Monetary Policy and Financial Stability in a World of Low Interest Rates

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Contents

Introduction

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The global financial crisis demonstrated how interconnected the global economy has become. A problem in one part of the global economy was rapidly spread by the financial system to every part. It made it clear that financial stability was not just the concern of bank regulators, but of all policymakers. In Australia, the interplay between macroeconomic and financial stability objectives has made the setting of monetary policy especially challenging. In particular, there are concerns that the low interest rates required to support macroeconomic objectives might be contributing to a build-up of financial stability risks, particularly those related to household balance sheets. This concern is not unique to Australia. Similar policy debates have occurred in countries around the world.

To learn from these policy debates and the large body of associated research that has developed since the financial crisis, the Reserve Bank held a conference in March 2017. The conference brought together a range of experts to discuss the relationship between financial and macroeconomic stability, and the approach to policymaking that a world of low interest rates requires. The conference was divided into three main sessions. The first session of the conference was devoted to establishing some facts about monetary policy, financial stability and their interactions. The next session looked at how institutional arrangements adapted and responded to the post-financial crisis world of low growth and heightened financial stability concerns. The final session of the conference built upon the first two sessions by considering how a monetary policy authority should incorporate financial stability concerns into its policy actions. The conference concluded with a panel discussion synthesising the themes of the conference. The papers, the discussants' comments and a summary of the discussions that followed these presentations are included in this volume.

The first session included papers by Reserve Bank economists Adam Cagliarini and Fiona Price, and BIS economists Claudio Borio and Boris Hofmann. Dr Cagliarini and Ms Price look at the relationship between financial and macroeconomic, or business, cycles. They reflect on an existing body of work that has generally argued that the business and financial cycles are distinct features of the economy, and that financial cycles are longer than business cycles. In contrast to the earlier literature, however, their paper finds that there is little statistical evidence that financial and business cycles operate at different frequencies. Despite this, the two cycles are not always synchronised. The authors consider how monetary policy should respond when the cycles are out of sync. They conclude that, while monetary policy has an effect on the financial cycle, there are limitations on its ability to manage the business and financial cycles at the same time. On the other hand, they observe that macroprudential policy

has the flexibility to help manage the financial cycle. As such, they advocate a coordinated approach to achieving economic and financial objectives with trade-offs managed across institutions rather than within institutions.

Dr Borio and Dr Hofmann look at whether monetary policy is less effective when interest rates are persistently low. Despite nominal interest rates being at or below zero in many advanced economies, economic growth since the financial crisis has disappointed. This has led some to question the effectiveness of monetary policy when interest rates are at low levels. The authors investigate this correlation by providing a detailed review of the theoretical and empirical literatures. They highlight two possible reasons for the observed outcomes: headwinds, such as debt overhang, that coincide with periods of low interest rates; or decreased effectiveness of monetary policy when interest rates are low. With headwinds, monetary policy is as effective as always, but drags on growth from other areas of the economy mean that the observed effect of low interest rates can be small. Conversely, with decreased effectiveness, monetary policy itself is much less effective. The authors discuss a number of reasons this might occur, most of which are linked to the presence of distortions as nominal interest rates approach zero. For example, investors may be seeking particular nominal – as opposed to real – rates of return, which could lead them to lower their consumption and raise their saving as nominal rates reach low levels. This would lessen the effectiveness of interest rate cuts. The authors acknowledge that there are significant issues separating headwinds from declining effectiveness and that more work is needed but, notwithstanding these difficulties, they conclude that there is evidence of both strong headwinds and a decline in policy effectiveness.

The second session, focused on how financial stability institutions have developed since the financial crisis, included papers by Rochelle Edge and Nellie Liang, and Luci Ellis and Charles Littrell. The paper by Dr Edge and Dr Liang examines the structure of financial stability committees around the world, with a particular focus on whether the choice of structure is related to certain country-specific observables. They highlight the particularly prominent role of central banks on these committees, but also note that finance ministries frequently chair these committees, particularly in advanced economies. Overall, they find that the majority of countries have financial stability committees in place to measure and monitor systemic risks, and that most these have been set up since the crisis. However, they also find that relatively few of these bodies have independent powers, and that they tend to focus on promoting information sharing and coordination. They express a concern that this lack of powers could limit the ability of these bodies to improve financial stability outcomes.

The second paper is a case study of Australia, focused on how interactions between the central bank and the prudential regulator in charge of financial stability have worked in practice. The authors emphasise the cooperative, system-wide perspectives adopted by both APRA and the RBA in their approach to financial stability. They argue that this approach stemmed from the history of the two institutions as much as from the formal institutional structure. For while APRA's legislation enshrined a formal mandate for financial stability, the failure of HIH early in APRA's life had significant effects on its culture and approach to regulation. The authors

further emphasise how the productive relationship between the two agencies was aided by personal connections between the institutions. At first this reflected the fact that APRA was initially staffed by many RBA employees who were transferred to the institution when APRA was set up, but later it reflected established cultural expectations and performance goals for key staff. Overall, the paper makes a strong case for the benefits that can flow from having two regulators working together cooperatively, rather than competitively.

The final session included a paper from the IMF reviewing the arguments for and against setting interest rates higher than is indicated by a traditional inflation-targeting framework, that is 'leaning against the wind', and a panel discussion to synthesise the views presented at the conference. The paper from the IMF, presented by Giovanni Dell'Ariccia, considers how a central bank should balance macroeconomic and financial stability concerns when setting interest rates. Leaning against the wind leads to lower inflation and higher unemployment than otherwise. These costs are compared to the harder-to-measure and longer-term benefits that arise from mitigating an increase in financial risks. They conclude that, based on current knowledge, the case for leaning against the wind is limited, as in most circumstances costs outweigh benefits. Nevertheless, they do note that our understanding of the interaction between monetary policy and financial stability is still evolving and that future research in this area is a key priority.

The panel discussion first focused on a number of themes that had emerged from the papers and discussions over course of the conference. A particularly common theme was the importance of institutions. It was noted, however, that while regulators around the world are implementing many changes to both institutional arrangements and macroprudential policy, there is no clear best practice. While institutions focused on financial stability have grown and evolved, they have done so in idiosyncratic ways rather than being guided by well-tested principles. Another consistent theme was how much remains unknown. In this respect a number of areas for future research were nominated. These areas reflected how interconnected economies and financial systems had become. For example, it was suggested that understanding networks is crucial to understanding how shocks to individual households or institutions can propagate. Modelling the linkages between financial systems and the macroeconomy was also nominated as a particularly important area for more research.

Reflecting the need for more research, panellists also commented on the difficulty of assessing the effectiveness of macroprudential policies as well as the difficulties associated with implementing them. They highlighted the political constraints on macroprudential policy that could limit their effectiveness. In particular, it was observed that macroprudential policy invariably involves restricting access to credit for a particular group of people – and this group has an incentive to either circumvent the restrictions or to lobby for them to be relaxed. The discussion concluded by considering the role of monetary policy in financial stability and of macroprudential policy in financial stability.

The Sense of the Room

Over the course of the two days many views were expressed and it is difficult to do them justice in this short introduction. This is particularly so because the topic is one where much remains to be understood and a number of views are held tentatively until better evidence comes to hand. Reflecting this, there was general agreement that more work is needed to better understand both the effects of macroprudential measures and their interactions with monetary policy. In particular, it was felt that more work on macroprudential institutions would be particularly valuable. While monetary policy frameworks have evolved over the course of decades and are relatively mature, macroprudential frameworks are still in their infancy. Across jurisdictions, a range of approaches had developed and this diversity would eventually provide a wide range of experiences to learn from. As such, it was felt that frameworks would undoubtedly evolve and that policy institutions should be ready to modify their frameworks and approaches as evidence on best practices emerged.

Reflecting the immaturity of policy frameworks and knowledge, there was disagreement over whether monetary policy should be the first line of defence against financial stability risks. Many participants felt that the available evidence was sufficient to conclude, as the IMF staff had in the paper presented by Dr Dell'Ariccia, that monetary policy should be set according to macroeconomic considerations rather than leaning against the wind. These participants generally believed that macroprudential policy should form the first line of defence against financial imbalances while keeping open the possibility that in some circumstances a monetary policy response might be warranted.

Notwithstanding this disagreement, there was consensus about the importance of having all arms of policy working together. In discussions about institutional arrangements it was observed that outcomes appeared to be better when regulators took a cooperative and macroeconomic perspective on regulation, rather than an adversarial or narrower perspective.

Exploring the Link between the Macroeconomic and Financial Cycles

Adam Cagliarini and Fiona Price*

1.   Introduction

The global financial crisis prompted an increased focus on the role of financial factors in driving real economic fluctuations. Recent papers have emphasised the significant economic effect of boom-bust cycles in credit and the overall importance of credit to the macroeconomy, including Reinhart and Rogoff (2009), Claessens, Kose and Terrones (2011), Borio (2012) and Aikman, Haldane and Nelson (2015). Several of these papers have suggested that there is a common cycle in financial variables (the financial cycle) that has a lower frequency and larger amplitude than the common cycle in real macroeconomic variables (the macroeconomic or business cycle), particularly since the 1980s. Borio (2012) defines the financial cycle as changes in market participants' perceptions of risk and attitude towards risk as well as changes in financing constraints. These developments tend to reinforce one another and lead to booms and busts in credit and asset prices, with the potential for these busts to have serious implications for financial stability, and therefore the broader economy, over a significant length of time. As a result of this work, the concept of a financial cycle that is different from the business cycle has become more widespread within the academic and regulatory communities. There has been increased attention on policies that aim to manage the financial cycle; in particular, the focus has been on tempering the build-up in financial stability risks that often occurs in phases when rapid asset price inflation is being fuelled by high credit growth, and on implementing policies that encourage the financial system to support economic activity following a financial crisis.[1]

Three questions naturally arise from the literature's findings: why might the financial cycle be different from the business cycle; does the financial cycle operate at a lower frequency than the business cycle; and how might these cycles be related? These questions are important for macroeconomic policymakers since the synchronisation and relationship between the cycles may influence the decision of whether to manage the business cycle separately from developments in the financial system, or whether these financial system developments (and any policies targeting these developments) should be considered when setting macroeconomic policy.

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*   The authors are from the Reserve Bank of Australia's Economic Research Department. All views expressed are those of the authors and in no way represent the views of the Reserve Bank of Australia or its Board.

1   For example, the Bank for International Settlements' countercyclical capital buffer and the Bank of England's new stress testing framework.

Since the fundamental role of the financial system is to facilitate the reallocation of resources from savers to investors, economic conditions should affect the resources available in the financial system. Economic conditions should also affect the demand for the financial system's services and borrowers' ability to repay their debts. As a result, it might be expected that the cycle in financial variables would be largely the same as the cycle in macroeconomic variables, abstracting from any phase shifts. However, it is likely to be more complicated than this, with other potential factors playing a role. The literature provides a number of reasons why the financial cycle might differ from the business cycle, including: the presence of financial frictions (Bernanke and Gertler 1989; Kiyotaki and Moore 1997; Adrian and Shin 2010); the tendency of financial market participants to inappropriately respond to risk (Borio, Furfine and Lowe 2001); and changes to policy regimes that can allow credit and asset price booms to take place at the same time that inflation (and the policy rate) remains low (Drehmann, Borio and Tsatsaronis 2012).

Developments in the financial system can also have an important effect on economic conditions. In particular, the financial system's resource reallocation role enables investment to take place that would otherwise have to be self-financed, thereby boosting income and asset prices (Lowe 1992). The influence on asset prices can then affect household consumption and business investment through household net worth, business net worth and the replacement value of capital stock (Cochrane 2008). As a result, credit and asset price booms may be able to influence economic conditions and amplify economic booms and downturns. If the financial cycle does differ from the business cycle and financial conditions can influence economic conditions, then there is the potential for any conflict between these cycles to have a real effect on the economy and at times, when these cycles are in different phases, this may pose a conundrum for policymakers.

While there has been much progress made in this area, work is by no means complete. Given the importance of this work for policymakers, we believe that further work is needed to help improve the understanding of cycles in financial and macroeconomic variables, and the relationship between these cycles. This paper adds to the existing literature by testing the differences in the cyclical properties of financial and macroeconomic variables, examining the extent to which the financial cycle is linked with the business cycle, and considering the implications of our results for monetary policy and financial stability policies. We have chosen to focus our analysis on the differences in the frequencies and phases of the financial and business cycles, rather than the amplitudes of these cycles. We acknowledge that there could be arguments for being concerned about the amplitudes of the cycles, given that the financial accelerator mechanism implies that larger amplitudes in the financial cycle may result in larger fluctuations in the business cycle (and vice versa). On the other hand, it is unclear what the welfare costs of a credit cycle with higher amplitude might be if this reflects households smoothing their consumption.

The remainder of the paper is structured as follows: the next section summarises the relevant literature; the third section outlines the theory, data, methodology and results; the fourth section provides discussion on the policy implications of the results; and the final section concludes.

2.   Summary of the Literature

Much of the recent literature on financial cycles builds on the arguments put forward in papers written as early as the 1930s (Fisher 1933; Gurley and Shaw 1955; Minsky 1977; Kindleberger 1978). In contrast with the mainstream economic literature in the second half of the 20th century, which argued that there was no role for finance in determining economic conditions (e.g. Modigliani and Miller 1958), these papers suggest that the financial system can propagate shocks as well as be the source of shocks that lead to economic instability. According to Minsky, financial crises are not random or the result of poor policy decisions. Instead, they are due to the normal functioning of the economy endogenously leading to fragile financial structures; in particular, the procyclical supply of credit creates a fragile financial system and increases the probability of a crisis occurring. These papers tend to be based on conjecture and more theoretical in nature, which reflects the lack of data that was available at the time.

Over the following decades, this work continued to be overshadowed by the literature that separated finance from economics. In the 1990s and early 2000s, new research emerged focusing on the procyclicality of the financial system and the concept of a 'financial cycle' was introduced. Bernanke and Gertler (1989), Kiyotaki and Moore (1997) and Bernanke, Gertler and Gilchrist (1999) develop theoretical frameworks that explicitly allow financial frictions to amplify and propagate shocks to the economy (commonly referred to as the 'financial accelerator' mechanism), for example, through the procyclicality of borrower net worth. Relatedly, Fostel and Geanakoplos (2008), Adrian and Shin (2010) and Geanakoplos (2010) highlight the importance of collateral rates (or 'leverage') for the economy; in particular, the procyclical variation in leverage can significantly affect asset prices, which can subsequently influence the behaviour of economic agents.

In addition to the financial accelerator mechanism, Borio *et al* (2001) argues that an additional source of financial procyclicality is market participants' inappropriate responses to changes in risk, which can result in significant financial and economic instability. Reflecting this, Borio *et al* suggests that policymakers should consider promoting a better understanding of risk and ensure supervisory rules promote better measurement of risk by using supervisory instruments in a countercyclical manner. The authors propose the use of monetary policy to contain financial imbalances and are among the first to discuss the concept of the financial cycle, which they define as the expansion and subsequent contraction in credit and asset prices, accompanied by changes in lending standards. A related paper, Borio and Lowe (2002), finds credit growth and asset price inflation to be good predictors of financial crises, and notes that financial imbalances can build up in relatively weak economic conditions. As a result, the authors argue that economic conditions and financial stability (and therefore the business cycle and financial cycle) can be in conflict in the short term, and therefore both monetary and prudential policymakers should be allowed to respond to financial imbalances in a weak economic environment.

Since the global financial crisis there has been a resurgence of work in this area, with many papers building on the earlier work and looking to determine the specific characteristics of the financial cycle, how these differ from the characteristics of the business cycle, and the relationship between these cycles. Many of these papers motivate their work based on improving the understanding of these cycles and their interactions to help macroeconomic policymakers achieve their mandates.

Reinhart and Rogoff (2009) examines a range of different financial crises and concludes that a common theme among these crises is excessive debt accumulation, which suggests that strong credit growth can have significant implications for the financial system and economy. Schularick and Taylor (2012) and Jordà, Schularick and Taylor (2015) use cross-country panel data and find that, since the Second World War, booms in credit and housing prices have been good predictors of crises that lead to large effects on economic output, and should therefore be carefully monitored by policymakers. The authors believe that this mainly reflects failures in the operation and regulation of the financial system rather than credit booms *per se*, and assert that their results are consistent with the notion that the financial system itself can generate economic instability.

A variety of econometric techniques have been used to empirically test the characteristics of the business and financial cycles in recent years, with most papers focusing on cycles in advanced economies. The four main techniques that have been used include: turning point analysis; frequency-based filters; model-based filters; and spectral analysis.

- The papers that use the Bry-Boschan turning point algorithm (updated to quarterly data by Harding and Pagan (2002)) find that: recessions following credit crises and asset price busts are generally longer lasting and more costly; financial cycles tend to be longer than business cycles; and these cycles can be highly synchronised (Claessens *et al* 2011; Drehmann *et al* 2012). There are some drawbacks to using the turning point technique; in particular, there is little theory available or offered to help explain the results, and the results can be sensitive to censoring assumptions.

- Papers that use frequency-based filters to obtain cycles in financial variables and in output find evidence that financial cycles are longer in length and larger in amplitude than business cycles, and are reasonably synchronised (Drehmann *et al* 2012; Aikman *et al* 2015; Schüler, Hiebert and Peltonen 2017). However, in most cases, these papers make *ex ante* assumptions about the length of business and financial cycles, resulting in longer financial cycles and shorter business cycles by construction.[2] Moreover, this work tends to disregard the research that finds output to have significant medium-term cycles (Comin and Gertler 2006). In addition, frequency-based filters can introduce spurious cycles into the results (Schenk-Hoppé 2001; Phillips and Jin 2015; Hamilton 2017).

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2   Schüler *et al* (2017) allows the frequency range to vary by country based on multivariate spectral density results, and so do not assume the length of the financial and business cycles.

- A few papers have opted to use model-based filters, which involves applying the Kalman filter to unobserved components models in order to extract cycles, rather than frequency-based filters (Galati *et al* 2016; Rünstler and Vlekke 2016). These papers have found that financial variables exhibit medium-term cycles that are longer than the traditional length of the business cycle (typically considered to be between 2½ and 8 years), though they also find that some countries have a business cycle longer than 8 years. Also, medium-term cycles in financial series are found to be highly correlated with the medium-term cycle in output. For the purpose of identifying cycles in data, a significant drawback of using this approach is its model dependence; the results depend on the assumptions made about the underlying data-generating processes.

- Several recent papers have looked at financial and economic variables in the frequency domain to understand the difference between the financial and business cycles (Aikman *et al* 2015; Strohsal, Proaño and Wolters 2015; Schüler *et al* 2017). These papers find evidence of a financial cycle that is longer than the business cycle and evidence for both short- and medium-term cycles in real credit growth. However, by only using the frequency domain, spectral analysis does not identify a time series measure of the cycle (without the use of a frequency-based filter) and generally requires stationarity, implying that it can only identify growth cycles.[3]

These techniques could be influenced by structural breaks in the data, though this should be less of a concern for turning point analysis. For example, the results found using some of these techniques may be affected by a lengthening in the business cycle; this is a potential explanation for the results found in Aikman *et al* (2015) and would suggest that it is not appropriate to compare the medium-term cycles in financial variables with short-term cycles in economic variables.

Despite some drawbacks, all four techniques seem to produce similar results, with most advanced economies found to have a longer cycle in financial variables than in economic variables, and some relationship between these cycles. However, the existing literature lacks any robust testing on whether the financial and business cycles are statistically different. In addition, apart from conjecture and observations from the data, it remains unclear how these two cycles relate to one another and what drives this relationship.

Our paper contributes to the literature by: estimating the length of the financial and business cycles, and providing confidence intervals around these estimates; analysing the relationship between these cycles; and providing some discussion around the policy implications of our results. To do this, we make use of the techniques commonly used in the literature in a way that aims to minimise the effect of their drawbacks on our results.

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3 Some papers, such as Priestley (1965) and Bayram and Baraniuk (2000), develop methods for estimating the spectral densities of non-stationary processes, referred to as time-varying power spectra.

3. Financial and Macroeconomic Cycles

3.1 Theoretical models

Before we present our empirical methodology, it is useful to outline some of the theoretical economic models that incorporate a financial sector, and what these theoretical models might imply for our results and optimal policy decisions. Under the Modigliani and Miller (1958) irrelevance theorem, real economic outcomes are not affected by financial conditions, though this assumes that no financial frictions are present. Given that financial frictions do exist, several influential papers have outlined theoretical models that explore what a financial system with frictions looks like and how a financial system with financial frictions can affect macroeconomic conditions.

One of the earlier theoretical papers is Bernanke and Gertler (1989). The authors develop a simple dynamic general equilibrium model to show how borrowers' balance sheets can affect macroeconomic conditions. In this model it is assumed that there is asymmetry of information between borrowers and lenders and therefore some deadweight loss will occur; that is, the agreed financial contract is sub-optimal when compared to the financial contract that would be agreed upon with no asymmetry of information. Bernanke and Gertler argue that this deadweight loss varies inversely with borrower net worth. If net worth varies procyclically with the business cycle, agency costs are countercyclical and amplify swings in borrowing, and therefore also investment, consumption and output. If there is a shock to net worth that is independent of economic conditions, the financial system can be a source of real economic fluctuations. Overall, this model suggests that the financial system can *amplify* macroeconomic shocks (the financial accelerator mechanism) as well as be a *source* of macroeconomic shocks.

Kiyotaki and Moore (1997) is another important paper in the literature. It uses a dynamic general equilibrium model to show how credit constraints influence macroeconomic conditions. In contrast to the model in Bernanke and Gertler (1989), where changes in net worth are due to changes in cash flow, in Kiyotaki and Moore changes in asset prices are the source of changes in borrower net worth. In their model, durable assets act as both a factor of production and as collateral. As a result, there is a dynamic relationship between credit constraints and asset prices; a temporary shock that affects asset prices reduces the net worth of constrained agents and leads to tighter borrowing constraints, which lowers production and spending and further reduces asset prices.

Building on the these two theoretical models, Bernanke *et al* (1999) develops a framework for credit market frictions that incorporates price stickiness, a role for monetary policy, decision lags in investment and heterogeneity among firms. These additions aim to incorporate the results of the empirical literature and improve the model's empirical relevance. Similar to the previous literature, the authors found that the financial accelerator has an important effect on macroeconomic conditions. In this model, the role of the financial accelerator mechanism in amplifying the business cycle would be muted to the extent that monetary policy could

stabilise output, though changes in policy have to be quite smooth in order for output to be stabilised.

Further building on the existing work and incorporating lessons learnt from the financial crisis, Gertler and Karadi (2011) and Gertler and Kiyotaki (2011) develop frameworks that allow for a significant disruption in financial intermediation. These papers not only consider how such a disruption would be expected to affect macroeconomic conditions, but also how policy responses, such as credit market interventions, might mitigate these effects. Gertler and Karadi introduce shocks to the asset quality of financial intermediaries, while Gertler and Kiyotaki introduce disruptions to financial intermediaries through constraints on obtaining depositor and wholesale funds. Both of these approaches work to increase the cost of credit, reduce the quantity of credit, and therefore reduce economic activity. Overall, these papers find that the net benefits of intervention in the credit market can be substantial, though this does depend on the severity of a crisis and the efficiency costs of government intermediation.

The recent crisis also increased the focus on the effect that leverage can have on the macroeconomy. In particular, Geanakoplos (2010) highlights the procyclicality of collateral rates due to uncertainty around future asset price growth and the subsequent effect this has on asset prices. The model in this paper assumes heterogeneity among buyers; for some reason one group of buyers values the asset more than any other buyers and are therefore willing to pay more for it, which often involves taking on more leverage. If there is a shock to these highly leveraged buyers, either from a tightening in collateral constraints or a deterioration in the balance sheet, they will buy less and the asset price will fall. This shock is often brought on by bad news that increases uncertainty about future asset returns, causing lenders to increase margins. As a result, a feedback loop will emerge that leads to sharper declines in asset prices. Geanakoplos argues that, in the absence of intervention, leverage becomes too high in a boom and too low in a downturn, and therefore the central bank should consider restricting leverage in boom periods to avoid future financial crises. Fostel and Geanakoplos (2008) uses a similar model to show that leverage cycles in an economy that has experienced some bad news (but not enough to warrant panic) can lead to contagion, a flight to well-collateralised assets and bond issuance rationing.

While much of the literature focuses on secured credit, Azariadis, Kaas and Wen (2015) observe that unsecured credit shows greater cyclicality and often leads output, challenging the notion that it is collateralised debt that plays a key role in influencing macroeconomic conditions. To explain this result, the authors develop a dynamic general equilibrium model in which the unsecured component of the loan depends on a firm's expectations of the future availability of unsecured credit, since these expectations represent the firm's chance of remaining solvent in the future. In addition to these constraints depending on future expectations of credit conditions, credit constraints and productivity are endogenous in the model; when constraints are binding, productivity falls causing constraints to rise. As a result, the model gives rise to self-fulfilling credit cycles, where shocks to expected future unsecured credit conditions can have persistent effects on credit, productivity and output.

Overall, the theoretical literature suggests that the financial system can be influenced by factors that are independent of economic conditions, and emphasises the link between the macroeconomy and the financial system. This suggests that the financial cycle could be different from the business cycle, though these cycles should still be connected. What does this mean for policymakers? It suggests that policymaking that only targets macroeconomic conditions and does not take developments in the financial system into account may not effectively prevent the occurrence of financial crises and the subsequent negative effects on the macroeconomy. We will come back to the discussion on policy implications in Section 4.

3.2   Data and descriptive statistics

We use several financial and macroeconomic variables to obtain indicators of the financial and business cycles: the financial variables are credit, housing prices, equity prices and the 10-year government bond rate; and the macroeconomic variables are gross domestic product (GDP), employment and the unemployment rate.[4] All nominal variables are deflated using the consumer price index (CPI). These variables are generally consistent with the variables used in the literature, though some papers have used only credit and housing prices in their measures of the financial cycle. Given that there is some evidence that other financial variables could affect systemic risk (e.g. Jordà *et al* 2015), we choose to include all four measures in our analysis and perform sensitivity analysis to determine whether our results are robust to the exclusion of equity prices and the 10-year government bond rate. It should be noted that we do not aim to determine which variables best represent the financial cycle; instead we choose widely available metrics that capture activity in the financial system.[5]

For parts of our analysis, we only use credit and GDP to represent the financial and macroeconomic cycles, respectively. This approach is similar to several other papers, including Aikman *et al* (2015) and Strohsal *et al* (2015). We have chosen to do this for simplicity; we acknowledge that it is not ideal given that GDP does not always capture the true state of an economy, and given that the interaction between house prices and credit is important (Drehmann *et al* 2012; Jordà *et al* 2015). For most of our analysis, the variables are expressed as log annual differences, except for the unemployment rate and 10-year government bond rate, which are expressed as annual differences. These data transformations are made to induce stationarity in the series, since most of our analysis requires the data to be stationary.[6]

Five countries are included in our analysis: the United States, the United Kingdom, Australia, France and Germany. These countries were chosen to facilitate a comparison with the findings in the literature as well as to provide a comparison across advanced economies.

A summary of the data is presented in Table A2, and the data are shown in Figures A1–A5. The summary statistics are broadly consistent across countries, which is not surprising given the

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4   See Appendix A for data sources and sample periods. Credit covers loans to, and debt securities issued by, the private non-financial sector; this measure will not capture credit provided by other sources, such as shadow banks.

5   While the credit gap and credit-to-GDP gap have been commonly used to measure the financial cycle, there is little theory behind these measures. In contrast to the output gap, it is not clear what the level of potential credit is or what distortion makes credit deviate from its potential.

6   We use the variables in level terms for turning point analysis.

similarities between the countries. However, Germany appears to be somewhat of an outlier, with negative average house price inflation and weaker credit growth over the past couple of decades. On visual inspection, credit growth and housing price inflation generally appear to have had larger and longer cycles compared with equity price inflation and the change in government bond yields, which is a common finding in the literature (Drehmann *et al* 2012; Strohsal *et al* 2015, Schüler *et al* 2017). There also appear to be cycles in the macroeconomic variables.

3.3 Methodology

As discussed in Section 2, several papers approach the question of whether there is a longer financial cycle by imposing *ex ante* assumptions on the cycles in the data. We use two methods that do not impose such assumptions. The first method is multivariate spectral analysis, which decomposes the cross-covariance of stationary time series into different cycle frequencies. The second method is the turning point algorithm developed in Bry and Boschan (1971), which has been extended to quarterly data in Harding and Pagan (2002) and to multiple variables in Harding and Pagan (2006). It is worth noting that, as in many existing papers, we estimate these cycles separately and, as a result, we are treating the cycles as if they are separate from each other. If they are related, a better approach might be to estimate the cycles simultaneously; however, we leave this for future work.

For the first method, the frequency with the greatest contribution to the cross-covariance is considered to be the dominant cycle length at which the time series co-move. The dominant cycle in the financial variables is used as an approximation of the financial cycle, and the dominant cycle in the real economic variables is used as an approximation of the business cycle. To do this, we follow Schüler *et al* (2017) and calculate a measure of the multivariate spectral density called the power cohesion:

$$PCoh_{\mathbf{x}}(\omega) = \frac{1}{(M-1)M} \sum_{a \neq b} \left| f_{x_a x_b}(\omega) \right|$$

$$f_{x_a x_b}(\omega) = \frac{s_{x_a x_b}(\omega)}{\sigma_{x_a} \sigma_{x_b}} = \frac{1}{2\pi} \sum_{k=-\infty}^{\infty} \frac{\text{Cov}\left[x_{a,t}, x_{b,t+k}\right]}{\sigma_{x_a} \sigma_{x_b}} e^{-ik\omega}$$

where $t = 1, \ldots, T$ reflects the time dimension, M reflects the number of stationary variables in the matrix $\mathbf{X}$, which is a $T \times M$ matrix, and $\omega \in [-\pi, \pi]$ reflects the cycle frequency. The function $f_{x_a x_b}(\omega)$ represents the cross-spectral densities for each pair of variables in $\mathbf{X}$, with σ_{x_a} and σ_{x_b} representing the standard deviations for variables a and b, $s_{x_a x_b}(\omega)$ representing the cross-spectrum for variables a and b, and $\text{Cov}[x_{a,t}, x_{b,t+k}]$ representing the cross-covariance between leads and lags of these variables; i is the imaginary unit. In our analysis, we have two $\mathbf{X}$ matrices, one for financial variables and another for economic variables. The dominant cycle is determined by finding the frequency, ω, at which $PCoh_{\mathbf{x}}(\omega)$ is at its maximum. To

determine whether these dominant cycles are different, we estimate a 95 per cent confidence interval for the dominant cycle frequencies using a parametric bootstrap method.[7]

There are two main limitations with using multivariate spectral analysis. Due to the volatility in the multivariate spectral density, we use a Parzen window to smooth the cross-spectral densities; while this could potentially compromise our results, we note that it is commonly used in the literature (e.g. Aikman *et al* 2015; Schüler *et al* 2017) and changing the bandwidth (or removing the smoothing window altogether) does not change our main conclusions. Another limitation with multivariate spectral analysis is that it requires stationarity and therefore we are only able to identify cycles in growth rates rather than classical cycles. It could also be a concern that we include both stock variables (credit) and flow variables (GDP) in our analysis and this could somehow influence our results. In Appendix B, we show that the spectral densities for a stock and its flow should be the same, though there is a phase shift between the stock and the flow.

To crosscheck the results from the multivariate spectral analysis, we use the Bry-Boschan quarterly algorithm to estimate the average duration of cycles in financial variables and in real economic variables. This algorithm identifies the peaks and troughs in a time series given specific censoring parameters, such as the minimum length of a peak, expansion and contraction.[8] This method has the advantage of being able to estimate classical cycles, rather than cycles in growth rates. However, it is not without its disadvantages; it is a purely statistical measure, with no underlying economic theory and it can be sensitive to the choice of censoring parameters.

If there is a financial cycle that is different in length from the macroeconomic cycle, as suggested in the literature, we would expect to find little overlap in the confidence intervals for the dominant frequencies for financial variables and economic variables in the multivariate spectral analysis. We would also expect to find large differences in the average duration of cycles in financial and economic variables as determined by the multivariate Bry-Boschan turning point algorithm.

Turning to how the financial and business cycles might be related, we first identify how often cycles in financial and economic variables are synchronised. For simplicity, we use credit growth to represent financial variables, and GDP growth to represent economic variables. To obtain the cycles in these variables we use a Christiano-Fitzgerald band-pass filter.[9] Using this filter, we extract two cycles from each time series: a longer cycle between 8 and 30 years, often described as the range for the length of the financial cycle in the literature, and a shorter cycle between 2½ and 8 years, often described as the range for the length of the business cycle in the literature. We use the Bry-Boschan quarterly turning point algorithm

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7 For the bootstrapping, we use a Gaussian kernel to smooth the cross-spectra and assume the errors between the smoothed and non-smoothed cross-spectra come from a chi-squared distribution with two degrees of freedom. For more information, see Franke and Härdle (1992) and Berkowitz and Diebold (1998).

8 The conditions we use are consistent with those used in Harding and Pagan (2002); a cycle needs to be at least five quarters long, a contraction or expansion needs to be at least two quarters long and peaks and troughs need to alternate.

9 Similar results are found using a Hodrick-Prescott filter, where lambda is chosen to optimise the unfiltered spectral densities between 8 and 30 years, and 2½ and 8 years. These filtering methods suffer from end-point problems, so care needs to be taken when interpreting the beginning and end of the filtered series.

on these cycle estimates to determine the degree of synchronisation between the cycles.[10] It is important to note here that we are not assuming that we know the true length of the financial cycle or business cycle; instead, we are trying to understand how often cycles in the economy and the financial system might be in conflict. If cycles in credit growth are independent from cycles in GDP growth, or there is a significant phase shift between these cycles, we might expect the cycles to have a low degree of synchronisation.

Following this, we explore the lead/lag relationship between the identified cycles in credit and GDP growth. In particular, we employ cross-correlograms, cross-spectral densities and Granger causality tests to understand the relationship between these cycles. The results should help identify which cycle, if any, tends to lead the other at different frequencies as well as the number of lags involved. Given the discussion in the literature of a long financial cycle that leads to economic instability, credit growth could lead GDP growth at longer frequencies. At the same time, as discussed at the beginning of the paper, we expect that economic conditions matter for financial conditions and so GDP growth may also lead credit growth.

3.4 Results

### 3.4.1 Is there a financial cycle separate from the business cycle?

Figure 1 shows the measures of co-movement between the financial variables and between the economic variables in the frequency domain for all five countries, while Table 1 presents the estimates of the dominant cycle lengths (at which most of the co-movement occurs) and the 95 per cent confidence intervals around these estimates. These estimates are used as an approximation for the length of the financial and business cycles.

The results suggest that the length of the common cycle in financial variables is different from the length of the common cycle in economic variables. For the United States, Australia and France, financial variables tend to co-move most at longer frequencies compared with economic variables; this is consistent with the literature that claims that financial cycles are longer than the business cycle, though the estimates of the length of the financial cycle are at the lower end of the range of the estimates reported in the literature. In contrast, financial variables in the United Kingdom and Germany tend to co-move most at shorter frequencies compared with economic variables. In several countries there is a secondary peak in the multivariate spectral density for economic variables and, to some extent, financial variables, which could suggest the presence of other cycles in the data that are less dominant but are nonetheless still important.[11]

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10 We do not compare the synchronisation of the shorter and longer cycles, since they will have low synchronisation by construction.

11 However, the presence of two dominant cycles could also be the result of changes in the co-movement in the data over time.

Figure 1: Multivariate Spectral Densities

Across countries
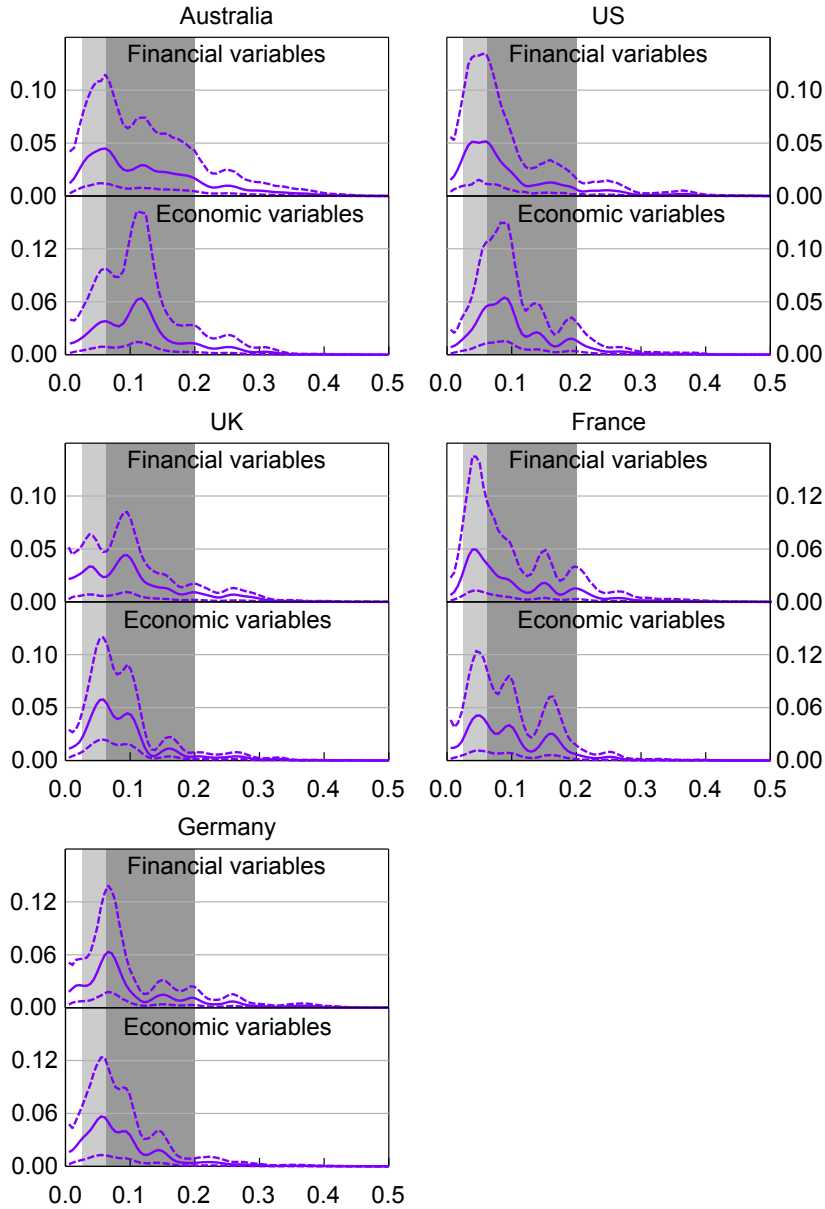
Notes: Smoothed with a Parzen window and standardised; dashed lines represent 95% confidence bands; lighter (darker) shaded area corresponds to cycle frequencies between 8 and 30 years (2½ and 8 years); financial variables are real credit growth, housing price inflation, equity price growth and change in 10-year government bond rates; economic variables are real GDP growth, change in unemployment rate and employment growth; all sample periods end in 2016:Q1 and start in: 1980:Q1 for Australia, 1971:Q1 for the United States, 1969:Q2 for the United Kingdom, 1972:Q1 for France and 1971:Q1 for Germany

Sources: ABS; Authors' calculations; Bank of England; BIS; Bureau of Labor Statistics; National Institute of Statistics and Economic Studies (INSEE); OECD

Table 1: Estimates of Financial and Business Cycles
Peaks in multivariate spectra

	Financial cycles		Business cycles	
	Years	95% confidence intervals	Years	95% confidence intervals
Australia	8.1	[2.9, 18.1]	4.3	[3.3, 14.5]
United States	8.2	[5.3, 22.6]	5.7	[4.3, 11.3]
United Kingdom	5.2	[4.5, 47.0]	8.5	[4.7, 13.4]
France	12.6	[3.4, 17.7]	9.8	[3.1, 17.7]
Germany	7.5	[5.7, 22.6]	9.1	[4.8, 22.6]

Sources: ABS; Authors' calculations; Bank of England; BIS; Bureau of Labor Statistics; INSEE; OECD

As a comparison to the estimates obtained using multivariate spectral analysis, we also estimate the average duration of cycles in financial and economic variables over the same time periods using the multivariate Bry-Boschan turning point algorithm. The results are presented in Table 2. In most countries, the differences between the average duration of cycles in financial variables are similar to that of economic variables.

Table 2: Estimates of Financial and Business Cycles
Average cycle lengths (years) using Bry-Boschan quarterly turning point algorithm

	Financial variables[a]			Economic variables[b]		
	Contraction	Expansion	Cycle	Contraction	Expansion	Cycle
Australia	3.8	2.0	5.7	1.3	5.1	6.4
United States	2.2	3.8	6.0	1.7	4.5	6.8
United Kingdom	1.8	6.4	8.3	1.2	5.3	6.5
France	1.3	5.0	6.3	1.3	4.3	5.6
Germany	2.2	2.4	4.8	1.9	3.5	5.5

Notes: (a) Includes credit, housing prices, equity prices and 10-year government bond rates
           (b) Includes GDP, employment and the (negative of the) unemployment rate
Sources: ABS; Authors' calculations; Bank of England; BIS; Bureau of Labor Statistics; INSEE; OECD

While the multivariate spectral densities are visually different, the large confidence intervals around the estimates for financial and business cycles and the considerable overlap between these confidence intervals cast uncertainty on the true cyclical behaviour of financial and economic variables. Given the overlap between the confidence intervals as well as the results from the turning point method, we cannot confidently conclude from our analysis that the financial cycle is longer than the business cycle.

There are some weaknesses in our analysis that could affect the results. The first is that structural breaks may have occurred, leading to changes in the cycles over time; this is

plausible given that our results cover a time period in which political and economic policy regimes changed significantly, including the reunification of Germany, financial liberalisation and changes in monetary regimes. The turning point method results should provide some robustness here, since the time-varying nature of this method implies that it would be less affected by structural breaks than spectral analysis. As an additional robustness check, we repeat the multivariate spectral analysis using data from 1980 onwards for all countries (Table C1).[12] While the change in sample periods does affect the results to some extent, particularly for the United States and the United Kingdom, the confidence intervals around our estimates remain wide and still overlap.

Secondly, our choice of financial variables could influence our results. As documented in the literature, there appears to be a consensus that credit growth and housing price inflation are more relevant when it comes to measuring the financial cycle than other financial variables, reflecting their superior ability to predict financial crises (Drehmann *et al* 2012; Jordà *et al* 2015). As a robustness check, we repeat our analysis excluding equity prices and the long-term government bond rate. As shown in Tables C2 and C3, excluding these variables leads to an increase in the dominant cycle lengths in the multivariate spectral densities for financial variables. Also, for the United States and France, this leads to an increase in the average duration of the cycles in financial variables from the multivariate Bry-Boschan turning point algorithm. Nonetheless, there remains a significant overlap in the confidence intervals around the dominant frequencies in the multivariate spectral densities for financial and economic variables, and the turning point method still estimates similar cycle lengths for some countries. Therefore, we believe that there is still insufficient evidence to conclude that the financial cycle is longer than the business cycle.

Finally, there is the issue of insufficient data. If, as claimed by other papers, there exists a longer financial cycle and we have data covering less than five decades, there will only be a limited number of cycles in the data and it will be difficult to confidently identify the length of the cycle. As another robustness check, we repeat the multivariate spectral analysis using the long-run annual database provided by Jordà, Schularick and Taylor (2017).[13,14] The results are provided in Table C4. These results are not entirely consistent with the quarterly data, particularly for the United Kingdom and Australia, which is unsurprising given that the annual data cover a much longer time period than the quarterly data and many structural breaks are likely to have occurred over this period. Notably, the confidence intervals remain large around the dominant frequencies for financial and economic variables, implying that, even

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12 We choose 1980 for two main reasons: a long enough sample is required for stationarity purposes and in order to capture longer cycles; and around this period many countries went through a period of financial liberalisation, so there is likely to be a structural break between the 1970s and the 1980s. However, we acknowledge that structural breaks are likely to have occurred in some of these countries since 1980.

13 This database covers the period 1870 to 2013. Due to data availability, the time period varies for each country. Note that the only economic variable used in this robustness check is GDP growth, since this database does not provide employment or unemployment data.

14 The turning point method is typically used on monthly and quarterly data; annual data will only be able to pick up major contractions in the cycles, and therefore the cycles are typically longer (Harding 2002). As such, we do not run this robustness check with annual data using the turning point method.

with a longer dataset, we cannot verify that the financial variables have a different cycle length to economic variables.

Given that the robustness checks do not provide evidence that cycles in financial variables differ considerably from cycles in economic variables, we conclude that our results do not provide sufficient evidence for the existence of a financial cycle that is longer than the business cycle. This is not to say that this claim cannot be true, but rather that we cannot find enough evidence to support this claim.

### 3.4.2   How are the financial variables and business variables related?

Despite the fact that we do not have evidence that the length of cycles in financial variables and economic variables differ considerably, it is still important to understand the relationship between these cycles. It is possible that these cycles have different lengths but we cannot prove it due to a lack of data, meaning that there would undoubtedly be times that they are in different phases of the cycle; and, even if they are similar in length, they could be in different phases at the same time. In fact, just observing current and recent events across many countries suggests that developments in financial variables can be at odds with developments in economic variables. If there is a relationship between these cycles, knowing how often the cycles are in the same phase will be useful to help understand how often there might be conflict between the cycles (and the policies that manage them).

Figure 2 presents the estimated cycles in credit growth and GDP growth across the five countries, using the Christiano-Fitzgerald band-pass filter; the longer and shorter cycles shown in this figure correspond to cycles of 8 to 30 years and 2½ to 8 years, respectively. It is clear that the cycles in credit growth and GDP growth are similar, though they are sometimes out of sync, and it looks as though these cycles are related. The longer cycles in credit growth and GDP growth appear to be particularly synchronised in the United States and Australia.

Using the Bry-Boschan turning point algorithm updated in Harding and Pagan (2002), Table 3 presents the average duration of contractions and expansions in the longer and shorter cycles in credit and GDP growth, as well as the degree of synchronisation between these cycles. The length of expansions and contractions are similar for the cycles in credit and GDP growth, suggesting a similar length in the cycles.

Figure 2: Cycles in Credit Growth and GDP Growth

Across countries, year-ended
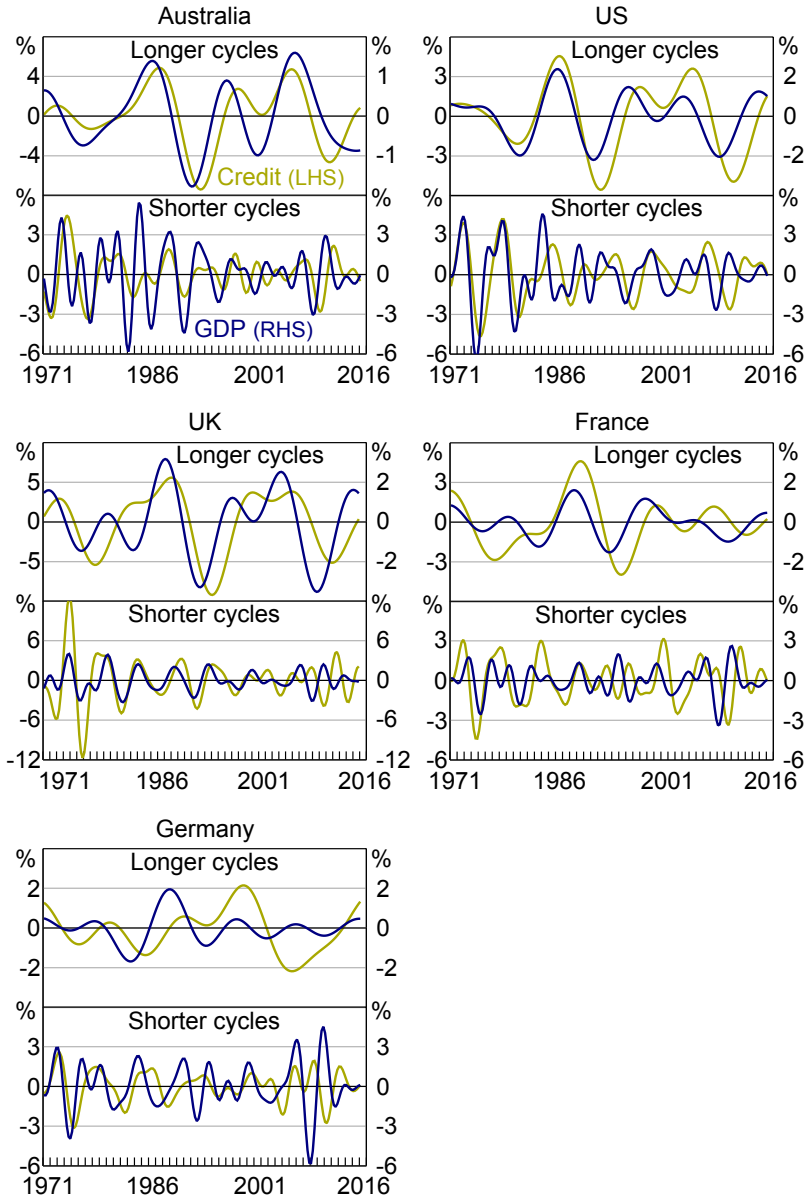
Notes: Cycles are obtained using the Christiano-Fitzgerald band-pass filter; longer (shorter) cycles
correspond to cycle frequencies between 8 and 30 years (2½ and 8 years)

Sources: Authors' calculations; BIS; OECD

Table 3: Synchronisation between Cycles
Average cycle lengths (years) and concordance statistics using
Bry-Boschan quarterly turning point algorithm

	Credit growth		GDP growth		Degree of synchronisation
	Contraction	Expansion	Contraction	Expansion	Concordance statistics
Longer cycles					
Australia	4.8	6.1	5.2	5.2	0.73
United States	5.8	4.4	4.4	4.3	0.77
United Kingdom	5.0	4.2	5.0	4.7	0.57
France	4.3	4.7	4.7	4.3	0.65
Germany	5.1	4.4	6.2	4.6	0.64
Average	**5.0**	**4.8**	**5.1**	**4.6**	**0.67**
Shorter cycles					
Australia	1.6	1.5	1.8	1.5	0.61
United States	2.3	1.7	2.2	1.8	0.55
United Kingdom	2.3	1.9	2.1	1.9	0.60
France	1.7	1.5	1.8	1.6	0.51
Germany	1.9	1.9	2.1	2.1	0.54
Average	**2.0**	**1.7**	**2.0**	**1.8**	**0.57**

Notes: Longer (shorter) cycles correspond to cycle frequencies between 8 and 30 years (2½ and 8 years); concordance statistics represent the proportion of time the cycles are in the same phase
Sources: Authors' calculations; BIS; OECD

In terms of synchronisation, the longer cycles in credit and GDP growth have a higher degree of synchronisation, compared with the shorter cycles in credit and GDP growth. Compared with two random series, which you would expect to be in sync 50 per cent of the time, the longer cycles were in sync 67 per cent of the time on average across the countries, while the shorter cycles were in sync 57 per cent of the time.[15] For the United States and Australia, the longer cycles are in sync for around three-quarters of the time. The high degree of synchronisation between the cycles in the United States and Australia could reflect the importance of the financial services sector to their economies, though it is interesting that we do not find a similar result for the United Kingdom, which also has a large financial sector. In addition to looking at synchronisation *within* countries, we can also estimate the degree of synchronisation *across* countries. Table D1 presents these results and shows that the cycles

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15 We would expect the concordance statistic to be 0.5 for two random series since they do not have a unit root (i.e. there is no drift in the series). It takes drift common to both series to increase the expectation of the concordance statistic above 0.5 (McDermott and Scott 2000).

across countries can be reasonably synchronised, which could mean that the cycles are influenced by international developments as well as domestic factors.

While the cycles in credit and GDP growth have often been in the same phase, there have still been times when they are in different phases. What this means for policymakers depends on the relationship between the cycles. The literature discussed in Sections 2 and 3.1 provides many reasons why a relationship may exist between developments in the financial system and the economy. If we do find evidence of a relationship, developing a better understanding of this relationship should help policymakers to forecast the future paths of the cycles in credit and GDP and set policy accordingly.

A visual inspection of the time series estimates of the cycles suggests that cycles in credit and GDP growth are related. This can also be seen in the cross-correlation between the cycles. In general, we find that lags in the cycles of GDP growth are positively correlated with the cycles in credit growth up to a few years ahead, particularly for the longer cycles (Figure 3).[16] This suggests that cycles in GDP growth could positively lead cycles in credit growth. At the same time, some longer leads/lags in GDP growth cycles are negatively correlated with credit growth cycles. This suggests that cycles in credit growth could negatively lead cycles in GDP growth. Therefore, the relationship could run both ways, or there could just be a one-way relationship with a phase shift.

Figure 3: Cross-correlograms
Cycles in real credit and GDP growth
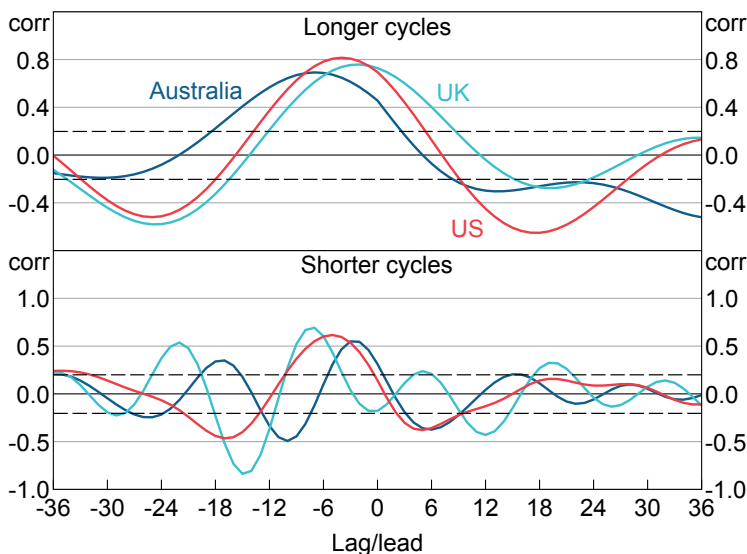
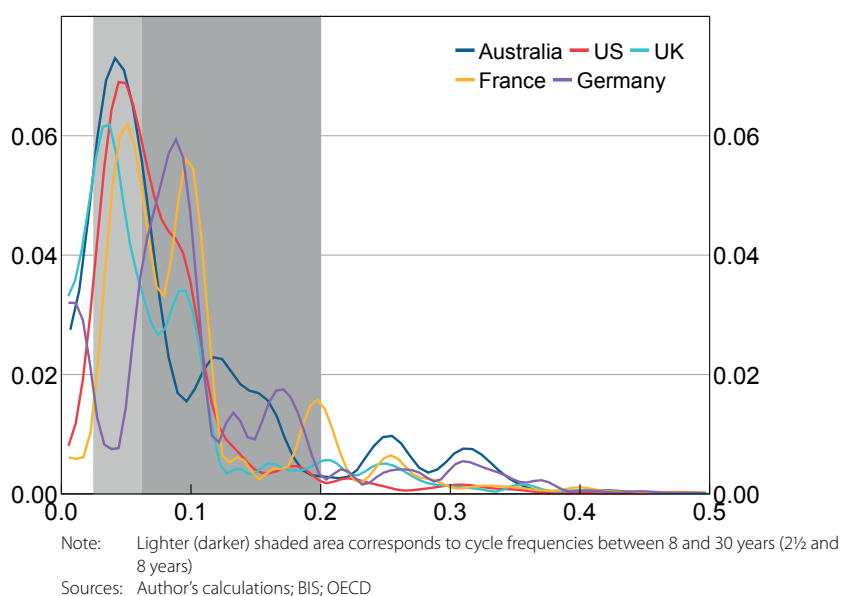Notes: Shows the correlation between the cycle in real credit growth at time 0 with 36 leads and lags of the cycle in real GDP growth; dashed lines represent approximate 95% confidence intervals; longer (shorter) cycles correspond to cycle frequencies between 8 and 30 years (2½ and 8 years)

Sources: Author's calculations; BIS; OECD

16   For the cross-correlograms for France and Germany, see Figure D1.

Moving from the time domain to the frequency domain, Figure 4 presents cross-spectral densities for credit and GDP growth, which are effectively decompositions of the cross-correlation between the cycles in the frequency domain. The co-movement between credit and GDP growth appears to be strongest at lower frequencies; that is, credit and GDP growth tend to co-move more in the longer run. The exception here is Germany, where a significant amount of cross-correlation occurs at frequencies between 2½ and 8 years. Using the phase spectrum, we can determine the lead/lag relationship between credit and GDP growth at different frequencies.[17] While the phase spectrum can often be difficult to interpret, our results suggest that credit growth tends to lead GDP growth at longer frequencies.

Figure 4: Cross-spectral Densities
Real credit and GDP growth

Note: Lighter (darker) shaded area corresponds to cycle frequencies between 8 and 30 years (2½ and 8 years)
Sources: Author's calculations; BIS; OECD

So far, we have only looked at the correlation between the cycles; this does not prove (nor rule out the possibility of) a relationship between credit and GDP growth. Assuming a relationship does exist and abstracting from other variables relevant in this relationship, there are two plausible cases of a causal relationship occurring between credit growth and GDP growth that are consistent with our results and the theory:

- **GDP growth → credit growth**. Changes in GDP growth are independent from changes in credit growth and cause changes in credit growth. The ability of GDP growth to affect credit growth is intuitive in terms of economic theory and is suggested in the results above. In this case, GDP growth leads credit growth and the negative correlation

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17   The phase spectrum can only be meaningfully interpreted at frequencies for which spectral mass is high.

between credit growth and the longer leads/lags of GDP growth merely reflects the same relationship but with a phase shift.

