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THE NEW ART OF CENTRAL BANKING

Jagjit S. Chadha

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National Institute of Economic and Social Research
2 Dean Trench St
London SW1P 3HE
T: +44 (0)20 7222 7665
E: enquiries@niesr.ac.uk
niesr.ac.uk
Registered charity no. 306083

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Abstract

This article outlines some of the intellectual lessons learnt by central bankers during the financial crisis. The key question is whether a broader range of policy options than simple inflation targeting has to be considered in order to limit instability. Interactions with overseas pools of savings, government debt markets and financial risk have all conspired to complicate significantly the task of monetary policymaking. These developments do not mean that the target for inflation has to be modified or dropped but that setting policy will be a more complex task and require more explanation than it has in the recent past.

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Contact details

Jagjit S. Chadha (j.chadha@niesr.ac.uk), National Institute of Economic and Social Research, 2 Dean Trench Street, London SW1P 3HE

The New Art of Central Banking*

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Abstract

This article outlines some of the intellectual lessons learnt by central bankers during the financial crisis. The key question is whether a broader range of policy options than simple inflation targeting has to be considered in order to limit instability. Interactions with overseas pools of savings, government debt markets and financial risk have all conspired to complicate significantly the task of monetary policymaking. These developments do not mean that the target for inflation has to be modified or dropped but that setting policy will be a more complex task and require more explanation than it has in the recent past.

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†NIESR. Professor of Economics, University of Kent, Visiting Professor at the University of Cambridge. j.niesr.ac.uk. An earlier version of this paper appeared in the National Institute Economic Review, 2015, 234, (1), R27-R39 and this version is forthcoming in "Macroprudential Policy and Practice", edited by P. Mizen, M. Rubio and P Tuner, 2017.

The New Art of Central Banking.

"[T]he result has been not merely that the world has been insufficiently prepared to deal with the new problems of Central Banking which have arisen in the years since the War, but that it has failed even to attain the standard of wisdom and foresight that prevailed in the nineteenth century."

"Moreover, they should endeavour to adapt their measures of credit regulation, as far as their domestic position permits, to any tendency towards an undue change in the state of general business activity. An expansion of general business activity of a kind which clearly cannot be permanently maintained should lead Central Banks to introduce a bias towards credit restriction into the credit policy which they think fit to adopt, having regard to internal conditions in their own countries. On the other hand, an undue decline in general business activity in the world at large should lead them to introduce a bias towards relaxation. " In pursuing such a policy the Central Banks will have done what is in their power to reduce fluctuations in business activity..."

R. G. Hawtrey (1932).

"The received wisdom is that risk increases in recessions and falls in booms. In contrast, it may be more helpful to think of risk as increasing during upswings, as financial imbalances build up, and materialising in recessions."

A. D. Crockett (2000).

1. Introduction

Without doubt money and monetary policy making has evolved significantly. The original function of money was to allow trade with a standardised unit of account. A monetary policy would originally have implied simply some arrangement of institutional practice so that the right amount of commodity-based money could be used to facilitate the level of trade. It is

probably the case, as is still the case in many parts of the world, that large amounts of trade stood outside the monetary system and relied on barter or non-pecuniary grace and favours. Even standardisation was no easy matter as it is no simple task to set the correct relative prices between various types of monies and goods, ensure the absence of counterfeiting or clipping and decide on how to get the right amount of money into circulation.

The experiences of the late 18th and 19th centuries involved both a recognition that the monetary rate of exchange might be changed in the event of crises but also that the banking and financial system required regular bouts of support. The guiding principles were framed by Bagehot and the evolution of monetary orthodoxy, or sound money, was evident. This orthodoxy suggested some adherence to low levels of public debt in peacetime, a gold standard and circumspect choices in the policy rate. The suspension of the Gold Standard associated with World War I, the interwar boom and bust and the Great Depression provided an incentive and a 'Keynes-inspired' blueprint for the operation of countercyclical monetary and fiscal policy. Whilst it is not clear whether these policies were responsible for the economic recovery prior to World War II, it is clear that there had been a profound change in the responsibilities of government. From now on the rate of inflation and economic growth would continue to be the government's problem and an important backdrop to the assessment of the performance of political leadership - which at some level is rather odd given that the dominant models of economic fluctuations do not predict a permanent impact on output from monetary policy.

Accordingly, in the postwar period, there was an incredible intellectual effort to understand not only the mechanical interplay between monetary policy and the real economy but also how monetary policy effectiveness was a function of its interplay with private agents' plans and expectations. The elegant models developed allowed the study of optimal monetary policy and the development of strategies to minimise inefficient fluctuations in output, particularly in the aftermath of the end of Bretton Woods and the subsequent costly inflation and disinflation. The great mirage of the Long Expansion was that whilst it appeared that business cycle risks had been eliminated they were, in fact, increasing rapidly.

