

# Monetary, prudential and fiscal policy: how much coordination is needed?

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## I. Introduction

Since New Zealand's path-breaking regime change nearly three decades ago, jurisdictions representing roughly two-thirds of world GDP have turned to inflation targeting in one form or another. And, as a consequence, global inflation has fallen.<sup>1</sup> In fact, a quick look at the dispersion of inflation across the world shows that in recent decades it has been lower than it was during the Bretton Woods fixed-exchange-rate era. That is, when a country's government gives the central bank a price stability mandate, its society gets low, stable inflation.<sup>2</sup>

Financial stability is something else. Laeven and Valencia (2012) list roughly 100 episodes of banking crises – defined as episodes of either “significant bank runs, losses in the banking system, and/or bank liquidations” or “significant banking policy intervention measures in response to significant losses in the banking system” – since 1990. This propensity toward instability is exemplified by the global financial crisis of 2007-09 and the euro-area crisis that is arguably still in progress.

It would be unfair to accuse central banks of indifference toward financial stability. In fact, quite the opposite. Even when financial stability is not explicitly a part of their mandate, central bankers treat it as if it were. The ultimate goal of macroeconomic policies – monetary, prudential and fiscal – is to provide the foundation for strong, sustainable and balanced growth, and high employment. Financial stability is a precondition for this. Efforts to reduce the amplitude of business cycles and the variability of inflation are of little relevance in the presence of financial booms and busts that are both frequent and intense.

The undeniable dependence of low, stable inflation and high, stable growth on the health of the financial system has brought into question the pre-crisis consensus concerning the division of labour among the different policy authorities. By the mid-1990s, it was agreed that prudential authorities would use capital and liquidity regulation to reduce the likelihood that individual institutions would fail; to limit contagion from such failures; to ensure continuous financial market function; and to counter the moral hazard arising from retail deposit insurance and implicit government guarantees. It was also agreed that fiscal policymakers, by setting taxes and expenditures, would focus on promoting growth and employment while addressing social preferences about the distribution of income. And, through straightforward countercyclical taxes and spending, automatic stabilizers would reduce the severity of business cycles. Finally, it was agreed that, through the judicious use of the central bank's balance sheet, and adjustment of short-term interest rates and the exchange rate, monetary policy would serve as the short-term, flexible tool for maintaining price stability and low unemployment.

The differences in time horizon – prudential policy, timeless; fiscal policy, long-term; and monetary policy, short-term – reduced the need for any one authority to be concerned about the objectives or actions of the other two. And, importantly, empirical models allowed officials to predict the response of target variables to changes in their instruments.

The global financial crisis made apparent the deficiencies in this consensus. Today, we are aware of a raft of overlaps and conflicts among the goals and tools of the various policy authorities. To give just a few examples: monetary policy influences fiscal policy through the management of the central bank's balance sheet; fiscal policy influences monetary and prudential policies through debt managers' financing choices;

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<sup>1</sup> Ciccarelli and Mojon (2010) document the dramatic drop.

<sup>2</sup> See Cecchetti and Schoenholtz (2014, 2015)

monetary policy influences prudential policy through choices about balance sheet size and composition; and prudential policy influences fiscal policy through its treatment of sovereign debt.

The existence of these overlaps lead to me to ask three overarching questions:

- 1) What is the role of monetary policy in ensuring financial stability?
- 2) What is the role of prudential policy in macroeconomic stabilization?
- 3) How important is monetary and fiscal policy coordination?

Each of these questions has both a secular and a cyclical component. That is, we need to consider both the structure of the policy framework itself and the efficacy of time-varying, discretionary actions.

In the case of monetary policy, we can ask if the nature of the targeting regime has an impact on the propensity for systemic risk to rise or fall. There are two related issues. First, does price-level targeting provide a more solid foundation for financial stability than inflation targeting? And second, what is the appropriate level for the inflation target itself? As for discretionary monetary policy, there is concern about the influence of interest rates on financial stability. What is the impact of monetary policy on the balance sheets of financial intermediaries, non-financial firms and households? Should central bankers do anything beyond their accepted role as the lender of last resort?

Turning to the prudential authority, again it is useful to divide the analysis into its structural and time-varying aspects. On the first, there are questions about the size of capital and liquidity buffers. On the second, we can ask to what degree prudential policy can and should respond to changing economic and financial conditions, aiming for low, stable inflation and high, stable growth.

As for fiscal policy, there have been renewed calls for coordination with monetary policy. Is there a case for discretionary fiscal policy to play a role in stabilizing the real economy? And how should we think about the fact that the structure of the consolidated balance sheet of the government is influenced by actions of both the central bank and the debt manager?

In what follows I will examine each of these issues, starting with monetary policy, then turning to prudential policy, and finally to fiscal policy. My conclusion is that the pre-crisis consensus largely holds. Each policy authority continues to have a distinct job. Monetary policy tools are ill-suited to manage financial stability risks, so central bankers should retain their focus on price stability. Prudential policymakers have the tools that are particularly ill-suited for stabilization. They should retain their focus on financial stability, except in the most extreme circumstances. Similarly, in almost all instances, fiscal policy should retain traditional focus on providing public goods and social insurance. But there are exceptions. Should prudential authorities falter, and despite their best intentions the financial system come under stress, monetary policymakers could be forced to use the tools at hand to address financial stability concerns. And, should monetary policy exhaust its stimulative capacity, fiscal policy may need to lend a hand.

To frame what is to come, I begin with a discussion of policy objectives. What is it that authorities should be trying to do? Section III follows with a detailed discussion of monetary policy objectives, tools and transmission mechanisms. Section IV covers prudential policy, first microprudential and then macroprudential. Section V contains a brief discussion of fiscal policy, with a focus on its relationship to monetary policy. The final section concludes.

## II. The stability objectives

The ultimate objective of any government policy intervention is to improve social welfare. This has three basic elements: the level, variability and distribution of consumption. While distributional issues are obviously important for the health and well-being of a society, they are not the primary objectives of monetary and prudential policy. With this in mind, I focus on long-run growth and the amplitude of cyclical fluctuations. And here, the objective of policy is clear: high, stable growth.<sup>3</sup>

Starting with monetary policy, since a central bank acts on nominal quantities – nominal interest rates, the nominal size and composition of its assets and liabilities – its ability to influence the real economy relies on the sluggish adjustment of prices. That is, if nominal prices could change costlessly, then the economy would be at its classical, full-employment equilibrium. But in reality, prices are sticky, so changes in nominal interest rates translate into changes in real interest rates. This in turn changes lending, nominal and real. The fact that changing prices is costly means that inflation reduces welfare. This is true both because of the direct costs of adjusting prices themselves ('menu costs') and as a result of the misallocation of resources that are the result of the fact that prices are generally not being at their 'correct' levels. This logic leads to the conclusion that the objective of monetary policy should be to stabilize inflation at a low level.<sup>4</sup>

Inflation targeting regimes are the modern central bank's implementation of this construct. While their primary focus is on price stability, the rationale behind this is that low, stable inflation provides the foundation for high, stable growth. To emphasize the point, inflation targeting central banks are deeply concerned with the volatility of growth and employment, even in the short run. As we know, central banks face an inflation-output volatility trade-off – the higher the variability of one, the lower the variability of the other.<sup>5</sup> And, we also know that the more a central bank cares about the variability of growth, the more slowly it will generally push inflation back to its target level following deviation.<sup>6</sup>

The existence of price statistics, national income accounts, and employment data make it straightforward to operationalize this macroeconomic stability objective. In advanced economies, consumer price indices, gross domestic product measures, and unemployment rates are well understood by the general population. This means that democratically elected officials can assign numerical targets to central bank authorities, and then hold them accountable for meeting them.

Financial stability policy contributes to ensuring growth is high and stable by keeping the financial system operating through thick and thin. Finance is at the core of market-based capitalist economies. Without financial systems, countries are poor and remain poor. When they can borrow and save, individuals can consume even without current income. With debt, businesses can invest when their sales would otherwise not allow it. And, when they are able to borrow, fiscal authorities can spend more than they receive in tax revenue, stabilizing rather than destabilizing aggregate demand.

But, for several reasons, we should think of finance as a double-edged sword. First, while a major purpose of financial intermediation is to channel resources to their most productive uses, the system

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<sup>3</sup> As the seminal work of Ramey and Ramey (1995) shows, these are related as less volatile growth tends to be higher.

<sup>4</sup> Woodford (2002) has worked out the details.

<sup>5</sup> See Taylor (1979) for the original derivation of the tradeoff.

<sup>6</sup> See Svensson (1999 b).

itself can grow too large and become a drag on growth. One measure of size is the level of household and non-financial corporate debt. The evidence suggests that as these approach and then exceed 100 percent of GDP, growth slows.<sup>7</sup> Second, when debt is used imprudently and in excess, the result can be a disaster. For individual households and firms, over-borrowing leads to bankruptcy and financial ruin. As debt rises, borrowers' ability to repay becomes progressively more sensitive to drops in income and sales as well as increases in interest rates. For a given shock, the higher debt, the higher is the probability of defaulting. Even for a mild shock, highly indebted borrowers may suddenly no longer be regarded as creditworthy. And when lenders stop lending, consumption and investment fall. If the downturn is bad enough, defaults, deficient demand and high unemployment are the grim result. The higher the level of debt, the bigger the drop in consumption and investment for a given negative shock to the economy. And the bigger the drop in aggregate activity, the higher the probability that borrowers will not be able to make payments on their non-state-contingent debt. In other words, higher nominal debt levels raise real volatility, increase financial fragility and reduce average growth.

While the ultimate objective of financial stability is not in question, the attempt to build an operation framework to deliver it often meets with comments along the lines of "while we know what financial instability looks like but, we don't really know how to define or measure it." This attitude leaves authorities either relying on mopping up after a collapse – a strategy that has been tried repeatedly and abjectly failed in virtually every instance – or chasing after each and every potential vulnerability or bout of exuberance in markets just in case they pose a risk to stability.

Following Cecchetti and Tucker (2016), I take the core of a regime for stability should be a standard for resilience. That is, the financial system as a whole should be 'sufficiently' resilient to ensure that the core services of payments, credit supply, and risk transfer and pooling can be sustained in the face of large shocks.<sup>8</sup>

Since economic and financial policy is about numbers – how much to raise or lower interest rates, capital requirements and the like – making a resilience standard operational requires observable metrics. The lack of obvious empirical measures, the fact that there is nothing that plays the role of the consumer price index in an inflation targeting framework, makes this a challenge.

While we can say that the objective is to minimise the probability and severity of crisis, what we need is a continuous quantity representing the likelihood of systemic collapse. Evidence, summarized in Box 1, suggests that financial crises are preceded by large build-ups in debt levels both inside and outside the financial system. This leads me to focus on two measures, both are related to leverage. So, in what follows, I implicitly and explicitly associate financial stability risks with either high levels of private non-financial debt or low capital buffers in the intermediation system, or both.<sup>9</sup>

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<sup>7</sup> See Cecchetti, Mohanty and Zampolli (2011) and Cecchetti and Kharroubi (2011).

<sup>8</sup> The appropriate degree of resilience depends on social views about the possible tradeoff between safety and growth.

<sup>9</sup> See Borio and Drehmann (2009) for a discussion of the first, and Acharya, Engle and Richardson (2012) for a derivation of the second.

