

Macroprudential policy: state of the art, and ways forward*

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Abstract

While macroprudential policy has become a primary policy to support financial stability and has become increasingly popular in policymaking, it faces important challenges. In this paper we discuss several key challenges in taking the analysis of macroprudential policy forward. The focus of our paper is on the challenge of coordination between macroprudential policy and monetary policy – particularly in the current environment where central banks are exiting or planning to exit from a highly accommodative stance. We also discuss other important analytical challenges: the coordination with fiscal policy, regulatory arbitrage and the regulation of the infrastructure of the financial system.

Keywords: Macroprudential policy, financial regulation.

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1. Introduction and Overview

Since the outbreak of the global financial crisis, there has been a widespread trend towards a re-orientation of prudential policy that goes beyond a purely micro-based approach to financial regulation and supervision. This macroprudential orientation has come to play a primary role in supporting financial stability. While early advocates of this re-orientation refer to the new orientation in terms of macroprudential frameworks and measures (e.g. Crockett, 2000; Borio, 2003, 2009), the policy debate and the literature have tended to use the term macroprudential policy. We therefore use the latter term, while acknowledging that it may be more appropriate to talk about macroprudential frameworks or instruments.

In spite of its popularity and growing usage, macroprudential policy faces important challenges. A recent paper by Mendoza (2016) highlights three of them: (i) complexity, because the optimal policy responds widely and non-linearly to movements in both domestic factors and global spillovers due to regime shifts in global liquidity, news about global fundamentals, and recurrent innovation and regulatory changes in world markets, (ii) lack of credibility, because of time-inconsistency of the optimal policy under commitment, and (iii) coordination failure, because a careful balance with monetary policy is needed to avoid quantitatively large inefficiencies resulting from violations of Tinbergen's rule or strategic interaction between monetary and financial authorities.

Kohn (2016) points to communication as a key challenge. Once the risk and its externality are identified and the policy decided upon, he argues, communication of the decision, its rationale and its expected effects are crucial in getting political and public support. This is particularly the case given the pre-emptive nature of macroprudential policy, with tools in the time dimension aimed at "taking away the credit punch bowl as the party gets going and making sure it is full when the party dies down".

In this paper we discuss several key challenges in taking the analysis of macroprudential policy forward. The focus of our paper is on the challenge of coordination between macroprudential policy and monetary policy – particularly in the current environment where central banks are exiting or planning to exit from a highly accommodative stance. Without coordination, one policy can have unintended negative side effects on the objectives of the other. It is important that research provides a systematic framework for considering trade-offs and for assessing unintended consequences of existing macroprudential and monetary policies. While we focus on this challenge, other challenges are also important. These include the coordination with fiscal policy, regulatory arbitrage and the regulation of the "plumbing" of the financial system (Constâncio, 2017).

2. Taking stock of the state of the art

In this section we take stock very briefly of the state of the art on the empirical evidence and theoretical models for macroprudential policy, drawing on surveys by Galati and Moessner (2013, 2017), and referring the reader to these survey papers and references therein for more details.