Once the risks became apparent, the economy quickly jumped to a world of profound financial constraints which acted to bear down on activity in a persistent manner. Interest rates hit the lower zero bound and public debt got stoked up to precarious peace-time levels.

Practically speaking two issues were then exposed, which have occupied much of the debate on the setting of monetary policy. How should policy makers deal with a response to large, negative economic shocks that seemed to threaten to exhaust policy ammunition? What kind of defences should be put up so that such shocks could not build up in the same way, or that stocks of policy ammunition would still be available? The former problem led to the re-discover of open market operations as a way of influencing longer term interest rates. And the latter problem led to the re-discovery of tools that act to constrain financial intermediation. But there is another issue that has become more relevant. As well as thinking in terms of normal times - with small changes from the steady-state - and abnormal times as the world we are now in, with low growth and extraordinary policies, it is becoming increasingly clear that there is a transitional state to work through. Debt does not disappear, default notwithstanding, overnight and so balance sheet repair is a tricky and time consuming business. Public debt will take time to get back to pre-crisis levels and financial intermediaries may eventually start to allocate capital to the most productive firms but at the same time, policy has to deal with nursing a sick economy rather than licking a healthy one into shape.

In this chapter, I examine the implications for policy from unbundling the consumption problem into lenders and borrowers. in Section 3 the main policy lever used in the financial crisis, quantitative easing. We shall go on to examine the case for macro-prudential instruments. The case for considering the policy nexus as some point in monetary-financial-fiscal space is still being explored but in this triplet lies a generalised way of thinking about policy and its transmission. In Section 5, I start to explore the need for further communication in order to guide people on possible central bank actions but also perhaps to elicit more information from people's private views. Finally I conclude.

2. Incorporating Risky Borrowing and Lending

In this section, we will examine the optimality conditions for a saver household and a borrower household.[1] We will examine the equilibrium from an unconstrained, and supply constrained perspective. And consider the case for macro-prudential instruments (MPIs) as a Pigovian tax. In this model, policy may operate either through the standard short rate set by the central bank or through operations in the bond market. Let us consider the standard consumer problem, for a saver, in a real, endowment economy, which we modify with a preference for holding bonds:

$$\max C = E_0 \sum_{t=0}^{\infty} \beta^t \left(\log C_t + \chi_t \log B_t \right), \tag{1}$$

where C is consumption of the saver household, E_0, are expectations formed at time 0, β is the discount factor for saver households and utility increases in consumption and the stock of bonds held, B_t, for which there is a stochastic level of preferences, χ_t. The saver households maximise consumption subject to their flow budget constraint:

$$C_t + D_t + B_t = Y_t + R^D_{t-1} D_{t-1} + R^B_{t-1} B_{t-1}, \tag{2}$$

where D_t are deposits with a commercial bank, R^D_t is the rate of interest on deposits, R^D_t is the rate of interest on one-period bonds and Y_t is the income endowment. The left hand side of (2) represents current period consumption and savings and the right hand side, represents disposable income. The standard optimality conditions for this problem include:

$$R^D_t = \beta^{-1} \frac{C_{t+1}}{C_t} \tag{3}$$

$$\frac{\chi_t}{B_t} = \left(\frac{1}{C_t} \right) - \frac{\beta R^B_t}{C_{t+1}} \tag{4}$$

[1] This section is a simplified version of Chadha, Corrado and Corrado (2013).

Savers have two assets in which to save, deposits with the commercial bank that yield the deposit rate, R_t^D, which we can also think of as the policy rate set by the central bank, as it reflects the costs of funding. They can also save in a period government bond, the yield of which has a wedge from the policy rate in the terms of the marginal utility from holding government debt $\frac{\chi_t}{B_t}$. Note that if this marginal utility is driven to zero, the R_t^B converges to the deposit rate, R_t^D. In both cases, we can note that the current level of consumption by savers is a negative function of both R_t^D and R_t^B and so the pool of savings is increasing in these interest rates.

