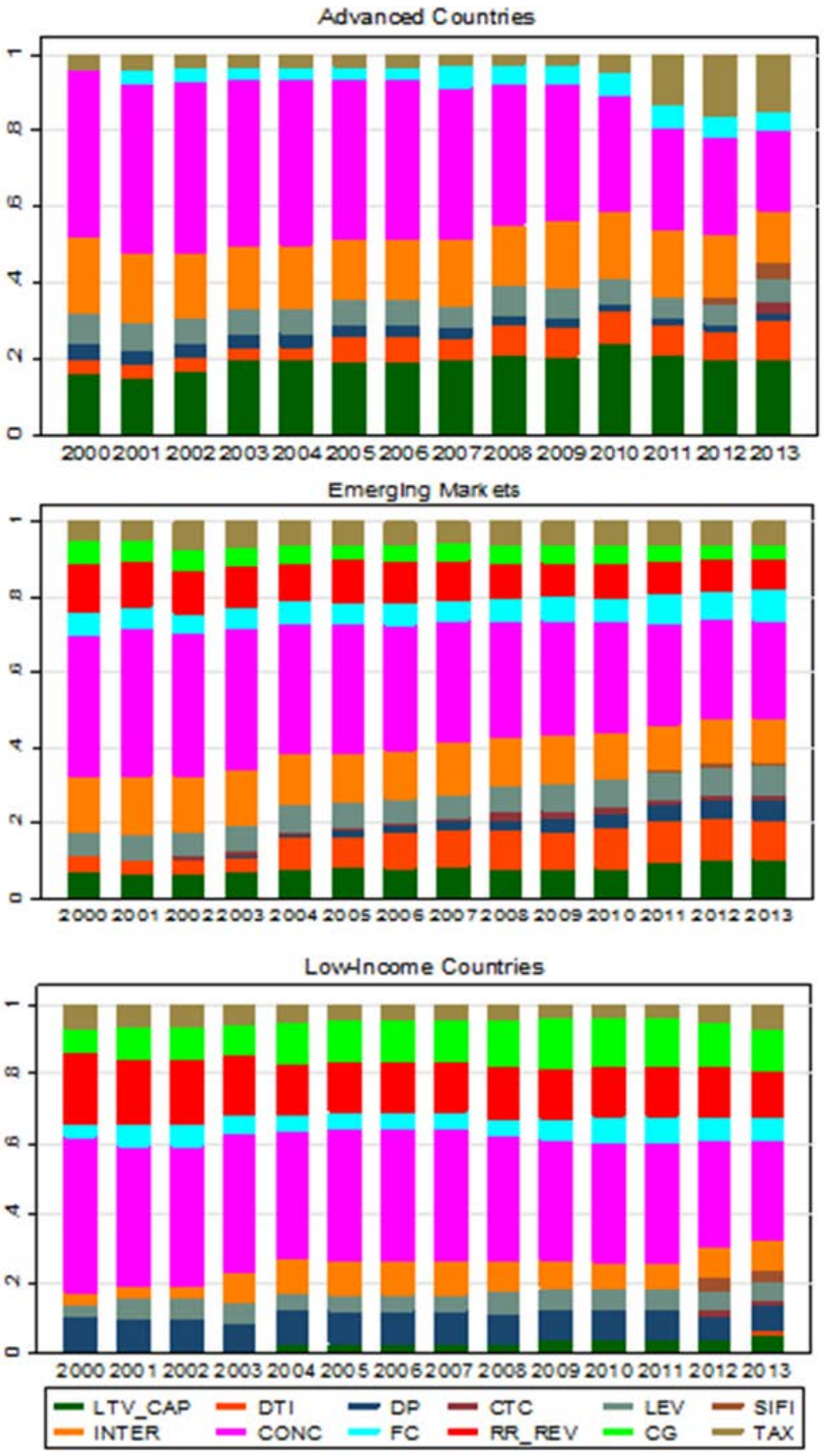
There is much variation in the outcome variables. Overall real credit growth ranges from −7.9% to 42.6%, with variability greater in emerging markets than in

[7] The same top four instruments emerge if the definition of usage is changed to being used in at least one year during the period 2000–13. CONC was used in 64% of the 119 countries in their sample, RR_REV in 37% of the countries, and LTV_CAP and INTER in 29% of the countries.

advanced countries. There is also ample variation in the MPI, which ranges from zero to seven with a mean of 1.8 and a standard deviation of 1.5. In terms of other policy and control variables, the variation is also large: for example, the policy interest rate varies between 0.25% and 20%. And credit/GDP, our proxy for financial development, varies from 8% to 175%.

The relative use of macroprudential policies over time, by income group

Figure 2



Effects of Macroprudential Policies

To analyse the effects of the various instruments, we estimate a basic panel regression model that relates the growth in countries' credit and house prices to the aggregate index (MPI), to two groups of instruments or to individual instruments. It also includes the lagged dependent variable and controls for factors such as the country's real GDP growth, the presence of a banking crisis, the central bank policy rate and a country fixed effect. The MPI and all other instruments are lagged by one year to capture delayed impacts. We lag the country variables to avoid some problems of simultaneity. The use of a GMM as well as OLS estimators provides some robustness.

The main result (Table 1) is that overall macroprudential usage has significant mitigating effects on credit developments: a one standard deviation change in MPI, a change of 1.5, which is large relative to the mean of 1.8, reduces credit growth by some 11 percentage points. This effect is the strongest for developing and emerging markets, where a one standard deviation change in MPI reduces credit growth by nine and eight percentage points, respectively, equivalent to two thirds and half its standard deviation. For advanced countries, the effects are smaller: a one standard deviation change in MPI reduces credit growth by some two percentage points, equivalent to about quarter of its standard deviation, Although still significant in open economies, policies are more effective for relatively closed economies, with a coefficient twice as large.

Main Regression Results — Table 1

Variables	All		Advanced	Emerging	Developing	Open	Closed
	(1) - GMM	(2) - OLS	(3) - GMM	(4) - GMM	(5) - GMM	(6) - GMM	(7) - GMM
MPI	-7.637***	-2.112***	-1.376*	-5.327***	-6.743**	-2.910**	-6.605***
	[1.876]	[0.651]	[0.781]	[1.619]	[3.076]	[1.251]	[2.073]
Credit Growth	0.245***	0.324***	0.485***	0.264***	0.157*	0.351***	0.231***
	[0.0715]	[0.0512]	[0.134]	[0.0897]	[0.0872]	[0.0869]	[0.0798]
GDP Growth	0.399	0.649***	0.123	0.427	0.902*	0.343	0.586**
	[0.243]	[0.144]	[0.215]	[0.288]	[0.517]	[0.226]	[0.291]
Crisis	-14.24**	-5.967***	-5.781***	-17.07	4.385	-3.147	-16.47
	[6.669]	[1.706]	[1.984]	[11.17]	[2.702]	[2.904]	[11.55]
Policy Rate	-1.071***	-0.697***	-0.952**	-0.645	-1.389***	-0.544	-0.958***
	[0.340]	[0.196]	[0.417]	[0.394]	[0.284]	[0.346]	[0.358]
Countries	106	106	31	56	19	47	58
Observations	972	972	318	525	129	452	509
AB AR(1) Test	0.00	-	0.00	0.00	0.01	0.00	0.00
AB AR(2) Test	0.11	-	0.18	0.13	0.38	0.11	0.26
Sargan Test	1.00	-	1.00	1.00	1.00	1.00	1.00

Notes: The estimates are determined using Arellano-Bond GMM treating the instrument and the control variables of credit growth, GDP growth, the crisis dummy, and the policy rate as endogeneous. Column 2 is estimated through OLS. The dependent variable is real credit growth. All variables except the categorical ones are winsorized at the 5 percent level. Country fixed effects control for individual trends. The regressions are performed over the period 2001-2013. The Sargan tests' null hypothesis of over-identifying restrictions are not rejected. Arellano-Bond (AB) test for AR(1) in first differences are rejected, but not for the AR(2) test. Robust standard errors clustered by country are in brackets. ***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.

The stronger effects for emerging markets may reflect a number of factors. First, emerging markets have relied more on macroprudential policies than advanced countries have. Second, advanced countries tend to have more developed financial systems which offer various alternative sources of finance and scope for avoidance,

making it possibly harder for macroprudential policies to be effective. Combined, this means that emerging markets countries have been able to use macroprudential policies more effectively. And the relatively open economies may see more circumvention of policies, including by borrowers substituting to nonbank sources of finance and obtaining funds through cross-border banking activities. This does indicate the need to consider macroprudential policies together with capital flow management policies. It may also be that more closed economies have less liberalised financial systems and may therefore find it easier to apply macroprudential policies more effectively. This suggests again the need to consider country-specific circumstances when designing and applying policies.

In terms of control variables, the degree of persistence in credit developments at the country level is larger in advanced countries. Economic growth has a positive coefficient, as expected, and a relatively high elasticity. There are some dampening effects of higher interest rates but these are relatively small, also compared to that of MPI: a one percentage point interest rate increase reduces credit by one percentage point across the entire sample. This suggests that macroprudential policies are on average more powerful compared to monetary policy. A country experiencing a banking crisis means a reduction in credit of some 14 percentage points.

Type of macroprudential policies

Borrower-based measures are generally negatively related to credit growth, with effects the highest for credit to households and in emerging markets. Financial institution-based policies are also associated with lower credit growth, especially in emerging and closed economies. These results are consistent with policies being more effective in emerging markets and relatively closed capital account countries than in advanced and relatively open countries. While various borrower-based measures have negative signs in the specifications using house prices as dependent variable, they are not significant, consistent with other findings that house prices are difficult to moderate using macroprudential policies. Rather, since, as analyses have shown, house price booms associated with increased leverage are the most destructive, borrower-based macroprudential policies can play a useful role in dampening household indebtedness, especially in advanced countries.

For corporate sector credit growth, policies work as well in general, but less than for household credit. This is not surprising as policies, including the borrower-based measures, are typically not directly targeted at corporations, but rather at financial institutions or households. Moreover, corporations, especially in advanced countries, can access sources of finance alternative to banks, such as capital markets which are typically not subject to policies.

Of the individual policies, caps on LTV ratio are strongly associated with lower overall credit growth in developing countries, and with less household credit in all countries. DTI limits help as well, especially for household credit in both advanced countries and emerging markets, and corporate credit in emerging markets. Overall and confirming earlier results, direct limits appear very effective, especially for household credit. Foreign currency limits (FC) are negatively related to credit growth, especially in emerging markets and developing countries, to corporate credit growth, again especially in emerging markets, and to household credit in advanced countries.

And for emerging markets,[8] RR affect strongly any type of credit, but especially corporate credit growth.

In terms of other policies, dynamic provisioning, almost exclusively used in emerging markets, has a negative relation with overall credit growth. Leverage and countercyclical capital requirements have negative effects in developing countries. Interconnection and concentration limits are negatively related to credit growth in all markets, with effects for interconnection driven by emerging markets and developing countries. Tax measures dampen growth in overall credit in developing countries and house prices in emerging markets. Otherwise, most other policies used are not significantly negatively related to credit and house price growth. We do find that the greater use of policies is associated with more reliance on cross-border claims for open economies, with a one standard deviation increase in MPI increasing the cross-border ratio by six percentage points, about a third of its standard deviation.

Taken together, these results suggest borrower-based measures have a significant impact for most countries, while foreign currency related measures are more effective for emerging markets. This suggests some scope for targeted policies such as caps on LTV and DTI ratios in advanced countries and foreign currency related policies in emerging markets. These are important findings given the adverse effects at times on overall financial and economic stability of real estate developments in advanced countries and of international capital flows for emerging markets. Our findings suggesting evasion, however, do point to the need to consider countries' circumstances, and to possibly adopt macroprudential and capital flow management policies simultaneously and in an integrated manner (see also Ostry et al (2012)).

Variations by country and phase of cycle

Further exploring whether effects of macroprudential policies vary by type of country, we find limited support for the view that (institutionally) more developed countries have greater ability to enforce policies and make them more effective. There is some evidence that open economies having more flexible exchange rates have greater difficulty to control overall credit, maybe as exchange rate appreciations (depreciations) related to capital inflows (outflows) further exacerbate domestic boom and bust financial cycles.

It can be expected that the effects of macroprudential policies vary by the intensity and phase of the financial cycle. For one, policies may be more effective when the financial cycle is more intense, ie if credit (or house price) increases (or decreases) are greater. And, importantly, policies are meant to be mostly ex-ante tools, that is, they should help reduce booms. To the extent that they are operative in busts, they are meant to limit declines in credit and asset prices. We investigate this by considering cases of exceptionally high (top 10% of the country-specific observations) or low (bottom 10%) credit growth. We find some support that policies have additional effects when credit growth is high, especially in more developed and financially open economies. There is also support for asymmetry in effects. Specifically, for the top 10% of credit growth, policies reduce credit, while for the bottom 10% they support growth, with these patterns existing for almost all groups of countries. This suggests that the effects of policies depend on the intensity and phase of the financial cycle.

[8] RR are not used in advanced countries.

Conclusions

Using a recent IMF survey and expanding on previous studies, we document the use of macroprudential policies for 119 countries over the 2000–13 period, covering many instruments. Emerging economies use macroprudential policies most frequently, especially foreign exchange-related ones, while advanced countries use borrower-based policies more. Usage is generally associated with lower growth in credit, notably in household credit. The effects are smaller in financially more developed and open economies, however, and usage comes with greater cross-border borrowing, suggesting some avoidance. And while macroprudential policies can help manage financial cycles, they work less well in busts.

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Financial development and the effectiveness of macroprudential measures[1]

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1. Introduction

Over the past two decades or so, many countries have used various types of macroprudential policy to maintain financial stability. The first wave of such measures was taken by several Asian economies just before the Asian financial crisis of 1997-98. The second was adopted during the boom years in the early to mid-2000s mainly by emerging market economies (EMEs).

After the global financial crisis of 2007-09, central banks and regulators around the world have agreed on the importance of macroprudential policies in securing both global and domestic financial stability.[6] Since then, significant progress has been made in implementing macroprudential policies. Many jurisdictions have established macroprudential policy authorities mostly in the form of collective decision making bodies such as councils or forums. Over the past several years, more and more countries, including not only EMEs but also advanced economies (AEs), have introduced macroprudential policy measures to slow down strong growth in housing credit and capital inflows as well as other aspects of financial stability.

The popularity of macroprudential policy has led policymakers and academics to conduct research on their use and effectiveness. Most of the papers in this relatively recent literature have focused on assessing the effectiveness of macroprudential policies either based on their legal types (ie monetary, prudential and fiscal), on their target groups (borrowers, lenders, home buyers and sellers) and their scope (general credit policies, narrow credit policies (such as housing or consumer credit)).

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[6] For example, in October 2010, the Group of Twenty (G20) finance ministers and central bank governors agreed to work further on macroprudential policy frameworks, including tools to mitigate the impact of excessive capital flows.

But few researchers have sought to assess the effectiveness of different macroprudential policy tools on credit growth in different countries. However, this is an important aspect to understand because the scope of individual tools differs and because the transmission channels can be so different. In particular, much will depend on how developed is a country's financial market. The challenge for a researcher is to simplify the enormous heterogeneity not only of tools but also of countries.

The research strategy adopted by this paper is to divide the main tools into quantity-based measures and price-based measures. The presumption is that bank-based financial systems tend to rely on quantity-based tools, while in those where capital market or external financing has a large weight, general price-based tools may work better.

This paper tries to answer the following two questions: (1) what type of macroprudential policy tool works best on credit growth? That is, are price-based or quantity-based tools more effective? (2) How does the effectiveness of price-based and quantity-based tools vary with the level of financial development? The simplifying schema guiding this research is summarised in Table 1 in section 3 below. The word "simplifying" deserves emphasis. A very prohibitive price imposed by a price-based tool could be equivalent to a quantity-based tool. Nor is there a hard-and-fast boundary between monetary and macroprudential measures. Nevertheless, this schema does help us reach some interesting conclusions.

A simple schema of types of macroprudential policies Table 1

	Price-based	Quantity-based
Non-interest rate monetary policy measures	Reserve requirements (RR) Liquidity requirements (Liq)	Credit growth limits (CRg)
Prudential policy measures	Risk weights on housing loans (RW)	Maximum loan-to-value ratio (Ltv)
	Provisioning rules (Prov)	Maximum debt-service-to-income ratio and other lending criteria (Dstilc) Exposure limits to the property sector (Expo)

The main results of this study are the following. First, we find that quantity-based domestic macroprudential measures taken by a country are effective in slowing its total credit growth. In particular, we show that quantity-based measures slow total credit growth on almost the entire distribution of the level of financial development, including relatively low levels of financial development. However, the differential effect of the financial development on the effectiveness of quantity-based measures is not statistically different from zero. These results are in line with the findings of many recent papers consistently showing that the maximum debt-service-to-income ratios and the maximum loan-to-value ratios were effective in slowing the growth of housing credit and general bank credit, since these two types of policy are the most important part of quantity-based measures considered in this study.

In contrast, we show that the price-based measures effectively slow credit growth only when the level of financial development is relatively high above the median of the distribution. We also find that the more financially developed a country is, the more effective the price-based measures are. The results for price-based measures,

together with those for quantity-based measures, confirm that financially developed countries benefit more from using price-based measures, while countries with low levels of financial development can achieve the desired outcome with quantity-based measures.

Finally, we show that the differential effects of financial development on the effectiveness of quantity-based and price-based macroprudential policies are robust when we use alternative composite indexes for financial development or alternative sample periods.

This article is organised as follows. Section 2 provides a literature review. Section 3 describes data and empirical approaches. In section 4, we provide empirical results. Section 5 concludes.

2. Literature review

This paper is related to three underexplored themes in the literature on the macroprudential policies, which is by itself relatively at its early stage of development: (1) the effectiveness of various types of macroprudential policy on the growth of credit; (2) price-based vs quantity-based tools; and (3) financial development and macroprudential policies.