### Box 1: Debt and Financial Crises

An accumulating body of evidence shows that as a country's debt level increases, it can become a drag on growth. Cecchetti, Mohanty and Zampolli (2011) and Cecchetti and Kharroubi (2014) examine the first of these. They conclude that as debt levels at the government, nonfinancial corporate or household level rise over 100% of GDP, they tend to reduce future growth.

What is even more disturbing is the fact that high debt levels tend to precede financial crises. Here, the work of Schlarick and Taylor (2012) and Jordá, Schlarick and Taylor (2010) establishes that, over the past 140 years, credit growth is the single best predictor of financial instability. These results reinforce those of presented in Chapter 3 of IMF (2009), which documents how credit build-ups tend to precede housing busts.

In using any indicator to indicate increased crisis risk, there is always the issue of the reliability of the signal. How frequently does an indicator signal impending crises that do not occur? What about the converse, missed crises? The problem of both false positives and false negatives is always an issue. Borio and Drehmann (2009) examine the case of credit exhaustively. In their preferred specification, they are able to predict roughly three quarters of crisis in their sample, with only a very small number of false positives.

### III. Monetary policy: targets, tools and transmission mechanisms

What role should financial stability play in the formulation of a monetary policy framework? I have already suggested that, for the most part, responsibility for systemic risk mitigation is appropriately assigned to the prudential authority. To understand this conclusion, why monetary policymakers' role should be limited, I need to examine monetary policy targets, then tools and finally transmission mechanisms. On the targets, there question about both the formulation and the level of the target, inflation or the price level, on the one hand, and 2 percent or higher, on the other.

Next, there is the question of operational policy and what were originally labelled 'unconventional' policies. To what extent should quantitative easing, targeted asset purchases, and forward guidance become a part of the conventional central bank toolkit? And finally, there is the transmission mechanism. How should we think about the impact of monetary policy on risk?

#### a. Monetary policy targets: price-level versus inflation

Following the previous discussion, I take as the starting point existing inflation targeting frameworks. This means that I am assuming that price stability remains the primary operational objective of central banks and ask what the implications are for financial stability. The question is how to frame that objective, not whether to change it.<sup>10</sup>

For a number of years, academics and policymakers have been asking whether countries could benefit by shifting from inflation targeting to price-level targeting.<sup>11</sup> In a traditional inflation targeting regime, the target for the price level is last period's realised level of prices plus the increment to the inflation target

<sup>10</sup> Over the years, there has also been a debate on the role of asset prices in policy targeting frameworks. But, as far as I know, the issue has been the nature of the central bank's *response* to perceived misalignments, not the inclusion of asset prices as explicit targets for policymakers. See Cecchetti et al. (2002), for an example.

<sup>11</sup> For a recent summary of the issues, see Ambler (2009).

while under price-level targeting the increment is added to last period's target. That is, the former allows for 'base drift' while the latter does not. Focusing on the elimination of this drift, the proponents of price-level targeting argue that it does a better job of allowing relative prices to allocate resources, at the same time that it reduces tax-related distortions and unintended transfers of wealth between lenders and borrowers. Insofar as the argument for price stability is that the long-horizon price level is more predictable, price-level targeting does a better job of meeting this objective.<sup>12</sup>

But, in the end, the choice depends on the structure of each country's economy and how slowly output growth returns to its sustainable growth rate following a shock that pushes it above or below. The more persistent output deviations from potential, the more likely it is that a country can benefit from a shift to price-level targeting. As Svensson (1999a) argues, if the output gap is relatively persistent, focusing on the price level rather than the inflation rate will contribute to reducing the fluctuations in output and inflation under a discretionary rule. Cecchetti and Krause (2007) examine a number of countries, including New Zealand. For that case, they find that the output gap persistence is sufficiently low (the first-order autocorrelation is between one-quarter and one-half in quarterly data, and in the range of three-quarters for annual data) that inflation targeting likely preferred. (Box 2 describes the details.)

Does the targeting regime itself have financial stability implications? Should we prefer inflation or price-level targeting based on how it influences the resilience of the financial system? Williams (2014) argues that price-level targeting can mitigate the potential negative impact of unexpected disinflation. The logic is similar to the familiar debt-deflation case. If prices turn out to be on average lower than borrowers expected when they took on a debt, the result will be higher real payments. This increase in the real debt burden weakens the balance sheets of households, nonfinancial firms and intermediaries. Under inflation targeting, since bygones are bygones, this increase in leverage throughout the economy is more or less permanent. Under price-level targeting, since the central bank's task is to ensure that prices return to a predetermined path, the real value of debt returns to the level borrowers and lenders originally anticipated they were going to obtain when they entered into the original contract. To quote from Williams (2014): "In this way, price-level targeting has the potential to reduce the risks to the financial system and spillovers to the economy from debt-fuelled booms."

It is worth noting that the claimed benefits of price-level targeting are theoretical. There are no practical, operational examples to which we can point for evidence of its effectiveness. And, while the arguments for financial stability are new, those for output stability are not. Why hasn't any country made the shift? I can see two reasons, first, the macroeconomic and financial stability benefits rely critically on the ability of the central bank to make good on its promise to bring prices back to the target price-level path. This means that, should inflation be too low, policymakers must be capable of engineering temporarily high inflation that does not get out of hand. Put slightly differently, there is room to question whether it is realistic to assume that policymakers will be able to maintain the level of credibility required for the price-level targeting regime to deliver the predicted benefits.

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<sup>12</sup> It turns out that, because of its forward-looking nature, pure inflation targeting can create nominal indeterminacy. Carlstrom and Fuerst (2002) note that there are circumstances under which forward-looking private agents will set prices in anticipation of monetary policy that validates their expectations at any level of inflation. By contrast, price-level targeting has a backward-looking feature that eliminates this problem. In a similar vein, Dittmar and Gavin (2005) employ a flexible price real business cycle model to show that pure inflation targeting leads to multiple equilibria, and that targeting a price-level path can eliminate this indeterminacy.

### Box 2: Inflation targeting vs. price-level targeting

Cecchetti and Krause (2007) provide a theoretical framework for examining the whether a country could benefit by shifting from inflation targeting to price-path targeting. They do this by studying a model that allows for a hybrid in which these two options are extremes. The paper develops a model based on the work of Svensson (1999a).

Begin by assuming that the central bank minimizes

$$(B3.1) \quad L^{CB} = E \int_t^{\infty} \beta^t b' [I (p_t - p_t^*)^2 + (1 - I)(y_t - y_t^*)^2] \dot{y}_t^u,$$

where  $L^{CB}$  is the central bank's loss function;  $E$  is the expectation operator,  $p$  is the log of the actual price level;  $p^*$  is the log of the desired (target) price level;  $y$  is log current output;  $y^*$  is the log of potential or desired output; and  $b$  is a discount factor. The targeting regime – whether it is inflation targeting, price-path targeting or something in between – depends on the definition of  $p^*$ . To see this, note that inflation targeting is where

$$(B3.2) \quad p_t^*(IT) = p_{t-1} + \rho^*,$$

where  $\rho^*$  is the inflation target. By contrast, price-path targeting is where

$$(B3.3) \quad p_t^*(PPT) = p_{t-1}^* + \rho^*.$$

Note that under inflation targeting the current target is last period's realized level of prices plus the increment  $\rho^*$ , while under price-path targeting the increment is added to last period's *target*. Put in the language of the literature on money growth targeting, inflation targeting allows for 'base drift' while price-path targeting does not.

It is only a small step from considering (B3.2) or (B3.3) in isolation to studying a weighted average. This is what Batini and Yates (2003) refer to as the hybrid case where the price level is allowed to drift somewhat following a movement away from the target. We can write this as

$$(B3.4) \quad p_t^*(Hybrid) = h(p_{t-1} + \rho^*) + (1 - h)(p_{t-1}^* + \rho^*) \\ = h p_{t-1} + (1 - h) p_{t-1}^* + \rho^*,$$

where  $h$  is the relative weight place on price-path targeting. The two extremes,  $h=0$  and  $h=1$ , represent price-path and inflation targeting respectively.

Normalizing  $p^*$  and  $y^*$  both to zero (so that the price path and output are both gaps measured as deviation from the targets) we can now rewrite the objective function (B3.1) as

$$(B3.5) \quad L^{CB} = E \int_t^{\infty} \beta^t \dot{a} b' [I (p_t - h p_{t-1})^2 + (1 - I) y_t^2] \dot{y}_t^u.$$

Following Svensson (1999a), close the model with an open-economy neoclassical Phillips Curve

$$(B3.6) \quad y_t = r y_{t-1} + a(p_t - p_t^e) + j p_t^F + e_t,$$

where  $y_t$  is now the output gap,  $p_t^e$  is the expectation of the log price level ( $p$ ) at  $t$ ;  $p_t^F$  is the log foreign price level denominated in domestic currency;  $r$ ,  $a$ , and  $j$  are constants; and  $e_t$  is a i.i.d. shock with variance  $s_e^2$ .

The role central bank policymakers is to choose a path for the price level  $p_t$  that minimizes the objective function (B3.5) subject to the constraint imposed by the dynamics in (B3.6). The rational expectations solution for this problem yields expressions of the form

$$(B3.7) \quad p_t = h p_{t-1} + b y_{t-1} + c(j p_t^F + e_t),$$

and

$$(B3.8) \quad y_t = r y_{t-1} + (1 + ac)(j p_t^F + e_t),$$

where  $b$  and  $c$  are complex functions of the structural parameters  $r$  and  $a$ , and the preference parameters  $l$  and  $b$ .

To complete the derivation, we move to society's problem. Assume that the social loss is written in terms of output and inflation variability. Taking the preference parameter  $l$  in the central bank's objective and the one in society's are the same, this is

$$(B3.9) \quad L^S = l s_p^2 + (1 - l) s_y^2$$

The value of  $h$  that minimizes (B3.9) – this is the optimal hybrid – satisfies the following condition

$$(B3.10) \quad h^* = \frac{1 - r}{2r}.$$

So, as the output gap becomes more persistent ( $r$ ) increases toward one,  $h^*$  goes to zero and the optimal hybrid targeting regimes approaches pure price-path targeting.

Cecchetti and Krause (2007) estimate  $h^*$  for 70 countries over the 1973 to 2003 time period using various techniques for estimating the output gap. For New Zealand, where  $r$  is estimated to be as low as 0.3, the value of  $h^*$  is in the range of 0.7 to 1.0, suggesting that inflation targeting is optimal.

But even if credibility is not in question, it is still easy to construct examples that would leave price-level-targeters in a very awkward position. Imagine, for example, that a very large negative supply shock that drives inflation up and growth down, both significantly. As a result, the price level is now so far above the target path that policymakers are obligated to engineer a deflation. Along with the deflation, comes the risk of a substantially deepening of an already severe recession. It is hard to see how anyone would want to risk being put into that position.

Nominal GDP targeting is yet another alternative. As discussed in Frankel (2012), in this case monetary policymakers would aim to keep nominal GDP growing at a constant, target rate. But nominal GDP targeting has a critical, and potentially undesirable, property. When the trend rate of real economic growth rises or falls, the implicit inflation objective also changes (in the opposite direction). This leads to a very difficult question. Would the central bank reduce systematic (undiversifiable) risk in the economy by stabilizing nominal GDP if doing so raises uncertainty about future inflation and the price level? Doing

so conceivably protects debtors who anticipated a certain level of future income, but it also complicates decisions for households and firms who must distinguish relative price changes from inflation surprises in order to make efficient choices.<sup>13</sup>

#### b. Monetary policy targets: the two percent level

A second structural issue in the construction of the monetary policy framework is the level of the inflation target itself. Looking at the numbers, advanced economies have almost uniformly chosen an objective of 2 percent. Emerging market economies have picked numbers that are higher (like the 4 percent central target adopted by India in 2015). This difference makes sense since advanced economies have systematically higher wages, and hence higher price levels than emerging economies. As the latter catch up with the former – what is commonly known as the Balassa-Samuelson effect – they are likely to face a transitional period of higher inflation for nontraded goods and services.