Let's now consider the same problem from the perspective of a borrower rather than a saver, where C^b is the consumption borrower households:

$$\max C^b = E_0 \sum_{t=0}^{\infty} \beta^t \left(\log C_t^b \right) \tag{5}$$

Subject to a resource constraint:

$$C_t^b + R_{t-1}^D L_{t-1} = Y_t^b + L_t \tag{6}$$

where the borrowers can borrow at the deposit rate and receive their own income endowment per period. We can add a side constraint to the borrowing constraint, for which the Lagrange multiplier is v_t and takes this form:

$$L_t < \frac{k_t q_t W_t}{R_t^D}, \tag{7}$$

where lending cannot be greater than the one period discounted present value of collateralisable wealth, $k_t q_t W_t$, where k_t is the loan to value ratio, q_t is the asset price and

W_t is wealth, which normally comprises net equity in housing for consumers. The optimality conditions in this case include:

$$v_t = \left(\frac{1}{C_t^b}\right) - \frac{\beta R_t^D}{C_{t+1}^b} \tag{8}$$

which we can see will equate to the deposit rate, (3), if the constraint on borrowing does not apply i.e. $v_t = 0$. But the log linear approximation of this expression gives us the external finance premium, as v_t:

$$R_t^D + v_t \approx c_{t+1}^b - c_t^b \approx \dot{y}_{t+1}^b + n\dot{l}_{t+1}$$

and explains how today's consumption by borrowers is deferred if the loan rate, $R_t^D + v_t$, increases. We can then re-write this expression in terms of the resource constraint, (6), and write net lending as $L_t - R_{t-1}^D L_{t-1} = nl_t$ and if we substitute the lending constraint we can see that:

$$nl_t = \frac{k_t q_t W_t}{R_t^D} - k_{t-1} q_{t-1} W_{t-1} \qquad \text{(demand for loans)}$$

net lending is constrained by the growth of the present value of collateralisable wealth. So that any policy that acts on the borrowing constraint directly will act to reduce net lending. We shall return to this point. The supply side of the lending is the financial intermediary:

$$\max_{\pi} f\left(L_t\right) - (R_t^D) D_t,$$

assuming, for the moment, that $L_t = D_t$ and taking optimality conditions, with no risk premium then the marginal return from lending equals the costs of funding:

$$f^{'}(L) = (R_t^D),$$

but with a financial premium that results from the borrowing constraint then this condition is modified:

$$f^{'}\left(\frac{k_t q_t W_t}{R_t^D}\right) = R_t^D + v_t, \qquad \text{(supply of loans)}$$

As loans increase the external finance premium, v_t, falls for standard marginal conditions. An increase in policy rate will also reduce the finance premium. But if the supply through financial intermediation or demand does not price social welfare, we may have more lending than is socially optimal. There are three possible reasons why intermediation may not price social welfare accurately:

- Risk shifting - the borrower may walk away from the debt and not pay the principal back;
- Risk shifting - the financial intermediary may not need to make provisions for losses if the state (via taxes on savers) will pay;
- Consumption may move sectorally or in aggregate strongly with asset prices and become too procyclical.

Proposition 1 *Consumption of savers and of borrowers will be negatively correlated and this will act reduce overall business cycle variance of aggregate consumption.*

Proposition 2 *The unconstrained equilibrium will clear the savings market but in the presence of an external finance premium aggregate demand will be attenuated.*

Proposition 3 *The market determined external finance premium may not accurately reflect the social costs of financial intermediation, which may also vary over the business cycle.*

Lemma 4 *MPIs, as a Pigovian tax on intermediation, may eliminate the social costs arising from excessive (inefficient) financial intermediation.*

Figure 1 illustrates the basic case for MPIs, that flows from our analysis. The supply of savings increase in the real interest rate, R_t, which we can think of as some combination of the deposit rate and the bond rate. The level of aggregate consumption is set by the R_t, which determines the level of consumption by savers and borrowers. At the unconstrained equilbrium, the external finance premium, v_t, is driven to zero and consumption is maximised at C^* for both savers and borrowers. When we add in an external finance premium, the level of consumption for borrowers is lower and higher for savers. Indeed to the left of C^*, consumption of borrowers and savers at time t move negatively. Total demand in this economy is determined by the real interest rate, R_t, and the sensitivity of borrower household consumption to resultant changes in the external finance premium and we show an possible equilibrium C^{efp}. The external finance premium falls when real rates rise and increases when it falls.[2]

But if the supply of savings, which is intermediated through the bank does not price social costs of lending. Then it may be appropriate to place a tax on supply and this will tend to reduce further the consumption of borrowers. The lower level of consumption here by borrowers may act to reduce the build-up in risks over the business cycle.

