

Monetary Policy and Financial Stability

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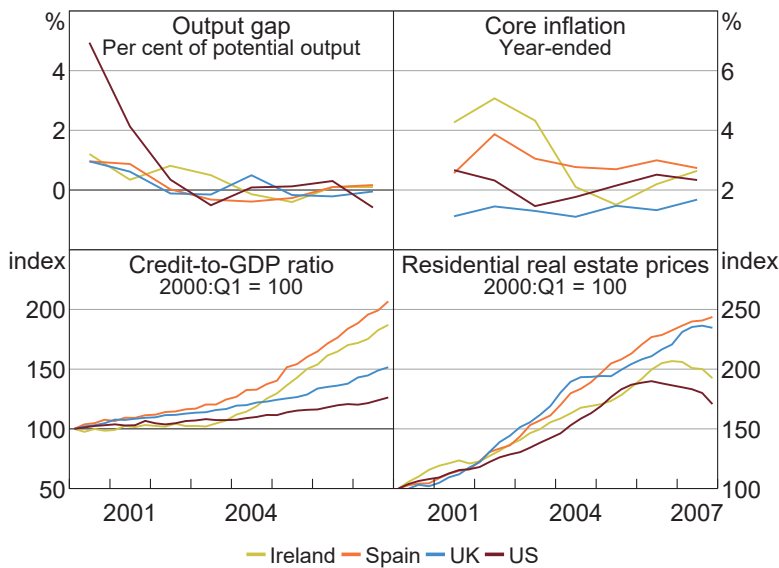
1 See Bernanke and Gertler (1999), as presented at the Federal Reserve Bank of Kansas City Economic Policy Symposium at Jackson Hole.