First, many papers considered the effectiveness of macroprudential measures on domestic bank credit growth, using a large cross-country sample. In particular, Borio and Shim (2007) conduct an event-study analysis on macroprudential policy actions taken by 18 Asian and European economies, and find that such actions reduce domestic bank credit growth in the years after their introduction. Lim et al (2011) consider 40 economies that took macroprudential measures. Using a panel regression analysis, they find that reserve requirements and dynamic provisioning are effective in reducing private sector real credit growth during booms, and that maximum loan-to-value (LTV) and debt-service-to-income (DSTI) ratios, dynamic provisioning and reserve requirements reduce the procyclicality of credit growth. Kuttner and Shim (2013) consider 57 economies that have taken macroprudential policy actions affecting housing markets, and find that a typical tightening of DSTI limits slows real housing credit growth by 5–6 percentage points over the subsequent year. Claessens et al (2014) show that macroprudential policy measures such as maximum LTV and DSTI ratios and limits on foreign currency lending are effective in reducing the growth in bank-level leverage and assets during booms. Finally, Cerutti et al (2016) find that macroprudential policies overall are effective in reducing real domestic bank credit growth and that borrower-based measures such as LTV and DSTI limits are very effective through their effects on household credit.[7]

Second, regarding the desirability of price-based vs quantity-based tools, Shin (2012) points out that a levy on wholesale/FX-denominated liabilities has the advantage of being price-based, but a leverage cap has the drawback of being not price-based and open to circumvention. To our knowledge, very few papers have

[7] In a historical perspective, Elliott et al (2013) consider macroprudential tools the Federal Reserve and other US agencies have used since the First World War, and find that macroprudential policies designed to tighten credit availability, especially tools such as underwriting standards, have a significant effect, but that macroprudential policies designed to ease credit availability have little effect on credit.

looked into the issue of relative effectiveness of price-based and quantity-based measures. For example, Cizel et al (2016) find that quantity-based macroprudential measures have stronger cross-sector substitution effects (from bank to non-bank credit) in advanced economies.

Finally, a small number of papers explicitly considered the relationship between a country's level of financial development and the choice/effectiveness of macroprudential policies using a large cross-country sample. Lim et al (2011) point out that the stage of economic/financial development affects the choice of macroprudential policy instruments, and consider dummies for exchange rate regime and country/year effects in their regression analyses. In a cross-country study, Sheng (2015) finds that FX-related prudential measures are more effective when the ratio of private bank credit to GDP is higher. Finally, Cerutti et al (2016) consider institutional variables such as the exchange rate regime, de facto financial openness, the log of per capita GDP (as a proxy for the level of economic development), the level of credit relative to GDP, and the International Country Risk Guide (ICRG) index of institutional quality. They find that (1) macroprudential policies are more effective for a sample of relatively (de facto financially) closed economies than for relatively open economies; (2) macroprudential policies are less effective in countries with more flexible exchange rates; (3) the level of economic development and the quality of institutions do not explain the effectiveness of macroprudential measures; and (4) economies with a higher credit-to-GDP ratio have more difficulty in lowering credit growth through macroprudential measures when they consider a sample of low-income developing economies or a sample of relatively (de facto financially) closed economies.

3. Data and empirical approaches

We use quarterly data on total credit, GDP, domestic macroprudential policy measures, financial development indicators, macroeconomic variables, and financial crisis dummies for 37 economies over the sample period of 1996Q1 to 2011Q4. The 37 economies include 20 AEs and 17 EMEs, with ten economies from Asia-Pacific, five from central and eastern Europe, one from Africa, three from Latin America, 16 from western Europe and two from North America. Table 2 provides the list of 37 economies.

Data on total credit to the private non-financial sector are from the BIS database on credit to the non-financial sector publicly available. Since we use the credit-to-GDP ratio as the dependent variable in our empirical analysis, we divide the quarterly credit series by quarterly GDP data from national sources.

Domestic macroprudential measures are obtained from the database in Shim et al (2013). In the database, each tightening action is assigned value +1, each loosening action value –1, and no action value zero. The eight types of policy action recorded in the database can be classified into price-based and quantity-based measures. In particular, reserve requirements (RR), liquidity requirements (Liq), risk weights (RW) and provisioning requirements (Prov) are price-based measures, while credit growth limits (CRg), LTV limits (Ltv), DSTI limits and other lending criteria (Dstilc) and exposure limits (Expo) are quantity-based measures (Table 1).

Price-based and quantity-based macroprudential measures

Number of distinct policy actions, Q1 1990–Q2 2012

Table 2

Region	Country	All price-based measures					All quantity-based measures					Total
		Sum	Tighten	Loosen	Monetary	Prudential	Sum	Tighten	Loosen	Monetary	Prudential	
Asia and the Pacific	AU	2	2	-	-	2	-	-	-	-	-	2
	CN	44	35	9	43	1	23	21	2	1	22	67
	HK	-	-	-	-	-	16	10	6	1	15	16
	IN	42	25	17	35	11	2	2	-	-	2	44
	ID	4	3	1	4	-	1	1	-	-	1	5
	JP	1	-	1	1	-	2	1	1	2	-	3
	KR	10	7	3	5	5	21	15	6	-	21	31
	MY	21	14	7	19	2	8	4	4	-	8	29
	SG	-	-	-	-	-	9	7	2	-	9	9
	TH	6	4	2	3	3	2	1	1	-	2	8
Central and eastern Europe	CZ	8	2	6	8	-	-	-	-	-	-	8
	HU	4	-	4	4	-	4	3	1	-	4	8
	PL	5	3	2	2	3	3	3	-	-	3	8
	RU	22	15	7	22	-	-	-	-	-	-	22
	TR	19	11	8	15	4	3	3	-	-	3	22
Latin America	AR	11	3	8	11	2	-	-	-	-	-	11
	BR	39	17	22	37	2	-	-	-	-	-	39
	MX	1	1	-	-	1	-	-	-	-	-	1
Africa	ZA	1	1	-	-	1	-	-	-	-	-	1
Western Europe	AT	2	-	2	2	-	-	-	-	-	-	2
	BE	2	-	2	2	-	-	-	-	-	-	2
	CH	1	1	-	-	1	1	1	-	-	1	2
	DE	6	-	6	6	-	-	-	-	-	-	6
	DK	-	-	-	-	-	4	2	2	-	4	4
	ES	5	2	3	2	3	3	1	2	-	3	8
	FI	5	-	5	5	-	-	-	-	-	-	5
	FR	10	3	7	8	2	-	-	-	-	-	10
	GB	2	-	2	2	-	-	-	-	-	-	2
	GR	3	-	3	2	1	4	3	1	3	1	7
	IE	7	1	6	6	1	1	1	-	-	1	8
	IT	10	2	8	9	1	1	-	1	-	1	11
	NL	2	-	2	2	-	3	3	-	-	3	5
	NO	8	2	6	4	4	3	3	-	-	3	11
	PT	3	-	3	3	-	2	1	1	-	2	5
	SE	-	-	-	-	-	2	2	-	-	2	2
North America	CA	5	-	5	5	-	6	6	-	-	6	11
	US	2	-	2	2	-	-	-	-	-	-	2
Total (37)		313	154	159	269	50	124	94	30	7	117	437

AU: Australia; CN: China; HK: Hong Kong SAR; ID: Indonesia; IN: India; JP: Japan; KR: Korea; MY: Malaysia; SG: Singapore; TH: Thailand; CZ: Czech Republic; HU: Hungary; PL: Poland; RU: Russia; TR: Turkey; AR: Argentina; BR: Brazil; MX: Mexico; ZA: South Africa; AT: Austria; BE: Belgium; CH: Switzerland; DE: Germany; DK: Denmark; ES: Spain; FI: Finland; FR: France; GB: United Kingdom; GR: Greece; IE: Ireland; IT: Italy; NL: Netherlands; NO: Norway; PT: Portugal; SE: Sweden; CA: Canada; US: United States. The figure in brackets is the total number of economies.

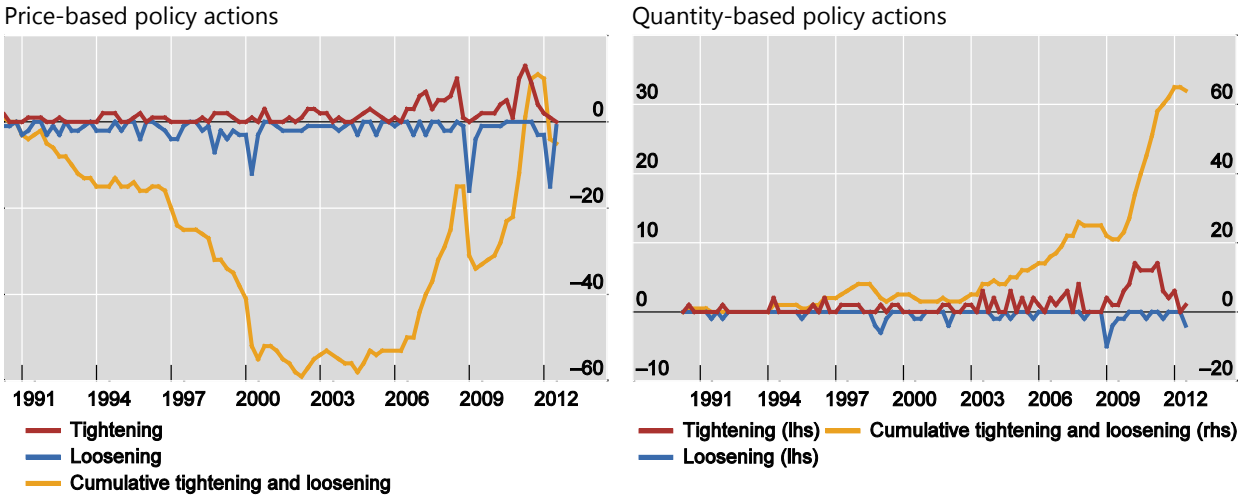
Source: Shim et al (2013); authors' calculation.

We can combine these individual policy indicators into various aggregate measures. In particular, we can define an indicator for monetary price-based measures (MonPrice) as the sum of the indicators for RR and Liq, an indicator for prudential price-based measures (PruPrice) as the sum of the indicators for RW and Prov, an indicator for monetary quantity-based measures (MonQuant) as the indicator for CRg, and an indicator for prudential quantity-based (PruQuant) as the sum of the indicators for Ltv, Dstilc and Expo. Finally, we can define an indicator for all price-based measures (AllPrice) as the sum of the indicators for MonPrice and PruPrice, and an indicator for all quantity-based measures (AllQuant) as the sum of the indicators for MonQuant and PruQuant. Table 2 shows the number of policy actions for the aggregate indicators as well as the number of tightening and loosening policy actions.

Figure 1 shows how price-based and quantity-based measures were used over time by the 37 economies. Generally speaking, these economies had more often loosened price-based measures than tightened from 1990 to around 2002 (Figure 1, left-hand panel). Between 2003 and 2008, there were more tightenings of price-based measures than loosenings. After a sharp increase in loosening actions during the peak of the global financial crisis, these economies overall took more tightening actions involving price-based tools than loosening ones after 2009. In contrast, the 37 economies overall had more often tightened quantity-based measures than loosened them from 1990 to 2012, except two brief periods of more loosening actions immediately after the Asian financial crisis of 1997 and during the peak of the global financial crisis of 2007–09 (Figure 1, right-hand panel).

Use of macroprudential measures

Number of policy actions in a quarter — Figure 1



The yellow lines denote the cumulative sum of tightening actions (each +1) and loosening actions (each –1) starting from Q1 1990.

Source: Shim et al (2013); authors' calculation.

It should be noted that the correlation of all price-based measure indicators (+1, 0, –1) and all quantity-based measure indicators (+1, 0, –1) over 1990–2012 is 0.15, and the correlation of cumulative indicators of all price-based measures and cumulative indicators of all quantity-based measures is 0.44. Also, the two measures were used at the same time during 1990–2012 in 17 out of 2782 country-quarter observations, in particular, at the same time in the same direction in 4 (loosen) and

13 (tighten) country-quarters. That is, we have no observation with two types of policy action taken in the opposition directions.

Composite index of financial development

Normalised and rescaled index

Table 3

Country	Average[1]
Argentina	1.19
Russia	1.33
Turkey	1.78
Hungary	1.83
Mexico	1.97
Poland	1.99
Indonesia	2.04
Brazil	2.29
India	2.34
Greece	3.36
Czech Republic	3.36
Norway	4.01
Italy	4.04
Finland	4.40
Korea	4.60
Belgium	4.75
Australia	4.83
Sweden	4.95
France	5.07
China	5.19
South Africa	5.22
Austria	5.29
Denmark	5.34
Ireland	5.47
Portugal	5.56
Germany	5.63
Thailand	5.71
United States	5.94
Canada	6.02
Spain	6.24
Singapore	6.28
Malaysia	6.58
Netherlands	6.97
United Kingdom	8.39
Switzerland	9.01
Japan	9.36
Hong Kong SAR	15.25
Median	5.07
Average	4.96

Note: [1] We first normalise 13 World Bank Financial Development indicators by subtracting mean and dividing by the standard deviation. Second, we take first principal components. Third, we subtract the minimum value to all normalised index values, so that the rescaled minimum value of the index becomes zero. Finally, for each economy, we calculate the average value of the index over the period of 1989 to 2011.

Source: World Bank Financial Development Indicators; authors' calculation.

To measure a country's level of financial development in a comprehensive way, we construct our own composite financial development indicators. In particular, we first normalise 13 World Bank Financial Development indicators by subtracting mean and dividing by the standard deviation, and then take first principal components. We consider the following ten ratios capturing the depth of a country's financial system: (i) (private credit by banks)/GDP, (ii) (bank assets)/GDP, (iii) (bank assets)/(bank assets and central bank assets), (iv) (liquid liabilities)/GDP, (v) (central bank assets)/GDP, (vi) (financial system deposits)/GDP, (vii) (private credit by banks and other financial institutions)/GDP, (viii) (domestic credit to private sector)/GDP, (ix) (stock market cap)/GDP, and (x) (stock market total value traded)/GDP. We also include the following two ratios proxying the efficiency of a financial system: (i) (credit to government and state-owned enterprises)/GDP, and (ii) stock market turnover ratio. Finally, we use the ratio of bank credit to bank deposits as a measure of the stability of a financial system. We consider all three categories of depth, efficiency and stability, and construct a composite variable for the level of financial development (*FinDev*).[8] Table 3 provides the average value of the composite index over the period of 1989 to 2011 for the 37 economies in the ascending order. However, it is worth noting that, while our composite index is a comprehensive measure capturing the common variation in a wide range of indicators for a country, it does not intend to measure the institutional or legal aspect of financial development.

We use standard macroeconomic variables as controls. In particular, we use short-term interest rates, real GDP growth, per capita GDP, CPI inflation and the ratio of current account to GDP. Finally, we also consider two crisis dummies, one for banking crises and the other for currency crises, in Laeven and Valencia (2012).

Using the data described so far, we conduct cross-country panel OLS regressions with time fixed effects and country fixed effects, denoted by μ_t and μ_i, respectively. In our regressions, we also consider country-specific linear trends in the credit-to-GDP ratio, ie, $\mu_i \cdot t$. All explanatory variables are lagged by one quarter. We consider four lags of policy variables, *P_MaPP* and *Q_MaPP*, denoting price-based and quantity-based measures, respectively, to capture the policy effect over one year after implementation. Specifically, we use the following econometric specification:

$$\begin{aligned}\Delta(credit/GDP)_{i,t} = {} & \beta_1 \Delta(credit/GDP)_{i,t-1} + \beta_2 \Delta(credit/GDP)_{i,t-1} \\ & + \sum_{j=1}^{4} \beta_{3j} (P\_MaPP)_{i,t-j} + \sum_{j=1}^{4} \beta_{4j} (Q\_MaPP)_{i,t-j} \\ & + \sum_{j=1}^{4} \beta_{5j} (FinDev)_{i,t} \cdot (P\_MaPP)_{i,t-j} + \sum_{j=1}^{4} \beta_{6j} (FinDev)_{i,t} \cdot (Q\_MaPP)_{i,t-j} \\ & + \beta_7 Controls_{i,t-1} + \mu_i + \mu_t + \mu_i \cdot t + \varepsilon_{i,t} \end{aligned} \quad (1)$$

It should be noted that interest rate policy is also a typical price-based measure for general credit and beyond ("gets in all the cracks in the economy"). This is because loose interest rate policy (ie lower interest rates) encourages greater borrowing by

[8] In addition to using the principal component method to construct a composite index for the level of financial development, we also calculated the simple average of the 13 indicators after normalising each of them. We also calculated the average level for each of the three categories and then calculated the average over the three categories. These two indexes have relatively high levels of correlation with the composite index from the principal component method (0.6 and 0.8. respectively).

households to bring spending forward from the future to the present (Bruno et al (2016)). Increased household borrowing will increase demand for housing, other things being equal.

The effect of price-based and quantity-based macroprudential policies on credit growth

Table 4

Dependent variable: Quarterly percentage point change in the credit-to-GDP ratio			
	(1)	(2)	(3)
Quarterly percentage point change in the credit-to-GDP ratio at t-1		0.227**	0.186*
		(0.104)	(0.107)
Quantity-based MaPP (t-1)	-0.001	-0.002**	-0.003
	(0.000)	(0.001)	(0.000)
Quantity-based MaPP (t-2)	-0.004	-0.004	-0.005
	(0.004)	(0.004)	(0.004)
Quantity-based MaPP (t-3)	-0.009***	-0.008***	-0.009***
	(0.002)	(0.002)	(0.002)
Quantity-based MaPP (t-4)	-0.004***	-0.002	-0.004
	(0.001)	(0.002)	(0.003)
Price-based MaPP (t-1)	0.003*	0.003	0.002
	(0.002)	(0.002)	(0.001)
Price-based MaPP (t-2)	0.002	0.002	0.002
	(0.002)	(0.001)	(0.001)
Price-based MaPP (t-3)	-0.002	-0.003	-0.003
	(0.002)	(0.002)	(0.002)
Price-based MaPP (t-4)	-0.003**	-0.003	-0.004*
	(0.001)	(0.002)	(0.002)
Crisis controls	Yes	Yes	Yes
Macroeconomic controls	Yes	Yes	Yes
p-value for H_o: $\sum_{j=1}^{4} \beta_{3j} = 0$	0.922	0.899	0.521
p-value for H_o: $\sum_{j=1}^{4} \beta_{4j} = 0$	0.000	0.000	0.000
Country fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Country linear trends	No	No	Yes
Observations	1600	1600	1600
R-squared	0.241	0.280	0.314

Note: We use robust standard errors clustered for country and time. *, ** and *** denote significance at 10, 5 and 1% levels, respectively. Macroeconomic controls include GDP growth rate, GDP per capita, current account to GDP ratio, annual inflation rate and the short-term interest rate. Crises controls include binary indicators for banking crises and currency crises.