- **Credit growth ↔ GDP growth**. As discussed earlier in the paper it is also entirely reasonable to expect that credit growth can influence GDP growth and this could help to explain some of the results from the cross-correlograms and cross-spectral densities. There is potential for both a positive and negative relationship to exist. For example, a strong rise in credit growth may be associated with a build-up in risks that, if they materialise, could significantly affect the financial system and the economy. There is also the potential for positive effects for the economy during these expansions, including the extension of credit to productive and innovative ventures.

To formally test whether the relationship is one-way, or whether it runs both ways, we employ Granger causality tests. Table 4 presents the p-values from the tests for whether GDP growth Granger causes credit growth and vice versa.[18] Overall, the results suggest that cycles in GDP growth Granger cause cycles in credit growth in all countries. For some countries, there is evidence that cycles in credit growth and GDP growth Granger cause each other, suggesting that the relationship could run both ways.

Table 4: Granger Causality Tests
p-values, 1980:Q1–2016:Q1

Alternative hypothesis	Australia	United States	United Kingdom	France	Germany
Actual data					
Credit growth → GDP growth	**0.04**	0.14	0.75	0.06	0.29
GDP growth → credit growth	**0.03**	**0.03**	**0.01**	**0.04**	0.13
Longer cycles[a]					
Credit growth → GDP growth	0.06	**0.05**	0.39	0.24	**0.01**
GDP growth → credit growth	**<0.00**	**<0.00**	**<0.00**	**<0.00**	**<0.00**
Shorter cycles[a]					
Credit growth → GDP growth	**0.01**	0.18	0.23	0.58	0.09
GDP growth → credit growth	0.10	0.06	**<0.00**	**<0.00**	0.08

Note: (a) Granger causality tests were not possible with the data filtered using a band-pass filter, so these cycles are identified using an HP filter with lambda chosen by optimising the spectral density of the actual series between 8 and 30 years for longer cycles and 2½ and 8 years for shorter cycles
Sources: Authors' calculations; BIS; OECD

18 This analysis only includes data from 1980 onwards, since we believe that the nature of the relationship between GDP growth and credit growth is likely to have changed during financial liberalisation.

Overall, it is clear that there is some lead/lag relationship between credit and GDP growth. The results suggest that GDP growth leads credit growth, but at the same time they do not rule out the possibility that credit growth leads GDP growth. The mixed results imply that we cannot confirm whether the cycle in financial variables leads or lags the cycle in economic variables in the long or short run. In a way, the mixed results are not surprising given the discussion on the links between the financial system and the economy at the beginning of this paper. It is likely that the relationship between credit and GDP growth depends on the circumstances and other factors not captured in this analysis, meaning that in some cases GDP growth will lead credit growth and in other cases credit growth will lead GDP growth. The interpretation of these results is further complicated by the potential for regime switching, for example, due to the presence of the financial liberalisation in the data. However, what is clear from our results is that the cycles are unlikely to be independent of each other and will sometimes be moving in different directions.

4.   Policy Implications

The analysis presented in this paper suggests that there is little evidence to conclude that cycles in financial and economic variables operate at different frequencies – in particular, it is difficult to argue that financial variables have a cycle that is longer than the cycle in economic variables. It is worth noting, however, that we cannot definitively conclude that these two cycles have the same frequency and the results may be subject to type II error (failure to reject the null hypothesis that the peak frequencies are the same when they are, in fact, different). Furthermore, the evidence suggests that developments in economic variables lead those in financial variables, but it is more difficult to conclude the converse. While the power of these tests may not be high, the results suggest that much more evidence is required to establish whether the cycles in these variables are distinct from one another, and if so, why that might be the case.

Unfortunately, our analysis, and those of many other authors, does not give us any insights into what drives these cycles and the mechanisms through which the two cycles affect each other. These are important considerations if we are going to draw some policy implications. Since we are unable to identify the drivers of these cycles, we are limited to considering general scenarios of how they may relate to each other.

It is highly unlikely that the two cycles are independent of each other and have similar frequencies by chance. It is very likely that if the two cycles have a similar frequency, they also have common drivers. As a result, financial variables should be useful in understanding developments in the business cycle.

If the main drivers of the two cycles were real (e.g. productivity), then fluctuations in financial variables, particularly credit, would reflect fluctuations in the need to finance economic activity. Financial variables would be used by policymakers to make an inference about the state of the economy. In this view of the world, the standard policy tools that have typically been used to address cyclical fluctuations in activity, namely fiscal and monetary policy, would continue to be used to 'smooth' out the business cycle and minimise variations in

GDP growth and unemployment, and minimise deviations of inflation from its target. The extent to which fluctuations in each are tolerated will depend on the weights placed on these elements in the policymakers' loss function. Policymakers would only be concerned with, and respond to, fluctuations in financial variables to the extent that these variables are informative about economic conditions.

However, some have argued that the conduct of monetary policy can contribute to the cycles we observe in financial variables (Borio 2012; Juselius *et al* 2016). Borio argues that monetary policy that is too narrowly focused on inflation may not necessarily tighten policy when financial 'booms' occur because inflation is low and stable. This paper suggests a scenario where the potential growth rate of the economy rises, causing credit growth and asset price inflation to rise, but the spare capacity in the economy constrains the monetary authority's ability to respond. We do not find this scenario convincing. The cause of the increase in potential growth matters. If the potential growth rate of the economy increased due to a rise in productivity growth, this would raise the neutral real interest rate in the economy, and soon enough the monetary authority would realise the need to begin to tighten monetary policy, which would reign in any boom in credit and asset prices.

It is possible, however, that some drivers of these cycles could be financial rather than real in nature; that is, drivers that are specific to the financial system and independent of economic conditions. In this case, there could be grounds for policymakers to address cyclical fluctuations in both economic and financial activity. The key question is what these drivers could be.

Many of the financial drivers identified in the literature relate to sentiment, particularly regarding risk, and expectations (especially for asset prices).[19] One mechanism by which a financial cycle can affect the business cycle is through changes in the perception of risk that can affect the propensity for agents to underestimate the risks that they are taking during economic expansions. This leads to agents taking on more risk than they would otherwise, which can be reflected both in the type of investments or portfolio allocations they make and in the amount of leverage they are willing to use to fund these activities. This can be reflected in 'overvalued' assets, expectations of sustained higher asset price inflation, unsustainable levels of debt and lower credit spreads and can, ultimately but not always, lead to higher loan defaults and a contraction in bank lending that results in a contraction of economic activity. This is not to say that it is just households and firms that take these risks; the financial sector can also underestimate risks that lead to imprudent management of its balance sheet. Once growth slows, or a recession begins, perceptions of risk adjust and could even lead to agents overestimating risk, leading to higher spreads and expectations of asset price deflation that can exacerbate the amplitude of the business cycle. The main question is: what causes these changes in perceptions of risk and expectations of asset price inflation? It seems likely that real shocks to the economy will play an important role here.

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19 In this paper, we do not discuss changes to prudential regulation and financial system deregulation, which have affected both real and financial variables and may distort the frequencies that we detect in the data.

If there are financial drivers, the business and financial cycles may sometimes be in different phases. In particular, there will be times when the economy is slowing (including the case where growth is positive but below potential) but there is reasonably high asset price inflation and accelerating credit. This raises the question of how to deal with such situations, whether it should be dealt with at all, and if so, what are the appropriate policy tools to address this confluence of events. The main research questions, which we do not address here, are: what are the market distortions and potential market failures that lead to this, admittedly infrequent, confluence of events? Why would agents continue to borrow (presumably unsustainably)? Why would the financial system continue to lend in this environment? Why are some asset prices not responding to slower growth in the economy? In a first-best world where we understand the answers to these questions and are unconstrained, we would be able to design policies to address the distortions and market failures that produce these outcomes. However, this is not always the case and so we focus on the role of policy in addressing the symptoms of these distortions and market failures, which we refer to as 'financial imbalances'.

4.1   Monetary policy and the financial cycle

Monetary policy has traditionally been used to deal with the business cycle. It is particularly good at doing this because interest rates provide the price signal for agents to intertemporally reallocate resources; during booms, interest rates rise and encourage agents to push economic activity into the future, while during downturns rates are lowered and encourage agents to bring economic activity forward from the future. Monetary policy does this to both keep unemployment around the non-accelerating inflation rate of unemployment and inflation around its target. However, by adjusting interest rates, monetary policy also has an effect on credit growth and asset price inflation. So if the economic conditions and inflation warrant lower interest rates but credit growth and asset price inflation are still 'too high', should monetary policy be used to curtail the potential risks this might pose to economic activity in the future?

Traditionally, the policymaking framework has focused on the role of monetary and fiscal policy to moderate the business cycle, and prudential policy to address the risks in the financial system.[20] The risks discussed in the financial cycle literature do not just consider the risks on financial institutions' balance sheets, but also the risks on private sector non-financial balance sheets. These risks can be magnified by asset prices that are too high and inflating at a rapid rate, and credit growing at an 'unsustainable' pace.

A *laissez-faire* view of this problem is that markets are efficient and that households and firms know the risks they are taking; they will bear the consequences if those risks materialise. Therefore, to the extent that these risks are idiosyncratic and uncorrelated, and that prudential policy has been applied appropriately, there is no need for further policy intervention. Another argument, however, is that these risks across households and firms are correlated, and that externalities related to a number of households and firms experiencing financial distress at once are large and negative – those who were more prudent in their decision-making would

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20 We will mostly ignore the role of fiscal policy in this paper.

still be affected if these risks materialised. Under such a scenario, there should be a policy intervention to ensure that these particular risks are managed appropriately and that the consequences of such a scenario are minimised.

The conundrum for monetary policy is that there are a number of channels by which it can affect risk-taking behaviour. Lower interest rates can encourage banks to take on more risks such as higher leverage, greater maturity mismatch and easier lending standards (Gambacorta 2009; Agur and Demertzis 2015). Lower interest rates can also encourage investors to 'search for yield' and to expose themselves to more risk (Rajan 2005). Together, these are often referred to as the 'risk-taking channel' of monetary policy (Borio and Zhu 2012; Bruno and Shin 2015). In addition, higher asset prices resulting from lower rates increases the value of collateral, potentially encouraging greater borrowing and creating an asset price boom fuelled by credit. Alternatively, higher interest rates increase debt repayment burdens, which can potentially lead to higher default rates (Sengupta 2010). Higher interest rates also put pressure on banks' funding costs, thereby compressing their profit margins and potentially encouraging them to engage in riskier lending (Agur and Demertzis 2015). Exchange rate appreciations associated with interest rate increases can encourage foreign currency borrowing, which can pose significant risks to unhedged foreign currency borrowers during any subsequent depreciation.

Agur and Demertzis (2015) finds that the 'risk-taking channel' tends to dominate banks' risk-taking behaviour during the upswing of a financial cycle, while the profitability channel tends to dominate during the contraction phase. Drawing on this result, the scenario outlined above where the macroeconomy is in a contractionary phase but the financial cycle is in an expansionary phase would put some pressure on the central bank to ease policy, but this could encourage more risk-taking at a time when these risks may already be unacceptably high. The choice a central bank makes in this situation will depend on how much value it places on achieving its objectives in the long term versus the short term. In the case of an inflation-targeting central bank, the other consideration would be the effect on inflation expectations, as a protracted deviation from the inflation target could lead to a shift in expectations and therefore make the inflation objective harder to achieve in the long term.

Despite the potential for short-term conflict, in the long run price stability should have some positive spillovers for financial stability, and vice versa, since a stable macroeconomic environment and a stable financial environment are necessary conditions for each other (Smets 2013). Furthermore, to the extent that easier monetary policy can raise inflation and nominal income growth, this should help reduce the debt repayment burdens for borrowers. Also, during a downturn, some risk-taking may be desirable to encourage more investment and growth. The difficulty for central banks is determining what amount of risk is desirable and when those financial risks become material enough to potentially pose a threat to macroeconomic stability. This is where prudential policy plays an important role. Smets (2013) and Maddaloni and Peydró (2013) find evidence that the effect of lowering interest rates on banks' risk-taking is reduced under more rigorous prudential policy. Therefore, one avenue to manage these risks is through prudential policy.

This begs the question as to what instruments should be used to address price and economic stability, and whether we can rely on one instrument to manage the business and financial cycles (assuming there are times they are in conflict). Tinbergen (1952) suggests that the number of policy instruments that should be used is the same as the number of policy objectives. Policy instruments should be used to achieve the objectives they can most efficiently attain. This principle would suggest that monetary policy should focus on targeting price stability, where it has been proven effective, and leave other instruments to target other policy objectives. Since the nominal interest rate is only one tool, can it be expected to effectively achieve its traditional objectives in addition to managing the financial cycle?

4.2 Macroprudential policy

Due to the blunt nature of monetary policy, many papers have concluded that using it to target concerns regarding risks to the financial system would require large changes in interest rates, which would be costly and inefficient, particularly when the risks are building up in a specific area of the financial system (e.g. Alpanda, Cateau and Meh 2014; Svensson 2016). In contrast, macroprudential policy consists of a range of tools, which means it can have greater flexibility to manage specific risks and allow monetary policy to focus on its primary objectives. The most common macroprudential tools include: caps on loan-to-valuation ratios (LVRs); minimum serviceability requirements; and capital requirements. These tools can be targeted to address the build-up of risks for particular sectors – such as the household sector – and strengthen the financial system's resilience.

It is unlikely that macroprudential policy is capable of perfectly addressing all types of risks that build up during the expansionary phase of a financial cycle. One clear side effect of using macroprudential policy to restrict lending to a particular sector of the economy is the diversion of borrowers to unregulated financial institutions (the shadow banking system) where policymakers tend to have limited influence; in this case, a blunt tool such as monetary policy could be more effective by controlling the cost of funds (according to Stein (2013), monetary policy 'gets in all of the cracks').

Another drawback is the uncertainty around the effectiveness of some macroprudential tools. The effectiveness is likely to vary depending on the type of tool used and the circumstances in which it is used (Cerutti, Claessens and Laeven 2015). Moreover, it can be difficult to measure the effectiveness of macroprudential tools for a number of reasons, including the lack of a clear and quantifiable target and limited experience with using these tools in the post-crisis period. Furthermore, it is not entirely clear under what circumstances these instruments would be effective and when they would be ineffective. For example, Guibourg *et al* (2015) suggests that countercyclical capital requirements would not have been sufficient to stop rapid credit growth in the lead-up to the financial crisis in the United Kingdom and Spain.

There are also significant institutional issues related to macroprudential policy. For the macroprudential tools to be a useful part of the policy arsenal, it must be clear that they can be used without political interference. That is, the responsible authority must have the independence to use the tools at its disposal. There is the question of who should be in

control of these instruments, particularly when the financial regulator and central bank are separate. Macroprudential policy determined by the central bank would require the financial regulator to implement these policies. It would be unclear, in this instance, which institution would be accountable for the use of the tools. Finally, there is a question as to how quickly some policies can be implemented and enforced – if the time required is too long, risks may have materialised before the policies can be implemented, by which time the policies may need to be abandoned.

The other drawback of trying to use macroprudential tools to manage financial risks in the economy is that they could alter the risk profile of projects being undertaken as lending to the private sector becomes a binding constraint on economic activity. While these policies may be effective, they can be just as blunt as monetary policy. This means that some viable, albeit riskier, investments may be denied funding, which could result in less funding for innovation that would have otherwise helped to drive higher productivity growth.

4.3   Implications for monetary policy

Despite these potential limitations and costs, macroprudential policy would still be a valuable complement by helping to manage some risks as monetary policy tries to stabilise economic activity. This means that we need to consider how monetary and macroprudential policies might interact. These policies should move together and reinforce each other when the cycles are in sync. However, when the business and financial cycles are out of sync, these policies may pull in different directions and counteract the effect of the other. We know from the previous section that the stance of monetary policy can influence the build-up of risks and therefore the appropriate stance of macroprudential policy. What is of interest in this section is how changes in macroprudential policy, responding to a change in financial imbalances either related or unrelated to the stance of monetary policy, will affect the transmission of monetary policy.

To some extent, this type of discussion is not new; there has been extensive research on the interactions between policies, most notably monetary and fiscal policy (the most obvious example being Sargent and Wallace (1981)). In the case of monetary and fiscal policy, both policies arguably target the business cycle and therefore have similar objectives; however, these policies have different tools and any conflict tends to come from political constraints.

We expect there to be some overlap in transmission channels between monetary and macroprudential policies since both policies work to achieve their objectives by affecting the price and quantity of credit in the economy as well as asset prices. The extent to which the interactions between these policies are significant will depend on the nature of the macroprudential tool that is being used (Dunstan 2014). In particular, it seems reasonable to expect that a broad-based macroprudential tool will have different implications for monetary policy than a narrow tool (i.e. one that targets a specific sector, institution or market).

Macroprudential tools that affect the distribution of credit, such as LVR limits, will likely affect the functioning of monetary policy's wealth and balance sheet channels, since these tools are

most effective in tempering rapid credit and asset price growth. For example, a tightening in these tools can reduce the effect of lower interest rates on housing price inflation, which can lead to lower household consumption through the wealth effect and tighter borrowing constraints due to lower collateral values. As a result, the demand and inflation outlook is likely to be lower than if a tightening of macroprudential policy had not occurred.

Capital-based macroprudential tools can alter the price and supply of credit since equity funding is generally more expensive than debt funding (Harimohan and Nelson 2014). In response to higher capital requirements, banks have the option to increase retained earnings through lower dividend payouts, to issue new capital and pass through higher funding costs to borrowers in the form of higher lending rates, or to change the composition or size of their lending portfolio. All options can have implications for the outlook for demand and inflation; for example, changes to banks' assets could reduce the supply of credit. Higher lending rates could offset some of the effects that accommodative monetary policy has in encouraging borrowing and current consumption. Though, if banks do choose to raise new capital, it is possible that more intense competition can limit their ability to pass on higher lending rates to borrowers.

Liquidity-based tools can affect banks' holding of illiquid assets, alter credit supply (e.g. long-term lending) and, to the extent that they weigh on bank profitability, may result in higher lending rates. In addition, banks may have to change their funding profiles, which can make funding more expensive. This would also be passed on to customers (e.g. higher lending rates), which would reduce the effectiveness of monetary policy.

Overall, it appears that when the cycles are in sync, macroprudential policy should reinforce monetary policy. When the cycles are out of sync, macroprudential policy may work against monetary policy by counteracting its effects on the price and quantity of credit in the economy, and therefore domestic demand and inflation. However, this will vary depending on the type and scope of the macroprudential tools used. Some coordination of monetary and macroprudential policies will be required to ensure that all objectives can be achieved and all trade-offs are managed over an appropriate horizon.

Despite the drawbacks of macroprudential policy as well as the potential for monetary and macroprudential to interact, we believe that it is not ideal to use monetary policy to manage the financial cycle by itself; it seems reasonable to think that macroprudential policy should play a part. There are some reasonable arguments for central banks to consider their effect on financial risks when determining the appropriate course of action for monetary policy. However, we would agree with the view expressed by Peter Praet (2016) that the first line of defence must be a strong institutional and legal framework that directly targets the distortions and market failures that allow financial imbalances to occur.

5. Conclusion

Since the global financial crisis, there has been substantial work to identify the causes of the crisis and understand how future crises can be prevented. Among this work, it has been proposed, and has become commonly accepted, that there is a financial cycle that is longer than the business cycle and which should be managed separately from the business cycle. Our results suggest that there is not enough evidence to conclude that the financial cycle is longer than the business cycle. Nonetheless, even if these cycles are similar in length, there could still be reasons for policymakers to address developments in the financial system. In particular, we find that the financial and business cycles are not always synchronised and could potentially influence each other. Generally, we expect the business cycle will lead the financial cycle, but our results and observations from financial crises suggest that it is also possible for financial developments to have a significant effect on economic activity.

While the literature suggests that monetary policy does have an effect on the financial cycle, we argue that there are limitations on its ability to manage the business and financial cycles at the same time. Although it is not a perfect solution, macroprudential policy has the flexibility to help manage the financial cycle, but if it were to be used, it would need to be coordinated with monetary policy to achieve policymakers' economic and financial objectives, and to ensure that the trade-offs are being managed appropriately across all the tools being used.

What our analysis does not do, nor do many other papers, is explain the drivers of these cycles. There is a very lengthy research agenda in the profession that has tried to explain business cycles and, while our understanding has improved in this process, our knowledge is still fairly limited. If that experience is anything to go by, it will take a long time to get a decent understanding of what drives financial cycles, if they exist.

Appendix A: Data Sources

Table A1: Data Sources and Available Data

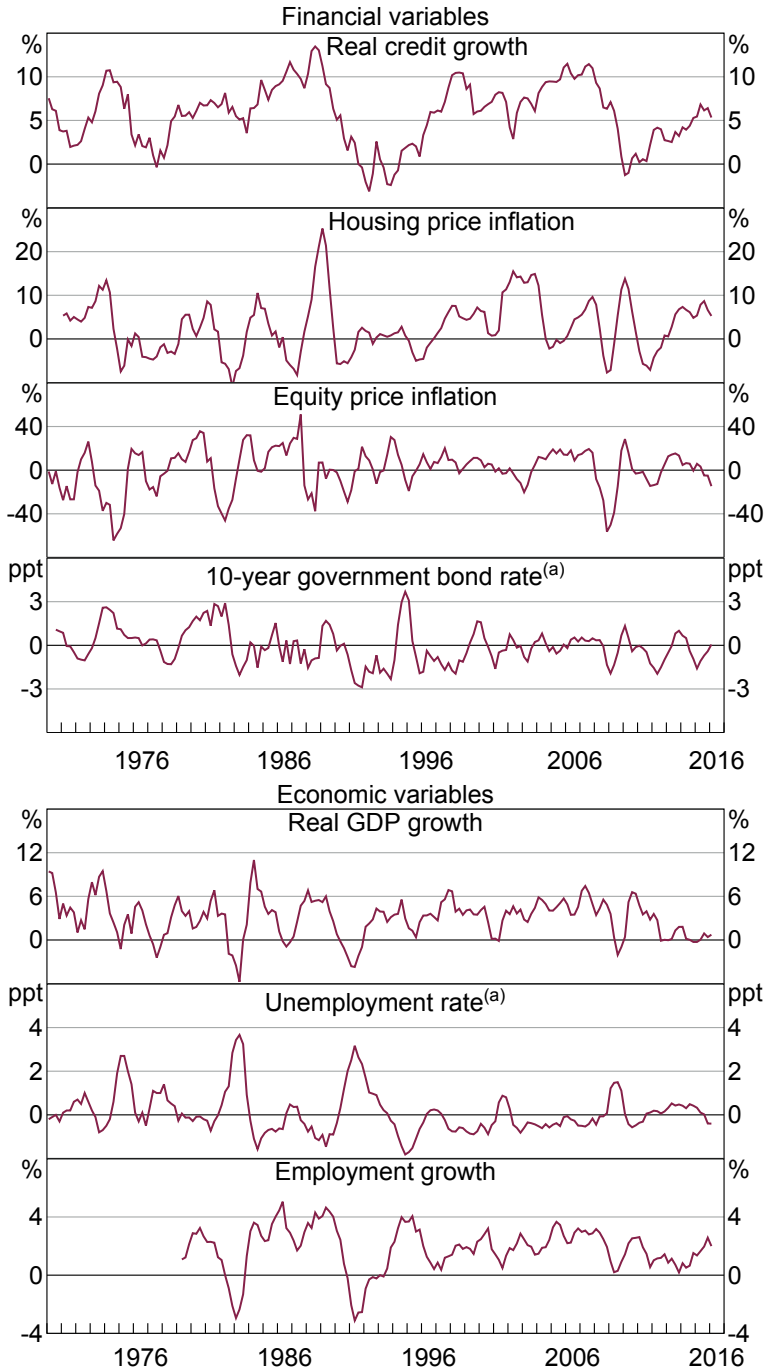|	Australia	United States	United Kingdom	France	Germany
Credit	BIS (1953:Q4– 2016:Q1)	BIS (1952:Q4– 2016:Q1)	BIS (1963:Q1– 2016:Q1)	BIS (1969:Q4– 2016:Q1)	BIS (1948:Q4– 2016:Q1)
Housing prices	BIS (1970:Q1– 2016:Q1)	BIS (1970:Q1– 2016:Q1)	OECD (1968:Q2– 2016:Q1)	BIS (1970:Q1– 2016:Q1)	BIS (1970:Q1– 2016:Q1)
Equity prices	OECD (1958:Q1– 2016:Q1)	OECD (1957:Q1– 2016:Q1)	OECD (1958:Q1– 2016:Q1)	OECD (1957:Q1– 2016:Q1)	OECD (1960:Q1– 2016:Q1)
10-year government bond rate	OECD (1969:Q3– 2016:Q1)	OECD (1953:Q2– 2016:Q1)	OECD (1960:Q1– 2016:Q1)	OECD (1960:Q1– 2016:Q1)	OECD (1956:Q2– 2016:Q1)
GDP	OECD (1959:Q3– 2016:Q1)	OECD (1947:Q1– 2016:Q1)	OECD (1955:Q1– 2016:Q1)	OECD (1949:Q1– 2016:Q1)	OECD (1970:Q1– 2016:Q1)
Employment	ABS (1978:Q1– 2016:Q1)	Bureau of Labor Statistics (1939:Q1– 2016:Q1)	Bank of England (1950:Q3– 2016:Q1)	INSEE (1970:Q4– 2016:Q1)	OECD (1962:Q1– 2016:Q1)
Unemployment rate	OECD (1966:Q3– 2016:Q1)	OECD (1955:Q1– 2016:Q1)	OECD (1955:Q1– 2016:Q1)	OECD (1967:Q4– 2016:Q1)	OECD (1968:Q4– 2016:Q1)
CPI	OECD (1948:Q4– 2016:Q1)	OECD (1955:Q1– 2016:Q1)	OECD (1955:Q1– 2016:Q1)	OECD (1955:Q1– 2016:Q1)	OECD (1955:Q1– 2016:Q1)

Table A2: Summary Statistics
1970:Q1–2016:Q1

	Australia	United States	United Kingdom	France	Germany
Financial variables					
Credit growth	5.7	3.4	4.6	3.7	2.7
	(3.6)	(3.4)	(6.2)	(2.9)	(2.8)
Housing price inflation	2.8	1.6	3.3	1.9	−0.3
	(6.4)	(6.1)	(9.4)	(4.8)	(2.5)
Equity price inflation	0.3	2.2	1.1	2.1	2.0
	(19.6)	(16.4)	(19.2)	(22.3)	(20.6)
10-year government bond rate (Δ_4)	−0.1	−0.1	−0.2	−0.2	−0.2
	(1.3)	(1.2)	(1.3)	(1.2)	(1.0)
Economic variables					
GDP growth	3.1	2.2	2.4	2.2	1.8
	(2.7)	(2.5)	(2.9)	(2.1)	(2.4)
Employment growth	1.8	1.4	0.3	0.6	0.4
	(1.6)	(1.9)	(1.4)	(1.4)	(1.6)
Unemployment rate (Δ_4)	0.1	0.0	0.1	0.2	0.1
	(1.0)	(1.1)	(1.1)	(0.6)	(0.8)

Notes: This table presents the means and standard deviation (in parentheses); all nominal variables are expressed in real terms; some variables cover shorter time periods; house price inflation data starts in 1971:Q1, with an exception for the United Kingdom; GDP growth and employment growth data for France start in 1971:Q1 and 1972:Q1, respectively; employment growth data for Australia starts in 1979:Q1
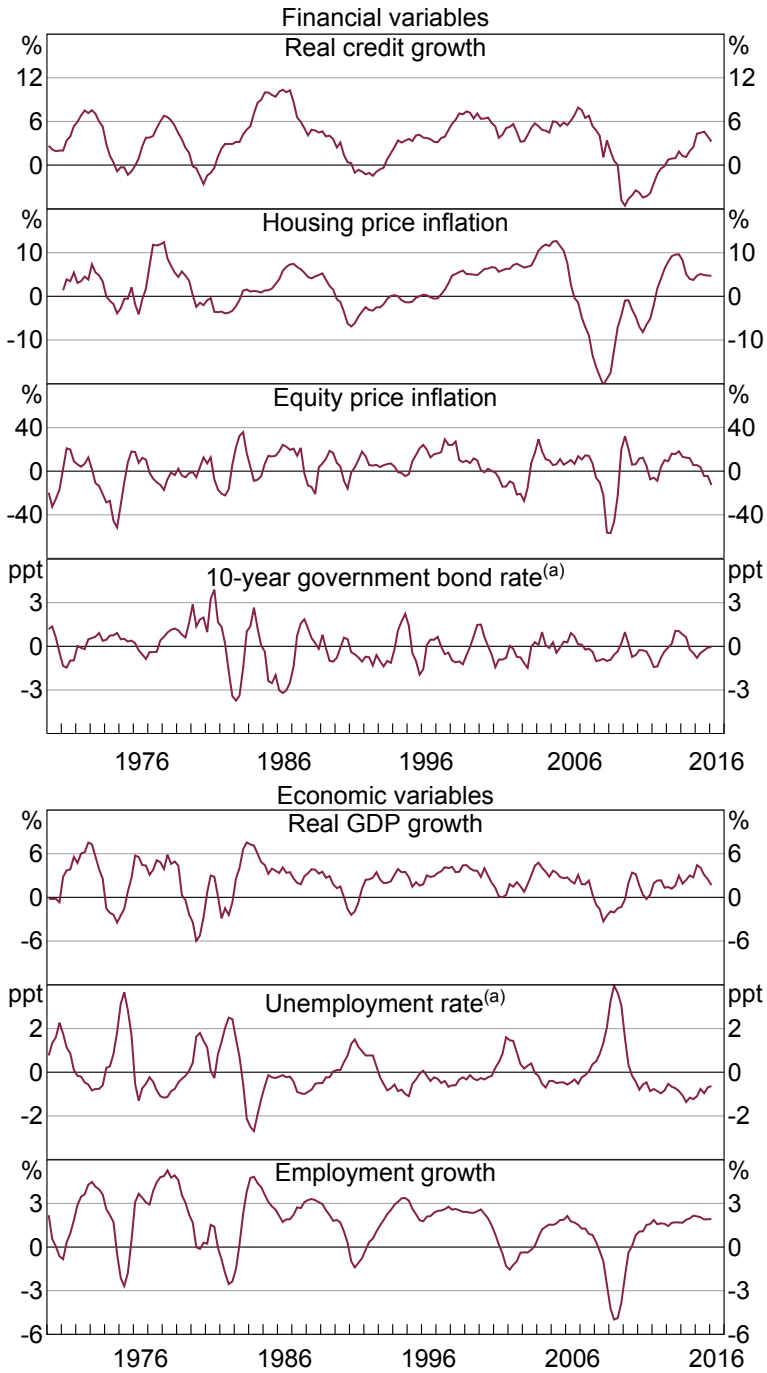
Sources: ABS; Authors' calculations; Bank of England; BIS; Bureau of Labor Statistics; INSEE; OECD

Figure A1: Australia

Financial variables

Real credit growth

Housing price inflation

Equity price inflation

10-year government bond rate[a]

Economic variables

Real GDP growth

Unemployment rate[a]

Employment growth

Notes: Growth rates are year-ended
          (a) Annual change in rate
Sources: ABS; Authors' calculations; BIS; OECD

Figure A2: United States

Financial variables

Real credit growth

Housing price inflation

Equity price inflation

10-year government bond rate[a]

1976   1986   1996   2006   2016

Economic variables

Real GDP growth

Unemployment rate[a]

Employment growth

1976   1986   1996   2006   2016
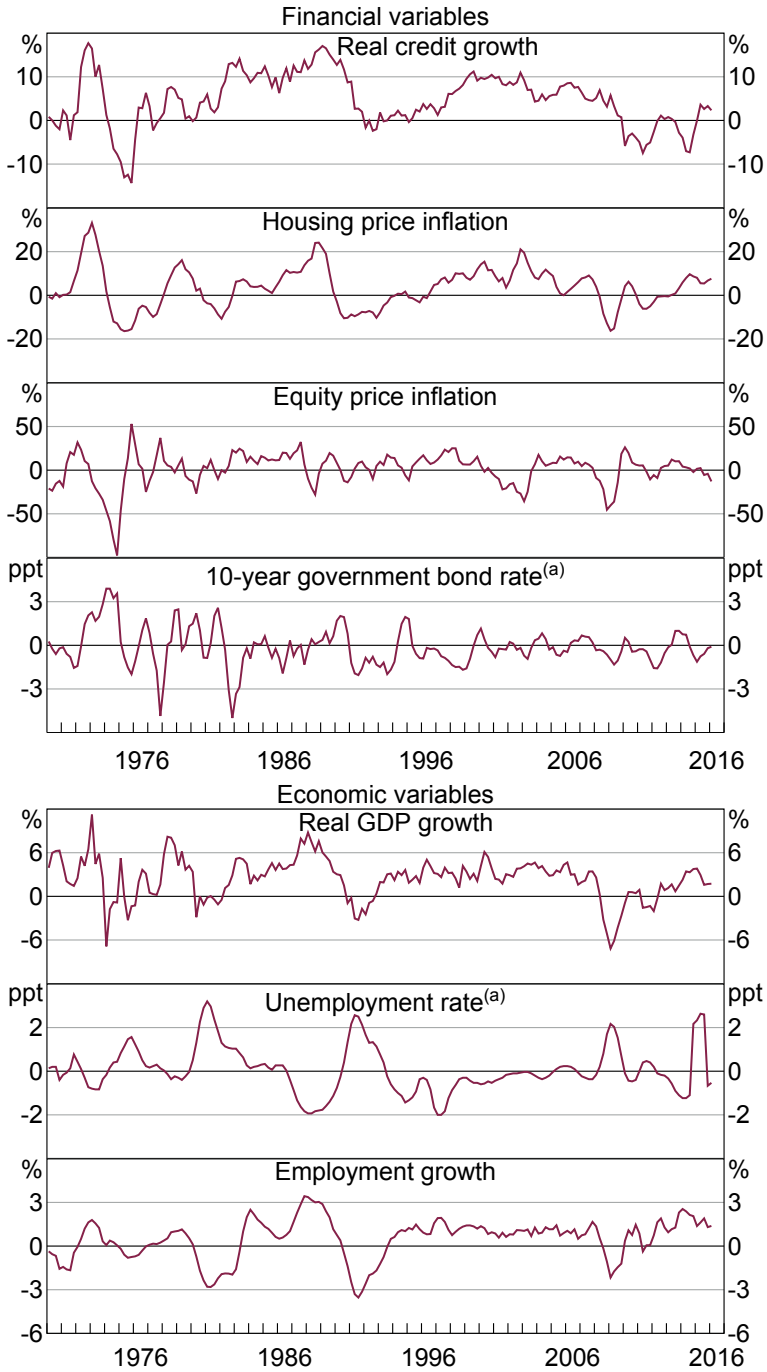
Notes: Growth rates are year-ended
           (a) Annual change in rate
Sources: Authors' calculations; BIS; Bureau of Labor Statistics; OECD
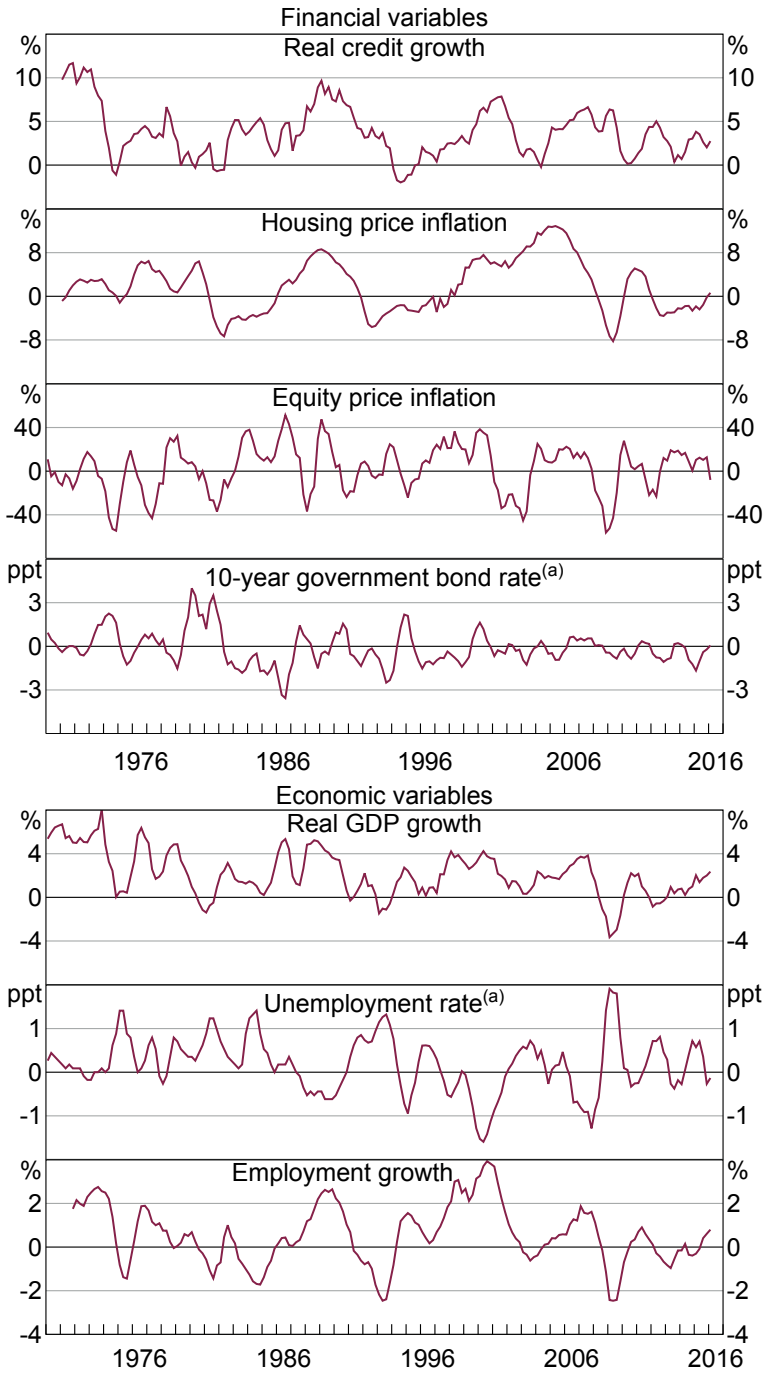
Figure A3: United Kingdom

Financial variables

Real credit growth

Housing price inflation

Equity price inflation

10-year government bond rate[a]

Economic variables

Real GDP growth

Unemployment rate[a]

Employment growth

Notes: Growth rates are year-ended
          (a) Annual change in rate
Sources: Authors' calculations; Bank of England; BIS; OECD

Figure A4: France

Financial variables

Real credit growth

Housing price inflation

Equity price inflation

10-year government bond rate[a]

1976   1986   1996   2006   2016

Economic variables

Real GDP growth

Unemployment rate[a]

Employment growth

1976   1986   1996   2006   2016

Notes: Growth rates are year-ended
          (a) Annual change in rate
Sources: Authors' calculations; BIS; INSEE; OECD

Figure A5: Germany
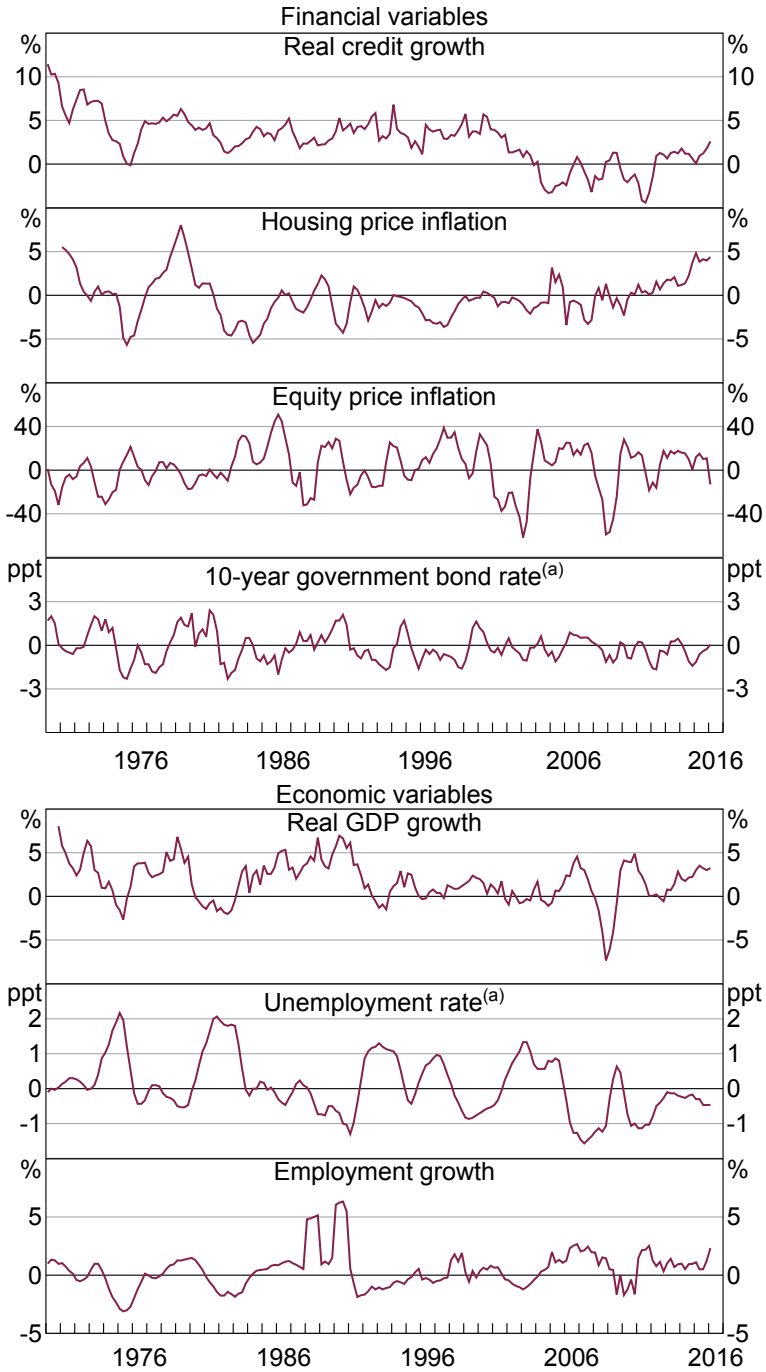
Financial variables

Real credit growth

Housing price inflation

Equity price inflation

10-year government bond rate[a]

Economic variables

Real GDP growth

Unemployment rate[a]

Employment growth

Notes: Growth rates are year-ended
              (a) Annual change in rate
Sources: Authors' calculations; BIS; OECD

Appendix B: Cycles in Stocks and Flows

We assume a continuous time model. All debt is taken out at time τ and is fully paid-off by period $\tau + T$ (i.e. it is T-period debt). Let $D_\tau(t)$ be the debt outstanding at time t for debt drawn down at time τ. For credit-foncier debt, the general expression for the outstanding balance of debt at time t is given by

$$D_\tau(t) = D_\tau(\tau)\left(e^{R(t-\tau)} - \frac{e^{RT}\left(e^{R(t-\tau)} - 1\right)}{e^{RT} - 1}\right) \text{ if } \tau \leq t \leq \tau + T$$

$$= 0 \text{ otherwise}$$

At time t, the total outstanding stock of debt $S(t)$ is equal to the sum of all outstanding debt drawn down between period $t - T$ and t

$$S(t) = \int_{t-T}^{t} D_\tau(t) d\tau$$

Now, suppose the flow of new debt, $D_\tau(\tau)$ in period τ has a cycle. So let $D_\tau(\tau) = A\sin(\alpha\tau) + B$. Without loss of generality we assume that there is no phase shift.

Then it can be shown that

$$S(t) = -A\frac{e^{Rt}}{e^{RT} - 1}\left(\frac{e^{-Rt}}{R^2 - \alpha^2}\right)\left(-R\sin(\alpha t) - \alpha\cos(\alpha t) + Re^{Rt}\left(\sin(\alpha(t-T)) - \alpha e^{RT}\cos(\alpha(t-T))\right)\right)$$

$$+ \frac{A}{\alpha}\frac{e^{RT}}{e^{RT} - 1}\left(\cos(\alpha(t-T)) - \cos(\alpha t)\right) - \frac{B}{R} + BT\frac{e^{RT}}{e^{RT} - 1}$$

So $S(t)$ has frequency $\dfrac{2\pi}{\alpha}$, albeit with a phase shift.

Details on the derivations are available from the authors upon request.

Appendix C: Robustness Checks

Table C1: Estimates of Financial and Business Cycles – Robustness Check Using a Shorter Sample
Peaks in multivariate spectra

	Financial cycles		Business cycles	
	Years	95% confidence interval	Years	95% confidence interval
Australia	8.1	[3.2, 24.2]	4.3	[3.3, 14.5]
United States	8.1	[6.0, 36.3]	8.1	[4.3, 14.5]
United Kingdom	12.1	[2.7, 36.3]	8.1	[4.8, 14.5]
France	10.4	[4.8, 24.2]	9.1	[4.8, 72.5]
Germany	8.1	[3.2, 72.5]	10.4	[4.5, 14.5]

Note: Sample size limited to 1980:Q1–2016:Q1 for all countries
Sources: ABS; Authors' calculations; Bank of England; BIS; Bureau of Labor Statistics; INSEE; OECD

Table C2: Estimates of Financial and Business Cycles – Robustness Check Using Fewer Financial Variables
Peaks in multivariate spectra

	Financial cycles[a]		Business cycles	
	Years	95% confidence interval	Years	95% confidence interval
Australia	14.5	[4.3, 18.1]	4.3	[3.3, 14.5]
United States	12.9	[7.5, 22.6]	5.7	[4.3, 11.3]
United Kingdom	13.4	[4.7, 23.5]	8.5	[4.7, 13.4]
France	12.6	[4.9, 17.7]	9.8	[3.1, 17.7]
Germany	12.9	[6.4, 45.3]	9.1	[4.8, 22.6]

Note: (a) Only includes credit growth and housing price inflation
Sources: ABS; Authors' calculations; Bank of England; BIS; Bureau of Labor Statistics; INSEE; OECD

**Table C3: Estimates of Financial and Business Cycles –
Robustness Check Using Fewer Financial Variables**

Average cycle lengths (years) using Bry-Boschan quarterly turning point algorithm

	Financial variables[a]			Economic variables[b]		
	Contraction	Expansion	Cycle	Contraction	Expansion	Cycle
Australia	na[c]	na[c]	na[c]	1.3	5.1	6.4
United States	2.3	9.6	11.5	1.7	4.5	6.8
United Kingdom	6.4	5.6	8.2	1.2	5.3	6.5
France	3.8	4.9	9.8	1.3	4.3	5.6
Germany	2.8	0.5	3.3	1.9	3.5	5.5

Notes: (a) Only includes credit and housing prices
(b) Includes GDP, employment and the (negative of the) unemployment rate
(c) Insufficient number of cycles identified
Sources: ABS; Authors' calculations; Bank of England; BIS; Bureau of Labor Statistics; INSEE; OECD

**Table C4: Estimates of Financial and Business Cycles –
Robustness Check Using a Longer Sample**

Peaks in multivariate spectra

	Financial cycles		Business cycles[a]	
	Years	95% confidence interval	Years	95% confidence interval
Australia	4.2	[2.6, 42.0]	6.7	[2.2, 30.3]
United States	7.9	[5.2, 49.5]	6.2	[5.0, 19.8]
United Kingdom	13.0	[4.2, 18.2]	7.6	[2.5, 91.0]
France	14.1	[6.3, 56.5]	12.6	[2.6, 56.5]
Germany	12.7	[2.0, 29.7]	12.7	[3.0, 29.7]

Notes: Using the annual Jordà *et al* (2017) database, data from 1920 onwards
(a) The only economic variable available in this database is GDP growth
Sources: Authors' calculations; Jordà *et al* (2017)

Appendix D: Synchronisation of Cycles across Countries

Table D1 suggests that the degree of synchronisation between longer cycles in credit growth has been highest between the United States, the United Kingdom and Australia. For longer cycles in GDP growth, the degree of synchronisation has been highest between the United States and the United Kingdom, and between France and Germany. These results are largely to be expected. The connections between the United Kingdom and the United States are likely to reflect strong financial and economic linkages. The results for France and Germany are likely to reflect the presence of strong regional economic and financial linkages, as well as common exposures to other European countries. Being a small, open resource-based economy, Australia's longer cycle in GDP growth does not seem to be substantially linked to those in the larger advanced economies; on the other hand, the longer cycle in credit growth appears to have been highly connected with the credit cycles in the United States and the United Kingdom. These results highlight that in addition to domestic conditions, conditions in other countries might also matter for the financial and business cycles.

**Table D1: Synchronisation in Longer Cycles across Countries**
Concordance statistics using Bry-Boschan quarterly turning point algorithm

	Australia	United States	United Kingdom	France	Germany
Cycles in credit growth					
Australia	1.00				
United States	0.85	1.00			
United Kingdom	0.87	0.73	1.00		
France	0.50	0.34	0.61	1.00	
Germany	0.43	0.39	0.50	0.60	1.00
Cycles in GDP growth					
Australia	1.00				
United States	0.65	1.00			
United Kingdom	0.62	0.82	1.00		
France	0.45	0.36	0.52	1.00	
Germany	0.57	0.50	0.68	0.83	1.00

Note: Concordance statistics represent the proportion of time the cycles are in the same phase
Sources: Authors' calculations; BIS; OECD

Figure D1: Cross-correlograms
Cycles in real credit and GDP growth
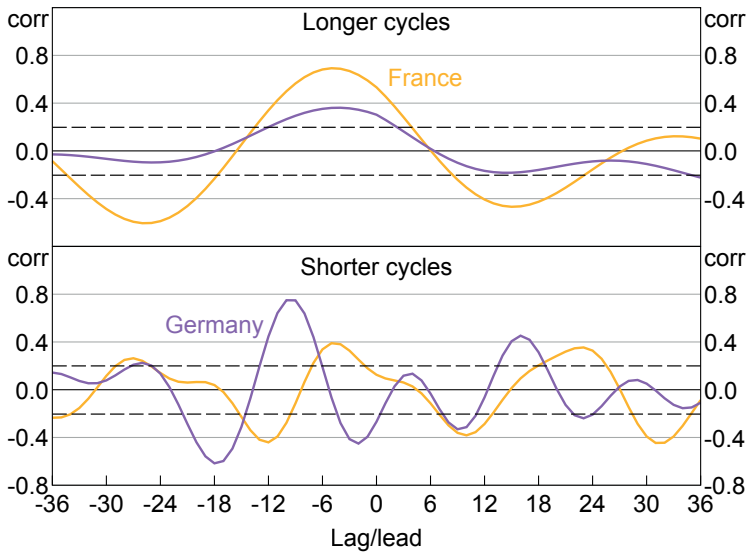
Notes: Shows the correlation between the cycle in real credit growth at time 0 with 36 leads and lags
of the cycle in real GDP growth; dashed lines represent approximate 95% confidence intervals;
longer (shorter) cycles correspond to cycle frequencies between 8 and 30 years (2½ and
8 years)

Sources: Author's calculations; BIS; OECD

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Discussion

1.   Piti Disyatat

In the wake of the global financial crisis, interest in studying the interaction between financial developments and the real economy has surged. One particular strand has focused on characterising the financial cycle. A number of papers, most prominently Drehmann, Borio and Tsatsaronis (2012), have shown that financial cycles tend to be much longer in duration as well as higher in amplitude compared to business cycles. The paper by Cagliarini and Price adds to this literature by examining the robustness of these conclusions in two key respects. First, it uses spectral analysis that does not *a priori* pin down the frequency of fluctuations to more flexibly characterise business and financial cycles. Second, they conduct the analysis across a number of countries to see how general the result is. The paper also offers a very balanced – and in some sense, because the authors do not take a firm stance one way or another, a *too* balanced – discussion of the pros and cons of using monetary and macroprudential policy to address financial stability objectives. Overall, they conclude that monetary policy may have a role, but as a last resort when all other tools have been exhausted.

The paper does a commendable job in both of the aspects above and the extensive literature review undertaken makes it a very useful entry point for those new to the debate. My comments centre around two main issues.

First is the presumption that business and financial cycles can be measured separately. The paper purports to investigate whether there exists financial cycles that are 'separate' and 'distinct' from business cycles. But the more relevant question to me is how business and financial cycles *interact* with one another and what the underlying drivers are. Given the intricate relationship between financial developments and economic activity, it would seem that one has no choice but to characterise them *jointly*. That is, one cannot have a view about the business cycle without implicitly having a view about the financial cycle and how it relates to the real economy. I will illustrate this below.

The second issue is that the paper seems to treat financial and business cycles as objectively measurable things that, once characterised, can be used to make judgements about policy trade-offs. But both business and financial cycles are *endogenous* to policy. And this endogeneity goes beyond just cyclical fluctuations; policy may have a very persistent effect on the trend itself so that the standard separation of trend from the cycle becomes problematic. Blanchard, Cerutti and Summers (2015), Martin, Munyan and Wilson (2015), and Reifschneider, Wascher and Wilcox (2015) provide a discussion of this issue.

In what follows, I elaborate on these points, drawing on some recent collaborative work that I have done (Juselius *et al* 2017). The starting point is a characterisation of the financial cycle based on two long-run relationships that together pin down the long-run sustainable credit-to-GDP ratio.

The first relationship relates the credit-to-GDP ratio to real asset prices and can be seen as a proxy for the role of collateral constraints. Deviations of this relationship from its long-run value are referred to as the *leverage gap*, $\widetilde{lev}_t$, which can be expressed as

$$\widetilde{lev}_t = (cr_t - y_t) - (p_{A,t} - p_t) - \overline{lev} \tag{1}$$

where cr_t is credit extended to the non-financial private sector, y_t is output, $p_{A,t}$ is a real asset price index, p_t is the consumer price level and $\overline{lev}$ is a steady-state constant. The asset price index is constructed from residential property prices, commercial property prices and equity prices (see Juselius and Drehmann (2015) for details).

The second relationship is between the credit-to-GDP ratio and the lending rate on the debt outstanding, and captures the effect of cash flow constraints that households face due to interest payments (e.g. Hughson *et al* 2016). Deviations of this relationship from its long-term value are referred to as the debt-service gap, $\widetilde{dsr}_t$, and can be written as

$$\widetilde{dsr}_t = (cr_t - y_t) + \beta_{dsr} i_{L,t} - \overline{dsr} \tag{2}$$

where $i_{L,t}$ is the nominal average lending rate on the stock of credit, and $\overline{dsr}$ is a steady-state constant.

Together, relationships (1) and (2) pin down the long-run level of the credit-to-GDP ratio, consistent with real asset prices (via the leverage gap) and the nominal lending rate (via the debt-service gap). In effect, when *both* the leverage and debt-service gaps are closed, the credit-to-GDP ratio, real asset prices and the lending rate take values that are consistent with their long-run levels. This can be thought of as a measure of *financial equilibrium*.

Figure 1 depicts estimated leverage and debt-service gaps for the United States. The debt-service gap was large and positive before and during the three recessions in our sample (Juselius *et al* 2017), and notably for the most recent one. By contrast, the leverage gap was very low during the commercial real estate and leveraged-buyout boom in the late 1980s, and the housing boom in the mid 2000s. This simply reflects the fact that asset prices tend to run ahead of the credit-to-GDP ratio during booms, even as this ratio increases beyond historical trends. This makes borrowers look deceptively solid in the boom phase.

The two financial gaps can be incorporated within a standard filtering system to estimate trends, such as potential output. As Borio, Disyatat and Juselius (2017) show, utilising information from the financial cycle leads to a more precise and robust characterisation of business cycles. Figure 2 compares estimates of the output gap that takes into account financial cycle information (labelled 'finance-neutral output gap') with those of Laubach and Williams (2015). The two gaps are clearly different. For example, the finance-neutral potential output is higher and, thus, the output gap more negative, in the aftermath of the 2008–09 crisis in recognition of the substantial financial headwinds at the time. And whereas the Laubach-Williams output gap is persistently negative during most of the 1980s and 1990s, the finance-neutral measure is positive ahead of the recession in the early 1990s, reflecting the financial boom that was under way at the time.