[2]Note also that changes in the lending constraint will change the size of the external finance premium

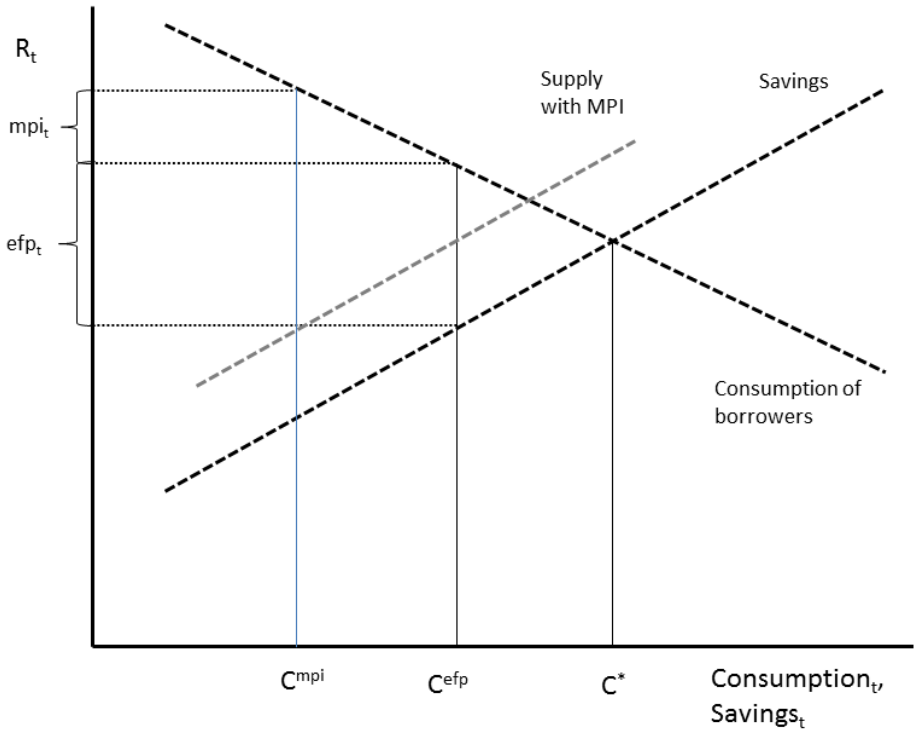

Figure 1: Saving and Borrowing with a Pigovian Tax

3. Quantitative Easing

Following the financial crisis of 2008 Quantitative Easing (QE) - which I define as large scale purchases of financial assets in return for Central Bank reserves - became a key element of monetary policy for a number of major Central Banks whose short term policy rates were at, or close to, the zero lower bound. But despite its widespread use, the question of the effectiveness of QE remains highly controversial. Given that consumption is tilted by either or both of a policy rate or the bond rate, then such policies may be able to offset constraints

on policy rates.

Effectiveness

Early work on the impact of large scale asset purchases as a tool of monetary policy probably began following 'Operation Twist' in the United States in 1961. Although not full Quantitative Easing in the sense of being financed by base money creation, this operation involved Federal Reserve purchases of long-term bonds (financed by sales of short-term Treasury Bills) as well as a change in Treasury issuance with the aim of lowering long-term interest rates. Modigliani and Sutch (1966) found that this operation had no significant effect on bond yields, though more recent work by Swanson (2011) has found that this operation had some significant market impact. In one of those interesting bits of interpretation the studies separated by over 40 years agreed on the basic impact in terms of basis points on yields but not on interpretation of their importance.

More recently, the QE programme implemented by the Bank of Japan from 2001 to 2006 generated new interest in unconventional monetary policy implemented through large scale asset purchases. In a survey of empirical evidence in the Japanese case, Ugai (2007) found mixed evidence. He concluded that the evidence suggested that QE had some signalling impact on market expectations in the sense of confirming that interest rates would remain low for some time, but the evidence on whether the QE operations had any direct effect on bond yields or risk premia was mixed. However, Bernanke et al (2004), examining the Japanese experience with QE, found little by way of announcement effects but some evidence from a macro-finance yield curve to suggest that Japanese yields were roughly 50bp lower than expected during QE. Unsurprisingly perhaps, the QE programmes implemented in the aftermath of the 2008 financial crisis have led to a dramatic increase on research in this topic. Most notably, the Federal Reserve's QE programme has spawned a large and rapidly growing literature. In the US case, despite a wide range of methodological approaches, there is near-unanimous agreement that the US programme had significant effects on longer-term bond yields though estimates of the scale of the effect vary considerably. For example Gagnon et al (2010) find that the $300bn of US bond purchases, which amount to approximately

2% of GDP, resulted in drops of some 90bp in US 10-year Treasuries, while Krisnamurthy and Vissing-Jorgensen (2010) find that a reduction in public debt outstanding of around 20% of GDP would reduce yields by between 61and 115 basis points. So far, the UK's QE programme has attracted less interest. Empirical estimates of the impact of the initial £125bn of QE and then the full £200bn (14% of GDP) on UK gilt yields by Meier (2009) and then Joyce et al (2010) suggest that yields are some 40-100bp lower than they would have been in the absence of QE. Caglar *et al* (2011) do, however, suggest that the event study methodology may have overestimated the effects because of the dominant, possibly exaggerated, impact of the first rather than the subsequent six announcements.