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

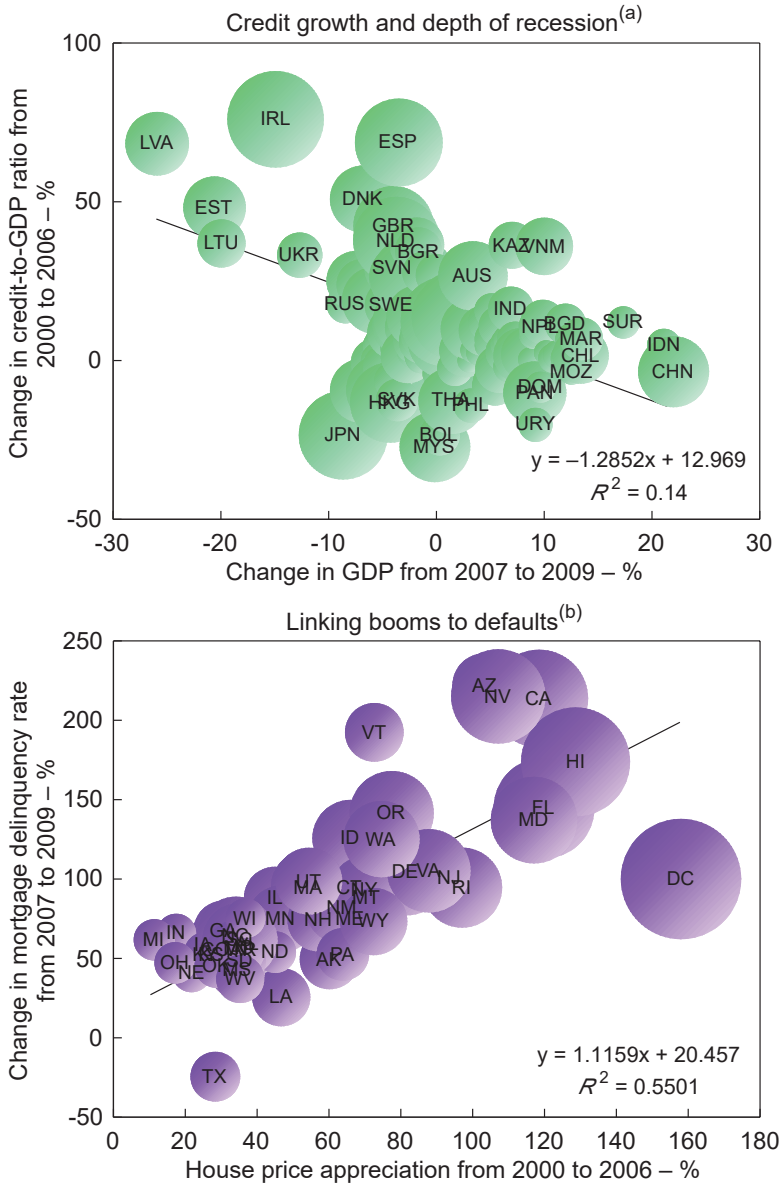


Note: September 2007 vintage used for the output gap
Sources: Haver Analytics; IMF World Economic Outlook database

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

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 pursuing 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.

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

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, Gali 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.

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

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.

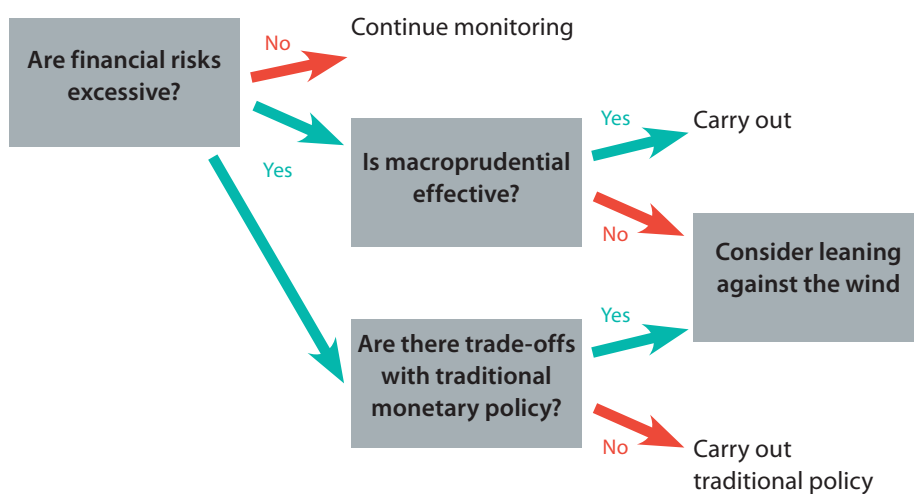
12 See the IMF's *Global Financial Stability Report* (GFSR) of October 2014 and April 2015 (IMF 2014a, 2015a).

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

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).

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,

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; Tresselt 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:

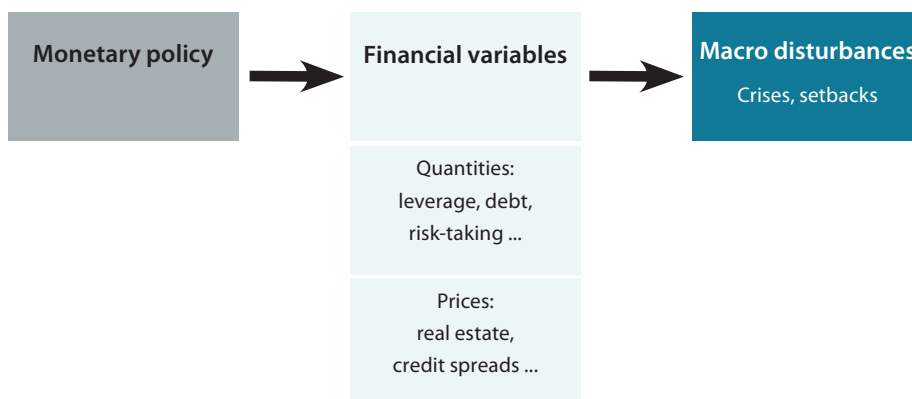
- First, the transmission channels need to be described. This involves estimating the links between policy interest rates and financial risks.
- Second, one needs to establish the nature and size of the trade-off between stabilising inflation and financial risks. As discussed above, if there is no trade-off, 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.