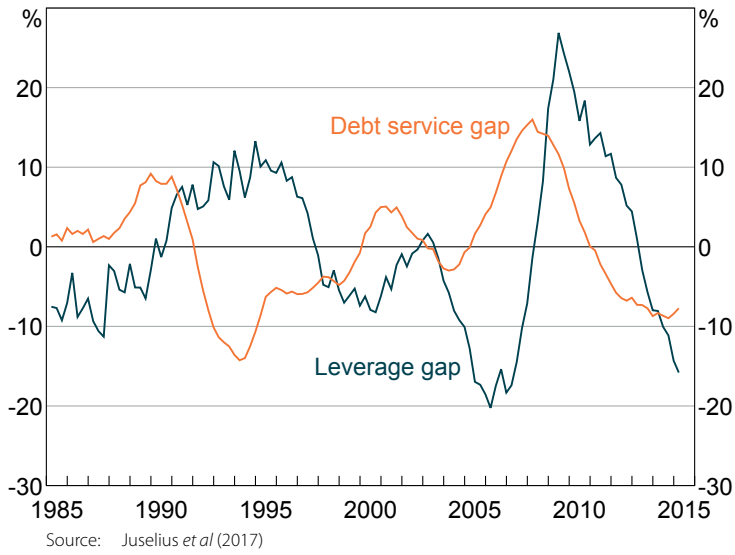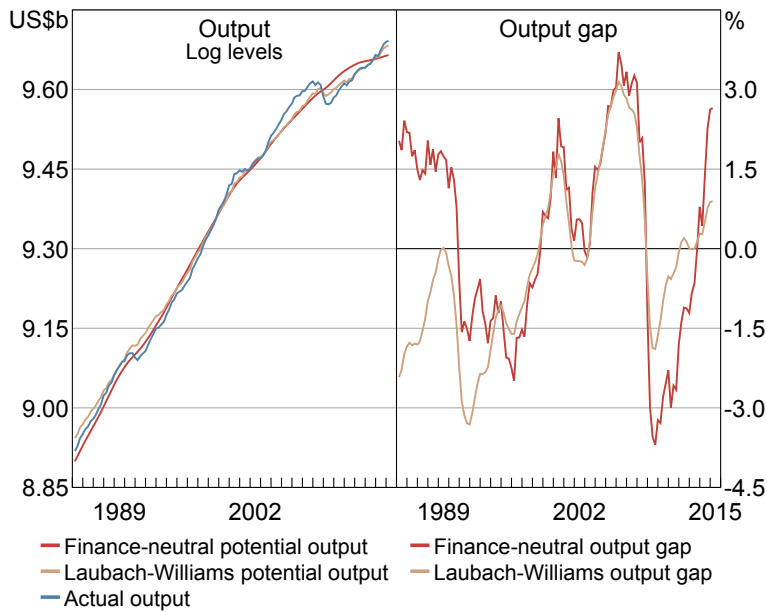## Figure 1: US Leverage and Debt Service Gaps

Source: Juselius *et al* (2017)

Figure 2: US Output and Output Gaps

Source: Juselius *et al* (2017)

The key point here is that business and financial cycles interact and that one must take a stance on this interaction in trying to characterise the cycles. Either one explicitly recognises the potential influence of financial factors on output or one does not, but either way, the resulting estimated cycle will be different. Instead of estimating the cycles separately, an approach that estimates them *jointly* would be more appropriate.

To study the interaction between financial and business cycles, the leverage and debt-service gaps can be combined in a vector autoregression that also includes output, inflation and the policy rate (Juselius *et al* 2017). The key takeaway from such an analysis is that the two financial gaps interact with one another to produce endogenous business cycles. For example, a negative leverage gap implies high credit growth and hence higher asset prices, which supports output, but also generates higher debt-service gaps which, in turn, act as a drag on growth. The latter effect, in particular, is very persistent implying that the current state of the financial cycle predicts subsequent output paths well. Indeed, Juselius and Drehmann (2015) show that knowledge of where leverage and debt-service gaps were before the global financial crisis is sufficient to predict much of the subsequent movement in output out of sample.

Within this set-up, the effects of different monetary policy rules can be studied. In particular, one can conduct counterfactual simulations of a policy rule in which monetary policy systematically reacts to financial imbalances with one that does not. Supposing that the counterfactual policy was implemented in 2003, Juselius *et al* (2017) shows that systematic reaction to the financial developments substantially dampens the financial cycle, with both leverage and debt-service gaps being smaller. This translates into significant output gains – by the end of the simulation period in 2015 the cumulative output gain is more than 12 per cent. Systematic policy matters and both business and financial cycles are endogenous to policy regimes. The gains are considerably larger if one starts the counterfactual experiment further back in history.

Relative to the standard arguments reviewed in the paper by Cagliarini and Price, this alternative perspective suggests that ignoring the financial cycle may lead to significant repercussions on medium-term output trajectories. The output effects occur regardless of whether a crisis takes place. Leaning against the wind should not be seen as taking policy actions only when signals of instability are apparent – within, say, the framework of an early-warning system – but policy should strive to maintain the economy close to financial equilibrium both in good and bad times. The path dependency generated by financial cycles implies that what matters is the cumulative role of policy. Finally, in its discussion of macroprudential policy, the paper would do well to recognise that utilising these tools as an offset to monetary policy – for example, to mitigate the financial stability effects of prolonged monetary easing – is both doubtful in effectiveness and may cause undesirable side effects. As with monetary policy, macroprudential tools also risk becoming overburdened.

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2. General Discussion

Much of the discussion focused on the policy implications of the work and, in particular, whether macroprudential tools can and should be used to target financial cycles. A number of participants argued that macroprudential tools should not be used to target financial cycles. One mused on whether macroprudential policies should focus on the 'macro' or the 'prudential'? They suggested that macroprudential policies should focus on building financial system resilience (i.e. the prudential), mostly because there is little evidence that macroprudential policies have significant effects on business and financial cycles. Relatedly, another participant suggested that the case for policy intervention is strongest where there are market failures, such as information asymmetry or moral hazard. Therefore, policy should focus on addressing these failures, rather than a financial cycle. Adam Cagliarini agreed and asserted that market failures should be addressed before turning to traditional macroeconomic policy tools to address financial system risks.

One participant suggested that it may be appropriate to use macroprudential tools to target financial cycles in some states of the world, but not in others. In some states there is no trade-off between macroeconomic and financial stability and so monetary policy can be used to achieve both goals. When there are trade-offs, there is more of a role for macroprudential policies to target the financial cycle. The participant cited an example from Canada, where the Bank of Canada responded to the 2014–15 oil price shock by lowering its policy rate twice. The participant argued that the main threat to financial stability at the time was higher unemployment, so lower policy rates were viewed as having supported both real economic activity and financial stability – even though lower interest rates were expected to lead to higher household indebtedness and higher housing prices.

The theme of state dependence was echoed by another participant, who argued that the role of macroprudential policy was not to prevent all private sector mistakes. Rather it is to address the private sector mistakes that have an 'aggregate demand externality', and which are significant enough to push the economy into a deep recession where the economy hits the zero lower bound. They also noted that the consequences of financial cycles can depend on the policy interventions themselves; for example, if Lehman Brothers had not failed, the world economy may have performed very differently, even though the state variables (unrelated to policy intervention) would have been the same.

Some participants questioned the paper's focus on measuring the length of financial cycles. One suggested that other aspects of the cycle are also likely to be important, particularly its amplitude. Piti Disyatat also reiterated his view that the interaction of the financial cycle with the business cycle was more important than the length of the financial cycle. Moreover, the separation between the two is somewhat 'fuzzy', given, for example, that monetary policy can influence both the business and financial cycles. These thoughts were echoed by two other participants. One suggested that modelling the interaction of financial and macroeconomic variables jointly could shed additional light on the relationship between financial variables and crises. Of particular interest is understanding when elevated levels of these variables tend to be associated with crises, and when they are not. The second participant built on this, noting that focusing on volatilities, as well as levels, was important.

In response, Dr Cagliarini stressed that the paper's focus on the length of financial cycles was a deliberate response to a series of existing papers that base policy prescriptions on the notion that financial cycles are longer than business cycles. Dr Cagliarini also highlighted that another related motivation of the paper was to assess whether activity variables are 'sufficient statistics' for the state of the business cycle and the macroeconomy. For Dr Cagliarini, the paper's results suggest that it remains unclear whether financial variables provide any extra information about business cycles.

Participants also discussed the data limitations that often plague financial cycle measurement. One participant highlighted the problem of small samples, noting that the most relevant period of analysis is after financial deregulation and that there have been very few financial and business cycles since then. In line with this thinking, they questioned the validity of the results of papers that employ long time series that extend back well before the 1980s. Another

participant agreed that there has been a regime change since the early 1980s, compared with the earlier post-war period, with the last three recessions in the United States having been associated with financial market disruptions. In contrast, a third participant argued that the historical causes and dynamics of financial crises remain relevant for today and therefore that long data sets can be useful.

Is Monetary Policy Less Effective When Interest Rates Are Persistently Low?

Claudio Borio and Boris Hofmann*

1. Introduction

Interest rates in the core advanced economies have been persistently low for about eight years now (Figure 1). Short-term nominal rates have, on average, remained near zero since early 2009 and have even been negative in the euro area and Japan, since 2014 and 2016 respectively. The drop in short-term nominal rates has gone along with a fall in real (inflation-adjusted) rates to persistently negative levels. Long-term rates have also trended down, albeit more gradually, over this period: in nominal terms, they fell from between 3 and 4 per cent in 2009 to below 1 per cent in 2016, on average (Figure 1); in real terms, they have been mostly negative since 2012. Indeed, at the end of 2016 a significant stock of global government bonds (more than $7 trillion or 20 per cent of the total outstanding[1]) was still trading at negative nominal yields, after reaching a peak of over $10 trillion in mid 2016. For all its prominence, the post-US election increase in yields has so far not fundamentally changed this picture.

From a historical perspective, this persistently low level of short- and long-term *nominal* rates is unprecedented. Since 1870, nominal interest rates in the core advanced economies have never been so low for so long, not even in the wake of the Great Depression of the 1930s (Figure 2). Elsewhere, too, including in Australia, short- and long-term interest rates have fallen to new lows, reflecting, in part, global interest rate spillovers, especially at the long end (Hofmann and Takáts 2015; Obstfeld 2015).

1 The numbers refer to the sovereign bonds represented in the Merrill Lynch World Sovereign index.

Figure 1: Low Interest Rates in Core Advanced Economies
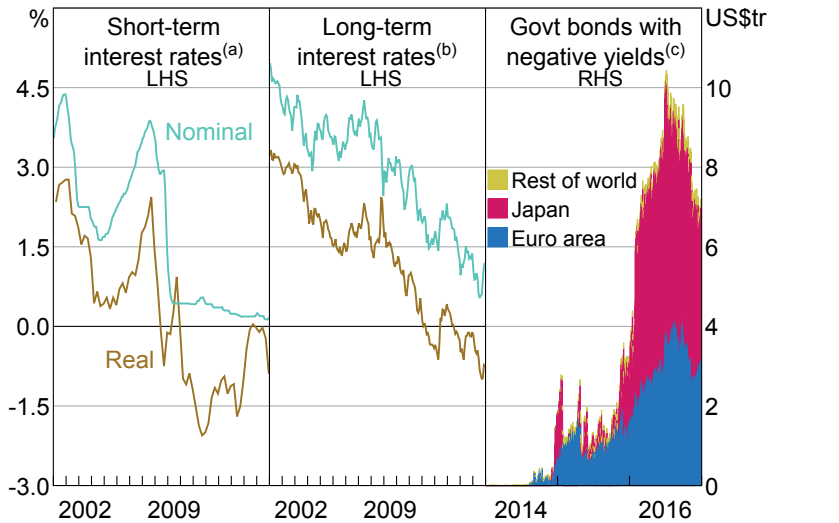
Notes: (a) Simple average of the euro area, Japan, the United Kingdom and the United States; real interest rates are the nominal policy rate minus CPI inflation (PCE inflation for the United States)
(b) Simple average of France, the United Kingdom and the United States; real interest rates are the long-term index-linked bond yield
(c) Stock of government bonds, based on the constituents of the Bank of America Merrill Lynch World Sovereign index

Sources: Bank of America Merrill Lynch; BIS; Bloomberg; National data sources; Thomson Reuters

Figure 2: Interest Rates
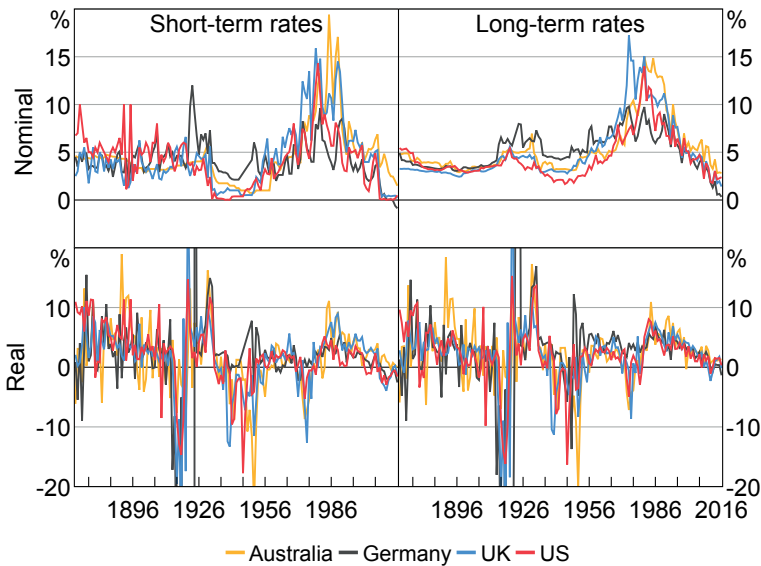
Sources: Global Financial Data; Jordà, Schularick and Taylor (2017); National data sources

The picture is not very different for interest rates measured in *real or inflation-adjusted* terms (Figure 2). There have been periods during which, as a result of high inflation, real rates have been even lower, notably during the Great Inflation of the 1970s, but recently real rates have generally been negative for even longer than at that time.

The persistently low rates of the recent past have reflected central banks' unprecedented monetary easing to cushion the fallout of the gobal financial crisis (GFC), spur economic recovery and push inflation back up towards their objectives. However, despite such efforts, the recovery has been lacklustre. In the core economies, for instance, output has not returned to its pre-recession path, evolving along a lower, if anything flatter, trajectory, as growth has disappointed (Figure 3). At the same time, in many countries, inflation has remained persistently below target over the past three years or so.

Figure 3: Output and Inflation Post-crisis
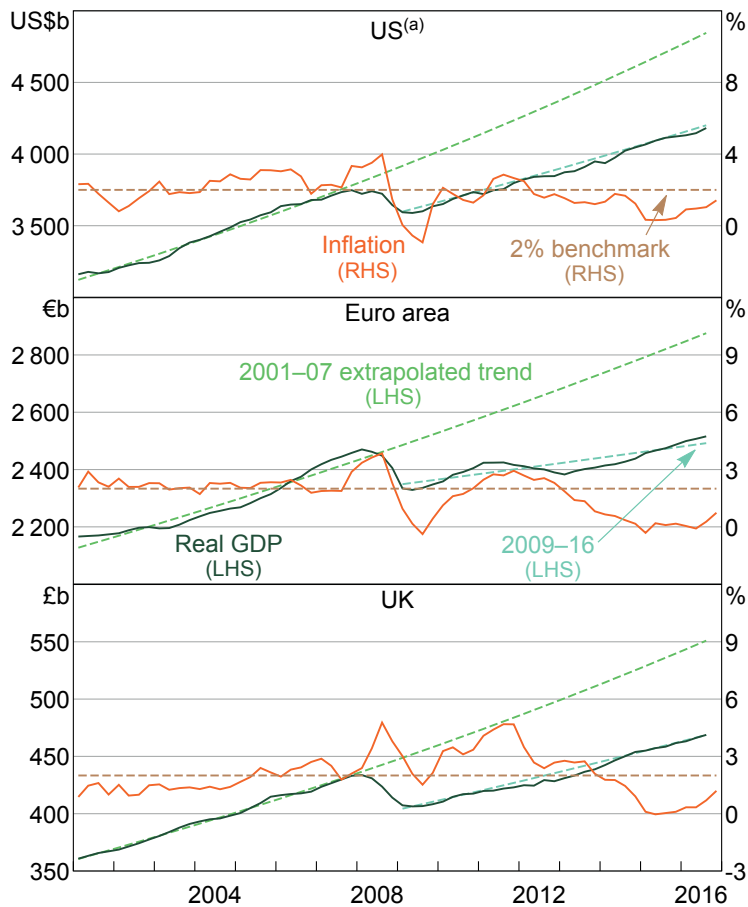
Notes: Output is seasonally adjusted
          (a) PCE inflation
Sources: BIS; National data sources; Thomson Reuters

Against this background, there have been questions about the effectiveness of monetary policy in boosting the economy in a low interest rate environment. This paper assesses this issue by taking stock of the existing literature. Specifically, the focus is on whether the positive effect of lower interest rates on aggregate demand diminishes when policy rates are in the proximity of what used to be called the zero lower bound. Moreover, to keep the paper's scope manageable, we take as given the first link in the transmission mechanism: from the central bank's instruments, including the policy rate, to other rates. The extensive literature on this question has already been reviewed elsewhere (e.g. Borio and Zabai 2016). Also we focus exclusively on domestic transmission channels, thereby excluding the effect through the exchange rate.[2]

We review the conceptual arguments and empirical evidence. Conceptually, monetary policy transmission may be weaker when interest rates are low for at least two reasons. The first has to do with the economic context: macrofinancial 'headwinds' may blow more strongly when interest rates are low. Specifically, persistently low interest rates often prevail in the wake of balance sheet recessions, such as in the aftermath of the GFC. These recessions feature impaired borrower and lender balance sheets, resource misallocations and heightened uncertainty, all factors that would tend to weaken the effect of monetary stimulus (Borio 2014a). The second reason has to do with the possibility that, regardless of economic context, the effect of a change in interest rates on aggregate demand and output may be smaller at very low rates. That is, nonlinearities are present. Nonlinearities may reflect the effect of net interest margins and bank profitability on credit supply, changes in consumption and saving behaviour, resource misallocations and possibly the effect on confidence and expectations.

The empirical evidence relating to these questions is rather scant. That said, what is available suggests that monetary policy transmission is indeed weaker when interest rates are persistently low. The economic context appears to matter, making it more likely that policy may push on the proverbial string as headwinds blow. More general nonlinearities may also be present, at least in the case of bank profitability and credit supply, as well as of consumption behaviour (i.e. a flattening of the IS curve). And there appears to be an independent role for nominal rates, regardless of the level of real (inflation-adjusted) rates.

At the same time, it is important to bear in mind the caveats in any such analysis. It is very difficult to distinguish empirically between the two possible reasons for weaker transmission. And it is also hard to ensure that the observed relationships are not 'spurious'. That is, that the weaker link between interest rates and demand or output does not simply reflect the very weak economic conditions, thus masking the true relationship. To varying degrees, the empirical tests are designed to filter out this possibility but the techniques are inevitably imperfect. At a minimum, though, the analysis suggests that there is ample scope for further investigation of this neglected question.

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2   It is not obvious why the exchange rate channel should be weaker, unless the link between changes in interest rates and the exchange rate is itself weaker. This, of course, could be possible to the extent that at very low rates the scope for further reductions is more limited. However, the empirical evidence suggests that, if anything, the impact of monetary policy shocks on exchange rates has recently become stronger (Ferrari, Kearns and Schrimpf 2017).

The paper is organised as follows. Section 2 discusses how an environment of persistently low interest rates might affect the effectiveness of monetary transmission. Section 3 reviews the existing evidence, including recent work carried out at the BIS. In the conclusion, we highlight a number of findings and promising areas for further analysis.

2. Lower Monetary Policy Effectiveness? Potential Mechanisms

There are two possible reasons why monetary policy may be less effective at persistently low rates: (i) headwinds resulting from the economic context; and (ii) inherent nonlinearities linked to the level of interest rates.

2.1 Headwinds

Persistently low interest rates tend to prevail in the wake of balance sheet recessions, that is, recessions that occur when private debt is high and which are associated with a period of balance sheet repair. This was the case, for instance, during the Great Depression of the 1930s, the Japanese financial bust of the 1990s and, more recently, the GFC and its aftermath.

The effectiveness of monetary policy may vary across the different phases of a balance sheet recession. In the initial phase, expansionary monetary policy can be highly effective in counteracting the uncertainty spikes and tail risks of a financial and economic meltdown, nipping adverse feedback loops in the bud (e.g. Mishkin 2009). In the aftermath of the acute phase of the recession, persistent adverse demand and supply conditions may continue to weigh on the economy and numb monetary stimulus (e.g. Borio 2014a, 2014b). These headwinds are to a large extent a legacy of the previous financial boom, typically characterised by unsustainable credit expansion, asset price increases and capital accumulation (at least in some sectors), as well as by aggressive risk-taking.

There are several reasons for such headwinds. First, debt overhangs may weaken demand. In particular, the drop in output and asset prices increases debt burdens relative to income and reduces net worth. Borrowers, who may have previously overestimated their income prospects, are likely to respond by lowering expenditures in order to cut their debt burdens and restore their wealth through higher saving (Juselius and Drehmann 2015; Mian and Sufi 2015). Giving priority to balance sheet repair over intertemporal expenditure smoothing would tend to dampen the effect of lower rates (e.g. Koo 2009; Di Maggio, Kermani and Ramcharan 2015).[3]

Second, an impaired financial sector may curtail credit supply. Losses on loans and other assets weaken financial institutions' capitalisation and make it harder and more costly to raise capital, thereby sapping lending capacity (e.g. Holmstrom and Tirole 1997; Diamond

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3 For example, in a stylised dynamic stochastic general equilibrium (DSGE) model, Alpanda and Zubairy (2017) show that in high-debt regimes household borrowing responds in a more muted way to an increase in housing collateral values engineered by monetary easing. This is because households first use rising housing equity values to reduce leverage, by letting the debt-to-equity ratio fall, before they start borrowing again.

and Rajan 2011). This would tend to reduce the pass-through of stimulus.[4] While the bank lending channel literature posits that monetary transmission is stronger when banks are weakly capitalised (e.g. Gambacorta and Mistrulli 2004; Jiménez *et al* 2012), this relationship may be reversed in the wake of financial stress or deep recessions, when lenders are under pressure from markets or regulators to compensate for the capital losses (Albertazzi, Nobili and Signoretti 2016).

Third, balance sheet recessions, especially if associated with full-blown crises, may tend to go hand in hand with low confidence and heightened uncertainty about economic prospects (Mian and Sufi 2015). Moreover, the switch from aggressive risk-taking to pervasive risk aversion is likely to be especially marked. This uncertainty would tend to dampen expenditures and may make agents less responsive to stimulus. It could boost precautionary saving (Skinner 1988; Deaton 1991; Dynan 1993) and raise hurdle rates for investment (e.g. Bernanke 1983; Dixit 1992; Dixit and Pindyck 1994).[5] In such a situation, firms may also prefer to take advantage of low interest rates to finance mergers and acquisitions and, even more safely, buy back shares or pay out higher dividends rather than embark on capital investment. Management incentives linked to the behaviour of share prices may strengthen this temptation. More generally, higher risk aversion may also dampen the effect of stimulus on asset prices and lending.[6]

Finally, the effectiveness of stimulus may be weakened by conditions on the supply side of the economy. Financial booms tend to go hand in hand with slower productivity growth, mainly as a result of a shift of resources into sectors such as construction (Borio *et al* 2015). The adverse implications for productivity growth become considerably larger if the bust ushers in a financial crisis. The mechanisms at work are poorly understood. But a possible explanation is that the boom results in the overexpansion of certain interest rate-sensitive sectors, such as construction, which then need to shrink during the contraction. The reallocation of resources may, in turn, be hindered if the banking sector runs into trouble. All else being equal, these headwinds would blow most strongly precisely in interest rate-sensitive sectors, where excess capacity would be prevalent. In addition, ultra-low interest rates could delay the welcome reallocation of resources to higher productivity sectors and firms. For instance, unless their balance sheets are quickly repaired, weakly capitalised, loss-averse banks would have an incentive to keep afloat weaker borrowers (i.e. 'extend and pretend') and curtail the quantity, or increase the cost, of credit for healthier ones – the so-called zombie lending phenomenon (see below).[7]

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4   The problem could be exacerbated if the sovereign's creditworthiness came under strain: historically, fiscal crises have often occurred on the heels of financial crises (e.g. Jordà, Schularick and Taylor 2016). This is partly because financial booms tend to flatter the fiscal accounts and financial busts drive large holes in public finances, including because of the need to deal with banking sector distress (e.g. Reinhart and Rogoff 2009; Borio, Lombardi and Zampolli 2016).

5   Bloom, Bond and Van Reenen (2007) and Aastveit, Natvik and Sola (2013) show theoretically that higher uncertainty not only reduces investment but also lowers the responsiveness of investment to demand shocks, specifically to monetary impulses.

6   Adverse initial conditions – asset prices and debt that are too high, risk-taking that has been excessive – will arguably also tend to weaken the risk-taking channel of monetary policy (see Adrian and Shin (2010) and Borio and Zhu (2012) for a description of the channel and, for example, Gambacorta (2009), Buch, Eickmeier and Prieto (2014), Peersman and Wagner (2015) and Cecchetti, Mancini-Griffoli and Narita (2017) for empirical evidence). Given these headwinds, it is possible that any higher risk-taking induced by unusually low interest rates may have an effect on the financial system (financial risk-taking) but feed less into expenditures.

7   For conceptual analyses of banks' decisions to charge-off loans, or to engage in zombie lending, see, for example, Lepetit, Strobel and Dickinson (2011) and Bruche and Llobet (2014).

The strength of some of the mechanisms outlined above will depend on country-specific characteristics. Of special relevance is the structure of debt contracts and their effect on deleveraging pressures. For instance, the higher the share of the debt stock that is at variable rates and that is more sensitive to the short-term rate, the bigger will be the effect on debt servicing costs and cash flows and, hence, on spending. Shorter maturities are also helpful here. The same is true of refinancing options, which allow borrowers to cut the net present value of their debt despite its fixed-rate long-maturity character.[8] Similarly, non-recourse loans allow over-indebted borrowers to reduce their debt burden, thereby obviating the need to cut spending. For these reasons, for instance, the US mortgage market may be more sensitive to monetary stimulus than some of its European counterparts.

2.2   Nonlinearities linked to the level of interest rates

There are a number of channels through which persistently low interest rates might themselves sap the effectiveness of monetary policy. These include their effect on: (i) bank profitability and hence credit supply; (ii) consumption and saving; (iii) expectations and confidence; and (iv) resource allocation.

2.2.1   Net interest margins, bank profitability and bank lending

Low *nominal* interest rates can harm bank profitability. Under quite general conditions, low *short-term* interest rates sap net interest income through the 'endowment effect'. Retail bank deposits are typically priced as a markdown on market rates, generally reflecting some form of oligopolistic power and compensation for transaction services. As a result, as rates decline, the markdown narrows and the benefit from this relatively cheap funding source shrinks. This is because banks are reluctant to reduce deposit rates below zero, even when the policy rate crosses that barrier. The effect is nonlinear: it becomes stronger at very low rates.[9] Intuitively, as deposit rates hit zero, any further reduction in the short-term rate would affect returns on the asset side without any corresponding effect on the cost of retail deposits.[10] The effect of low short-term rates is compounded if policy also compresses long rates and hence the *slope of the yield curve*, eroding the returns from maturity transformation (i.e. borrowing short and lending long). A compression of the term premium is especially costly.[11]

The negative effects of low interest rates on net interest income are counterbalanced by positive effects on other components of profits. Lower interest rates reduce loan-loss provisions, as they reduce borrowers' debt servicing costs and default probabilities. They also increase non-interest income by boosting securities' valuations. Thus, the overall effect

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8   However, lower collateral values post crisis, possibly in combination with tighter lending standards, such as lower loan-to-valuation ratios, may limit the effectiveness of refinancing options.

9   Borio, Gambacorta and Hofmann (2017) illustrate the nonlinearity based on a version of the Monti-Klein model (Equation A12 in the paper's annex).

10   The endowment effect was a big source of profits at high inflation rates and when competition within the banking sector, and between banks and non-banks, was very limited, as was the case in many countries in the late 1970s. It has again become quite prominent but operating in reverse post crisis as interest rates have become extraordinarily low.

11   While the impact on the risk-free curve is temporary, that which reflects a compression of the term premium is permanent. See, for example, Dietrich and Wanzenried (2011) and Borio *et al* (2017).

of low rates on bank profitability is unclear *a priori*. However, the net effect of *persistently* low rates would likely be negative. This is because net interest income is usually the largest single component of bank profits and because the effect of lower rates on net interest income is long-lasting while that on the other components is only temporary,[12] or at least wanes over time. This helps to explain, for instance, the very negative response of bank stocks in January 2017 to markets' perceptions that interest rates would stay lower for longer (BIS 2017).

A negative effect of low rates on bank profitability can reduce the effectiveness of monetary policy. It may inhibit loan supply, which depends positively on bank capitalisation and hence on profits – retained earnings being the main source of capital accumulation. For example, based on a stylised general equilibrium model, Brunnermeier and Koby (2016) show that the negative effect of lower rates on banks' net interest margins can give rise to a 'reversal interest rate' – the level of the policy rate at which accommodative monetary policy becomes contractionary. In their model, this level could even be positive, depending on structural features of the economy and the financial system.

2.2.2   Consumption and saving

Conventional consumption theory suggests that low real interest rates depress saving and boost consumption through intertemporal substitution. When the real interest rate is low, the returns from postponing consumption are also low. This means that current consumption should increase (substitution effect). This reasoning is the cornerstone of the standard Euler consumption equation – the consumption demand-block of modern DSGE models.[13]

In more general settings, interest rates may also affect consumption by influencing income or cash flows and through wealth effects. In particular, there is a redistribution channel of monetary policy that works by redistributing incomes and/or cash flows between agents (La Cava, Hughson and Kaplan 2016). Lower interest rates mean lower interest payments by borrowers to the extent that loans are at adjustable rates or can be refinanced. But they also mean lower interest receipts for lenders and depositors. While these channels are in essence redistributive, they can give rise to first-order effects in the aggregate whenever borrowers have higher marginal propensities to consume than lenders and depositors, as is typically assumed (Tobin 1982; Auclert 2016). Clearly, the strength of the redistribution channel will also depend on the structural features of credit markets. For instance, the redistribution to borrowers will be greater if debt contracts are at adjustable rates (Garriga, Kydland and Šustek 2016).

If interest rates are persistently low, additional expected income effects may come into play. If agents become concerned that the low returns on savings will persist and render their envisaged lifetime savings insufficient to ensure an adequate standard of living after retirement, they may step up saving and reduce consumption to compensate for the shortfall (White 2012; Hannoun 2015). To be sure, in principle this effect should operate *regardless* of

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12   The capital gains on securities holdings would actually be reversed if the securities were held to maturity (and would not even show up in the income statement in that case). The impact on loan-loss provisions would be much longer lasting. At the same time, the low carrying costs of non-performing loans could delay balance sheet repair, weighing on profitability.

13   See Woodford (2003, Chapter 4) for a discussion of how consumption depends on the expected future path of real interest rates in textbook New Keynesian models.

the level of interest rates. But it may become much more visible and prominent when interest rates are unusually and persistently low. For instance, concerns about the viability of pension funds or much less remunerative life insurance saving products can highlight the need for higher saving for retirement (see below). As a result, the effect of low rates on consumption may diminish and even reverse as rates drop to very low levels. That said, while this argument is often brought up in public debate, we are not aware of a formalisation of this point in a theoretical model of consumption and saving.

A possible countervailing force relates to wealth effects, linked to the boost that lower interest rates give to asset prices.[14] Standard asset pricing theory suggests that changes in real interest rates should actually have a *larger* effect on asset prices when real interest rates are low.[15] As a result, the corresponding wealth effects on consumption (and possibly investment) would be *stronger* in a low rate environment. Of course, such a countervailing force would tend to be weaker during recoveries from a balance sheet recession, given heightened risk aversion and initial overvaluation.[16]

Finally, just as in the case of bank lending, nominal interest rates may matter quite independently of real rates. In addition to cash flow effects, agents may exhibit 'money illusion', so that their behaviour is influenced by nominal magnitudes regardless of changes in the price level.[17] In this case, the potential nonlinearities linked to the various effects on consumption would apply to nominal, rather than real, rates.

2.2.3 Uncertainty

While monetary expansions usually appear to attenuate uncertainty and risk perceptions (Bekaert, Hoerova and Lo Duca 2013; Hattori, Schrimpf and Sushko 2016), persistently very low rates could have adverse effects on expectations and confidence. If central banks push rates to levels that are unusually low by historical standards, agents might interpret this as signalling dark economic prospects, potentially offsetting the usual stimulus.[18] The effect could also operate through pension funds and insurance companies: prominent public discussions about the risk of underfunding for defined benefit pension schemes[19] and, possibly, about insurance companies' viability, could raise concerns about their ability to

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14 Under 'wealth effects' we also include the indirect effect of the relaxation of borrowing constraints through the use of assets as collateral.

15 This follows from the standard dividend discount model.

16 Of course, wealth effects will tend to benefit wealthier households disproportionately. This matters because such households may have a lower propensity to consume. See Domanski, Scatigna and Zabai (2016) for a review of the implications of wealth inequality for monetary policy in light of cross-country differences in the distribution and type of wealth.

17 If the agent prefers the outcome with a higher nominal income but the same real income, then he/she is said to suffer from 'money illusion' (Fisher 1928). For a discussion of the concept of money illusion and the related evidence, see Borio and Zabai (2016).

18 The problem of such negative confidence effects counteracting the intended expansionary effects of low rates was discussed in policy and academic circles in the context of forward guidance. The economic news element of forward guidance was referred to as 'Delphic' (the central bank acting as an oracle) and the policy accommodation element as 'Odyssean' (the central bank providing information about the mast it ties itself to in order to withstand the call of the sirens). This taxonomy was originally proposed by Campbell *et al* (2012). Specifically, calendar-based forward guidance, where the guidance applies to a clearly specified time horizon, was seen as being potentially less effective due to an overly strong Delphic element.

19 The underfunding of pension funds could also erode investment by reducing firms' profits and their cash flows. These effects would come into play only at very low rates and would exhibit nonlinearities.

honour their previous commitments to ensure post-retirement consumption and the need to save more for old age.

Here, too, nominal interest rates may play a special role. Insurance companies' contracts, and their guaranteed returns, are typically set in nominal terms. The discounting method of pension fund liabilities varies across countries and institutions but stickiness in long-term assumptions about inflation and wage growth would generally tend to heighten the effect of changes in nominal rates. And here, in contrast to the effect on asset prices, the effect on the value of the *liabilities* would actually increase at lower rates.[20]

2.2.4 Resource allocation

Persistently low interest rates may also create disincentives to address a debt overhang and resource misallocation, fostering what has been graphically called a 'zombification' of the economy. The best known channel here works through the banking sector. Low rates reduce the perceived need for banks to clean up their balance sheets. They tend to encourage banks to roll over rather than charge-off non-performing loans in a number of ways. Lower rates increase the expected recovery from non-performing loans by reducing the discount factor.[21] They also reduce the opportunity cost of carrying non-performing loans on the balance sheet, as the returns from alternative investments, and the cost of funding the bad loans, are low. All this saps banks' intermediation capacity because rolled-over bad loans crowd out new lending for more productive borrowers. In turn, this can complicate the prudential authorities' task of identifying and resolving weak institutions, in concert with other policymakers.[22]

Here, too, nominal rates may have a prominent role to play. This is because they influence banks' funding costs and are commonly used in the discounting of non-performing loan recovery values. It is also because some loan covenants become less effective when interest rates, and hence contractual repayments, are very low. In general, distinguishing viable from less viable businesses becomes harder.

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20 Theoretically, there may also be adverse effects on inflation expectations and ultimately on actual inflation, according to the so-called 'neo-Fisherian' perspective (Bullard 2015; Cochrane 2016) which emphasises the long-term relationship between nominal interest rates and inflation. If interest rates are too low compared with the prevailing rate of inflation, the long-run relationship would normally be restored by adjustments in the nominal interest rate to counter rising inflationary pressures. However, if nominal rates are not increased, the adjustment could also be brought about by a drop in inflation expectations (and ultimately inflation itself).

21 Specifically, the decision to charge-off or roll over will depend on how the expected repayment from a loan compares with its liquidation value, which is typically its collateral value. So, for given collateral values, higher discounted repayments can induce more banks to decide to roll over a larger part of their bad loans, particularly in crisis times when the market for collateral can be depressed and illiquid. See Lepetit *et al* (2011) for a formal analysis.

22 Another potential channel is of a more political economy nature: persistently and unusually low rates can make it less pressing for policymakers to address the structural root causes of protracted weak economic performance. Structural reforms in the real economy or needed fiscal consolidation are possible examples.

3. The Evidence

Testing the hypothesis of reduced monetary policy effectiveness at persistently low rates faces a number of challenges.

To start with, assessing the effectiveness of monetary policy requires disentangling its effects from those of other factors driving the macroeconomy. The coexistence of persistently low interest rates and economic weakness is in itself no proof of policy ineffectiveness. Monetary policy may be as effective as ever but its power may be masked by the depressed economic conditions. Put differently, the apparent reduced effectiveness may just be spurious if the countervailing forces are not controlled for. This, of course, is a familiar identification issue in econometrics. But it may be especially hard to resolve when economic conditions are particularly depressed or unusual, as they are during a balance sheet recession, and when the central bank resorts to multiple policy instruments in addition to the policy rate, such as large-scale asset purchases, which can confound the signal.

In a similar vein, and for similar reasons, even if policy is indeed less effective, it is difficult to disentangle the factors at work. In particular, is it because of headwinds that coincide with low rates or because of inherent nonlinearities linked to the level of rates? True, one might be able to shed further light on this issue by focusing on specific channels and using more granular data (e.g. the banks' profit-lending nexus or the effect on resource misallocation). Even so, this would still leave open the question of relevance of the detected effect at the aggregate level.

In what follows, we provide a selective review of the extant evidence. Two main strands of empirical literature can be distinguished: (i) studies that assess the role of headwinds in monetary transmission but which could also capture effects coming from inherent nonlinearities; and (ii) studies that focus on specific nonlinearities, such as the effect of low rates on bank profitability (and through this on credit supply), on consumption and on resource misallocation.

3.1 Headwinds

In the wake of the GFC, a growing literature has sought to assess whether financial crisis-related headwinds influence the effectiveness of monetary policy. Since periods of financial stress are usually also periods of low interest rates, this literature also speaks to the question of whether transmission is different when rates are low, albeit only indirectly.

As already mentioned, one has to differentiate between the different phases of a financial crisis and a balance sheet recession. Monetary policy is probably more effective than usual in the acute phase of a crisis but less effective in the recovery phase. This conjecture seems to be borne out by the empirical evidence, for both conventional policy (i.e. for the policy rate) and unconventional policy (i.e. measures working through instruments other than the policy rate, in particular, large-scale asset purchases).

A number of recent studies have found that conventional monetary policy has stronger effects in periods of financial stress. Ciccarelli, Maddaloni and Peydró (2013) suggest that the estimated effects of a monetary policy shock in the euro area increase when the GFC period (2007–11) is added to their sample. More generally, Dahlhaus (2017) finds that the effect of a monetary

policy shock in the United States is larger in periods of financial stress than otherwise. This result is confirmed by Jannsen, Potjagailo and Wolters (2015) for a sample of 20 advanced economies based on panel vector autoregression (VAR) analysis. They find that the effect of monetary policy in the acute phases of a financial crisis is larger than in normal phases. These results are consistent with the notion that monetary policy might be more effective in the acute phase of a financial crisis as it can reduce uncertainty and tail risks. That said, the mechanisms through which higher policy effectiveness during crises work remain untested.

At the same time, there is evidence that monetary policy is less effective in the recovery from a balance sheet recession, presumably reflecting the effects of persistent headwinds and possibly low rates themselves. Jannsen *et al* (2015) allow for three different phases in the analysis of monetary policy effectiveness: a normal phase, a crisis phase and a recovery phase. While, as noted, they find stronger transmission during crises than during normal phases, their analysis also suggests that monetary policy has essentially no macroeconomic effect during the recovery from a financial crisis. This finding is consistent with previous BIS research. Based on a sample of 24 economies, Bech, Gambacorta and Kharroubi (2014) find that lower real interest rates during 'normal' business cycle downturns are followed by stronger cyclical recoveries, but that there is essentially no statistically significant link between real rates and recovery strength after downturns associated with financial crises (Figure 4, left-hand panel). Instead, deleveraging seems to be the key factor determining the speed of recovery (Figure 4, right-hand panel). Overall, these results support the relevance of balance sheet-related headwinds in reducing monetary policy effectiveness once the acute crisis phase is over.

Figure 4: Monetary Policy, Deleveraging and Economic Recoveries
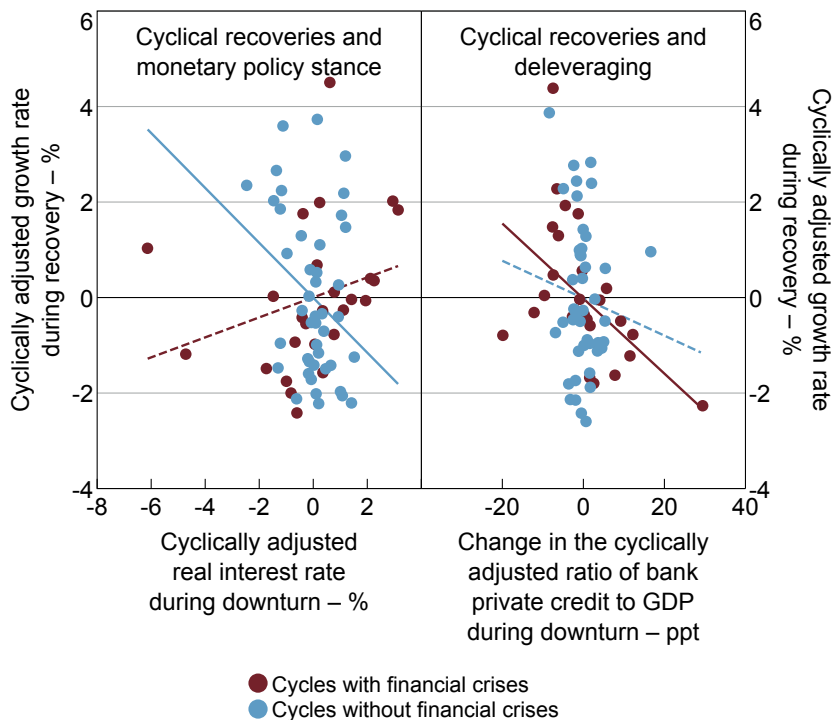
Notes: The solid (dashed) regression lines indicate that the relationship is statistically significant (insignificant); sample of 24 economies since the mid 1960s; downturns are defined as periods of declining real GDP and recoveries as periods ending when real GDP exceeds the previous peak; data covers 65 cycles, including 28 with a financial crisis just before the peak; data for cycles are adjusted for the depth of the preceding recession and the interest rate at the cyclical peak; see Bech *et al* (2014) for details

Source: Bech *et al* (2014)

Other studies test directly for the effect of specific types of headwind, in particular, debt overhang and heightened uncertainty.[23] Specifically, Alpanda and Zubairy (2017) find for the United States that monetary transmission is weaker in states where household debt is relatively high, reflecting in their view the attenuating effect of deleveraging motives. Bloom *et al* (2007) show for the United Kingdom that higher uncertainty, measured by stock market volatility (proxying financial headwinds more generally),[24] significantly reduces the responsiveness of investment to demand conditions, which in turn depend on the monetary policy stance.

23 There is a somewhat related literature that considers asymmetries in monetary transmission according to the direction of monetary impulses. This literature tends to find larger effects of monetary contractions than expansions. Angrist, Jordà and Kuersteiner (2013) find that US policy rate hikes have larger effects on the economy than rate cuts. Similarly, Barnichon and Matthes (2016) and Tenreyro and Thwaites (2016) suggest that monetary policy shocks have larger effects in expansions than in recessions. All these studies interpret their findings as reflecting the well-known string metaphor: that it is harder for monetary policy to push on a string than to pull it because of the headwinds prevailing in situations when monetary policy is loosened. And there is also a literature on the dependence of monetary transmission on the phase of the business cycle, which, however, has come up with conflicting findings. While some studies find stronger transmission in recessions (Peersman and Smets 2002; Lo and Piger 2005), the analysis of Tenreyro and Thwaites (2016) finds the opposite.

24 See Forbes (2016) for a comparison of different measures of financial and economic uncertainty for the United Kingdom.

Similarly, Aastveit *et al* (2013) find that in the United States the monetary transmission to real output is weaker when uncertainty (also measured by stock market volatility) is high. They interpret this result as reflecting the effect of uncertainty on investment but acknowledge that other mechanisms might also be at work since the response of consumption drops significantly too. This suggests that the relationship between uncertainty and monetary transmission may itself be state dependent: while monetary policy may be more effective in the acute crisis phase where it can work to lower the elevated level of uncertainty and tail-risk perceptions, heightened uncertainty in general seems to sap monetary policy effectiveness.

The literature on the effectiveness of unconventional monetary policies implemented in the wake of the GFC should also give us some clues about monetary policy effectiveness in environments of persistent headwinds and low interest rates. Indeed, the lacklustre recovery from the GFC has raised doubts about the effectiveness of extraordinary measures, as discussed in BIS (2016). There is by now a large literature assessing the effectiveness of the measures on financial market prices and a somewhat smaller one investigating the ultimate effect on the macroeconomy (see Borio and Zabai (2016) for an overview). The overall picture is that the measures have been effective in easing monetary conditions by lowering interbank rates, bond yields and credit risk spreads, and, less conclusively, that these effects have also boosted the macroeconomy.

For our purposes, however, the extant studies are less informative than would be desirable. The reason is that they do not specifically test the hypothesis of reduced effectiveness at low rates. More generally, they tend to assume that previous relationships continue to hold – whether these concern the link between central bank balance sheets and activity (and hence indirectly interest rates), or that between interest rates and economic activity. One obvious reason is the limited sample size. Indeed, for any time series analysis of the extraordinary measures' effect on macroeconomic variables the sample period is typically rather short. That said, with now eight years of available data, it is becoming easier to assess whether the effects have changed over time, although the results should be taken with a pinch of salt.

In this vein, a recent BIS study by Hesse, Hofmann and Weber (2017) suggests that, at least for the United States, there is some indication that the effectiveness of large-scale asset purchase programs (LSAP) has fallen (Figure 5).[25] The authors find that, while an unanticipated increase in LSAP1 and LSAP2 purchases had a significant positive effect on real GDP and the price level, the effects of the same sized shock were much smaller for the maturity extension program (MEP) and LSAP3. Similar evidence is reported in Haldane *et al* (2016). They find that QE shocks have a significant effect when financial market stress is high but not when it is low, with the two regimes roughly coinciding with the sample split of Hesse *et al* (2017). Panizza and Wyplosz (2016) explore the decreasing effectiveness hypothesis for the core advanced economies that implemented large-scale asset purchases (United States, euro area, Japan and United Kingdom), also based on sub-sample analysis, and come to inconclusive results. For some empirical exercises they find decreasing effectiveness, but not for others.

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25 Specifically, Hesse *et al* (2017) follow the approach by Weale and Wieladek (2016) and assess the macroeconomic effects of a quantitative easing (QE) shock in an otherwise standard Bayesian VAR with the QE policy instrument being the cumulated size of asset purchase announcements.

**Figure 5: The Macroeconomic Effect of Asset Purchase Shocks
in the United States**
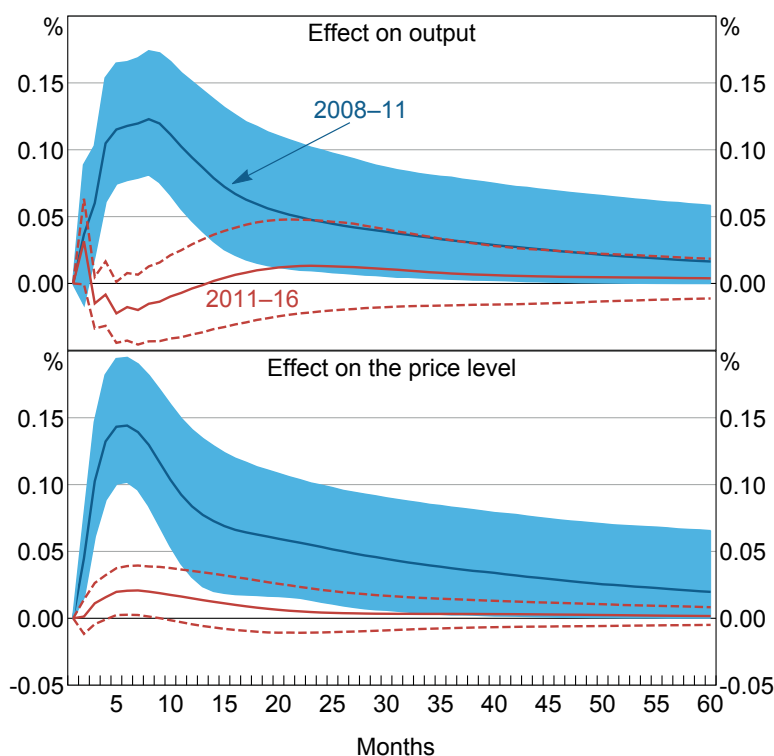
Notes: Impulse responses to the unexpected component of a US$100 billion asset purchase
announcement in a Bayesian VAR for the United States, consisting of log real GDP, log CPI, the
cumulative size of the announced asset purchases, the 10-year Treasury yield and the log S&P
500 (the set-up closely follows that of Weale and Wieladek (2016)); the asset purchase shock is
identified using a recursive identification scheme with the variables ordered as they were listed
before; the figure shows the median and 68 per cent probability range of impulse responses;
the two sub-samples considered are January 2008 to June 2011 (covering LSAP1 and LSAP2)
and July 2011 to June 2016 (covering MEP and LSAP3)
Source: Hesse *et al* (2017)

This evidence of potentially reduced effectiveness of unconventional monetary policy may
reflect various factors. One possibility is headwinds or inherent nonlinearities at low rates.
Another may relate to factors specific to large-scale asset purchases. For instance, such
purchases may be most effective when financial markets are segmented and dislocated,
so that the authorities' intervention can help alleviate the corresponding distortions. As
the distortions vanish over time, the effectiveness of policy may diminish. Moreover, there
are limits to how far risk premia can be compressed, expectations guided and interest
rates pushed into negative territory. Indeed, the consecutive programs seem to have had
a progressively smaller effect on financial market prices (Figure 6). The reduction in bond
yields and loan rates per dollar spent in the programs have consistently fallen over time in
the G3 economies. This might simply reflect the fact that the programs were increasingly well
anticipated by market participants. But the alternative possibility cannot be excluded either.

Figure 6: Financial Market Impact of Asset Purchase Announcements

Effect per 100 billion units of local currency
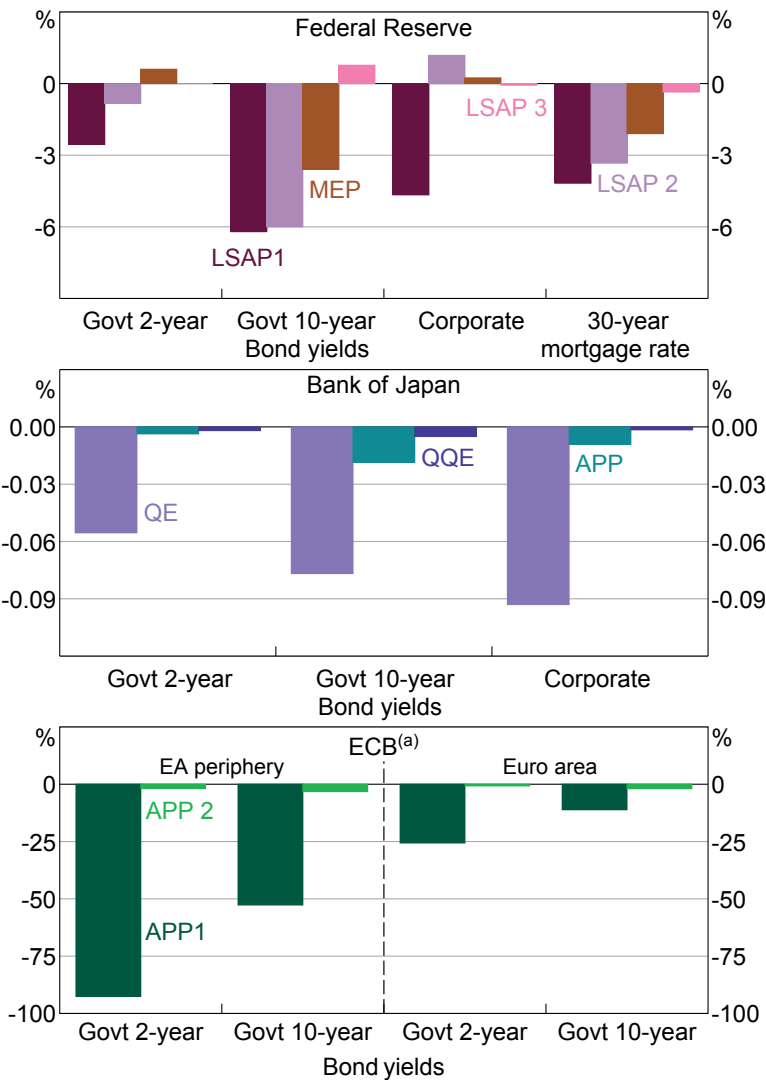
Notes: APP denotes asset purchase program, LSAP denotes large-scale asset purchases, MEP denotes maturity extension program, QE denotes quantitative easing and QQE denotes quantitative and qualitative monetary easing; for each program, the cumulative two-day change in basis points around the announcement dates, divided by the total size of each program in local currency; for open-ended programs, it is divided by the estimated size of the program assuming an unchanged pace of purchases until December 2017; for terminated programs, it is divided by the total amount of purchases at the time of termination

(a) Government bond yields for the ECB are weighted averages based on rolling GDP and PPP exchange rates of the economies listed: EA periphery includes Greece, Ireland, Italy, Portugal and Spain; euro area includes Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal and Spain

Sources: Bank of America Merrill Lynch; BIS calculations; Bloomberg; National data sources

In sum, there is evidence that monetary transmission is weaker in recoveries from balance sheet recessions. The conditions identified with weaker transmission are also those that would be expected to be associated with lower interest rates. This is the case for high debt overhangs, the recovery phase after banking crises and, admittedly less specifically, high uncertainty. Thus, the detected asymmetries may at least in part also reflect headwinds that tend to blow when rates are generally low.

3.2 Nonlinearities linked to the level of interest rates

There is very limited analysis of nonlinearities in monetary transmission linked to the level of interest rates. The empirical literature is scant for both nonlinearities in aggregate relationships and in specific channels.

### 3.2.1 Net interest margins, bank profitability and bank lending

The positive link between interest rates and bank profitability has been long established in the academic literature (Samuelson 1945; Flannery 1981; Hancock 1985). English (2002) studies the link between interest rate risk and bank interest rate margins in ten industrialised countries. He finds that, as the average yield on bank assets is more closely related to long-term rates than the average yield on liabilities, a steep yield curve raises interest margins. More recently, Alessandri and Nelson (2015) establish a positive long-run link between the level and slope of the yield curve, and bank profitability in the United Kingdom. Genay and Podjasek (2014) also find that persistently low interest rates depress US banks' net interest margins. They also note, however, that the direct effects of low rates are small relative to the economic benefits, including through better support for asset quality. For Germany, Busch and Memmel (2015) argue that, in normal interest rate environments, the long-run effect of a 100 basis point change in the interest rate on net interest margins is very small, close to 7 basis points. In the recent low interest rate environment, by contrast, they find that interest margins for retail deposits, especially for term deposits, have declined by up to 97 basis points. The Bundesbank's Financial Stability Review of September 2015, analysing 1 500 banks, also finds that persistently low interest rates are one of the main risk factors weighting on German banks' profitability.[26]

Borio *et al* (2017) revisit the link between bank profitability and interest rates for a sample of 108 internationally active banks. In contrast to previous studies, they allow for nonlinearities in the relationship, as theory would suggest. They find evidence that, controlling for aggregate demand, a reduction in both short-term interest rates and yield curve slope depresses the return on assets, and that the effect increases when rates are lower or the yield curve is flatter (Figure 7). The estimated effect is significantly larger than in studies that do not allow for

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26 Using capital market prices, rather than financial statements, English, Van den Heuvel and Zakrajšek (2012) also find a negative effect of low interest rates on bank profitability. In their analysis, they find that while the stock prices of US banks fall following unanticipated increases in interest rates or a steepening of the yield curve, a large maturity gap weakens this effect. Thus, because of their maturity transformation function, banks gain from a higher interest rate or a steeper yield curve.

nonlinearities.[27] Taken at face value, the results indicate that, in the sample of banks covered, the combined effect was, on balance, positive in the first two years post-GFC (2009–10), increasing ROA by an estimated cumulative 0.3 percentage points. The effect turned negative in the following four years (2011–14), lowering ROA by an estimated cumulative 0.6 percentage points, equivalent to one year of profits for the average bank in the sample.