QE as an open market operation

Generally speaking, quantitative easing is really just an extended open market operation involving the unsterilised swap of central bank money for privately held assets. The key difference is that the duration of the swap is both intended to be long-term and of uncertain length. An open market operation, if unsterilised, leads to an increase in the quantity of base or outside money. This money represents claims on the public sector and will not be neutral with respect to any given expenditure plans if there is a real balance effect that induces a fall interest rates. This is because the increase in money changes the price of claims on the public sector. If, however, the private sector fully discounts the present value of taxes that will need to be paid to meet these obligations then these bonds will not represent net wealth and the operation will be neutral. The debate on the efficacy of such operations hinged on the question of whether the supply of outside money changed the wealth position of the private sector (see Gale, 1982).

But the analysis of such operations lay outside the remit the workhorse New Keynesian (NK) Model in which the evolution of monetary aggregates, which were simply a veil by which real planned transactions were effected, provided no additional feedback to the state of the economy. These models are highly tractable and were used to develop simple, precise policy prescriptions, even at the lower zero bound of Bank rate, by influencing expectations of the duration of any given level of Bank rate in order to induce exchange rate depreciations

or positive inflation shocks and so close any given sequence of output gaps in expectation. In these models, open market operations were neutral because at the lower zero bound money and bonds become perfect substitutes and any swap of one for the other does not change the wealth position of the private sector. In fact, in these models QE-type policies are simply forms of commitment strategies that provide signals about the long term intentions of the central bank to hit a given inflation target.

The NK argument that monetary policy can only work through the management of expectations is not a universal result as it relies on particular assumptions. In these models, financial markets are complete in which a representative agent can spring into life and financial wealth is allocated over an infinite life. Idiosyncratic risk in these economies can be hedged and asset prices depend on state-contingent payoffs. In this case, the price of financial assets are not influenced by changes in their net supply, as demand is perfectly elastic. It seems quite possible though that demand curves for assets, particularly which are issued in large quantities, may become downward sloping, in which case changes in net supply can affect their relative prices. This possibility then means that the relative supply of money or credit can influence market interest rates and so impact directly on expenditure paths without having to rely on pure signalling effects. It is this possibility which gives quantitative easing its influence.

4. Macro-prudential instruments

There is no workhorse model (yet) for understanding financial frictions. But Hall (2009) provides a useful taxonomy. He reminds us that an increase in any financial friction will tend to increase the interest rate wedge between those who provide capital and the cost of capital paid by firms and such a wedge will tend to depress output and employment. The story is similar to the Diamond-Mirrlees analysis of the inefficiency of taxation of intermediate product, with capital playing the role of an intermediate product. The legs of the argument are that an increase in financial frictions acts to increase the price of capital and so reduce its demand and because of the economy-wide resource constraint this will increase both

the output-capital ratio and the consumption-capital ratio accordingly. Through the Cobb-Douglas production function the labour-capital ratio rises along with the output-capital ratio. And the lower level of capital induces a fall in output. The argument goes through in the opposite direction with a fall in the size of financial frictions. Indeed under this kind of analysis financial frictions are embedded in the supply side of the economy and may be particularly hard to understand in a NK model, which concentrates on demand and cost-push shocks in the production of goods.

Monetary and Financial Stability

It is possible to take the view that financial and monetary policy should simply run in tandem. So that managing the latter well also requires attention to be paid and information to be exchanged in the pursuit of the two objectives jointly. Indeed the historical record suggests a similar juxtaposition - that the nature and scope of the regulation of financial intermediation was closely linked to the monetary policy regime. And so the immediate postwar period with the Bretton Woods system of fixed-but-adjustable exchange rates was associated with both extensive regulation of the financial system and also the virtual elimination of banking crises, apart from in Brazil in 1962.[3]

But the cost of such extensive supervision, was such that it is probably the case that the financial system did not allocate investment particularly efficiently over this period and momentum for deregulation built up to a considerable degree. In principle therefore there is a trade-off between designing instruments to stabilise the financial system and prevent excessively volatile financial outcomes and ensuring that the financial sector retains the correct incentives to locate investment opportunities and allocate funds accordingly. It is not initially clear that employment of macro-prudential instruments (MPIs) in single currency area can work independently of further controls on the movement of capital across currency regions, particularly when financial intermediaries have interests overseas. And so what we are looking for are instruments that will work given some form of monetary policy regime that closely resembles what we currently have in place.