So, why the 2 percent solution? After the experience of the 1970s and early 1980s, when inflation hit 20 percent in a number of countries, a broad consensus developed to restore price stability. Research on inflation measurement convinced many policymakers that commonly used consumer price indices overstate inflation by one percentage point or more.<sup>14</sup> In other words, if the central bank could achieve *measured* inflation of 1 percent, then true inflation would be close to zero. Not wanting to flirt routinely with deflation, the thinking went, it was safer to choose a slightly higher target.<sup>15</sup>

Once a small group of countries chose 2 percent as their objective, others soon followed. Then policymakers worked hard to establish that objective as credible and responsible, and to reinforce expectations that inflation over the long run would return to 2 percent even if there were occasional and temporary moves higher or lower. As a consequence of decades-long public education programs, there is now an entire generation of citizens in many countries who grew up learning why 2 percent was the appropriate inflation target.

But in the aftermath of the crisis, both academics and central bankers have started to question the 2 percent objective. The key reason is the troubled experience that many countries had (and still have) with setting policy interest rates at or below zero.<sup>16</sup> The fact that in current policy regime driving the real

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<sup>13</sup> Advocates of price-level targeting also see it as a device for lowering the expected real interest rate when policymakers' target interest rate hits the effective lower interest rate bound (ELB). With a price-level target, for example, sub-target inflation is expected to be followed by above-target inflation. That is, policymakers are committed to make up for lost ground rather than (as in the case with many forms of inflation targeting) ignore past misses. So, imagine a situation in which a central bank has a 2 percent inflation target, but actual inflation has been 0 percent for two years and the interest rate is at the ELB (modestly below 0 percent). With an inflation target, the real interest rate cannot go much below -2 percent. But instead, if the central bank has a credible price level target, people will expect inflation to rise temporarily to 4 percent, so the real interest rate can fall to -4 percent. See Woodford (2013) for discussion.

<sup>14</sup> In the United States, the Boskin Commission Report (1996) summarized this thinking. For Europe, see Wynne and Rodriguez-Palenzuela (2004) and Cecchetti and Wynne (2006).

<sup>15</sup> There was a debate in the 1990s over whether the target should allow for sustained increases in the price level, as modest inflation would facilitate relative price and wage adjustments. Research at the time suggested that inflation of 3 percent or even a bit more would have such benefits. See Akerlof, Dickens and Perry (1996).

<sup>16</sup> At this writing, the central banks in Denmark, the Euro Area, Japan, Sweden and Switzerland all have set policy rates below zero.

interest rate below two percent requires driving nominal interest rates below zero is seen as an obstacle to expansionary policy when it is most needed.

There are two arguments for why a two percent inflation target may no longer provide sufficient headroom for stabilising prices and the real economy. First, the crisis suggests that the distribution of shocks has a fatter lower tail than was previously thought – very bad outcomes are more likely than we believed a decade ago. And second, the neutral real rate appears to have fallen below one percent.<sup>17</sup> Taken together, this raises the odds that with a two percent inflation target policymakers will seek to drive real rates negative. Over the past few years, this has led to suggestions that the target be raised as high as four percent.<sup>18</sup>

It is at this point that financial stability enters the discussion. Negative nominal interest rates, while technically feasible, may be ill-advised. For better or worse, people simply do not seem to understand that real interest rates are often negative, so that when it comes to real returns, there is nothing special about zero. Given the difficulty households, firms and even government officials seem to have in understanding negative nominal interest rates, we need to ask whether this is a policy that will have its intended effect.<sup>19</sup>

So, we are left with the following conclusion. Overall, taking into consideration real, nominal and financial stability, price-level targeting may be superior to inflation targeting in theory, but seems unlikely to be desirable in practice. And, considering the increased likelihood of a negative shock driving the desired policy rate below zero, something that may harm the financial system, there is a legitimate argument for raising the inflation target above two percent. But unless a number of countries were to choose to act simultaneously, such a move to a higher inflation target would seem to be ill-advised.<sup>20</sup>

### c. Monetary policy tools: conventional and unconventional

Turning from the policy framework to dynamic stabilisation, how is it that monetary policymakers influence inflation and growth? What are the tools and how are their actions transmitted to the real economy? And, what are the implications of time-varying discretionary monetary policy for financial stability? I now turn to these questions.

Starting with how monetary policy affects prices, output and employment, the answer is that changes in the size and composition of the central bank's balance sheet influence the behaviour of banks, nonfinancial firms and households. The slightly longer answer is that, prior to the crisis, central bank policymakers would target a specific interest rate – an overnight interbank lending rate, the rate at which the central bank remunerated commercial bank deposits, or something similar – and let their balance sheet adjust accordingly. That is, as the monopoly supplier of reserves, the central bank chose to fix the price and allow the quantity to adjust based on demand conditions.

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<sup>17</sup> See Laubach and Williams (2015).

<sup>18</sup> See Blanchard, Dell'Ariccia and Mauro (2010), Ball (2014) and Williams (2016) for discussions.

<sup>19</sup> See Cecchetti and Schoenholtz (August 22, 2016).

<sup>20</sup> Any formal evaluation of the level of the inflation target would have to start with a model that admits measurement of the costs and benefits of a particular level of inflation. While it may be possible to measure the benefit of reducing the frequency of hitting the effective lower bound for nominal interest rates, it is very difficult to determine the costs associated with slightly higher steady state inflation.

The severity of the global financial crisis forced a number of central banks to reduce their interest rate targets to zero or even below.<sup>21</sup> Wishing to inject further accommodation into their economies, and assuming that they could not push nominal rates down any further, policymakers looked for alternative instruments and found three: quantitative easing, targeted asset purchases and forward guidance.

The simplest way to see how these unconventional policies work is to focus on long-term nominal interest rates. We can think of long rates as the sum of four parts: (1) the current risk-free short-term interest rate, (2) the sequence of expected future risk-free short-term interest rates, (3) a term risk premium and (4) a default risk premium. Different monetary policy instruments influence these in the following ways:

- Conventional policy influences the current short rate.
- Forward guidance, broadly construed, influences the path of future short rates.
- Quantitative easing, or balance sheet expansion through the purchase of sovereigns, influences the term premium.
- Targeted asset purchase in the form of purchases of private bonds, influences the default-risk premium.

The effectiveness of these unconventional policies has been the subject of substantial debate. Overall, researchers conclude that, with the policy rate at zero (or below), both balance sheet policies and forward guidance are effective in providing further accommodation.<sup>22</sup> That is, unconventional policies have allowed policymakers to ease financial conditions in a way that is equivalent to reducing interest rates below zero, in some cases substantially below zero.<sup>23</sup> But calibration remains an issue, as the impact of a purchase of a specific size at a particular time can vary substantially.

#### d. Monetary policy: transmission mechanisms

Turning from the tools of policy to the mechanisms, it is useful to review the channels of monetary policy transmission which underpin many macroeconomic models. These are:

- Interest rates: lower interest rates reduce the cost of investment, making more projects profitable.
- Exchange rates: lower interest rates reduce the attractiveness of domestic assets, depressing the value of the currency and increasing net exports.
- Asset prices: lower interest rates lead to higher stock prices and real estate values which, through collateral value and household wealth effects, fuel an increase in both business investment and household consumption.
- Bank lending: an easing of monetary policy raises the level of bank reserves, increasing the supply of funds.
- Firms' balance sheets: lower interest rates raise firms' profits, increasing their net worth and reducing the problems of adverse selection and moral hazard.

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<sup>21</sup> See Cecchetti and Schoenholtz (February 29, 2016) for a discussion of how long policy rates can go.

<sup>22</sup> See Hamilton (2014) for a summary and Rogers, Scotti and Wright (2014) for a recent review and update of the evidence.

<sup>23</sup> Lombardi and Zhu (2014) estimate that, at their peak, unconventional policy in the United States were equivalent to lowering the policy rate to nearly -5 percent.

- Household net worth: lower interest rates raise individual borrowers' net worth, improving their creditworthiness and allowing them to increase their borrowing.

This textbook list may seem varied, but in an important way it is not. Remember, commercial banks are the central bank's point of contact with the financial system. It is by changing commercial banks' ability and willingness to issue deposits and make loans that monetary policy has any impact at all. What this means is that monetary policy has an impact on the economy by influencing leverage and risk-taking.

There is now substantial empirical support for the hypothesis that lower interest rates lead banks to lend to higher-risk borrowers than they otherwise would.<sup>24</sup> Furthermore, as the evidence in Box 3 shows, Cecchetti, Mancini-Griffoli and Narita (2016) study the impact of prolonged monetary policy easing on risk-taking behaviour and find that the leverage ratio, as well as other measures of firm-level vulnerability, increases for banks and non-banks each quarter that monetary policy easing persists in a firm's home country.<sup>25</sup>

It is important to keep in mind that this is exactly how stabilization policy is intended to work. Faced with an impending decline in real activity arising from a fall in consumer or business sentiment, monetary policymakers will react by cutting interest rates. Their purpose is to get people to take risks that they were previously unwilling to take. By getting households and firms to change their behaviour, pushing them to increase their consumption and investment (or not cut them), policymakers are able to stabilise growth and employment. Increases in leverage by individual institutions result in higher output and lower levels of financial stress. This is the *intended* consequence of stabilisation policy - it reduces aggregate volatility and risk.

Before concluding the discussion of monetary policy tools, it is worth commenting on the widely held view that low interest rates create a *search for yield*. This term is usually used to refer to behaviour resulting from certain types of investors to meet nominal return targets.<sup>26</sup> For example, a pension fund may have promised its beneficiaries annuities that can only be sustained if portfolio returns are sufficiently high. When nominal risk-free interest rates fall, the only way to option is to reallocate funds to investments with a higher risk. The consequence of this search for yield is both an increase in the volatility of institutional portfolio returns and the fact that compressed risk premia give rise to an increase in borrowing by high-risk borrowers.<sup>27</sup>

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<sup>24</sup> See Gambacorta (2009), and Altunas, Gambacorta and Marques-Ibanez (2014).

<sup>25</sup> Cecchetti, Mancini-Griffoli and Narita (2016) also note that financial institution leverage rises following monetary policy easing in the United States. That is, there are significant spillovers that have financial stability implications.

<sup>26</sup> See, for example, Rajan (2005).