Figure 7: Interest Rate Effects on Bank Profitability
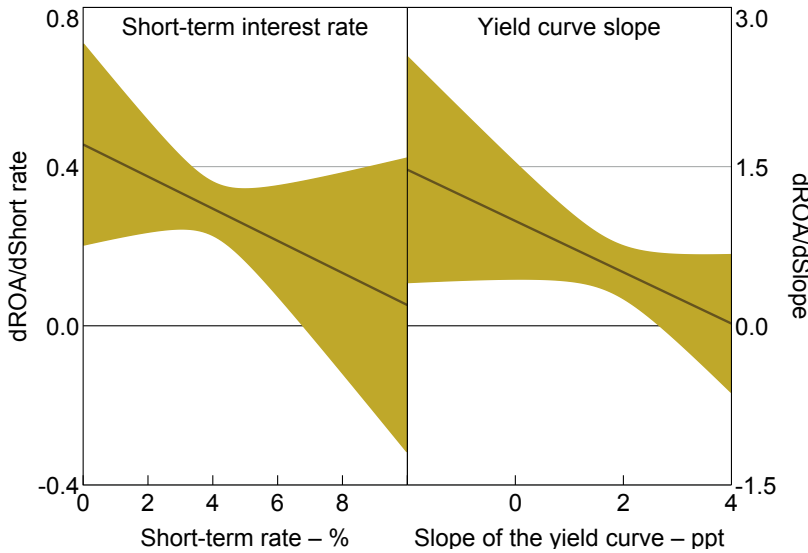
Notes: Horizontal axes show possible values for the level of the short-term interest rate (3-month interbank rate) and the slope of the yield curve (the difference between the 10-year government bond and the 3-month interbank rate), respectively; vertical axes show the derivative of bank profitability (return on assets) with respect to the short-term rate and the slope, respectively; shaded areas indicate 95 per cent confidence bands

Source: Borio *et al* (2017)

In another recent paper, Claessens, Coleman and Donnelly (2016) confirm the findings of Borio *et al* (2017) based on a sample of 3 418 banks from 47 countries for the period 2005–13. They classify countries for each year as being in a low- or high-rate environment based on whether the three-month Treasury bill rate was below or above 1.25 per cent (other cut-offs were also tested and yielded similar results). After documenting that both net interest margins and returns on assets are on average higher in high-rate environments, they find that the negative effect of a decrease in the short-term interest rate is statistically larger in low-rate regimes.

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27 Specifically, an increase in the short-term rate from 0 per cent to 1 per cent raises the return on assets (ROA) by 0.4 percentage points over one year, but by only 0.15 percentage points if the rate increases from 6 per cent to 7 per cent (Figure 7, left-hand panel). By contrast, Alessandri and Nelson (2015) find that the (linear) impact is around 0.2 percentage points and Genay and Podjasek (2014) find that it is 0.1 percentage points. Of course, other aspects of the studies could account for the results. Similar differences apply to the effect of changes in the slope (e.g. a 1.2 percentage point decline in ROA for increases in the slope from –2 to –1 percentage points, compared with 0.1 to 0.7 percentage point decline in the ROA in linear specifications). Here, however, comparisons are even harder given the different slope measures used in the literature.

These findings suggest that, over time, bank capital is negatively affected by lower interest rates and that the effect is larger when rates are low. This could then inhibit credit expansion if the supply of credit is capital constrained, especially given that banks are generally reluctant to raise capital externally. The results reported in Gambacorta and Shin (2016) suggest that higher bank capital is indeed associated with stronger lending, and that the mechanism involved in this channel is the lower funding costs enjoyed by better capitalised banks.[28]

Borio and Gambacorta (2017) directly address the question of the effect of low interest rates on bank lending. They find evidence that lending becomes less responsive to reductions in short-term interest rates when interest rates are already low. Figure 8 conveys this point in a simple way based on raw data. The figure plots the average log level of lending to the non-financial sector of 108 internationally active banks against the average short-term interest rate that each bank has faced in the jurisdiction in which it operates. The usual negative link between lower rates and bank loans is not apparent at very low rates (middle panel) – in fact, the relationship switches sign. Borio and Gambacorta (2017) find that the pattern suggested by Figure 8 also holds after controlling for business and financial cycle conditions, and different bank-specific characteristics, such as liquidity, capitalisation, funding costs, risk and income diversification. Importantly, it also holds when financial crises are controlled for. And it operates through the effect of lower rates on net interest margins. A simple back-of-the-envelope calculation suggests that the reduction of net interest income caused by the low-rate environment could explain one-third of the subdued evolution of lending in the period 2010–14.[29] To be sure, any such result should not be taken at face value. And fully controlling for the various influences, including weakness in loan demand, is not straightforward. But the results do suggest that the effect could be material and worthy of further exploration.

Overall, therefore, there is evidence that persistent low interest rates compress net interest margins and bank profitability, and that such a negative effect on bank profitability may in turn inhibit lending. How relevant this effect is for aggregate macroeconomic outcomes remains an open question.

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28 A positive association between bank capitalisation and credit supply had already been found in previous studies, for example by Albertazzi and Marchetti (2010), who show that credit contraction in Italy in the wake of the GFC was driven by weak bank capitalisation. Michelangeli and Sette (2016) use a novel dataset constructed from randomised applications to online mortgage brokers to show that better capitalised banks lend more. Also the results reported in EBA (2015) suggest that more strongly capitalised banks are in a better position to expand lending.

29 Borio and Gambacorta (2017) suggest that the result may reflect the impact of lower rates on the profitability of the lending business. If capital is perceived to be scarce, banks would have an incentive to allocate it towards activities that are more profitable at the margin. And lower interest rates could have a larger effect on the profitability of such activities relative to, say, mergers and acquisitions or trading. Any such impact would be even larger at the margin if the banks operated under some minimum profit constraint (e.g. so as to remain attractive to investors while seeking to maximise some managerial objective).

**Figure 8: Semi-elasticity of Bank Lending to the
Short-term Interest Rate**
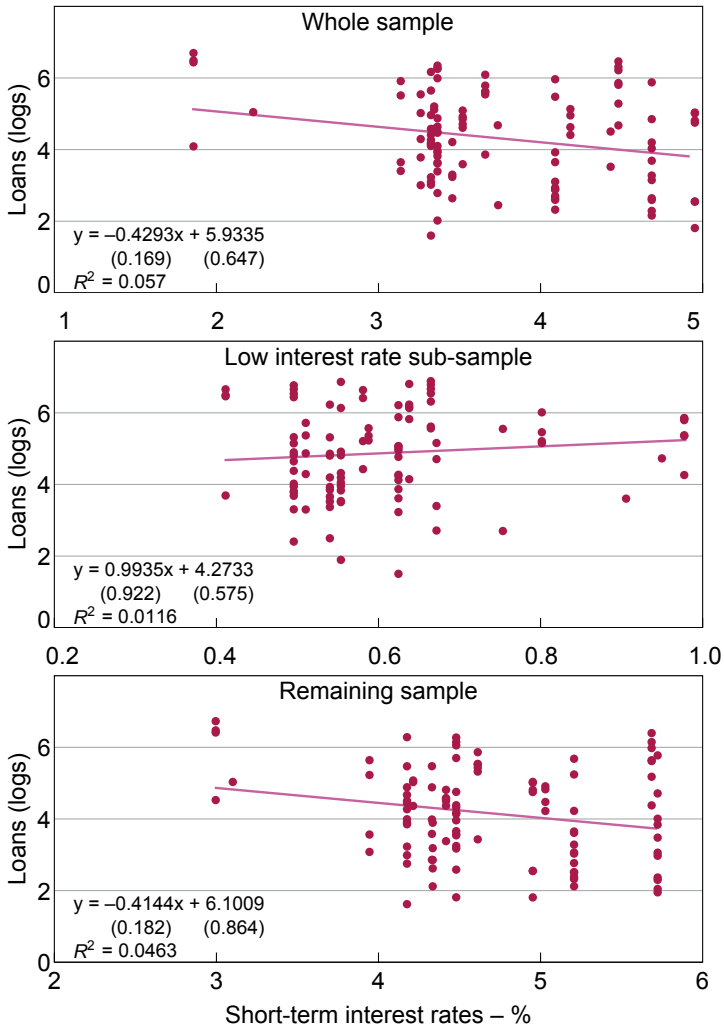
Notes: Shows the average level of lending (in logs) against the level of the short-term interest rate
for a group of 108 international banks, the dots thus refer to semi-elasticities; the interest rate
is the average for the currencies in which each bank obtains funding; whole sample covers
1995–2014, low interest rate sub-sample covers only periods in which the average interest
rate was very low (bottom quartile of the distribution, below 1.25 percentage points), and
remaining sample covers the rest of the sample; standard errors are shown in parentheses
Source: Borio and Gambacorta (2017)

3.2.2 Consumption and saving

A screening of the literature reveals that work on the possible nonlinear effects of low interest rates on consumption and saving is very limited.

Recently, Cliffe (2015) reported the results from an Ipsos survey that sought to shed some light on this question. The survey asked 13 000 consumers from Europe, the United States and Australia how their saving behaviour had changed in response to low interest rates and how they would react to negative interest rates in the future. According to this survey, 31 per cent of respondents had changed their behaviour, albeit possibly only their portfolio decisions. Of those that did change their behaviour, some 38 per cent said that they had saved less. However, as many as 17 per cent said that they had in fact saved *more*. The rest answered that they had mainly changed their asset allocation. This indicates the possibility of adverse effects from very low rates. But the study is silent about how behaviour would have changed at higher rates.

Recent BIS research explores further the possible nonlinearities in the consumption-interest rate nexus through formal panel-econometric analysis. Specifically, Hofmann and Kohlscheen (2017) estimate reduced-form regressions linking real consumption growth to the level of the interest rate.[30] The analysis is based on annual data for a panel of 31 countries over the period 1995–2015. Nonlinearities are modelled using piece-wise regressions, allowing the interest rate semi-elasticity to vary across different interest rate level thresholds.[31]

The results yield two main insights. First, real consumption growth seems to be linked to the level of *nominal* rates rather than *real* rates, pointing to the empirical relevance of money illusion or specific transmission channels working through, or proxied by, the nominal interest rate.[32] Second, there is evidence that the interest rate elasticity of consumption growth increases with the level of the interest rate (Figure 9). The magnitude of the elasticity rises from 0.3 for the full set of observations to above 1.2 when only observations with a nominal rate of above 5 per cent are included. The nonlinearity also carries over to aggregate output growth, albeit in this case it is weaker and is not statistically significant owing to large confidence bands, suggesting that the nonlinearity works mainly through consumption.

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30 There is a voluminous empirical literature on the baseline Euler equation for consumption, which tests the intertemporal elasticity of substitution in consumption. Establishing a link between consumption and real interest rates has turned out to be difficult and has required modifications to the baseline model of intertemporal consumption optimisation, such as allowing for consumption habits, hand-to-mouth consumers and wealth effects. See Ascari, Magnusson and Mavroeidis (2016) for a review and an empirical assessment of the various extensions of the baseline equation for the United States.

31 The controls included in the regressions comprise: country and time fixed effects; the real GDP growth rate; real house and stock price increases; the level of per capita income; the credit-to-GDP ratio; and the dependency ratio.

32 One important transmission channel of the nominal rate is the debt-servicing ratio, defined as the ratio of interest obligations to income, which is directly influenced by the nominal interest rate. Recent studies have found a significant negative link between the debt-servicing ratio and consumption growth (e.g. Kharroubi and Kohlscheen 2017), which would also be picked up by the nominal interest rate elasticity of consumption growth. Another reason could be that the short-term nominal rate proxies for the *ex ante* long-term real interest rate, as suggested by Fuhrer and Moore (1995).

Figure 9: Interest Rate Semi-elasticity of Consumption and GDP Growth
Inverted scale
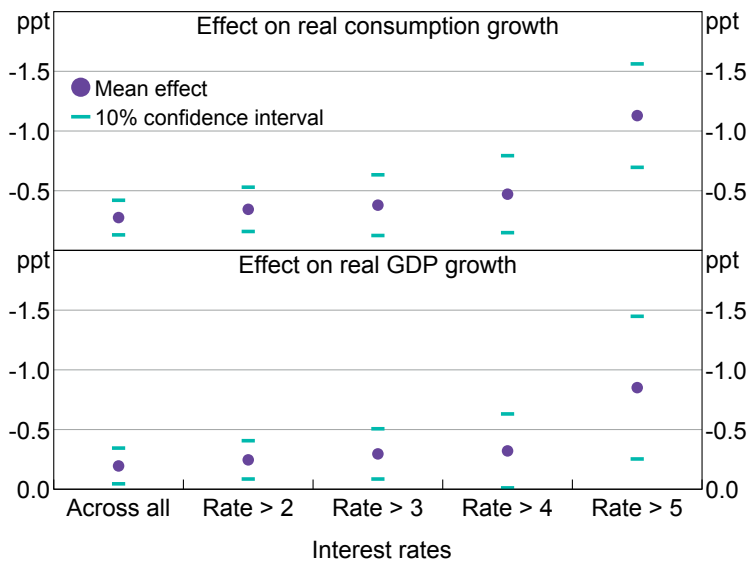
Notes: Estimated semi-elasticities from reduced-form empirical Euler equations linking real
          consumption and real GDP growth to the level of the nominal short-term interest rate; based
          on annual data for a panel of 31 countries over the period 1995–2015; nonlinearities are
          modelled by means of piece-wise regressions, allowing the interest rate semi-elasticity to vary
          across different interest rate thresholds
Source: Hofmann and Kohlscheen (2017)

These findings could be interpreted as indicating a flattening of the IS curve at low rates. However, the nonlinearities detected at such an aggregate level cannot shed light on the underlying mechanisms. They might reflect specific nonlinear effects of low interest rates on consumption (arising from the channels discussed before). Yet, just as the studies testing for the role of headwinds may pick up effects originating from low rates, the detected lower interest rate elasticity at low interest rates may likewise partly reflect the effects of headwinds, as the two mechanisms cannot be clearly disentangled in an empirical analysis of aggregate relationships.

3.2.3   Resource allocation

The empirical literature on the existence of possible resource misallocation at very low interest rates typically finds evidence of such a mechanism at work. Caballero, Hoshi and Kashyap (2008) find that after the asset price crash of the late 1980s and early 1990s, Japanese banks kept credit flowing to 'zombie' firms (defined as firms receiving subsidised credit) – a form of forbearance. The market congestion created by the zombies reduced the profits of healthy firms, depressing investment, employment growth and productivity. A recent study by the OECD suggests that such zombification is a more general phenomenon since the mid 2000s. Specifically, Adalet McGowan, Andrews and Millot (2017) show that zombie

firms, defined as old firms that have persistent problems meeting their interest payments, are stifling labour productivity performance because they are themselves less productive and because they constrain the growth of more productive firms. This paper suggests that the rise of the zombie firms has probably been a key factor behind weak investment and low productivity growth in the OECD countries over this period, and that forbearance lending has probably been a channel through which zombie firms contribute to the productivity slowdown.

There is, however, only scant *specific* econometric evidence on the role that very low interest rates play in this context. The bank-level regressions reported by Lepetit *et al* (2011) indicate that banks' loan charge-offs significantly increase with the level of short-term interest rates, consistent with the prediction of their theoretical analysis. Similarly, Borio *et al* (2017) find that the interest rate sensitivity of loan-loss provisions increases at low rates, which might reflect evergreening (i.e. keeping afloat weaker borrowers). But in both cases the link between interest rates and loan charge-offs could also reflect other mechanisms, notably the effect of monetary conditions on default probabilities through aggregate demand.

Closely related evidence on possible misallocations comes from a recent paper by Acharya *et al* (2017), who study the effects of the ECB's Outright Monetary Transactions announcement. The paper finds that banks that benefited from the announcement (through the revaluation of their sovereign bond holdings) increased their overall loan supply but that this supply was mostly targeted towards low-quality firms that enjoyed pre-existing lending relationships. There was, however, no positive effect on real economic activity, such as on employment or investment, as these firms mainly used the newly acquired funds to build up cash reserves. The paper further documents that creditworthy businesses in industries with a prevalence of zombie firms suffered significantly from the misallocation of credit and that this slowed down the economic recovery.

4. Conclusion

This review suggests that both conceptually and empirically there is support for the notion that monetary transmission is less effective when interest rates are persistently low. Reduced effectiveness can arise for two main reasons: (i) headwinds that typically blow in the wake of balance sheet recessions when interest rates are low (e.g. debt overhang, an impaired banking system, high uncertainty, resource misallocation); and (ii) inherent nonlinearities linked to the level of interest rates (e.g. effect of low rates on banks' profits and credit supply, on consumption and saving behaviour – including through possible adverse confidence effects – and on resource misallocation). Our review of the existing empirical literature suggests that the headwinds experienced during the recovery from balance sheet recessions can significantly reduce monetary policy effectiveness. There is also evidence that lower rates have a diminishing effect on consumption and the supply of credit. Importantly, these results point to an independent role for *nominal* rates, regardless of the level of real (inflation-adjusted) rates.

Our review reveals that the relevant theoretical and empirical literature is much scanter than one would have hoped for, in particular given that periods of persistently low interest rates have become more frequent and longer lasting. While there are appealing conceptual arguments suggesting that monetary transmission may be impaired when rates are low, many of these have not been formalised by means of rigorous theoretical modelling. And the extant empirical work is limited, both geographically and in scope. For instance, most studies assessing changes in monetary transmission in low-rate environments focus on the United States. Similarly, there is hardly any work assessing specific mechanisms. The field is wide open and deserves further exploration, not least given the first-order policy implications.[33]

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33 This paper did not explore the policy implications of the analysis. But a possible one is that policymakers should pay closer attention than hitherto to the financial cycle, that is, boom-bust cycles in credit and asset markets that then usher in balance sheet recessions and persistently low interest rates. See Borio (2014a, 2014b) for a more detailed exposition of this view.

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Discussion

1.   Bruce Preston

This paper reviews recent analyses addressing the important practical question posed in its title – 'Is Monetary Policy Less Effective When Interest Rates Are Persistently Low?' Getting a handle on the empirical and theoretical issues is challenging: empirics must confront non-trivial identification issues, and existing models may not be all that useful to organise relevant ideas. The following comments attempt to draw out some of these difficulties and what they might mean for the paper's conclusions. For the most part, the comments centre on questions of identification and interpretation. They are unavoidably narrow given the wide scope of the paper, but my hope is they will nonetheless underscore broader issues relevant to the interpretation of the literature. And in fairness to the authors, some comments reflect the relative infancy and quality of the literature, rather than the specific details of the review. Some reflections on policy implications, which are not addressed in the review, are also offered.

Impulse and propagation

The review is largely motivated by balance sheet recessions. While perfectly reasonable given recent events, there is little consideration of the precise underlying driving economic developments, which can be important for policy design. The manner in which we arrive at a particular economic situation will matter for the appropriate choice of policy.

Consider a scenario characterised by persistently low interest rates, with weak real activity and inflation below target. Such data could be the outcome of two distinct narratives: either a large, persistent, but ultimately transitory, shock of the kind envisaged by Eggertsson and Krugman (2012); or, alternatively, low-frequency developments, such as shifting demographics, inequality or productivity changes, which depress the natural real interest rate and potentially represent a new 'steady state', as considered by the secular stagnation model of Eggertsson, Mehrotra and Robbins (2017). Both frameworks plausibly describe recent developments. Yet conventional monetary policy and forward guidance are effective only in one case.

Various related challenges confronting policy are easily found and highlight the importance of identifying the source of the macroeconomic disturbance. For example, in the context of short-run stabilisation policy, Mertens and Ravn (2014) evaluate the role of fiscal policy when monetary policy is constrained by the zero lower bound on interest rates. They show fundamentals-driven recessions have different implications for fiscal policy, when compared with 'sunspot' or expectations-driven recessions. Increases in fiscal spending and taxes are expansionary for the former, but contractionary for the latter. Additionally, low-frequency patterns in data, which have little to do with business cycle variation, may confound inference on contemporaneous developments. For example, Gutiérrez and Philippon (2016) and Jones and Philippon (2016) provide evidence that rising mark-ups have had significant effects on

investment activity in the United States, and potentially explain the weak response of private investment to low interest rates. These low-frequency properties reflect long-run changes in the level of competition in product markets, and have little to do with a balance sheet recession, or imperfections in financial intermediation. Monetary policy is unlikely to be effective in addressing these trends.

Policy interaction

Inflation and real activity are jointly determined by the available set of policy instruments. For example, one can't meaningfully discuss monetary policy, without some assumption, explicit or implicit, on the stance of fiscal policy. Yet the review discusses interest rate policy in isolation from financial stability policy and fiscal policy. While the authors necessarily must limit the scope of inquiry, general equilibrium considerations imply one needs to have a view about these arms of policy. Without a clear conceptual framework about the mechanisms through which policies affect the economy, and how these policies interact, it is difficult to: (i) properly identify and assess the consequences of economic policy; and (ii) properly prioritise the various concerns highlighted in the paper.

In regards to the first issue, policies that are in some sense equivalent can have unintended consequences. Consider conventional interest rate policy versus quantitative easing. Both aim to lower longer-term interest rates, and are in this sense equivalent, but may have different financial stability considerations. Conventional policy might raise financial stability risks by encouraging excess maturity and liquidity transformation, as lower rates increase the incentives to issue private short-term safe liabilities in order to fund the purchase of risky illiquid assets (though the paper appears to argue the opposite). In contrast, quantitative easing might lower financial stability risks through the supply of additional safe assets that lower the 'money premium' and therefore financial fragility. See Stein (2012), Caballero and Farhi (2013) and Woodford (2016) for discussion and modelling of these mechanisms.

Similarly, fiscal policy might constrain monetary policy. Central banks often have the view that they can offset any changes in the stance of fiscal policy. As made clear by the fiscal theory of the price level, this is false as a general proposition. Beliefs regarding future fiscal balances regulate the effects of monetary policy, with potentially surprising consequences when the zero lower bound on interest rates is a relevant constraint. Indeed, current discussion in Australia calls for increased future surpluses. Such a policy will be highly contractionary if households and firms doubt they are in a Ricardian regime. This doubt might occur because of scepticism about the commitment to the inflation target (inflation and interest rates have been low for a sustained period), or simply because a central bank is unable to meet its objectives. Alternatively, if agents believe surpluses are insensitive to outstanding public debt, because of political economy considerations, falls in interest rates can be contractionary – the neo-Fisherian view.

In regards to the second issue, absent an integrated treatment of economic policy, it is difficult to organise thinking about the different objectives of policy. The review raises many issues that might concern monetary policy, but how should a central bank prioritise these

concerns? Without some kind of model (formal or otherwise) policy discussions risk reversion to a 'checklist approach', where interest rates are set with respect to an assortment of partial considerations and without any coherent view of how those considerations contribute to the ultimate objective of price stability. As an example germane to the conference, how do we think about 'leaning against the wind' – using monetary policy to target housing prices and private debt? At a minimum, such a policy requires a clearly articulated view of how the housing market affects the goods market, and also a perspicuous understanding of the objectives and responsibilities of various policy institutions that may have a stake in how certain sectors of the economy develop. Issues of this kind raise fundamental questions about the execution and communication of policy.

Interpretation

By the stated metrics of the paper, monetary policy is less effective in low interest rate environments. However, one can easily view the same evidence and arrive at the opposite conclusion.

There are two basic concerns. The first regards the identification of the effects of monetary policy. If households are in fact deleveraging, then low interest rates greatly facilitate such adjustment, and welfare is likely substantially improved by hastening the day normal consumption growth resumes. Stated differently, if the monetary authority raised interest rates by 100 basis points do we really believe there would be no effect? This highlights the fundamental importance of theory and modelling, and the potential identification issues that arise when interpreting data without an economic model. Just because consumption doesn't increase, or rises weakly, in response to falls in interest rates in low-rate environments does not mean there are no welfare relevant effects, or that the effects are small. Indeed, what is the counterfactual? Observations of this kind remind one of a classic identification problem: if a central bank is successful in stabilising inflation there will be no correlation between interest rates and inflation. Does this mean interest rate policy is ineffective?

The second, related, concern regards the conflation of mechanisms. The recent literature on uncertainty shocks provides evidence that heightened uncertainty could be behind the apparent decrease in the effectiveness of monetary policy – see, for example, Bloom (2009), Bloom *et al* (2012) and Caggiano, Castelnuovo and Nodari (2017). Recessions are times when uncertainty is high. Monetary policy is less effective because investment is optimally delayed: high uncertainty engenders an inaction region, independent of the level of interest rates, as firms and households optimally delay substantial commitments to learn more about the true state of the economy. Furthermore, Vavra (2014) and Castelnuovo and Pellegrino (2017) show high idiosyncratic and aggregate uncertainty might lead to greater price flexibility, which steepens the short-run trade-off between inflation and the output gap so that monetary policy has smaller real effects. Both mechanisms suggest that policy might have less traction on the real economy, not because interest rates have been low for a sustained period, but simply because uncertainty is high.

Implications for policy

The paper is relatively quiet on the implications for stabilisation policy. Reading between the lines, one presumes the authors believe conventional and unconventional monetary policy are unlikely to provide satisfactory results in economic environments currently confronting many countries and so should be eschewed. Putting aside the various identification issues raised above, presumably if the interest rate elasticity of demand is smaller, this just calls for greater adjustment in the policy rate. Indeed, this is the standard policy response in a range of economic problems. Interestingly, much commentary in the Australian policy debate gives little credence to either view. A popular argument is to 'keep the powder dry'. Proponents of this view appear to argue that, even if current and future anticipated economic conditions warrant a reduction in the current policy rate, it is optimal to delay policy action. This is because reducing rates today would have negative consequences as it would lead to a decline in confidence, while acting later, when conditions deteriorate substantially, would have substantial positive effects by raising confidence.

Regardless of how one might view such perverse logic, it is certainly plausible to think there might be important nonlinearities related to changes in the stance of policy in low-rate environments. Indeed, two 25 basis point interest rate changes need not be equivalent to a 50 basis point change. However, it is unclear why this would be an argument for delay. There are two dimensions attached to a possible change in the policy rate: the timing of the adjustment; and the size of the adjustment. If the zero lower bound is anticipated to bind at some future date, conditional on the current understanding of economic conditions, then failure to act now can only exacerbate weakness in subsequent real activity: waiting is a gamble on unexpectedly good outcomes in the future. This is true in both New and Old Keynesian models, and is not the result of highly sensitive forward-looking behaviour in rational expectations equilibrium modelling.

What if changes in the policy do, in fact, convey the central bank's private information about the current state of the economy? For example, Garciá-Schmidt (2015) shows that reductions in interest rates in Brazil lead to a fall in longer-term inflation and output expectations. While these data may not be representative, the findings are certainly inconsistent with standard rational expectations models used for policy evaluation, but are consistent with interest rate policy signalling information. Obviously this complicates matters, but it is unclear whether such concerns would result in optimal delay, or just more conservative adjustment in the policy rate – most likely the latter by a simple argument of continuity. Moreover, two obvious questions are: what private information does the central bank have and why doesn't it try to better communicate that information to the public?

Confidence effects are also likely to lead to a recommendation of policy conservatism, not inaction. For example, Eusepi, Giannoni and Preston (2015) explore optimal monetary policy in a model of imperfect knowledge, in which household and firm long-run projections of inflation and output are sensitive to surprise movements in the policy rate. This model could be interpreted as a model of confidence, to the extent we think confidence is well captured by adjustments in long-run beliefs in response to short-run policy changes. Optimal monetary

policy is less aggressive relative to that in a full information rational expectations model, but it is still responsive: a negative demand shock elicits an immediate but smaller adjustment in policy. Again, delay is not optimal.

Implications for credibility

The paper doesn't talk much about the potential credibility problems attached to persistently low interest rates, which presumably go hand-in-hand with persistently low inflation and weak real activity. What is the likelihood that long-term expectations become unanchored from inflation targets? Can we clearly identify the source of movements in long-term rates? There is fairly persuasive evidence that in US data, much of the decline in long-term rates is due to a secular decline in term premia, rather than declines in expected real rates or inflation, though little is understood about how term premia are determined. This type of issue gets back to earlier identification problems. Apparently ineffectual monetary policy might just reflect movements in term premia – to wit the Greenspan Conundrum. But more recently there has been much discussion of declines in long-term inflation expectations. Again, this is an understudied topic, though Carvalho *et al* (2017) provide evidence that central bank inflation targets may be less credible after sustained periods of inflation below target.

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2. General Discussion

Discussion initially focused on nonlinearities in the effectiveness of monetary policy, and whether these were likely to be related to the level of interest rates or to other state variables. One participant reinforced the discussant's view that the existing empirical evidence indicates that the effectiveness of monetary policy is state dependent, and is related to the level of economic uncertainty and, more generally, to the business cycle. However, they argued that the existing empirical literature has not established the level of interest rates as the threshold variable. In response, Boris Hofmann highlighted the lack of studies that directly speak to the effectiveness of monetary policy at low rates. He noted that, from a historical perspective, the persistently low level of interest rates is unprecedented and, therefore, that statistically testing the interest rate as a threshold variable is difficult. He suggested that more work should be done in this area.

One participant questioned whether there was actual empirical support for the paper's observation that interest rates could be less effective at low levels due to a reassessment of future income. Specifically, they argued that for households to lower their consumption on the expectation that lifetime savings will fall due to persistently low interest rates the income effect of lower rates needs to substantially outweigh the substitution effect. The participant suggested that there was little evidence to support this contention.

Another participant wondered if the effectiveness of monetary policy could depend on the level of household indebtedness and, more specifically, on household 'debt overhang', as suggested by the paper. In response to a shock, households may reassess their preferred level of indebtedness and so reduce their debt and strengthen their balance sheets more generally. While monetary policy can speed the adjustment process by lowering interest payments and potentially stimulating income, households are unlikely to increase their consumption and borrowing until after the adjustment has run its course.

Building on this point, another participant suggested that these debt overhang dynamics would mean that monetary policy has not become less effective, but that the response had simply become more delayed. In this sense, it is the integral of the response that is important, not the

short-term effect. The participant also noted that similar, but reversed, timing issues could occur if agents anticipate that rates will remain low for an extended period. In this case, agents may bring forward their response. This could help to explain the evidence reviewed in the paper that policy was effective during the acute phase of the crisis, but less so in the recovery.

One participant argued that institutional arrangements regarding the structure of debt contracts could help to explain the varying effectiveness of monetary policy. In particular, they noted the relevance of the cash flow channel of monetary policy. Rate cuts reduce interest payments for borrowers with floating-rate debt, resulting in higher cash flows and potentially more spending, particularly for borrowers who are liquidity constrained. This channel is likely to be more important in countries where a large share of the debt stock has floating rates. However, banks do not necessarily pass on rate cuts in terms of required debt repayments, and this can affect the correlation between consumption and monetary policy.

A participant was surprised that the paper did not discuss the exchange rate. They noted that the exchange rate is a crucial channel of monetary policy transmission for small open economies. The participant argued that, globally, low interest rates could weaken the exchange rate channel of monetary policy due to a squeeze of interest rate differentials. In response, Dr Hofmann explained that the paper focused exclusively on domestic transmission channels, thereby abstracting from the exchange rate channel. He noted, however, that some studies show that, if anything, the effect of monetary policy shocks on exchange rates has become stronger in a number of economies in recent years.

Another topic of discussion was the role of quantitative easing. One participant noted that quantitative easing is often considered to be a last resort. The participant wondered if, during balance sheet recessions, quantitative easing could be a more effective first line of attack instead of progressively lowering interest rates. They cited evidence from other research that the risk-taking channel of unconventional monetary policy is moderate to support this contention. The argument for using quantitative easing would be even stronger if it was more effective than conventional monetary policy at stimulating additional lending. Another participant pointed to the uncertainty surrounding the costs of unwinding quantitative easing policies as a counterargument. They argued that reversing aggressive monetary base expansions may be difficult for central banks, as it is likely to be associated with large losses on their portfolio of purchased assets. Dr Hofmann added to the discussion by emphasising that quantitative easing also works by lowering interest rates. As such, using quantitative easing as a conventional tool to fight balance sheet recessions could lead to the same risk-taking as standard monetary policy.

Some general comments and suggestions were made regarding a few aspects of the paper. One participant noted the broad definition of low interest rates. They suggested refining the analysis by making a distinction between short- and long-term interest rates. In particular, they noted that changes in term premia can lead to quite different outcomes for short- and long-term interest rates and so making a distinction can be important.

Lastly, one participant questioned what reduced monetary policy effectiveness could imply for the policymaking process, and what policy implications could be drawn from the analysis. The participant wondered if monetary authorities should reduce their intervention in the face of lower effectiveness, or whether they should act more aggressively instead. The general discussion was then concluded with the observation by another participant that crisis management, especially the management of balance sheet recessions, can be potentially more effective under coordination between fiscal and monetary policy, and therefore the role of government policy should probably be reinforced.

New Financial Stability Governance and Central Banks

Rochelle Edge and Nellie Liang*

1.   Introduction

Since the global financial crisis, countries have been assessing and reforming their regulatory structures, strengthening their microprudential policy regimes and creating or enhancing frameworks for macroprudential policies directed at system-wide or macro-level risks. Examples of such macroprudential frameworks are laid out in, among others, Bank of England (2009), CGFS (2010) and IMF (2011). These documents emphasise that the ultimate objective of macroprudential policy is the stability of the financial system as a whole, across all likely macroeconomic and credit market environments. The documents describe three components of macroprudential policy frameworks, specifically: (i) measuring and monitoring systemic risk; (ii) implementing policies to mitigate identified systemic risks; and (iii) establishing an institutional and governance structure for implementing policy.

This paper reviews progress on the third component – institutional arrangements and governance. We review public official documents for 58 economies to evaluate whether they have put in place arrangements to consider and implement pre-emptive macroprudential policies, that is, those aimed at reducing potential financial stability risks, particularly time-varying or cyclical systemic risks.

There are two reasons for the interest in frameworks for time-varying risks. The first is the concerns expressed in recent years about financial stability risks that could emerge from a sustained period of low interest rates, such as asset price bubbles and excessive risk-taking, which could leave banks and investors vulnerable to a fall in asset prices. These concerns have been the focus of many country and cross-country financial stability reports (FSRs), including the October 2016 International Monetary Fund (IMF) *Global Financial Stability Report* (IMF 2016) and the November 2016 report by a joint ESRB–ECB taskforce on macroprudential issues and structural change in a low interest rate environment (ESRB and ECB 2016).[1] The second is the fact that, though the arrangements to address structural risks, such as writing new regulations

1   In late 2015, the Basel Committee on Banking Supervision Macroprudential Group undertook a detailed study of current macrofinancial risks and official sector responses that involved a review of member financial stability reports. This review found the most widely noted current concern among members to be the potential effect of the global low interest rate environment. These concerns related to both how the extended period of low interest rates and compressed risk premia could lead (and in some cases have led) to excessive risk-taking, asset price acceleration and a weakening in lending standards, and how low rates have promoted significant cross-border flows into emerging economies.

to enhance bank capital and liquidity, are generally grounded in the standing microprudential regulatory system, the governance framework for implementing macroprudential policies to address cyclical risks is new and less well established. Cyclical policies, including adjusting residential mortgage loan-to-valuation ratios (LVRs) or the new Basel countercyclical capital buffer, involve identification of emerging financial vulnerabilities such as high credit and compressed risk premia. As such, they may require the macro-based analytical skills of central banks (CBs) and the political judgements of the government, in addition to the expertise of prudential regulators (PRs).

In our review of the governance structures implemented to address cyclical financial stability risks, we look at the composition and leadership of financial stability committees, and whether they have separate tools or rely on the tools of their members. We also focus on the role of CBs as members of their economy's financial stability governance arrangements. Some international agencies, such as the IMF and Financial Stability Board (FSB), have argued for CBs to have a strong role in national financial stability governance structures because it will lead to greater consideration of macroprudential factors, reflecting CBs' expertise in setting monetary policy and in functioning as the lender of last resort.

Although the literature on governance structures for implementing macroprudential policies is small – a fact often remarked on by Tucker (2014, 2016) – a few papers have studied post-crisis macroprudential policy governance structures, albeit with a different emphasis to us. We briefly review these papers in Section 2. A 2010 IMF survey on financial stability and macroprudential policy (IMF 2011) is a major source of information for many previous studies, but a large number of countries have implemented changes to their macroprudential governance structures since 2010. For our analysis, as discussed in Section 3, we choose as a starting point for our sample the economies that have taken macroprudential policy actions that appear to be related to credit cycles, based on Cerutti *et al* (2016). This choice leads to a review of 58 economies as of 2016, with substantially more advanced economies relative to earlier studies, which had a greater focus on emerging market and developing economies. In addition, we retrieve information directly from national authorities' websites and FSRs, IMF Article IV reports and, where available, IMF financial sector assessment program (FSAP) reports. We perform significant crosschecks against other papers, though our measures of macroprudential governance structures are, nonetheless, based on our interpretations of public statements.

We find that nearly all economies now have institutional arrangements in place to monitor and communicate views about systemic risks, but they have made more modest changes to how they would take macroprudential actions. Of the 58 economies in our dataset, 41 have formal or de facto financial stability committees (FSCs). The chairs and co-chairs are almost always the ministry of finance (MoF) or the CB, and are rarely a PR. Another 15 economies have placed the responsibility for macroprudential policies with a single entity, almost always the CB, and many of these appear to have informal communication arrangements with other regulators or the government. Both sets of structures should facilitate better engagement between financial regulators and macro policymakers. And, consistent with Bodenstein, Guerrieri and LaBriola's (2014) finding that recognition by policymakers of other policymakers'

objectives can improve policy formulation, this may lead to better macroprudential outcomes. Interestingly, however, only 11 FSCs have separate tools, such as 'comply or explain', to direct macroprudential actions. The lack of separate tools may not be surprising given countries are building on pre-existing regulatory and legal systems, and may be unsure about the transmission and effectiveness of new macroprudential policies. Nonetheless, they raise the risk of inaction and ineffectiveness, as suggested by the Tinbergen separation principle, if new financial stability mandates conflict with existing separate mandates, such as the safety and soundness of banks or price stability.

We review research on the rationale for giving the CB a significant role in economies' financial stability governance structures in Section 4. We then empirically examine determinants of the strength of the role of the CB or the MoF on the FSC in Section 5. We look at whether the role of CBs reflects interests in building on a CB's expertise in the analysis of macroeconomic and cyclical developments. In particular, because two-thirds of the CBs are also PRs, we look at whether related informational advantages lead to a stronger role. Finally, since the implementation of time-varying macroprudential tools, like monetary policy, may be politically unpopular (the proverbial taking away the punchbowl), we look at whether CBs that are more politically independent are given a stronger role.

Consistent with previous studies, we find that CBs play an especially prominent role in financial stability governance. The CB is either a member of, or is the chair or co-chair of the FSC, or is the single agency with responsibility for macroprudential policymaking in all but two economies. Preliminary regression results suggest that the most significant determinants of having a governance structure where the CB is the single responsible agency are that the economy's GDP is small, and that the CB is the PR for not only banks but also for broader parts of the financial system.

Nevertheless, if an economy sets up an FSC, the CB is less frequently the chair than is the MoF. Regression results suggest the MoF is more likely to be the chair in advanced economies with low credit-to-GDP ratios, while the CB is more likely to be the chair of the FSC in emerging market and developing economies, and in economies with high credit-to-GDP ratios. Moreover, surprisingly, and in contrast to previous research, we do not find that CBs are more likely to be the chair of the FSC when they are also a PR, suggesting informational advantages are not driving the committee structures. Thus, while CBs generally have a prominent role because they are a member of nearly all financial stability arrangements, they are the lead mainly in smaller countries or emerging market and developing economies.

Overall, the lack of separate tools for committees suggests that there is some risk – similar to the risk from the widespread growth in the past couple of decades in the production of FSRs – that current arrangements will lead to better monitoring and communication, but not necessarily better financial stability outcomes. Thus, on balance, our review suggests that, while greater coordination should be beneficial, attention should be paid to whether procedures are in place for FSCs to take actions when needed, especially if there are conflicts between traditional microprudential mandates of the individual agencies and a new financial stability mandate.

2. Previous Research on Governance Structures for Macroprudential Policies

The literature on governance structures for macroprudential policies is limited, but growing, and generally focuses on either what institutional structures are in place to support the implementation of macroprudential policy or what explains the choice of governance structures across countries. Policy papers by institutions like the IMF covering the topic of macroprudential policy governance structures in more general terms are quite prominent, alongside academic studies that typically focus on a few specific issues.

2.1 Identifying institutional structures

In general, the question of whether institutional structures are in place to support the implementation of macroprudential policy has received the most focus. Ultimately, the identification of the governance structures is intended to help answer questions about how to best structure the institutional set-up to identify system-wide risks and implement policies to mitigate risks, given that both processes require cooperation, at a minimum, across multiple autonomous agencies.

Nier *et al* (2011) provides a comprehensive summary of macroprudential institutional frameworks, based on IMF case studies and a 2010 survey with responses from 50 countries.[2] They group the institutional frameworks observed internationally into seven broad *types* and consider the capacity of these different types of framework to provide for: (i) the effective identification, analysis, and monitoring of systemic risks; (ii) the timely and effective use of macroprudential tools; and (iii) the coordination across policies to address systemic risks, while preserving autonomy of institutions. Within (iii), Nier *et al* note the potentially important role of the CB in supporting effective coordination of macroprudential policy with monetary policy as well as microprudential policy, although they caution that this could suggest a propensity to have a concentration of power in a single institution and the need for safeguards in this situation (an issue also considered by ESRB (2012) and Tucker (2014, 2016)). Also related to (iii), Nier *et al* (2011) note the importance of coordination and cooperation between agencies, supervisors, and the CB.

Lim *et al* (2013) use the database from Nier *et al* (2011) to develop measures of institutional set-ups for macroprudential policies in 39 countries (12 advanced and 27 emerging or developing), based on the respective roles of CBs and governments in macroprudential regulation. They define and calculate three indices: a macroprudential (MaPP) index, a microprudential (MiPP) index and a MoF index. The three indices are ranked from 1 to 4 to reflect the degree to which the CB is responsible for financial stability (the MaPP index) and for individual institution safety and soundness (the MiPP index), as well as the role of the government for financial stability (the MoF index).

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2   They catalogue existing structures by five criteria: (i) the degree of institutional integration between central bank and financial regulatory and supervisory functions; (ii) the ownership of the macroprudential mandate; (iii) the role of the government (treasury) in macroprudential policy; (iv) the degree to which there is organisational separation of decision-making and control over instruments; and (v) whether or not there is a coordinating committee that, while not itself charged with the macroprudential mandate, helps coordinate several bodies.

Lim *et al* (2013) document commonalities in institutional arrangements: for 62 per cent of their sample, the financial stability mandate is shared by multiple agencies and the CB is a member of the coordination body but is not the chair. The CB chairs the coordination body in 10 per cent of countries and is the sole owner of the financial stability mandate in 21 per cent of countries. For microprudential policy, they find that in 67 per cent of countries the CB supervises at least the banking sector, while in the remaining 33 per cent of countries the supervisory agency has this responsibility. With regard to the role of the MoF, they document that it is also a major player and coordinates the FSC in about 31 per cent of countries. Below we document that the role of the CB may have increased since the 2010 survey used by Lim *et al* (2013). We find this despite the fact that our sample includes a larger number of advanced economies, which are less likely to rely solely on the CB as the main financial stability authority.

Additionally, Lim *et al* use their measures of the strength of CBs and MoFs in the macroprudential policy framework to explain the timeliness of responses by financial stability authorities to emerging financial system vulnerabilities. They show that a stronger CB role is conducive to a quicker policy response.

Lombardi and Siklos (2016) also develop a measure of a country's capacity to implement macroprudential policy based on a large number of factors.[3] Some of these factors are similar to those in Lim *et al* (2013), such as factors related to the structure of countries' inter-agency financial stability coordinating bodies, including which bodies are the chair, which are the members, and what is the extent of the CB's involvement. But many factors go beyond inter-agency issues, such as: the CB's internal institutional set-up for financial stability; how the CB views the relationship between macroprudential and monetary policy; and CB communications on macroprudential policy and financial stability topics, which they interpret as capturing transparency and accountability. Some factors also seem to go beyond macroprudential policy, such as the country's deposit insurance regime. While they link capacity to various measures of financial stability – including credit growth, but also variance of real GDP growth and of inflation – they note that it may be difficult to formally evaluate whether capacity affects these measures. For example, they find a statistically significant positive relationship between their measure of capacity and credit growth, which they interpret as evidence that the institutional capacity is designed to deal with the financial stability challenges of credit growth rather than vice versa. Relative to Lombardi and Siklos (2016), our study of economies' frameworks for implementing macroprudential policy is more focused on FSC structures, which are largely inter-agency, and the role of the CB.

Smaga (2013) considers similar issues related to the role of CBs in FSCs and as the single agency with authority over macroprudential policy tools for a sample of 27 European Union (EU) countries, although he considers this question in the context of a much broader index of 'central bank involvement in financial stability'. This index, which builds on an earlier literature –

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3   They summarise eight broad criteria, which are based on 30 elements: implementing macroprudential policy; coordination and responsibility for macroprudential policy; deposit insurance; transparency and accountability; organisational structure of the CB; view of the CB of links between monetary policy and macroprudential policy; distance to FSB/G20 recommendations; and response time to recommendations.

some of it, pre-crisis – takes a broader view of CBs' involvement in financial stability that includes their involvement in the payments system, in microprudential supervision, and in liquidity support (roles also considered by Healey (2001)), as well as factors related to whether CBs have financial stability mandates, how CBs view their role in financial stability, how CBs organise their financial stability function internally, and whether CBs publish FSRs (roles also considered by Osterloo and de Haan (2004)).[4] Additionally, Smaga (2013) also considers publication of an FSR and of stress test results as indicators of a CB's financial stability involvement. In contrast to Lim *et al* (2013) and Lombardi and Siklos (2016), Smaga's interest in measuring CB involvement in financial stability is not to assess how effectively countries utilise macroprudential policy tools or maintain financial stability, but rather is to consider whether countries joining the common currency area led to a refocusing of efforts and resources.

2.2 Determinants of governance structure

In a series of essays, Tucker (2014, 2016) considers the appropriate assignment of macroprudential authorities across agencies, particularly as they relate to time-varying policies. Tucker notes that – similar to monetary policy – the immediate risk of unpopularity that stems from activating time-varying macroprudential policies leads to the tendency for policymakers to delay action until financial system vulnerabilities are unquestionably evident, and thereby precariously high. This consideration, he notes, would argue for entrusting authority for time-varying policies with unelected officials.[5] That said, he notes that macroprudential policies both increase the resilience of the system to prevent future crises and – particularly for time-varying policies – correct credit cycles and misallocations of credit. Since the latter have important distributional consequences, such decisions should rest with elected, rather than unelected, officials. For example, he argues that debt service-to-income ratio and LVR caps should not be set by unelected officials, such as a prudential authority or CB, because of their significant distributional consequences. Unelected officials' authorities should instead be limited only to setting caps on the fractions of mortgages exceeding some ratio.

Bodenstein *et al* (2014) consider strategic interactions among different policymakers, with different tools when policymakers' objective functions include not only maximising household welfare but also achieving a policy variable target, and when each policy tool can affect other policymakers' objectives in addition to their own. In an example with a monetary policymaker whose objective function additionally includes stable inflation and a macroprudential policymaker whose objective function additionally includes maintaining sustainable levels of bank capital and lending, they show that substantial welfare gains can be obtained from coordination, relative to the outcome that is associated with the model's open-loop Nash equilibrium solution. Additionally, these authors find that adding to each policymakers' objective function some recognition of the other policymakers' additional objective would move the sub-optimal Nash equilibrium allocation notably closer to the

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4   In Smaga's review of the literature, it appears that it is mainly in post-crisis papers – specifically the Ingves Report (BIS 2011) by the Central Bank Governance Group of the BIS and Vinals Report (IMF 2010) by the IMF – that the use of macroprudential policy tools and inter-agency coordination start to enter into consideration for CBs' involvement in financial stability.

5   The European Systemic Risk Board (ESRB) guidance to countries on their macroprudential policy framework emphasises that they should be shielded against outside pressures through independence; see ESRB (2012).

cooperative policy outcome. This result could be interpreted as suggesting benefits from either making both policies the responsibility of one policymaker or for a forum, such as an FSC, to facilitate coordination between members.

Masciandaro and Volpicella (2016) adopt a political economy perspective to explain the strength of the CB's role in the macroprudential policy infrastructure of 31 countries, as measured by Lim *et al*'s (2013) MaPP index. They find that if the CB already has micro supervisory responsibilities for banks, it is more likely to have a stronger role, perhaps reflecting a desire to take advantage of informational advantages. They also find a stronger role for the CB if the CB has less political independence, which they speculate may represent attempts by governments not to give too much power to the CB. Moreover, they find some evidence that the CB tends to have a stronger role in macroprudential policy if it has a clear monetary policy mandate, such as a clear inflation target, consistent with governments attempting to limit the power and discretion of the CB. We consider some similar issues to Masciandaro and Volpicella (2016), although our analysis covers a larger number of economies with a greater representation of advanced economies. Additionally, Masciandaro and Volpicella do not explore factors that might explain the role of the MoF in the coordinating body, which is one of the issues that we explore below.

3. Characteristics of Governance Structures for Macroprudential Policy

We collect data on governance structures for a sample of 58 economies (listed in Appendix A). A brief outline of how we collected our data is provided in the first sub-section and a description of our findings is given in the second sub-section.

3.1 Sample and data sources

Because we view an important future question to be the link between governance structures and the use of tools, specifically cyclical tools, we started with the sample of 64 economies in the macroprudential policy tool database of Cerutti *et al* (2016). We dropped from the database, however, six of the seven economies that Cerutti *et al* highlight as having limited information about the use of tools, although we did not drop Saudi Arabia because we wanted to include the full set of G20 economies in our dataset. We did, however, drop Taiwan because of lack of information about its governance structure. We also added Cyprus because it is the only EU country excluded from the Cerutti *et al* macroprudential tool database and we wanted to include the full set of EU countries. This process results in a sample of 58 economies, of which 28 are advanced economies and 30 are emerging market or developing economies, as categorised by Arnone and Romelli (2013), with this categorisation being consistent with the IMF's 2007 World Economic Outlook (WEO) reports.[6]

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6   More recent IMF WEOs have added seven additional countries to the listing of advanced economies. With the exception of the Czech Republic, the countries that have been added are those that have in recent years become members of the common currency euro area. (See the IMF's web page 'Changes to the Database: World Economic Outlook Database', available at <https://www.imf.org/external/pubs/ft/weo/data/changes.htm>, for a listing of these changes.) Given this reason for the change in classification, we do not use the more recent WEO definition. Moreover, we want the variable to represent the economy's status at the time countries were considering how to structure their new governance structures, and 2007 is right before the global financial crisis and when most new structures were beginning to be formed.

The main sources for our information on economies' financial stability governance structures, safety and soundness authority's responsibilities, and tool availability were national authorities' websites (and further documents referenced therein), national authorities' FSRs, IMF Article IV reports, and, where available, IMF FSAP reports. In addition, we undertook various crosschecks, including comparing what we inferred from our sources with Lombardi and Siklos (2016) for macroprudential policies, with Nier *et al* (2011) for microprudential policies, and with an appendix table on institutional structure in a recent IMF/FSB/BIS (2016) report.[7] For information on CB financial stability mandates, we also consulted Jeanneau (2014) and CGFS (2016b). For information about the availability of tools, we additionally consulted responses to the IMF's global macroprudential policy instrument survey for 2013. A large reason for our preference for national authority websites are the ongoing changes in financial stability governance structures, some of which have occurred as recently as 2015.

3.2   Financial stability committees

Our review of governance structures finds that 41 of the 58 economies have formal or de facto FSCs (Table 1). Of these 41 economies, 34 have an FSC formally created by legislation and 7 have a de facto FSC, which means that a committee exists and meets regularly but exists only as a result of non-legislative arrangements between the agencies, such as memorandums of understanding (MOUs). Of the 17 economies that do not have formal or de facto committees, we determine that 15 have assigned, at least in practice, macroprudential responsibilities to a single institution, and of these, 14 have the CB as the single authority (where in all cases the CB is also a PR)[8] and 1 economy has the PR as the sole institution.[9] Finland and Israel have informal arrangements, in which meetings take place between agencies, though they occur at the staff level and have not been formalised through any procedural documents.

In addition, a number of the 17 economies without an FSC have informal information sharing and coordination arrangements in place among agencies. For example, New Zealand has an arrangement in which there is a written MOU between the CB governor, who is responsible for macroprudential policy, and the minister for finance, which says that the governor must consult with the minister when macroprudential policy actions seem likely. In Singapore, where 'stamp duties' have been an important policy tool to address rapidly increasing home price valuations, informal consultative arrangements are in place between the CB and MoF.

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7   While in the vast majority of cases our findings on institutional structure were the same as those of the sources against which we performed our crosschecks, there were instances in which we differed. Our approach in these instances was to recheck our sources and if we considered our assessment to be correct we proceeded with that.

8   The 14 economies for which the CB is the single authority are Argentina, Belgium, Cyprus, Czech Republic, Greece, Hungary, Ireland, Lithuania, New Zealand, Portugal, Saudi Arabia, Singapore, Slovak Republic and Thailand. Note that in the paper we denote the CB that is also a PR as a CB.

9   Of the 17 economies, 10 are EU members, which means that under the ESRB's recommendation on the macroprudential mandate of national authorities (ESRB 2012), they are required to explicitly designate a macroprudential authority. In 9 of these economies the CB is the designated authority, and in 1 economy – Finland – the PR is the designated authority. In the 7 non-EU economies, the extent to which the macroprudential authority is explicitly assigned to a particular government agency varies. If not explicitly stated, we judge the agency that is responsible for prudential regulation to be the macroprudential authority. In all but one case, Peru, this agency is the CB.

Table 1: Macroprudential Governance Structures

Type of governance structure		Year FSC formed		Chair or co-chair of FSC[a]		Members with voting rights on FSCs	
Type	No	Year	No	Type	No	No of agencies	No of FSCs
Formal FSC	34	≤ 2008	11	CB	18	2	6
De facto FSC	7	2009	1	CB is a PR	10	3	8
Single agency	15	2010	5	MoF[b]	25	4	17
CB	14	2011	3	PR	1	5	7
CB is a PR	14	2012	3	No chair	2	≥ 6	3
PR	1	2013	10				
Informal	2	2014	4				
		2015	4				
Total	58	Total	41			Total	41

Notes: (a) Sums to more than 41 because for 3 committees the CB and MoF are co-chairs, for 1 committee the CB and MoF (and the other FSC members, the market regulator and deposit guarantee fund) are rotating chairs, and for 1 committee the CB and PR are co-chairs
(b) Includes the First Deputy Prime Minister who chairs the FSC of the Russian Federation

Most of the 41 FSCs that are in existence today were created relatively recently and, specifically, after the global financial crisis. Only 11 FSCs were formed before 2008, and 30 were formed in 2009 and later. The most frequent year for formation is 2013, with 10 economies. Of these 10 economies, 7 were EU members, so it is possible that this large number of FSCs formed was tied to the ESRB's recommendations that were issued in 2012 (ESRB 2012). Indeed, of the 18 FSCs formed from 2013 onwards, 12 were from EU economies. The fact that such a large number of FSCs were formed quite recently indicates the importance of ongoing updates on progress.

For the 41 economies that have formal or de facto FSCs, we identify the chairs. We find that the CBs and MoFs are the most frequent chairs. The MoF is the chair or co-chair of 25 FSCs and the CB is the chair or co-chair of 18 FSCs. The MoF and CB co-chair 3 FSCs, and the PR and CB co-chair 1 FSC. In no economy is the PR the sole chair. In one economy – Romania – the chair of the FSC rotates between members and in two economies with a de facto FSC – Japan and the Philippines – there is no FSC chair.

In our analysis, we separately include each of the 19 countries in the euro area rather than treating the euro area as a single entity. There is considerable heterogeneity in governance structures across these countries, so this treatment does not bias the results. In particular, 11 of the euro members have a formal or de facto FSC, 1 has an informal committee, and 7 have designated the CB as the single authority. Moreover, for the 11 euro area FSCs, 7 have designated the MoF as the chair and 4 have designated the CB as chair. In general, the larger members, including France, Germany, Italy, and Spain, have an FSC with the MoF as chair.

Most (33 of 41) formal or de facto FSCs have three to five agencies as members with voting rights: 17 have four voting agencies, 9 have three voting agencies, and 8 have five voting agencies. Only 3 FSCs have members from more than five agencies and 5 FSCs have members from only two agencies. Note that we are reporting here the number of agencies represented and that vote, not the number of members of the committee, to represent the structure of the financial system. Many committees include more than one representative from any member agency and many committees include external members or experts on specific topics.

Policy committee structures were active areas of research in the monetary policy arena in the late 1990s and early 2000s following the significant changes in monetary policy formulation that occurred in the early 1990s. The literature considered several issues, including the degree of consensus that committees sought to achieve, the strength of the leadership of the committee chair, committee size, committee membership, and committee appointments. Researchers in this area – such as Blinder (2007, 2008) – noted that desirable committee size depends on a number of factors, including the range of expertise that was desired on the committee, the degree of consensus that was desired on committee decisions, and the size of the country, which determines the talent pool and the ability to staff the committee. Given this logic, it is not surprising that the most frequent committee size is four, with a typical representation being a CB, PR, market regulator, and MoF. In addition, a more complicated financial sector would likely call for a larger committee, while a higher desire for consensus among policymakers would likely call for a smaller committee. In our review, only three economies have FSCs with six or more members, and all FSCs with tools – with the exception of the United States – have five or fewer members, which seems a manageable number for coordination.

3.3   Authority for macroprudential tools

Few FSCs have what the IMF/FSB/BIS (2016) report and the IMF (2013) paper would consider as 'hard' or 'semi-hard' powers: hard powers give policymakers direct control over macroprudential tools or the ability to direct other regulatory authorities, and semi-hard powers enable policymakers to make formal recommendations to other regulatory authorities, coupled with a comply or explain requirement. Comply or explain requirements can be used to influence the wide range of regulatory actions that would ultimately be undertaken by other supervisory and regulatory agencies.