4. Empirical results

In this section, we apply the econometric methods detailed in the previous section to analyse the effects of price-based and quantity-based macroprudential measures on credit growth, and then the differential impact of price-based and quantity-based measures depending on the level of financial development.

4.1 Effectiveness of macroprudential measures

We start our analysis by investigating the effectiveness of the price-based and quantity-based measures without differentiating their effects with respect to the level of financial development. In terms of Equation (1), this corresponds to $\beta_{5j} = \beta_{6j} = 0$ for all values of *j*. Column (1) of Table 4 compares the relative effectiveness of these measures in a specification with no control for the lagged dependent variable, proxying for latent time-varying persistent dynamic effects. When we consider the dynamic structure of our specification, the overall effects of the price-based and quantity-based tools are measured by $\sum_{j=1}^{4}\beta_{3j}$ *and* $\sum_{j=1}^{4}\beta_{4j}$, respectively. Table 4 shows that we cannot reject the hypothesis that the effect of price-based tools is equal to zero. In contrast, we find that the tightening of quantity-based tools is effective in slowing total credit growth, as we reject $\sum_{j=1}^{4}\beta_{4j} = 0$ at the 1% level. Controlling for the lagged dependent variable in column (2), and for the country specific linear trends for the credit-to-GDP ratio in column (3) does not change this result, suggesting that the results of the effectiveness of the quantity-based tools and ineffectiveness of the price-based tools hold under different conditions.

4.2 Effectiveness of price-based vs quantity-based measures

We next analyse our key question, ie whether the degree of financial development matters for the effectiveness of price-based and quantity-based tools. In Equation (1), the overall effect of price-based and quantity-based measures deployed at time *t-j* can be stated, respectively, as:

$$\frac{\partial\Delta(credit/GDP)_{i,t}}{\partial(P\_MaPP)_{i,t-j}} = \sum_{j=1}^{4}\beta_{3j} + \sum_{j=1}^{4}\beta_{5j}(FinDev)_{it} \quad (2)$$

$$\frac{\partial\Delta(credit/GDP)_{i,t}}{\partial(Q\_MaPP)_{i,t-j}} = \sum_{j=1}^{4}\beta_{4j} + \sum_{j=1}^{4}\beta_{6j}(FinDev)_{it} \quad (3)$$

In this specification, $\sum_{j=1}^{4}\beta_{3j}$ and $\sum_{j=1}^{4}\beta_{4j}$correspond to the effect of price-based and quantity-based measures, respectively, when the financial development measure is equal to zero, which is the minimum possible value of the financial development variable in our sample. Regarding the differential effects, $\sum_{j=1}^{4}\beta_{5j} \neq 0$ in Equation (2) implies that the effect of the price-based macroprudential tools vary with the level of financial development. Similarly, $\sum_{j=1}^{4}\beta_{6j} \neq 0$ in Equation (3) corresponds to the effect of quantity-based tools varying with the financial development. In particular, $\sum_{j=1}^{4}\beta_{5j} < 0$ and $\sum_{j=1}^{4}\beta_{6j} < 0$ imply that the macroprudential tightening becomes more effective in slowing credit growth for higher levels of financial development.

The estimation results for Equation (1) are presented in Table 5. Since the overall effect of the policy measures shown in Equations (2) and (3) differs at different levels of financial development, it is convenient to present the key results with a figure rather than a table. The left-hand panel of Figure 2 shows the quarterly percentage point change in the credit-to-GDP ratio in response to a tightening of price-based macroprudential tools, as well as the upper and lower bounds of the 90 percent confidence interval to assess the significance of the effect. We find that, at low levels of financial development, ie when the financial development index is around 2.5 or at

The effect of financial development and price-based and quantity-based macroprudential polices on credit growth

Table 5

Dependent variable: Quarterly percentage point change in the credit-to-GDP ratio	
Quarterly percentage point change	0.188*
in the credit-to-GDP ratio at t-1	(0.109)
Financial development (FinDev)	0.002**
	(0.001)
Quantity-based MaPP (t-1)	-0.004
	(0.004)
Quantity-based MaPP (t-2)	0.004
	(0.004)
Quantity-based MaPP (t-3)	-0.008
	(0.006)
Quantity-based MaPP (t-4)	-0.003
	(0.002)
Price-based MaPP (t-1)	0.004
	(0.003)
Price-based MaPP (t-2)	0.003
	(0.004)
Price-based MaPP (t-3)	0.001
	(0.004)
Price-based MaPP (t-4)	0.001
	(0.004)
FinDev x Quantity-based MaPP (t-1)	0.000
	(0.001)
FinDev x Quantity-based MaPP (t-2)	-0.001***
	(0.000)
FinDev x Quantity-based MaPP (t-3)	0.000
	(0.001)
FinDev x Quantity-based MaPP (t-4)	0.000
	(0.000)
FinDev x Price-based MaPP (t-1)	-0.001*
	(0.000)
FinDev x Price-based MaPP (t-2)	-0.001
	(0.001)
FinDev x Price-based MaPP (t-3)	-0.001
	(0.001)
FinDev x Price-based MaPP (t-4)	-0.001*
	(0.001)
Macroeconomic controls	Yes
Crisis controls	Yes
p-value for H_o: $\sum_{j=1}^{4} \beta_{5j} = 0$	0.073
p-value for H_o: $\sum_{j=1}^{4} \beta_{6j} = 0$	0.250
Country fixed effects	Yes
Time fixed effects	Yes
Country linear trends	Yes
Observations	1600
R-squared	0.317

We use robust standard errors clustered for country and time. *, ** and *** denote significance at 10%, 5% and 1% levels, respectively. Macroeconomic controls include GDP growth rate, GDP per capita, current account to GDP ratio, annual inflation rate and the short-term interest rate. Crises controls include binary indicators for banking crises and currency crises.

the 20th percentile of the financial development distribution, the value of the overall effect of a tightening of price-based tools is positive but insignificant. This effect of a tightening of price-based macroprudential tools on credit growth becomes significant and negative as the financial development index exceeds 5.5, which approximately corresponds to the 60th percentile of the financial development distribution.

As for the effect of the quantity-based macroprudential measures, the right-hand panel of Figure 2 shows that the negative effect on tightening on the credit growth is insignificant at very low levels of financial development. When the financial development index is above 1.59, corresponding to the 9th percentile of the financial development distribution, the effect of quantity-based macroprudential policies become statistically significant. This implies that a tightening of quantity-based macroprudential policies effectively slow credit growth when a country's level of financial development is above the very low threshold.

Financial development and the effects of macroprudential measures Figure 2

Note: The horizontal axis shows the normalised and rescaled composite index of financial development described in section three.

One important result in Table 5 that deserves emphasis is that the hypothesis $\sum_{j=1}^{4} \beta_{5j} = 0$ is rejected at 7 percent significance level. In contrast, we find no evidence that the level of financial development plays a statistically significant role in the magnitude of the effect of the quantity-based macroprudential tools on credit growth. This partly explains why the effect of price-based measures is insignificant at low levels but significant at high levels of financial development.

We believe that it is important to document the difference between the effectiveness of the price-based and quantity-based macroprudential tools, and how their effectiveness changes with the level of financial development. One possible channel that may drive the role of financial development in the effectiveness of price-based and quantity-based tools is difference in the price sensitivity of loan demand with respect to financial development. In particular, in an economy where the credit market is less developed and the agents have relatively limited access to credit, one may expect that the credit demand may be insensitive to the variations in the price of credit. That is, the availability of credit may matter more for the credit market outcomes in this economy, than its price, compared to other economies with higher financial development. Therefore, in such an economy, one may expect the

policies aiming at affecting the price of borrowing to be less effective in slowing credit growth than those directly targeting the quantity of borrowing.

5. Concluding remarks

Using a cross section of 37 countries, we evaluate in this paper whether quantity-based and price-based macroprudential measures differ from each other in terms of smoothing the variations in total credit. While this question by itself is a relatively less explored one, we further analyse how the level of financial development of an economy matters for the relative effectiveness of these two sets of tools.

This paper provides novel findings on the effects of macroprudential policies. When we do not consider the differential effect of financial development, we find that the quantity-based tools can effectively smooth the variations in total credit, whereas the price-based tools are ineffective. However, our results highlight the fact that these effects are not independent from the degree of financial development, particularly for the price-based tools. While the quantity-based tools are effective in moderating credit cycles almost irrespective of the level of financial development, the price-based tools effectively curb excess variations in total credit in relatively more developed financial markets. This finding is robust to different empirical specifications as well as to different composite measures of financial development.

While this study does not provide a detailed analysis on the channels leading to different performance of price-based and quantity-based macroprudential tools, one possible channel is that the price elasticity of the credit demand is low in countries with low levels of financial development. As a result, policy tools aiming at making credit more expensive may not be effective in deterring the credit demand in those countries. However, when a country's level of financial development is sufficiently high, the price of credit may start becoming as relevant as its availability, and thus the policies focusing on the cost of borrowing (ie price-based tools) may become effective as well in smoothing credit cycles.

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Macroprudential measures for addressing housing sector risks

Dong He, Erlend Nier and Heedon Kang[1]

Many episodes of financial instability and crises have been associated with housing market booms followed by busts. Reinhart and Rogoff (2009) show that the six major historical episodes of banking crises in advanced economies since the mid-1970s were all associated with a housing bust. They document that this pattern can also be found in many emerging market crises, including the Asian financial crisis of 1997–98, with the magnitude of house price declines being broadly similar in both advanced and emerging market countries. Since house purchases typically involve household borrowing, house prices are likely to be strongly driven by credit conditions and household leverage.

The targeted use of *sectoral* macroprudential tools can help address the build-up of systemic risk due to excess credit to the housing sector (IMF (2014a, 2014b)). These tools include sectoral capital requirements (risk weights or loss given default (LGD) floors), limits on loan-to-value (LTV) ratios and caps on debt-service-to-income (DSTI) or loan-to-income (LTI) ratios.

Evidence shows that these tools can be effective in increasing the resilience of borrowers and the financial system to house price or income shocks. They also help contain the procyclical feedback between credit and house prices that can lead a housing boom to end in a costly bust (see Figure 1 and Cerutti et al (2015)). The main benefit of a higher risk weight is that it increases the resilience of lenders, while an important benefit of LTV and DSTI caps is to increase resilience of borrowers to asset price or income shocks (Crowe et al (2011)). In particular, by enforcing a minimum down payment, LTV limits reduce borrowers' incentive for strategic default and lenders' LGD in a bust scenario.

All these tools may also dampen mortgage credit growth, even if the effects on house prices are smaller. DSTI or LTI caps can be especially effective as automatic stabilizers – becoming more binding when house prices grow faster than disposable income, thereby helping smooth the credit boom and limit the procyclical feedback between credit and house prices. All tools can also reduce speculative demand by containing expectations of future house price increases.

A wide range of indicators should be used to assess the need for policy action, especially the growth of mortgage loans and house prices. These are core indicators of housing market vulnerability, since they jointly provide powerful signals of a procyclical build-up of systemic risk (Figure 2). Deviations of house prices from long-term trends can predict financial stress, especially when combined with credit growth (Borio and Drehmann (2009) and IMF (2011a)), while house price-to-rent and house price-to-income ratios can indicate over- or under-valuation of house prices. In addition, other indicators should be closely monitored, such as (i) the average and

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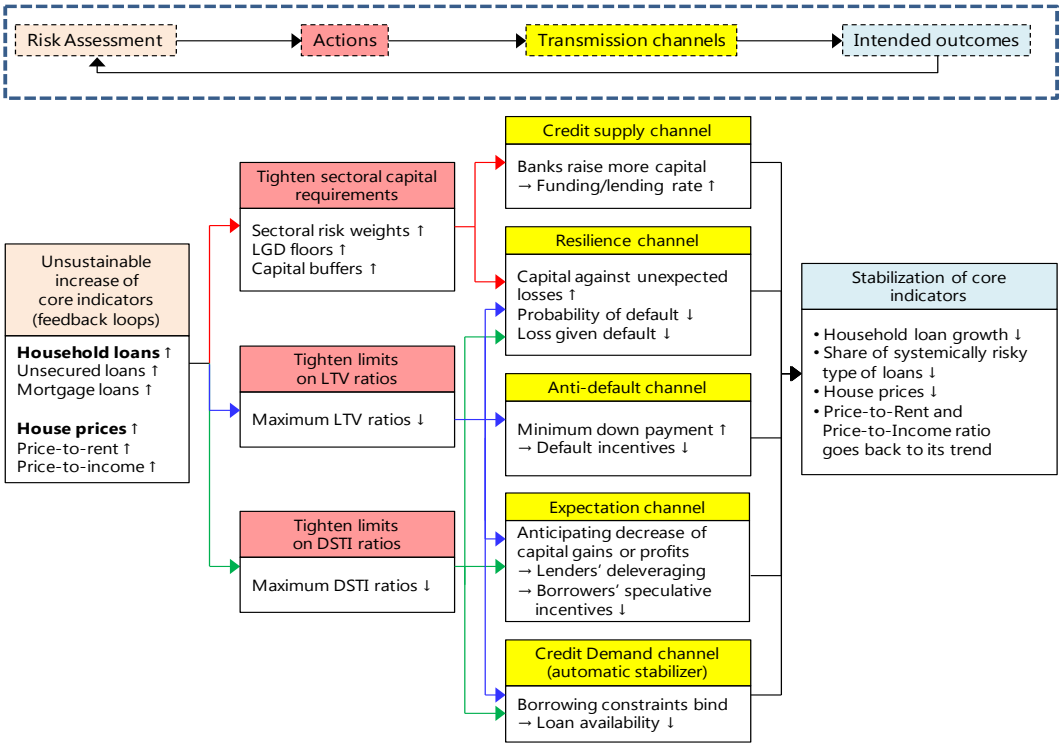
The views expressed here are those of the authors and do not necessarily represent those of the IMF or IMF policy.

the distribution of LTV, DSTI, and LTI ratios across new loans over a period, and outstanding loans at a given point in time; (ii) the share of foreign currency denominated mortgage loans or interest-only mortgage loans; and (iii) housing price growth by regions and types of properties.

Transmission mechanism of sectoral macroprudential instruments — Figure 1



Source: IMF Staff

Sectoral tools should be activated or tightened when multiple indicators consistently point to rising systemic risk. A single signal, or mixed signals from multiple indicators, may not be sufficient for action. For example, strong growth in mortgage loans without house price growth may simply indicate improving housing penetration rather than an increase in risk. Conversely, a sharp increase in house prices, without strong mortgage loan growth, may reflect a shortage of housing supply requiring structural policies to improve supply rather than a macroprudential response.

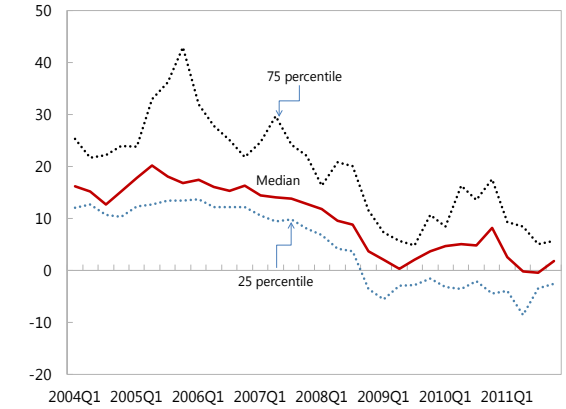
Policymakers should take a gradual approach when introducing or tightening sectoral tools. When several indicators show signs of a gradual build-up of risk in the housing sector, policymakers should first intensify supervisory scrutiny and step up communication. As a next step, sectoral capital requirements should be tightened to build additional buffers. Tighter limits on LTV and/or DSTI ratios can follow if these former defenses are not expected to fully meet policy objectives (See Figure 3 and Table 1 for country examples). LTV and DSTI caps should always be imposed on the flow of new household loans. Otherwise, it could precipitate distress by forcing existing high LTV or DSTI borrowers to provide more collateral or repay part of their loans.

Mortgage loans and house prices around the global financial crisis

Figure 2

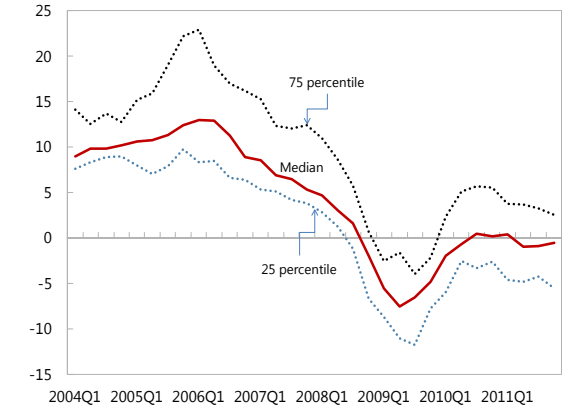
Mortgage loan growth

(In percent, Y-o-Y)



House price growth

(In percent, Y-o-Y)



Notes: The sample includes 18 countries that have been in a systemic banking crisis (Laeven and Valencia (2012)) and had at least two consecutive quarters of negative nominal house price growth during 2007–11, such as Belgium, Denmark, France, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Luxembourg, the Netherlands, Russia, Slovenia, Spain, Sweden, Ukraine, the United Kingdom and the United States.

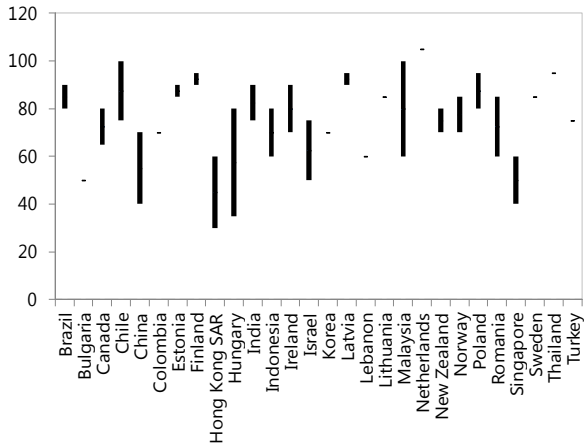
Source: IMF Staff calculation.