2.1 Empirical evidence

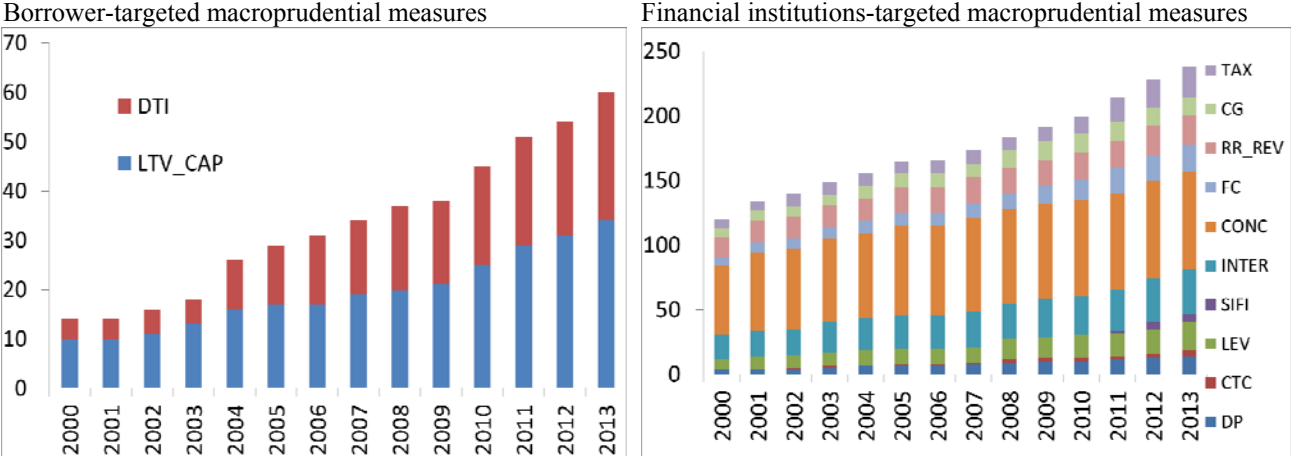
One way to classify macroprudential policy tools is according to whether they address externalities on the lender or the borrower side. Claessens et al. (2013) and Cerutti et al. (2017) classify macroprudential tools into borrower-targeted policies (those aimed at borrowers' leverage and financial positions) and financial institutions-targeted policies (those aimed at financial institutions' assets or liabilities). The former include caps on the debt-to-income ratio (DTI) and the loan-to-value ratio (LTV). In principle, they might also include the possibility of changing laws about limited liability and about bankruptcy but this aspect has not been addressed yet in the literature on macroprudential policy. The latter include limits on domestic currency loans, limits on foreign currency loans, countercyclical capital buffers, the leverage ratio for banks, (dynamic) loan-loss provisioning, margining requirements on secured financing and derivative transactions, reserve

requirement ratios, a levy on financial institutions, capital surcharges on systemically important financial institutions, limits on interbank exposures, concentration limits, limits on open foreign exchange positions or currency mismatches, liquidity requirements/buffers, and loan-to-deposit ratios.

One issue that has received insufficient consideration in the literature is that even if externalities are on the borrower’s side, macroprudential tools are imposed on lenders, and this can create problems of detection and enforcement. Another issue is that the distinction between financial institution-targeted – or more generally, lender-targeted – and borrower-targeted instruments may to some extent be artificial. Setting loan-to-value (LTV) or debt-to-income (DTI) ratios, for example, also constrains lenders’ ability to supply credit, and directly affects their non-price lending terms. Moreover, these tools are critical to building lenders’ resilience, just like higher capital ratios.

Empirical studies have analysed the impact of macroprudential policy tools on a range of intermediate target variables, for example quantities and prices of credit, asset prices, or the amplitude of the financial cycle. The evidence so far is clearest regarding the effects of borrower-targeted macroprudential measures, with many different studies finding some effects of these measures, especially of LTVs and DTIs, on house price growth and housing credit growth. However, evidence on the effects of financial institutions-based macroprudential measures, and within these of macroprudential capital flow management tools, is less conclusive (see Galati and Moessner, 2017, and references therein).

Figure 1: Use of macroprudential policy tools: Number of countries in which a given tool was in usage



Notes: Tools: DTI: Debt-to-Income Ratio; LTV_CAP: subset of LTV measures used as a strict cap on new loans, as opposed to a loose guideline or merely an announcement of risk weights; TAX: levy/tax on financial institutions; CG: limits on domestic currency loans; RR_REV: subset of reserve requirement measures that impose a specific wedge on foreign currency deposits or are adjusted countercyclically; FC: limits on foreign currency loans; CONC: concentration limits; INTER: limits on interbank exposures; SIFI: capital surcharges on SIFIs; LEV: leverage ratio for banks; CTC: general countercyclical capital buffer/requirement; DP: dynamic loan-loss provisioning.

Source: Online appendix of Cerutti, Claessens and Laeven (2017), version of 24 February 2015, authors' calculations.