Only 11 of the 41 FSCs have semi-hard or hard powers (Table 2). France's High Council for Financial Stability (HCSF) and the UK's Financial Policy Committee (FPC) have hard powers over time-varying macroprudential tools.[10] Other than these two cases, most FSCs have only

10 Some FSCs have hard powers to address structural vulnerabilities. The US Financial Stability Oversight Council (FSOC) can designate non-bank financial firms as systemically important. Such designation needs two-thirds majority support from the members of the FSOC and the Secretary of the Treasury must be part of this majority. Somewhat similarly, the UK FPC has the power to make recommendations to HM Treasury on the regulatory perimeter and on which activities should be regulated and whether an institution carrying out regulated activities should be designated for prudential regulation by the Prudential Regulation Authority rather than the Financial Conduct Authority and vice versa. Notably, however, this tool is not a time-varying tool in that it is not used to designate firms during credit expansions and de-designate during contractions with an intent to promote moderate credit growth.

semi-hard powers, which in all cases is the authority to make recommendations along with formal comply or explain authority. The remaining 30 FSCs have either only 'soft' powers, which enable policymakers to express an opinion, a warning or a recommendation but without any comply or explain requirements, or have only an information sharing function. Thus, it appears that most committees appear to function to promote information sharing and coordination, rather than to directly implement policies.

Table 2: Authority for Tools

FSC powers		Authority for countercyclical capital buffers (CCyB)		Authority for stress tests[a]		Authority to set LVRs	
Soft only	30	No	5	No	0	No	19
Semi-hard or hard	11	Yes	53	Yes	57	Yes	39
		If Yes:		If Yes:		If Yes:	
		FSC	2	FSC	0	FSC	1
		CB	31	CB	37	CB	22
		CB is a PR	30	CB is a PR	33	CB is a PR	21
		PR	16	PR	18	PR	7
		MoF[b]	4	Joint CB and PR	2	MoF[b]	9
				MoF	0		
Total	41						

Notes: (a) Unknown for South Korea
(b) Note that for Switzerland and Denmark the government (rather than the MoF) sets the CCyB and for Spain the government sets LVRs

The IMF (2013) views comply or explain powers as being well suited to situations where further judgement by the relevant agency is important. The IMF also views them as potentially well suited to situations where a policy action is expected to face considerable political pressure and where a comply or explain directive could both broaden support for the agencies' action as well as result in greater transparency for the decision. It also views comply or explain powers as being more practical for addressing the structural component of systemic risk, rather than the cyclical component, since they may be better suited to macroprudential policy interventions that are less frequent in nature. An example of this is the US FSOC recommendation to the market regulator in 2014 to eliminate the fixed net asset value in order to reduce the risk of investor runs in prime money market funds that were permitted to invest in instruments with credit risk. More recent experience, however, suggests that FSC comply or explain instructions can likely also be directed at cyclical risks. For example, in June 2014 the UK FPC made recommendations to microprudential authorities in relation to cyclical developments in owner-occupied mortgage lending. Likewise, in November 2016,

the ESRB issued comply or explain warnings on medium-term vulnerabilities in the residential real estate sector to the MoFs of eight EU member states (Austria, Belgium, Denmark, Finland, Luxembourg, the Netherlands, Sweden and the United Kingdom).[11]

Strong communication is recognised to be an important part of countries' macroprudential arrangements in order to promote public awareness of risks and understanding of the need for authorities to take mitigating actions (IMF 2013, 2014; CGFS 2016b). FSRs have for some time been used by CBs to present their analyses of financial stability issues. Čihák *et al* (2012) document the rapid growth in the number of CBs – from 1 to about 50 – issuing FSRs between 1996 and 2005, and the publication of FSRs by 44 countries over much of the period 2000–09. However, they find only modest evidence that better FSRs yielded better financial stability outcomes. Relatedly, Correa *et al* (2017) document that while the sentiment conveyed in FSRs correlates with the financial cycle – indicating that CBs communicate financial conditions and changes in financial conditions in FSRs quite accurately – FSR communications have little effect on the financial cycle. These outcomes suggest limited success of FSRs as a communication-based macroprudential policy tool. This outcome has been interpreted by some as indicating that information provision on its own is not sufficient to reduce the risk of sub-optimal non-cooperative Nash equilibriums (Bodenstein *et al* 2014).

Čihák *et al* (2012) also document that some FSCs have begun publishing FSRs, including the US FSOC that published its first FSR in 2011, and Mexico's Financial System Stability Council, which has also published reviews and assessments on financial stability. It is possible that FSC publication of FSRs could lead to better financial stability outcomes because the actual production process facilitates greater information sharing, cooperation, and the recognition of alternative objectives. Still, the finding that many FSCs do not have their own tools – comply or explain, or powers to direct actions – raises the risk that FSCs will lead to similar outcomes as FSRs; that is, gains in financial stability outcomes would be only modest. If each member agency already uses its own tools to achieve its own mandates, a first-best outcome based on the Tinbergen separation principle would be difficult to achieve if financial stability objectives were to conflict with existing mandates.

Since our review found that most FSCs have only soft tools, we looked further at which agencies had the authority to implement time-varying tools, specifically CCyBs, bank stress tests, and LVRs. Cerutti *et al* (2016) show that of the twelve macroprudential tools considered by Cerutti, Claessens and Laeven (2017), only five were used frequently, and the others were changed very infrequently over 2000 to 2013. Among the five tools that were used frequently, they document that LVRs and reserve requirements (for purposes other than monetary policy) are correlated with credit growth in a way that suggests that they have been used to reduce boom-bust credit cycles. The other three tools, general capital, concentration limits, and interconnections, have not been adjusted in a way consistent with countercyclical intentions. Their finding that capital is not used as a countercyclical tool reflects the fact that their

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11 Heads of national macroprudential authorities also received copies of their country's warning. The ESRB's rationale for sending the warnings to MoFs was that the policies needed to respond to the risks may extend beyond the mandate of macroprudential authorities (ESRB 2016).

analysis captures the adoption of higher Basel III capital requirements, which is a structural adjustment, and does not include the new CCyB or the increasing use of bank stress tests.[12]

Overall, our tabulation suggests that while most economies have granted an agency the authority to implement CCyBs, stress tests, and LVR adjustments, the FSC almost never directly controls these tools. The CCyB as a new tool went into effect in 2016, is calibrated generally to system-wide rather than bank-specific risks and allows for cross-border reciprocity arrangements, so it seems plausible that economies could have established the authority at the new FSCs or it would involve the MoF (or government more broadly). On the other hand, the skills for calibrating CCyBs, which are based on time-varying system-wide financial vulnerabilities, would normally be at the CB and the tool would be applied to regulated banks. The vast majority, 53 economies, have established the authority to set the CCyB (Table 2). For the 53 economies, we found that only 2 have the FSC as setting the CCyB. The CB has the power in 31, the PR has it in 16 and the MoF (or government more generally) in 4, albeit most with a strong role for the CB in providing advice. While it appears that the CB is the most frequent authority, all but one of the CBs is also the PR. Only in Indonesia is the authority for the CCyB assigned to a CB that is not a PR, and here there is a somewhat specific situation in which the CB was the PR until only a few years ago.

Our findings for stress tests are similar. Stress tests are a relatively new tool but pre-date the formation of many of the FSCs, and are used by almost all economies. No doubt there is great variation in how they are implemented, from whether banks or supervisors estimate the losses to whether they are designed to support only microprudential objectives or also macroprudential objectives. In terms of which entity has the authority to implement them, the primary agency is the CB in 37 economies and the PR in 18 (Table 2). Among the 37 CBs, 33 are also PRs. In no economies is the FSC or MoF in charge, even less than in the case of CCyBs. Perhaps the limited role for FSCs for these two tools is because they are applied to banks, and PRs and CBs have inherent information and skill advantages.

In contrast, LVRs are borrower- rather than lender-based, suggesting political or other factors, such as home ownership goals, may be considerations and a more system-wide analysis is needed. We find that 39 economies have established the authority to set LVRs, less than for CCyBs and stress tests, although we recognise that economies may be able to establish a new authority if they were to want to use LVRs as a macroprudential tool (Table 2). Again, we find that FSCs do not direct this tool. The FSC has authority in 1 economy, while the CB has the authority for 22, the MoF has the authority for 9 economies, and the PR for 7. Of the time-varying macroprudential policy tools, LVRs have the most cases of the authority being assigned to the MoF. This outcome is consistent with the view – often articulated by Tucker (2014, 2016) – that policies like LVRs that have distributional consequences should not be directed by unelected officials in independent agencies.

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12 We assume the CB retains the authority for reserve requirements, even if an FSC exists, and as such do not include this tool in Table 2. (Recall that only two FSCs have hard tools – the UK's FPC and France's HCSF – and neither list reserve requirements as one of their policy tools.).

Although the authorities for these tools reside primarily with the traditional agencies, the creation of FSCs in which the traditional agencies participate as members should – per the findings of Bodenstein *et al* (2014) – lead to improved policy outcomes. For example, in economies where the PR has the authority for CCyBs, stress tests, or LVRs, they are members of the FSC in all but one or two economies, and in economies where the MoF (or the government) sets LVRs there exists an FSC in all but one. There is only one case where the government sets the CCyB where the MoF is not on the FSC (Switzerland), but in this case there is a clearly articulated process for consultations with the CB and PR. Thus, while we find that tools are not taken from existing regulators and granted to FSCs with a financial stability mandate, there may still be gains to financial stability because the FSC improves communications among the existing regulators.

To summarise our analysis of governance structures so far, the majority of economies in our dataset have established FSCs and most were created recently. CBs and MoFs are the most frequent chairs. The CB is the chair or co-chair of the FSC in 18 economies, and is the sole agency in another 14. The CB is part of the governance structure – either as an FSC member or as the sole agency – in all but 2 economies, Chile and Peru. This near-universal representation suggests that CBs play a special role. The MoF also has an important role and is chair or co-chair in 25 economies.

In addition, committees appear to be set up in many cases to encourage cooperation and coordination among existing regulators rather than to establish new separate entities with independent tools. Most FSCs have between three and five voting agencies, which usually include the primary PR, the CB, and the MoF, and appear to be small enough to successfully coordinate actions across the entities. But few committees have independent authority for comply or explain, or for time-varying tools. Although most economies have adopted the CCyB and stress tests, and many use LVRs, the authorities for these tools reside primarily with the CB or PR. But in most economies, these agencies are also members of FSCs, so there may be gains from information sharing, which could lead to better macroprudential policies.

4.   Rationale for the Special Role of the Central Bank

There is a commonly held view that CBs should be prominent in macroprudential policymaking (IMF 2011; ESRB 2012).[13] For example, the ESRB recommends '"the national central banks should have a leading role in macro-prudential oversight because of their expertise and their existing responsibilities in the area of financial stability." This conclusion is further strengthened when central banks are also in charge of micro-prudential supervision' (ESRB 2012, p C 41/1).

We summarise the main reasons provided for granting the CB an important role in Table 3. Nier (2009) and Nier *et al* (2011) support a strong CB role because CBs have expertise in identifying and analysing systemic risks that is crucial to inform macroprudential policies aimed at reducing procyclical risks. In addition, a strong CB role enables use of the CB's

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13 Earlier studies of financial stability policymaking capacity focused almost entirely on the CB rather than coordinating bodies (Smaga 2013).

existing experience in communicating risks to the markets and general public, and it would lead to greater coherence about risk warnings and messages. They cite drawbacks as well, including: lack of institutional mechanisms to challenge the risk assessment views formed within just one institution; the risks of managing too many functions within the CB; and concentration of too much power at the CB, which is run by unelected officials.

Tucker (2014, 2016) also discusses the principles by which macroprudential policy decision-making authorities should be assigned to CBs, PRs, and market regulatory authorities. With regard to CBs he notes that CBs both with and without PR responsibilities are reasonable candidates for having authority for time-varying macroprudential policies. As the liquidity reinsurer for the financial system, CBs are called to the scenes of financial disasters regardless of whether or not they have prudential authority. Moreover, their core purpose of maintaining stability in the monetary system overlaps with financial stability given that it is private institutions (mainly banks) that issue monetary liabilities. Additionally, the deliberations and processes for undertaking time-varying macroprudential policies are much more akin to monetary policy than they are to microprudential policies. The key considerations against strong CB authorities for time-varying macroprudential policies are that it may be granting the CB too much power, as well as assigning additional responsibilities to the CBs that take it too far away from their monetary functions.

Nier *et al* (2011) also provide some empirical evidence, albeit somewhat limited, that suggest a greater role for CBs tends to be associated with better outcomes. In particular, they cite that losses are lower in the event of failures when the CB is also a bank supervisor or there is a good coordinating mechanism. Nier *et al* look at three measures of the costs of banking crises – failed banking assets, capital injections, and guarantees – and find that the group of countries with close integration between the CB and banking supervisory agencies have lower average costs than those countries with separate arrangements. They cite an earlier study by Goodhart and Schoenmaker (1995) as one of very few existing studies to examine the effect of the institutional structure on outcomes. That study found, based on a sample of 104 (large) bank failures that occurred across 24 countries in the 1980s and early 1990s, that there were significantly lower actual and expected bank failure rates in the 11 countries with an integrated regime than in the 13 countries with a non-integrated regime. Merrouche and Nier (2010) found that the build-up of financial imbalances (measured by the ratio of loans to deposits) depends on institutional structure, with a less severe build-up where the CB had full control of supervision and regulation.

However, Koetter, Roszbach and Spagnolo (2014) examine for 44 countries whether the CB being the PR affects the credit risk or non-performing loan ratio at banks, and finds no evidence of a relationship. Thus, the empirical evidence is mixed on benefits from the CB also having supervisory authorities. Nevertheless, these studies are somewhat limited in the sense that they focus only on the effects of greater CB interaction on the financial condition of the banks, rather than the entire financial system, and so do not reflect the more recent focus by regulators on system-wide risks or broader tools.

Table 3: The Role of Central Banks for FSCs and Macroprudential Policymaking

Arguments in favour of a stronger role
Information synergies
CB expertise from other responsibilities, including being the lender of last resort for financial firms, operating the payments system, and – for some CBs – being the PR (Nier 2009; Tucker 2014, 2016; Masciandaro and Volpicella 2016)
Skill advantage in time-varying analysis
CB has expertise in: • monitoring macroeconomic and financial conditions over time (i.e. filtering signal from noise) • analysing and assessing the broader systemic implications of identified vulnerabilities, derived from its monetary policy responsibilities • communicating potential risks that may require a policy response
Required skills are more similar to monetary policy than to microprudential supervision (Nier 2009; Tucker 2014, 2016)
Independence
Independent authority and thus better able to set countercyclical policies that are unpopular (Tucker 2014, 2016)
Consistency advantage
Greater consistency and coherence in using a range of tools in a single entity (Nier 2009)
Arguments in favour of a weaker role
Power
CB is already an independent monetary authority, and would have too much power (Nier 2009; Tucker 2014, 2016; Masciandaro and Volpicella 2016)
Responsibilities
CB with many functions, given limited resources, will not perform all functions well, and the function that is most visible will receive the most attention (Nier 2009; Tucker 2014, 2016)
Undermine monetary policy mandates
A leadership role for financial stability could undermine its commitment to monetary policy objectives, which could lead to higher inflation (Ueda and Valencia 2012; Tucker 2014, 2016; Masciandaro and Volpicella 2016)
Could threaten monetary policy independence if it leads to additional government scrutiny (Tucker 2014, 2016) or if crises result and the CB loses credibility (Smets 2014)
Inappropriate
Would inappropriately give unelected officials authority for policies with distributional effects (Nier 2009; Tucker 2014, 2016)

Lim *et al* (2013) examine if the institutional arrangements can explain response times for the use of tools to moderate credit growth. For example, for one measure of response time, they identify a break in the trend of credit and then measure how long it takes to implement one of eight macroprudential tools. For their sample of 39 countries, from 2008 to 2011, they find a negative correlation between policy response time and the involvement of the CB, suggesting that including the CB is conducive to reducing policy response time. Their results support the IMF's position that the CB needs to play an important role, reflecting its unique position to monitor macrofinancial linkages, identify systemic risks, and its experience in communicating risk to markets and the general public. They do not find a similar link to the strength of the MoF in the macroprudential set-up.

CBs face a unique situation as part of a macroprudential policy committee. CBs also set monetary policy, and even if they do not have financial stability as a mandate, they may not be able to ignore the potential effects of monetary policy because it can affect the build-up of vulnerabilities through a risk-taking channel. Ueda and Valencia (2012) consider how time inconsistency and political pressures can distort the incentives of a monetary authority that makes simultaneous monetary policy and macroprudential decisions. Smets (2014) presents a simplified, static version of this model in which policymakers minimise a quadratic loss function for inflation and output variability, augmented with a loss term for leverage variability (where this function can be obtained from a second-order approximation to the social welfare function in a model with nominal rigidities and agency costs in credit markets). Additionally, economic activity and leverage in this model are affected by the macroprudential policy instrument, and the economy's full employment level of output is below that of its efficient level (a standard assumption in the Barro-Gordon literature), while leverage is above its optimal level (due, for example, to fire sale externalities).

When the CB can credibly set inflation expectations, and monetary policy has price stability as its sole objective, policy will be set to achieve the optimal level of inflation, and macroprudential policy also delivers the optimal level of output and leverage, knowing that if it is lax and allows debt to become excessive, monetary policy will not inflate away the debt by delivering higher inflation. But if monetary policy also has financial stability as an objective, it will have an incentive to inflate away debt. Knowing this, macroprudential policy will be lax, which will mean higher output, but also higher optimal debt and an upward inflation bias. Smets (2014) notes that these time-inconsistency risks can be mitigated if the objectives, instruments, communications, and accountability for price stability and financial stability are separate, albeit with information sharing between the two bodies, leading to the view that this type of structure is beneficial. An additional reason that Smets notes to keep macroprudential policy separate from monetary policy is that, since monetary policy cannot fully prevent crises, the actual occurrence of a crisis could compromise the credibility and, in turn, independence, of the CB.

5.   Empirical Analysis of FSC Structures

5.1   Variable definitions

It is not surprising that FSC structures differ, given they are starting from regulatory structures already in place, but there are some commonalities in terms of having representation from all the different regulators and having a prominent role for the CB. As noted, the chairs of the committee are primarily either the CB or the MoF. Chairs are especially important members of the committees because they set the agenda, and even if only for an information sharing committee, they may be held relatively more accountable for the committee's actions.[14]

As highlighted in Table 3, the advantages of having the CB as chair include: an information advantage because of its other functions (most notably, for some CBs, being the prudential supervisor); a skill advantage because of its focus on time-varying analysis, which is typical for its monetary policy duties; and its independence from the government, which may allow it to impose unpopular but necessary policies.

Offsetting these advantages, there could be concerns of: excessive concentration of power without accountability in the CB; too many responsibilities; reduced commitment to price stability; or some risk to losing its credibility or independence in the future, which could jeopardise price stability. If these concerns were high, countries might want to make the MoF or other entity the chair, or create a strong FSC with its own tools.

To test if there are observable factors that can explain the choice of chairs, we start by defining several variables, which are summarised in Table 4.

Table 4: Strength of Central Banks and Ministry of Finance

Strong_CB_in_FS		Strong_MoF_in_FS		CB_is_a_PR	
= 1 (CB not on FSC or not single agency)	2	= 1 (MoF not on FSC or not single agency)	22	= 0 (CB not a PR)	23
= 2 (CB on FSC and not chair)	24	= 2 (MoF on FSC and not chair)	11	= 1 (CB is a PR for banks only)	18
= 3 (CB on FSC and chair or co-chair)	18	= 3 (MoF on FSC and chair or co-chair)	25	= 2 (CB is a PR for banks and some non-banks)	10
= 4 (CB is single agency)	14	= 4 (MoF is single agency)	0	= 3 (CB is a PR for the entire financial system)	7

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14 Clearly, the role of the chair may differ across FSCs but at this stage we do not attempt to evaluate these possible differences. The issue of chair dominance has been studied in the context of monetary policy committees; see Blinder (2007, 2008).

The first variable we construct is 'Strong CB in financial stability' (*Strong_CB_in_FS*) and we assign a value to it for each economy according to the following definitions:

- *Strong_CB_in_FS* = 1, if an FSC *exists* but the CB *is not* a member of the FSC or if an FSC *does not exist*, another agency is the economy's macroprudential authority;

- *Strong_CB_in_FS* = 2, if an FSC *exists* and the CB *is* a member but *is not* the chair of the FSC;

- *Strong_CB_in_FS* = 3, if an FSC *exists* and the CB *is* the chair or co-chair of the FSC; and,

- *Strong_CB_in_FS* = 4, if an FSC *does not exist* but the CB *is* the economy's macroprudential authority either in effect or by designation.

The second variable we construct is 'Strong MoF in financial stability' *(Strong_MoF_in_FS)* and we assign a value to it for each economy according to the following definitions:

- *Strong_MoF_in_FS* = 1, if an FSC *exists* but the MoF *is not* a member of the FSC or if an FSC *does not exist*, another agency is the economy's macroprudential authority;

- *Strong_MoF_in_FS* = 2, if an FSC *exists* and the MoF *is* a member but *is not* the chair of the FSC;

- *Strong_MoF_in_FS* = 3, if an FSC *exists* and the MoF *is* the chair or co-chair of the FSC; and,

- *Strong_MoF_in_FS* = 4, if an FSC *does not exist* but the MoF *is* the economy's macroprudential authority either in effect or by designation.

Our *Strong_CB_in_FS* and *Strong_MoF_in_FS* are conceptually similar to variables that Lim *et al* (2013) construct, and that are used subsequently in Masciandaro and Volpicella (2016). As shown in Table 4 (and discussed above in Section 3), the CB is the chair or co-chair in 18 economies, and is the single agency for an additional 14. The MoF is chair or co-chair in 25 economies, and is never the single agency. Relative to Lim *et al* (2013), we show CBs have a stronger role in financial stability governance. In Lim *et al*, CBs are either the chair or single agency for 31 per cent of their sample, while we show a higher percentage of 52 per cent. A reason for this higher share is that there are now more coordinating committees than in Lim *et al*'s (2013) 2010 sample. In addition, we show that MoFs also have a somewhat stronger presence, and are the chair 43 per cent of the time, rather than the 31 per cent found in Lim *et al*. Interestingly, even if the MoF is not a member of the FSC, it is singled out to be an observer in five economies.

We also construct a variable describing the strength of the CB as a PR, which we use to test for a CB's information advantage about the financial sector. The variable *CB_is_a_PR* is defined as:

- *CB_is_a_PR* = 0, if the CB *is not* a PR;

- *CB_is_a_PR* = 1, if the CB *is* a PR and regulates *only* banks;

- *CB_is_a_PR* = 2, if the CB *is* a PR and regulates banks and some non-banks; and,

- *CB_is_a_PR* = 3, if the CB *is* a PR and regulates *all* of the regulated parts of the financial system.

As shown, CBs are not the PR in 23 economies, but they are in 35 (Table 4). In these 35 economies, they only regulate banks in 18 economies, while in 17, they regulate more than just the banking system. This is an important variable in our analysis, and below we divide it into two variables: *CB_is_a_PR indicator*, which is equal to one if *CB_is_a_PR* is greater than or equal to one, and zero otherwise; and *CB_as_wide_PR*, which is equal to one if *CB_is_a_PR* is greater than or equal to two, and zero otherwise. If a CB is also a PR, then it not only is an independent agency, but it has a substantial information advantage over other regulators and the government about potential risks to financial stability arising via the banking system. If an economy wants to take advantage of this type of informational synergy, we would expect that the strength of the CB in financial stability would be positively related to whether the CB is also a PR. In contrast, if the strength of the MoF were positively related, it might reflect that an economy sets up arrangements to prevent too much power or responsibility for financial stability in the CB. We investigate these issues with a set of regressions, described below, aimed at understanding our variables *Strong_CB_in_FS* and *Strong_MoF_in_FS*.

5.2   Baseline regressions

We run three logit regressions to assess what factors determine the choice to grant the CB a strong role in financial stability policymaking. The basic structure is similar to Masciandaro and Volpicella (2016), but we use a larger and more updated sample, separate the cases of CB as chair of the FSC and as a single agency, and examine determinants of having the MoF as the chair in order to help interpret the CB results. We also assume, as they do, that the microprudential regulatory structure is largely fixed when economies set up their financial stability governance structures.[15]

The regressions take the form:

$$\Pr\left(\mathbf{Y}_i = 1 \middle| \mathbf{X}_i = x_i\right) = \frac{\exp\left(x_i'\beta\right)}{1 + \exp\left(x_i'\beta\right)}$$

where $\mathbf{X}_i$ is a vector of explanatory variables, discussed below. The vector $\mathbf{Y}_i$ is an indicator variable, which differs between the three regressions:

- in regression 1, it takes on the value one if *Strong_CB_in_FS* = 3, and zero if *Strong_CB_in_FS* = 1 or 2;

- in regression 2, it takes on the value one if *Strong_CB_in_FS* = 4, and zero if *Strong_CB_in_FS* = 1 or 2;

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15 Although outside the scope of our study, our review of economies' FSCs uncovered only a few instances of economies reorganising their microprudential regulatory structures. Hungary and Belgium had created FSCs but later changed to a single macroprudential authority after moving the PR into the CB. Hungary, in 2010, following the financial crisis, created an FSC with three members, the CB, PR, and MoF, but in 2013 merged the PR into the CB, and made the CB the single authority. Belgium, in 2002 in the aftermath of the 11 September terrorist attacks, created a business continuity-oriented FSC consisting of the CB and PR (also a markets regulator). In 2010, it moved the prudential regulation of financial institutions into the CB, created a separate markets regulator, and made the CB the single authority for financial stability. In contrast, Indonesia moved the PR out of the CB into a separate newly created PR authority.

- in regression 3, it takes on the value one if *Strong_MoF_in_FS* = 3, and zero if *Strong_MoF_in_FS* = 1 or 2.

We treat CB as chair or co-chair of a committee (*Strong_CB_in_FS* = 3) separate from CB as the single agency (*Strong_CB_in_FS* = 4). Unlike in Lim *et al* (2013) and Masciandaro and Volpicella (2016), we do not assume that a single agency represents a stronger CB than when the CB is the chair of an FSC. Our reason is that their formulation combines two decisions – to create a committee and to designate a chair – rather than a simple ranking that the CB is a stronger presence in financial stability when it is a single agency than when it is a chair of a committee. We run these two cases separately and show they empirically depend on different economy characteristics.

- The main explanatory variables are the indicator variables, *CB_is_a_PR indicator* and *CB_as_wide_PR*, as well a number of other variables described below and summarised in Table 5. The baseline estimation results for regressions 1 to 3 are shown in Tables 6 and 7. All the variables, except the number of voting agencies, are measured in 2007, just before the recent financial crisis and before most of the FSCs were created. As such, they represent information available to country authorities when establishing the FSC structures.

- The credit-to-GDP ratio, denoted *Credit-to-GDP*: this variable may affect the governance structure since credit intensity may amplify output variability and, thus, affect the need for time-varying macroprudential policy and the skills of a CB. It may also reflect a more advanced financial system and financial deepening, and affect the need for coordination.

- The current account-to-GDP ratio, denoted *Current_Acct-to-GDP*: this variable may affect governance structure since an economy with large gross capital flows may be more vulnerable to exchange rate variability and could therefore have greater need for time-varying macroprudential policy and the skills of a CB.

- The fiscal cost of the most recent financial crisis, denoted *Fiscal_Cost-to-GDP*: this is from Laeven and Valencia (2012), who document significant fiscal outlays associated with banking crises, averaging 6.8 per cent of GDP during 1970–2011. These costs may affect governance structures since economies may want more active participation of the MoF or other parts of the government when the costs of crises are high, in order to coordinate macroprudential policies with other macroeconomic policies.

- *Advanced_Economy* or not (according to the IMF WEO classification): advanced economies may have more complex financial systems because there may be more types of firms, markets and regulatory agencies. Macroprudential policymaking in these economies would require more coordination. Economies concerned about concentration of power may not give the CB more authority.

- The number of voting agencies (not members) on the committee, denoted as *#_of_FSC_Voting_Agencies*: the greater the number, the higher the need for coordination. As with advanced economies, concern over concentration of power may lead to an economy not granting the CB more authority.

- The political independence of the central bank, denoted as *CB_Independence*, measured by the Grilli, Masciandaro and Tabellini (1991) index. Political independence is based on the involvement of the government in appointing the central bank governor or as a participant for formulating monetary policy.[16] This may affect governance structures since the more independent the CB, the more able it is to implement policies that might be unpopular.

- The size of the economy, measured by US dollar-denominated GDP and denoted *GDP*. This variable may affect governance structures since larger economies have more resources to staff different agencies.

Table 5: Sample Characteristics of Selected Explanatory Variables

Variable	No of obs	Mean	Standard deviation	10th percentile	90th percentile
Credit-to-GDP	58	91.8	53.7	29.5	171.9
Current_Acct-to-GDP	58	−1.1	9.8	−14.0	10.8
Log(*Fiscal_Cost-to-GDP*)	55	1.7	1.3	0.0	3.5
Advanced_Economy	58	0.5	0.5	0.0	1.0
#_of_FSC_Voting_Agencies	41	4.0	1.4	2.0	5.0
CB_Independence	58	0.6	0.3	0.3	1.0
Log(*GDP*)	58	26.4	1.5	24.4	28.6

Looking first at the results for CB as FSC chair (regression 1), as shown in Table 6, the coefficients on *CB_is_a_PR indicator* and *CB_as_wide_PR* are not significant in various specifications (shown in columns (A) to (C)), suggesting that economies do not see the information advantages the CB gains by also being the PR as important when deciding whether or not to make the CB the chair. This result is in contrast to Masciandaro and Volpicello (2016), an issue we will discuss further below. The coefficient on *Credit-to-GDP* is positive and significant, indicating CBs are more likely to be the chair when credit intensity is higher and so may be a more significant factor for macroeconomic performance, suggesting economies value the macroeconomic skill advantage of CBs.[17] However, the coefficient on *Current_Acct-to-GDP*, also meant to capture the need for the macroeconomic skills of CBs, is not significant. The coefficient on *Advanced_Economy* is negative and significant, indicating the CB is less likely to be the chair in advanced economies, perhaps because of concerns of granting additional powers to a CB in a more complex financial system, and perhaps because its information advantage over other regulators is smaller. The coefficient on *#_of_FSC_Voting_Agencies* is negative, though not significant, consistent with this interpretation.

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16 Masciandaro and Volpicella (2016) distinguish between political independence and operational independence. Operational independence is based on linkages between the CB and government in terms of credit provision by the CB to the government, and also if the CB is a PR. Because of this last criteria, we do not include operational independence.

17 We also included the percentage change in the credit-to-GDP ratio from 2007 to 2014, and the coefficient is positive but generally not significant. This variable is meant to approximate the variability of the credit-to-GDP ratio, where higher variability would lead to greater demand for CB macroeconomic analytical skills. We plan to include the standard deviation of the credit-to-GDP ratio in the next version.

**Table 6: Logit Estimation Results for Central Bank as Chair of FSC
or as Single Agency**

| | Regression 1: CB as FSC chair | | | Regression 2: CB as single agency | |
| | Sample of FSCs | | | Sample for CB_is_a_PR | |
	(A)	(B)	(C)	(D)	(E)
CB_is_a_PR indicator	−0.33	−0.71	−0.23		
CB_as_wide_PR		0.88			1.51*
Credit-to-GDP	0.02**	0.02**	0.02*	−0.01	−0.01
Current_Acct-to-GDP			0.02		
Advanced_Economy	−2.87**	−2.99**	−3.16**	1.77	1.98
#_of_FSC_Voting_Agencies			−0.39		
CB_Independence	1.32	1.24	1.24	0.73	0.90
Log(GDP)	0.03	0.09	0.06	−0.62*	−0.75**
Constant	−0.94	0.66	−1.68	15.30*	17.80**
No of obs	41	41	41	35	35
Pseudo R-squared	0.14	0.15	0.18	0.12	0.20

Note: *, ** and *** denote statistical significance at the 10, 5 and 1 per cent level, respectively

In terms of the magnitude of the effects implied by these coefficient estimates, whether or not the economy is advanced is the most important determinant.[18] If the economy is an advanced economy, the probability of the CB being the FSC chair is around 50 to 60 percentage points lower, relative to what it would have been had the economy been an emerging market or developing economy. The magnitude depends on the values of *CB_is_a_PR indicator* and *CB_as_wide_PR*. The marginal effect of the credit-to-GDP ratio on the probability of the CB being the FSC chair is relatively small. Specifically, a one standard deviation increase in the credit-to-GDP ratio from its mean across economies – which represents an increase from 97 per cent to 150 per cent – raises the probability of the CB being the FSC chair in an advanced economy by about 3 percentage points from around 14 per cent (estimates vary slightly depending on the settings of the values of *CB_is_a_PR indicator* and *CB_as_wide_PR*). For an emerging market or developing economy, where the implied probability of the CB as FSC chair is much higher, 75 per cent, a one standard deviation increase in the credit-to-GDP ratio implies an increase in the probability of 5 percentage points.

We estimate regression 2 for CB as the single agency (*Strong_CB_in_FS* = 4) separately because the decision over leadership also involves an additional decision of whether or not to set up a committee. Also, CB as single agency may or may not represent a stronger CB role than CB as chair, depending on what arrangements it may have to coordinate with

18 Note that, as is standard practice, all of the marginal effects that we report in this section are calculated setting all the continuous variables to their mean values.

other financial regulators and the government. Because all 14 CBs that are the single agency in charge of macroprudential policy are also PRs, we can estimate this regression only for the sub-sample of 34 economies for which the CB is a PR. The results for what determines the CB as the single agency authority, shown in columns (D) and (E), differ markedly from results for CB as the chair for an FSC (*Strong_CB_in_FS* = 3), shown in columns (A) to (C). We find that in economies in which CBs are PRs for more than just banks (that is, *CB_as_wide_PR* = 1) it is more likely that the CB will be the single agency in charge of macroprudential policy. This result suggests these economies are taking advantage of information synergies if they did not set up a committee. Moreover, the effects are economically sizable. For example, the CB being the regulator of more than just banks boosts the probability of the CB being the single agency in advanced economies from 17 per cent to 69 per cent, while for emerging market and developing economies it boosts the probability from 4 per cent to 34 per cent. The other significant variable is size (measured by *GDP*). The CB is more likely to be the single agency in smaller economies, suggesting that this choice could reflect resource constraints in smaller economies. Nevertheless, the magnitude of the effect is small. We also include the other variables in the CB chair regressions, such as the advanced economy indicator and the credit-to-GDP ratio, and they are not significant.

These two sets of results confirm that the determinants of having a single CB authority and having the CB as the chair of an FSC are very different. Masciandaro and Volpicella (2016) interpreted a positive coefficient on *CB_is_a_PR* as countries giving central banks a stronger role in financial stability governance if they also were a PR. In contrast, our results show that for the 41 economies that create a committee, whether or not the CB is the chair does not depend on whether it is also a PR, suggesting potential benefits from information advantages are not a significant determinant of leadership. It is only for the 17 economies where no committee is created that the likelihood of the CB as the lead macroprudential authority is related to whether it is also a PR. Thus, our results suggest a more nuanced interpretation and do not support greater information advantage as the primary determinant for the prominent role of the CB in financial stability governance.

We turn next to the determinants for MoF as chair of the FSC (Table 7). Results for regression 3 show that an MoF being chair is less likely when the credit-to-GDP ratio is high and is more likely in advanced economies. Committees with more voting agencies are also more likely to have the MoF as chair (column (D)), though this result appears to mostly reflect that if the MoF is on the committee, there are more voting agencies. Similar to the CB as chair regressions, the most economically significant factor is whether the economy is advanced or not. The probability of the MoF being the FSC chair is about 40 percentage points higher for advanced economies, where the precise increase varies depending on the values of *CB_is_a_PR indicator* and *CB_as_wide_PR*. Thus, the results for CB as chair and MoF as chair combined suggest that while there is some support for economies designating the CB as chair because of its analytical skills, the most significant determinant is whether the economy is an advanced economy. One interpretation of this result is that these economies have more complex financial systems with more types of firms, markets and regulatory agencies,

and that there may be concerns about giving CBs additional power over such a broad and complex system as it could lead to an undue concentration of power. As such, these economies prefer to designate the MoF as chair of the FSC.

Table 7: Logit Estimation Results for Ministry of Finance as Chair of FSC

	Regression 3: MoF as Chair of FSC Sample of FSCs			
	(A)	(B)	(C)	(D)
CB_is_a_PR indicator	−0.79	−0.63	−0.24	−1.24
CB_as_wide_PR			−1.51	
Credit-to-GDP	−0.02*	−0.02*	−0.02	−0.02
Current_Acct-to-GDP				−0.03
Log(Fiscal_Cost-to-GDP)		0.55		
Advanced_Economy	2.20*	3.50**	2.26*	3.18*
#_of_FSC_Voting_Agencies				1.05**
CB_Independence	0.27	0.30	0.58	1.34
Log(GDP)	−0.02	−0.20	0.08	−0.33
Constant	1.61	5.29	1.16	4.64
No of obs	41	40	41	41
Pseudo R-squared	0.13	0.19	0.17	0.30

Note: *, ** and *** denote statistical significance at the 10, 5 and 1 per cent level, respectively

For both the CB and MoF as chair regressions, we also included measures of CB political independence, but did not find them to be significant determinants for either choice. Masciandaro and Volpicella (2016) found a significant negative coefficient on political independence based on a sample of 31 countries, which they interpret as countries not wanting to give CBs additional macroprudential powers if they were already an independent agency, for fear of creating an all-powerful bureaucracy. We explored another measure of CB independence, specifically the measure developed by Cukierman, Webb and Neyapti (1992) and updated to 2010 recently by Bodea and Hicks (2015), but did not find a relationship with this measure either. We plan to explore this issue further. It is possible that there is a countervailing force in some economies, to grant more leadership to a CB when it is independent because it is more willing to take away the punchbowl, which offsets concerns about placing too much power in the CB.

We also tested the sensitivity of the results to whether the economy is part of the euro area. We included a dummy variable for an economy being in the euro area, but it was not significant. We also excluded economies in the euro area when we ran the regressions, but the results were not significantly changed. As noted above, countries that are members of

the euro area have not adopted a single common governance structure, although all are members of the ESRB.

Overall, our preliminary regression results for the strength of the CB role differ from Masciandaro and Volpicella (2016), which may reflect our more recent and larger sample with more advanced economies, since CBs have stronger roles in smaller economies and emerging market and developing economies. We do not find support for the hypothesis that economies could try to take advantage of information synergies from CBs also being a PR when choosing which institution should chair an FSC. Nor do we find that more political independence of the CB leads to a stronger role for the CB in setting macroprudential policies. Instead, our results overall provide some evidence for the CB as being more likely to be the chair of an FSC in emerging market and developing economies, and in economies with high credit, perhaps a proxy for macro-based skill advantages related to developing monetary policy. The MoF is the chair or co-chair in 25 of 41 of the FSCs, and this is more likely in advanced and more complicated financial systems, perhaps because they require more coordination among many agencies, which may be a role better suited for government than a CB.

6. Summary and Conclusions

Using a newly constructed dataset of governance structures for macroprudential policies for financial stability, we find that nearly all of the 58 economies in our sample have a formal or de facto FSC as of 2016 or have placed that responsibility with the CB. Most FSCs were created after the recent global financial crisis.

In terms of leadership, the CB is the chair or co-chair in 18 economies and the sole agency in 14. It has authority to implement various time-varying macroprudential tools in more economies than the PRs and FSCs. However, the MoF is also an important member of FSCs, and is the chair or co-chair in 25 economies. Unlike the CB, however, it is never the sole agency. PRs are on nearly all of the committees and have the authority for tools in many economies. But they are the co-chair in only 1 economy, indicating that PRs are important in the institutional set-ups for financial stability, but they are not in charge of macroprudential policies. Representation of securities regulators is similar to PRs, with representation on most committees but they are never the chair.

FSCs appear to function in most economies as information sharing bodies to promote cooperation, and are not independent agencies with new tools. Indeed only 11 committees have hard or semi-hard tools and, in most cases, the tool is a comply or explain authority. Instead, the authorities for CCyBs, stress tests and setting LVRs rest with the existing regulators. This structure suggests that committees could not direct, but would need to convince the members to use their tools to mitigate identified financial stability risks. This set-up may simply reflect the political realities of trying to create a new governance structure for macroprudential policy without overly disrupting the existing system for microprudential policy and a cautious approach on the part of economies given uncertainty about how to calibrate macroprudential policies and their effectiveness. A recent CGFS paper (CGFS 2016a) highlights the importance of promoting wider cooperation in conducting appraisals of how macroprudential tools can

affect the financial system and economy. The skills required for these appraisals are unlikely to exist within one entity and rely heavily on expert judgement given the nascent science, and policy effectiveness may depend on the setting of other policies.

We also investigated what factors might explain the role assigned to CBs in financial stability governance. Preliminary regression results suggest that for economies that set up a committee, emerging market and developing economies are more likely to make the CB the chair, while advanced economies assign the role to the MoF. The likelihood of having the CB as chair is also positively related to the economy's credit-to-GDP ratio, but surprisingly it is not related to whether the CB is a PR. We plan to investigate these preliminary findings further, especially those related to political economy decisions for establishing FSCs in advanced economies and the roles assigned to CBs that are more politically independent.

Overall, these governance characteristics suggest that the new structures are most likely to promote financial stability through information sharing and coordination. The near-universal participation of CBs in arrangements may also be helpful. However, because most FSCs do not have independent powers, and existing regulators may have other mandates, the structures may be prone to inaction. As experience is gained – and, possibly, as economies experience situations in which financial system vulnerabilities are detected by an FSC but policy responses are unavailable – economies may adjust their committees. In the meantime, given that many committees are coordinating bodies of the relevant prudential agencies, they represent an additional regulatory layer. In this regard, economies should clarify the role of FSCs to avoid overlap and conflicts with existing agencies to be most effective. In addition, to reduce a tendency to inaction, they could take a number of steps other than to grant independent tools (such as comply or explain powers) to the committees. One would be for FSCs to ask the CB or PRs that currently have the powers to set the CCyB, LVRs and stress tests, to articulate frameworks ahead of time for the conditions that would prompt them to use the tools for macroprudential purposes. Another would be to create automatic mechanisms for FSCs to request tools from the government when needed, as in the United Kingdom, rather than to just issue a warning about a potential risk.

In terms of other avenues for further research over time, it will be important to monitor whether differences in governance structures actually affect the use of tools. For example, it might be useful to evaluate whether a stronger CB role would make it more likely for economies to implement time-varying macroprudential tools or whether it makes implementation more timely. Given the recent formation dates for many FSCs, however, there has not yet been enough experience with the use of tools, but we expect that governance measures like those developed in this paper will be useful for such analysis in the future.

Appendix A: Sample Economies

Table A1: Economies Considered

Argentina	Finland	Luxembourg	Singapore
Australia	France	Malaysia	Slovak Republic
Austria	Germany	Malta	Slovenia
Belgium	Greece	Mexico	South Africa
Brazil	Hong Kong	Netherlands	South Korea
Bulgaria	Hungary	New Zealand	Spain
Canada	Iceland	Norway	Sweden
Chile	India	Peru	Switzerland
China	Indonesia	Philippines	Thailand
Colombia	Ireland	Poland	Turkey
Croatia	Israel	Portugal	Ukraine
Cyprus	Italy	Romania	United Kingdom
Czech Republic	Japan	Russian Federation	United States
Denmark	Latvia	Saudi Arabia	
Estonia	Lithuania	Serbia	

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Discussion

1.   Patricia C Mosser

I thank the RBA for the opportunity to discuss this paper, which is part of a small, but important, literature on the governance of financial stability and macroprudential policy. In addition to showcasing a newly gathered dataset on financial stability governance structures, the paper provides an empirical analysis of the drivers of the choice of governance structures across economies. Along the way it raises a number of interesting policy questions for the next round of research.

The paper's motivation is straightforward. It aims to identify what factors have been important in determining the institutions and structures that economies have created to respond to financial imbalances, such as those caused by an extended period of very low policy rates. Institution building in this area has been enormous in recent years. A key contribution of the paper is an updated view of the determinants of the institutional settings within which economies identify risks to financial stability and make decisions on countercyclical financial policy.

The core of the paper is a very interesting set of empirical results – plus a puzzle or two – on the determinants of the structure of financial stability committees (FSCs) across economies. The empirical results are focused on the role of the chair of the FSC, which is nearly always either the central bank or the ministry of finance.

An important contribution of the paper is a new and expanded dataset on financial stability governance structures, which was gathered directly from individual government and central bank websites. Previous studies such as Nier *et al* (2011) and Lim *et al* (2013) relied more on survey data from a smaller group of predominantly emerging market economies. The authors' new dataset covers 58 economies, 41 of which have FSCs. The greater coverage reflects in part the large expansion in financial stability institutions, particularly in advanced economies, since the global financial crisis. The authors – and particularly their research assistants – deserve thanks for pulling together this new data, which I believe will be useful for addressing several additional governance and policy research questions, a few of which are proposed below.

Main empirical results and a few puzzles

Central banks are the predominant institutions in financial stability governance. If an economy has an FSC, the central bank always has a seat. In addition, if financial stability is delegated to a single authority, the vast majority of economies delegate that authority to the central bank. However, in economies with FSCs, the most likely chair is the ministry of finance, not the central bank. So what factors determine which entity chairs the FSC? Here is where the puzzles begin.

Puzzle #1: Being a prudential regulator is not important in determining whether a central bank is FSC chair, but the credit intensity of the country's economy is. Central banks are more likely to be chair in credit-intensive economies.

The authors' interpretation of these results is that, for credit-intensive economies, central bank expertise in monetary policy and macro stabilisation is important for financial stability, which makes it more likely that it will chair the FSC. But the particular information advantage of being a regulator is not important in determining the central bank's power in FSCs.

Perhaps, but an equally likely explanation in my view is that the central bank possesses informational advantages as lender of last resort, which are directly relevant to financial stability assessments. The lender of last resort responsibilities of central banks provide insights into credit formation, the quality of different classes of financial assets and a high-level assessment of the soundness of banks across their financial systems. Even central banks without regulatory powers often have large staffs who analyse collateral across asset classes, assess the health of banks and financial institutions individually and in aggregate, and have some ability to gather additional data and information on financial risks. As such, lender of last resort responsibilities also provide central banks with an information advantage that is likely to be particularly important for credit-intensive economies. Under this interpretation, the *additional* information advantage of being a prudential regulator is not important over and above the knowledge gained through lender of last resort activities.

An alternative approach would be to examine more carefully how a country's regulatory structure affects the FSC and its leadership. Is financial regulation highly concentrated (in the central bank or an independent agency) or is it diffuse? How does this affect leadership? The authors show that larger, complex (advanced economy) financial systems are more likely to have the ministry of finance as FSC chair. Is that because of financial system complexity or regulatory structure (or both)? In such a set-up, one could test whether the breadth of a central bank's regulatory powers is important in determining governance structure and which institution is chair. For example, if regulatory responsibilities are concentrated and the central bank has broad regulatory powers – across a broad range of financial institutions or financial markets – then is it more likely to be chair (informational advantages matter) or less likely to be chair (because of concerns about concentration of power at the central bank)? This is an avenue worth pursuing in future work.

Puzzle #2: In contrast to the findings of previous papers such as Masciandaro and Volpicella (2016), the degree of central bank independence does not appear to be important in determining the governance structure of the FSC. I agree with the authors that statistical results with respect to the FSC chair may reflect offsetting governance concerns in different economies. For example, one economy with a strongly independent central bank might be inclined to not have the central bank as FSC chair because it is concerned that adding financial stability to the central bank's mandate will concentrate too much power in an independent agency. Alternatively, in another economy, a central bank might be seen as an attractive FSC chair if it has a history of implementing politically unpopular policies that are beneficial in the long run. I would also add an additional rationale: independent central banks typically have

the financial independence to hire and retain senior technical experts on key policy topics with less political interference, and so may have more expertise and, thus, may be seen as an attractive FSC chair.

Future research

In light of the rapidly changing landscape and institutional structures for financial stability analysis and policy, the results in this paper are likely the tip of the iceberg on governance and policy powers. As the authors point out, most economies are moving cautiously with respect to financial stability policy, with some limited experimentation with both tools and governance. This makes it difficult to draw strong conclusions at present. That said, the results in the paper suggest a wealth of potential future research questions that I encourage the authors and others to examine.

The authors offer several ways that they would like to expand and extend their results – for example, by introducing alternative measures of central bank independence. These are good ideas. In addition, I encourage them to include a measure of the breadth (or concentration) of central bank regulatory powers, in an effort to (perhaps) disentangle when and how having the central bank as a regulator is important to the FSC governance structure.

Another avenue of interest is to analyse the factors driving changes to governance. This research may be more of a political science exercise that could involve analysing legislative language and intent. But given the rapid changes that have happened and are likely to continue, this seems an important area to explore to understand how financial stability policy structures might change.

In light of the relatively small number of financial stability committees that have their own policy tools (only 11 of 58 economies), an important question that is not covered in the paper is the governance structure around the tools themselves. In other words, what drives the governance structure for the elements of Table 2 in the paper? Which policy tools are owned by regulators, by the central bank, by the FSC and what determines this allocation? What are the criteria for using a policy tool – that is, financial stability or individual firm safety and soundness?

Relatedly, if an FSC controls particular macroprudential policy tools, how are they linked to the other policy tools that the regulators and central bank control? Alternatively, one can imagine asking the question: if the central bank or the prudential regulator owns most macroprudential tools, but isn't chair of the FSC, then does the structure of the FSC matter for policy purposes? Finally, are the empirical results from this paper – the wide variety of committee structures, the 'puzzles' regarding FSC governance, the lack of formal policy tools for most FSCs – largely a reflection of fragmentation of control over the tools, rather than clear design decisions about committee governance?

Of course, to do this type of analysis will require even more data gathering, but it seems to me to be critical to understanding the governance issues. Moreover, it could inform the broader debate about governance and the use of regulatory tools versus monetary policy tools for financial stability.

In the paper, the authors provide data and information on three cyclical regulatory tools, but, in practice, the macroprudential tool kit is significantly larger. Reserve requirements, dynamic provisioning, credit limits (concentration), dynamic capital controls, and even tax policy have been employed as macroprudential tools in various countries. Moreover, in case studies where macroprudential tools have been successfully employed, countries have typically had to use several different tools, repeatedly, often over long periods of time and with increasing force (Claessens 2015). This suggests that analysing the governance of financial stability policy may be much broader than the structures suggested by the authors, and that a clear separation between cyclical and structural policy tools may not be possible, or even advisable.

Looking much further into the future, the ultimate policy question is how governance structures affect the use of policy tools and economic outcomes. Obviously it is early days for that kind of analysis given the current state of financial stability institutions and policymaking, but clearly it is what we really want to know. Will the 'right' governance structure lead to good countercyclical financial stability policies to mitigate the kinds of risks we see, for example, due to long periods of exceptionally low interest rates and risk premia? At present, case studies and analysis of individual country experience – for example, Danthine (2015) on the governance and implementation of countercyclical capital buffers in Switzerland – seem to provide some preliminary lessons on governance, but they are not definitive.

It took more than 20 years after the end of Bretton Woods for central banks to develop a monetary policy framework and governance structure – inflation targeting – that works relatively well (most, but not all, of the time, and for many, but not all, countries). In that period, central banks did a lot of experimentation with different models, frameworks and governance structures and, as we know, they made a number of policy mistakes along the way. Financial stability policy has a long way to go by that yardstick, although, with careful research and clear policy goals, we can strive for a shorter time frame and fewer bumps along the way.

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2.   General Discussion

Discussion began with one participant asking what the best set of governance arrangements for macroprudential policymaking might be. Some participants suggested that there is unlikely to be one 'best' structure and that it is likely to vary depending on the context. Moreover, they emphasised the importance of culture, giving the opinion that it was important to look beyond the architecture and consider factors such as the internal processes for discussion and the interactions between agencies. Nellie Liang suggested that there are still likely to be some commonalities and that a good governance arrangement for an FSC might involve having the ministry of finance as the chair, with a strong role for the central bank. In addition, she stressed that every institution on the FSC should have a financial stability mandate.

More generally, Dr Liang also suggested it was important to have structures and tools set up *ex ante*. One participant disagreed, suggesting that this presumes knowledge about future stresses, but that, in reality, unexpected things always happen. Setting up too much *ex ante* can lead to a false sense of security. Dr Liang responded by noting that policymakers should not take comfort from the setting-up of FSCs themselves, as these committees typically do not have tools to address risks, but rather focus on information sharing. Patricia Mosser added that our understanding of macroprudential tools and frameworks was still rudimentary and that it was important to further discuss and think about these issues.

Discussion then moved on to evaluating the effectiveness of different governance structures. One participant commented that a lack of financial crises makes it difficult to evaluate the effectiveness of different structures. Another argued that this is not a significant issue, as it is more useful to evaluate effectiveness by thinking in terms of continuous and probabilistic metrics rather than binary outcomes. For instance, whether the set of structures leads to a decrease in the probability of a financial crisis is a more useful metric than whether they prevent a financial crisis. One participant suggested that another alternative is to look at ratings agencies' ratings of different countries' institutional arrangements and to use these ratings to identify the characteristics of good governance structures.

Related to effectiveness, Dr Liang suggested that an important avenue of future work would be the relationship between governance structures and the types of tools used, as well as how they are used. For example, it may be interesting to examine whether countries that have a separate prudential regulator use countercyclical capital buffers differently, compared to countries that have the central bank as their prudential regulator. Similarly, it would be useful to examine how jurisdictions conduct stress tests and whether this differed based on the institutional structures. Dr Liang noted that in the course of her research, she had examined loan-to-valuation policies and their correlation with different governance structures, but the paucity of data made it difficult to draw conclusions.

A number of other areas were touched on in the discussion. One participant asked whether governance structures tended to factor in market competition and efficiency issues, which could have tensions with financial stability. Dr Liang indicated that competition and efficiency

were not traditionally part of financial stability mandates and that it was unclear at this stage how they would be considered in financial stability-related policies. She highlighted recent money market fund reforms in the United States as an example of a conflict between investor protection and financial stability.

Another participant asked for more information about the output of FSCs, particularly as some committees do not have explicit policy tools. Dr Liang stated that FSCs tended not to produce many formal outputs, though a few had started taking on the responsibility of producing financial stability reports in recent years. Rather, the work of FSCs was more focused on information sharing and coordination. Discussions concluded with a comment that maintaining financial stability will always be a shared responsibility between different institutions and therefore is more complicated than monetary policy, which is left to the central bank.

Financial Stability in a Low Interest Rate Environment: An Australian Case Study

Luci Ellis and Charles Littrell*

1.   Introduction

This paper examines two periods in which the RBA and APRA worked cooperatively to moderate potentially dangerous Australian home lending booms. The first intervention, with the benefit of hindsight, proved successful; time will tell whether the second intervention proves equivalently successful.

This paper is also, to some extent, a personal reflection from two people who had been deeply involved in the policy response to financial stability risks in the post-global financial crisis period. Charles Littrell was Executive General Manager at APRA – first for the Policy and Statistics division and later for the Supervisory Support division – during the entire pre- and post-crisis period; Luci Ellis was head of the Reserve Bank's Financial Stability Department from October 2008 until December 2016. In many respects, the evolving views and relationship of the agencies described below are also the authors' own story.

To start the story, the next section gives some background on the evolution of Australia's institutional arrangements for financial regulation. The paper then discusses how the institutional arrangements and past experiences of the agencies influenced their thinking about the implications of low interest rates for financial stability. That thinking helped frame the agencies' responses to two episodes of strong housing market and household borrowing activity, which are detailed in Section 5. A brief conclusion follows.

2.   Background to Australia's Institutional Arrangements

The financial stability policy framework in Australia in the post-crisis period was shaped by some crucial prior decisions and events. Its institutional context had as its starting point the recommendations of the Wallis Inquiry (Financial System Inquiry 1997). This set up the institutional framework of an integrated prudential regulator (APRA), separate from the central bank, and a central bank with a more general financial stability mandate. Subsequent events, specifically the failure of the insurance company HIH, spurred some modifications to these arrangements (HIH Royal Commission 2003). APRA's governance was changed; its resourcing was increased; and its mandate was clarified in a way that empowered it to respond to broader risks. Consequently, in the period leading up to the global financial crisis,

Australia had a set of institutional arrangements that allowed policymakers to be proactive and empowered them to respond to financial stability risks.

In the initial phase after separation, APRA and the Bank set up formal and informal structures to ensure effective cooperation in achieving shared goals. The two agencies entered into a memorandum of understanding (MOU) that, among other things, set up a coordination committee made up of senior staff from each agency. These more formal arrangements were assisted, in the first instance, by existing personal relationships between RBA staff and former RBA staff at APRA. Over time, with turnover and attrition, these existing links could no longer be relied upon. The expectation of a duty to forge good working relationships had, however, already been set up. It was also supported by specific measures, such as the inclusion of a key performance indicator in the job description of the Bank's Head of Financial Stability Department requiring the incumbent to build and maintain good relationships with APRA.