Limits on LTV and DSTI ratios and the number of economies at each range

Figure 3

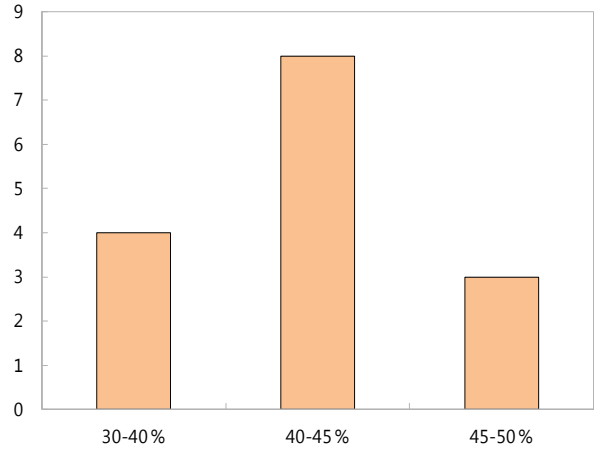
Limits on LTV ratios

(In percent)



Caps on DSTI ratios

(Number of countries)



Note: Observed limits on LTV ratios are below 80 percent in more than half of 28 sample countries, and most countries with DSTI ratios have imposed 40–45% as the limit (eight out of 15 countries), and four countries restrict it to be below 35%.

Source: IMF staff calculation.

Use of sectoral macroprudential tools Table 1

	Advanced economies	Emerging market economies	Total
Sectoral capital requirements	Australia (2004), Hong Kong SAR (2013), Ireland (2001), Israel (2010), Korea (2002), Norway (1998), Spain (2008), Switzerland (2013)	Argentina (2004), Brazil (2010), Bulgaria (2004), Croatia (2006), Estonia (2006), India (2004), Malaysia (2005), Nigeria (2013), Peru (2012), Poland (2007), Russia (2011), Serbia (2006), Thailand (2009), Turkey (2008), Uruguay (2006)	23
Limits on LTV ratio	Canada (2007), Estonia (2015), Finland (2010), Hong Kong SAR (1991), Ireland (2015), Israel (2012), Korea (2002), Latvia (2007), Lithuania (2011), Netherlands (2011), New Zealand (2013), Norway (2010), Singapore (2010), Sweden (2010)	Brazil (2013), Bulgaria (2004), Chile (2009), China (2001), Colombia (1999), Hungary (2010), India (2010), Indonesia (2012), Lebanon (2008), Malaysia (2010), Poland (2013), Romania (2004), Thailand (2003), Turkey (2011)	28
Caps on DSTI ratio (including LTI caps)	Canada (2008), Estonia (2014), Hong Kong SAR (1997), Korea (2005), Ireland (2015, LTI), Lithuania (2011), Netherlands (2007), Norway (2010, LTI), Singapore (2013), United Kingdom (2014, LTI)	China (2004), Colombia (1999), Hungary (2010), Latvia (2007), Malaysia (2011), Poland (2010), Romania (2004), Thailand (2004)	18

Note: Parentheses show the year a jurisdiction introduced currently imposed measures; changes tracked since 1990.

Source: IMF staff calculation.

Combining sectoral tools can reinforce their effectiveness and mitigate the shortcomings of any single tool. For example, LTV limits – which cap the size of a mortgage loan relative to the appraised value of a house – may become less effective when house prices increase, but DSTI caps – which restrict the size of debt service payments to a fixed share of household incomes – continue to tie credit to household income. DSTI and LTI caps can also enhance the effectiveness of LTV limits by containing the use of unsecured loans to meet the minimum down payment. In a low interest rate environment, *stressed* DSTI caps (ie where the DSTI ratio under a specified stress scenario is capped) can complement LTV limits and mitigate defaults when interest rates eventually rise.

During housing busts, sectoral tools can be relaxed to contain feedback loops between falls in credit and house prices. A housing bust can result in a credit crunch that puts further downward pressure on house prices. Strategic default, fire sales and contraction in the supply of credit can create negative economic externalities that can be cushioned by relaxing these tools (IMF (2011b), Geanakopolos (2009) and Shleifer and Vishny (2011)).

Indicators that inform the tightening phase can also be used for decisions to relax. Fast-moving indicators, such as house transaction volumes and spreads on housing loans, can also guide relaxation decisions. However, a softening housing market is not sufficient alone to justify a relaxation. Evidence of systemic stress is required, such as a simultaneous decline in prices and credit, or an increase in non-performing loans or defaults. The relaxation would then be targeted to reduce stress in the housing market.

Any relaxation needs to respect certain prudential minima to ensure an appropriate degree of resilience against future shocks. If large additional buffers have been built during the tightening phase, they can be released to avoid a credit crunch without jeopardising banks' resilience. However, the relaxation should not go beyond a "permanent floor", ie a level considered safe in downturns. Policymakers should also communicate clearly that a tightening can be followed by a relaxation, so that market participants do not take an adverse view of the relaxation during downturns.

A relaxation of these tools can be effective, but may have limited effects when it is "pushing on a string." Even if policymakers loosen sectoral instruments, banks may be reluctant to provide credit due to increased risk aversion or capital constraints, and may apply more stringent lending standards than the regulatory thresholds. Potential borrowers may be reluctant to enter the housing market while prices are still falling. Nonetheless, the relaxation would still be useful in containing the spillback from falling prices and credit where it removes a binding constraint on some agents.

Policymakers should bear in mind that sectoral tools can create domestic or cross-border leakages, and unintended consequences. An increase in credit by domestic non-banks and foreign bank branches may render the sectoral tools less effective or even ineffective if they are applied only to the domestic banking sector. Policymakers should then expand the regulatory perimeter to non-banks and foreign branches. Where there are separate regulators, inter-agency cooperation would be needed at the national or cross-border level. Extending the tools to unregulated entities may require expanding the licensing regime to those institutions. Finally, policymakers may want to tailor limits on LTV and DSTI ratios to contain unintended distributional effects.

Containing housing booms and busts may require policy levers beyond macroprudential policy tools. Where fiscal distortions, such as mortgage interest relief, contribute to systemic risks in housing markets, they should be removed (eg the United Kingdom and Netherlands). When supply constraints drive up asset prices (eg Hong Kong SAR, Sweden and Australia), structural policies to boost housing supply are needed.

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Turkey's experience with macroprudential policy[1]

Hakan Kara[2]

1. Introduction

The global financial crisis have led to a reassessment of macroeconomic policy formulation across the globe. As a consequence, countries have expanded their policy toolkits with macroprudential policies in recent years to deal with macro financial risks.[3] The heightened volatility in capital flows during the post-crisis period has led to significant challenges especially for emerging economies by worsening policy trade-offs. Such an environment made additional tools of macroeconomic and financial policy more valuable.[4]

Against this backdrop, Turkey has taken a number of steps towards building an institutional setup for implementing explicit macroprudential policies since 2011. To this end, the Central Bank of the Republic of Turkey (CBRT) modified the inflation targeting framework by incorporating financial stability as a supplementary objective. Moreover, a formal Financial Stability Committee (FSC) was founded to respond to macro-financial risks in a more systematic and coordinated fashion.

This study conducts a broad evaluation of the macroprudential policy implementation in Turkey during this process and draws some policy implications. We first highlight the central role of the capital flow volatility and the associated tradeoffs in designing the macroprudential policy framework. Next, we describe policy implementation and outcomes. Our analysis suggests that macroprudential policies have improved external balances, dampened financial amplification channels, and reduced the sensitivity of the Turkish economy to capital flows.

How to design and implement macroprudential policies has been of great interest to both policy institutions and academia after the global financial crisis. The renewed interest in conducting macroprudential policy yielded a substantial amount of research in recent years. New theoretical results and empirical findings triggered attempts to streamline and standardise the conduct of macroprudential policy.[5] Although these efforts have tremendously contributed to our understanding of macroprudential policy, they are mostly based on theoretical results or cross-country evidences with limited attention to country-specific characteristics. Given the

[1] The views expressed in this paper are those of the authors' and do not necessarily represent the official views of the Central Bank of the Republic of Turkey. I would like to thank Koray Alper, Uğur Çıplak, Pınar Özlü, Faruk Aydın, Deren Ünalmış and Canan Yüksel for useful contributions.

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[3] For an overview of macroprudential policy measures across advanced and emerging economies see, eg, Lim et al (2011, 2013), Tovar et al (2012), Ostry et al (2012), Claessens and Ghosh (2013), Claessens et al (2013), Claessens (2014), Galati and Moessner (2013, 2014), Bruno and Shin (2015) and Akıncı and Olmstead-Rumsey (2015), among others.

[4] See Obstfeld (2015).

[5] See IMF (2013, 2015) and Schoenmaker (2014), among others.

complexity of instruments, long lags with which they affect the final policy objectives, and the short size of the data, the existing theoretical and empirical literature may still have to be complemented by case studies. In that sense, we believe that individual country experiences may provide valuable insights for the design and conduct of macroprudential policies.

Macroprudential policy experience of Turkey may yield contributions for the current debate at least for two reasons: first, Turkey has been quite active on the macroprudential front in recent years, using a wide range of tools imposed through restrictions on both borrowers and financial institutions; second, design and implementation of macroprudential policy framework in Turkey reflects a purely emerging economy perspective, where special emphasis has been given to the role of capital flows. Understanding this approach may yield particularly valuable insights, because recent studies have mostly focused on advanced economy settings. The central role of capital flows in driving business cycles and macro-financial risks in emerging economies may have different implications for the conduct of macroprudential policies as well as for the interaction between monetary and macroprudential policies.

The design and implementation of macroprudential policies are largely country-specific, depending on the initial cyclical and structural characteristics of the economy as well as the institutional background. Therefore, we proceed by describing the initial conditions and the background for the Turkish case.

2. Background

Turkey faced rapid credit growth during the past decade on the back of improved economic fundamentals after the 2001 crisis and easy global liquidity conditions. The 2001 crisis, which was a home-made event consisting of a mixture of banking, fiscal, and balance of payment crises, incorporated many features of the conventional crisis literature. The response to such a devastating crisis was strong. Several structural adjustments took place on fiscal, monetary and prudential dimensions. The new Central Bank law, introduction of a floating exchange rate regime along with inflation targeting, consolidation and strengthening of the banking system and fiscal balances, and foundation of a new banking regulatory and supervisory agency have made Turkey an attractive destination for capital flows. Fueled by ample global liquidity and also supported by demographic factors, Turkey faced rapid credit growth during the 2000s, as private credit to GDP ratio rose sharply (Figure 1).

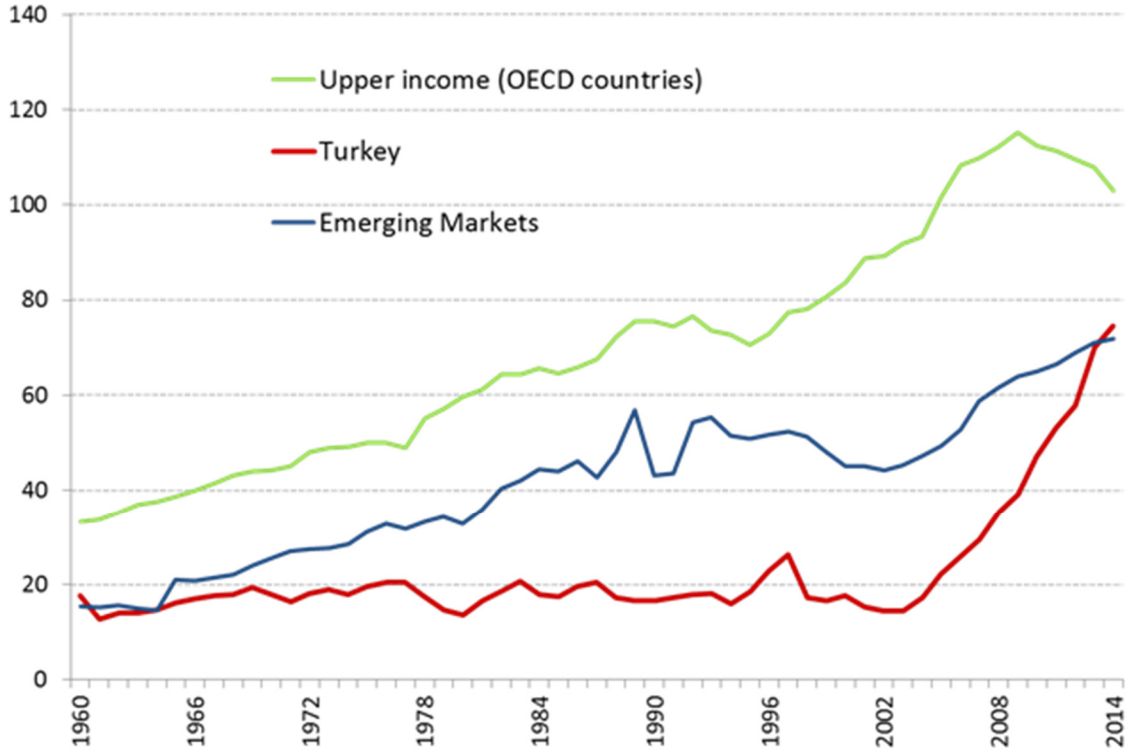
Perhaps paradoxically, rapid credit growth during the past decade coincided with a considerably tight bank regulation and supervision. Prudential policies in Turkey are traditionally implemented through the banking system, as Turkish financial intermediation is dominated by banks.[6] Reflecting the bitter experience of the past financial crises, bank regulation and supervision has been unambiguously prudent during the past decade. For example, banks were not allowed to have currency mismatches, foreign currency loans to consumers were prohibited, and there were restrictions on foreign currency lending to non-financial firms. Tight restrictions were

[6] As of September 2015, 92.3% of the financial liabilities of households are to banks (see CBRT Financial Stability Report, November 2015, Table II.1.2).

imposed on distributing bank dividends, new bank entry, branch openings etc. Moreover, Banking Regulation and Supervision Agency (BRSA) imposed significantly higher minimum capital adequacy and liquidity coverage ratios than required by international standards. Reflecting the cautious prudential framework, banks have maintained ample capital and liquidity buffers during this period.[7]

Private Credit/GDP Ratio

Figure 1



Source: World Bank.

Although many of these prudential features had macro implications, a formal macroprudential perspective was lacking during the 2000s. BRSA had a microprudential mandate, mostly focusing on the health of individual banks. CBRT published a financial stability report with a macro perspective, but monetary policy was conducted under a conventional inflation targeting regime, with no explicit mandate or tool(s) for responding to macro-financial risks.

The quantitative easing by advanced economies and the surge of capital flows to emerging economies after the global financial crisis further highlighted the need to adopt an explicit macro approach to financial stability. The underlying trend of private credit growth rate climbed to 40% at the end of 2010. Meanwhile, Turkish lira appreciated rapidly in real terms. These developments were accompanied by an overheating in the economy and a sharp widening in the current account deficit. Perhaps more importantly, the quality of external finance deteriorated sharply. By the end of 2010, almost all the current account deficit was financed by either short-term

[7] For example, the capital adequacy ratio of the system was above 16% throughout the period of 2002–10.

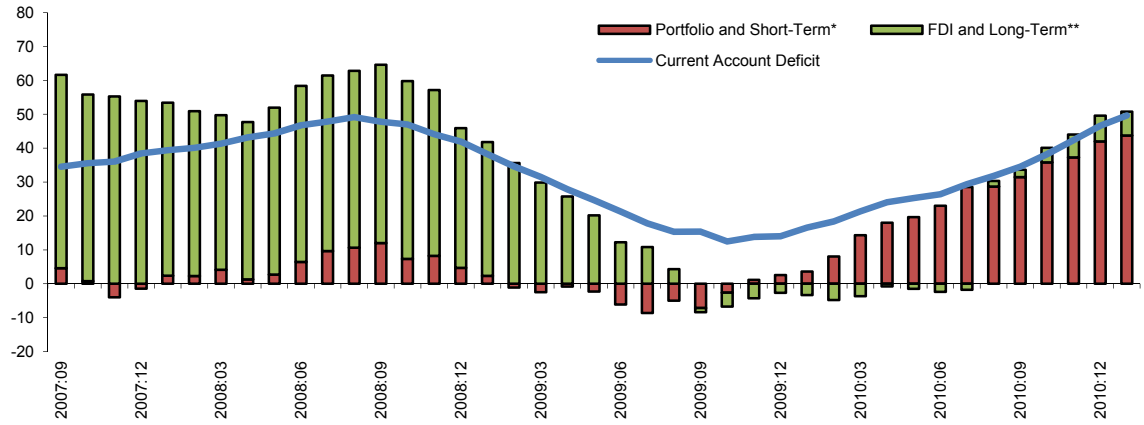
or portfolio flows, leaving the economy susceptible to sudden reversals in global sentiment (Figure 2).

The large external financing needs and the deterioration in the quality of inflows in 2010 have increased the so called "sudden stop" risks for the Turkish economy. Historically, capital outflows have been the main trigger of output losses across emerging economies[8] and Turkey has been no exception in this regard. Turkish business cycles were dominated by boom-bust episodes, which were amplified by sudden movements in capital flows. The massive economic contractions in 1994, 2001, and 2009 reflected such episodes. Each recession was accompanied by a negative net capital inflow (sudden stop) and a disruption in the financial system. Given such an historical background, the sharp deterioration in the current account balance and the quality of external financing by the end of 2010 called for a timely response, once again highlighting the need to adopt a macro approach to financial stability.[9]

Initial Conditions: Current Account Deficit and Net Inflows

12 months cumulative, billion USD

Figure 2



Source: CBRT.