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



Source: IMF

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

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

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 investigate 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

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.

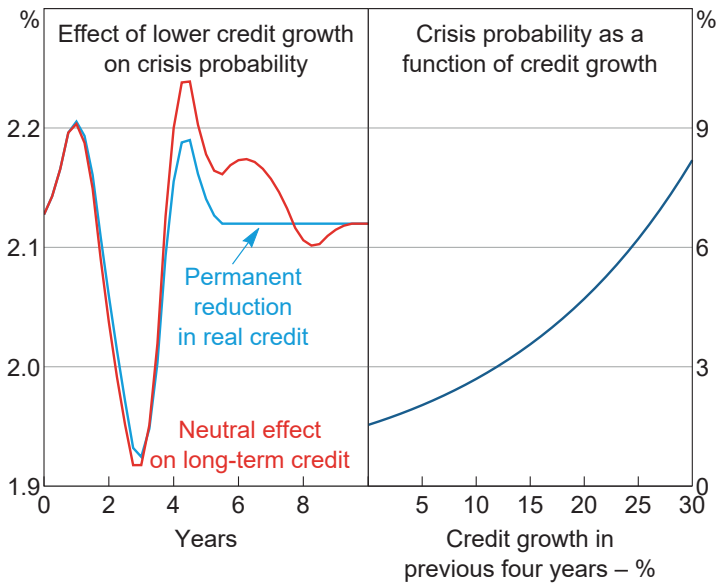
28 If a crisis might involve unemployment that is higher by 5 percentage points for 3–4 years, the corresponding numbers for a setback might be 1–2 percentage points for 1–2 years.

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

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

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.

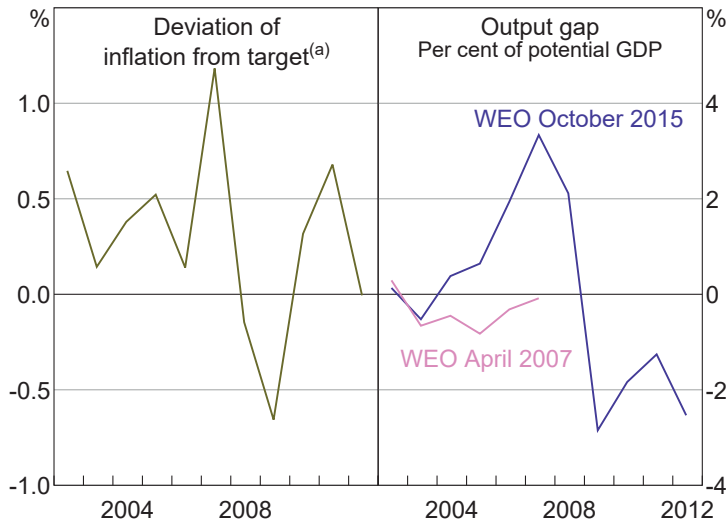
rates is large for price stability purposes (at least in AEs in tranquil times) – central banks rarely lift rates by more than 25 or 50 basis points at most on any given announcement date (though on a cumulative basis the US Federal Reserve, for instance, raised rates by about 200 basis points per year 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.

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).