2.2 Theoretical models

While still at an early stage, considerable progress has been made in incorporating macroprudential policy in theoretical models. However, intermediation activity in these models is still modelled in a very stylized way, since the models are complex and difficult to solve. In particular, most models fail to model default by financial intermediaries. Different kinds of models exist, modelling incomplete asset markets, aggregate shocks, heterogeneous agents and endogenous systemic risk. Due to their complexity, such models are usually only calibrated, and not estimated. Moreover, due to their complexity, it is difficult to apply solution methods to large models. For details of the different kinds of models, see Galati and Moessner (2013, 2017) and references therein.

3. A key challenge: the interaction with monetary policy

In this section we focus on the key challenge of the interaction of macroprudential policy with monetary policy.

3.1 General issues

How macroprudential policy works and how effective it is depends to a very important extent on its interaction with other policy areas. In other words, we should not look at macroprudential policy and its effectiveness in isolation. This is a key issue in general but it is particularly important during an exit from the current low interest rate environment.

An important interaction is that between macroprudential policy and monetary policy. Both the policy debate and the research literature have stressed that the effectiveness of macroprudential policy depends importantly on its interaction with monetary policy.

Sinclair and Allen (2017) argue that since macroprudential policy actions can have macroeconomic effects, and monetary policy decisions can have financial stability effects, with for example credit aggregates being central to both macroprudential analysis and to monetary policy transmission, it might be useful to make decisions about monetary and macroprudential policies jointly. And if macroprudential and monetary policy needed to be used in opposite directions, it may be better to use both instruments more, rather than not to use either. Turner (2017) also argues that macroprudential tools should not only be tightened in combination with higher interest rates. One concern is that for political economy reasons, macroprudential policy might be tightened as a substitute for increasing short-term interest rates, which may be feared would be very unpopular because it would quite likely strain household and corporate finances.¹

When analyzing the interaction between monetary policy and macroprudential policy, one should bear in mind that there is an equally important interaction between monetary policy and microprudential policy.

3.2 The existing literature

The existing literature has been couched in terms of two questions (see Stein, 2013; Smets, 2014).² First, are macroprudential policy instruments effective on their own – i.e. are they sufficient on their own to achieve their objectives – or do they benefit from monetary policy? And second, does monetary policy geared exclusively towards price stability affect financial stability?

The answer to the first question depends on the objective of macroprudential policy, and in particular whether it aims at strengthening the resilience of the financial system or also at constraining financial booms. This issue is both “technical” and of a political economy nature, i.e. to what extent macroprudential instruments can be realistically calibrated. There are two alternative views on this question. According to one view, macroprudential policy has imperfect tools to counter threats to financial stability that emerge in an environment characterized by strong incentives for risk-taking. Compared to macroprudential policy, monetary policy has one important advantage – it affects the cost of finance for all financial institutions, including the shadow banking sector. As such, monetary policy sets the universal price of leverage (Borio and Drehman, 2011; Caruana, 2016) or, in the words of Jeremy Stein, it “gets in all of the cracks and may reach into corners of the market that supervision and regulation cannot” (Stein, 2013). In this “BIS view”, macroprudential policy on its own is not sufficient for financial stability (e.g. Borio, 2014). One important reason why macroprudential policy may be insufficient is regulatory arbitrage (see below). An alternative view is that monetary policy is

¹ For a discussion of the impact of public pressures on central banks’ decision making process, see e.g. Forbes (2017).

² For a more detailed discussion, see also Galati and Moessner (2017).

too blunt a tool for addressing financial stability risks exactly because “it gets in all of the cracks” (Bernanke, 2015; Svensson, 2016, 2017).³

In the empirical literature, there is no consensus on whether macroprudential policy and monetary policy are complements or substitutes, and the results seem to be sensitive to the empirical approach followed (see the survey by Galati and Moessner, 2017). A different way this has been put is whether for balance, it is better to use both in the same direction or not, and under what circumstances.