[3]See Allen and Gale 2007, Chapter 1 on this observation.

From the perspective of monetary policy makers, the initial debate was whether inflation targeting could be modified so that an additional instrument could be used to stabilise financial imbalances or directly control the extent of financial intermediation. The answer that emerged prior to the full force of the financial crisis was understood was that there was limited scope to do much. As previously outlined, Bean (2004) argues that it is optimal under discretion to ignore any asset price boom and only mitigate any fallout on collapse and under commitment it turns out there is even less incentive to stabilise output when the economy is overheating. Svensson (2009) considers that 'flexible inflation targeting' that stabilises output and inflation may have an occasionally binding constraint to ensure financial stability and booms (busts) can justify an inflation undershoot (overshoot), as well as an extended period of adjustment back to target. Even if a limited number of modifications to monetary policy operating procedures are sufficient to stabilise macroeconomic outcomes, they may not be enough to realise financial stability for which appropriate supervision and regulation are unlikely to be replaced simply by new instruments.

Actually, it turned out in the event that another instrument was developed but this was quantitative easing and was designed to deal directly with the lower zero bound constraint. The purchase of gilts under QE1 seems to have driven medium term yields down by the extent to which they might have been expected to fall had short term interest rates been lowered by some 2-4%. The swap of reserves for bonds has not palpably augmented bank lending but the counterfactual - with a changing regulatory framework for liquidity in prospect and a large shortfall in output below its pre-2007 trend - is rather hard to evaluate. There seems to be no attempt to consider using this stock of bonds held to help regulate the financial system on an ongoing basis. Under risk aversion financial intermediaries cannot create sufficient liquidity and so in principle the central bank can regulate the flow of liquidity over the business cycle in order to prevent excessive amplification of the business cycle by financial intermediaries.[4]

In fact a number of non-conventional monetary policy tools have been developed here

[4]See Gale (2011) on this point who also argues that when risk appetite is high, too much liquidity can be created.

and overseas that might have implications for both monetary and financial stability. In recent work, Caglar *et al* (2011) found that each of a number of non-conventional tools augmented the stabilising properties of the interest rate rule from each of the asset (via reserves) and liability (via bank capital) side of a bank's balance sheet as well as preferences of household to hold short run bonds and also implied less financial volatility. Overall non-conventional tools would seem to have some financial stability considerations, there is (i) guidance or signalling, which includes the recent fashion for central bank forecasts of policy rates for extended periods, which fits in with both the New Keynesian orthodoxy, in which monetary operations do not impact on net wealth and therefore do not affect consumption but might impact on the expected path of interest rates, but also with an older tradition of the 'governor's eyebrows'; (ii) there have been temporary liquidity injections of reserve money, or extended OMOs, which are essentially QE; (iii) the direct purchase of distressed assets. And on the fiscal side, there is bank recapitalisation and credit easing and although in the latter case, this has come to mean in the US context the composition of the CB balance sheet rather than direct lending directly to the private sector. So I think we have (i) signalling; (ii) liquidity; (iii) asset support; (iv) fiscal policy. Clearly, there are elements of one in each of the others and any operation is surely tantamount to a signal of some sort, as well as providing some fiscal support by reducing the cost of debt service - each of these can be viewed through some lens as a form of MPI.

Loss Function

MPIs might involve capital, margin, liquidity and equity-loan ratios. There is a danger that, given the recent experience of an overextended financial system, the mindset with which we are pursuing the development of MPI implies an asymmetric concern with the stability of the financial system, rather like that with the foundations of a building or the construction of a dam, so that we are in general concerned with reining in excessive intermediation rather than too little. Put rather bluntly: who on the FPC would lose their job if the financial system were considered to be excessively safe compared to the converse?

But an asymmetric loss function does not necessarily have to be pursued asymmetrically.

The policy maker simply has to pursue a slightly different target. This is because the minimum loss of an asymmetric loss function, such as that presented in Figure 2, is not at the minimum but at some point in the opposite direction of the steeper asymmetric loss. As drawn for the minimum would lie to the left of the 0. In fact it would be given by a term in governing the asymmetry of the function and the likely size of any shocks. So the target will be driven further to the left for larger shocks and greater asymmetry in the loss function. Once this principle has been established it makes sense to develop steady state targets that build in a precautionary target for more liquidity, capital and equity to loan ratios than a strict minimum might imply.