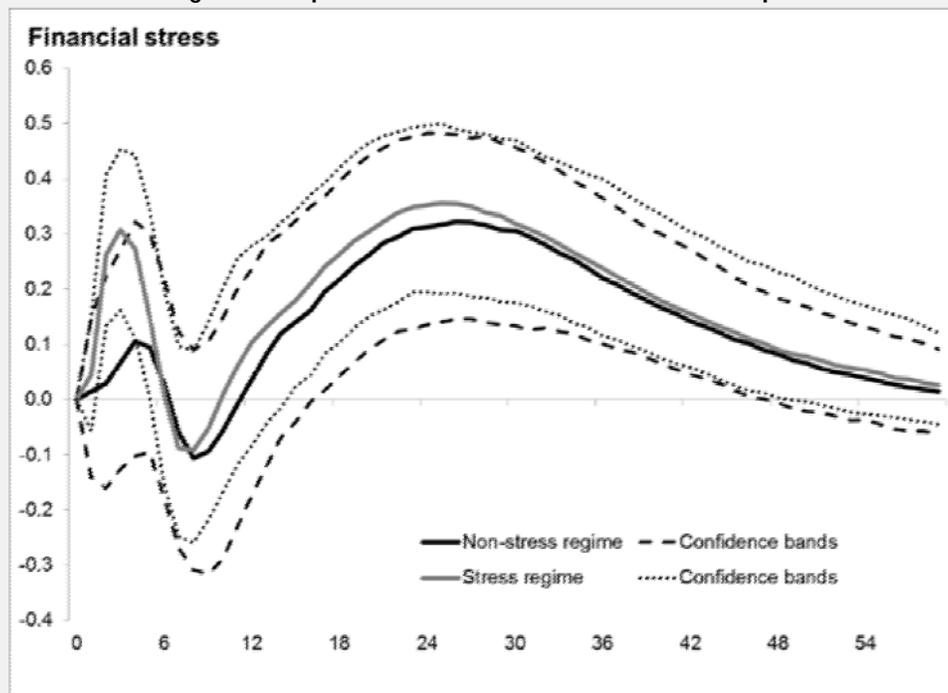
<sup>27</sup> The same thing can happen if volatility, and hence risk premia, are low. Low risk-premia, mean low overall returns, suggesting that hitting a return target requires taking additional risk. However, this logic suggests that, if volatility and risk-premia are low, in fact risk is high. But, of course, if risk-premia are high, then risk is likely high as well. The conclusion is then that risk is always high, which surely can't be the case.

### Box 3: Monetary Policy and Financial Stability Risks

Does monetary policy easing increase the vulnerability of the financial system? Several studies examine this question in detail. IMF (2015) presents estimates of a Bayesian Threshold-VAR based on monthly data on industrial production, inflation, the slope of the U.S. Treasury term structure measured as the difference between the 10 year bond and the 3 month bill rate, and a measure of financial stability based on average distance to default for the largest publicly traded banks and insurance companies over a period from 1984 to 2014.<sup>a</sup> The estimates of periods of high and low financial stress correspond to low and high distance to default – high financial stress is when distance to default is low.

The following figures display the impulse response function for a 100 basis point increase in the slope of the term structure, which is the size of a typical monetary policy easing. Figure 1 shows the impact on year-on-year output growth, and Figure 2 shows the impact on the average distance to default.

Figure 1: Impact of interest rate reduction on output

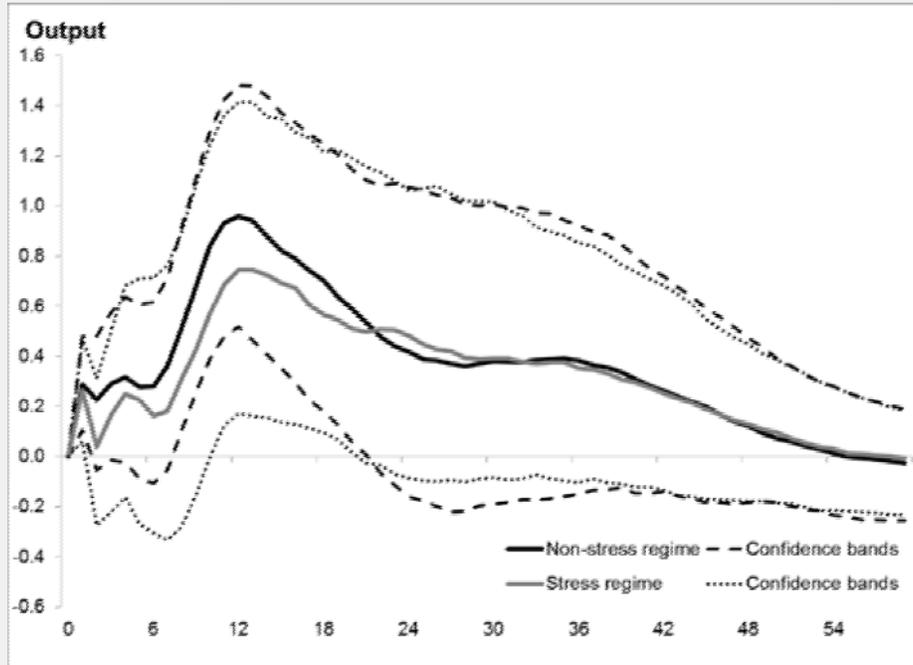


Results from Threshold VAR with output, inflation, average distance to default for the U.S. financial system, and the slope of the term structure. Shock is 100bps decrease in 10yr-3mon slope. Frequency is monthly.

Source: IMF (2015) and correspondence with the authors.

From this evidence, I draw two qualitative conclusions: policy easing tends to have roughly the same impact on output regardless of whether the financial system is under stress, and monetary policy reduces financial stress in the short term.<sup>b</sup>

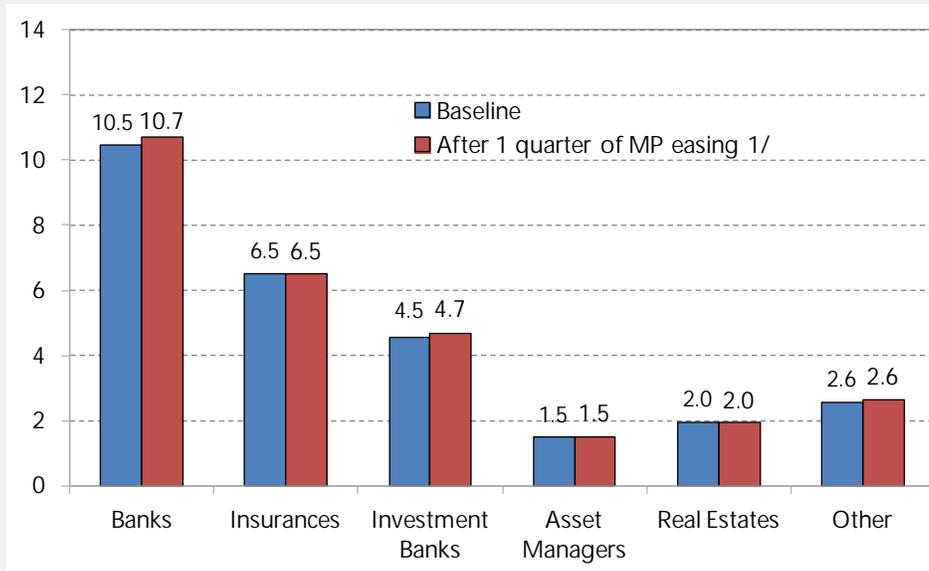
Figure 2: Impact of interest rate reduction on financial stability



Source: See Figure 1.

Turning to the second study, Cecchetti, Mancini-Griffoli, Narita (2016) examine the impact of extended monetary policy easing on financial institution balance sheets. Specifically, we examine the impact of a sustained decline in the two year sovereign interest rate relative to its average over the prior two years on leverage in the a set of 1003 publicly listed financial firms in 22 countries from 1998 to 2014. Following Acharya et al. (2012), the authors' measure leverage as liabilities plus market value of equity over market value of equity.

Figure 3: Change in assets to equity ratio following a one quarter monetary policy easing

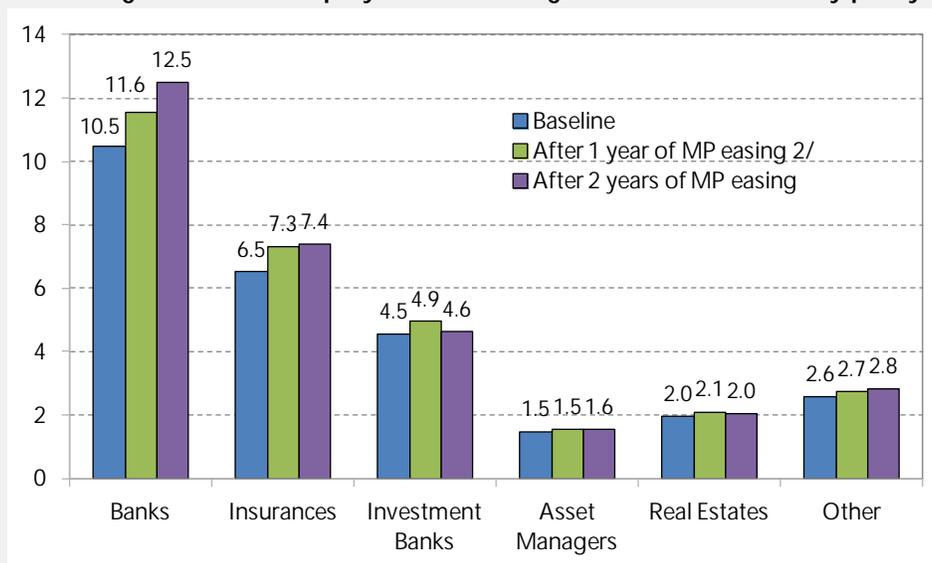


Based on data for a total of 994 publicly listed financial firms from 22 countries (19 advanced economies plus Brazil, Mexico & South Africa) from 1998Q1-2014Q4. The asset to equity ratios before and after monetary policy accommodation periods are

calculated using the median percent change and the median level in each industry. The duration measure in the left panels is the number of consecutive quarters of a trend decline in the overnight rate (i.e., a decline in the moving average over the previous two years). The duration measure in the right panels is the number of consecutive quarters of a trend decline in the two-year yields (i.e., a decline in the moving average over the previous two years). 'Other' category includes consumer finance, specialty finance, and other diversified services.

Source: Cecchetti, Mancini-Griffoli, Narita (2016).

**Figure 4: Change in assets to equity ratio following an extended monetary policy easing**



Source: See Figure 3.

Figures 3 and 4 reports the results of this simple exercise for six groups of financial firms. Focusing on the first three – banks, insurance companies and investment banks – note that in Figure 3 the short run impact of a policy easing is that leverage is roughly constant. Since policy easing likely raises equity valuations, the denominator of the leverage measure is going up. This means that in the short-run borrowing is rising, otherwise leverage would rise. At least that is the case initially. Turning to the longer-term impact, if the accommodation is sustained, things change dramatically. Figure 4 shows the impact of accommodation that lasts for one year (the centre bars) and two years (the right-most bars). The median bank has an increase in leverage from 10.5 to 12.5. For insurance companies, leverage rises from 6.5 to 7.4. And for investment banks, the increase is from 4.6 to 5.1. This means that, as policy accommodation is driving up the market value of the intermediaries, they are lending at a rate that is more than prior to the interest rate cut. And, the effects are large.

<sup>a</sup> The model I am describing is the one in Box 5, page 37, of the IMF Staff Discussion Note. I thank the authors for providing me with their data. The measure of financial stress, average distance to default, is based on Merton (1974). The resulting measure, computed by Moody's KMV, has a standard normal distribution. So, for example, a value of two implies a probability of default of 2.28%.

<sup>b</sup> It is important to note that this result is at odds with that in some other papers. For example, in their study of a model with three states rather than two, Avdjiev and Zheng (2014) do find changes in the transmission mechanism.