Although the build-up of macro-financial risks in 2010 required a prompt policy response, it was not clear *who* should react and *how* the response would be executed in practice. Given the dominant role of the banks in the Turkish financial intermediation, one natural candidate was the bank regulator. The BRSA had all the relevant tools to contain credit growth, which would help limit the over-borrowing tendency of economic agents. Yet, looking from the regulator's *micro* perspective, there was no sense of urgency to respond to the rapid loan growth: bank balance sheets looked healthy, profitability was high, capital and liquidity positions were comfortable, and non-performing loans were low. Nonetheless, the situation looked far more concerning and urgent from a *macro* point of view. Under these circumstances, the CBRT decided to step in.

[8] See Claessens and Gosh (2013) for some evidence.

[9] See Başçı and Kara (2011) for more details on the rationale behind the change in the policy approach.

3. Macroprudential policy implementation

The first phase: devising monetary instruments for macroprudential purposes

The lack of a formal institutional setup for containing macro-financial risks in Turkey has prompted the CBRT to take a leading role at the end of 2010. Accordingly, the CBRT adopted a new policy strategy to contain macro-financial risks and to address the challenges posed by volatile capital flows. To this end, the conventional inflation targeting regime was modified by incorporating financial stability as a supplementary objective. Price stability remained as the overriding objective, while policy focus was broadened to include macro-financial risks – especially macroeconomic volatility caused by excessive global liquidity cycles. To this end, the policy toolkit was expanded to include reserve requirements and a flexible interest rate corridor system (Table 1).

Augmenting the Traditional Inflation Targeting Framework — Table 1

	Previous Approach	New Approach
Objectives	Price Stability	Price Stability Financial Stability
Policy Tool(s)	Policy Rate	Policy Rate Interest Rate Corridor Reserve Req. Policy

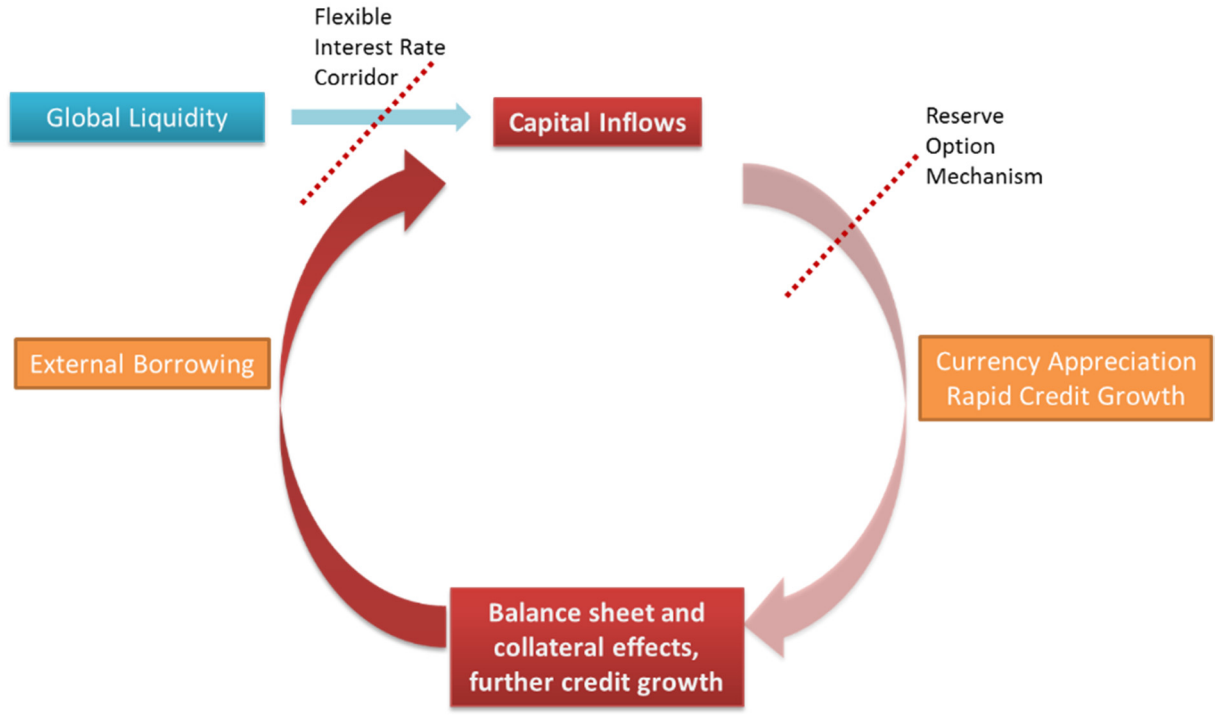
The new strategy focused on containing the adverse effects of the capital flow volatility on the domestic economy. Faced by rapidly widening current account deficits and a deterioration in the quality of external finance, priority was given to reducing the probability of a sudden disruption in external financial flows. In this context, the CBRT pointed out the importance of containing excessive borrowing (credit growth) and reducing exchange rate misalignments. Meanwhile, the CBRT also highlighted the need to dampen the interaction between capital flows, exchange rates and credit growth, which amplifies the business cycle fluctuations in an emerging economy with currency mismatches as illustrated in Figure 3.[10]

[10] Hofmann, Shim and Shin (2016) use a similar mechanism for explaining the role of cross-border flows as an amplifying factor for business cycles.

Needless to say, such a diverse approach necessitates the use of a variety of policy instruments. Accordingly, the CBRT devised new instruments such as "asymmetric interest rate corridor" and "reserve option mechanism". As Figure 3 depicts, the former aims at smoothing the volatility of capital flows, while the latter is designed to weaken the link between capital flows and domestic macroeconomic variables.[11] Overall, these unconventional tools aim to ease the policy tradeoffs associated with the volatility in capital flows by dampening the amplifying role of capital flows.

The role of CBRT's monetary instruments to dampen the amplification effects of cross-border flows

Figure 3



Source: CBRT.

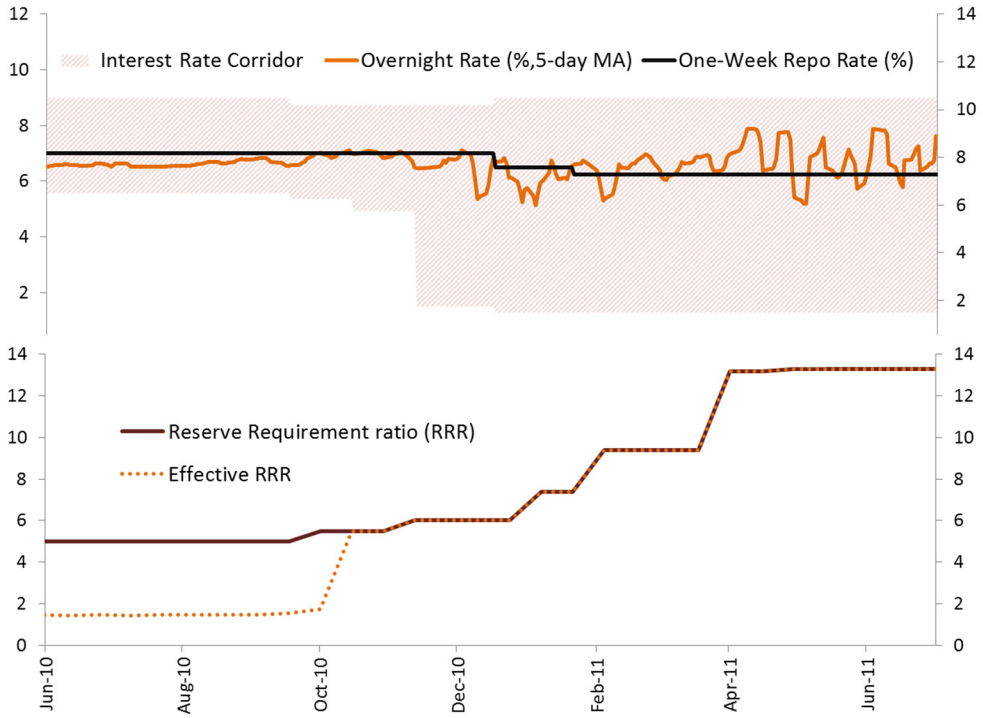
Implementation of the new policy framework during the initial stages deserves special attention, as it provides an interesting example of using monetary tools for macroprudential purposes. In the absence of a formal institutional setup and explicit tools to conduct macroprudential measures, the CBRT decided to use reserve requirement ratios and a wide interest rate corridor as cyclical tools to respond to credit growth and capital flow volatility. Figure 4 shows how the two main tools evolved between mid-2010 and mid-2011. The CBRT raised reserve requirement ratios (Figure 4, bottom panel) significantly and stopped remunerating required reserves at the end of 2010 to contain rapid credit growth. At the same time, volatility

[11] The mechanics and transmission of the wide interest rate corridor and the reserve option mechanism (ROM) are explained through several working papers and documents published at the CBRT website. See, for example, Alper, Kara, and Yörükoğlu (2013a), Küçüksaraç and Özel (2013) and Aslaner et al (2015) on the ROM; Başçı and Kara (2011), Kara (2013), Alper, Kara, and Yörükoğlu (2013b), Binici et al (2013) and Akçelik et al (2015) on the interest rate corridor, among others.

in short-term money market rates were increased through the active use of interest rate corridor (Figure 4, top panel) in order to reduce the attractiveness of short-term carry-trade type of inflows.[12] As a result, effective reserve requirement ratio for the banking system rose sharply by about 10 percentage points and interest rate volatility in the overnight repo market increased substantially.

Interest Rate Corridor and Reserve Requirement Ratios

Figure 4



Source: CBRT.

Despite these intensive efforts by the CBRT, a significant slowdown in credit could be observed only after the bank regulator's measures by mid-2011 (Figure 5).[13] Unconventional monetary instruments alone were not able to bring down the private credit growth to reasonable levels initially, because of their indirect nature to influence the supply and demand for loans.[14] Although the acceleration of credit stopped after the hikes in the reserve requirement ratio, annual loan growth remained elevated at around 35% during the first half of 2011, leading to concerns regarding the effectiveness of the CBRT's new policy strategy.

The new multiple-tools-multiple-objectives framework complicated the communication of monetary policy. Uncertainty regarding the transmission mechanism of new instruments hampered the predictability and accountability of

[12] Kara (2015) provide the operational details on how the short-term interest rates are set flexibly within the interest rate corridor by changing the composition of central bank funding.

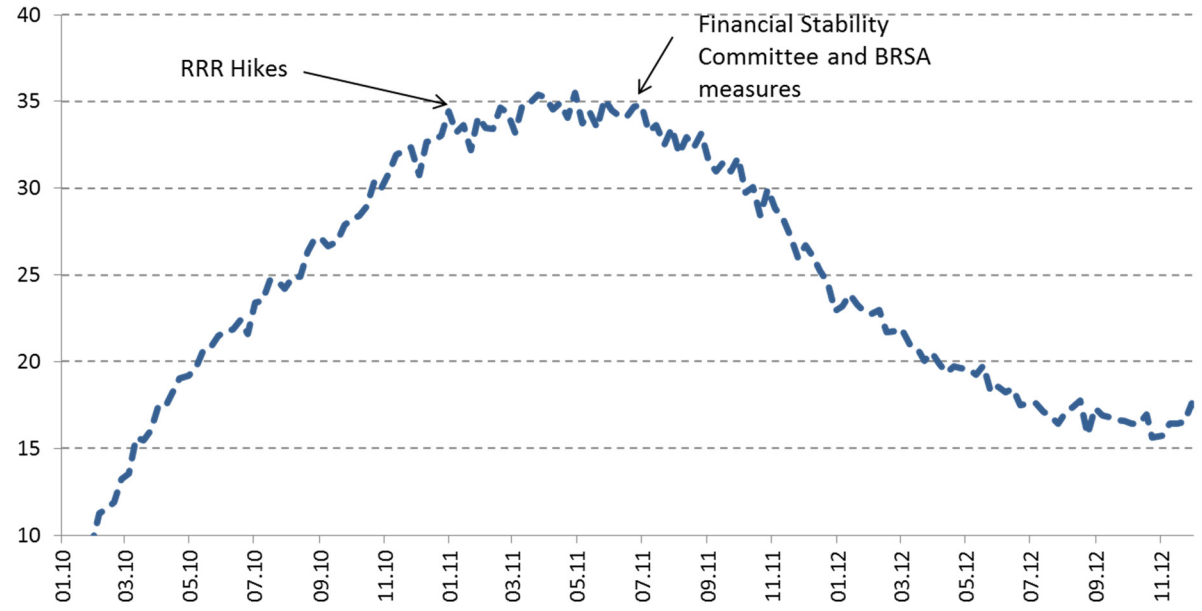
[13] The next section provides more details on BRSA measures.

[14] Başçı and Kara (2011) provide an assessment of the impact of reserve requirements and short-term interest rate volatility on financial variables and credit growth during the initial stages of policy implementation. Alper et al (2014) offer more detailed analysis on the transmission mechanism of reserve requirements through bank lending behavior.

policies. The theoretical and empirical literatures on the effectiveness of these instruments were scarce and not robust enough to convince the public. Given the inherently vague nature of financial stability and the difficulty of linking each tool to objectives, the joint use of multiple instruments for multiple purposes posed significant communication challenges for the CBRT. Notwithstanding the drawbacks related to communication and effectiveness of unconventional instruments, the efforts by the CBRT to contain macro-financial risks have increased the awareness of the need to establish a formal institutional body for macroprudential policies, paving the way for the foundation of the Financial Stability Committee.

Credit Growth

annual % change, adjusted for exchange rate valuation effects Figure 5



Source: CBRT.

The second phase: Financial Stability Committee (FSC)

Organisation structure and functions of the FSC

The foundation of the FSC in June 2011 was a major step towards establishing a formal macroprudential framework in Turkey. Chaired by the deputy prime minister in charge of economy, the FSC is a body that brings together all the major relevant institutions for financial stability: Banking Regulation and Supervision Agency, Central Bank, Treasury, Capital Markets Board, and Saving Deposit Insurance Fund. The idea is to enhance information sharing, coordination and cooperation between parties. The FSC does not have its own tools; each institution has its own mandate and responsibility. Therefore, the power and the tools rest with the relevant authorities. The main duties of the FSC are to assess systemic risks, identify necessary measures and make policy recommendations.

The FSC facilitated the implementation of prudential policies directly for the aim of reducing macro-financial risks. The establishment of the FSC helped the relevant

institutions to internalise the macroeconomic and systemic dimension of financial stability, lifting some of the weight off the CBRT's shoulders. Through the recommendations of the FSC, relevant institutions have taken a comprehensive set of measures to contain excessive leverage and improve the quality of external financing.

Macroprudential policies envisaged under the guidance of the FSC have further extended the CBRT's previous individual efforts to alleviate the adverse impact of global liquidity swings on the domestic economy. To this end, the FSC focused on two main pillars:

1. containing credit growth (especially by reducing household indebtedness); and
2. improving the quality of bank liabilities.

The first pillar is related to over-borrowing and current account deficit, while the second one largely pertains to the quality of capital inflows. Taken together, these intermediate goals intend to increase the resilience of the economy against external finance shocks.

Containing credit growth and household debt

The link between macro-financial risks and credit growth has been well documented by the literature. Historically, credit booms are identified to be the most robust and significant predictors of financial crises.[15] More recent evidence suggests that the composition of credit matters as well. For example, a rise in the household debt-to-GDP ratio is associated with higher current account deficits and predicts lower output growth over the medium run.[16] For the Turkish case, macro-financial aspects of the household debt is even more relevant due to its close relation with the current account deficit.[17]

Against this backdrop, containing consumer loan growth has been one of the priorities for the FSC. The measures to contain credit growth and household debt were mainly taken by the BRSA, with the recommendations of the FSC. The measures were introduced in two rounds of macroprudential tightening. The first package, which was implemented throughout 2011, included higher risk weights and general provisions for consumer loans, higher minimum payments for credit card debt, and loan-to-value (LTV) caps for housing loans. The second package, which came in late 2013–early 2014 introduced further caps, limits and higher risk weights on credit cards, LTV ceilings for vehicle loans, and maturity restrictions for uncollateralised consumer loans.

These measures, coupled with a tighter monetary policy stance, had a significant impact on loan growth as depicted in the Figure 6-a. Consumer loans displayed a marked deceleration each time a new round of measures were introduced. The annual rate of growth in consumer loans slowed from 45% in mid-2011 to less than 15% in 2015. As a consequence, the upward trend in household indebtedness ratio (household liabilities over assets) has reversed since 2013 (Figure 6-b). The

[15] See, for example, Borio and Lowe (2002), Reinhart and Rogoff (2009), Jorda et al (2011), Gourinchas and Obstfeld (2012) and Schularick and Taylor (2012).

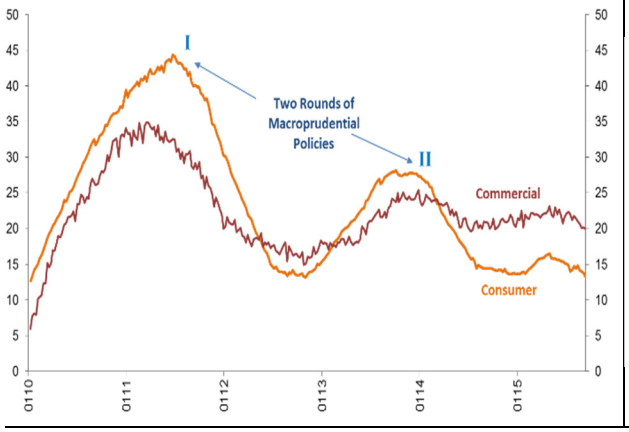
[16] See Mian, Sufi and Verner (2015).

[17] Alioğulları et al (2015) find that consumer loans are tightly associated with the current acount balance in Turkey, while the link between commercial loans and current account is weaker.

deceleration in commercial loans were less pronounced, because this segment was not directly targeted by the macroprudential measures. Overall, these observations suggest that macroprudential measures have been instrumental in containing credit growth and household indebtedness, and changing the composition of credit.[18]

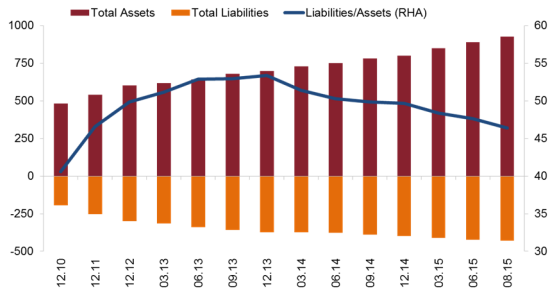
Consumer and Commercial Loan Growth

(annual % change) Figure 6a



Household Assets and Liabilities

(billion TL) Figure 6b



Source: CBRT.