The second question is whether monetary policy that is geared exclusively towards price stability affects financial stability. In the literature, this question has been addressed by looking at whether monetary policy has a systematic impact on ex-ante risk-taking in the financial sector, thereby influencing financial conditions and ultimately the real economy – the so-called “risk-taking channel” of monetary policy (Borio and Zhu, 2012). To the extent that such a channel is relevant, and that macroprudential policy influences the real economy by affecting financing conditions, both policies should be coordinated. While most of the literature has focused on the role of the risk-taking channel, monetary policy is bound to have an impact as long as it affects key asset prices, interest rates, debt and exchange rates. The debate is about through which channels and how much. And for this the risk-taking channel is a sufficient, not a necessary, condition.

A number of empirical papers have found that monetary policy affects financial stability through a risk-taking channel. De Nicolò et al. (2010), Borio and Zhu (2012) and Smets (2014) survey this literature.

The theoretical research literature is split across two diametrically opposed approaches, depending on how the interaction between financial factors and the macroeconomy is modelled. Macro models that do not incorporate features of a credit cycle and a risk-taking channel of monetary policy (e.g. Svensson, 2016) typically predict that monetary policy does not complement macroprudential policy in addressing risks to financial stability.

Models in which monetary policy does have a meaningful impact on risk-taking by financial intermediaries (e.g. Angelini et al, 2011; Beau et al., 2012; Agur and Demertzis, 2015), instead predict that monetary authorities should explicitly include financial stability objectives. In these models, macroprudential policy and monetary policy are complementary and benefit from coordination.

Recent research by Gorton and He (2016) and Stein (and co-authors) argues for integration based on a model in which monetary policy actions have direct impacts on the private production of runnable short-term debt and risky collateral so this impact must be part of “optimal” policy. Gorton and He’s model has a fundamental friction: cash cannot be securitized and Treasuries cannot be used to satisfy cash-in-advance constraints. They analyze optimal central bank policy in this context as a dynamic (infinitely repeated) game between one large player – the central bank – and many small players – private agents. In equilibrium, the central bank sometimes optimally triggers recessions to reduce systemic fragility.

This latter line of research provides analytical support for the “BIS view” that a greater attention to financial imbalances is useful to the extent that their future unwinding can have major macroeconomic consequences (see e.g. Borio, 2014). Following this BIS view, it is possible to keep the current mandate of price stability – that is, not introduce financial stability or asset prices as a separate second goal for monetary policy – and still contribute to avoiding the build-up of financial imbalances.

Underlying this view is the idea that in the longer run, financial imbalances may turn out to have disruptive effects on price stability once they burst. When financial imbalances are systematically built up, monetary policy should take this, via its monetary analysis, into consideration. This could then entail that monetary policy should not be expansionary even though inflation is below target. In more extreme cases this could even require that monetary policy tightens pro-actively before these excesses unwind in a disorderly fashion and thereby threaten price stability.

³ Adrian and Liang (2018) present counterarguments to Svensson (2016), which are argued against in turn by Svensson (2017).

Empirical evidence that supports the BIS view, according to which benefits of a financial stability-oriented monetary policy outweigh its costs, is overviewed in Borio (2016) and Borio et al. (2017). A key point made in both articles is the need to start adjusting policy early, not waiting for the signs of financial imbalances to become clear, and to take into account the financial cycle, in addition to output and inflation.

To be successful, this pro-active monetary policy needs to be imbedded into a broader response to the build-up of financial imbalances, in which macroprudential policy plays a primary role. Underlying this idea is a common vision on financial stability and monetary policy, where macroprudential and monetary policy work in the same direction in order to be successful.

3.3 Unintended negative “side effects”

Strictly speaking, monetary policy having an impact on financial stability does not imply that monetary policy should have a financial stability objective. But ignoring this impact raises a critical issue, which has received only little attention. Without coordination, macroprudential policy and monetary policy can have unintended negative “side effects” on the objectives of the other. Irrespective of whether one takes the “BIS view” or the Bernanke view, the effectiveness and transmission mechanism of the two policies are strongly interrelated. This issue is particularly important in a situation where the financial system has been hit by distress, and both conventional and unconventional monetary policy has been employed to counter its effects on macroeconomic performance.