One of the key decisions in the post-Wallis setting that turned out to be remarkably helpful was that the Bank elected not to retain a residual supervisory function once it was no longer the prudential supervisor of banks. Many other central banks in countries that had made similar institutional changes around the same time instead retained an independent on-site inspection function, on the grounds that the central bank needed this capacity for financial stability purposes. A common effect, unfortunately, was that the new supervisory agency and the central bank commenced operations as rivals rather than colleagues, and the new supervisory agency suffered from a lack of experienced bank supervisors.

The MOU between APRA and the Bank contemplated that Bank staff could accompany APRA staff on supervisory visits, which has indeed occurred. The Bank has also engaged in its own non-supervisory liaison meetings with selected banks ahead of the drafting of each half-yearly *Financial Stability Review*. But the Bank refrained from setting up a rival source of supervisory intelligence and influence, and therefore avoided diminishing the authority of the actual prudential supervisor. This marker of mutual respect between agencies seems to have been helpful in building relationships and cooperation, and avoiding misunderstandings or 'turf wars'.

Another useful decision in the post-Wallis environment was the government's allocation of a legislated financial stability mandate to APRA. (The Bank's financial stability mandate has never been explicit in legislation, but was referenced in the Treasurer's second reading speech for the Australian Prudential Regulation Authority Bill 1998. It was subsequently included in the Statement on the Conduct of Monetary Policy agreed between the Governor and the Treasurer.) Much of the post-crisis international policy debate has pointed to the limitations of a purely 'microprudential' approach to prudential regulation and supervision (FSB, IMF and BIS 2011a, 2011b; IMF 2013). Under this approach, the supervisor is assumed to be narrowly focused on the safety and soundness of individual financial institutions, rather than taking responsibility for the broader financial stability and risk environment (a 'macroprudential' approach). Regardless of whether or not this was a fair characterisation of the conduct of prudential supervision in other countries, it did not describe APRA's mandate or its approach. To give some examples:

- APRA conducted its first banking industry stress test in 2002/03, called 'Project Panama', which among other things led to substantial strengthening of bank capital requirements for home loans, and to stronger capital and reinsurance arrangements for lenders mortgage insurance (LMI) companies (Coleman *et al* 2005).

- APRA warned off the banking industry from material participation in subprime lending.

- From 2003, APRA amended its supervisory approach to ensure that the most resources, and the earliest responses to indications of weakness, would be applied to the largest, systemically important institutions (Littrell 2004). This is precisely the 'cross-section' dimension of macroprudential policy, as described in Borio (2003), though arrived at independently of the literature that identified it.

- APRA's policy infrastructure, notably in adopting International Financial Reporting Standards (IFRS) in 2005 and Basel II from 2005 to 2008, followed a consistently conservative line, which (along with other decisions) has led to Australian bank capital rules that are materially 'super-equivalent' to (i.e. stricter than) the international minimum standards (APRA 2016).

The adjustments to regulatory arrangements in the wake of the failure of HIH were also crucial to the resilience of these arrangements during the crisis. The Wallis Inquiry recommendations had been predicated on presumptions common in the North American and European regulatory debate: that market discipline would be superior to bureaucratic intervention; and that traded markets and investments would come to dominate banking. One implication of these presumptions was that, as market-based finance gradually supplanted the role of financial intermediation the prudentially regulated sector would fade in importance. Another implication was that smaller institutions, being relatively insulated from market discipline, required more prudential scrutiny than larger ones. The failure of HIH challenged those presumptions, prompting a rethinking of the importance of prudential supervision generally, and of the attention given to large entities in particular. A new Australia-specific consensus developed in favour of a strong and inquiring supervisor. The HIH Royal Commission recommended that APRA 'develop a more sceptical, questioning and, where necessary, aggressive approach to its prudential supervision of general insurers' (Recommendation 26). This more aggressive approach was not limited to general insurance: in Recommendation 28, the Royal Commissioner recommended that APRA 'develop systems to encourage its staff and management continually to question their assumptions, views and conclusions about the financial viability of supervised entities, particularly on the receipt of new information about an entity' (HIH Royal Commission 2003).

By the time the financial crisis began to hit major financial centres abroad, Australia had a reasonably well-developed framework for thinking about broader risks to the economy emanating from the financial sector. It also had mature arrangements for interagency cooperation, and these deepened further in response to the crisis. Therefore, unlike the authorities in some other countries, the Australian agencies did not have to change their approach significantly in response to the experiences of the crisis.

Some changes were nonetheless needed, mainly to adjust to the greater degree of post-crisis international policy activity. Both agencies were invited to join the Basel Committee on Banking Supervision (BCBS) in 2009. This required the Bank to develop a deeper understanding of the prudential framework, after a decade of being little involved in formulating prudential policy. In addition, the Bank's participation as a member of the Financial Stability Board (FSB) became more intensive, in line with the increased activity of the FSB relative to its predecessor, the Financial Stability Forum. As well as the direct implications of this for resourcing and the activities of senior Bank staff, this also necessitated more interagency cooperation with APRA and the other member agencies of the Council of Financial Regulators: the Australian Securities & Investments Commission (ASIC) and Treasury. Because much of this work involved the same senior staff, it tended to reinforce the strength of the relationships needed for effective day-to-day management of domestic risks.

3. How Institutional Arrangements and History Shaped the Philosophy of Financial Stability Policy in Australia

The institutions and events described in the previous section shaped the Australian agencies' approach to financial stability policy in a number of ways. Firstly, as noted above, APRA's financial stability mandate and approach meant that it was never narrowly microprudential in its outlook. Both the micro (institution-specific) and macro (industry- or system-level) perspectives were at play in the supervisory priorities APRA set over the past 15 years. More broadly, the Australian authorities came to understand that prudential tools were not the only ones available and necessary to the pursuit of financial stability. Macroprudential supervision was defined in Australia as being 'subsumed within the broader and more comprehensive financial stability policy framework' (RBA and APRA 2012), and a broader 'macro prudence' approach was articulated, being '[t]he way in which the public sector works collectively to promote financial stability' (Littrell 2013). This broader perspective became stronger and more explicit following the HIH failure. That experience had taught the authorities that even the biggest and most prominent institutions could fail, and that such failures could be very harmful.

Related to this, over the post-crisis period, the Australian authorities began to see their financial stability mandates as being more closely related to conditions in the non-financial sectors, especially households, rather than focused primarily on the financial sector. The RBA was already putting relatively more resources than some other central banks into analysing household and housing developments' implications for financial stability, even before the crisis (Ellis 2014b). That emphasis was validated by the experience of the crisis and by a careful reflection on the legislated mandate the Bank actually had – the economic prosperity and welfare of the people of Australia – in place of an explicit financial stability mandate.[1] Towards the end of this period, the Bank's public statements about its financial stability mandate were making it clear that its role was not to 'care about asset prices or credit for their own sakes', but rather, to improve the welfare of society, which is comprised of *people* (Ellis 2014c).

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1   See Clause 10(2)(c) of the *Reserve Bank Act 1959* (https://www.legislation.gov.au/Details/C2015C00201).

Secondly, the experience during the peak of the crisis underlined to the senior officials involved just how important it was to work closely together and to respect each other's expertise. Personal relationships and rapport were important – including our own – and needed to be built. As summarised by one of this paper's authors, 'a culture of cooperation, dialogue and mutual respect is more important than formalised arrangements' (Ellis 2012a).

Finally, an appreciation for the importance of supervision, along with the sensibilities of the senior people in both agencies (including the authors of this paper), drew them to develop an intellectual framework that was less model-driven and more behavioural than in some other countries. Two specific features of that framework stand out as having been influential in the development of the policy responses outlined in Section 5.

First, APRA was more willing to lean against banks' risk and capital choices where needed. This was enabled by a legislative mandate that gave APRA rule-making powers. But it was also made possible by an intellectual framework that recognised that the incentives of bank management often push them in the direction of taking more risk than is socially optimal. APRA's approach made no presumption that the 'market outcome' could be assumed to be 'optimal'.

Second, both agencies were highly aware of the importance of lending standards as a driver of risk in both the banking system and the non-financial sector. This view had percolated up in APRA through the experience of practical supervision. The Bank's view was also particularly influenced by the example of the US mortgage crisis, where a breakdown in lending standards was essential to the outcome (Ellis 2010, 2011a). Over time, an explicit view of lending standards as a multidimensional concept developed in the Bank (Ellis 2012b). This shared sensibility shaped the response to issues associated with mortgage lending standards in recent years, as discussed below, and in particular influenced the two agencies to avoid framing the issues solely, or even initially, in terms of high loan-to-valuation ratio (LVR) lending, as had been the case in some other countries.

4. Interpretation of the Effect of Low Interest Rates on Financial Stability

The connections between low interest rates and financial stability risk are of particular concern in a country like Australia, given some of its structural features. For example, the Australian banking system is heavily concentrated in its mortgage business, increasingly so in recent decades (Figure 1). The mortgage book is also overwhelmingly structured as variable-interest rate loans, and the fixed-rate loans that are available generally only have short fixed-rate periods (1–5 years, see Tsatsaronis and Zhu (2004)). Therefore, monetary policy decisions strongly affect the mortgage market and developments in the mortgage market are important for the stability of the banking system.

Figure 1: Bank's Domestic Housing Lending
Share of total resident assets
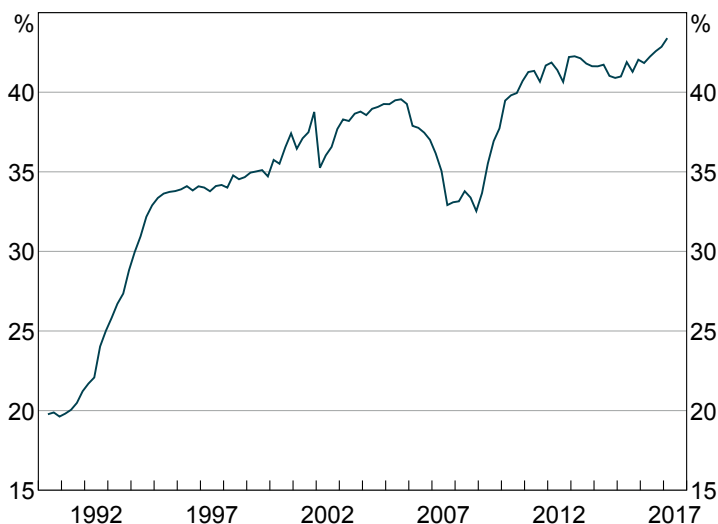
Source: APRA

Unlike some other countries' authorities and some international agencies, the Australian agencies have not tended to interpret movements in macro-level measures of indebtedness or asset prices as directly measuring changes in financial stability risk. The background to this more nuanced analysis was that Australia had changed from being a high-inflation country to a low-inflation country in the early 1990s; this change was cemented by the Bank's inflation-targeting regime. Over the course of the late 1990s and early 2000s, the consequences of this change, and some financial deregulation, became apparent in the housing and mortgage markets. The details of this change were explained by the Bank at the time (Stevens 1997; RBA 2003a, 2003b) and more recently (RBA 2014b, pp 14–42), so this paper will not repeat that material. The key message from that analysis is that the equilibrium sustainable ratio of household debt to household income is higher when nominal interest rates are (permanently) lower. This is largely because each individual new borrower can service a larger mortgage than when interest rates are higher, but with the same repayment.[2] Because of this, households would tend to bid up the price of the existing housing stock and the housing price-to-income ratio would also rise; this is exactly what happened.

These developments were an important aspect of the Australian agencies' thinking on the effects of low interest rates on financial stability. They did not immediately interpret any increase in indebtedness or price-to-income ratios as being synonymous with increased financial stability risks. Instead, they were more focused on how these macro-level developments translated into risk profiles at a more granular level. On the other hand, while

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2   There is an additional effect from the slower growth of nominal incomes, in that the individual debt-to-income ratios of households that borrowed do not decline as quickly as they would if inflation and nominal income growth were higher. In other words, the debt does not inflate away as quickly.

the increase in indebtedness and housing prices in the late 1990s and early 2000s was regarded as being potentially benign, it was already well understood that there was a limit to that transition. It was also understood that once that transition was complete, further rapid growth in credit and housing prices should be interpreted as less benign.

With this context in mind, the regulators in Australia interpreted most (though as noted below, not all) of the increase in housing prices or household debt relative to household incomes over the 10 years to around 2005 as being the result of the disinflation and deregulation described above. Although some speculative behaviour from both borrowers and lenders occurred in the late stages of the transition period, overall the key macro-level changes, such as to the household debt-to-income ratio, seemed likely to be sustained and sustainable. Subsequent events tended to support this view. A point of inflection seemed to have been reached around 2005: housing price growth slowed; household debt stabilised as a proportion of household income; the household saving ratio turned around and began to rise; and mortgage arrears rates stayed low overall. Some of these developments, particularly the rise in the saving ratio, might have been amplified by the (temporary) positive income effects of the large increase in the terms of trade and the resulting mining investment boom. But the slowdown in housing prices and credit growth was the opposite of what one might see if expected future income growth had increased because of the mining boom; clearly, the high incomes were understood to be transitory. This suggests that some other factor, such as the end of the transition to a new equilibrium, is likely to have been at play in producing the housing market outcomes. Also relevant was the tightening in prudential settings affecting the provision of mortgage finance and lenders mortgage insurance that followed on from the 'Project Panama' stress tests.

The focus on risk profiles at the granular level implied a need for disaggregated and distributional analysis. Past Bank work emphasised that most of the mortgage debt was held by higher-income households, the ones most able to service it (Ellis, Lawson and Roberts-Thomson 2003). But both agencies were highly aware that the 'average' or 'typical' borrower is unlikely to be the locus of financial difficulties or default risk. They were also influenced by the example of the United States, where a minority of borrowers (subprime, as well as borrowers of 'Alt-A' and other non-standard products) were nonetheless numerically important enough to pose issues for lenders. In a low interest rate environment, market segments that were particularly sensitive to incentives set by the level of interest rates, such as borrowers with interest-only loans, were understood to require particular attention.

In addition to this more structural analysis of a permanent change in (nominal) interest rates, the Australian authorities have long been highly alert to the connections between lower interest rates at a more cyclical frequency and a heightened potential for financial stability risks. The background to that awareness comes from the banking system's concentration in variable-rate mortgage exposures. This had increased in the wake of the period of banking system distress in the early 1990s. After that experience, most of the banking system chose to concentrate on mortgages and other lower-risk business. In effect, the banks switched, by acquisition and new business choices, to a common low-risk business model.

One of the policy consequences of this shift to a largely common business model was that APRA came to regard the mortgage business as the low-risk 'ballast' in the banking system, with the crucial caveat that home loan underwriting standards could not be allowed to materially slip. APRA therefore strives to ensure that the mortgage business of the banking sector remains low risk. Periods of cyclically low interest rates have tended to be met by increased supervisory attention on the risk profiles and underwriting practices for home lending. A recent example of this was the suite of supervisory measures announced by APRA in December 2014 (APRA 2014). Earlier examples included the changes to prudential requirements for banks and lenders mortgage insurers following the 2003 'Project Panama' stress test, as already mentioned in Section 2 (Laker 2003).

Similarly, the Bank's analysis of the connections between low interest rates and financial stability risks were shaped by the importance of the housing and mortgage markets in the transmission of monetary policy. Bank staff have long been conscious that monetary policy easing works through getting people to borrow more and take on more risk. This does not mean that rates should never be lowered because that might increase risks. Firstly, the financial stability mandate has never been interpreted to mean that risks should be driven to near zero, even if that were possible. Secondly, periods of slow growth and excess real-economy capacity are periods when some additional economic risks should be taken.

At the same time, policy easing in an environment of already low rates needs to be approached with some caution. This is because the physical realities of the property market imply sluggish adjustment in the stock of property, which can inherently generate cycles in prices and increases financial distress. Demand for property – and credit – is demand for a stock. But the supply induced, in the form of new construction, is only small relative to that stock, limiting the adjustment that is feasible in any one year. Moreover, a decline in interest rates pulls some housing construction forward, meaning that there is less incremental demand to be met in the future and therefore potentially leaving a 'hole' to be filled further out (Ellis 2015). Conventional models do not capture these mechanisms particularly well (Ellis 2014a). It should be noted that, relative to many other advanced economies, demand for housing in Australia exhibits a high background rate of expansion because of a relatively high population growth rate, as well as inward investment by foreigners.

Caution is also needed because, after a long period of economic expansion and rising housing prices, some exuberance on the part of lenders and borrowers could be expected. One way this caution plays out is APRA's focus through on-site examinations both on bank lending policies and on how these policies are reflected (or not) in each bank's lending decisions.

Against that need for caution, the Australian policy environment includes some features that tend to mitigate the financial stability risks when interest rates are low. The first is the flexible inflation-targeting regime and floating exchange rate. Australia has a freely floating exchange rate regime and does not use monetary policy or other tools to target the level of the exchange rate. In general, the Australian dollar moves over medium to longer time horizons in ways that at least partially cushion Australia from economic shocks from abroad, including movements in the terms of trade. Because of this, the Bank is unlikely to set interest

rates lower than the level required by domestic economy considerations alone. International experience suggests that countries with fixed or managed exchange rate regimes are more likely to face challenges in balancing macroeconomic policy objectives and financial stability risks (Crowe *et al* 2013).

Another aspect of a floating exchange rate regime is that it makes it easier for the central bank to set monetary policy according to domestic conditions – even if the level of interest rates is therefore noticeably different from global levels – without generating excessive financial stability risks from the ensuing capital flows from abroad. The most direct reason why this is the case is that, under a freely floating exchange rate regime, these flows do not generate a balance of payments surplus and monetary expansion. In addition, the capital flows attracted by higher interest rates would bid the price of domestic currency up (the exchange rate appreciates); in other words, the flows are moving the price against themselves and making this 'carry trade' investment strategy less attractive. That 'carry trade' strategies are less attractive when the exchange rate is freely floating is suggested by the complete lack of relationship between interest rate differentials and private debt capital flows into Australia (Figure 2).

Figure 2: Interest Rate Differential and Debt Inflows
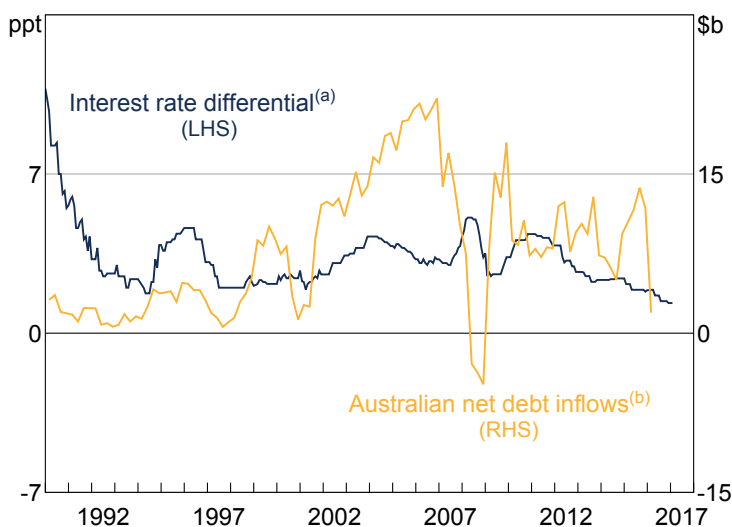
Notes: (a) Difference between Australia's target policy rate and the average of the target policy rates in the G3
          (b) Four-quarter forward moving average
Sources: ABS; Central banks; RBA

Another mitigant to financial stability risks from low interest rates stems from the structure of Australia's retirement saving arrangements. In Australia, superannuation is compulsory for almost all employees and is structured into defined contribution, rather than defined benefit, plans. As a result, a large fraction of financial sector assets – representing more

than 100 per cent of GDP – is unleveraged. Much of this asset pool is held on behalf of younger beneficiaries with very long investment horizons. Fund managers do not have to take extra risk to meet return hurdles when interest rates are low, because they have not made any particular promises about returns, as would be the case for a defined benefit fund (RBA 2014b, pp 171–189). There is, therefore, arguably less of a tendency for the Australian asset management industry to engage in 'search for yield' behaviour when rates are low than would be the case in some other countries where defined benefit pensions (and similar life insurance products) are more common (Antolin, Schich and Yermo 2011; FSB 2017).

More recently, nominal interest rates have declined further, relative to the averages seen in the rest of the inflation-targeting period. This has raised the question of whether Australia is seeing another step-down in the equilibrium nominal interest rate, and hence an increase in the equilibrium household debt-to-income ratio. This possibility cannot be entirely ruled out, but seems unlikely. Given that the Bank's inflation target has not changed, a decline in the equilibrium nominal interest rate can only come from a decline in the equilibrium real interest rate. If that is the case, in the current circumstances it cannot be a response to past financial deregulation or a decline in the inflation risk premium, because no such deregulation has occurred recently and the inflation risk premium is unlikely to have declined in recent years. A decline in real interest rates could occur because trend economic growth has declined, but that is not a scenario in which an increase in household indebtedness would be regarded as benign. More importantly, the cost of assuming that the equilibrium debt-to-income ratio has risen, and being wrong about that, has far more negative implications for financial stability and economic welfare than the cost of making the opposite mistake. The authorities have therefore chosen not to interpret recent developments as an equilibrium phenomenon.

5. Policy Actions Taken in Recent Years

5.1 Countercyclical intervention 1.0: 2002–05

By late 2002, APRA had largely absorbed the lessons from the HIH and other failures, and had fundamentally restructured its approach to supervision and regulation. Among many other changes, APRA commenced looking harder for signs of emerging systemic risks. Given that the banking system comprises the largest part of the financial system, and loans backed by housing are the largest item on the banking industry's balance sheet, home lending was a natural early focus.

This focus turned out to be fortunate, because from the late 1990s to the early 2000s the home lending industry and its associated service providers had succeeded in greatly increasing housing credit, but partially at the cost of degrading lending standards. While APRA was observing potentially reckless lending behaviour from individual lenders, the RBA was regarding the aggregate credit indicators with increasing disquiet, even in the context of a shift to lower interest rates and higher equilibrium prices.

Accordingly, from 2002 and continuing through 2005, both agencies commenced a considered and coordinated intervention which sought to improve the quality of Australia's home lending, with 'quality' defined at both the macro and micro levels.

APRA's focus in this work was largely upon ensuring that each bank's loan portfolio was soundly capitalised and well managed. Major elements in this work included:

1. Public and private warnings intended to discourage reckless lending.[3] Among other things, and as it turned out presciently, APRA warned off the industry from subprime lending, and instituted discouraging measures for other unconventional lending, such as low doc.

2. In 2003, APRA conducted one of the earliest 'modern' industry stress tests, which focused upon home lending.[4] This stress test indicated that the industry was generally in reasonable shape with respect to home lending, but a number of outlier institutions and several common deficiencies were identified for supervisory follow-up. This test and the resultant publicity also helped to ensure that bank boards understood the need to focus upon risks in home lending (Littrell 2004).

3. In January 2003, APRA released a report and raised standards for lending through brokers (Chanthivong, Coleman and Esho 2003).

4. In June 2003, APRA disallowed capitalised expenses (such as broker commissions) relating to loan originations from the prudential balance sheet (Kingston and Maddox 2003).

5. In November 2003, APRA announced an intention to switch from the Basel I 50 per cent risk weight for home loans, to a three-factor model based upon LVRs, insurance status, and the conventionality (or not) of the loan (APRA 2003). The resulting risk weights ranged between 50 and 100 per cent. This three-factor approach carried over to APRA's implementation of the Basel II standardised approach in 2008 (with the safest home loans being reduced to 35 per cent risk weights – the previous approach was therefore super-equivalent to the Basel II standard).

6. After further stress testing, APRA announced its intention to approximately double LMI capital requirements, and to tighten up business arrangements between LMI companies and banks, and between LMI and reinsurance companies (Coleman *et al* 2005).

The RBA's actions during this period fell into two camps:

1. Steady interest rate increases, justified by generally strong economic conditions, but with a clear reference to buoyant conditions in home lending and housing prices.[5]

2. Enthusiastic use of the bully pulpit. A partial list includes:

    (a) The RBA's inaugural half-yearly *Financial Stability Review* in March 2004 devoted six of its opening seven paragraphs to issues associated with a home lending boom that had speculative elements (RBA 2004).

    (b) The RBA commissioned a Roy Morgan Research survey in early 2005 on household behaviour towards home equity (Schwartz *et al* 2006).

    (c) Many references in speeches by senior staff, among which Governor Macfarlane's speech in April 2003, entitled 'Do Australian Households Borrow Too Much?', is a representative example (Macfarlane 2003).

    (d) Many references to home loan risks in Parliamentary testimony.

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3   See, for example, APRA's warning to credit unions and building societies on overexuberant lending practices (APRA 2002).

4   In fact, the BCBS's initial guidance document on stress testing was drafted by a former APRA officer, based in large part on the lessons from APRA's initial and follow-up stress testing.

5   See, for example, the double rate increases in May and June 2002, and the November 2003 rate increase announcement.

One particularly important piece of public communication was the Bank's submission to the Productivity Commission's Inquiry into First Home Ownership (RBA 2003b). This longer document provided an opportunity for a more complete analysis of the drivers of the increase in housing prices in the preceding years. In particular, it was possible to draw out the role of increased demand in generating this growth and, therefore, divert the attention of some observers that had previously been exclusively focused on supply – an exclusivity that was, in the Bank's view, probably erroneous. The submission made a particular issue of the role of small-scale property investors in the household sector buying properties to rent out to other households. This sector seems to have been something of a bellwether of risk and speculative intent, and therefore the Bank paid particular attention to it (and continues to do so). This understanding was informed by a Bank study tour of Canada, the Netherlands, the United Kingdom and the United States that was undertaken as part of the work going into the submission. Dr Ellis was one of the two Bank staff involved in that study. In addition to the public bully pulpit, the Governor and other senior staff also jawboned in private, which both encouraged APRA's interventions, and provided useful support for them with government and industry.

As a result of the above initiatives, the Australian banking industry entered the global financial crisis with a sounder and better capitalised home loan portfolio than would have otherwise been the case.

5.2   Countercyclical intervention 2.0: 2014–17

From 2008 through 2010, the public sector's focus was on encouraging the banking industry not to become timid, in the face of many temptations to do so. This work has been well publicised elsewhere and included deposit guarantees, new debt guarantees, fiscal stimulus, and the like. While APRA did not cease to focus upon high-quality home lending, the regulatory stance was generally less constraining. Significant supervisory actions were occurring behind the scenes, but these were more in the usual mode of engagement with boards to influence behaviour, rather than through public and industry-wide actions. The effects of this were somewhat discernible in the data: for example, the share of high LVR mortgage lending reduced over the course of 2014, even before any publicly announced actions were taken (RBA 2014a).

In the early 2010s, the mining investment boom, which had proven so helpful during the global financial crisis, was also reaching its end. From a macroeconomic perspective the RBA was happy to see other construction activity, including a large increase in activity associated with new housing construction, take up the slack until around 2013.

By 2014, however, both the macro- and micro-related comforts with the large increases in home lending had run their course. APRA was observing more marginal lending decisions by many banks. The RBA could see potentially worrisome trends in the aggregate statistics. By the second half of 2014, therefore, all four members of the Council of Financial Regulators (APRA, RBA, ASIC and Treasury) were comfortable that a period of constrained growth for home lending would be the most sensible strategy.

Accordingly, in December 2014, APRA wrote to the banking industry, asking them to maintain firmer underwriting standards, and suggesting a benchmark of 10 per cent growth in investment property lending. APRA then commenced a comprehensive increase in supervisory pressure to ensure these suggestions were met, which made real progress by mid 2015, and was largely complete by the end of 2015.

Following on from the December 2014 letter, APRA's supervisors also commenced a comprehensive and detailed review of bank home loan underwriting policies, particularly borrower serviceability models (a Bank officer participated in the review team). APRA uncovered information confirming its suspicions that marketing pressure had often overbalanced bank risk management caution, with the result being that banks were in some instances willing to lend more than was prudent to their most aggressive borrowers. By various means, APRA has encouraged the banking industry to adopt more conservative assumptions in their underwriting models, which as a general rule has reduced the maximum potential loan for some classes of borrowers by around 15 per cent (Richards 2016). This reduction only affected borrowers seeking to maximise their borrowings, not the average borrower, but that is exactly how one can lean against developing risks most efficiently.

In its supervisory work, APRA formed the view that institutional arrangements in banks had tended to favour marketing-driven relaxation of underwriting quality, rather than prudence-driven risk management decisions. This is unsurprising 25 years into a historic economic expansion. At any rate, APRA determined that its prudential practice guide on home lending, which had been issued in 2014, was not sufficiently helpful to bank risk managers. Accordingly, a new and more directive version of this prudential guidance was issued for comment in 2016, and finalised in 2017 (APRA 2017).

As an unrelated but highly relevant initiative, the Financial Systems Inquiry recommended that APRA narrow the disparity between the internal models based and standardised approaches to home loan credit risk.[6] APRA announced a change in 2015 that had the effect of increasing major bank equity-to-asset ratios for home lending by about 40 per cent. This increase was from a ratio of 1.5 per cent on average, to 2.5 per cent, compared with approximately 4 per cent for 'standardised approach' banks. Finally, APRA introduced some helpful statistical changes intended to clean up the relevant data, and also began publishing aggregate and industry segment exposures to residential and commercial property lending (available at <http://www.apra.gov.au/adi/Publications/Pages/Quarterly-ADI-Property-Exposures-statistics.aspx>).

The Bank's contribution in this phase was primarily centred around communication and providing analytical input. In the period around 2012–13, when housing prices were beginning to increase, Bank officials took a relatively balanced stance, cautioning against 'unrealistically alarmist' interpretations of the data (Edey 2013) or reading too much into minor price movements (Ellis 2011b). The intended message was that aggregate housing prices were not, in and of themselves, a risk indicator or a target of financial stability policy.

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6   Recommendation 2, Financial Systems Inquiry (2014).

Over the course of 2013 and 2014, the Bank began to communicate increasing concern about several developments in housing and mortgage markets. First, lending to investors for housing (mainly buy-to-let) had picked up sharply, especially in New South Wales and Victoria. The experience of 2002–03 had primed senior Bank staff to interpret strong investor lending as a sign of speculative intent. Second, both APRA's and the Bank's information were pointing to an unwelcome easing in some aspects of lending standards. Third, inner-city apartment construction had picked up, primarily in Melbourne and Brisbane (RBA 2015). Although additional supply might be expected to help take the pressure off prices, Bank staff were concerned that this new supply was unusually concentrated, both geographically and in the types of property being built, in ways that could make this market segment more vulnerable to a downturn. They were also mindful that loans to property developers tended to pose more risk to lenders than mortgage loans to households (Ellis, Kulish and Wallace 2012; RBA 2016).

In addition to APRA's focus upon sound lending from the bank perspective, for many years ASIC has focused upon responsible lending from the borrower's perspective. ASIC has taken enforcement action against dishonest sales practices in real estate, and has successfully prosecuted a number of home loan brokers who have manufactured fraudulent loan applications (e.g. ASIC 2016). APRA and ASIC are continuing to investigate the degree to which banks might be exposed to incorrect or fraudulent home loan application data.

Although it is arguably still early days, the measures APRA and ASIC announced in late 2014 had some observable success. How the industry would respond was not predictable ahead of time. After an initial period of transition, the ultimate outcomes were achieved about a year later and were broadly satisfactory. Credit growth and new lending moderated for a period (Figure 3), and the composition of the new lending had a better risk profile (Figure 4). Importantly, high LVR lending never really reached worrying levels during this period. The few lenders that had particularly high shares of such lending in prior years had already been induced to pull back on this kind of activity by APRA's normal supervisory activities (RBA 2014a). Calls by some observers during this period for APRA to put quantitative constraints on high LVR lending therefore struck the agencies as somewhat misdirected. The issues, rather, were with serviceability, a dimension of lending standards that has many moving parts and is therefore not especially amenable to quantitative restrictions. That said, APRA's Prudential Practice Guide did impose some quantitative restrictions, specifically on the interest rates used in the repayment calculations determining maximum allowable loan size.

Figure 3: Housing Credit Growth

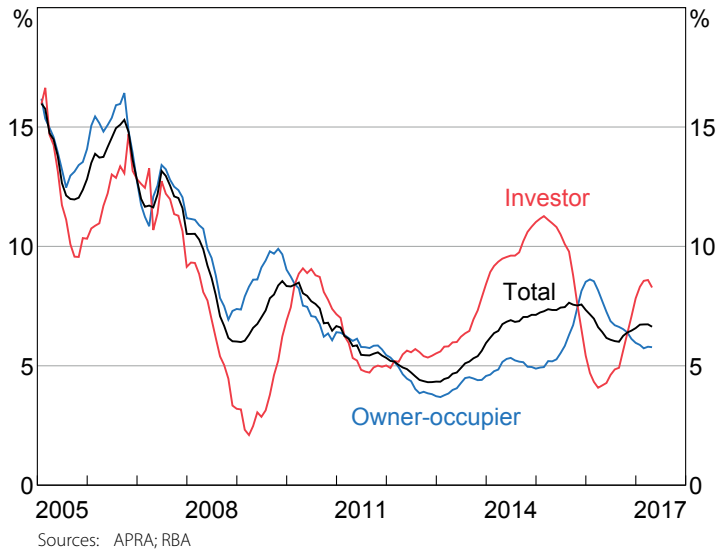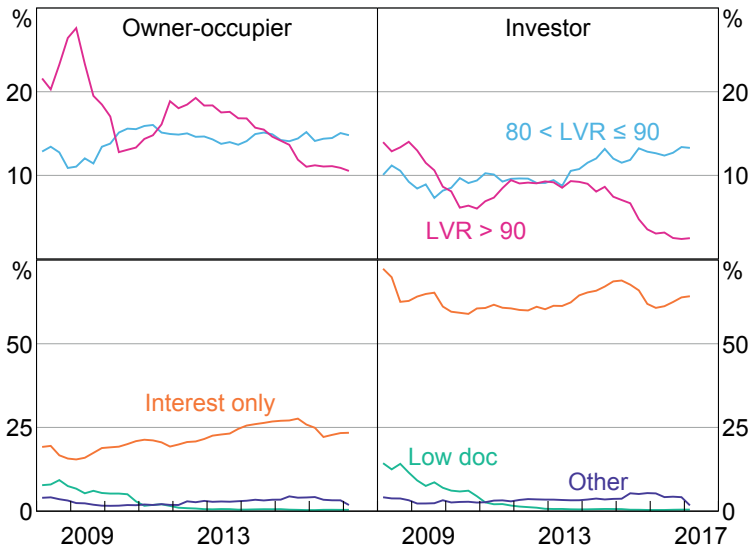Six-month-ended annualised

Sources: APRA; RBA

Figure 4: ADI's Housing Loan Characteristics

Share of new loan approvals

Notes: Series are break adjusted for reporting changes; 'Other' includes loans approved outside normal debt-serviceability policies and other non-standard loans; 'Interest only' is seasonally adjusted

Sources: APRA; RBA

One of the challenges in calibrating the policy measures and communicating the agencies' concerns was that neither agency felt that the risk outlook was cause for extreme alarm. Neither agency viewed the risk in the mortgage book, or the dynamics in the mortgage market, as likely to create a crisis or cause a bank to fail. While the increase in indebtedness and weakening in lending standards made the sector more vulnerable to a negative shock emanating from elsewhere in the economy, or overseas, this would only exacerbate a low-probability scenario, not create it. Some procyclicality in housing market dynamics was envisaged, but again, this fell well short of a future crisis. It would therefore have been difficult to justify draconian measures. Similarly, it would have been hard to justify the kinds of policy responses that had been employed in recent years based only on a decision framework that focused on 'bubbles'. Housing prices were not obviously at odds with 'fundamentals', such as strong population growth, as much of the private sector commentary over this period highlighted. Instead, a risk management approach of being alert to changes in resilience to shocks was a better characterisation of the agencies' framework.

Another challenge was maintaining public focus on the aims of policy – maintaining prudent lending standards and resilience to shocks – rather than more accessible metrics such as housing price growth. Both APRA and the Bank reiterated this message in speeches and testimony. It is not clear that these communications were completely effective, given the public attention on housing prices as an indicator of affordability.

A third challenge in calibrating the policy response was Goodhart's law: the likelihood that an empirical regularity will no longer be reliable once it is exploited for policy purposes. This is particularly the case in the prudential realm, where lenders and borrowers have incentives to find a mutually agreeable contract that is not restricted by regulatory constraints. APRA's 10 per cent benchmark on investor lending portfolio growth is arguably an example of this phenomenon, given that lenders initially redirected their competitive enthusiasm into owner-occupier lending, especially refinancing where the valuation of the collateral is less certain than a recent market sale price would be.

6.   Conclusions

Over recent decades, Australia has been well served by a strong, forward-looking supervisor and good relationships between the supervisor and the other regulators, including the central bank and Treasury. It has also been well served by a macroeconomic policy framework that supported financial stability goals. Given the potential financial stability consequences of low interest rates, it is important to ensure that interest rates are low only when the economy genuinely needs them to be low. Having your own monetary policy (and by implication, a freely floating exchange rate) makes this feasible. Having an inflation target that allows some flexibility in the speed of return to the target also helps. Faced with a macro need for low interest rates, but worries about a home lending boom, prudential regulators can take supervisory and regulatory steps to retard aggressive lending for targeted sectors. We are confident that such steps will work in the short to medium term. It is unclear if tighter prudential regulation can permanently offset lower rates in the long term.

How much of the low level of interest rates can be attributed to secular, permanent, drivers versus cyclical might affect how much of the resulting increase in indebtedness the authorities would want to accommodate. It is important to be mindful that debt burdens inflate away more slowly when inflation (and thus nominal income growth) is low. In the end, though, the interaction between nominal interest rates and serviceability tests means that a permanent disinflation effectively eases an artificial credit constraint on new borrowers, created by high inflation. In this sense, its effects should probably be accommodated, as long as one is sure that the change is genuinely secular and permanent.

It is less clear whether the effects of cyclically low interest rates on debt levels should be accommodated. Ultimately, this will have to be reversed, which could be difficult for some borrowers and may involve some asymmetries in the adjustment. But shutting off this response entirely is not practical, because cyclically low interest rates are a product of the monetary policy stance, and monetary policy works in part by encouraging more borrowing. As a result, low interest rates tend to magnify both the upswing and the downswing in prices of leveraged assets, thereby also magnifying the potential for financial distress.

One issue from low nominal interest rates is that the central bank has less room for conventional monetary stimulus. For the regulator, this affects the calculation of how much capital is necessary in the banking system. Loss of shock absorption in monetary policy may require additional shock absorption in capital requirements. As a corollary, low interest rate strategies probably become more flexible and less risky if they are combined with effective and proactive prudential supervision of speculative lending. On the other hand, repeated episodes of success in managing these challenges could be leading both lenders and borrowers to underestimate risks of upswings in housing markets.

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Discussion

1.   Mark Zelmer

Let me begin by thanking John Simon and Tams Pretty for your hard work in organising this conference. I appreciate having the opportunity to escape an Ottawa winter and join you here in beautiful Sydney. I would also like to thank Luci and Charles for such an interesting paper. It is a testament to the excellent working relationship between the RBA and APRA that the two of you could combine forces to offer us a common view on the evolution of Australian financial stability policy, and the current challenges you are facing from rising household indebtedness and high housing prices.

Reading your paper and listening to your presentation was a good reminder of the many things Australia and Canada have in common when it comes to the structure and vulnerabilities of our financial systems. But it also reminded me of some differences that exist, both in our histories and in how we are approaching similar challenges. In the interest of stimulating discussion, I will focus on the latter.

In doing so, I want to leave you with three questions to ponder for the general discussion.

1.   Are the close working relationships that exist between the central bank and prudential regulator as robust and effective as we might like to think?

2.   Can one assume that the exchange rate will always be so well behaved in an inflation-targeting regime with a floating exchange rate?

3.   Different countries have been dealing with the household debt and housing price issue in different ways. To what extent are structural differences across our housing finance systems responsible for our different policy responses?

Let me take each of these questions in turn.

Relationships among financial sector authorities need to be constantly nourished with a system-wide perspective

The institutional settings for cooperation between the central bank and prudential authority are similar in Australia and Canada, though the histories of how we got here are rather different. As in Australia, we in Canada have committees that foster close working relations among the agencies tasked with overseeing the financial system. And staff at all levels have forged good working relations over their careers. Unlike the RBA, however, the Bank of Canada never had any responsibilities for overseeing individual banks and insurance companies. Instead, Canada has had a long history of delegating these tasks to separate agencies with specific mandates granted to their heads by Parliament.

It is easy to take this strong working relationship for granted. Looking around the world I have often been surprised at the rivalries that exist in many, if not most, countries among central

banks, finance ministries and financial regulatory agencies. Not to mention that in central banks with supervisory responsibilities, some supervisory staff may feel that they are not loved as much by their executive parents as their monetary policy siblings.

Charles and Luci offer some good advice on how one can forge good relations across agencies. Much of what they said rang true for me in Canada as we have similar interagency committees, memorandums of understanding and strong personal working relationships at all levels.

But I have to ask whether these arrangements have been truly fully tested? Certainly, the relationships among the agencies worked very well for Australia and Canada during the global financial crisis; but we should remember that neither of us was confronted by the prospective failure of a major domestic institution during that crisis.

I believe that the true test of those arrangements will be if we ever find ourselves having to manage such a domestic crisis. You might be surprised at how what may appear to be good working relations before a crisis can quickly become contentious in the midst of a crisis when the narrow interests of each agency start to diverge. Thus, I encourage you to continue what you are doing to foster strong working relations, anchored to a system-wide focus. No doubt you are doing this already, but I would also encourage you to look for ways to encourage your staff to spend time during their careers working in different agencies to help further cement a system-wide focus. I know I certainly benefited from the insights and perspectives I gained from working in more than one institution over the course of my career.

Before I close off this issue, let me also note that both Australia and Canada are rather unusual in giving so much discretion to prudential authorities to set regulatory requirements and supervise individual institutions with limited political oversight. That discretion is valuable, but fragile.

There are many ways it could be lost if we are not careful. If we are too strict, and are not sufficiently attuned to innovation and competitive pressures, financial institutions and their customers could start advocating for more political oversight to ensure that prudential regulation meets their day-to-day needs. Conversely, if prudential supervisors are too lax, the financial crisis is a good reminder that major failures can be a recipe for political intervention that can displace supervisors.

We should not take our independence for granted. We need to continue looking for ways to demonstrate that we are looking after the prudential interests of depositors and policyholders, while respecting the fact that institutions take risks, are responsible for their own behaviour, and need to be allowed to compete to meet the needs of the public they serve.

Exchange rate movements can complicate life for central banks

Time is marching on, but I can be more succinct in my next point. At a macroeconomic level Australia's history with its exchange rate certainly resembles that of Canada's over the past 20 years. So the lessons drawn in the paper for monetary policy certainly apply most of the time for us in Canada too. But not all the time.

Looking further back in time, I recall that in the first half of the 1990s the Canadian dollar and Canadian debt markets were often buffeted by foreign capital outflows. These flows reflected investor preoccupation with political uncertainty in Canada and the state of public finances, despite our currency having been allowed to float for many decades. As a result, the Bank of Canada often had to pay more attention to exchange rate developments in conducting monetary policy than was the case in Australia.[1] While this may not be an issue for Australia now, or for the foreseeable future, it is a caveat that other countries should not ignore – especially if public finances and political uncertainty become bigger issues in the future.

Dealing with rising household indebtedness and high housing prices

Let me now conclude with some remarks on rising household indebtedness and high housing prices – the key domestic vulnerabilities confronting both of our financial systems. The Canadian response to these vulnerabilities has differed from that of Australia's in some important ways.

First, the role of the state in housing finance in Canada is more pervasive than in Australia, which has given us more avenues for tackling this vulnerability. All residential mortgages in Canada with loan-to-valuation ratios in excess of 80 per cent at time of origination must be insured against default by law, and the mortgage insurance market is dominated by a federal-crown corporation that operates with a full federal government guarantee. Even the private mortgage insurers operating in Canada benefit from a 90 per cent federal government guarantee, in the event that they cannot meet their claims. On top of that, investors in Canada have only had an appetite for mortgage-backed securities (MBS) consisting of insured mortgages. And, that MBS program is also operated by the federal-crown mortgage insurer, which offers a timely payment guarantee to investors.

While one can debate the merits of such a pervasive state presence in housing finance, it has given the Canadian Government more levers to influence lending behaviour. It allows them to control the terms and conditions governing access to mortgage insurance and mortgage securitisation, over and beyond the measures that can be taken by a prudential regulator or a central bank. The government has not been shy in this regard, as evidenced by the numerous steps taken over the past 10 years to gradually tighten up lending terms and conditions for insured mortgages and the mortgage securitisation market.[2]

Second, in contrast to APRA, the Office of the Superintendent of Financial Institutions (OSFI), Canada's prudential supervisor, has striven to avoid setting broad-based floors on capital requirements. This reflects a desire on OSFI's part to avoid dis-incentivising low-risk lending. Moreover, in Canada, the dynamics of housing-related vulnerabilities vary considerably across the country, given differences in housing market conditions across Canada. Thus, a more

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1   Further information on monetary policy tactics in Canada in the first half of the 1990s can be found in Clinton and Zelmer (1997).

2   These measures are summarised in the annex of a recent Department of Finance Canada consultation document (Department of Finance Canada 2016).

targeted approach has been required in setting bank regulatory capital requirements for uninsured residential mortgages that makes allowances for regional differences (Zelmer 2015).

OSFI also prefers to have capital requirements that operate more mechanistically in the housing finance space given the high public attention devoted to housing finance issues.

The point is that the institutional setting governing household lending differs considerably across countries, even between two countries like Australia and Canada that have similar banking systems. This can make it challenging to draw lessons from other countries.

Finally, I have a quibble with one of the arguments in the paper. I personally do not think that one should downplay increases in household indebtedness that arise as nominal interest rates decline in response to lower inflation. It is true that lower interest rates make it easier for households to carry larger debt burdens, if one is speaking of a sustained decline in real interest rates. But the same is not true if nominal rates fall in response to lower inflation. Why? Because one also needs to take account of the associated decline in future nominal income growth, which will mean that the debt inflates away more slowly. So, while the household may be able to service a larger loan due to the lower nominal interest rate, it will also have a higher level of debt for longer.

That may not pose much of a macroeconomic or financial stability issue in the near term; but it cannot help but reduce the resiliency of the household sector over the medium term. If nothing else, it may affect the responsiveness of households to future macroeconomic policy interventions, be they fiscal or monetary. Clearly this has not been an issue in the past for Australia, but I would not ignore it in the future, given household indebtedness levels are much higher today than they were in the past.

Conclusion

Let me close by thanking the RBA again for inviting me here to discuss this interesting paper. I learned a lot about Australia from it, and it made me think more about how things are done back in my home country. I look forward to hearing what the rest of you have to say in the general discussion.

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2.   General Discussion

The discussion began with one participant noting that tensions can arise between prudential regulation and monetary policy when conditions differ between sectors of the economy. In particular, when there are negative shocks to non-interest-sensitive parts of the economy, using monetary policy to boost economic activity and inflation could exacerbate vulnerabilities in other more interest-sensitive sectors of the economy, such as housing. The participant gave the example of the dot-com bust, when US monetary policy was used to stimulate the economy following a shock to the (non-interest-sensitive) technology sector, and mused that similar dynamics may be evident in Australia following the end of the mining boom.

This led to some discussion of the appropriateness of different macroprudential tools. One participant noted that in the situation where conditions differ between sectors of the economy, it is important to choose tools that will directly affect the interest-sensitive sectors, without impinging on the less sensitive sectors. Tools such as countercyclical capital buffers are likely to be too blunt, especially given that activities such as business lending tend to be capital intensive, while housing lending tends to be less capital intensive. In an environment in which monetary policy and prudential regulation are moving in the same direction, these tensions are less of an issue. In either case, communication and coordination between monetary and prudential authorities is likely to be helpful in picking the most appropriate tools.

One participant raised the issue of culture within financial institutions, suggesting that institutional culture was a relevant factor for financial stability. For example, regulatory actions in protecting banks and the financial system more generally could lead to moral hazard and excess risk-taking. It was acknowledged that a 'toxic' culture within financial institutions could be detrimental, but that regulators are limited in their ability to assess culture or to intervene. In this sense, regulators need to try, but try humbly, and should use expertise from other public sector institutions.

Discussion turned to the feasibility and appropriateness of using macroprudential tools in a countercyclical manner. In terms of feasibility, one participant asked whether it would be possible under current governance structures to ease prudential policy in a downturn. It was noted that, in Australia's case, prudential regulation is more stringent than the Basel III requirements, meaning there was scope to ease policy in a downturn. More generally, one participant opined that if tighter macroprudential policy is imposed during a boom, it may be easier to motivate an easing in policy during the downturn, since policy would be returning to normal. However, it was noted that it could be difficult for banks to adjust their balance sheets in response to a policy easing during a downturn if they might be penalised by the market, for example, through higher funding costs.

Political constraints on using macroprudential policies in a countercyclical manner were also discussed. It was noted that prudential changes can be unpopular, especially at times

when they are most important. In a boom, the need for regulation can be questioned; in a downturn, regulators may be perceived as being too lax. For this reason, central bank support for prudential changes is important, particularly in the form of public moral support.

On appropriateness, participants acknowledged that keeping bank lending markets open during a downturn is crucial to any recovery. In this context, prudential policies need to ensure that banks are strong enough to step in to fill any void left by institutions that fail during a crisis. The example of major Australian banks filling the void after European banks left the domestic market following the financial crisis was cited in this context. Participants suggested that countercyclical macroprudential policies could help to keep lending markets open.

Monetary Policy and Financial Stability

Giovanni Dell'Ariccia, Karl Habermeier, Vikram Haksar and Tommaso Mancini-Griffoli

(with an IMF staff team)*

1.   Introduction and Motivation

Before the global financial crisis, a widespread consensus supported a strict division of labour between different policy levers. Price stability was the primary – and sometimes sole – mandate of monetary policy. Financial stability was the realm of prudential regulation and supervision (often managed by agencies separate from the central bank). This framework found an intellectual foundation in New Keynesian models, which implied that – under broad conditions – price stability would keep output around its natural level.

As a result, most central banks took a '*benign neglect*' approach to asset price and credit booms. Monetary policy was to react to movements in asset prices and credit aggregates only to the extent that they affected inflation (and output).[1] This was reinforced by a belief that it was too difficult to distinguish fundamental-driven movements from speculative bubbles in real time. And, in any event, the policy rate was too coarse an instrument to address the associated financial risks. If monetary policy had a role, it was to respond to the macroeconomic consequences of financial instability, if and when it materialised. This debate is often summarised by the phrase '*lean versus clean*'.[2]

Policymakers recognised the dangers associated with financial imbalances. Indeed, central banks tended to follow the consensus framework with some flexibility. In many emerging markets, concerns about financial imbalances (for instance, large foreign exchange exposures or fast credit growth) weighed significantly on monetary policy decisions. But in most advanced economies (with Australia, Norway, and Sweden as notable exceptions) preserving financial stability was solely the job of prudential policy. Financial regulation and supervision were, however, predominantly focused on the stability of individual institutions,

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1   See Bernanke and Gertler (1999), as presented at the Federal Reserve Bank of Kansas City Economic Policy Symposium at Jackson Hole.

2   That being said, central banks should always be ready to 'clean' if a crisis materialises.

with relatively little attention to the stability of the financial system as whole, thus leaving an important gap in the overall policy framework. Furthermore, regulation and supervision of individual institutions was deficient.

In the run-up to the crisis, financial stability risks grew, largely undetected, beneath the surface of seemingly close-to-target inflation and output gaps. There was a sharp increase in the ratio of credit to GDP and in real estate prices – two important measures of financial vulnerabilities (Figure 1, where output gaps are estimated based solely on information available before the crisis). Some have argued that central bank policies during this period raised incentives for risk taking, as rewards could be appropriated by individuals, while costs would be alleviated by swift policy reaction and borne by the public.[3]

**Figure 1: Output Gaps, Core Inflation and
Financial Indicators before the Crisis**
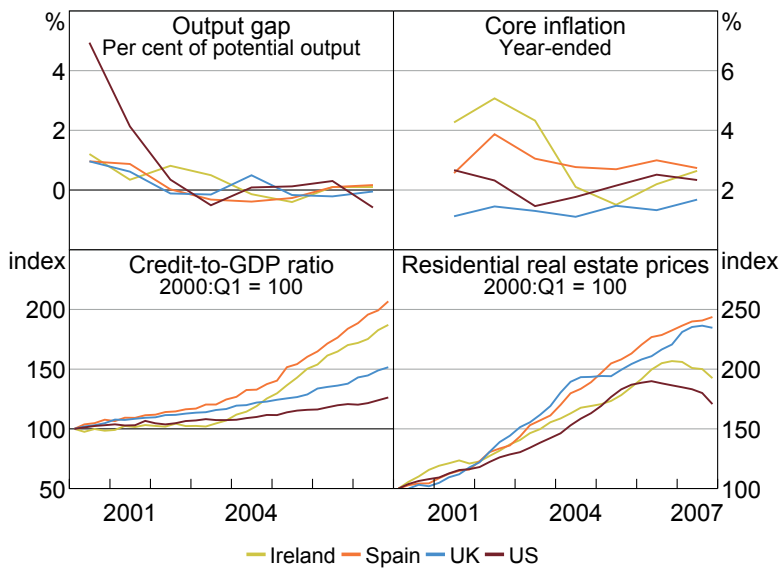
Note: September 2007 vintage used for the output gap
Sources: Haver Analytics; IMF World Economic Outlook database

Contrary to pre-crisis beliefs, the costs of cleaning up after the crisis proved to be very large, especially for those countries where financial imbalances had grown the most. There was a remarkable correlation between the two measures of financial vulnerabilities just mentioned – pre-crisis credit growth and housing price appreciation – and the drop in GDP and rise in household loan delinquencies in the two years following the global financial crisis (Figure 2). This is consistent with the findings of a large literature outside of mainstream macroeconomics that links financial fragility with poor macroeconomic performance. For instance, there is evidence that financial crises are deeper and more persistent than normal

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3   As emphasised in Farhi and Tirole (2012), and Caballero and Krishnamurthy (2003).

Figure 2: Growing Financial Vulnerabilities and Costs of the Crisis
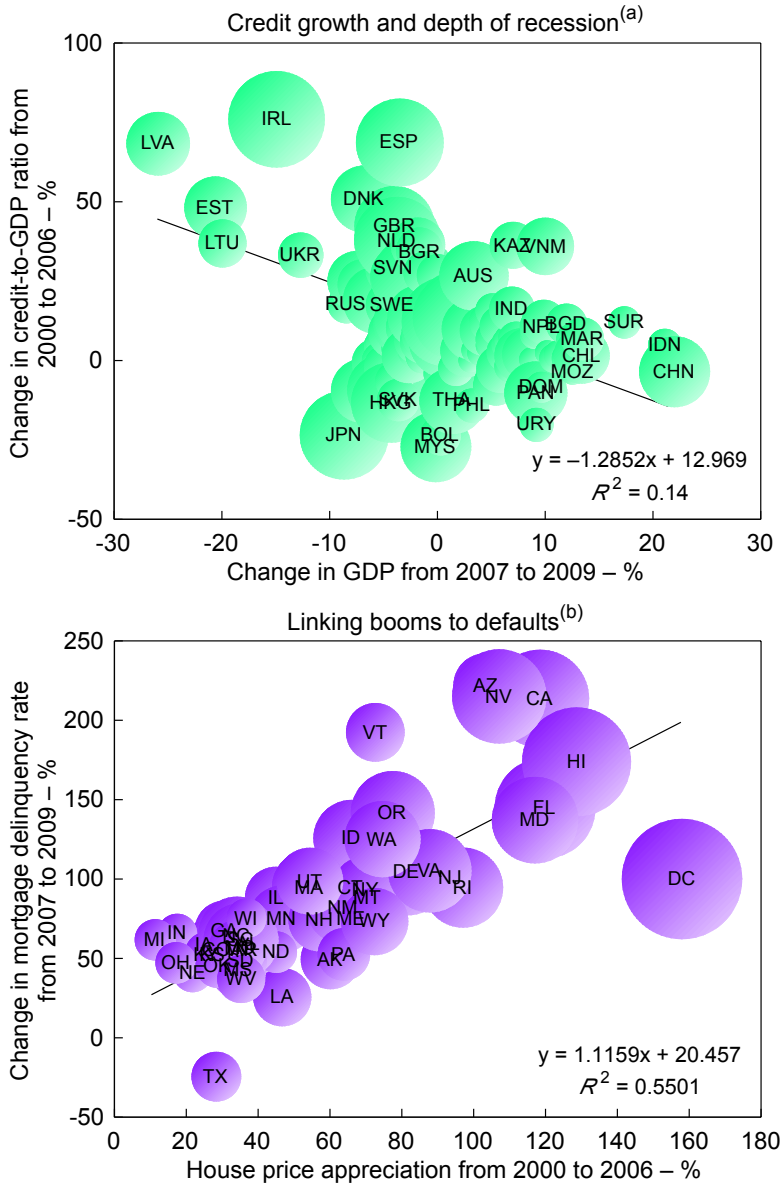
Notes: (a) Each data point corresponds to an economy, indicated by the three-letter abbreviations; bubble size shows the level of credit-to-GDP ratio in 2006
(b) Each data point corresponds to a US state, indicated by the two-letter abbreviations; bubble size shows the percentage point change in the ratio of mortgage credit outstanding to household income from 2000 to 2006

Sources: Bureau of Economic Analysis; Federal Housing Finance Agency; IMF; Mortgage Bankers Association; US Census Bureau

recessions. In advanced and emerging market economies after World War II, financial crises have on average led to negative GDP growth for two years, with a peak loss of GDP per capita of about 1.5 per cent. In these crises, GDP has lagged behind its average recovery path after normal recessions by about 4 to 5 per cent after five years.[4] Moreover, crises typically undermine countries' fiscal positions, as well as social and political stability and cohesion.