Improving the quality of financing

The BRSA measures to contain credit growth mainly addressed the issues related to current account balance and *asset* side of the financial intermediaries. On the other hand, improving the quality of the *liability* side, which is closely associated with the financing of the current account deficit, was also deemed essential to increase the resilience of the financial system. After the global financial crisis, the banking system financed credit growth predominantly through external borrowing (non-core liabilities). Moreover, the share of short-term non-core liabilities increased substantially during this period. Although the banks in Turkey do not hold excessive currency mismatches in their balance sheets due to regulatory restrictions, the increasing share of non-core liabilities (as evidenced by rising credit-to-deposit ratios) and shortened maturities were still of concern to the FSC from a macro-financial perspective.

Macroprudential measures to improve the composition of bank liabilities were mainly implemented by the CBRT through reserve requirement (RR) policies. To this end, RR ratios and remuneration rates were differentiated across several dimensions, providing incentives for the banking system to prefer (i) core liabilities over non-core liabilities, (ii) long-term over short-term liabilities, and (iii) Turkish Lira (TL) over FX liabilities. Among these objectives, lengthening the maturity of external debt and

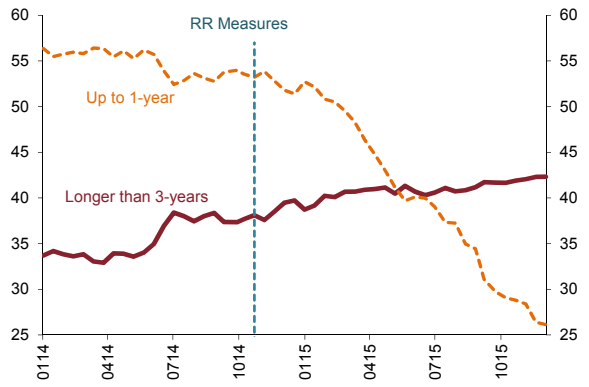
[18] More sophisticated analysis also confirms our descriptive argument that the measures to curb consumer loan growth were effective. For example, using bank-level micro data, Arslan and Taşkın (2015) explore the impact of loan-to-value restrictions on vehicle loan growth using panel regression methods and reach similar conclusions.

increasing the share of core liabilities were seen as particularly essential to boost the resilience of the financial institutions against external finance shocks.

Although RR policies have been used actively since end-2010, it is important to note that during the initial stages, they were used mostly for cyclical purposes (see the previous section), and thus did not directly target non-core versus core components of liabilities.[19] The most significant package regarding the composition of liabilities came at late 2014 and early 2015, when the CBRT decided to increase the RR ratios for short-term (up to one-year maturity) non-core liabilities sharply from 13% to 20% in two consecutive steps. At the same time, the remuneration rates for required reserves were adjusted so as to provide incentives to increase the share of core liabilities.

Figure 7 suggests that RR-based measures have induced significant changes in the composition of bank liabilities. Following the announcement of RR measures by the CBRT, the share of non-core short-term liabilities in total non-core liabilities has declined significantly, falling from 53% to 28% throughout 2015 (Figure 7-a). Meanwhile, the increasing trend of credit/deposit ratio, which has been ongoing for many years, receded after the introduction of RR measures (Figure 7-b).

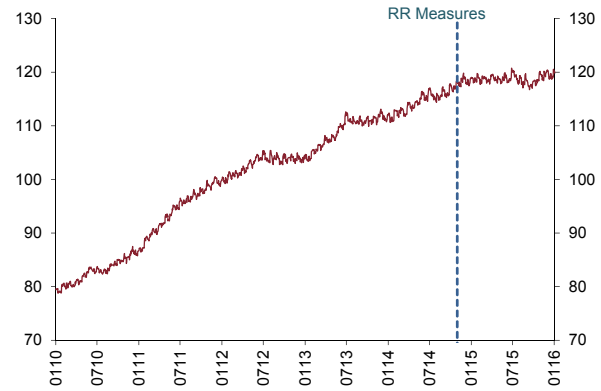
Maturity Structure of Non-core Bank Liabilities (percent)* Figure 7a



*Calculated using flow data.

Source: CBRT.

Credit/Deposit Ratio (percent) Figure 7b



Source: BRSA, TURKSTAT.

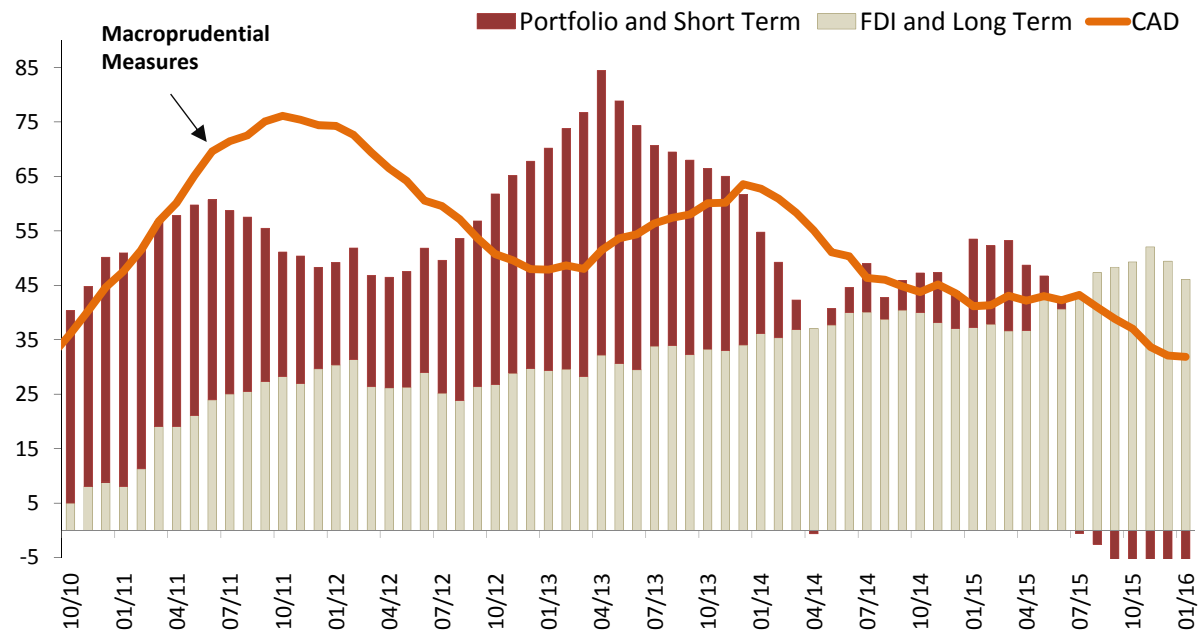
Up to this point, we have evaluated the impact of macroprudential policies through bank balance sheets. Now we turn to macroeconomic implications. In macro terms, the main goals of macroprudential policies in Turkey during the 2011–15 period were to contain current account deficits, improve the quality of external finance and reduce the sensitivity of domestic economy to the excessive volatility in capital flows. In order to assess the overall rebalancing performance, we will document the evolution of relevant variables after the introduction of macroprudential measures.

[19] During the initial stages, the CBRT also attempted to use the RR ratios for the purpose of lengthening maturities of domestic currency deposits, which had a limited impact on the average maturity of deposits.

We begin with the current account balance and the composition of external finance. Figure 8, which is an extended version of Figure 2, shows the current account deficit and net capital inflows on a 12-month cumulative basis. Since 2011, there has been a steady decline in the current account deficit. Moreover, the share of FDI and long-term inflows in total net inflows have increased persistently. As of the writing of this note, current account deficit was financed entirely through FDI and long-term borrowing.

Current Account Deficit and Net Inflows

(12 months cumulative, billion USD) Figure 8



Source: CBRT.

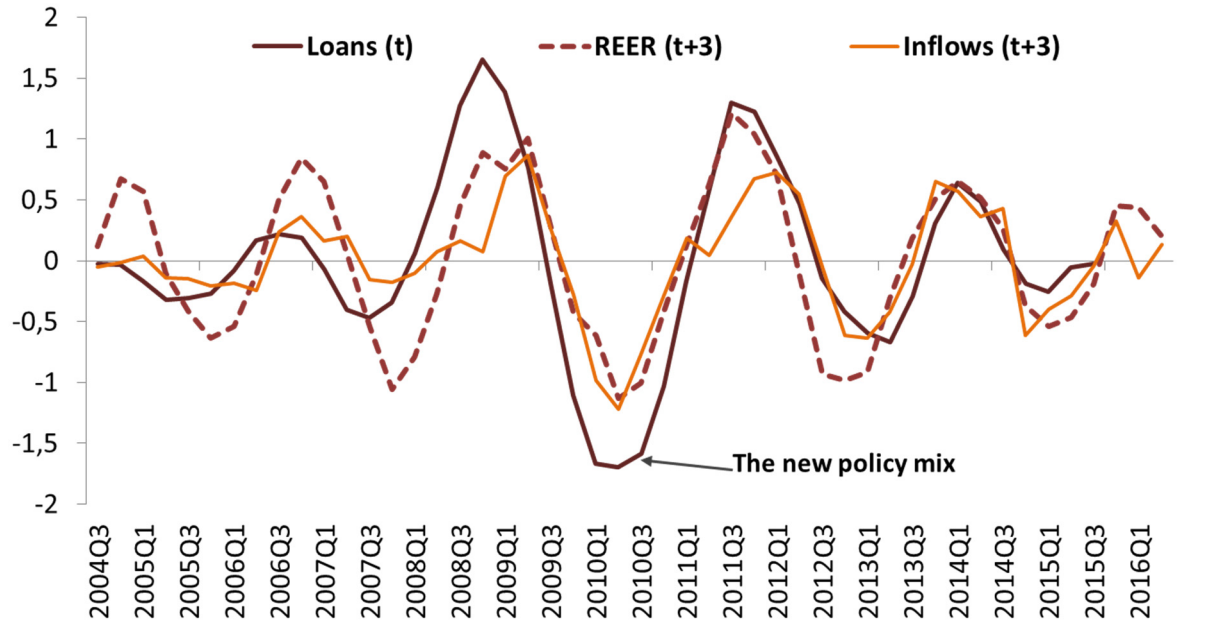
In sum, both the current account balance and the quality external finance have improved markedly since the implementation of macroprudential policies. Admittedly, the Fed tapering process and the decline in commodity prices have also contributed to the rebalancing process since 2013. However, it is also important to note that the improvement in the current account balance and the composition of external financing have begun way earlier, coinciding exactly with the formal introduction of explicit macroprudential measures by the authorities. These observations lend support to the view that macroprudential policies were instrumental in driving the rebalancing in the Turkish economy since 2011.

Another purpose of the macroprudential policies in Turkey was to weaken the amplification channels driven by global financial flows. The interaction between net capital flows, exchange rate and domestic credit is likely to be the key mechanism in emerging economies amplifying the impact of the cross-border flows, as suggested by Mendoza and Terrones (2008), Bruno and Shin (2015) and Hofmann, Shim and Shin (2016), among others. Figure 9 suggests that this mechanism might have been relevant for the Turkish case. The cyclical component of capital flows, real exchange rate and bank loans for Turkey typically move closely with each other with some lead-lag relationship, confirming the close interaction between capital flow cycles and

key financial variables. Yet, the evolution of these variables before and after the adoption of macroprudential policies reveals an interesting point: the amplitude of the cycles have been dampened considerably since the adoption of the macroprudential policies in 2011. This observation suggests that the macroprudential policies may have had some impact on the financial accelerator mechanisms driven by cross-border flows, although more concrete evidence is needed to assess the exact drivers underlying these developments. Our interpretation is that domestic credit growth and exchange rates have become less sensitive to capital flows due to macroprudential measures adopted to curb credit growth.[20] Several recent studies by the CBRT staff also suggest that unconventional measures such as flexible use of interest rate corridor and the reserve requirement policies may have contributed to this process (see also the diagram in Figure 3).[21]

Net Capital Flows, Real Exchange Rate, and Credit Cycles

(HP filtered, standardised) Figure 9



Source: CBRT.

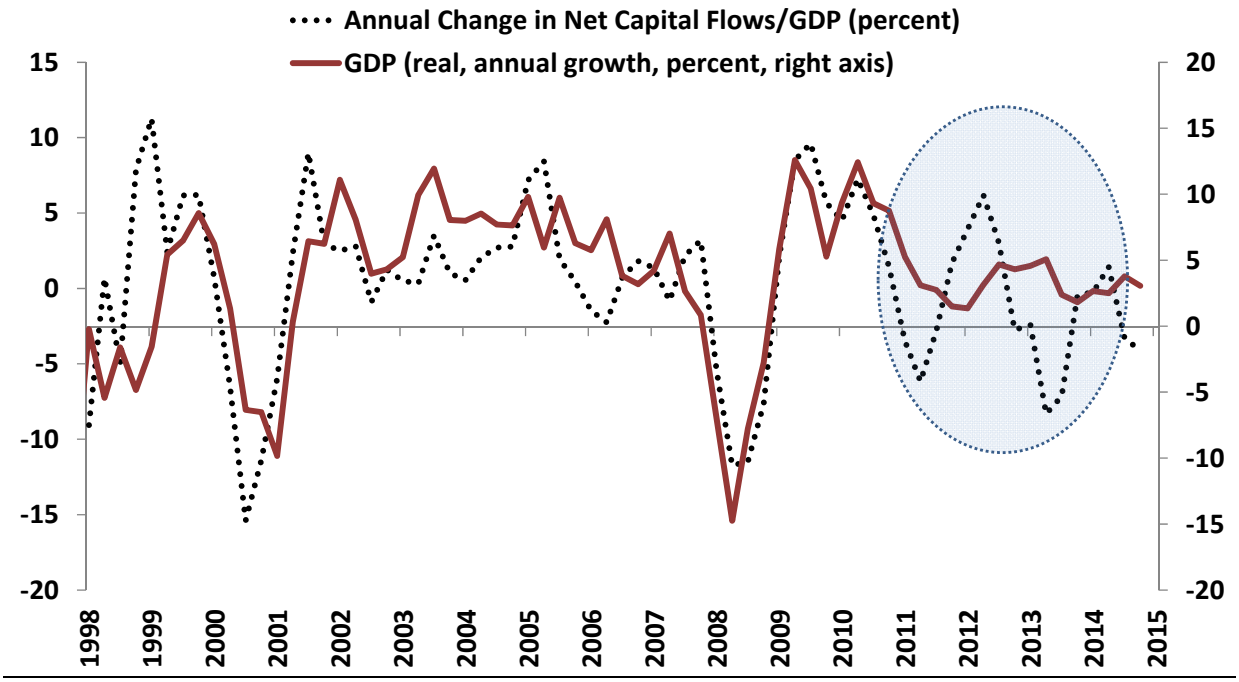
Given the central role of capital flow volatility in the design of Turkey's macroprudential policies, the ultimate success during the period of interest should be rather judged by the following question: has the domestic economic activity become less sensitive to cross-border flows? A simple eyeballing of the co-movement between net capital flows and domestic economic activity in Figure 10 suggests that the answer is likely to be affirmative. Historically, Turkish GDP has been closely correlated with capital flows (possibly with a two-way causality). However, the

[20] Using a comprehensive panel data set, Aysan et al (2015) find that domestic credit growth has become less sensitive to cross-border portfolio flows in emerging economies after the implementation of macroprudential policies.

[21] See Mimir et al (2012), Oduncu et al (2013), Binici et al (2013), Değerli and Fendoğlu (2015) and Aysan et al (2014) on the effectiveness of interest rate corridor and the reserve option mechanism on credit growth and exchange rate volatility.

relationship seems to have weakened considerably since 2011. Net capital flows exhibited heightened volatility during this period, while the GDP growth rate hovered between 2% and 5%, which was remarkably stable compared to historical patterns.

GDP Growth and Net Capital Flows — Figure 10



Source: Kara, Özlü, and Ünalmış (2015).

4. Conclusion and final remarks

Turkey's experience with macroprudential policy confirms that there is no single recipe for the design of macroprudential policies. Initial conditions and structural characteristics matter for the choice and implementation of particular instruments, which inter alia implies that policies designed for emerging economies may need to involve different features than advanced economies. For example, the interaction of monetary policy with financial stability and macroprudential policies should take into account the complex trade-offs exacerbated by the capital flow cycles and their implications for monetary policy. Against this backdrop, macroprudential policies in Turkey have focused on containing the adverse impacts of the global liquidity cycles and the associated capital flow volatility on the domestic economy. Policies were oriented towards dampening the adverse feedback loops and credit cycles in order to reduce the probability of a sudden stop. At the same time, additional measures were introduced to increase the resilience of the financial system against global shocks.

We have argued that the macroprudential policies have significantly contributed to the rebalancing process and bolstered the resilience of the economy against external shocks. Since 2011, the current account deficit has been on a steady declining trend and the sensitivity of economic activity to capital flow volatility have weakened

considerably, implying a more balanced and sustainable growth path. Overall, Turkey's recent experience have demonstrated that, targeted macroprudential policies along with unconventional monetary measures can improve the tradeoffs posed by volatile capital flows.

However, it is also important to note that macroprudential policies cannot be a substitute for sound structural reforms. In many cases, macroprudential policies can rather be regarded as second-best solutions that save time until deeper structural adjustments take place. To the extent structural policies are able to sufficiently increase the resilience of the economy on their own, there could be less of a role for unconventional monetary policy as well as for macroprudential policies. Therefore, in the long term, it is essential to undertake structural measures to improve the trade-offs posed by large and volatile capital flows. As with the Turkish case, bringing down structural component of the current account deficit (by increasing saving rates and boosting productivity) and reducing dollarisation (by deepening financial markets and achieving price stability) can be listed among priorities.

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The macroprudential policy framework in New Zealand

David Hargreaves[1]

Introduction

Like many countries, New Zealand has developed a macroprudential policy framework over the last 5 years. I only have time to make some key remarks about that framework, but I will provide references to relevant Reserve Bank of New Zealand (RBNZ) publications for interested readers.