As documented by Mendoza (2016), monetary and macroprudential policies each use instruments that affect the variables that the other policy targets (e.g. managing credit conditions affects inflation; adjusting policy rates or non-standard measures influences credit conditions). Given that the objective functions of monetary and financial authorities generally differ (e.g. monetary authorities focus on inflation while financial authorities focus on credit growth), these cross-effects create a potential for inefficiencies resulting from violations of Tinbergen’s rule or strategic interaction. This is true regardless of institutional arrangements.

On the one hand, monetary policy can thwart the intentions of macroprudential policy. This is most evident in a crisis situation, such as the one we are still witnessing in the euro area. Standard and non-standard monetary policies that provide ample liquidity may avoid a collapse of the banking sector. But this can come at the expense of reduced incentives for structurally weak banks to recapitalize and restructure. In the extreme, they may actually promote the evergreening of non-performing loans and regulatory forbearance. There is some evidence in the literature that this type of interaction has played a role in the case of Japan (Shiratsuka, 2003). There is also some evidence for the euro area (e.g. Acharya et al., 2017). But much greater research efforts are needed to explain when and how these unintended consequences of monetary policy arise.

It is argued that targeted macroprudential policies can offset these side effects. To paraphrase Stein, macroprudential policy could be fine-tuned in such a way that it gets in as many cracks as possible (Knot, 2017). However, the empirical research on the effectiveness of macroprudential policy indicates that there are limits to what macroprudential tools can achieve in practice (see the surveys by Cerutti, Claessens and Laeven, 2017 and Galati and Moessner, 2017). In particular, both theoretical and empirical research has pointed to the relevance of regulatory arbitrage, which arises because the negative externalities in financial intermediation that justify macroprudential policy can occur both within and outside the (traditional) domestic banking sector.⁴ Hence, macroprudential tools can cause a shift in risk-taking and exposures outside the regulated banking sector, while remaining systemically important. One argument is that the more detailed the design of macroprudential policy, the more likely it is that these leakages arise.

⁴ For theoretical work that examines the reasons for regulatory arbitrage and its mechanisms, see e.g. Jeanne and Korinek (2014) and Bengui and Bianchi (2014). Important empirical work includes Jiménez et al. (2013), Reinhart and Sowerbutts (2015) and Cizel et al. (2016).

On the other hand, macroprudential policy can thwart the intentions of monetary policy. The more general point is that macroprudential policy influences the transmission of monetary policy (Caruana, 2014).

For example, changes in loan-to-value or debt-to-income ratios affect the supply of lending and thereby consumption decisions. Moreover, macroprudential tools can influence credit conditions, thereby affecting the relevant real interest rate. In turn, this indirectly affects the monetary policy stance, even in the absence of any direct policy rate changes. Changes in (micro and macro) prudential policy will affect banks' risk-taking, their financing conditions and balance sheet composition. They will therefore have an impact on the real economy and on price stability. From a modeling point of view, ignoring this interaction affects the usefulness of macroeconomic models used to assess what level of interest rates is required to meet the prescribed inflation target.

One particular negative side-effect of the lack of coordination between regulatory policies and (unconventional) monetary policy is the recent "deglobalisation" in cross-border bank lending. Forbes et al. (2017) show that the interaction between prudential regulations and the Funding for Lending Scheme can explain roughly 30% of the contraction in aggregate UK cross-border bank lending between mid-2012 and end-2013, corresponding to around 10% of the global contraction in cross-border lending.

The fact that the ongoing unprecedented monetary policy stimulus does not translate into rapid credit growth in the euro area might then not imply that monetary authorities are not doing enough. Rather, banks are reacting to stricter regulatory rules that have been introduced in the wake of the global financial crisis in an attempt to make the financial system more resilient. These regulatory changes therefore weaken the pass-through of monetary policy measures to the supply of bank credit and, ultimately, to aggregate demand and inflation.