The severity of such crises required extraordinary monetary policy accommodation, all the more so when fiscal policy was constrained by high and rising public debt burdens. In many advanced economies, short-term nominal rates quickly ran into the effective lower bound, and large-scale unconventional monetary policies (UMP) were required. Despite their overall effectiveness, UMP were difficult to fine-tune, and their implications for future financial stability and cross-border spillovers are yet to be fully understood.[5]

This has rekindled the debate on *'lean versus clean'*. Many policymakers now recognise the need to mitigate crisis risk proactively, rather than only relying on cleaning up after a crisis. On the monetary policy front, price stability is no longer believed to be sufficient to ensure macroeconomic stability. And, on the prudential front, the emphasis has shifted to containing systemic risk by complementing traditional microprudential policies aimed at individual institutions with macroprudential policy frameworks, as recommended in Viñals (2013), and IMF (2013c, 2014b). Examples of the latter include both cyclical instruments (e.g. countercyclical capital buffers, loan-to-value limits, or dynamic loss provisioning) and permanent measures to strengthen the structural resilience of the financial system. But there is still concern that even the stronger emerging combination of micro and macroprudential policies may not suffice to contain financial stability risks.[6]

If that were the case, should monetary policy lend a hand – by pursing a financial stability objective in addition to its primary mandate of price stability? This question is central to this paper, and the answer potentially affects all countries with developed financial systems (and sufficiently high probabilities of crisis), effective and independent monetary policy, as well as rapidly evolving prudential policies. As such, this paper is more appropriate for advanced and emerging economies with freely floating exchange rates, than low-income countries, or countries with exchange rate pegs or other constraints on monetary policy.[7] The question tackled here has implications for the conduct of monetary policy in normal times, not just in rare crisis periods. And by reopening a debate on established monetary policy frameworks, it raises sensitive political and institutional issues.

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4   These are average numbers; individual crises can lead to larger losses. See, for instance, Allen and Gale (2000), Calvo and Mendoza (1996), Kaminsky and Reinhart (1999), and more recently, Taylor (2015), which suggests that evidence for advanced and emerging market economies is quite similar. Even before the crisis, this work was highly influential in emerging markets, but remained at the periphery of policymaking in most advanced economies.

5   These are explored in IMF (2013a, 2013e), Chen, Mancini-Griffoli and Sahay (2014), and Chen *et al* (2016). Fiscal space does not have to be limited during crises, if countries build fiscal buffers in good times.

6   A recent review of empirical work is Galati and Moessner (2014). For a collection of papers, see Claessens *et al* (2011). And for an extensive treatment, see Freixas, Laeven and Peydró (2015). Viñals (2013) points to strong inaction bias of macroprudential policies.

7   The conceptual framework advanced in this paper remains applicable to all countries. However, the empirical estimates attached to it are more representative of advanced and emerging market economies. In low-income countries, monetary transmission often differs, due to excess liquidity in the banking system, or thin credit and government securities markets. In addition, trade-offs with prudential policies might differ, given the limited data to motivate and fine-tune such policies.

Two approaches are possible to using monetary policy. The first involves responding by keeping nominal interest rates persistently higher than implied by a traditional reaction function focused only on inflation and output stability. In other words, interest rates would be raised a bit more and faster in the upswing, and lowered a bit less and more slowly in the downswing. The second involves responding occasionally by 'leaning against the wind' as needed to counter evolving financial risks.[8] The latter could be part of a state contingent rule-based approach; for instance, one in which deviations from a traditional inflation-targeting framework were guided by previously identified financial indicators (for example, credit growth, leverage, and others). This paper – as most of the policy debate – focuses on the second approach. The first does not seem especially promising. Higher rates would create persistently lower inflation. This would eventually decrease inflation expectations, and in the end leave real rates – and thus financial risks – unchanged, while aggravating risks of hitting the zero lower bound.[9] The second approach might be difficult to communicate in the light of long and variable lags. However, it is more consistent with the view that financial risks evolve over time, and that in some cases – as discussed later – price and financial stability will require the same policy reaction.

Not surprisingly, given the limited empirical evidence and the lack of an accepted theoretical framework, the question of leaning against the wind is hotly contested. Influential economists and policymakers espouse very different views, some praising the virtues of monetary policy to affect lending and potentially risk-taking behaviour in all markets, others underscoring the risks and costs of using one instrument for two targets. John Williams, President of the San Francisco Federal Reserve, represents one side of the debate: 'monetary policy is poorly suited for dealing with financial stability concerns, even as a last resort'. Øystein Olsen, Governor of the Norges Bank – Norway's central bank – epitomises the other side: 'we have been "leaning against the wind"'. As a result, the Norges Bank publishes interest rate forecasts that respond to risks of financial imbalances in its *Monetary Policy Report*. Janet Yellen, the Chair of the Board of Governors of the US Federal Reserve Board, sees valid arguments on both sides: 'monetary policy faces significant limitations as a tool to promote financial stability … [However,] it may be appropriate to adjust monetary policy to "get in the cracks" that persist in the macroprudential framework'.[10]

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8   The concept is sufficiently broad to capture a wide range of policy reactions, including hiking more or cutting less, as well as hiking earlier, than warranted to maintain price stability. Note that leaning against the wind implies a higher rate than would have been adapted to stabilise prices alone. The concept is thus different from what is commonly known as the Taylor principle, which stipulates that interest rates should be raised by more than observed inflation deviations from target, in order to stabilise prices. In the early literature (Clarida, Galí and Gertler (1999) for instance), the concepts of the Taylor principle and leaning against the wind were taken to be synonymous.

9   The paper does not dwell on how a policy of leaning against the wind might be codified in the central bank's legislature. Typically, this would entail an amendment to the central bank's mandate, stating that monetary policy is responsible for financial stability in addition to price stability. Establishing the relative priority of these mandates is more difficult; it is not just a matter of making the inflation mandate primary and the financial stability mandate secondary. Leaning against the wind implies sometimes undershooting the inflation mandate so as to support financial stability. As this paper argues, the pursuit of financial stability could preclude the central bank from satisfying its price stability mandate, if benefits of doing so were clearly greater than costs.

10 For full texts of speeches, see Williams (2015), Olsen (2015), and Yellen (2014). A useful overview of the literature on leaning against the wind, along with policy recommendations, is provided in Smets (2014). See also Stein (2014) and Svensson (2015) for particularly articulate discussions of the policy trade-offs.

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The Bank for International Settlements (BIS) has also been a prominent contributor to this debate, expressing support for a stronger role for monetary policy in maintaining financial stability: 'financial stability is too large a task for prudential … frameworks alone. Monetary policy strategies also need to … lean against the build-up of financial imbalances even if near-term inflation remains low and stable'. The BIS argues in favour of higher interest rates for extended periods, as '[f]inancial imbalances can build up gradually, over many years … If central banks are to counteract such build-ups, they will need longer policy horizons'. These, argues the BIS, grow over a 'financial cycle', lasting longer than the business cycle (Caruana 2011; Habermeier *et al* 2015, Box 1).

The debate has taken on added urgency in the current economic environment. Tensions between price and financial stability mandates have emerged in several advanced economies (AEs) that still face considerable slack in the economy and low inflation.[11] Meanwhile, these countries have seen a mix of rising house or other asset prices, and credit growth (Appendix I in Habermeier *et al* (2015) provides an in-depth survey of various countries' macroeconomic context, financial risks, and current policy debates). In emerging market economies (EMs), these tensions between policy objectives are currently not so marked:

- In Sweden, Switzerland, and the United Kingdom (UK), house prices and credit growth are either accelerating or still increasing, sometimes from already elevated levels.

- In Australia and Canada, house prices are rising despite moderate credit growth.

- In the Netherlands and Norway, house prices and credit have decreased, but are recently recovering.

- In contrast, in the United States (US), after a sharp correction in house prices and subdued credit growth, a range of asset markets other than housing show signs of stretched valuations.[12]

This paper aims to bring some clarity to these issues. While it cannot provide final answers, it aims to help policymakers assess the value and implications of using monetary policy to support financial stability. It does so in three ways: by providing a framework to conceptualise and clarify the channels of transmission and policy trade-offs, advancing initial policy guidance based on the most recent empirical findings, and emphasising the gaps that still need to be filled before more definitive policy advice can be formulated. Put simply, the paper asks: 'what do we know and can be quantified, what should we do based on what we know, and how much do we really know?'

The paper is divided into five sections. The first provides the policy context, conceptual underpinnings and definitions. The second reviews the available empirical estimates of the relationship between interest rates and financial variables, and ultimately with the macroeconomy. The third, discusses trade-offs between price and financial stability. The fourth builds on these findings by evaluating the welfare implications of using monetary policy

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11 Though in some countries inflation has been pushed down by external factors, such as lower oil prices and domestic currency appreciation. In these cases, policy does not necessarily have to be especially accommodative; the trade-off with financial stability may be less stark than immediately apparent, at least over a temporary period.

12 See the IMF's *Global Financial Stability Report* (GFSR) of October 2014 and April 2015 (IMF 2014a, 2015a).

to support financial stability. The fifth section provides some additional discussion, including of open economy implications. Finally, the sixth section considers the implementation issues, and the last offers some concluding thoughts.

2.   The Policy Context and Definitions

The lesson from recent years is that policy should aim to decrease the likelihood of crises, not only rely on dealing with their repercussions; the question is how to do so. In particular, what is the role for monetary policy? Answering this question leads policymakers to contemplate two dimensions of policy: one is cyclical, the other structural. The first adapts to the conjuncture and may target a specific source of risk. The second remains unchanged over time, aiming to support the resilience of the financial system to a wide set of shocks. Such policies rely on capital and liquidity requirements, as well as limits on exposure to foreign exchange, or redemption risks. Recent work suggests that strong policies aimed at structural stability can materially improve systemic resilience.[13] In these cases, the burden on cyclical policies – including on monetary policy – to support financial stability could be lighter. Given this paper's focus on monetary policy, though, the emphasis here will be on cyclical policies. Setting policy over the cyclical dimension involves answering a series of questions, illustrated in Figure 3 (that offers only a stylised snapshot of what is actually a repeated decision-making process with substantial uncertainty at each node).

**Figure 3: Dealing with Financial Stability over the
Cyclical Dimension: A Decision Tree**
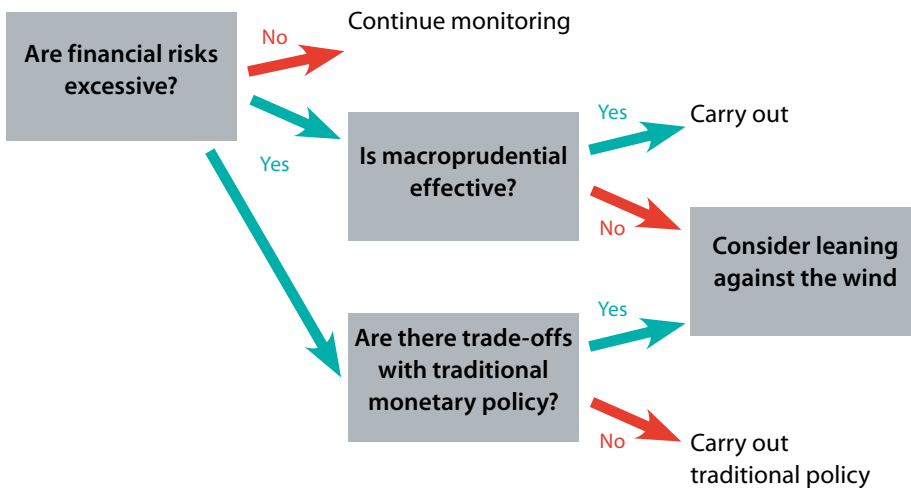
Source: IMF

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13 Dagher *et al* (2016) suggests that 15 per cent to 20 per cent capital requirements on banks would have avoided 80 per cent to 90 per cent of financial crises in advanced economies since the 1970s. Other papers investigating the effects of capital and leverage requirements on financial stability include Ratnovski (2013), and Miles, Yang and Marcheggiano (2013). Papers providing an overview of policies aimed at the structural dimension include Viñals *et al* (2013), Boot and Ratnovski (2012), and Laeven, Ratnovski and Tong (2014).

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The first question is: are financial risks excessive? Financial risks capture the likelihood of large disturbances to future macroeconomic conditions originating in financial variables. Variables such as asset prices can be a direct source of shocks, for instance through a large drop in prices. Other variables, such as leverage or debt of financial firms, household and corporates, tend to amplify other shocks through financial distortions. Such distortions include, for instance, the relationship between asset prices and credit growth, whereby higher asset prices allow borrowers to pledge more collateral and thus increase debt, until a shock forces them to deleverage rapidly, with potential externalities on other debtors.[14] Estimating financial risks is not easy.[15] At the end of the day, determining whether risks are excessive will have to rest on a socially agreed maximum for the probability and severity of large disturbances to macroeconomic conditions. This is similar to defining an inflation target for monetary policy.

The second question is whether other policies – in particular macroprudential policies – can address financial risks, when they are excessive. Macroprudential policies offer the hope of targeting specific sources of vulnerabilities, whether they arise from exuberance in a particular sector, or specific financial distortion affecting multiple sectors. And, as discussed in IMF (2013b) and Blanchard, Dell'Ariccia and Mauro (2010), the policy burden should fall primarily on these measures, should they prove both well targeted and effective. However, empirical evidence as to their effectiveness remains slim and scattered though is growing quickly.[16] Other policies should also be considered for their effect on financial stability and their interaction with monetary policy. More expansionary fiscal policy, for instance, can lead to the build-up of sovereign risk and counter the impact of higher interest rates targeted at reducing financial stability risks.

The third question, to be answered in parallel with the second, is whether tighter monetary policy warranted by price stability is also sufficient for financial stability. Financial risks commonly grow in periods of economic expansion in which inflation pressures build up,

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14 As initially framed in Bernanke, Gertler and Gilchrist (1999). See Brunnermeier, Eisenbach and Sannikov (2012), as well as Leeper and Nason (2014) for a survey of financial frictions. Other distortions than discussed above include: incomplete or asymmetric information, liquidity constraints, funding constraints, moral hazard stemming from policy actions like bailouts, monitoring costs or costly state verification, incentives and principle-agent problems, and regulatory arbitrage.

15 A major limitation of these endeavours is the data in which crises are rare events. To some extent, stress tests have been designed to gauge the risks built up in a system. Also, a large literature has emerged under the umbrella of 'early warning exercises'. For instance: Blancher et al (2013) organises indicators and monitoring tools around key questions on systemic risk; the IMF's 'Staff Guidance Note on Macroprudential Policy' (IMF 2014b), and the IMF Detailed Guidance on Macroprudential Policy Instruments discusses indicators used to activate policy tools related to broad-based, sectoral (households and corporate), and liquidity risks; IMF (2011), Arregui et al (2013), and Borio and Drehmann (2009) combine credit and asset price growth to assess the likelihood of crises; Arsov et al (2013) formulates an operational definition of a systemic stress event and assesses the ability of several popular near-term ('near-coincident') systemic risk measures to provide an early warning of impending financial crisis, such as JPod (Segoviano and Goodhart 2009), distance-to-default, VIX, and the yield curve.

16 See IMF (2014b) for guidance on the use of macroprudential policy; Cerutti, Claessens and Laeven (2015), Akinci and Olmstead-Rumsey (2015), McDonald (2015), Claessens, Ghosh and Mihet (2013), Dell'Ariccia et al (2012), and Lim et al (2011), for a cross-country study; Zhang and Zoli (2014), as well as Bruno and Shin (2014), for a review of macroprudential policies in Asia; Cerutti et al (2015), Kuttner and Shim (2013), Crowe et al (2011), for a focus on instruments geared towards the real estate market; He (2013) for an overview of Hong Kong's approach to financial stability; Tressel and Zhang (2016) for an assessment of prudential policies and their transmission channels in the euro area; Jácome and Mitra (2015) for a review of DTI and LTV limits; and Dassatti Camors and Peydró (2014), Aiyar, Calomiris and Wieladek (2012), Jiménez et al (2012), Igan and Kang (2011), Wong et al (2011), and Saurina (2009) for studies based on sectoral or firm-level data. The IMF's Global Macroprudential Policy Index (GMPI) offers a database of macroprudential instruments for research purposes.

and output growth is sustained. In these periods, interest rates should be tightened for price stability regardless of financial stability concerns. However, higher rates may well, as a by-product, also stabilise the financial system. Cases in which financial stability risks are sufficiently contained as a result of higher rates are said to induce 'no trade-offs' between price and financial stability objectives.[17]

If there is a trade-off, and if prudential policy is not sufficiently effective, a final question emerges: should monetary policy lean against the wind? Trade-offs can arise starkly when there is no economic expansion yet growing financial risks, but also more subtly when financial risks warrant a greater interest rate hike than necessary to tame prices. The question of leaning against the wind while there are trade-offs is the main focus of the paper, as it provides a clear test of the issues involved than the (more typical) case where rising financial risks are accompanied by a strong economic expansion. The paper does not explore the trade-offs and interactions between monetary and prudential policies in details. Instead, the paper assumes that prudential policy, including policy aimed at structural resilience, cannot stabilise the financial sector completely, so some financial risks remain. In principle, to the extent structural policies are able to sufficiently increase resilience of the financial system on their own, there could be less of a role for monetary policy as well as cyclical macroprudential policies. These interactions across different policies – and their welfare implications – are an important area for further study. The focus of this paper remains on documenting and quantifying the link between monetary policy and financial stability.

Evaluating the policy of leaning against the wind requires three broad steps:

- First, the transmission channels need to be described. This involves estimating the links between policy interest rates and financial risks.

- Second, one needs to establish the nature and size of the trade-off between stabilising inflation and financial risks. As discussed above, if there is no trade-off, the argument for leaning against the wind would become trivial, as pursuing price or financial stability would be one and the same.

- Third, the welfare implications of leaning against the wind need to be assessed in the context of a clear framework, allowing for a cost-benefit analysis.

3.   Step 1: Transmission

The transmission between monetary policy and financial stability entails two links. The first is between interest rates and key financial variables. And the second is the relation between these financial variables and the probability of large disturbances to macroeconomic conditions. This is as illustrated in Figure 4.

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17   The question of trade-offs is at the heart of the assignment problem often discussed in policy circles: using as many instruments as there are targets is important to avoid costly trade-offs, to the extent instruments do not have offsetting effects on targets other than their own.

Figure 4: From Interest Rates to Macroeconomic Conditions
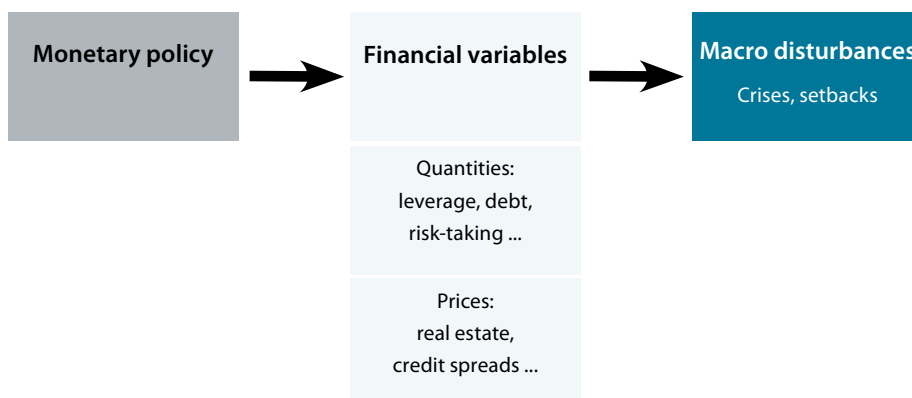
3.1   Interest rates and financial variables

This paper focuses on five financial variables. The first three measure quantities (leverage of financial firms, household debt, bank risk-taking), and the last two prices (of assets – especially real estate – and credit spreads). These variables have received attention in the literature on the relation between monetary policy and financial vulnerabilities, and on crisis prediction. Other variables may also be important, notably loss absorption capacity, liquidity, maturity, and foreign exchange balance sheet mismatches, but data are often weak, and the literature not as conclusive.

Interest rates can affect each of these financial variables. Effects change – and can even reverse – depending on the time horizon of the analysis, as well as initial conditions.

- In the short term, before agents are able to adjust their balance sheets, theory suggests that higher interest rates are likely to weaken financial stability. First, by reducing aggregate demand, a monetary tightening reduces household earnings and firms' profitability. Second, it leads to an increase in the interest rate burden, especially if liabilities are at variable rates and have short maturities. Finally, it tends to reduce asset prices and the value of legacy assets held by financial institutions. These effects weaken the financial conditions of households and firms, possibly leading to a temporary increase in delinquencies and defaults especially if balance sheets are weak to begin with.

- In the medium term, however, these effects are likely to reverse as households, firms and financial institutions rebalance their balance sheets and adapt their behaviour. In particular, higher borrowing costs should induce households and firms to gradually reduce *leverage* through the conventional intertemporal substitution effect. Tighter monetary conditions are likely to gradually reduce leverage also in the banking sector, as shown in Dell'Ariccia, Laeven and Marquez (2014). The effects on *risk-taking* are instead less clear-cut. By reducing search-for-yield motives, higher rates should reduce

risk-taking by financial intermediaries with fixed long-term liabilities, such as insurers and pension funds. The response of banks is instead ambiguous: higher funding costs that compress intermediation margins should lower the incentive for monitoring, but lower leverage should induce banks to behave more prudently.

Empirical results broadly support these theoretical predictions. The papers discussed below investigate the effects of monetary policy on financial variables. Findings are new and separate from a slightly older literature that investigates the effects of financial variables on the transmission of monetary policy.[18]

- Real debt levels generally decrease following a temporary monetary policy tightening of 100 basis points, by up to 0.3 per cent and 2 per cent, after 4 to 16 quarters, depending on the model.[19]

- However, in the short term, real debt to GDP seems to rise.[20] The intuition is that nominal GDP responds faster than nominal debt to an interest rate hike, especially with lengthy loan amortisation periods.

- Because real debt and debt servicing costs increase with higher interest rates, default rates rise in the quarters following an interest rate shock (Habermeier *et al* 2015, Box 3).[21]

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18 This older literature generally concludes that monetary policy shocks have larger effects on output and inflation in times of financial stress. This probably comes from monetary policy relaxing or tightening financial constraints that are more likely to bind in times of stress. Three approaches have been used to tackle this question. The first are constant parameter VAR models augmented to capture asset prices and credit. The second are Markov-switching VAR models (such as Hubrich and Tetlow (2015), Hartmann *et al* (2013), Kaufmann and Valderrama (2010), and Eickmeier, Marcellino and Prieto (2013)). The third are threshold VAR models that allow for the endogenous determination of high or low financial stress regimes based on the level of specific financial variables, such as credit growth (Balke (2000) for the US, Calza and Sousa (2006) for the euro area, Li and St-Amant (2010) for Canada, and Atanasova (2003) for the UK), financial stress indices such as the Chicago Fed's ANFCI index (Zheng 2013), as well as output growth (Avdjiev and Zeng 2014). All papers find a significant difference in the impulse response functions of monetary policy shocks between regimes of high and low financial stress. Somewhat different results are discussed in Habermeier *et al* (2015, Box 5), in which impulse response functions for some countries cannot be statistically differentiated.

19 The largest body of literature focuses on the effects on real household debt. Papers usually consider a 100 basis point hike, lasting one year or returning to steady state with some persistence. Angeloni, Faia and Lo Duca (2015) is at the bottom of the range, suggesting that debt decreases by 0.7 per cent at the peak, after 16 quarters. Robstad (2014) finds effects of similar magnitude, though after 4 quarters. Diaz Kalan *et al* (forthcoming) find that debt decreases by 2 per cent, after 10 quarters. Chen and Columba (2016) find similar effects, though reached after 4 quarters already, perhaps a result of relying on a DSGE model estimated on Swedish data, as opposed to the VAR models used in other papers. Sveriges Riksbank (2014) comes to middle-of-the-road results, showing that debt contracts by 1 per cent at the peak, after 8 quarters. Other studies, such as Goodhart and Hofmann (2008), as well as Musso, Neri and Stracca (2011) find similar peak effects, though reached after 10 to 40 quarters. Ananchotikul and Seneviratne (2015) generally corroborate these findings, while exploring further dimensions. Evidence from Asia suggests that higher rates will induce banks to contract their loan portfolio, especially in more financially constrained banks (with higher loan-to-deposit ratios, or lower liquidity ratio). The paper also finds that the presence of foreign banks dampens the effect of monetary policy. In general, focusing on peak effects may overplay the possible effect of monetary policy on credits. As discussed in the paper, credits may or may not return to their steady state following the monetary policy shock; the empirical literature is split on this question, and results regarding longer-term effects on credits are sensitive to specification assumptions.

20 This is as in Alpanda and Zubairy (2014) and Gelain, Lansing and Natvik (2015).

21 Effects can be substantial. Box 3 in Habermeier *et al* shows that household loan delinquency rates increase by 126 basis points for the US and 25 basis points for Spain in the first 15 and 7 quarters, respectively, following a 100 basis point unexpected hike to interest rates. Effects for the US are estimated on a sample from 1987 to 2014; using the pre-global financial crisis sample delivers smaller – though still significant – effects of monetary policy on default rates.

- Banks and non-banks generally respond to higher interest rates by reducing their leverage, though after 1–2 quarters (Habermeier *et al* 2015, Box 4).[22] In the initial quarters, leverage tends to rise across financial firms.

- Higher interest rates seem to induce banks to tighten their lending standards, grant fewer loans to risky firms, and extend less risky new loans.[23] The economic significance of these effects is difficult to quantify as results are based on survey data. One measure is that Sharpe ratios (a measure of riskiness of assets) of financial firms – both banks and non-banks – decrease somewhat following protracted rate cuts.[24] The implication is that Sharpe ratios would increase (lower financial risks) following interest rate hikes.

- A very different approach confirms that banks (primarily, but also non-banks to some extent) are perceived to hold a less risky portfolio after an interest rate hike. However, once again, these are medium-term effects. In the short term, banks become riskier. These results follow from tracking banks' distance to default, a market-based measure of expected default based on balance sheet data and equity prices. Some papers find that distance to default eventually rises (lower riskiness), as interest rates are increased. However, in the short term, distance to default decreases (higher riskiness) and can reach levels commensurate with past crises. This is especially true when the rate hike occurs in periods of financial stress, underscoring that effects of monetary policy on risk-taking behaviour are state-contingent. More details are offered in Box 5 in Habermeier *et al* (2015).[25]

- Real estate prices decrease on average following a hike in interest rates. The effect is of the order of 2 per cent, following a 100 basis point interest rate shock, though after a significant lag, of between 10 to 16 quarters.[26]

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22 Cecchetti, Mancini-Griffoli and Narita (2017), for instance, finds that repeated interest rate cuts amounting to 100 basis points increase leverage across both banks and non-banks. Estimated changes in leverage are (full sample medians between 1998 and 2014): 10.7 to 11.2 for banks, 7.0 to 7.3 for insurance companies, and 4.7 to 5.0 for investment banks. Effects are notable, though leverage remains low if it starts from its sample median. Further details are provided in Box 4 (Habermeier *et al* 2015). Bruno and Shin (2015) find that a 90 basis point hike in rates decreases leverage of US broker dealers from 22 to 21.5 (after increasing leverage initially). Miranda-Agrippino and Rey (2014) find a significant relationship between monetary policy expansions in the US and bank leverage abroad.

23 Papers include Maddaloni and Peydró (2011), Jiménez *et al* (2014), Dell'Ariccia, Laeven and Suarez (2013), De Nicolò *et al* (2010), Adrian and Shin (2009), Freixas, Martin and Skeie (2011), Diamond and Rajan (2012), Borio and Zhu (2012), and Acharya and Naqvi (2012).

24 In Cecchetti *et al* (2017), Sharpe ratios decrease (implying greater volatility or risk of assets) from (full sample medians between 1998 and 2014): 6.1 to 5.4 for banks, 4.0 to 3.5 for insurance companies, and 2.6 to 2.1 for investment banks.

25 Distance to default is based on Merton (1974); it increases with asset growth, and decreases with leverage and equity price volatility. Altunbas, Gambacorta and Marques-Ibanez (2010), as well as Gambacorta (2009) show that distance to default increases in a sample of 600 US and euro area banks as interest rates are raised above those indicated by a Taylor rule. Estimates in Habermeier *et al* (2015, Box 5) instead investigates the short-term impact of higher rates using a threshold VAR (TVAR) method that splits the sample into periods of high and low financial stress (corresponding to periods of low and high distance to default). After a positive interest rate shock (taken to be a flattening of the yield curve), distance to default decreases on impact, especially in periods of high financial stress. It then rises again, though only back to levels existing before the interest rate shock. More details are provided in Habermeier *et al* (2015, Box 5).

26 See Habermeier *et al* (2015, Box 3), Walentin (2014), Diaz Kalan *et al* (forthcoming). Results are generally supported by Jordà, Schularick and Taylor (2015), as well as Iacoviello and Minetti (2008).

- Credit spreads tend to increase following an interest rate hike.[27] As discussed in detail later, higher spreads are symptomatic of lower risk-taking behaviour and correlated to higher future output growth.

An important caveat emerges: estimates of the effect of interest rates on financial variables may be biased downwards. Relationships among variables are mostly estimated over periods of relative stability. In those years, higher rates were associated with good times, and thus mostly growing financial vulnerabilities. The relationship between the two variables, despite attempts to carefully isolate monetary policy shocks, will therefore appear weak. Moreover, the analysis to date emphasised costs to unemployment. But other costs also exist, to inflation, public finances, as well as social and political stability and cohesion.

3.2 Financial variables and macroeconomic conditions

Estimating how changes in financial variables affect the risk of future macroeconomic disturbances is tricky. First, two types of disturbances can be distinguished: crises and 'setbacks'. Crises imply infrequent, but very substantial drops in output and increases in unemployment. Setbacks affect the economy more frequently, but are smaller, akin to a mild recession with financial roots.[28] The emphasis in this paper will initially be on crises, taken to be the primary concern of financial stability policy, though setbacks will also be discussed.

The second complication stems from crises being rare events. Taylor (2015) reports on crises in advanced and emerging market economies since 1800, finding that while crises have not occurred uniformly over time (the postwar years, for instance, saw a period of relative calm until the 1970s), they have on average struck every 15 to 20 years. And crises are difficult to predict, with little agreement on how to gauge potentially rising risks.

This paper initially focuses on the relationship between bank credit and crises. This particular link seems to be the clearest among the variables discussed above. Using annual data from 1870 to 2008 for 14 advanced economies, Schularick and Taylor (2012) document that faster credit growth over the previous five years is associated with a higher probability of a financial crisis. Staff obtained similar results using a larger set of 35 advanced countries and quarterly data post 1960. While both the probability and severity of crises should be a concern to policymakers, analysis focuses on the first link which seems more robust.[29]

According to the evidence, higher interest rates reduce the probability of crises over the medium term.[30] The above reduced form estimates, when taken together, suggest that the

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27 This is established in Gertler and Karadi (2013), in which a surprise decrease in one-year bond yields by 20 basis points reduces the non-default component of corporate bond credit spreads by about 8 basis points for eight months, a move they describe as relatively large. Gilchrist, López-Salido and Zakrajšek (2014), echoed in López-Salido, Stein and Zakrajšek (2015), find similar results. Rey (2016) finds a significant relationship between US monetary policy and international credit spreads.

28 If a crisis might involve unemployment that is higher by 5 percentage points for 3–4 years, the corresponding numbers for a setback might be 1–2 percentage points for 1–2 years.

29 Flodén (2014) shows that a 1 percentage point lower DTI ratio might, all else equal, result in only a small gain in the rise in the unemployment rate associated with a crisis of 0.02 percentage points.

30 Provided the borrowers are sufficiently robust, and the financial system sufficiently well capitalised and liquid, to withstand the initial interest rate shock.

probability of crises first increases, then decreases to its trough after 3 to 5 years.[31] At that point, the probability is reduced by 0.04 to 0.3 percentage points following a 100 basis point interest rate hike for a year, given the range of effects found in the literature. The left-hand panel of Figure 5 illustrates this effect for a middle-of-the-road response, in which real credit growth decreases by 1 percentage point for one year, from its historical average of 5.4 per cent.

Figure 5: Credit Growth and the Probability of Banking Crises
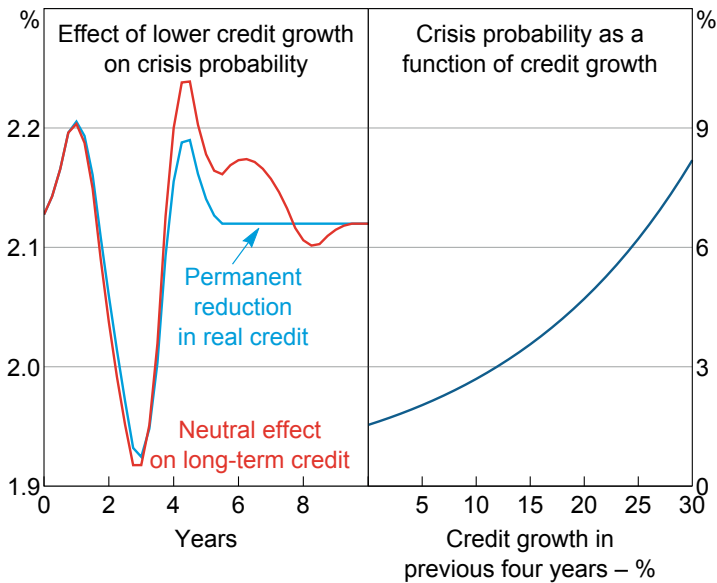
Source: IMF

There are various caveats to these findings:

- The average reduction in probability of crisis is lower than the maximum effect (at the trough). This is because crisis risk initially spikes following an interest rate hike, due to the stock effects discussed earlier.[32]

- The path taken by the probability of crisis depends strongly on the behaviour of credit. If the level of credit is assumed to return to steady state, after the temporary interest rate hike, credit growth has to increase substantially after reaching its trough to catch up for periods when credit was growing slowly. In this case, the probability of crisis can overshoot the initial point (left-hand panel of Figure 5 in red). However, if credit

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31 Interestingly, some papers have found apparently contradictory evidence of interest rates on the probability of crises. Melecky and Podpiera (2015) as well as Frankel and Saravelos (2012) associate higher interest rates with lower incidence of crises. In contrast, Demirgüç-Kunt and Detragiache (1998, 2005) find that exposure to high real interest rates, which intensifies credit risk and negatively affects bank profits, was a source of bank fragility during 1980–2002. The findings reported in this paper can help elucidate this apparent contradiction; papers focused on short-term responses will find that crisis probability tends to increase, while those focused on the long-term will uncover lower probabilities.

32 The average probability reduction per year across the full set of models over the first four years ranges from 0 to 0.05 percentage points. Put differently, the reduction in the probability of crisis cumulates to 0 to 0.2 percentage points over the four years following the initial interest rate hike.

is assumed to stabilise at a lower steady state after the interest rate hike, credit growth does not need to overshoot its steady state. As a result, the probability of crisis returns to its initial level in a smoother fashion (left-hand panel of Figure 5 in blue).[33]

• An interest rate hike would reduce the probability of crisis more if it occurred during a credit boom. Indeed, the right-hand panel of Figure 5 shows that the probability of a crisis increases nonlinearly as credit growth reaches very high rates.[34]

Other approaches, including that underpinning vulnerability analysis at the Fund, indicate that other financial variables can also explain crisis risk. Two approaches are used (see Habermeier *et al* (2015, Box 6)). The first is drawn from the literature on early warning indicators. It determines the signal-to-noise ratio of each variable by measuring its ability to accurately sort the sample into crisis and non-crisis periods minimising both type I and II errors. The second is the more standard logit regression discussed in the paper. Crises are explained by the growth of financial variables as well as their deviation from trend. The results suggest that a range of indicators, including equity and house prices, credit growth, and even simply the output gap, may be worth monitoring when forming judgements about stability risks and the scope for monetary policy action.

Indeed, the effect of interest rates on the probability of crises may be stronger if links through other financial variables are also taken into account. The earlier analysis focused on the link between interest rates and crisis probability, as intermediated by real credit growth. The link through other financial variables, though developed at the IMF (see above), has not been quantified as precisely, nor have links through specific variables been sufficiently separated from one another. However, as discussed above, interest rates have significant effects on more than just real household credits: on leverage of financial firms, risk-taking behaviour, asset prices, and credit spreads. Changes in these variables are likely to entail financial vulnerabilities through different and, at least partly, independent channels to those related to household credit. To the extent these are relevant, the effect of higher interest rates on lowering crisis probability should likely be revised up, at least somewhat.

4.   Step 2: Trade-offs

Trade-offs between stabilising inflation (or output) and financial risks should be evaluated on the basis of magnitude and direction of effects. The first thing to establish is whether the periods when interest rates have to be tightened for price stability purposes often coincide with periods when financial stability concerns also call for higher rates such that rates would be raised for both reasons. The second question regards the size of interest rate changes; should interest rates be hiked by the same degree to ensure that both objectives are met? The earlier analysis suggests this will often not be the case. A 100 basis point rise in interest

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33   These assumptions are not innocuous. The first follows from standard monetary neutrality. The second entails hysteresis (and thus may better capture the effects of substantial interest rate hikes or the effect of monetary policy on behaviour, such as by putting an end to exuberant borrowing or lending behaviour, or changing the structure of the banking industry – these effects would likely stem from large and persistent interest rate hikes).

34   For example, if credit growth were to decline for one year from 20 to 19 per cent, the probability of a crisis would decline by about 0.4 per cent after three years, about twice as much as the effect shown in the left-hand panel of Figure 5. Nevertheless, effects remain relatively small.

rates is large for price stability purposes (at least in AEs in tranquil times) – central banks rarely lift rates by more than 25 or 50 basis points at most on any given announcement date (though on a cumulative basis the US Federal Reserve, for instance, raised rates by about 200 basis points per year in the 2004–06 tightening cycle). Meanwhile, the earlier analysis suggested that a 100 basis point increase in rates is associated with a small decrease in the probability of a crisis.

However, trade-offs may not always be severe, at least on the basis of the direction of effects, and with hindsight. Often, financial risks develop in periods of economic expansion, which also warrant higher interest rates for the purpose of price stability. Figure 6 shows inflation and output gaps in the advanced economies that experienced systemic banking crises in 2007–08.[35] The left-hand panel shows that inflation was running slightly above target prior to the crisis, thus calling for a somewhat tighter monetary stance from a pure inflation-targeting perspective. The deviation from target did remain moderate, but a possible lesson from the crisis is that, given the flattening of the Phillips curve, policymakers may need to react more promptly as inflation deviates from target. The right-hand panel considers the evolution of output gaps. Real-time estimates from the April 2007 WEO show no sign of economic overheating in the run-up to the crisis. However, revised estimates from April 2015, based on revised data and the realisation of the crisis, reveal large positive output gaps that would have warranted considerable monetary tightening. In these cases, trade-offs may have been small on the basis of both sign and size of interest rate responses. The analysis underscores a well-known point: policymakers should seek to improve real-time estimates of potential output, possibly using financial variables, as well as external balances – this remains a key and difficult challenge.[36] Box 2 in Habermeier *et al* (2015) offers a similar analysis based on comparing output gaps with financial gaps – a measure of financial stability risks – and also suggests that trade-offs between stabilising inflation and financial risks may not always be severe.

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35 Banking crises are from Laeven and Valencia (2012); 11 'systemic banking crisis' (Austria, Belgium, Denmark, Germany, Greece, Ireland, Luxembourg, Netherlands, Spain, United Kingdom, United States) and 5 'borderline systemic cases' (France, Italy, Portugal, Sweden, Switzerland).

36 Measures of output gaps may be biased downwards, as the growth of credit may fuel consumption and non-productive investment beyond what is sustainable in the long run. See, for instance, Berger *et al* (2015), Borio, Disyatat and Juselius (2014), Rabanal and Taheri Sanjani (2015), and Furlanetto, Gelain and Taheri Sanjani (2014).

Figure 6: Economic Dynamics in AEs with Banking Crises in 2007–08
Average across countries
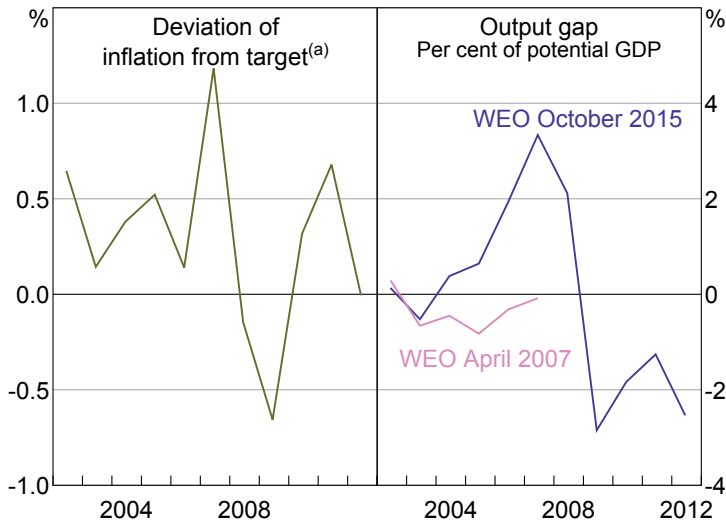
Note: (a) Defined as the midpoint of target range, end of period, WEO October 2015 sourced
Source: IMF

5. Step 3: Welfare Implications

Ideally, implications of leaning against the wind should be taken in a fully specified model. Empirical relationships estimated on past data only go so far. Importantly, they are rooted in a period during which monetary policy did not lean against the wind. Had it done so, agents might have adapted their behaviour by taking fewer risks in the first place, or by cutting back on risk more aggressively following interest rate hikes. Only models can account for the endogenous response of households and firms to a structural change in policy, such as the decision to lean against the wind. To do so, though, models need to fully take into account the structural relationships between agents' risk-taking behaviour, and financial and macro variables (the so-called micro-foundations).

Indeed, a new class of models suggests that leaning against the wind, absent other tools, can be welfare improving. These models take into account some financial distortions, as well as heterogeneous agents.[37] However, these models do not as yet generate crises of major proportions as considered in this paper. The build-up of financial imbalances and the subsequent crises are modelled as small fluctuations around the economy's steady state growth path. Hence, they exclude large nonlinearities – associated, for example, with default states – that could meaningfully impact the welfare considerations. It remains for now that

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37 See Carlstrom, Fuerst and Paustian (2010), Cúrdia and Woodford (2009, 2010), Quint and Rabanal (2014), Leduc and Natal (2015) which tackles the issue of optimal monetary policy, Laseen, Pescatori and Turunen (2015), Unsal (2011), Lambertini, Mendicino and Punzi (2013), Gambacorta and Signoretti (2014) and Woodford (2012).

reacting systematically to swings in financial variables (asset prices, leverage, and risk premia) reduces inefficient fluctuations in output.[38]

The welfare improvements in many current models are generally fairly small and state (or shock) dependent. Hence, simple rules that react to observable variables may lead to policy mistakes – emphasising the need for judgement in actual policy decisions.[39] Also, welfare gains of leaning against the wind in these models are small relative to complete macroprudential policies that are able to more directly target financial frictions (Figure 7). In these models, though, macroprudential policy remains highly stylised (a reduced form means of affecting lending rates that is completely effective) and cannot be attributed to a specific real-world instrument.

Figure 7: Welfare Gains from Leaning against the Wind versus Using Macroprudential Policy
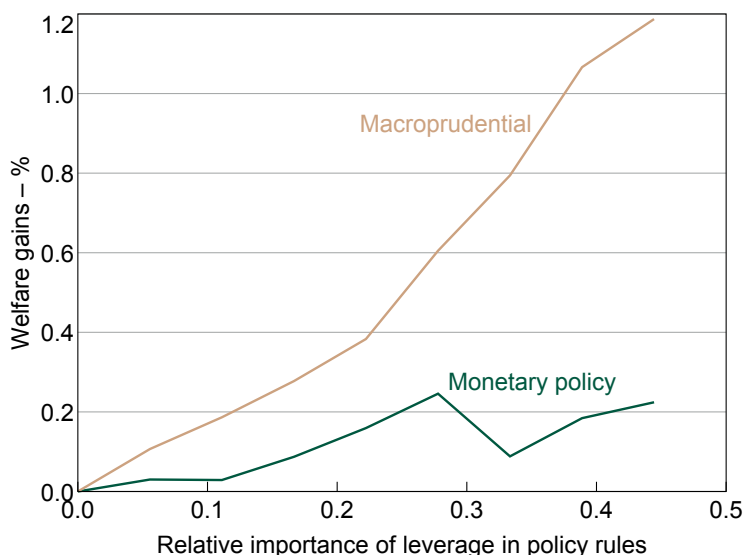
Note: Welfare is measured in terms of consumption relative to baseline with no reaction to leverage
Source: IMF

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38 A systematic response, nonetheless, does not mean that leaning against the wind is done in a mechanistic fashion, by keeping interest rates always higher than they would otherwise have been. A systematic response merely implies reacting to the dynamics of financial variables in an expected fashion, and may well imply only temporary deviations from the interest rate path consistent with price stability (a policy rule could call for the central bank to respond only to excessive levels of financial variables). The concept of leaning against the wind therefore remains unchanged relative to earlier sections of the paper. The main difference is that in a model setting, markets expect the central bank to lean against the wind, and adjust their behaviour correspondingly.

39 For instance, if the source of a credit boom is a productivity shock, and the monetary authority reacts mechanically to a credit variable (rather than to the effects of the shock) by tightening policy, welfare would decrease, in part due to a strong undershooting of inflation driven by higher productivity and tighter policy. See Christiano *et al* (2010), Quint and Rabanal (2014), or Unsal (2011).

While useful for informing policy intuition, the new models remain very stylised and more work is needed. They have not yet fully captured the foundations of financial distortions and the specific dynamics of risk-taking behaviour. It is not clear how much monetary policy can affect the root cause of these distortions, such as incentive structures, or funding liquidity constraints due to asymmetric information or balance sheet mismatches. Also, in the real world, distortions are multiple, interrelated, and time varying. They may include a mix of frictions, each with a different effect on the risk-taking behaviour of different actors. Models, for instance, might consider effects of higher rates on the leverage of financial intermediaries, but not on household loan delinquencies. Moreover, crises are mostly modelled as small fluctuations around the economy's steady state growth path. Multiple equilibria where one pole captures a state of massive defaults, debt overhang and asset price spirals, are mostly excluded. This seems at odds with the observation that crises follow extended departures from steady state followed by sharp deviations. This indicates the need for a richer analysis of nonlinearities that could have sizable implications for the role of monetary policy.

In the meantime, a simpler framework for cost-benefit analysis can be used as a rough guide for policy deliberations. The framework, inspired by Svensson (2015), is useful to build intuition, highlight interactions among variables, and explore rough magnitudes. Leaning against the wind involves paying a short-term cost – lower output or higher unemployment – in exchange for a medium-term benefit in the form of lower expected costs from a financial crisis.[40] There is less of an inter-temporal trade-off (illustrated in Figure 8) with respect to the role of monetary policy in stabilising inflation, because of the strong correlation between inflation and output over shorter horizons, where bringing inflation to target typically also implies bringing output towards its target.[41]

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40 The calculation is similar to that considered in Svensson (2015). In the first period, the central bank raises interest rates and incurs higher unemployment for 3–4 years, while reducing financial vulnerabilities. Once unemployment is back to steady state, the second period begins with a roll of the dice, determining whether the economy is hit by a crisis. That probability is lower if rates were raised in the first period. In the case of a crisis, unemployment increases by a significant amount, for a period equal to, or longer than, the first period. In the end, welfare is approximated by squaring unemployment over both periods (technically, squaring the deviations of unemployment from the natural rate, which can be assumed to be zero to simplify computations).

41 Blanchard and Galí (2007) referred to the fact that in many models bringing inflation to target meant also bringing output to target as 'the divine coincidence'. Since, most models have exhibited some – though not very substantial – trade-offs, by introducing wage rigidities or cost-push shocks (see Blanchard (2006) for a discussion, or Goodfriend (2004)). Signs that the trade-off may be weakening are discussed in Bayoumi *et al* (2014).

Figure 8: To Lean or not to Lean, Such are the Trade-offs
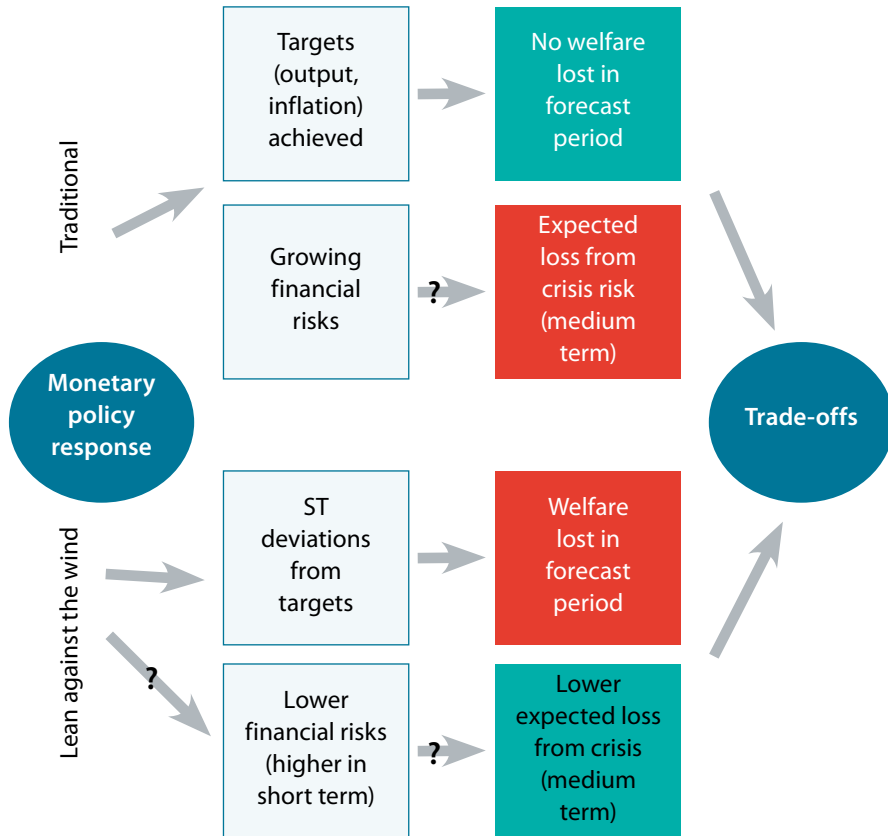
Source: IMF

One important parameter in the illustrative cost-benefit analysis is the unemployment loss from higher interest rates in the short run. This loss can be approximated by using any standard DSGE model used for policy analysis. The IMF's GIMF model, which is also used by many central banks, implies that unemployment would rise by somewhat less than ½ percentage point as a result of a 100 basis point increase in short-term interest rates for a year.[42] This estimate is broadly consistent with those obtained using vector autoregression (VAR) models to estimate the transmission of monetary policy.[43]

The costs of leaning against the wind appear greater than benefits, unless a severe crisis is foreseen. The cost-benefit analysis is highly sensitive to the strength of the linkages between the policy rate and crisis risk, and the assumed severity of the crisis. In order to justify leaning

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42 Effects peak after 1 to 2 years, and unemployment returns to steady state after 3 to 4 years. This result is based on averaging two model variants, one capturing a large, mostly closed economy, and the other a small open economy.

43 See Altavilla and Ciccarelli (2009) for a survey. Other models, more tailored to small open economies, also exist and are used widely by central banks; each has its own particular features. In the 'Ramses' model used by the Sveriges Riksbank, for instance, unemployment reacts more sluggishly to monetary policy shocks.

against the wind these parameters need to be close to the upper range of existing empirical estimates. Note, however, that such calculations focus on the benefits of avoiding major crises, but do not consider additional benefits of reducing smaller economic setbacks (a topic discussed further below). Three scenarios among many are illustrated in Table 1.[44]

- The first is based on the average decrease in crisis probability computed earlier, as a result of a 100 basis point increase in short-term interest rates. In this scenario, the crisis is assumed to increase unemployment by 5 percentage points and last 4 ½ to 6 years.

- The second scenario assumes the crisis probability can be reduced by 0.3 percentage points – the maximum effect found in the literature surveyed earlier.

- In the third scenario, the crisis is assumed to be acute (an event further in the tail), with unemployment increasing by 7 percentage points for 6 to 8 years.

- In the first two scenarios, the costs of leaning against the wind are notably higher than benefits. Only in the third scenario does leaning against the wind seem to pay off.

Table 1: Illustrative Scenarios

Building blocks	Average probability	High (peak) probability	High (peak) probability, severe crisis
Lower crisis probability (pts)	0.02	0.3	0.3
Duration of crisis (years)	4.5–6	4.5–6	6–8
Unemployment gap in crisis (%)	5	5	7
Higher unemployment (pts)	0.5	0.5	0.5
Benefits	0.008	0.113	0.294
Costs	0.25	0.25	0.25
Ratio (B:C)	**0.03**	**0.45**	**1.18**

Source: IMF

A more detailed alternative approach comes to similar conclusions and provides various refinements.[45] The first is that the above illustration draws on earlier results that represent broad averages; trade-offs will be different depending on specific country circumstances. In some cases, benefits can rise above costs, but only somewhat and in the medium to long term. Costs of leaning against the wind are apparent in the short run, whereas benefits materialise more slowly and with uncertainty. In addition, benefits are sensitive to various

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44 The first line of the table captures the decrease of the probability of crisis. The second and third lines represent the severity of the crisis, if it occurs: its duration in years, and the unemployment rate (in deviations from the natural rate that is assumed to be zero to simplify computations). Benefits of leaning against the wind are therefore composed of the first three lines: a lower probability of a bad outcome. A numerical estimate of benefits is reported in line five, as the product of the lower probability, the crisis duration ratio, and the unemployment rate squared (assuming squared utility). The crisis duration ratio expresses the duration of the crisis in years (line two) in relation to the duration of the initial period with higher unemployment resulting from the rate hike. The ratio is 1.5 for the first two scenarios, and 2 for the last scenario. Costs, reported in line six, are more straightforward; they are the square of the increase in unemployment following the interest rate hike (expressed in line four, as a rough average of the various models discussed above in the text).

45 A Bayesian VAR analysis, based on data from six countries, takes into account the full evolution of the probability of crisis over time (see Habermeier *et al* (2015, Box 7)).

assumptions, one of which is the return of real credits to steady state, as discussed earlier. Initial conditions are also important, and the case for leaning against the wind improves as initial unemployment is close to target, and unemployment gets squared in the welfare calculations.[46] Any potential policy response must therefore be state contingent, and is thus more complicated than adding a variable with a fixed coefficient to a Taylor rule.

6.   Further Considerations

Three considerations are relevant: the impact of leaning against the wind on the probability of setbacks, in addition to crises, effects on central bank credibility, and open economy implications.

A fruitful area for further research is the case for leaning against the wind in cases other than a full-fledged crisis. In the analysis above, we rely on a 'zero-one' definition of crisis. The methodology implicitly assumes that the only positive impact of leaning against the wind is reducing the probability of a full-fledged crisis. However, it is possible that higher interest rates may also reduce the severity and incidence of 'non-crisis' recessions stemming from financial imbalances. Then, if one used a more continuous definition of financial instability and, hence, included less severe economic setbacks with financial roots, the expected benefits from leaning against the wind might increase. This is tantamount to considering the effect of leaning against the wind on the entire distribution of future unemployment, not just its (crisis) tail. The same cost-benefit framework sketched out earlier would apply equally well to this setting.

But empirical results capturing this additional benefit are still scarce and inconclusive. Some work shows that credit spreads are mean reverting and correlated to economic activity. Spreads that are compressed by buoyant sentiment today often forecast a widening of spreads in the future, lower credit supply especially to lower credit-quality firms, and an economic contraction. To the extent that expansionary monetary policy contributes to tighter spreads, it may also increase the risk of a reversal in credit markets and corresponding drag on output.[47] As discussed earlier, the link from monetary policy to setbacks could also occur through other variables. Credit growth, for instance, leads to a future expansion and then contraction of GDP, according to staff estimates. However, GDP never substantially falls

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46 This is as in the simple exercise above in which unemployment is taken to start at its steady-state value. Benefits would be lower under different assumptions; in particular, if the crisis occurred while unemployment was still recovering from the initial interest rate hike. Thus, in countries in which unemployment responds sluggishly to interest rates, the case for leaning against the wind will be harder to make.