New Zealand's macroprudential policy framework focuses on what Borio (2009) described as the 'time dimension' of macroprudential policy – that is, leaning against procyclicality in the supply of credit. This is not to say that we consider cross-sectional distributions of risk unimportant. It is more that our existing approach to the calibration of prudential settings such as capital and liquidity rules seeks to be sufficiently robust to protect the system as a whole rather than simply ensuring the solvency of a particular individual institution.

An interesting historical point in the New Zealand context is that in the early 2000s (prior to the global financial crisis (GFC)) interventions of a sort we would now call 'macroprudential' were contemplated because of significant concern about the balance of monetary policy pressure and the overvaluation of the exchange rate. A booming housing market was insulated from monetary policy restraint because the high level of the exchange rate (weakening export activity) meant limited interest rate rises were required. This prompted a search for interventions that would restrain domestic demand without exacerbating pressures on the tradable sector. While no formal policy was actually implemented, possibilities including loan-to-value restrictions were being contemplated by 2006 (see Blackmore et al (2006)).

NZ macroprudential policy implementation

As in other countries, credit conditions in New Zealand tightened in the immediate wake of the GFC. Once credit began to flow more smoothly from around 2011, lower long term mortgage rates put intense upward pressure on house prices, particularly in Auckland (New Zealand's largest city). Auckland house prices fell slightly during the GFC, but then rose sharply between 2012 and 2015 (Figure 1), to reach around 9 times the average income. Banks resumed high volumes of high loan-to-value ratio (LVR) mortgage lending by 2012 after being unwilling to do substantial high LVR lending during the GFC.

Internationally, the idea of cyclical adjustments to prudential requirements to lean against procyclicality had become more mainstream by 2011, as the Basel Committee on Banking Supervision worked on the countercyclical capital buffer rules

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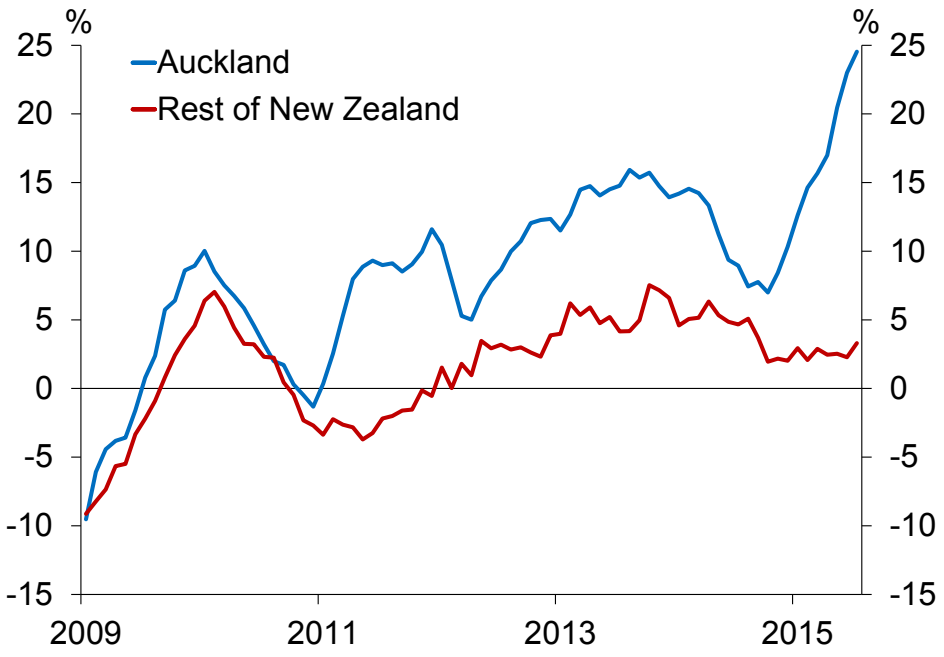
and a wide variety of countries introduced or tightened LVR restrictions and other tools (see, eg, Lim et al (2011)). While the RBNZ had the existing legal powers necessary for cyclical variation of prudential tools, it was considered appropriate to agree on a framework with the Government and Treasury that formalised the objectives of macroprudential policy, the tools under consideration, and the consultative processes that would be followed if macroprudential tools were to be used. The Memorandum of Understanding on Macroprudential Policy was put in place in May 2013 (see RBNZ (2013)) and is described in detail in Rogers (2013) and Wheeler (2013). The Memorandum establishes that the RBNZ initiates any macroprudential policy action, but only after consultation with the Treasury and Minister.

House price developments after the global financial crisis

(annual percentage changes) Figure 1

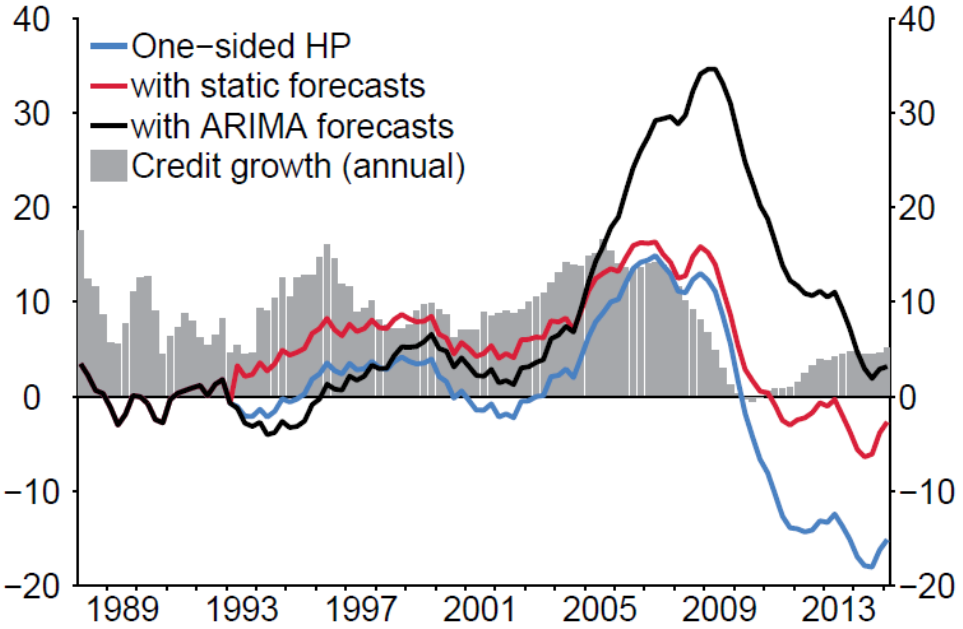


To support macroprudential policy decision making, the RBNZ has examined international literature on relevant indicators and compiled a regular macroprudential chartpack which is published on its website. However, our experience suggests that there will still be a significant discretionary element in decisions to apply macroprudential tools, reflecting the likelihood that each financial cycle will differ in important ways. For example, while BIS work suggests the so-called credit gap was a fairly reliable indicator of risk prior to the GFC, most countries implementing macroprudential policy tightening since the GFC (such as New Zealand) are doing so in the context of a significantly negative credit gap (using one-sided HP filters). Credit has been growing moderately in New Zealand and key asset prices have been reaching record levels, so there is clear evidence of risk, but credit is well below its pre-crisis trend (Figure 2). This demonstrates that lessons (and indicators) derived from past financial cycles are not always reliable guides to the future. For these reasons, the chartpack is used to inform risk assessment (which is then discussed in the RBNZ's Financial Stability Report) rather than the indicators being used mechanically to set policy.

The RBNZ was relatively unique in using a 'speed limit' approach for LVR restrictions and intending the restrictions to apply temporarily. In mid-2013, rules were introduced that required banks to reduce the volume of high LVR lending to below 10% of new commitments (from circa 30% prior to the new rules). Because there is scope to shift lending outside of the banking system (eg via securitisation), temporary restrictions may be more effective since the costs of setting up new lending business models may be unjustifiable when the LVR restrictions are expected to be temporary. More generally, temporary macroprudential interventions (such as cyclical monetary policy) are likely to be a useful complement to permanent policy settings if the central bank is able to diagnose elevated financial risk and respond to it, rather than leaving policy settings tighter permanently.

Measures of New Zealand's "credit gap"

(excerpt from RBNZ Macroprudential Chartpack) Figure 2

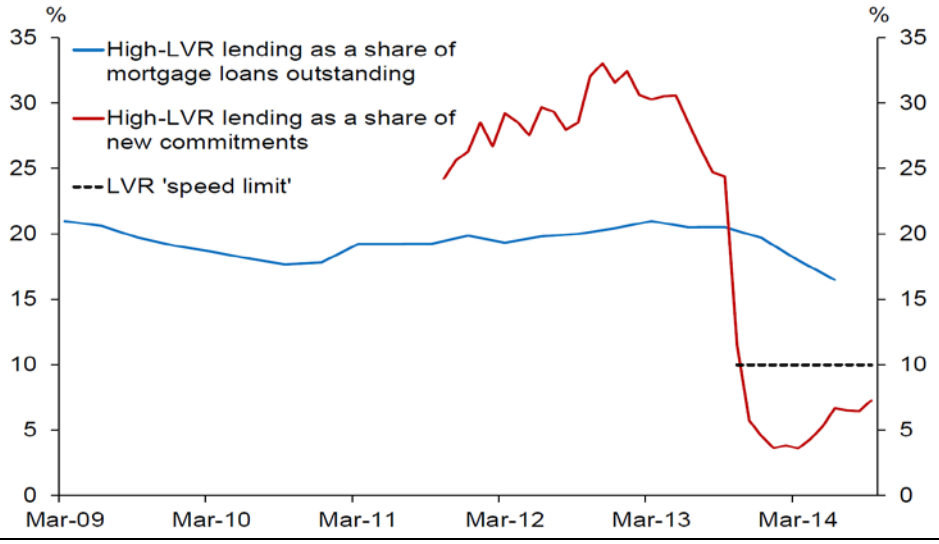


The 'speed limit' approach allows some high LVR lending to continue, which allows banks to deal with special cases (eg restructuring loans for customers in unexpected difficulty) which would otherwise be problematic.

It is difficult to produce a formal counterfactual analysis of the impact of a policy such as LVR restrictions. A key and enduring benefit of the policy is to improve financial system resilience by reducing the proportion of high LVR loans on bank balance sheets (Figure 3). In terms of macroeconomic impacts, our approach has been to look at a wide range of housing market indicators, both informally and formally in a VAR model (see Price (2014)). The VAR model is estimated up to the point LVR restrictions are put in place and then used to predict the evolution of key variables like house prices contingent on the actual outturns for certain exogenous variables such as external migration. If actual house prices fall below the track predicted by the VAR analysis during the period of LVR restrictions, this provides some evidence the LVR policy has been effective.

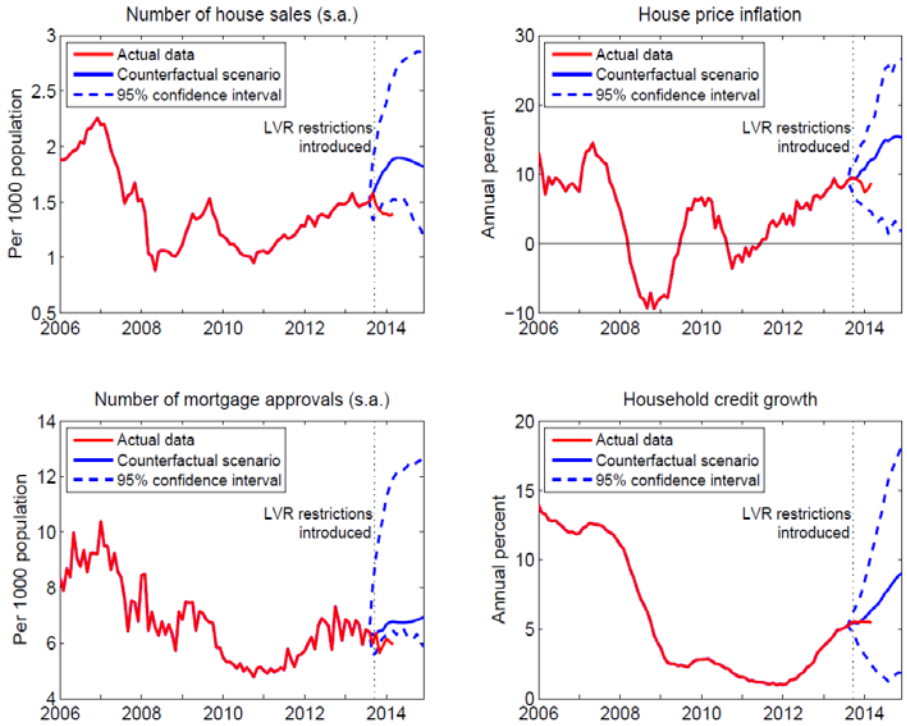
Stock and flow of high-LVR mortgage lending

(>80% LVR as the share of all lending) Figure 3



Counterfactual scenario without LVR restrictions

(from Price (2014)) Figure 4



Note: the estimated impact of the policy can be gauged by comparing the actual line (red) to the counterfactual scenario (blue).

Figure 4 shows that most variables moved in the expected direction (relative to the model prediction) when the policy was put in place. Our overall view is that LVR restrictions had a discernible impact on house prices, slowing them through 2014, but that the impact was not particularly large relative to the ongoing house price cycle, which intensified again during 2015, particularly in Auckland (Figure 4). This was

consistent with our expectations prior to enacting LVR restrictions – they were not expected to dramatically alter the house price outlook.

The issues faced in 2015 were somewhat different from those leading to the application of nationwide LVR restrictions in 2013. First, pressures (and apparent overvaluation) were most evident in the Auckland market. Second, there was evidence of increased investor activity in Auckland. Analysis of Irish default experience and other evidence suggest that investor lending would be relatively risky in a severe downturn (see RBNZ (2015a, 2015b)). For these reasons, the RBNZ proposed tighter restrictions on lending to people buying investment properties in the Auckland region, essentially requiring 30% deposits for that sort of lending. At the same time LVR restrictions outside Auckland were eased with the speed limit on high LVR loans (LVR>80%) raised from 10% to 15%.

Reflections on the role of macroprudential policy based on New Zealand experience

The first point I would like to make is that cyclical macroprudential policy is complicated, and is no substitute for striving for the appropriate permanent policy settings. When the RBNZ contemplates cyclical policy settings, we first consider whether other permanent policy adjustments would be a more efficient way to solve the underlying problem. Before LVR restrictions were put in place, the RBNZ made permanent changes to our housing risk weight rules, and discussed with the government the possibility of initiatives to boost residential dwelling supply. For countries that may have systemic risks arising from issues such as foreign currency-denominated lending to the household sector, I would advocate concentrating resources on permanent responses to these issues before turning to cyclical policies once all desired permanent policies are in place.

We have continued to consider the potential relationship between monetary and macroprudential policy in recent years (see Dunstan (2014)). In general, I think we agree with the views expressed by Erland Nier earlier – that the two policies have separate goals and tools, and are able to operate independently while taking the other into account. However, at the margin, the policies may be able to assist each other. One obvious example would be easing of macroprudential policy where monetary policy has reached the zero lower bound. I also mentioned above that the RBNZ had an interest prior to the GFC in macroprudential policy as a way of shifting the balance of monetary policy sector towards the nontradable sector.

There may also be times when one policy may have an unusually large impact on the other's objectives. For example, the very low level of interest rates worldwide has been seen as a potential cause of risk-taking behaviour and asset bubbles (see Stein (2013)). With respect to the household sector and house prices, in my opinion these risks are probably larger than for other asset markets. For example, households may take a myopic view of the current level of interest rates and push house prices up on the assumption rates will stay low forever. House prices may then come under downward pressure in the future if interest rates normalise or the high level of house prices prompts a substantial construction response. This suggests that very low interest rates (while they may be needed for monetary policy objectives) can be detrimental to financial stability. At a minimum, this seems to be a good reason to study the behaviour of housing markets at very low interest rates further.

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A liquidity-based approach to macroprudential policy[1]

Jean-Pierre Landau[2]

Introduction

It is widely recognised that an excess of credit caused the financial crisis. In the future, one objective of macroprudential policy will be to regulate the financial cycle in order to prevent the disruptions associated with booms and busts. Tools have been available for a long time to regulate credit in specific sectors or categories, such as loan-to-value or loan-to-income ratios, as well as margin requirements. New instruments are now being developed at the aggregate level, first of all the countercyclical capital buffer. All share a common feature: they rely exclusively on the direct control of leverage.

This paper argues for a different approach, based on liquidity and maturity transformation inside and by the financial sector. Basel III has introduced liquidity ratios that will play an important role alongside capital requirements. But there is an asymmetry. Whereas capital ratios have a cyclical component (through the countercyclical buffer), this is not the case for liquidity requirements, that are fixed and unchanged over the cycle.

This may be a source of inefficiency. Financial cycles are created by the interaction between leverage on the one hand and maturity transformation on the other. In this process, maturity transformation is often the main driver. Without maturity transformation, leverage would not be profitable, and often not possible.

Macroprudential measures that would act directly on liquidity and maturity transformation would therefore be more effective. Since maturity transformation by banks involves money creation, they would also make interaction with monetary policy more palatable and, ultimately, easier to manage. The framework and tools for cyclically regulating liquidity inside the financial system are currently available. They may prove especially appropriate over the next period when the balance sheets of Central Banks are expected to stay large in proportion of their GDP.

Regulation through leverage: an imperfect cyclical tool

The cyclical component in the behaviour of leverage is well documented. It is associated with the measure and perception of risk (Adrian and Shin (2008)). It seems, therefore, natural to counteract this natural procyclicality by moving capital

[1] I am deeply indebted to Philip Turner for numerous suggestions, advice and guidance in preparing this paper. He suggested many new ideas and improvements. All errors are mine only.

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requirements over time. This is the rationale for the countercyclical capital buffer created by Basel III.

If successful, the benefits of this approach would be significant for financial stability, but also, for monetary policy. As noted by Philip Turner in this volume, acting independently on the credit channel would give monetary policy an additional degree of freedom – and efficiency. It would enable authorities to target domestic demand more directly, thus avoiding unwanted side-effects that monetary policy triggers through exchange rate appreciation or depreciation.