3.4 Interactions that affect the functioning of financial markets

One important aspect of the interaction between macroprudential policy and monetary policy – and how it affects the transmission mechanism of both policies – involves the functioning of financial markets.

In the wake of the Global Financial Crisis and through their response with non-standard measures, central banks have come to play a dominant role in financial markets. In this process, monetary authorities' measures have interacted with changes in prudential regulation, and may have been accompanied by distortions in market functioning (CGFS, 2017). In the United States, for example, compared to the pre-crisis period, the Federal Reserve's regulatory and monetary policy framework has arguably left it counterparty to a much higher volume of financial transactions with a much wider set of market participants. This may have led to distortions in financial markets that affect the transmission mechanism of monetary policy (CGFS, 2017).

Financial regulations can affect monetary policy implementation. Differences in the implementation of the leverage ratio in the United States and the euro area⁵ could have an impact on the US repo market; the Federal Reserve's overnight reverse repo facility seems to have acted as a shock absorber in the tri-party repo market by limiting the effect of variations in euro area banks' demand for funds on broader money market conditions (Egelhof et al., 2017). CGFS (2015) argues that central banks should be able to deal with the effects of Basel III regulation for monetary policy implementation by adjusting the terms and conditions of their facilities. While this analysis covers regulatory changes introduced with a microprudential lens – such as the leverage ratio implemented in the United States, the underlying mechanics would apply also to regulation calibrated with a macroprudential perspective.

The research literature has documented how the interaction of new regulatory measures with central banks' monetary policy may have led to distortions in financial markets and lack of arbitrage. One

⁵ Banks headquartered in the euro area report their leverage ratios on the last day of the quarter, while those in the United States report most leverage ratio components as averages of their daily values over the quarter.

example are studies that document and explain persistent deviations from Covered Interest Parity (see Du et al., 2016; Iidea et al., 2016; Sushko et al., 2016; Rime et al., 2017). Iidea et al. (2016) argue using a theoretical model that monetary policy divergence between the Federal Reserve and other central banks, including the Bank of Japan, widens CIP deviations, and that regulatory reforms (eg stricter leverage ratios) increase the sensitivity of CIP deviations to monetary policy divergence by increasing the marginal cost of global banks' US dollar funding. They also find some evidence that monetary policy divergence has recently led to larger CIP deviations. But we are still far from seeing a systematic analysis of these types of effects.

3.5 Eligibility policy as a macroprudential policy tool

Eligibility policy, ie the rules for which kinds of assets a central bank is prepared to buy or take as collateral for loans in its open market operations, which forms part of monetary policy implementation, could also be used as a macroprudential policy tool, as suggested by Allen (2014) and Sinclair and Allen (2017): Including high-quality liquid assets from banks' commercial customers among the assets which a central bank is willing to buy or take as collateral for loans, would encourage the banks to acquire such high-quality liquid assets from their commercial customers. Such high-quality liquid commercial assets could also be included as Level 1 liquid assets in the Liquidity Coverage Ratio of Basel III (Allen, 2014; Sinclair and Allen, 2017). However, central banks are likely not to want to buy many of the assets that commercial banks now hold, due to their credit risk.

3.6 A research agenda

To improve our understanding of the interaction between macroprudential policy and monetary policy, it would be useful to design a research strategy that would systematically go through the different channels of transmission of monetary policy that also matter for the way macroprudential tools affect the financial sector. The underlying idea is that the literature on the monetary transmission mechanism offers an ideal framework for understanding the effectiveness and transmission mechanism of macroprudential policy. Both policies operate through their influence on the balance sheets of banks, non-bank financial institutions, non-financial firms and households. Investigating systemically the interactions through these balance sheets would provide valuable information about how macroprudential policy and monetary policy interact. In particular, it is important that research sheds light on how monetary policy impulses and macroprudential policy decisions work through the bank lending channel, the credit channel, the network channel, the risk-taking channel, the capital channel and the exchange rate channel.

4. Other challenges

While the focus of this paper is on one key challenge, namely the interaction between macroprudential regulation and monetary policy, there are other important challenges for macroprudential policy.