Turning to financial stability, since monetary policy influences borrowing and risk taking, it has an impact on the resilience of the system. Consider the case of a policy easing. As I noted above, the intended

consequence is an increase in leverage and risk taking. More riskier lending would seem to reduce systemic resilience. But lower interest rates increase asset values, improving the net worth of financial intermediaries, firms and households alike. Furthermore, since a lower short-term interest rates tends to steepen the yield curve, it will increase net interest margins, improving bank profitability.

The evidence in Box 3 provides the key to understanding what happens. In the short-term, there is no apparent conflict between macroeconomic stability and financial stability. Monetary policy easing designed to raise output (and inflation) reduces financial stress. While the impact is small during in normal times, it is large when the system is under stress. But at the level of individual firms, accommodation takes some time to have an impact. Initially, leverage is largely unchanged. But when interest rates remain low for several years, the result is an increase in leverage that will almost surely reduce the resilience of the system.

It is worth noting that an important link between monetary policy and financial stability runs through the residential real estate market. Transmission goes something like this: Lower interest rates increase both the present discounted value of housing services that flow from a residence and reduce the cost of mortgage borrowing for a potential owner. This drives up housing prices and increases household debt. There are instances in which this could create a housing boom, followed by a bust. The bust could lead to defaults, which translate into losses for leveraged financial intermediaries, precipitating a crisis.<sup>28</sup> I will come back to this in my discussion of prudential regulation, as that seems like the right tool for addressing this concern.<sup>29</sup>

Does this provide us with sufficient grounds for advising monetary policymakers to alter their behaviour and take account of financial stability risks? Current work suggests that the answer is no.

To give a few examples: Svensson (2015) shows convincingly that, for realistic model calibrations, the inflation and output losses that would arise from using monetary policy as a financial stability tool outweigh the benefits by a factor of several hundred. (See the discussion in Box 4.) Ozkan and Unsal (2014) show that, assuming macroprudential policy is available, there is no welfare gain from monetary policy reacting to credit growth. IMF (2015, Box 3) provides evidence that, while interest rate increases may have a positive effect on financial stability in the long run, they have a negative effect in the short run. And, using a calibrated dynamic stochastic general equilibrium model, Ajello et al. (2016) show that even optimal central bank policy reacts only very modestly to financial stability risks.

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<sup>28</sup> Jordá, Schularick and Taylor (2015) estimate that a one percentage point decrease in short-term interest rates in the U.S. results in a roughly fifty basis point decrease in the mortgage rate, driving down house prices by more than four percent cumulatively over a four year horizon.

<sup>29</sup> The debate on the efficacy of monetary policy in addressing asset price booms has been going on for nearly two decades. Cecchetti (2006) provides a summary of the arguments for and against. The most powerful argument against leaning against bubbles comes is in Gruen, Plumb, and Stone (2003). The difficulty arises from the fact that interest rates influence economic activity with a lag, but affect the bubble immediately. Because of the first of these, as output falls following the bursting of a bubble, policymakers would like to have interest rates low for some period before a crash. But lowering interest rates reduces the probability of the bubble bursting, causing it to become larger. Gruen et al. (2003) proceed to show that successful stabilization policy requires the central bank to detect the bubble when it is just developing – something that most people agree is nearly impossible. This very convincing line of reasoning leads to the inevitable conclusion that interest rates are probably not the right instrument for the job.

This increasing body of evidence leads to the conclusion that using monetary policy to directly combat incipient financial stability risks is unlikely to pass the cost-benefit test.<sup>30</sup>

#### Box 4: Asset Prices and Monetary Policy: The Welfare Costs of Leaning against the Wind

Should monetary policy lean against asset price and credit booms in an effort to reduce the probability of a crisis? Svensson (2016) tackles this question head on. He constructs a simple model in which interest rate increases have the potential to reduce the likelihood of a crisis. Balancing this against the known employment costs of contractionary policy, he answers the question with a resounding 'no'.

To understand Svensson's (2016) conclusion, we can examine the consequences of a one percentage point increase in the policy rate. He assumes realistically that this raises the unemployment rate by one half of a percentage point – that is the cost of the policy. To compute the benefit, he assumes that when the policy rate goes up, the crisis becomes both less likely and less severe. The likelihood goes from an annual probability of six percent to four percent, and the unemployment rate during the crisis falls from ten percent to nine percent.

The cost-benefit calculation starts by noting that the expected cost is simply the rise in unemployment of one half of a percentage point in the steady state. The benefit is then the sum of two parts: the lower expected future unemployment and lower unemployment in the crisis. This sums to roughly point four basis points on the unemployment rate. So, the ratio is on the order of 250.

The conclusion from this simple exercise is that the benefits of using interest rates to counter financial stability risks, raising the policy rate to reduce the likelihood and severity of the crisis is extremely unlikely to ever exceed the unemployment costs. And, overturning this result would require either that monetary policy be ineffective at influencing aggregate demand conditions, at the same time that it is very effective at affecting the financial system. As Svensson (2016) points out, this is extremely unlikely.<sup>a</sup>

<sup>a</sup>For a somewhat more detailed summary of the argument, see Box 7 in IMF (2015).

#### e. Monetary Policy: a note on the lender of last resort

It is worth taking a moment to discuss the role of central bank lending. While not the focus of the debate on how to formulate an effective financial stability policy framework, the lender of last resort is a critical component of any well-functioning modern financial system. The rationale for central bank lending has not changed for over a century: to ensure that sudden deposit outflows from a single institution (or a set of institutions) does not turn into a system-wide panic, the central bank should stand ready to provide liquid assets to solvent intermediary. The exact terms under which central banks make these loans – the price and term of the loan, and the type of collateral accepted as security – depend on the institutional details in each jurisdiction. But the basics remain the same: in the very short-run, maintaining financial stability requires that the central bank act as the lender of last resort.<sup>31</sup>

Now, it is important to keep in mind that the construction of the lender of last resort presumes that the financial system is populated primarily by banks. While this is likely to be the case for some time to come,

<sup>30</sup> Cecchetti (2016) comes to the same conclusion. Caruana (2011) comes to the opposite conclusion.

<sup>31</sup> For a discussion of the importance of only lending to solvent institutions, see Cecchetti and Schoenholtz (July 25, 2016).

should there be a shift to a more market-based finance, there may be a need to change the role of the central bank as well. If intermediation were to run primarily through financial market rather than institution, central banks would have to consider changing their operational structure.<sup>32</sup>

Greenwood, Hanson and Stein (2016), explore a move in this direction. They argue that central banks should retain very large balance sheets in order to be ready to supply low risk assets should they become scarce in the market. Not only would this stabilise market, but it would also discourage private sector agents from fabricating low risk assets of their own.

### III. Prudential policy

So, if monetary policymakers are not to be on the front line in the fight to maintain financial stability, who is? The answer is prudential policymakers. Systemic resilience is their responsibility.

There are two types of prudential policy, institution specific, microprudential; and system-wide, macroprudential. These are more alike than they are unlike. They are alike in that they use the same set of tools and operate through the same mechanisms. They are unlike in that they have somewhat different objectives. Microprudential policy is concerned with the robustness of individual institutions, minimising the probability of failure. Macroprudential policy is concerned with systemic resilience, minimising the frequency and probability of crises. I will now consider each of these in turn.

#### a. Microprudential regulation

To understand the basis for regulating financial intermediaries (banks for short), it is worth starting with a discussion of their function. Following Pozsar, Adrian, Ashcroft and Boesky (2012), I take the fundamental functions of a bank to be credit transformation, liquidity transformation, maturity transformation, and access to the payments system. Each transformation function generates returns by producing assets with a set of characteristics that diverge from those of liabilities: credit transformation produces assets that are riskier than liabilities; liquidity transformation constructs assets that are less liquid than liabilities; and maturity transformation entails purchasing or issuing assets that are longer term than liabilities. And access to the payments system comes from providing liabilities that are accepted in settlement of transactions.

Focusing on intermediation, a traditional bank performs all of these functions — funding long-term, illiquid, high-risk assets with short-term, liquid, low-risk liabilities. In doing so, banks significantly reduce the cost of credit provision relative to what it would be if lending were done directly by individuals. They achieve this efficiency in numerous ways. The most important is by overcoming information asymmetries in the extension of credit – that is, screening potential borrowers to establish creditworthiness and monitoring borrowers to ensure performance once loans are made. The consensus view is that banks have a comparative (and likely absolute) advantage over other types of intermediaries in conducting these activities.<sup>33</sup> But as intermediaries, banks are inherently fragile. By offering withdrawal on demand on a first-come first-served basis, they are subject to runs. Because bank assets are generally opaque – liability

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<sup>32</sup> See Tucker (2009, 2014) for a detailed discussion of the principles underlying the lender of last resort, as well as a discussion of the concept of the market-maker of last resort.

<sup>33</sup> While this may change, for the time being it seems unlikely that peer-to-peer lending schemes screen and monitor borrowers more efficiently than traditional banks. See Cecchetti and Schoenholtz (May 23, 2016) for a discussion.

holders cannot readily evaluate what they are worth – perceived as well as actual losses can produce runs. And problems at one bank (again, perceived or real) can spread rapidly to others, creating system-wide panic. If banks are forced to sell their assets in an attempt to meet withdrawals, they just add fuel to what may already be a very hot fire.

In response to this fragility, policymakers have created a safety net with two elements: deposit insurance and central bank liquidity support (this is the lender of last resort discussed earlier). The first reduces the likelihood of deposit runs, and the second eliminates the need for forced asset sales. But these protections create a new systemic risk: moral hazard. With the public guarantees in place, a bank's owners and managers reap the benefits of their success but not the full costs of their failures, so they will tend to engage in too much credit transformation, too much liquidity transformation, and too much maturity transformation. Too much, that is, relative to what society ideally needs. That is the basis for microprudential regulation.

In line with that rationale, the global financial regulatory reforms in Basel III are based on the idea that the system needs to create limits that guide financial sector participants to act in ways that further the public interest.<sup>34</sup> Enhanced capital requirements are designed to address the tendency of banks to engage in too much credit transformation, while liquidity requirements are intended to reduce the urge to engage in too much liquidity and maturity transformation. In each case, the idea is to impose a type of tax on banks. For a given asset composition, capital requirements restrict the liability structure. Liquidity requirements either restrict banks' asset structure for a given set of liabilities (as in the liquidity coverage ratio), or restrict liability structure for given set of assets (as in the net stable funding ratio). We can think of the liquidity coverage ratio as addressing excessive liquidity transformation and the net stable funding ratio as constraining maturity transformation. And a regime capable of resolving any bank, regardless of its size or complexity, ensures that liability holders (including equity owners) face the consequences of insolvency without relying on public funds.

#### b. Macroprudential regulation and the tragedy of the commons

To understand macroprudential regulation, we start with the properties of financial stability more generally.<sup>35</sup> Following Tucker (2015), it is useful to think of financial stability as a tragedy of the commons analogous to grazing on public lands or fishing in public waters. In such a circumstance, individuals have the incentive to do things that degrade the environment for everyone else. To be specific, since financial stability is based on a common resource, the resilience of the system is non-excludable but rival. That is, if the financial system is stable, no one can be kept from basking in the glow of its stability.