Practically, however, it is doubtful that aggregate leverage control can be efficiently used to smooth out the credit cycle. There may be three difficulties.

First, coordination problems will arise. Cecchetti and Kohler (2012) show that capital requirements and interest rates are perfect substitutes as monetary tools. There is a distinct possibility that monetary and macroprudential policies pull in opposite directions, thereby nullifying each other and creating unwanted side-effects in the financial system.

Second, there is considerable uncertainty about leads and lags. Under Basel III, banks will have up to 12 months to comply with a countercyclical buffer. How much longer will it take to effectively act on credit distribution? We don't really know. There is not enough experience to assess the elasticity of credit aggregates to changing capital requirements. Recent attempts to act more directly on the marginal capital ratio through "funding for lending" schemes (that carried zero capital requirements for new credits) have not been considered as fully successful.

Finally, there is a calibration issue. The denominator of capital ratios is composed of long-term (slow rotation) assets. Cyclical changes in the overall capital requirements will therefore imply brutal adjustments in new credit flows. This may inhibit authorities in effectively implementing the necessary measures. It could be argued that countercyclical capital requirements are rule-based; and therefore, banks will anticipate their evolution and adjust ex ante their credit behaviour. However, rules will necessarily refer to aggregate (credit) quantities. To determine its lending capacity, each bank will have to assess the behaviour of all other intermediaries. In a competitive environment, this will open the way to many strategic interactions and multiple equilibria.

Taking into account those difficulties, it may be more efficient to affect the cyclical component of leverage at the levels of sectors and credit instruments – through haircuts, loan-to-value ratios and minimum margins. Geneakoplos (2010) lists several advantages of such an approach. Different securities include different amounts of “embedded leverage”. The leverage of an investor is often a meaningless number, for instance, when losses reduce equity and arithmetically increase leverage (additional prudential action may, in this case, aggravate the situation). A focus on securities leverage would lead to better control of derivatives. More generally, it is harder to hide securities leverage than investor leverage.

Aggregate capital ratios should best be used to fulfil their essential function, that is, as buffers against unexpected losses. And cyclical regulation of credit may be better achieved by other tools.

The next section will make the case that liquidity – and maturity transformation – dynamics are an important – maybe dominant – driver of the credit cycle. Therefore, if authorities were able to cyclically "regulate" liquidity, they may have a powerful tool to prevent the build-up of financial imbalances.

Maturity transformation[3], liquidity creation and the financial cycle

Maturity transformation is a permanent fixture of modern financial systems. Without maturity transformation, it would be impossible to reconcile the preferences of savers and investors. Capital allocation in the economy would be extremely inefficient. Maturity transformation also carries specific risks and is the source of major fragilities and negative externalities (runs on short-term liabilities possibly leading to fire sales of illiquid assets). Whatever their underlying causes, all crises develop, start and amplify through a breakdown in intermediation and maturity transformation. The last one was no exception.

There are good reasons, therefore, to regulate maturity transformation. Basel III has marked major steps forward with the creation of the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR). Both ratios, in effect, put quantitative limits on maturity transformation performed by a specific bank. They do not, however, allow for cyclically adjusted constraints or requirements. While they permanently strengthen the resilience of individual institutions, it is not their objective, nor their effect, to prevent the build-up of excessive maturity transformation across the system. Nor do they provide an effective protection against aggregate liquidity shocks, affecting a large set of financial intermediaries.

From a cyclical perspective, it is useful to think of maturity transformation as a service provided by the financial sector. For that service, there is a demand, a supply and a price. The question then becomes: where to apply regulation. As mentioned, Basel III ratios act by quantitatively controlling the supply of maturity transformation by the banking sector, therefore potentially repressing demand. Such interventions may lead to unintended consequences. Maturity transformation may migrate to other, less secure, parts of the financial system. Or the equilibrium could be reached at a distorted price. Since that price can be measured as the spread between safe/liquid and risky/illiquid assets, mispricing appears under different guises. For instance, safe assets can be overpriced and yield returns that would be abnormally low. Alternatively, the spread required to perform maturity and risk transformation could be very high, so that only those long-term (risky) investments with very high expected returns would be undertaken. Excess demand for maturity transformation would ultimately show up as insufficient physical investment. These are all symptoms currently observed in advanced economies. Indeed, one possible interpretation of the so-called disconnect between economic and financial risk taking, could be an insufficient supply of maturity (and risk) transformation. Reaching a proper equilibrium, therefore, is a matter of great importance for policy makers aiming at the best possible trade-off between efficiency and stability in the financial system.

A comprehensive analysis of the demand for – and supply of – maturity transformation is beyond the scope of this paper. We are interested here in the cyclical variations in maturity transformation that may fuel the dynamics of leverage and, more generally, the financial cycles. From that perspective, an essential component is the capacity of financial intermediaries to create "inside" liquidity by

[3] Here, the words "maturity transformation" are used in a very loose sense, to designate three possible transformations: from short-term to long-term; from safe to risky; and from liquid to illiquid assets.

engaging into money creation or reciprocal transactions, and, in the process, expand or contract their balance sheets.

Modalities depend on the specific features of financial intermediation. Banks create deposit money. They also issue short-term instruments that are accepted by other financial intermediaries or non-financial entities. The process is commonly known as "funding". In economies where "shadow banks" and securitisation play an important role, financial intermediaries permanently both issue and trade very short-term debt instruments especially through repo markets operations. Intermediation is organised through a "long chain" of financial institutions, with new liquidity created at each and every step, together with progressive maturity transformation. That mechanism allows maturity transformation and, at the same time, fuels leverage. As a result, "an important fraction of private money creation now takes place entirely outside of the formal banking sector, via the large volumes of short-term collateralised claims created in the "shadow banking" sector" (Gorton and Metrick (2010)).

This process drives the endogenous expansion of balance sheets. If funding is easy, maturity transformation is inexpensive and can seem riskless. As a consequence, leverage grows. It is therefore no exaggeration to say that liquidity drives leverage.[4]

Inside liquidity itself moves endogenously with risk appetite. This is well documented in recent research. To quote Brunnermeier (2014): "funding is not an input". It results from a dynamic process depending on the (time-varying) propensity of intermediaries to take counterparty risk on each other. When inside liquidity dried up during the crisis, credit stopped. Because it depends on risk perception and appetite, there is also a strong "cyclical" component in inside liquidity and this cyclical component is subsequently reflected in the evolution of leverage.

As a result, the consolidated balance sheet of the financial sector can expand or contract for a given level of the policy interest rate. In turn, it can be shown the size of the financial system's balance sheet determines credit, risk premia, asset prices and overall financial conditions (Adrian and Shin (2010)).

From a monetary policy point of view, money (and credit) multipliers may be highly unstable as leveraging and de-leveraging take place independently of policy rates. Money creation and interest rates can be disconnected and "In this richer environment, monetary policy as it is conventionally practised is generally not sufficient to rein in excessive money creation" (Stein (2011)). From a macroprudential perspective, the main takeaway is that the dynamics of inside liquidity and maturity transformation ultimately drive leverage and the financial cycle. It is therefore natural to look at the possibility and modalities of regulating liquidity and maturity transformation in a countercyclical fashion.

An elastic supply of maturity transformation

Borrowing from monetary theory literature, it may be said that the supply of maturity transformation must be elastic enough, but not too much. It has to be elastic because

[4] One would conjecture further that *expectations* on the availability of future funding liquidity drive decisions on leverage.

the demand itself is time-varying. But excesses should be avoided, because they can lead to dangerous financial fragility.

An elastic supply of maturity transformation would perform a double function. One is monetary stability. Maturity transformation, when done by banks, frequently involves money creation. Too low maturity transformation may therefore lead to insufficient supply of money and deflation (Brunnermeier and Sannikov (2014)).[5] The other is financial stability. An excess supply of maturity transformation may create financial fragility.

In theory, there should be, at any point in time, an optimal level of maturity transformation that would balance the benefits in efficiency against the costs in terms of financial fragility. In practice, the optimum has to be found by trial and error. For that reason, it is important for the authorities to have the tools to regulate permanently the amount of maturity transformation in the economy.

Two sets of such tools are potentially available that will be discussed in the following sections.

First, Central Banks can step in and use their balance sheets to undertake maturity transformation on their own. They have done so extensively during the crisis. An important question is whether, with very large balance sheets, this may become a more permanent feature for managing the interactions between price and financial stability.

Second, Central Banks may influence the price of maturity transformation by creating a "tax" through an appropriate system of reserve requirements and liquidity provision.

The Central Bank's balance sheet as a financial stability tool

By nature, all Central Banks are engaged into maturity transformation. This role has traditionally been marginal in the economy, as their balance sheets – and the volume of reserves kept by banks – were small in proportion of the overall size of the financial sector. In many countries, the access of financial intermediaries to the central bank balance sheet is restricted. Open market operations have generally been very short-term.

Following the crisis, those balance sheets have considerably expanded and are now commensurate with the size of annual GDP. In addition to traditional refinancing operations through repos, Central Banks have purchased long-term (and sometimes risky) assets in implementing unconventional monetary policies. Through various new facilities, they gained direct access to (until then) remote parts of the financial system. In that new environment, the role of Central Banks in financial intermediation and maturity transformation can hardly be ignored.

From a monetary policy perspective, the consequences are significant. Through the asset side of their balance sheets, Central Banks have triggered portfolio rebalancing in the private sector and exerted significant influence on term premia,

[5] Well-capitalised banks are therefore a necessary – maybe not sufficient – condition for an elastic supply of maturity transformation

long-term rates and overall financial conditions. Although the precise quantitative impact remains a matter for discussion and debate, the existence and direction of such effects are widely recognised.

The financial stability impact is as important, if less advertised. Central Banks are the ultimate issuers of safe and liquid assets. For many decades, before the crisis, this liquidity provision function had been "passive" as Central Banks accommodated the demand for reserves at the policy interest rate. But, during and post-crisis period, the Central Banks' balance sheets have taken up an active role and carried out an intermediation function that the private sector was (temporarily) no longer capable of providing (Papadia (2014)). By actively providing outside liquidity, Central Banks have reduced the risk of market disruption, eliminated any uncertainty on funding and, ultimately, encouraged maturity transformation and risk taking by all financial intermediaries (both banks and non-banks).

That approach has worked well during the crisis. Will it continue to do so when the times come to exit unconventional policies? Exit can be done in a number of different sequences, starting either by raising policy interest rates or reducing the size of central bank balance sheets, or both. But exit to where? As noted by Turner (2015), there is no consensus on the "new normal" for the balance sheets of Central Banks. Broadly speaking, there are two sets of (intertwined) arguments. One is on the size of balance sheets: should Central Banks try to come back to pre-crisis levels? Or will they accept as permanent the situation created by the legacy of the crisis and expanded assets and liabilities. The other argument is about instruments: will, in the future, Central Banks keep a diverse set of (conventional and unconventional) tools, therefore acting on different parts of the financial system (including long-term bonds rates)? Or will they rely only on the short-term policy rate, coming back to the "benign neglect of the long-term rate" (Turner (2013)) that has prevailed until the crisis?

Those fundamental policy choices matter enormously, of course, for the implementation of monetary policy. They also matter for financial stability. The idea of using the Central Bank's balance sheet as a financial stability tool is not universally accepted. Many policymakers still consider Central Banks' expanded role in financial intermediation as a necessary, but temporary, evil. They long for a situation where interbank markets would return to their pre-crisis level of activity and functions. Other policymakers see merits for Central Banks in keeping expanded balance sheets for some time. From this perspective, an ample balance sheet is one way for the Central Bank to provide an elastic supply of safe asset (Bernanke (2015)) or, equivalently, an elastic supply of maturity transformation.

The possibility only exists, however, in (current) circumstances when there is an excess supply of reserves by the Central Bank. When reserves are in short supply, the Central Bank cannot easily control their amount (and the subsequent level of maturity transformation it provides) independently of monetary policy. It has to satisfy the demand for reserves at the prevailing policy rates if it wants to keep the interbank rate close to its objective. Therefore, banks are assured to get any reserve they need to compensate for shortfalls in funding. There is no effective brake on maturity transformation.[6]

Some freedom may be gained by implementing a "floor system" (Keister et al (2008)) whereby the policy rate is, in effect, the deposit rate. Provided reserves are

[6] Other than the restriction on demand that may come from higher policy rates.

quantitatively sufficient to bring down the interbank rate to the floor, they can be increased or reduced without impacting the interbank rate. Liquidity provision is "divorced" from monetary policy. The same result can be achieved by remunerating reserves at the policy rate, in which case the remuneration of reserves serves as an effective floor to money market equilibrium.

However, from a point of view of financial stability, the freedom given by those schemes remains limited. These are still situations where the Central Bank is committed to meet any demand for reserves unless it is prepared to let a bank fail. In effect, the amount of Central Bank liquidity is endogenous to commercial banks' behaviour. This is the fundamental moral hazard issue raised by liquidity provision. If, at the prevailing policy rate, the amount of maturity transformation provided by banks is excessive from the point of view of financial stability, there is nothing the Central Bank can do ex post to correct this situation. The demand for reserves materialises after decisions on credit and funding have been made – and it has to be met. In effect, when bidding for liquidity against collateral, banks transfer part of their maturity transformation to the Central Bank. For individual banks, liquidity provision acts as an insurance against any difficulty they may encounter as a result of excessive maturity mismatch between their assets and liabilities. In such a situation, additional tools are necessary to regulate ex ante maturity transformation.

Reserve requirements and liquidity regulation

As underlined above, what is needed is a regime of liquidity regulation that allows for cyclical action on inside liquidity and maturity transformation. It turns out that basis for such a regime exists in the literature and that instruments are potentially available. It rests upon three pillars: first, the ability to impose reserve requirements on a broad range of short-term financial liabilities; second, the use of interest on reserves as a separate and independent tool; and, third, the ability of the central bank to set the monetary policy rate separately from the remuneration of reserves.[7] The analytical foundations have been extensively developed in Stein (2012) and Kashyap and Stein (2012).

Reserve requirements (RR) introduce a wedge between market rates and funding costs. An intermediary that issues a short-term liability subject to RR would, in effect, pay an additional charge (a "tax"). The effective weight of the tax would depend on the reserve requirement ratio and the interest rate paid on reserves (that has to be lower than the policy rate).

In such a framework, the Central Bank would have three instruments available to pursue price and financial stability: two interest rates (the policy rate and the interest on reserves) and one ratio (on reserve requirements). Depending on the structure of the financial system, for a given (monetary) policy rate, the authorities could choose to move one or the other two instruments to counter unwanted cyclical movements in maturity transformation. By doing so, the Central Bank can ex ante make maturity transformation more or less expensive, with a very quick effect as, by assumption,

[7] Most EMEs actually operate under such a kind of framework except for, in most cases, paying interest on reserves.

those liabilities are very short-term and would have to be rolled over at high frequency.

Further considerations on reserve requirements

Prior to the crisis, compulsory reserve requirements had basically been abandoned by Central Banks in most advanced economies. They continued to exist at low rates in some jurisdictions – in the euro area, in particular – as an accessory tool of short-term liquidity management, helping the Central Bank to create a permanent excess demand for reserves.

The demise of compulsory reserves can be attributed to several causes. They are seen as a distortionary tax on bank intermediation, thus pushing maturity transformation into other, less secure, parts of the financial system. They seemed to relate to an outdated intellectual framework: the simplistic "money multiplier approach" where controlling banks' reserves would also ensure control of the money supply and (with constant velocity) help achieve price stability. Finally, of course, in an era of (very ample) excess reserves, compulsory requirements may seem redundant and superfluous.

The approach developed here takes a totally different tack. First, compulsory reserves are used as a financial stability – not a monetary policy – tool. Second, there is no presumption of any stability of the money multiplier. On the contrary, as mentioned above, endogenous fluctuations in the multiplier are taken as a defining feature of contemporary financial systems. Influencing those fluctuations is therefore a major intermediary objective for macroprudential policy. Finally, interest is paid on reserves, but the rate of interest may differ from the policy rate that the Central Bank wants to target for monetary policy purposes.

Obviously there would be numerous technical, practical and legal difficulties in implementing such a system, especially in deciding on the perimeter of liabilities subject to reserve requirements.[8] Also, regulators would give themselves the right to influence the relative costs of different sources of funding, and this may be seen as excessively intrusive. Yet, this is exactly what regulators have been doing recently with the creation of the LCR and NSFR. These new ratios have the same "taxing" and distortionary effect as compulsory reserves – with less transparency. And they will probably lead to a lasting increase in the demand for reserves as Gagnon and Sacks (2014) argue. But, how far the demand for reserves will rise when these new instruments come into force is unknown? This instrument uncertainty itself creates a case for considering more direct measures such as varying required reserves. As compared to quantitative ratios, reserve requirements can be introduced and changed flexibly. They can be made to vary according to risk (for instance, with higher reserve requirement ratios for short-term or foreign-currency deposits). Maturity transformation is now severely constrained by “quantitative” tools. Using compulsory

[8] Maturity transformation may migrate outside the perimeter of reserves implementation. This is already happening as an increased share of maturity transformation is directly taking place on securities markets where there are doubts concerning market liquidity. This new kind of maturity transformation, however, is dissociated from leverage and raises different issues that relate to the overall fragility of the financial system rather than to its cyclical behaviour.

reserves in a flexible way would introduce a "price" component in liquidity regulation that would increase the overall efficiency of macroprudential policy.

Conclusion

Considerable progress has been made since the global financial crisis in strengthening the resilience of financial systems. New regulations have created or increased capital and liquidity buffers, in effect quantitatively constraining leverage and maturity transformation especially in "systemic" institutions.

This paper argues that those efforts could usefully be complemented by an additional "pillar" for macroprudential policy, with the objective of regulating the financial cycle, preventing the build-up of imbalances and reducing the risk of financial fragility. The best approach is to cyclically regulate liquidity creation and maturity transformation inside the financial system as, ultimately, they drive the dynamics of leverage and credit supply. Central banks have the necessary tools. They can use their expanded balance sheets to bring some elasticity in the supply of maturity transformation in the economy. They can also put a price on maturity transformation by financial intermediaries through a flexible use of reserve requirements and interest paid on reserves.

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