47 Gilchrist and Zakrajšek (2012) show that the non-default component of corporate credit spreads has substantial predictive power for economic activity. An increase of 100 basis points in spreads predicts a drop in real GDP growth of more than 1.5 percentage points over the subsequent four quarters. Other papers documenting the link between credit spreads and economic activity are Gilchrist, Yankov and Zakrajšek (2009), and Faust et al (2013). López-Salido et al (2015) suggest that lower spreads seem to be mean reverting and predict a surprisingly strong economic contraction. A 30 basis point increase in the sentiment-driven component of credit spreads, corresponding to a jump from the 25th to the 75th percentile of its historical distribution, tends to decrease real GDP per capita by 4.2 percentage points over the subsequent two years. Other papers have also documented a correlation between shocks to financial stress indices and output, both domestic and foreign; see, for instance, Metiu, Hilberg and Grill (2015), and Alessandri and Mumtaz (2014). The link between monetary policy and credit spreads is mixed. While various papers discussed earlier find that lower interest rates increases banks' willingness to take credit risk, and Gertler and Karadi (2013) find the easier monetary policy reduces spreads, Gilchrist et al (2014) do not find any impact of monetary policy on credit spreads.

back below its initial level. There is therefore no clear case to lean against credit growth from the standpoint of containing risks of setback. More work in this area is clearly warranted, as also argued by the authors active in this nascent field.

Leaning against the wind might undermine the credibility of the central bank, and the effectiveness of monetary policy, including a de-anchoring of inflation expectations. Credibility and policy effectiveness largely stem from transparency, predictability, and observable success, which are key underpinnings of the standard inflation-targeting framework. Leaning against the wind, by contrast, requires policy action to be justified on the basis of distant events that are difficult to forecast, or even to define precisely. It also involves using one instrument for two targets. Transparency and predictability could suffer, making communication more complicated.[48] Credibility may also suffer because crises will most likely occur despite leaning against the wind, and because the central bank will under deliver on inflation, at least at times, which could destabilise inflation expectations.[49] Moreover, if central banks underdelivered on their inflation mandates, real debt and real interest payments on debt would increase, thereby undermining financial stability. Nonetheless, it is also the case that not responding to risks and so allowing crises to emerge could undermine the credibility of the policy framework.

For large economies with strong cross-border financial links, both benefits and costs of leaning against the wind may be larger, once spillovers are taken into account. The analysis in this paper measured the costs of crises in terms of domestic effects. However, financial crises in large countries can have strong spillover effects across borders due to financial linkages, as discussed in past editions of the IMF Spillover Report (IMF (2013d, 2014c, 2015b) for instance). Thus, if monetary policy in a large country were to decrease the probability of crisis, it would avoid higher domestic, but also international costs. From a global welfare perspective, this would tip the cost-benefit analysis of the earlier simple framework towards leaning against the wind, everything else equal. However, higher interest rates in the large country could also have negative effects on smaller countries through trade linkages (more sluggish demand from the large country, compensated in part by a stronger currency). In addition, in practice, central banks will first and foremost take policy decisions to satisfy their domestic mandates, unless spillover effects on foreign countries could spill back to the domestic economy or if mitigating cross-border spillovers would not affect achieving the domestic objectives.[50]

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48 That being said, communication would become easier as the central bank learns more about the transmission mechanism to financial stability, and refines its models to forecast crisis probability. The fact that communication is currently difficult also applies to setting prudential policy. For now, this points to the value of separating the monetary policy and prudential policy-setting functions of central banks (to the extent both are housed under the same roof), so that as the second improves through trial and error, the credibility of the first is not damaged.

49 Central banks that are responsible for financial stability, though also have control of macroprudential policy, shield the independence and credibility of monetary policy by separating the decision-making bodies responsible for financial stability and price stability within the central bank. Central banks benefiting from strong credibility might be able to undershoot their inflation target without unsettling inflation expectations, but only for some time. Credibility is not exogenous, and depends on consistently satisfying one's target. If this is not the case, credibility can quickly be lost. Williams (2015) points to evidence in this respect from Norway and Sweden, where inflation expectations dropped below target when their central banks were highlighting financial stability worries, though other factors may have contributed to a decline in both headline and expected inflation in this period.

50 Despite underscoring the existence and importance of spillover effects, the US Federal Reserve's Vice-Chairman, Stanley Fischer, recently emphasised that '[o]ur mandate, like that of virtually all central banks, focuses on domestic objectives' (Fischer 2015).

However, for small open economies, the case for leaning against the wind may be weaker. First, in such economies, financial stability concerns often stem from strong capital inflows that drive up asset prices and compress credit spreads (see Sahay *et al* (2014)). In this case, increasing domestic interest rates (or cutting rates by less than warranted to stabilise prices) may be counterproductive, and exacerbate instability by attracting further capital inflows.[51] Second, whatever the source of financial vulnerability, higher rates would tend to appreciate the domestic currency, and thus strengthen balance sheets for those with debts in foreign currency (the IMF's October 2015 *Global Financial Stability Report* (GFSR) highlights the extent to which firms in emerging markets are exposed to foreign currency debt; IMF (2015a)). In fact, higher rates could even increase the share of foreign currency debt, a common problem in highly dollarised economies. As a result, debt levels may actually increase, instead of decrease.[52] Other policies may be more appropriate to manage financial stability risks stemming from capital inflows.[53]

7. Implementation Issues

Whatever guidance the cost-benefit analysis may provide, implementation is also crucial; three issues arise:

- *First, when to act.* If action comes when financial vulnerabilities are already very large, leaning against the wind could bring about a crisis: the immediate effect of higher interest rates is to worsen, not improve, vulnerabilities. Decisions on leaning against the wind must thus take account of the resilience of the financial system. Similarly, as was pointed out earlier, leaning against the wind should not be done after a crisis, when unemployment is already very high. Leaning against the wind should thus be done early in the development of financial vulnerabilities; but this raises new questions as discussed below.

- *Second, how to detect vulnerabilities and predict crises in real time.* It is precisely in the initial phases of economic expansion and recovery that central banks would find it most difficult to justify leaning against the wind. In this phase, it is difficult to distinguish between credit expansions that are good (driven by productivity) and bad (driven by consumption and expectations of capital gains), and crises appear distant and unlikely events. The difficulty of policymaking under uncertainty is augmented relative to price stability, given the longer horizons over which crises must be forecasted. It is instructive,

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51 See Ahmed and Zlate (2014), Forbes and Warnock (2012), Fratzscher (2011), and Ghosh *et al* (2012) for a discussion of how interest rate differentials drive capital flows.

52 This dynamic is pointed out in Ozkan and Unsal (2014), who examine the costs and benefits of leaning against the wind in a DSGE model of a small open economy.

53 Countries should consider the complete policy mix (monetary, fiscal, and exchange rate policies) taking into account the country's economic cycle, reserve adequacy, and exchange rate valuation. According to IMF (2012), there is scope to temporarily resort to capital flow management measures, as well as exchange rate interventions, to address systemic financial risks stemming from inflows, provided they accompany needed macroeconomic policy adjustment and financial sector regulations. Such measures can also be useful in managing large inflows in certain circumstances, such as when macroeconomic conditions are highly uncertain, the room for macroeconomic policy adjustment is limited, or appropriate policies require time to take effect. More work is needed to better understand the interplay between all policies available in how they affect financial stability.

for instance, to go back to the US experience in 2002, when house prices and household debt were beginning to grow especially rapidly (see, for instance, Jordà *et al* (2015)). Had policymakers expected a large increase in crisis probability and severity (a rise in the unemployment rate of 4 per cent on average for six years, starting in 2007), they may well have decided to lean against the wind.[54] However, in 2002, even the most pessimistic forecasts of US growth did not foresee such a dramatic surge in unemployment coming just five years later. The IMF's 2002 WEO, for instance, focused on immediate downside risks stemming from equity prices, investment spending and the exchange rate, but does not discuss risks further out on the horizon. The hope is that today policymakers can benefit from better frameworks to judge the impact of interest rates on financial stability, and better estimates to consider the link between the dynamics of financial variables and crisis probability. In the end, judgement will always need to be applied when indicators on balance suggest some gain from a monetary response.

- *Third, combining monetary and prudential policies.* The analysis in this paper has focused on the role that monetary policy can play in supporting financial stability, everything else equal. But this is not sufficient to provide policy guidance: in the end, monetary and prudential policies must be considered together.[55] To begin with, well targeted macroprudential (and micro) policies should shoulder most of the burden to contain financial instabilities. Further, macroprudential and monetary policy seem to be strongly complementary. For example, if an early interest rate hike could contain a possible spike in asset prices (due to nonlinearities), it would facilitate the job of prudential policies down the road. Moreover, monetary and prudential policies must be systematically compared on three counts: their relative uncertainty (both policies could potentially have the same expected effects, but the effects of one could be more uncertain than those of the other), expected effects, and expected costs (prudential policies too give rise to distortions even as they correct others).[56] Ultimately, the mix of prudential and monetary policy to support financial stability would need to be determined by a joint maximisation of social welfare. In doing so, the practical constraints on each policy should be compared, to see if one policy may or may not be able to overcome the hurdles facing the other. For instance, if political pressures are the main hurdle to prudential policy, they will also hinder a potential focus of monetary policy on financial stability.

8.   Concluding Thoughts

On balance, based on current understanding and circumstances, the case for leaning against the wind is limited. With substantial slack in the macroeconomy, transmission from interest rates to financial risks seems weak, costs often appear greater than benefits, and implementation hurdles are substantial. Macroprudential policies, including both cyclical

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54 The rise in unemployment was about half as large as the third stylised scenario presented earlier; however, these scenarios remain a simple benchmark and judgement could have convinced policymakers to act nonetheless.

55 For an initial discussion, see IMF (2013b).

56 IMF (2014b) offers an overview of recent papers estimating the costs of macroprudential policies; in many cases, these are found to be relatively small.

and structural measures, will remain a key element of the defence against financial instability. Indeed, these measures, when well targeted and effective, can target imbalances and market imperfections much closer to their source than monetary policy does. Also, they could allow monetary policy to focus on its price stability mandate, thereby simplifying communication and enhancing accountability.

Further research is warranted. First, our understanding of the transmission mechanism from monetary policy to financial stability is limited. New evidence and analysis could identify new channels of transmission and strengthen the case for leaning against the wind. Second, even based on current knowledge (and the analysis in Habermeier *et al* (2015)), benefits can plausibly outweigh costs in particular, albeit relatively unlikely, circumstances. These circumstances can reflect a confluence of initial conditions pertinent to the conjunctural cycle and structural conditions characteristic of specific countries. For example:

- *Initial conditions*. Benefits relative to costs can be boosted by: low unemployment (when rate hikes could lead to smaller macroeconomic costs); rapid credit growth (when rate hikes could have a stronger effect on credit growth and crisis probability by discouraging exuberant, self-fulfilling behaviour); and when borrower and bank balance sheets are strong (and hence can withstand the initial interest rate shock).

- *Structural conditions*. Benefits also rise relative to costs when: crises are likely to be particularly severe (due to a large and interconnected financial system and the absence of well-targeted macroprudential measures); financial spillovers could be large (as for systemically important countries with open capital accounts); and if future financial risks can be reliably identified early (so that early increases in interest rates may be able to avoid a large build-up of risks).

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Discussion

1.   James Yetman*

I'd like to thank the organisers for the opportunity to participate in this conference and discuss this very interesting topic. The background paper from the International Monetary Fund (IMF) that this presentation was based on – the 2015 IMF Staff Report on 'Monetary Policy and Financial Stability' (Habermeier *et al* 2015) – is an excellent summary of the arguments for and against using policy rates to lean against the wind of excessive financial growth. If I wanted to recommend one document to bring someone up to speed on the issues, this would probably be the one I would cite. It's balanced, nuanced and comprehensive.

The document contains a decision tree, and highlights the circumstances when leaning against the wind might be considered: when there are financial excesses that macroprudential measures would be ineffective against and the macroeconomic developments do not call for an interest rate rise, so that there is a trade-off between financial stability and price stability objectives.[1] Overall, the authors conclude that the answer to the question of whether interest rates should be used to learn against the wind is:

> Based on our current knowledge, and in present circumstances, the answer is generally no. But, the door should remain open as our knowledge of the relationship between monetary policy and financial risks evolves and circumstances change (Habermeier *et al* 2015).

I don't have any strong objections to the background document, or the presentation today, so let me instead add another perspective on where we stand in the leaning against the wind debate. First, here's a definition of leaning against the wind: in the face of 'excessive' financial growth, raising interest rates more quickly than warranted by inflationary developments.

I like this definition because it's not symmetric, but focuses only on the use of monetary policy tools in the face of financial excess. That's because one way to think about leaning against the wind is that it's actually a call for symmetry. There is a strongly held view among some that monetary policy is already used in the case of financial weakness, beyond what can be justified by output and inflation, to cushion asset prices. In the US context, this has sometimes been referred to as the 'Greenspan put': you don't have to worry about asset prices falling too far because the central bank will come riding to the rescue and use monetary policy to put a floor under asset prices. In that context, one could view leaning against the wind as providing symmetry: reducing the need for worry about missing out on an asset price increase, since monetary policy will be used to step in to put a ceiling on financial markets if

1   The macroprudential measures could be ineffective because the excesses lie outside of the regulated financial system, where macroprudential measures have their strongest effects, or because the use of these measures would lead to the associated financial activities moving from the regulated to the unregulated parts of the financial sector.

things get too hot. But there are at least two ways to gain symmetry here: lean against the wind, or remove the Greenspan put.

So when does leaning against the wind make sense? I'd argue that there are three necessary and sufficient conditions:

- Interest rate increases are effective enough at curbing excessive financial growth, without being too effective at slowing real activity and inflation.

- The expected costs of excessive financial growth are high.

- There's no better tool for lowering excessive financial growth available.

There's some version of these embedded in any assessment of leaning against the wind, including in the IMF background paper. Put differently, the first condition essentially says that interest rates have the desired effect; the second that these effects are worth having; and the third that there's no better way of achieving the desired outcome. Together, they form a three-legged stool on which leaning against the wind rests. If any one of the three legs of the stool is removed, leaning against the wind is not optimal policy. Let's unpack them one at a time.

Interest rate increases are effective enough at curbing excessive financial growth, without being too effective at slowing real activity and inflation

This first requirement cannot be generally true, or central banks would have a very serious problem on their hands. If interest rates are good at influencing financial growth with little real consequence, then interest rates should be primarily viewed as a financial stability tool rather than a monetary policy tool. Then central banks would be in search of a new monetary policy tool instead (or maybe even a complete rethink of monetary policy frameworks would be required).

While I don't believe we're there yet, we could get there one day. For example, my colleague Boris Hofmann with his co-author Geert Peersman (Hofmann and Peersman 2017) suggest that interest rates have become much more effective at influencing credit and house prices over time, and less effective at influencing inflation. If this process were to continue, we would eventually get to a state where interest rates were no longer an effective monetary policy tool.

But, even if this first condition is not generally satisfied, it could hold sometimes. Consider a simple model of leveraged investment in a capital good, the returns on which are given by:

$$\pi = r + g - i(p - k)$$

where π is profit, r is the rent or revenue generated from the investment, g is the expected growth of the price of the capital good, i is the interest rate, p is the price paid for the capital, k is the amount that was invested, and therefore $p - k$ is the amount borrowed. Note that I'm taking these variables as given. It could be that expected growth of asset prices, g, cannot be justified based on fundamentals, as is likely to be the case with asset price bubbles.

Now, if investors care about the return on each unit of investment, this can be written as:

$$\frac{\pi}{k} = \left(\frac{r+g}{p} - i\right)l + i$$

where $l = \frac{p}{k} > 1$ is the leverage that the investor takes. To the degree that interest rates affect the returns per unit of investment, they are likely to be effective tools for influencing excessive investment. Given that:

$$\frac{d\left(\frac{\pi}{k}\right)}{di} = (1-l) < 0$$

interest rate increases are likely to be most effective at dissuading leveraged investment when leverage is highest, which is exactly what we'd want if we wished to use interest rates in pursuit of financial stability objectives.

But there's a double-edged sword here, which we can think of in terms of the flow versus the stock of investment. In terms of flows, an increase in interest rates reduces the incentives for borrowing to finance new investment, which would help to reduce financial excess. This is the intended consequence. But there's also a large stock of leveraged investment out there and, depending on how it is funded, raising rates might help to bring about the very crisis that the central bank is trying to prevent. Put another way, before a central bank commenced leaning against the wind, it would be important to know how the existing capital stock has been financed, where any associated maturity mismatch lies within the financial system, and whether the associated entities can absorb the financial strain. I think this double-edged sword helps to explain the results reported in Dell'Ariccia *et al* (2015) and elsewhere that increased interest rates tend to reduce financial stability in the near term (when stock effects are likely to dominate), but increase financial stability over time, as flow effects accumulate.
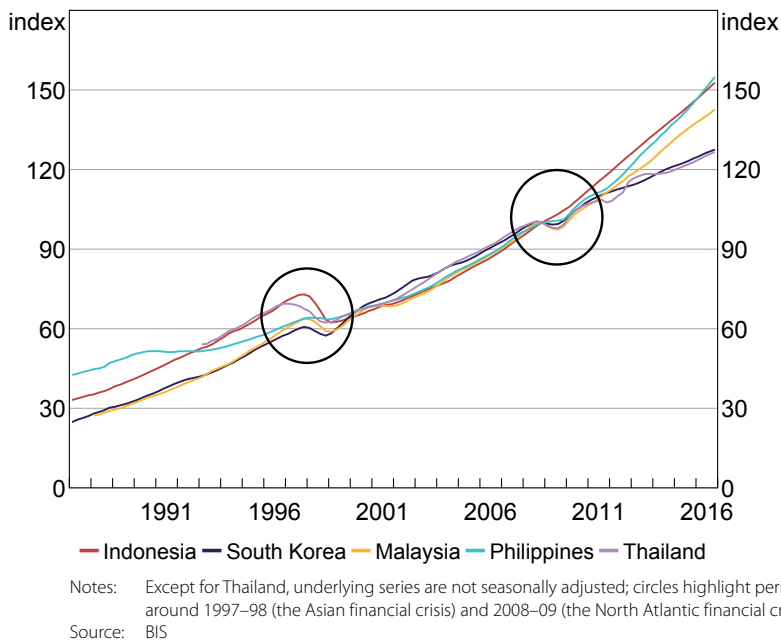
The expected costs of excessive financial growth are high

Prima facie evidence that the costs of excessive financial growth are high is very easy to find. A plot of real GDP for some of the most affected economies during the recent crisis (Figure 1) suggests that the crisis had a substantial effect, with a visible step down in both the level and the growth rate of real GDP around 2008–09 that is substantially larger than anything seen in other downturns in recent decades.

Figure 1: Real GDP Growth

Source: BIS
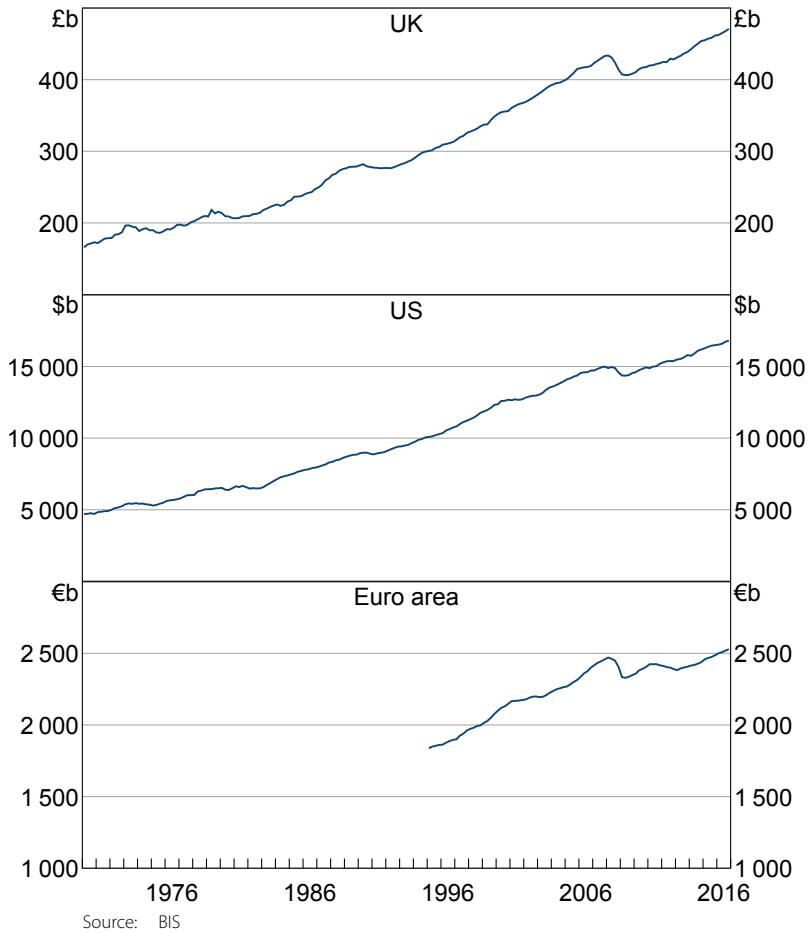
Looking to economies closer to Australia, we see similar evidence for some of the hardest hit economies from the Asian financial crisis in 1997–98, in some cases with another smaller step down in 2008–09 (Figure 2).

Figure 2: Real GDP for Selected Asian Economies

Four-quarter moving average, 2008:Q4 = 100

Notes: Except for Thailand, underlying series are not seasonally adjusted; circles highlight periods around 1997–98 (the Asian financial crisis) and 2008–09 (the North Atlantic financial crisis)

Source: BIS

Assessing the costs (in terms of real GDP) requires taking a view of the right 'counterfactual' for output in the event that a crisis is averted. The top left-hand panel of Figure 3 displays a stylised representation of the effects of a crisis on real GDP consistent with the real-world data in the above figures. The dotted line in the top right-hand panel displays one possible counterfactual, assuming that, without a crisis, real output would have continued to follow its pre-crisis trend. In this case, the costs of a crisis are very large and increase over time. One way to think about the underlying economics here is that there is some limit on the growth rate of the economy, based on the full employment of limited factors of production. Excessive financial growth doesn't increase the growth rate as much as it results in substitution, perhaps away from the services sector, where the need for capital is relatively low, to real estate and other capital-intensive sectors. A financial crisis then sees a substantial loss of wealth due to this malinvestment, with highly persistent, or even permanent, effects on output.

But there is another view of the counterfactual, which Piti Disyatat alluded to in his comments earlier in this conference, in which output before the crisis is artificially high as a result of financial excess. The bottom left-hand panel of Figure 3 illustrates this possibility: the dotted line is the underlying sustainable output growth path. This possibility has been labelled 'finance-neutral' potential output (Borio, Disyatat and Juselius 2013). In the stylised example in the figure, the crisis leads to a persistent deviation between output and potential, but one that ultimately disappears. In the case illustrated, financial crises may still be very costly,

but the costs are more akin to a very severe business cycle: there is no permanent cost from financial excess. On this basis, the incentives for leaning against the wind may be lower with finance-corrected output gaps than in the counterfactual where output would have followed the pre-crisis trend. Reality is quite possibly somewhere between these two cases, with severe business cycle-like effects as well as a permanent shift down in real activity.

**Figure 3: Stylised Representations of the Effect of a Crisis
on Real GDP and Possible Counterfactuals**
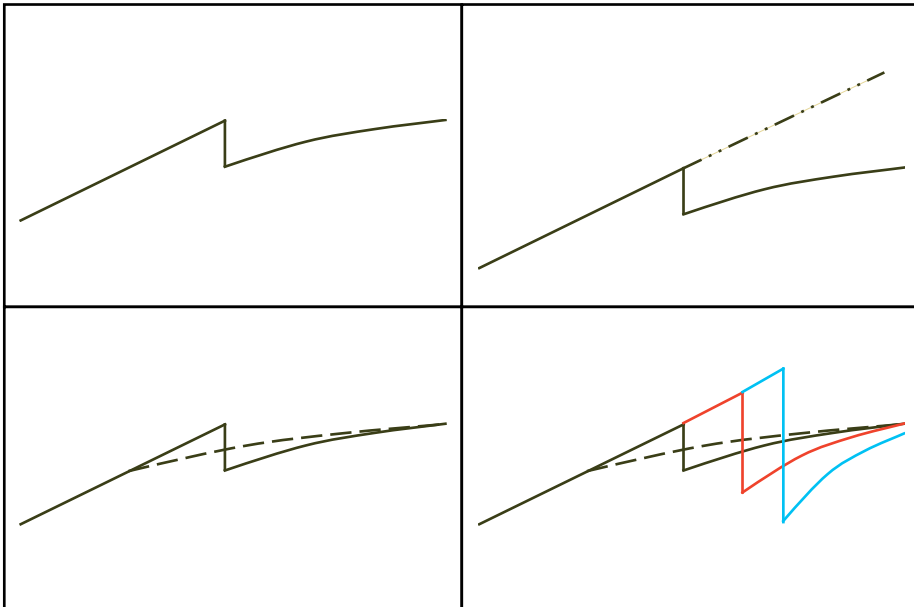
Notes: The top right-hand panel represents the counterfactual where output would otherwise have grown at
          pre-crisis trend; the bottom left-hand panel represents a case where pre-crisis output was artificially high,
          fuelled by financial excess; the bottom right-hand panel shows the same scenario, but where the policy
          choice is between the different lines

In the case that excessive financial growth increases output above sustainable levels, the policymaker may be forced to choose between the different lines presented in the bottom right-hand panel of Figure 3: the trade-off is between either a smaller crisis sooner or a larger crisis later. In this view, once financial excesses start to build, a crisis of some magnitude becomes inevitable. This assumption may dramatically increase the calculated benefits from leaning against the wind to prevent the build-up of excesses in the first place or, failing that, burst the bubble sooner rather than later. Filardo and Rungcharoenkitkul (2016) provide a model consistent with this idea. They assume that once financial excesses start to build, the probability of a future crisis tends to increase over time, such that a crisis becomes almost impossible to prevent. In such a framework, leaning against the wind will tend to be desirable (especially in the absence of other policy tools), even when excesses are still minor. By contrast, a model in which financial excesses tend to mean-revert, rather than building over time, will weaken the case for leaning against the wind.

There's no better tool for lowering excessive financial growth available

On this one, I tend to be optimistic on the effectiveness of alternative, macroprudential tools, although the empirical evidence is still accumulating. The problem with financial excess is not typically with the price of credit itself, but instead with the rate at which the quantity of credit is expanding. If there are good ways to directly influence the quantity, then surely they're likely to be more effective, at lower cost, at reducing financial excesses than using policy rates, which are a blunt tool that may have many undesired side effects. Such tools include maximum loan-to-value ratios, limits on debt-service ratios, countercyclical capital buffers and higher capital standards more generally.

There is now a growing body of evidence that these tools serve as intended. For example, my colleagues have put together a detailed database of the use of macroprudential measures aimed at the housing market (Shim *et al* (2013); data available at <http://www.bis.org/publ/qtrpdf/r_qt1309i_appendix2.xls>). Kuttner and Shim (2016) use this database to assess the effectiveness of the different tools and find that debt service-to-income limits and housing-related taxes slow housing credit growth. There will undoubtedly be many more such studies in the coming years, as experience with the use of macroprudential tools increases.

There is also a need for theoretical work to establish the optimality of different tools under different modelling assumptions. To mention just one recent example, Alpanda, Cateau and Meh (2014) find that loan-to-value ratios dominate higher capital standards, which in turn dominate leaning against the wind in their model. It would be good to see similar work in a range of frameworks to illustrate just how robust their result is, and the modelling assumptions that it rests on.

It's important not to overstate the case for macroprudential tools. There are challenges to their use, not least that they may see excesses simply move from the regulated to the unregulated parts of the financial system. And macroprudential policies are often very unpopular politically, and may, in some cases, be beyond the mandate of the central bank. Furthermore, calibrating the necessary policy to achieve a desired response at this point requires some guesswork, although this will decrease with their ongoing use.

Another important factor to keep in mind with the use of macroprudential tools is what they can be used to achieve. Preventing an asset price bubble, or having a first-order effect on asset prices more generally, may be an unrealistic expectation of any such tools available to the central bank. But, suitably deployed, macroprudential tools may have a role to play in ensuring the preservation of the financial system in the event that an asset price bubble bursts.

Conclusion

To conclude, of the three conditions that I argued are necessary and sufficient for the use of leaning against the wind: i) interest rates are likely to be an especially effective tool at influencing financial excess when that excess is greatest, but can have the pernicious effect of driving up financial risks in the near term, given the stock of leveraged assets already in

existence; ii) recent experience suggests that the expected effects of financial excess are very high; and iii) macroprudential tools show promise at increasing financial stability at a lower cost than raising policy rates, although there is a need for more evidence. Looking at the three-legged stool, I find myself reaching a similar conclusion to Dell'Ariccia *et al* (in this volume).

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2. General Discussion

The discussion initially focused on whether the standard cost-benefit frameworks used to assess the merits of 'leaning against the wind' are adequate. One participant noted that the estimated benefits of leaning against the wind could be higher if non-standard measures, such as public debt, were included in the loss function alongside more standard measures, such as unemployment.

Another participant suggested that the binary view of financial crises taken in the cost-benefit analyses may be misleading. Financial imbalances tend to accumulate over time and, once they have built up, it may be too late to address them and, therefore, prevent a crisis. The standard cost-benefit framework ignores this path dependence and so can lead to misleading conclusions. The importance of path dependence was echoed by another participant, who argued that the build-up of debt in the United States before the financial crisis was an example of financial imbalances growing to a point where a crisis was inevitable. Giovanni Dell'Ariccia was sympathetic to these views. However, he argued that our ability to incorporate a more 'continuous' view of crises into the analysis is limited by well-known difficulties in constructing systematic measures of financial imbalances or crisis probabilities

in real time. Moreover, he noted that it could be politically difficult to implement policies to address future potential risks associated with a current build-up of financial imbalances, given that the benefits are far removed and are largely unobserved.

In response, several participants argued that standard cost-benefit exercises are valid and clearly show that the costs of leaning against the wind outweigh the benefits. One participant noted that this reflected the fact that interest rates are a poor instrument for addressing financial stability risks. Moreover, another participant suggested that central banks could be harming the economy by even indicating that they might consider leaning against the wind in the future, as it removes pressure from other public institutions to develop alternative policies to address financial stability.

Another key topic of discussion was whether the discourse around macroprudential tools, as well as the tools themselves, is focused on the correct metrics. One participant suggested that the emphasis on the quantity of lending, rather than the quality, is a shortcoming in the discourse. Another participant argued that discussions too often centre on households and household leverage, and that more consideration needs to be given to other sectors and metrics. In particular, they pointed to the financial crisis as having been caused by dislocations in funding markets. They argued that the introduction of liquidity coverage ratios is likely to have lowered banks' funding risk by forcing them to extend the maturities of their liabilities. However, more importance still needs to be placed on ensuring banks' funding is institutionally and geographically diverse.

There was also a more general discussion of some of the shortcomings of macroprudential tools. Several participants noted that these tools tend to address the symptoms not the underlying incentives. One participant noted that putting caps on leverage within the banking system does not fundamentally change the incentives to borrow. Instead, borrowers are likely to shift to the less heavily regulated non-bank sectors. Picking up on this theme, another participant noted that the use of macroprudential tools tends to be characterised by countries requiring round after round of tightening before finally focusing on the root causes, such as the tax code.

Another shortcoming that was discussed was timeliness. One participant pointed out that monetary policy, while blunt, is able to be implemented more quickly than more targeted regulatory measures. This was echoed by another participant who noted that such regulatory actions are more complex, and generally need to go through lengthy consultations and legislative processes. Nevertheless, they suggested that this concern could be alleviated somewhat by starting the process early, and by shifting to more rules-based approaches that need less consultation.

On the broader topic of the role of central banks in ensuring financial stability, many participants agreed that central banks should take an active role in supporting policies that promote financial stability, even if they don't actively lean against the wind. It was noted that the Reserve Bank has a long history of supporting the Australian Prudential Regulation Authority in both public and private fora and that this has been a contributing factor to Australia's relatively good outcomes in terms of financial stability.

Wrap-up Panel Discussion

The final part of the Conference was a panel discussion focused on the use of monetary and macroprudential policies to address financial stability in a world of low interest rates. The discussion was moderated by John Simon, Head of Economic Research at the Reserve Bank of Australia, and included the following panellists:

- Ricardo Caballero, Professor of Economics at the Massachusetts Institute of Technology

- John McDermott, Assistant Governor and Head of Economics at the Reserve Bank of New Zealand

- Cecilia Skingsley, Deputy Governor of the Sveriges Riksbank.

As the Conference and panel were conducted under the Chatham House Rule, no individuals' comments are attributed.

1. Introduction

The session opened with the moderator reiterating that the questions and issues covered in the conference were live ones that many countries, including Australia, were trying to navigate.

Two panellists then discussed their experiences in implementing macroprudential policies to address financial stability risks. They outlined the economic backdrops and risks that had prompted action, what policies were implemented, the processes for implementing these policies, and whether the policies had effectively addressed the relevant stability risks. The panellists also discussed a number of lessons they had learnt from these experiences.

2. Importance of Institutions

The two case studies highlighted that institutional arrangements play an important role in determining the nature and effectiveness of macroprudential policies. This was a major theme of discussion throughout the session. In one of the two countries, the body with the mandate for macroprudential policies had fairly narrow powers and needed legislation to be passed in order to implement its desired policies. This delayed implementation significantly. In contrast, in the other country the relevant body had much broader powers. This allowed it to implement polices more quickly and easily, without the need for formal legislative approval. Nevertheless, the body still consulted with the government to ensure they had adequate support from other public institutions.

In this context, one panellist noted that Rochelle Edge and Nellie Liang's work on the institutional arrangements around macroprudential policy, presented earlier in the

conference, is important. Institutional arrangements tend to form organically over time based on country-specific factors and history. Thinking properly about what potential structures could be implemented, and what the relative strengths and weaknesses of these structures are, is likely to allow countries to better direct the development process.

Nevertheless, while the panellist agreed that institutional arrangements are important, they argued that other factors, like institutional culture, are also relevant. Regulators, and the financial system more broadly, need to have a culture of trying to serve the greater good, rather than one of self-interest. Referring to an earlier session, the panellist also cited the importance of coordination between public sector institutions. This can take many forms, including the provision of public 'moral' support. Another panellist noted that such public support is particularly crucial in the context of macroprudential policies as these policies involve saying 'no' to people, which will always be unpopular.

3.   Future Research

The third panellist focused their comments on three areas for future research. The first area is networks – the linkages between different agents and institutions in the economy. They noted that understanding networks is crucial for understanding how shocks to individual households or institutions can interact and proliferate, and affect the macroeconomy.

Better understanding networks would also facilitate further research into the use of reverse stress testing. Traditional stress testing examines whether the system can withstand a given set of shocks and so requires the user to calibrate specific scenarios. This could be difficult for countries that have experienced relatively few crises and so have relatively few empirical observations upon which to base scenarios. In contrast, reverse stress testing involves identifying the types and magnitudes of shocks that would be sufficient to cause a crisis. This would allow countries to identify weaknesses in the system that have not previously been exposed or identified in past crises.

The third area for future research is how best to build risk into macroeconomic models. The panellist noted that risk and financial systems tend to be appendices that are added onto existing models, but that in reality they are central to the economy – as exemplified by the global financial crisis. To this end the panellist outlined a stochastic model of the economy with risk on the production side of the economy. They showed that such a model can help to explain the simultaneous occurrence of low levels of economic growth and high asset price growth that has been observed in a number of countries in recent years. Moreover, the model can help to elucidate the potential benefits of macroprudential policy.

A number of participants agreed that more research should be carried out into embedding risk and financial sectors into macroeconomic models, and improving these models more generally. One contended that the most important graph presented at the conference showed real-time estimates of output gaps leading up to the crisis, and compared them with current estimates of what the output gap was at the time. The current estimates show that the US economy was overheating in the lead-up to the financial crisis, whereas the real-time measure did not. They argued that this showed that, with the benefit of hindsight,

monetary policy should have been set very differently. Another participant suggested that more research is needed to improve the measurement of risk and our understanding of when and why the economy 'switches' to periods of high risk and volatility.

Panellists and participants also noted a number of areas for research related to the effectiveness of macroprudential tools. These included: how and whether macroprudential policies make balance sheets more resilient; whether macroprudential policies are more or less effective when interest rates are low; and how macroprudential tools interact with monetary policy. One panellist also suggested that further research is needed on the interaction between new liquidity regulations and monetary policy.

4. Difficulties Associated with Macroprudential Policies

When asked about their key takeaways from the conference, two panellists cited the difficulties in implementing and assessing the effectiveness of macroprudential policies. One suggested that some of these difficulties reflected the nature of macroprudential policies. Unlike monetary policy, where the central bank plays a coordinating role in ensuring mutually beneficial price stability, macroprudential policies are aimed at constraining people's behaviour. Still, the panellist argued that policies could potentially become more effective as policymakers became more 'credible', citing parallels to the anchoring of inflation expectations in an inflation-targeting regime.

Picking up on the theme of difficulties in constraining people's behaviour, a number of panellists and participants contended that macroprudential policies could cause riskier borrowing to shift to less heavily regulated parts of the financial system, and to the creation of 'grey markets'. While conceding the point, one panellist argued that a way to avoid this regulatory leakage was to indicate that the policies are temporary. This would limit the incentives for people to invest in creating these markets. Moreover, coordinating behaviour between banks can help ensure a cooperative equilibrium.

Another participant argued that more fundamentally, while macroprudential polices can be used to treat the symptoms, it is crucial to deal with the root causes: distortionary policies that create misaligned incentives. This sentiment was echoed by a number of other participants. In particular, one noted that they were sceptical of using macroprudential policies to control risk-taking behaviour, as individuals are better judges of what risks they can manage. Rather, the issue is a lack of adequate information, and policies should be aimed at addressing information asymmetries through better product disclosure rules. Others were less convinced by this, noting that even with better disclosure it is difficult for individuals to know the future and that they tend to use simple heuristics in making decisions. Moreover, there are numerous agency issues and externalities that would be difficult to address using disclosure rules.

The moderator asked the panellists whether the difficulties and uncertainties associated with macroprudential polices are of sufficient concern that policymakers should eschew macroprudential tools. All three agreed that this was not the case. One suggested that policymakers can't wait to gather more evidence, but need to act. However, they need to do this carefully and test different tools as they do. This was seconded by another panellist,

who suggested that the only way to learn about these policies was to use them. If they fail, at least we will have learnt something. The third panellist echoed the others, noting that it was probably safer to overdo the policy response, rather than to underdo the response. Nevertheless, one of the panellists suggested that the difficulties probably mean that monetary policy will remain the first line of defence against financial stability risks.

5.   The Role of Monetary Policy in Financial Stability

In contrast, the other two panellists argued that macroprudential policies should be the first line of defence against financial stability risks, though there may be a secondary role for monetary policy.

One panellist argued that there was some scope to use monetary policy as a secondary tool when doing so does not conflict with a central bank's key role of achieving low and stable inflation. To this end, a central bank should only consider 'leaning against the wind' when inflation is near target and inflation expectations are well anchored. Carrying on this discussion, a number of participants pointed out that there is not always a trade-off between ensuring financial stability and maintaining price stability. They suggested that one of the biggest risks to financial stability is unemployment, and that lowering interest rates can simultaneously lower unemployment and raise inflation back towards target.

The other panellist noted that the significant degree of interaction between macroprudential and monetary policies meant that they both need to be set with the other in mind. For example, macroprudential policies affect the allocation of credit in the economy and so could affect the pass-through of monetary policy just as the level of interest rates affects risk-taking. This line of discussion was picked up by the participants. One argued that macroprudential policies are essentially trying to constrain the interest-sensitive sectors of the economy, which will necessarily make monetary policy less effective. Instead, if policymakers are worried about financial stability risks it may be better to use fiscal policy to stimulate the economy, as fiscally sensitive sectors are likely to be different to interest-sensitive sectors.

The interactions between the policies were also discussed more broadly. Participants noted that, if financial imbalances are supporting the economy, implementing macroprudential polices aimed at reducing these imbalances may lead to an economic slowdown and the need for more stimulus. At the same time, lowering interest rates could encourage more risk-taking and therefore essentially offset any financial stability gains stemming from macroprudential policy.

6.   The Role of Macroprudential Policy in Financial Stability

There was also a discussion of the role of macroprudential tools and, in particular, whether they should be seen as cyclical or structural tools. In general, panellists and participants were sceptical about using macroprudential tools in a countercyclical manner. One panellist stated that, while they found the idea appealing, they believed that policymakers do not have a sufficient understanding of the business and financial cycles to do so. As such, the focus needs to be on making the system more resilient.

Echoing this, one participant argued that they find it hard to imagine that any of the supposedly cyclical tools that have been employed around the world will actually be removed. In this sense, the polices just become 'good regulations', which contribute to banking system resilience by helping to ensure that appropriate lending standards are employed throughout the boom and bust. While broadly agreeing, another participant noted that, as yet, we do not have a clear understanding of if and how these tools actually contribute to structural resilience.

The importance of avoiding Ponzi schemes was also discussed in the context of ensuring financial system resilience. A number of participants noted that Ponzi schemes and predatory lending activities are generally associated with particularly severe economic and financial crises. Policies aimed at preventing such activities could therefore play an important role in ensuring financial system resilience. To this end, consumer protection regulations could help to promote financial stability.

There was also a broader discussion of the role and purpose of macroprudential policies. One participant commented that they found it surprising that macroprudential policies generally focused on setting limits and quotas on the quantity of lending, rather than changing the price of lending more directly. Another remarked that most of the discussion had centred on using macroprudential tools to ensure that the banking system is resilient, but that the resiliency of households' and businesses' balance sheets is also important. Building on this, the moderator noted that one of the crucial questions is what risks are we really worried about, and that it is difficult to design policies without knowing what they are intended to address.

Biographies of Contributors

Claudio Borio

Claudio Borio was appointed Head of the Monetary and Economic Department (MED), Bank for International Settlements (BIS) on 18 November 2013.

Since joining the BIS in 1987, Claudio has held various positions in the MED, including Deputy Head and Director of Research and Statistics, as well as Head of Secretariat for the Committee on the Global Financial System and the Gold and Foreign Exchange Committee (now the Markets Committee). From 1985 to 1987, he was an Economist at the OECD, working in the Country Studies Branch of the Economics and Statistics Department. Prior to that, he was Lecturer and Research Fellow at Brasenose College, Oxford University.

Claudio holds a DPhil and an MPhil in Economics and a BA in Politics, Philosophy and Economics from Oxford University. He is the author of numerous publications in the fields of monetary policy, banking, finance and issues related to financial stability.

Ricardo J Caballero

Ricardo J Caballero is the Ford International Professor of Economics, a director of the World Economic Laboratory at the Massachusetts Institute of Technology (MIT) and an NBER Research Associate. He was the Chairman of MIT's Economics Department (2008–11) and has been a visiting scholar and consultant at most major central banks and international financial institutions.

His teaching and research fields are macroeconomics, international economics and finance. His current research looks at global capital markets, speculative episodes and financial bubbles, systemic crises prevention mechanisms, and dynamic restructuring. His policy work focuses on aggregate risk management and insurance arrangements for emerging markets and developed economies. He has also written about aggregate consumption and investment, exchange rates, externalities, growth, price rigidity, dynamic aggregation, networks and complexity.

Ricardo has a very extensive list of publications in major academic journals and has served on the editorial board of several journals. He was the winner of the 2002 Frisch Medal of the Econometric Society for 'Explaining Investment Dynamics in U.S. Manufacturing: A Generalized (*S*,*s*) Approach' (*Econometrica*, July 1999; with Eduardo Engel). Other major awards include both the American Finance Association's Smith Breeden Prize and the Emerald Management Review Citation of Excellence Award for 'Collective Risk Management in a Flight to Quality Episode' (*The Journal of Finance*, October 2008; with Arvind Krishnamurthy) and the

2014 Brattle Group Prize in Corporate Finance for 'Fire Sales in a Model of Complexity' (*The Journal of Finance*, December 2013; with Alp Simsek).

In April 1988, he attained a PhD (Economics) from MIT. The same year, he was elected a Fellow of the Econometric Society and, in April 2010, a Fellow of the American Academy of Arts and Sciences.

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Adam Cagliarini is Senior Representative, China Office at the Reserve Bank of Australia (RBA), having previously been Deputy Head of the Economic Research Department. He completed a BSc (Hons)/Bcomm (Hons) at the University of Melbourne before starting as a graduate at the RBA. He completed a PhD in Economics at Stanford in 2008 and has worked in the RBA's Economic Group and Financial Markets Group. He recently spent a year as a Principal Advisor on the Secretariat of the Financial System Inquiry, which was chaired by David Murray. His research has involved examining decision-making under uncertainty, macroeconomic modelling, the interaction of fiscal and monetary policy and he has developed techniques to solve rational expectations models.

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Giovanni Dell'Ariccia is Deputy Director of the Research Department, International Monetary Fund (IMF), where he supervises the activities of the Macro-Financial Division. Previously he worked in the IMF's Asia and Pacific Department. His research interests include banking, the macroeconomics of credit, monetary policy, international finance and conditionality in international lending and aid programs.

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Rochelle Edge is an Associate Director in the Division of Financial Stability at the Federal Reserve Board (FRB) in Washington, DC. In the Division, she has led teams to design the macroeconomic scenarios used in the supervisory Comprehensive Capital Adequacy and Review (CCAR) and Dodd-Frank stress tests; to operationalise the Basel III countercyclical capital buffer in the United States; and to analyse interest rate risk at banks. She currently represents the FRB on the Financial Stability Board's Analytic Group on Vulnerabilities and she has represented the FRB on several working groups for the Committee on the Global Financial System, including a group that is currently studying the financial stability implications of a prolonged period of low interest rates. Prior to joining the FRB's Division of Financial Stability in 2010, she held various positions in the Division of Research and Statistics and the Division of International Finance and from 1993 to 1995 she was an economist at the Australian Treasury.

Her current research interests are in the areas of financial stability, banking, and macroeconomics and her papers have been published in the *Journal of Monetary Economics*, *The Review of Economics and Statistics*, *Review of Economic Dynamics*, *Journal of Economic Dynamics & Control*, *Journal of Applied Econometrics*, and *Brookings Papers on Economic Activity*.

Rochelle received her undergraduate degree from the Australian National University in 1992 and her PhD from Princeton University in 2000, both in Economics.

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Luci Ellis is the Assistant Governor (Economic) at the Reserve Bank of Australia, a position she has held since December 2016. She is responsible for the Bank's Economic Analysis and Economic Research Departments and is the chief economic advisor to the Governor and the Board. She also chairs the Bank committee responsible for its data strategy and is the executive sponsor of the Bank's Business Analysts Community, its Mathematica Users Community and its LGBTI+ allies employee resource group. Luci has been a member of the Australian Statistics Advisory Council since November 2015.

Prior to holding this role, Luci was Head of Financial Stability Department for eight years. She has also served as a Deputy Head of Economic Analysis Department and spent almost two years on secondment at the Bank for International Settlements.

Luci holds a PhD from the University of New South Wales, a Masters in Economics degree from the Australian National University and a first-class Bachelor of Commerce (Honours) degree from the University of Melbourne.

Karl Habermeier

Karl Habermeier is Assistant Director in the Monetary and Capital Markets Department of the International Monetary Fund (IMF) and has been responsible for the department's work on monetary and exchange rate policy since 2006. His work has focused on capital flow management (including the development of the IMF's Institutional View in 2012), unconventional monetary policies, and macroprudential policies. He has also led Financial

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Boris Hofmann is a Principal Economist in the Monetary and Economic Department of the Bank for International Settlements (BIS). He joined the BIS in February 2011. Before that he worked at the Centre for European Integration Studies of the University of Bonn (1999–2003), the Economics Department of the Deutsche Bundesbank (2003–06) and the Economics Department of the European Central Bank (2006–11). During his career he has published extensively on topical issues in monetary economics, including in leading academic journals such as the *Journal of Monetary Economics*, the *Journal of Money, Credit and Banking* and the *European Economic Review*.

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Nellie Liang

Nellie Liang was director of the Division of Financial Stability of the Federal Reserve Board before her retirement in late 2016 after 30 years of service to the Board, including 6 years as director. In February 2017 she joined the Brookings Institution as the Miriam K Carliner Senior Fellow in Economic Studies.

Dr Liang began her career at the Board in 1986 when she joined the Division of Research and Statistics as an Economist. In 2010, she was appointed Director of the newly created Office of Financial Stability Policy and Research, which became the Division of Financial Stability in 2016. During her tenure as Director, Nellie led the division's efforts to systematically assess risks to financial stability and to develop macroprudential policy responses to mitigate those risks. Nellie was a key participant in crafting the Federal Reserve's response to the financial crisis and, in 2009, helped lead the Supervisory Capital Assessment Program, or bank stress tests, which helped increase public confidence in the banking system.

According to Board Chair, Janet Yellen, Nellie's perceptive leadership and thoughtful analyses contributed to the advancement of the Federal Reserve's efforts to rigorously assess financial stability risks and incorporate them into the development of both monetary and supervisory policy. Dr Yellen also expressed her appreciation for Nellie's service and wise counsel, especially during the financial crisis and, in the years afterward, when she was the founding Director of the Board's Division of Financial Stability.

Dr Liang's recent research has focused on financial sector conditions and macroeconomic dynamics, fragilities in short-term funding markets, effect of creditor rights on real economic activity, and the cost of equity capital for banks. Her research has been published in *The Journal of Finance*, *Journal of Financial Economics*, *Journal of Financial and Quantitative Analysis*, and *Journal of Public Economics*, among other places.

She has an undergraduate degree in Economics from the University of Notre Dame and a PhD in Economics from the University of Maryland.

Charles Littrell

At the time of writing, Charles Littrell was the Executive General Manager, Supervisory Support Division at the Australian Prudential Regulation Authority (APRA). Mr Littrell is now Inspector of Banks and Trust Companies at the Central Bank of The Bahamas. Prior to joining APRA in 2002, Mr Littrell spent 20 years in the banking industry, mainly at Westpac. While at Wsestpac, Mr Littrell was at various times responsible for Group Strategy, the Australian Retail Deposits business, and the group's Capital Management.

Mr Littrell has been a member of the Australian Council of Financial Regulators and a member of the Basel Committee on Bank Supervision.

Mr Littrell's qualifications include a Bachelor of Arts (Economics) degree from Yale University and a Master of Economics (First Class Honours) from the University of Sydney. He has also completed the Executive Fellows Program at the Australia and New Zealand School of Government.

Tommaso Mancini-Griffoli

Tommaso Mancini-Griffoli is a Deputy Division Chief in the Monetary and Capital Markets Department at the International Monetary Fund (IMF), in charge of work in monetary policy. He has advised country authorities and published widely on issues related to unconventional monetary policies, monetary policy spillovers, exchange rate regimes, and evolving monetary policy frameworks. Prior to joining the IMF, Dr Mancini-Griffoli was a senior economist in the Research and Monetary Policy Division of the Swiss National Bank, where he advised the Board on quarterly monetary policy decisions. Dr Mancini-Griffoli spent prior years in the private sector, at Goldman Sachs, the Boston Consulting Group, and technology start-ups in the Silicon Valley.

Dr Mancini-Griffoli holds a PhD from the Graduate Institute in Geneva.

John McDermott

John McDermott is the Assistant Governor and Head of Economics at the Reserve Bank of New Zealand. He is responsible for advising the Governor on the economic outlook and the management of monetary policy. His current research interests include business cycles and commodity prices.

John has held posts at Victoria University of Wellington, the National Bank of New Zealand and the International Monetary Fund, where he was also a visiting scholar, and taught at the World Bank Institute.

He gained a BSc and MCom from the University of Auckland and a PhD in Economics from Yale University.

Patricia C Mosser

Patricia Mosser is a Senior Research Scholar and Senior Fellow at Columbia University's School of International and Public Affairs (SIPA) and the Founding Director of a new SIPA initiative on central banking, monetary policy and prudential oversight. Previously, Patricia was Deputy Director and Head of Research and Analysis for the Office of Financial Research at the US Department of Treasury.

Patricia spent over 20 years at the Federal Reserve Bank of New York, including as a Senior Manager in the Markets Group, responsible for financial market analysis, monetary policy implementation, foreign exchange operations and analysis of financial stability and financial reform issues post crisis. She was also an economist in the New York Fed Research Department, managing both the Macroeconomics and Capital Markets research areas, and she was an Assistant Professor in the Economics Department at Columbia. She has written extensively on monetary policy and financial stability topics including financial crisis policy tools, financial structure and the monetary policy transmission mechanism, financial reform post crisis and housing finance reform.

She is a member of the Bank of England's Macro Prudential Advisory Committee and has served as a member of the Deputies Committee of the Financial Stability Oversight Council. She is on the Board of the American Economic Association's Committee on the Status of Women in the Economics Profession and on numerous international central banking and financial policy committees.

She holds a PhD in Economics from Massachusetts Institute of Technology, and MSc (Distinction) from the London School of Economics and a BA (Mathematics and Economics) from Wellesley College, Massachusetts.

Bruce Preston

Bruce Preston, Professor of Economics, University Of Melbourne, is one of Australia's most outstanding macroeconomists. He held the Richard Snape Chair in Business and Economics at Monash University; is an Australian Research Council Future Fellow; Senior Research Adviser to the Reserve Bank of Australia and former faculty member at Columbia University.

His main interests concern monetary policy and the formation of expectations. A specific focus of his research explores empirical evidence supporting different theories of belief formation and also how 'near-rational expectations' potentially constrain what can be achieved by macroeconomic policy.

His recent work has been published in prestigious journals such as *The American Economic Review*, *Journal of Monetary Economics*, the *Journal of International Economics*, the *Journal of the European Economics Association*, and the *Journal of Econometrics*.

Bruce holds a PhD in Economics from Princeton University.

Fiona Price

Fiona Price is a Research Economist at the Reserve Bank of Australia, focusing on using micro data to analyse household behaviour and financial stability. Fiona's expertise is in the realm of Stata, household-level datasets and panel data econometrics. She has been involved in a number of collaborative publications – four RBA *Bulletin* articles and a Research Discussion Paper on 'Household Saving in Australia'.

She holds a Bachelor of Economics (Honours) from University of New South Wales.

John Simon

John Simon is Head of Economic Research Department at the Reserve Bank of Australia. Before this he undertook a three-year secondment to the International Monetary Fund, where he worked on the *World Economic Outlook*. He was previously the Chief Manager in the Payments Policy Department of the Reserve Bank. He has published numerous articles on macroeconomics, including on the 'Great Moderation', monetary policy and payments policy.

John holds a Bachelor of Economics (Hons) and a Bachelor of Science from the Australian National University and a PhD from the Massachusetts Institute of Technology.

Cecilia Skingsley

Cecilia Skingsley took up the post of Deputy Governor of the Sveriges Riksbank on 22 May 2013 with a term of office of six years. Her assignments include the Committee on the Global Financial Systems at the Bank of International Settlements. Cecilia was previously Chief Economist and Head of Foreign Exchange and Fixed Income Research at Swedbank. From 2000–07 she was a financial journalist at *Dagens Industri*, Sweden's daily business paper.

She has a Bachelor of Arts in Economics and Political Science from the University of Stockholm and a Financial Analyst Degree (CEFA), Stockholm School of Economics.

James Yetman

James Yetman is Principal Economist in the Monetary and Economic Department, based at the Bank for International Settlements (BIS) Representative Office for Asia and the Pacific in Hong Kong SAR. He joined the BIS in May 2008. He conducts research of relevance to central banks in the region.

Previous posts include Assistant Professor in the School of Economics and Finance at the University of Hong Kong (2001–08) and Research Economist for the Bank of Canada (1998–2001). He has also spent shorter periods visiting the European Central Bank, the Reserve Bank of New Zealand and the Hong Kong Monetary Authority.

After attaining a BSc (Hons) Economics from the University of Canterbury (NZ) and an MA Economics from the University of British Columbia, he completed his PhD Economics at Queen's University in Canada.

James's main fields of interest are econometrics, macroeconomics and monetary economics, and international economics.

Mark Zelmer

Mark Zelmer has more than 30 years experience dealing with financial sector policy and regulatory issues, having worked for the Office of the Superintendent of Financial Institutions, Canada (OSFI); the Bank of Canada; and the International Monetary Fund (IMF). He served first as an Assistant Superintendent and then as Deputy Superintendent of Financial Institutions at OSFI from December 2011 until June 2016. Prior to that, he spent more than 20 years with the Bank of Canada serving in progressively more senior positions, including as the first leader of its Financial Stability Department from September 2008 until November 2011. He also spent almost four years with the IMF from January 2000 until November 2003, where he served first as Senior Economist and then as Deputy Division Chief in what is now its Monetary and Capital Markets Department.

Mark also has been an active contributor to the global regulatory reform agenda in the wake of the financial crisis. As a member of the Basel Committee on Banking Supervision from September 2008 through June 2016, he chaired the development of several components of the Basel III framework and led a peer review assessment of the European Union's adoption

of Basel III capital requirements. He also served on the Financial Stability Board's Standing Committee on Supervisory and Regulatory Co-operation from July 2014 to June 2016 and co-chaired its work on structural vulnerabilities associated with the global asset management industry.

Mark holds a Master of Science (Business Administration) degree from the University of British Columbia and a Bachelor of Commerce (Honours) degree from Queen's University. He is a Senior Fellow at the C.D. Howe Institute.

List of Conference Participants

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Guy Debelle	Reserve Bank of Australia
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Alexandra Heath	Reserve Bank of Australia
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Ryo Kato	Bank of Japan
Christopher Kent	Reserve Bank of Australia
Michael Kouparitsas	The Australian Treasury
Gianni La Cava	Reserve Bank of Australia
Lucius Laeven	European Central Bank
Nellie Liang	Brookings Institution
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Daniel Rees	Reserve Bank of Australia
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Chris Ryan	Reserve Bank of Australia
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Acknowledgement

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