Importantly, however, individuals can act in ways that reduce the resilience of the system as a whole. Just as a farmer has the incentive to overgraze his or her cows, letting them eat until the public green becomes bare, leading to the starvation of others' herds and eventually their own, an actor in the financial system has an incentive to behave in ways that deplete its resilience and so put others at risk.

Individual institutions can deplete the resilience of the financial system outside of the public view through their hidden actions. For example, they can issue debt so that, given the inherent opacity of their

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<sup>34</sup> See Basel Committee (2011). Note that the international standards established by the Basel Committee and the Financial Stability Board are intended as minima. Some jurisdictions may choose to implement stricter standards. This is particularly the case in small countries.

<sup>35</sup> This discussion is drawn from Cecchetti and Tucker (2016).

portfolios, they are in fact more risky than they outwardly appear. The fact that an individual institution has an incentive to deplete the financial stability commons means private and social incentives diverge. That is, there is a classic externality. In the case of a bank, owners and managers succumb to moral hazard due to a combination of limited liability, the government safety net, and authorities' past tendency to bail out insolvent firms. Spillovers involving the case of a single bank failure turning into a system-wide panic, and the fire-sale and credit-crunch externalities arise from generalised balance sheet shrinkage. These are the externalities that macroprudential regulation are designed to address.<sup>36</sup>

### c. Prudential tools: banks

The prudential policy toolkit that is used to ensure resilience, discouraging hidden actions to ensure maintenance of the common good, has a vast array of elements. These include tools aimed at borrowers, lenders and markets. For most of the tools, there is steady-state calibration and then the potential for time-variation.

In the case of banks, prudential tools are a combination of capital requirements, liquidity requirements, concentration limits, risk weights and stress tests. It is worth touching on each of these. Starting with liquidity requirements, our lack of any experience makes it difficult to even speculate on the appropriate calibration. All we can say is that the liquidity coverage ratio (LCR) is designed to ensure that commercial banks are not overly reliant on central bank lending facilities in the event of a sudden and potentially large deposit outflow, and that the purpose of the net stable funding ratio (NSFR) is to ensure that commercial banks minimise the use of short-maturity interbank (wholesale) funding to finance long-term loans. But the details of the requirements – the run-off rates for various liability classes assumed in computation of the LCR or the weights used on various categories of assets in the calibration of the NSFR – are untested.<sup>37</sup>

Capital requirements are an entirely different matter. Here, we have decades of history. Recall that the purpose of bank capital is to absorb negative shocks to asset valuation. The first question we need to address is calibration. How big a capital buffer should banks be required to hold? There is some disagreement about the answer to this question. For example, Admati and Hellwig (2013) make a case for requiring an unweighted leverage ratio of at least twenty percent of total assets, somewhat higher than the model-based estimate in Begeau and Landvoigt (2016).

An alternative view is provided by Daher et al. (2016) who use the information in the Laeven and Valencia (2012) crisis database. They conclude that if banks held capital equal to roughly twenty percent of risk-weighted assets, this would be sufficient to avoid eighty-five percent of post-1970 crises in OECD countries.<sup>38</sup> Put differently, with capital levels reducing the frequency of crises from an average of once every twenty years to once every 100 years requires twice the capital stipulated in the Basel III standard. As it turns out, this is not too far from the level that is implied by the Financial Stability Board's (2015b) standard for total loss absorbing capital (TLAC).<sup>39</sup> There is some disagreement about the optimal level of

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<sup>36</sup> See Hanson, Kashyap, and Stein (2011) for a discussion of the externalities that form a theoretical basis for broad-based capital and liquidity regulation.

<sup>37</sup> For a description of the standards themselves, see Basel Committee (2013, 2014).

<sup>38</sup> This computation assumes that total assets are roughly twice risk-weighted assets, so the unweighted leverage ratio requirement would be roughly ten percent.

<sup>39</sup> See Financial Stability Board (2015 b).

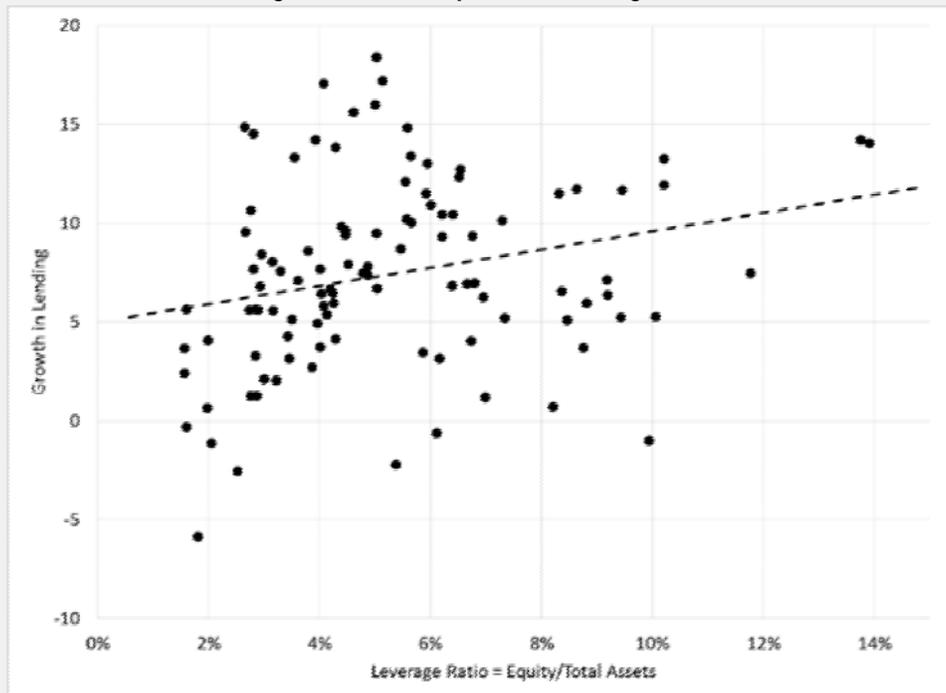
capital. That said, there is very little evidence that higher levels of capital hamper lending. In fact, there is every reason to believe that better capitalised banks lend more. (See Box 5.)

### Box 5: Bank Capital and Bank Lending

A recent paper by Gambacorta and Shin (2016) highlights three important consequences of having well-capitalised banks: lower funding costs, greater ease of bank borrowing and increase in bank lending.

Figure 5 from Gambacorta Shin (2016) illustrates the positive relationship between bank capitalisation and lending growth.<sup>a</sup> Each dot represents average level of leverage for one of 105 large banks from 14 advanced economies over the 19 years from 1994 to 2012. (At the end of the sample, these banks held nearly \$59 trillion of assets, equivalent to nearly 80% of 2012 global GDP.) The horizontal axis shows the ratio of equity to assets (the leverage ratio above), and the vertical axis measures the average annual rate of lending growth. While the sample is noisy, even this raw data (unadjusted for bank and time fixed effects, or for other macroeconomic controls) exhibits a clear positive relationship, consistent with the view that better capitalised banks lend more.

Figure 5: Bank capital and loan growth



Source: Leonardo Gambacorta and Hyun Song Shin, "Why bank capital matters for monetary policy," BIS Working Papers No 558, April 2016, Figure 1; and authors' calculations. Note that we plot the inverse of each bank's average ratio of assets to equity.

This positive relationship between bank capitalisation and lending growth should provide comfort to regulators who are still in the process of raising capital requirements. In 2010, research from the banking industry argued that raising capital requirements would diminish long-run economic growth, while a study by the Macroeconomic Assessment Group for the Financial Stability Board and Basel Committee on Banking Supervision concluded that the impact would be meager.<sup>b</sup> The latter result was obtained despite the assumption — in contrast to the first stylised fact above and in violation of the

Modigliani-Miller theorem — that higher capital would *not* lower bank debt funding costs, and that these higher combined funding costs would be passed on to borrowers one-for-one. And, as a result the gradual imposition of higher capital requirements generally did not diminish lending.

The importance of capital as a foundation for bank lending is consistent with the painful lessons learned by many monetary policymakers who, in recent decades, sought to stimulate their economies in the face of impaired banking systems. The experience of Japan in the 1990s is the premier example. While the collapse of land and equity prices began in 1990 and was far advanced by 1992, persistent regulatory forbearance delayed a thorough recapitalisation of Japan's banks for more than a decade.<sup>c</sup>

The conclusion is clear: healthy, highly capitalised banks lend to healthy, creditworthy borrowers; weak, undercapitalised banks lend to weak, vulnerable borrowers (if at all).

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<sup>a</sup> Figure 5 in Cecchetti (2015) makes the same point.

<sup>b</sup> See International Institute of Finance (2010) and Macroeconomic Assessment Group (2010).

<sup>c</sup> See Hoshi and Kashyap (2010).

Turning to time-varying capital buffers, the Basel III standard includes a provision for what is called the countercyclical capital buffer (CCyB).<sup>40</sup> By triggering the CCyB, a prudential authority can increase the required level of capital relative to risk-weighted assets by as much as two and one-half percentage points. The Basel Committee guidelines state that the buffer should be used whenever private-sector debt is increasing rapidly. It is difficult to see how anyone knows enough to adjust CCyB, or any other macroprudential tools, to either manage the credit cycle or lean against asset price bubbles. Instead, the focus is on maintaining resilience, assuring that the financial system can absorb busts without the drying up of the supply of core financial services necessary to maintain economic activity.<sup>41</sup>

Continuing with policies that can address behaviour of the lenders, there are concentration limits and risk weights. It is surely possible to have an impact on lending to particular sectors by reducing the former and increasing the latter. And, these are common tools used by both bank's risk managers and their supervisors. The recent report by the Committee on the Global Financial System (CGFS) (2016) cites two cases in which these were used: in 2010, the Central Bank of Brazil raised the risk weights for auto loans with high loan-to-value ratios and long maturities; and in 2011, the Mexican National Banking Commission lowered the concentration limit on within-banking-group exposures. A study by Afanasieff et al. (2015) finds that the Brazilian policy raised the cost of auto loans, successfully discouraging demand. The purpose of the Mexican policy was to limit contagion risk. Given that there was no systemic stress following implementation, assessing the impact of the policy would require construction of a compelling counterfactual - something that is extremely difficult.<sup>42</sup>

Finally, there are stress tests. Modern stress testing builds on the U.S. experience during the crisis. In late 2008, the solvency of the largest American intermediaries was in doubt. That uncertainty made their own managers cautious about taking risk and it made potential creditors, counterparties, and customers wary of doing business with them. Those doubts contributed to the extreme fragility in many financial markets, leading to a virtual collapse of interbank lending. Part of the remedy was a special disclosure procedure

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<sup>40</sup> See Basel Committee (2010).

<sup>41</sup> See Cecchetti and Tucker (2015) for a more detailed discussion.

<sup>42</sup> See Batiz-Zuk et al. (forthcoming).

in which American authorities conducted an extraordinary set of 'stress tests' and, in May 2009, published the results. The tests evaluated, on a common basis, the prospective capital needs of the nineteen largest U.S. banks in light of the deep recession that was well under way. While observers questioned whether the tests were stringent enough—the 'stress' scenario quickly turned into the central forecast — the results were sufficient to reassure the government, market participants, and the banks themselves that most of the institutions were in fact solvent. Partly as a consequence, conditions in financial markets rapidly improved. And, armed with the stress test evidence of their wellbeing, most large banks were able to attract new private capital for the first time since the Lehman failure the previous September.