4.1 Interaction with fiscal policy

The interactions between macroprudential and fiscal policies also need to be better understood, especially since some fiscal tools (such as housing-related taxes or subsidies or the tax relief on mortgage interest payments) influence the housing market in a similar way as macroprudential tools such as loan-to-value or debt-to-income ratios. More generally, since macroprudential policy actions can have macroeconomic effects, and fiscal policy decisions (such as the deductibility of interest payments but not of dividends from taxable income of corporates, which favours leverage) can have financial stability effects, it might be useful to coordinate fiscal and macroprudential policy. This issue is explored in BIS (2016), which highlights the close two-way link between banks and public sector balance sheets that can create the potential for an adverse feedback loop. BIS (2016) starts from a review of the historical record of this link – which complements work by Bordo and Meissner (2011),

Jorda et al. (2016) – and presents evidence on the dynamics of fiscal balances over the financial cycle. It then discusses possible changes in the fiscal and the prudential framework that can help address this issue. One aspect that has received much attention since the euro sovereign debt crisis is that financial booms can hide persistent weaknesses in public finances and bias perceptions of sovereign risk. To the extent that macroprudential policy restrains the financial cycle, it will strengthen fiscal sustainability, thus providing more room for fiscal policy. Borio et al. (2016) argue that fiscal policy should play a more proactive role to restrain financial booms, leaning more deliberately against them, perhaps using taxation and other fiscal tools to remove any bias in favour of debt over equity.

The financial crisis has exposed an adverse feedback loop between bank risk and sovereign risk, with financial system weakness damaging public finances, and a deterioration in sovereign risk damaging the health of financial institutions. An increase in sovereign risk depressed the market value of banks' holdings of government debt and reduced the availability of high-quality collateral, thereby adversely affecting banks' funding conditions; it also reduced the perceived ability of the government to provide a backstop to the financial system, leading to increases in the borrowing costs of financial institutions (BIS, 2012).

The literature on the adverse feedback loop examines the link between fiscal policy and financial stability. Brunnermeier et al. (2016) provide a model for this adverse feedback loop, with three main ingredients: (i) home bias of banks' sovereign debt portfolios, which makes their equity value and solvency dependent on swings in the perceived solvency and market value of their own government's debt; (ii) inability of governments to commit ex-ante not to bailout domestic banks, since bailout is optimal once banks are distressed; and (iii) free capital mobility, which implies that international investors' perceptions of future government solvency are incorporated in the market value of domestic government debt. They suggest that policy must remove one of these three ingredients in order to break the adverse feedback loop, for example by restricting banks' domestic sovereign exposures relative to their equity. Empirical research suggests that fiscal authorities may face incentives not to pursue macroprudential objectives forcefully. Ongena et al. (2016) find that during the European sovereign debt crisis, domestic banks in fiscally stressed countries were considerably more likely than foreign banks to increase their holdings of domestic sovereign bonds in months with relatively high domestic sovereign bond issuance. They argue that this reflects at least in part a “moral suasion” mechanism.

There is a parallel between macroprudential policy–fiscal policy interaction and monetary policy–fiscal policy interaction over the cycle, which has been studied extensively. The main conclusion for monetary policy–fiscal policy interaction has been that even if the two policies interact, each of the policies can be adjusted to account for those interactions, provided that both policies work effectively; the issue of coordination arises when either of the policies is not operating perfectly, and the other policy has to compensate for this.

4.2 Regulatory arbitrage

As mentioned above, regulatory arbitrage arises because the negative externalities in financial intermediation that justify macroprudential policy can occur both within and outside the (traditional) domestic banking sector. The introduction of macroprudential instruments can cause risk-taking and exposures to move outside the regulated banking sector, while remaining systemically important. If macroprudential objectives encompass different regulatory jurisdictions but tools affect only a subset of these jurisdictions, and in particular the traditional banking sector, a gap opens between objectives and instruments of macroprudential policy (Jeanne and Korinek, 2014). This gap limits the effectiveness of these tools.