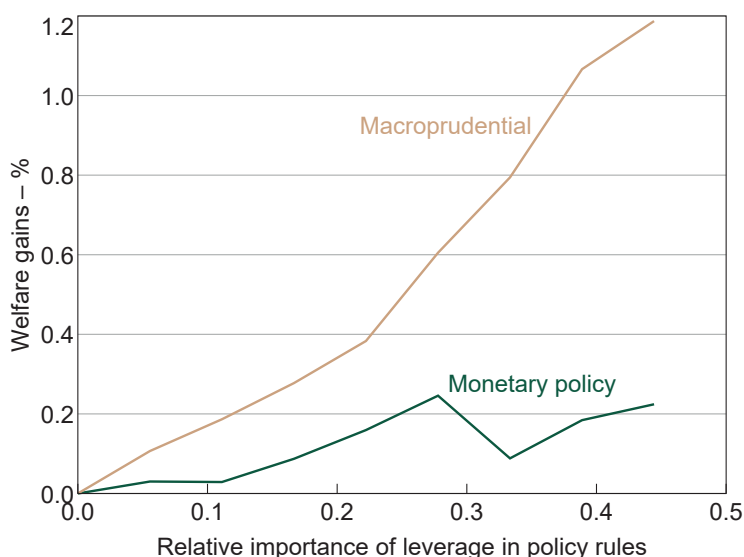
Indeed, a new class of models suggests that leaning against the wind, absent other tools, can be welfare improving. These models take into account some financial distortions, as well as heterogeneous agents.³⁷ However, these models do not as yet generate crises of major proportions as considered in this 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

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

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).

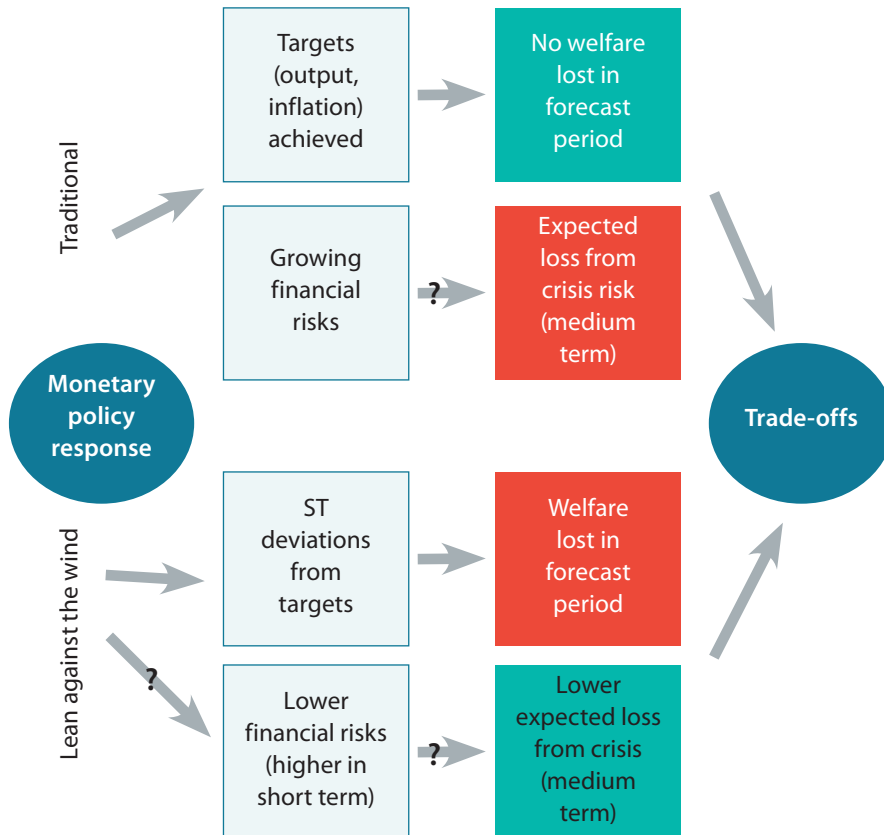
While useful for informing policy intuition, the new models remain very stylised and more work is needed. They have not yet fully captured the foundations of financial distortions and the specific dynamics of risk-taking behaviour. It is not clear how much monetary policy can affect the root cause of 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

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

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

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

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

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,

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

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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