Stress tests have the potential to be one of the most powerful prudential tools available for safeguarding the resilience of the financial system. They take seriously the fact that when a large common shock hits, there is no one to sell assets to or raise capital from. Ensuring that each individual institution can withstand significant stress raises the likelihood that the system can survive. And, importantly, by adjusting the scenarios, prudential authorities can maintain a chosen level of resilience. At least in principle, stress tests can both account for changes in the distribution of the shocks that can hit the system and ensure that the amplification potential of the propagation mechanism does not increase. Moreover, they reveal otherwise hidden information on the firms and on the work of supervisors.<sup>43</sup>

Before moving on, I should note that the structure of prudential policy depends critically on the nature of the resolution regime. In an ideal world, the owners of equity, the bondholders and the large depositors, as well as the managers of the firm face the consequences of failure without harm to others. That is, we would have a resolution framework that forced the internalisation of the externalities. The extent to which this is the case influences the calibration of the tools that I discussed above. That is, the more robust the resolution framework, the lower we can set required capital and liquidity buffers.<sup>44</sup>

#### d. Prudential tools: markets

An important element of the 2007-09 crisis is that financial markets ceased to function. Two issues arose: the procyclicality of haircuts and margins, and the fragility of over-the-counter (OTC) derivatives trading.<sup>45</sup> On the first, whenever volatility rises, standard practice in risk management is to increase the size of haircuts and margins on collateralised lending, repurchase agreements, and derivatives transactions. Since securities prices have a tendency to fall more quickly than they rise – the distribution of returns tends to be negatively skewed – the rise in haircuts and margins tends to be larger when markets drop.

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<sup>43</sup> Stress tests are not a panacea, as they rely on the use of models—both supervisory models and institutions' own internal risk models. Calibration of these can be quite difficult. People are working on solutions, one of which involves the use of common hypothetical portfolios.

<sup>44</sup> See White and Yorulmazer (2014) for a discussion of the tradeoffs.

<sup>45</sup> A common misinterpretation of the 2007-09 crisis is that it was a consequence of securitisation. It is important to note that there is nothing inherently wrong with originate to distribute, so long as the originator does in fact distribute. This is not what happened in the US. In fact, as a consequence of regulatory failure, banks originated and then kept the highest-risk portion of the mortgage pools either on their own balance sheets or on the balance sheets of entities to which they provided backup lines of credit. The cause of the crisis was the fact that banks and intermediaries had insufficient capital. With very high leverage it did not take much to create the systemic stress that resulted in the crisis.

Importantly, the result of collateral and margin calls can be forced sales, driving prices down further, increasing volatility, and making matters worse.<sup>46</sup>

The second concern is OTC derivatives. The global derivatives market is enormous. At the end of 2013, the gross notional amount peaked at more than \$710 trillion. Since then, it has fallen substantially so that, as of mid-2015 (the last data available), the level was just over \$550 trillion. To put this number in perspective, it remains more than six times the capitalisation of global stock markets.

In acknowledgment of the role that this enormous market played in the 2007-2009 financial crisis, at their summit on September 24-25, 2009 in Pittsburgh, the leaders of the G20 agreed that “[a]ll standardised OTC derivative contracts should be traded on exchanges or electronic trading platforms, where appropriate, and cleared through central counterparties by end-2012 at the latest.”

Three episodes over the past twenty years highlight the rationale for moving to central counterparties (CCPs): Long-Term Capital Management (LTCM), AIG and Amaranth Advisors. Starting with the last of these, in September 2006, Amaranth Advisors, a U.S.-based hedge fund specialising in trading energy futures, lost roughly \$6 billion of its \$9 billion in assets under management and was liquidated with little market-wide disruption. By contrast, eight years earlier, the impending collapse of LTCM threatened a financial crisis; financiers sprang into action to work out its debt without bankruptcy. Importantly, whereas Amaranth was engaged in trading futures on an organised exchange (a special form of a CCP), LTCM had entered into thousands of bilateral OTC swaps.

The AIG case focused everyone’s attention on the concentration risks arising from OTC trading. By end-June 2008, AIG had London-based Financial Products Group taken on \$446 billion in notional credit risk exposure as a seller of credit risk protection via credit default swaps (CDS). These positions, which were largely unhedged and uncollateralised, concentrated credit risk in a financial institution that did not have the cash to meet crisis-related margin calls. Because the transactions were bilateral and OTC, no single counterparty could observe the aggregate risk concentration and charge an appropriate risk premium (say, in the form of a heightened collateral requirement). Unlike LTCM, where the private sector provided the funds needed to resolve the crisis, with AIG, it was the Federal Reserve that had to step in with an \$85 billion loan.

Central clearing is the key difference between Amaranth Advisors on the one hand, and LTCM and AIG on the other. CCPs provide three important functions. The reduce interconnectedness through a process known as trade compression (or multi-lateral netting), they ensure collateralisation and they provide information. Would many of LTCMs interest swaps with its thousands of counterparties have been eliminated through trade compression and required to collateralise those that weren’t? Probably yes. Would AIG have been able to write nearly half a trillion dollars face-value of insurance if they had been forced to post cash or other collateral commensurate with this risk concentration? Almost surely not.<sup>47</sup>

To ensure the resilience of financial markets, we need appropriate infrastructure. That means margining and haircut practices that do not exacerbate cyclicity and CCPs that reduce interconnectedness and

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<sup>46</sup> See CGFS (2010) for a description of the experience during the financial crisis.

<sup>47</sup> See Cecchetti and Schoenholtz (March 28, 2016).

concentration risk. These are structural features of any financial stability framework that are completely within the purview of prudential authorities.<sup>48</sup>

#### e. Prudential policy: households

Finally, we have the example of prudential policy aimed at borrowers. While firms borrow, the focus here is generally on households, with policymakers' attention directed primarily at mortgage borrowing.<sup>49</sup> The reason is that households tend to become more highly leverage than firms, and property values tend to experience pronounced booms and busts. On the former, debt to equity for a nonfinancial corporate is rarely in excess of one, while for a standard mortgage with twenty percent down payment, a household will have debt to equity equal to four. Furthermore, residential property booms tend to be fuelled by debt, so that when they turn to busts, it can put the entire financial system at risk.

The response to the risks posed by mortgage debt, especially during periods of rapid housing price appreciation, has been to impose borrowing limits either in the form of maximum loan-to-value (LTV) or maximum debt-service-to-income ratios. The objective of such policies is both to reduce borrowing and to slow the rate of increase of property prices. And, by limiting household balance sheet leverage, increasing resilience should the boom turn to a bust. The evidence suggests that these borrower-based policies are effective.<sup>50</sup>

There are, however, a number important preconditions for macroprudential policies aimed at limiting borrower leverage to work. First, there must be a credit registry that allows for tracking of individual borrowing. And second, it has to be possible to ban home equity loans or second liens on residential housing, keeping homeowners from simply going to elsewhere to increase their leverage beyond what their initial mortgage allows. In jurisdictions where one or both of these conditions are not met, it is hard to see how LTV limits can be effective.<sup>51</sup>

#### f. Prudential policy and macroeconomic stability

One could think of using macroprudential tools for stabilisation purposes. In theory there is no difference between the way in which traditional monetary policy alters loan supply and the mechanism through which an increase in capital requirements changes the cost of bank lending. Analogously, there is little distinction between how a rise in interest rates affects housing markets and the means through which a lowering of the maximum LTV ratio influences mortgage demand. As Cecchetti and Kohler (2014) show, under some fairly general conditions, capital adequacy requirements and interest rate policy are substitutes.

But theory is one thing, practice is another. The big question is whether this will work to limit the credit expansion, or just provide an extra buffer against the eventual bust. As Aiyar, Calomiris and Wieladek (2014) note, there are three preconditions for the capital buffer to work as a stabilisation tool: capital

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<sup>48</sup> See Committee of Payment and Settlement Systems (2012).

<sup>49</sup> A recent exception is the Federal Reserve Board's guidance on leveraged lending. See Board of Governors of the Federal Reserve et al. (2013).

<sup>50</sup> See Akinci and Olmstead-Rumsey (2015); Alpanada and Zubairy (2014); Cerutti, Claessens and Laeven (2015); and McDonald (2015).

<sup>51</sup> Neither of these conditions is met in the United States, for example. Furthermore, since small business loans are often secured by residential housing, it is unlikely that they ever will be.

requirements have to bind before they are raised, equity has to be costly and difficult to raise in the short term, and alternatives to bank credit have to be relatively unavailable and costly.

The experience summarised in Cecchetti (2015) is not very encouraging for the efficacy of the countercyclical buffer as envisioned in Basel III. The difficulty is at least three fold. First, lending spreads do not appear to be the first-order response to higher capital requirements. Second, loan volumes do not look sensitive to changes in capital so long as banks are reasonably well capitalised. And finally, at the stage in the business cycle when the countercyclical buffer would be needed, banks' business is likely to be booming and profitable, making it cheaper and easier to raise equity.

Beyond that, there is reason to believe that discretionary prudential policy is impractical for all the reasons that associated with the debate of rules versus discretion. These included information and recognition lags, response and decision lags, and implementation and transmission lags, as well as governance and political resistance.<sup>52</sup> That is, using macroprudential policies for the purpose of stabilisation would require that we have some sense of the elasticities. Again, since policymaking is about numbers, calibrating the instruments would mean having a clear sense of how much a change in capital requirements would influence aggregate demand at various horizons. If authorities were to start making small, frequent adjustment to the quantity of capital banks are forced to hold, we might gain this knowledge. But the costs of such an experiment are very unlikely to be worth the benefits – especially since we have a fairly good sense of how interest rate policy works. So, the conclusion is fairly clear: macroprudential tools are ill-suited for stabilisation. Instead, the focus of prudential authorities should remain on ensuring financial system resilience.

#### g. Prudential policy and fiscal policy

Before moving to a more detailed discussion of fiscal policy, it is worth pausing to discuss the potential for conflicts and complementarities with prudential policy. Interactions exist in the way capital and liquidity regulation is structured, the nature of the resolution regime, and the details of the tax code. Starting with the first, it is fairly easy to see how changes in risk weights can make it more or less attractive for banks to hold sovereign debt. For example, if the prudential regulator were to increase the risk weight on government securities, this would raise the cost to banks, decrease overall demand and raise the cost of government finance.

Changes in liquidity regulation are also likely to alter the demand for sovereign debt. To see how, consider the liquidity coverage ratio (LCR). The LCR states that a bank must hold banks must sufficient high-quality liquid assets to meet their liquidity needs for a thirty calendar day liquidity stress scenario. The simplest way to understand this is that there are a set of assumptions about liabilities – what are called 'run-off rates' – and certain securities qualify as high-quality liquid assets. Sovereign securities are (nearly) always high-quality and liquid. But if either the run-off rates or what counts as liquid changes, then the demand for government debt can change, driving the cost up or down.

This leads to the first conclusion: changes in prudential policy can change the cost of government finance. So, if the fiscal authority wishes to run an expansionary policy, the prudential authority can make this less costly adjusting either capital or liquidity requirements to make it more attractive for banks to hold sovereign exposures.

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<sup>52</sup> See the discussion in Cecchetti and Schoenholtz (March 10, 2014).

That said, it seems quite unlikely that a responsible prudential regulator would actively and intentionally support fiscal expansion in this way. The reason is that deficit-financed expenditure, and the consequent increase in overall government debt would normally generate an increase in the perceived riskiness of the sovereign and increase, not decrease, the capital a bank is required to hold for a given quantity of bonds. So, attempts at expansionary fiscal policy could be blunted by tighter prudential policy.