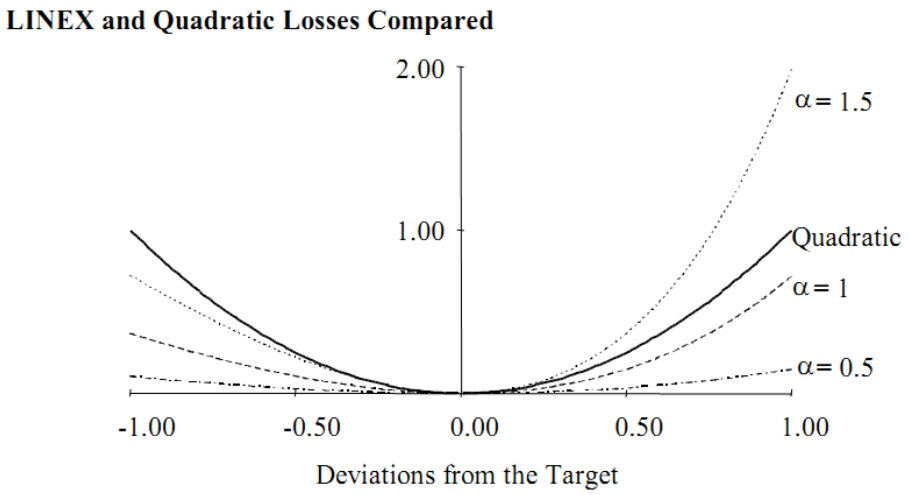

Figure 2: Asymmetric Losses

Target and instruments

As is rather well known, we want to count the number of independent instruments and objectives. In the current set-up, the MPC will continue to set Bank rate to pursue the inflation target and it will be the FPC that will have instruments at its disposal to pursue

financial stability. To the extent that we cannot be sure about the impact of any instrument, Brainard uncertainty introduces a trade-off between the achievement of the target and the minimisation of uncertainty induced by the use of an instrument. There are two further problems here in the case of MPIs, (i) there is likely to be considerably more uncertainty with a set of untried instruments that may also have a correlation structure with each other but (ii) also because they may alter the behaviour of the financial system, they will impact directly on the impact of any given stance of monetary policy.

On the first point, it might be that we can treat the new MPIs as a portfolio of instruments that jointly will reduce the idiosyncratic risk of using any one new instrument. But without specification, calibration or testing of the impact of any one instrument in combination with the others, we cannot probably be very sure at all whether such a portfolio of instruments will be available. The discussion paper might therefore give more thought not only to which instruments may be used but how they might be used together and in a manner that does not induce greater uncertainty into the operation of monetary policy.

To the extent that changing the constraints faced by financial intermediaries will alter the financial conditions, as the choice made on the quantity and price of intermediation will be affected, there may not only be an impact on the appropriate stance of monetary policy but also an impact on the appropriate MPIs conditioned on the monetary policy stance. Consider a world in which the monetary policy maker wishes to smooth the response of consumption to a large negative shock to aggregate demand and reduces interest rates faced by collateral-constrained consumers. Simultaneously, financial stability may be considered to be threatened and various MPIs may be tightened, which would act against the interest rate changes made by the monetary policy maker and may need further or extended lower rates of interest rates. If on the other hand, sufficient precautionary moves had been made by the FPC in advance there may be no immediate conflict.

Operating MPIs

MPIs may be used to help stabilise the financial system over the business cycle. There are though quite separate issues to consider when designing MPIs to help stabilise a reasonably

well functioning financial system, which might be thought of leaning against the wind, and in considering the correct responses for a highly vulnerable and undercapitalised financial system. The former implies the use of cyclical instruments to prevent a problematic build up of risk and the latter some attention to the superstructure of the financial system with individual firms and the sector as a whole not only able to withstand shocks but sufficiently robust as not to amplify them.

And yet the financial system is already undergoing a considerable deleveraging that has involved a build up in core capital, increased holdings of liquid assets and greater margin requirements. In a sense the financial system is moving from a loose regime to another tighter one but too fast a transition may have unwanted macroeconomic consequences. The extent to which difficulties in obtaining finance may constrain the investment or consumption plans of some firms and households may imply that although what may be optimal are tougher long run regulatory targets there may be some sense in thinking about how to allow the divergence from these targets for extended periods. Rather like a credible fiscal regime that ensures sustainable public finances is one more likely to allow the full force of automatic stabilisers to operate. In this sense, if banks are forced to observe a target at all times, this may be counterproductive for the system as a whole. It is an example of Goodhart's (2008) taxi: where a taxi at a railway station at night could not accept a fare because of a regulation that at least one taxi had to be at the railway station all the time.