Most of the existing research has concentrated on forms of regulatory arbitrage that result from the increasing international integration of banking systems, as borrowers get access to funding from foreign banks (either directly or through their domestic branches). When macroprudential tools are applied to financial institutions operating in a country without reciprocal arrangements with home country regulators, domestically-regulated banks are more constrained in their risk-taking and credit

supply compared to foreign branches and cross-border lenders. Borrowers can therefore avoid macroprudential policy to the extent that they can shift their funding to foreign banks.

Regulatory arbitrage is also partly related to the growth of the shadow banking system and the associated risks to the main banking system, and growth in non-bank forms of financing and associated financial stability risks, on which there has been only little research (Claessens, 2017).

Regulatory arbitrage matters empirically. Evidence that both forms of regulatory arbitrage – through cross-border banking and through non-bank financial institutions – matter comes from empirical work based on either aggregate cross-country data or micro data on individual financial institutions (Reinhardt and Sowerbutts, 2015; Cizel et al., 2016).

4.3 Macroprudential policy and the infrastructure of the financial sector

Financial stability implications of aspects of the financial infrastructure and recent reforms are attracting increasing attention (Claessens, 2017). But there is still little research on systemic risk arising from vulnerabilities in the financial infrastructure and its implications for macroprudential policy (see Domanski et al., 2015). An exception is the paper by Menkveld (2015), which analyses financial stability risks of central counterparty (CCP) clearing.

In 2009, OTC Derivatives Reform and Central Clearing was agreed by the G20 with the aim that all standardized OTC derivatives should be centrally cleared, and non-centrally cleared derivatives should be subject to higher margin and capital requirements. It is an open question whether the reforms enhanced financial stability and how they can be improved (Glasserman et al., 2016). Specific questions are: (i) Do new bilateral margin requirements incentivize central clearing, as intended?; (ii) How should margin levels be set to mitigate procyclicality?; (iii) What are the consequences of overlapping membership across multiple central counterparties? (iv) If connectedness was not the main problem in 2008, as suggested e.g. by Scott (2016), have efforts that have been devoted to reducing it, e.g. by forcing settlements into CCPs, been misdirected?

Ghamami and Glasserman (2016) provide a model which suggests that the higher capital and margin requirements adopted for bilateral contracts with the aim of providing a cost incentive for central clearing do not necessarily favour central clearing.

Adrian and Shin (2010) found that leverage of market-based financial intermediaries is procyclical, ie leverage is high during booms and low during busts, with procyclical leverage reflecting increased collateral requirements during downturns. Geanakoplos (2009) and Gorton and Metrick (2012) found that the risk-bearing capacity of the financial system can be significantly reduced when leverage falls due to an increase in collateral requirements.

There is a danger that higher risk-sensitive margin requirements in the bilateral OTC markets could lead to greater procyclicality, thereby reducing the risk-bearing capacity of the financial system in a downturn, and amplifying shocks. Glasserman and Wu (2016) examine how margin levels in OTC derivative transactions can be set so that counterparty credit risk is sufficiently reduced while avoiding their amplifying procyclical effects. They find that margin levels required to achieve this depend on time series properties, such as persistence in volatility, which are not captured in current rules, with greater persistence requiring a higher buffer to avoid procyclicality.

Singh (2014) argues that CCPs have become too important to fail, suggests that there should consequently be more risk sharing by all participants of the CCP, and proposes a variation margin gains haircut in order to limit the use taxpayers' money in case of problems of a CCP.

5. Conclusions

While macroprudential policy has become a primary policy to support financial stability and has become increasingly popular in policymaking, it faces important challenges. In this paper we discussed several key challenges in taking macroprudential policy forward. The focus of our paper was on the challenge of coordination between macroprudential policy and monetary policy – particularly in

the current environment where central banks are exiting or planning to exit from a highly accommodative stance. We also discussed other important challenges: the coordination with fiscal policy, regulatory arbitrage and the regulation of the infrastructure of the financial system.

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