Turning to resolution, I have already mentioned the interaction with prudential regulation – the better the resolution regime, the lower capital requirements could be (at least in principle). In addition to this, there is an interaction between fiscal policy and the resolution regime. Here, the point is that the stronger and more robust the resolution regime, the less likely public funds will be required to resolve an insolvent institution. The implication is that the government can be less concerned about the need to produce funds, and run at a higher level of debt during normal times.

Finally, there is the fact that the tax code interacts with prudential regulation. A simple example is mortgage lending. In lieu of a decrease in the LTV ratio limit that would be imposed by the prudential authority, the fiscal authority could implement a tax on home purchase transactions.

I find all of these potential conflicts between prudential regulation and fiscal policy to be additional arguments for both regulatory simplification – increased reliance on a simple leverage ratio – and high steady-state capital requirements that do not require any adjustment as the fiscal policy stance changes.

#### IV. Fiscal policy

I now turn to the third element of the policy trinity: fiscal policy. Pre-crisis, the consensus was that the role of fiscal policy was to determine distribution of income and production in the society, at the same time that it provided the foundation for strong, sustainable and balanced growth. That is, the government would use its authority to tax and spend, determining both the division of output into its constituent parts (consumption, investment, exports, imports and direct government consumption) and the distribution of income and production among the various households and firms. And, as it does, the structure of the tax and expenditure system would be such that it would naturally dampen economic fluctuations. That is, because taxes are proportionate to income, and benefits tend to rise as activity falls, the system has an automatic stabilisation property.

While the original Keynesian notion was that fiscal tools should be used to combat cyclical downturns, since at least the mid-1980s, discretionary tax and expenditure policy has been somewhat unusual in advanced economies. The principal argument against discretionary fiscal policy is that there are long lags between the recognition that spending would be needed and the time funds would actually be spent. To see the point, note that it is not unusual for a recession to last for roughly one year from peak to trough. It takes time to recognise that the downturn has started, then (in most jurisdictions) legislation needs to be passed, programs put in place, and funds spent. Only then does the private sector react. Even in the best of circumstances, the recession will be over by the time that this process is complete. What that means is that fiscal expansion will provide an impetus to the recovery once it gets going.

A second reason fiscal policy has been out of favour for the past thirty years has to do with political dynamics. Spending is politically popular. Elected officials are rewarded with re-election when they spend public monies. Tightening budgets to repay for previous largesse, even its purpose is to repay for previous expenditures intended to reduce the impact of a recession, is unpopular. As a result, with discretionary

fiscal policy, government debt has a tendency to rise during cyclical downturns but not fall during subsequent booms. That is, borrowing is not followed by repayment, so debt levels rise, albeit in fits and starts.

Given this consensus view, it is easy to see why stabilisation policy was assigned to an independent central bank with a price stability objective. Should we revisit this? Does it make sense for discretionary fiscal policy to become a tool for macroeconomic stabilisation?

I believe that the answer is no. That is, fiscal authorities should not stray from their province of structural policies designed to provide public goods and social insurance, thereby meeting the objectives of society. They should ensure that there is sufficient infrastructure investment, adequate regulation, enforcement of property rights, an income distribution consistent with national social norms, and the like. They should leave short-run stabilisation to monetary policy, with its ability to change interest rates quickly, frequently, and by large amounts when needed.

That said, we can think of a number of cases where explicit or implicit coordination between fiscal and monetary authorities is warranted. The first case is exemplified by the experience of the recent past. As the financial crisis intensified in late 2008, policy rates in the United States and Europe quickly hit zero. At this point, central banks entered previously uncharted territory, engaging in the unconventional policies discussed earlier. It surely would have been better at this point, in early 2009, for the government to engage in a discretionary fiscal expansion. The United States did this, but the view among some observers is that they could and should have done more. In parts of Europe, fiscal expansion would have been possible, but was not undertaken. Nevertheless the conclusion remains: when monetary policy has run its course, and the economy is still struggling, fiscal policy should provide a helping hand.<sup>53</sup>

A second instance where fiscal and monetary policy coordination may be called for is in the context of debt management policy. Since the sovereign term structure of interest rates depends on the maturity of outstanding public debt, it is the result of the combined decisions of the fiscal debt manager and the central bank. To see the point, consider the consolidated balance sheet of the government – that is, net out all of the sovereign liabilities that are central bank assets. And, recall that central bank reserves – commercial bank deposits at the central bank – are essentially zero maturity floating rate securities. When the central bank purchases a security issued by the fiscal authority, this shortens the maturity of privately-held government debt, replacing a long-term bond with reserves. This means that the maturity structure of privately-held government debt is determined by the combined actions of debt manager and the central bank.

While the interaction may be a mere curiosity most of the time, during periods of unconventional monetary policy, it is not. Take the case of the U.S. Federal Reserve's Maturity Extension Program. During the second half of 2012, the Federal Reserve redeemed \$667 billion in shorter-term U.S. Treasury securities and used the proceeds to purchase longer-term securities. The point was to drive down long-term interest rates. That is, once short rates were at zero, monetary policymakers then worked to flatten the yield curve. They did this both to lower expected future short rates, making their forward guidance

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<sup>53</sup> As an aside, one could ask if this is likely to be the normal state of affairs going forward. That is, will monetary policy hit the effective lower bound with some frequency, so that the discretionary fiscal policy is needed regularly? One can hope not, but we cannot rule it out.

more credible, and to lower term premia. And, by lowering long-term risk-free interest rates, the hope was that all long-term rates would follow.

Now, consider the consequences of the Fed's action from the perspective of the fiscal debt manager. Starting in 2007, U.S. Treasury debt more than doubled over a six year period, rising from less than \$6 trillion to more than \$12 trillion. The Treasury has a fiduciary responsibility to the public to borrow as cheaply as possible. That means issuing debt at the lowest interest rate it can find along the yield curve. So, if the Federal Reserve is pursuing a policy to push down long-term rates, isn't it the debt manager's obligation to issue long-term bonds?

Greenwood et al. (2014) address this question, and conclude that this did happen. They find that Treasury issues undid roughly one-third of impact of quantitative easing on the 10-year bond rate. So, while the Fed was able to drive the 10-year rate down by 137 basis points, Treasury issuance pushed it back up by 48 basis points, for a net impact of 88 basis points.

So, when monetary policy pushes short-term interest rates to zero (or its effective lower bound) there is need for fiscal policy coordination of two types. First, fiscal authorities may wish to engage in discretionary expansionary policy. And second, if the central bank is trying to reduce the maturity of publicly-held government debt, the fiscal authority's issuance policy should not be moving in the other direction.<sup>54</sup>

The overall conclusion is that in normal conditions, when interest rates are far from their effective lower bound, fiscal and monetary policy can operate independently. While they will take each other's actions into account, they need not coordinate.<sup>55</sup>

## V. Conclusions and a parable

My main conclusion is that monetary, prudential and fiscal policy each have their role. As has been the case for decades, monetary policymakers should be concerned with price stability, prudential policy should focus on financial stability, and fiscal policy should concentrate on providing the foundations for strong, stable and balanced growth. There are overlaps, so actions of one group of policymakers do have an impact on what goes on elsewhere. Information needs to flow and cooperation is important. But goals and objectives can largely remain separate.

This conclusion is justified by the fact that monetary policy has only very modest impact on financial stability. While central bank actions are transmitted to the real economy through the financial system, encouraging or discouraging actions that have implications for the level of systemic risk, these are not the

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<sup>54</sup>Our knowledge about the determinants of the sovereign yield curve is currently in flux. It is possible that we will learn that the maturity structure of government debt matters all the time. If that is the case, we will need to set up coordination mechanisms even when short-term policy rates above zero.

<sup>55</sup> There are surely a number of other examples of cases where coordination, or at least cooperation may be important. One involves automatic stabilisers. As Fatas and Mihov (1999) point out, the bigger the government, the more stable the economy overall, suggesting the less need for discretionary monetary stabilisation when automatic stabilisers are large. A second concerns the argument made by Sims (2016). He asks whether policies that expand the central bank's balance sheet can work to raise inflation in the absence of fiscal coordination. Specifically, whether monetary policy can be expansionary depends critically it being accompanied by expansionary fiscal policy that increases deficits. If, alternatively, governments take advantage of lower interest rates to lower debt service payments reduce deficits or create surpluses, monetary policy will be subordinated to fiscal policy. The case of Japan brings into question the empirical relevance of this logic.

first order effects. The implication is that the costs of monetary policy addressing financial stability are almost surely far in excess of the benefits. Instead, minimising the frequency and severity of financial crises is in the purview of the prudential authority. Capital requirements, liquidity requirements and stress tests for lenders; appropriate infrastructure for markets; and mortgage loan-to-value limits for borrowers are the appropriate tools to use to address financial stability risks. And the fiscal authority's power to tax and spend should remain focused on providing the services and redistribution that accord with society's preferences.

All of that said, it is surely possible to imagine cases when one policy does need intrude on what is normally the domain of the others. I have already mentioned the possibility of fiscal policy lending an expansionary hand when monetary policy has reached its limit. We can envision something similar for the case of monetary and macroprudential policy. Again, the case is extreme, but it is worth considering. To see when this might happen, consider the following parable.

Imagine that recent history in the fictitious country of Freedonia is as follows. Equity markets are booming, doubling in the last three years. Fuelled by skyrocketing debt, over the same period property prices have risen by a factor of four. Nonfinancial debt is now at a rarely seen 300 percent of GDP. Meanwhile, macroeconomic indicators suggest that the economy is doing extremely well. Real growth is stable at three percent, unemployment rate is at a close to full-employment level of five percent, real and nominal exchange rates both look to be close to fundamental values, and consumer price inflation is hovering around Reserve Bank of Freedonia's (RBF) two percent target.

Following best practice, Freedonia has divided the job of macroeconomic stabilisation among three groups. The Monetary Policy Committee's (MPC) primary objective is price stability. And, to the extent that it does not compromise the price stability, to support full employment and balanced growth. The Macroprudential Policy Committee (Macro PPC) has the task of ensuring that the financial system is resilient, reducing the frequency and severity of financial crisis. And the Microprudential Policy Committee (Micro PPC) is responsible for the safety and soundness of individual financial intermediaries.

Each of these committees has been doing their job. Focused on price stability and full employment, the RBF's MPC has been maintaining their target short-term interest rate at their estimate of the neutral level of five percent – that's five percent real plus two percent inflation. Seeing the boom in leverage, the Macro PPC has done what it can. For the lenders, it has raised the countercyclical buffer to two and one half percentage points, so that domestic systemically important Freedonian banks are now required to meet a requirement that capital be no less than twelve percent of risk-weighted assets. And, for borrowers, the maximum LTV ratios for residential mortgages are at the previously unheard of low of sixty percent.

Have the RBF policymakers done enough? Should the Macro PPC raise capital requirements or lower LTV limits even further? In reaction to higher capital requirements, nonbank intermediaries that operate outside the regulatory perimeter are taking over more lending activity. And, because of housing price appreciation, home owners seem unfazed by the LTV limits.

We can hope that such a circumstance never arises. But if it does, interest rate increases look to be the last hope. As Stein (2013) put it: "while monetary policy may not be quite the right tool for the job, it has one important advantage relative to supervision and regulation--namely that it gets in all of the cracks."

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