One of the results to emerge from the analysis of monetary policy is that the control of a forward-looking system is best achieved by setting predictable policy that allows forward-looking agents to plan conditional on the likely policy response. There has been considerable work to suggest that the impact of monetary policy is a function of both the level and the path of interest rates, which is likely to be closely related to predictability. As well as thus evaluating instruments, the a FPC will have to pay careful attention to how expectations of changes in MPIs are formed and whether partial adjustment towards some intermediate or cyclical target for a given level of capital, liquidity or loan-to-value will be adopted. The alternative of jumping to new requirements may induce large adjustment costs for

the financial sector and the use of considerable resources to predict future movements in requirements. The private sector may also be induced to bring forward or delay financial transactions depending on the expectations of collateral requirements. In a slightly different context, the pre-announced abolition of double rates of mortgage interest relief at source (MIRAS) may have played a role in stoking some aspects of the house price boom of the late 1980s.[5] Under some circumstances, such a response reflecting strong intertemporal switching may be entirely what an FPC may wish to bring about but, more generally, when agents are well informed and forward-looking some thought has to be given to developing a framework for understanding agents' responses to any expected or pre-announced changes in the rules governing financial intermediation.

Monetary Policy and Liquidity

Some recent work on the nexus of MPIs and monetary policy does suggest that there may be a complementarity. The widespread adoption of non-conventional monetary policies has provided some evidence on the efficacy of liquidity and asset purchases for offsetting the lower zero bound. Central banks have thus been reminded as to the effectiveness of extended open market operations as a supplementary tool of monetary policy. These tools can essentially be thought of as fiscal instruments, as they issue interest rate bearing central bank liabilities. These instruments are placed in the government's present value budget constraint and the consequences of these operations in a micro-founded macroeconomic model of banking and money is examined. The responses of the Federal Reserve balance sheet to the financial crisis are mimicked. Specifically, the role of reserves for bond and capital swaps in stabilising the economy and also the impact of changing the composition of the central bank balance sheet is examined. It is found that such policies can significantly enhance the ability of the central bank to stabilise the economy. This is because balance sheet operations supply (remove) liquidity to a financial market that is otherwise short (long) of liquidity and hence allows other financial spreads to move less violently over the cycle to compensate.

The case for the systematic use of balance sheet or reserve policies can also be examined.

[5] See Lawson (1992) on this point.

Because compared to a model that does not explicitly model bank balance sheets, more recent models can deliver an endogenous dynamic response for various risk premia and for the supply of loans and deposits. Using standard DSGE methods, we can also compare the responses of our artificial economy with and without reserve injections. Having approximated the welfare of the representative household, it is found that the economy in which commercial banks have an endogenous choice over reserve holdings performs better in welfare terms than when commercial banks do not have such an choice. The holding of reserves over the business cycle acts as a substitute for more costly provision of illiquid commercial bank assets and thus reduces the volatility of interest spreads to shocks, and varying the availability of reserves over expansions and contractions, acts to help stabilize the impulse from the monetary sector.

But the work, in my view, is rather at an early stage and has yet to be tested under more uncertainty under instrument choice. It would be useful to summarise some of the emergent literature as well, which I cannot do here under the time constraint. And there are a number of missing elements to the analysis: (i) the consideration of fiscal policy, which if excessively expansionary may induce increases in liquidity premia, or may be in a position to offset liquidity shortages by trading long run debt for short run liabilities and (ii) the consideration of non-linearities or discontinuities in responses e.g. from bankruptcy. That said, there may be some gains from jointly determined MPIs and standard interest rate responses, conditioned on sustainable public finances, may lead to welfare gains for the representative household.

Following the financial crisis, and need to undo the Separation Principle for monetary and financial stability, we can agree there are missing instruments and there is a hunt to locate ones that can be employed, or suggested for us, by the FPC. I remain concerned as to how long run targets for capital, liquidity and asset-mix and lending criteria will be set and whether a bias to over-regulation may be set in train. It is not at all clear how many new cyclical MPIs will interact with each other and impact on the setting of monetary policy. A reverse causation is also possible, whereby the stance of monetary policy may have implications for the correct setting of MPIs. The management of expectations over

any announcements of changing MPIs will be a crucial area in a modern financial system - it was probably significantly easier in a world of extensive capital and exchange controls that characterised the immediate postwar period. All that said, early results from a new generation of micro-founded macro models do suggest that there may be significant gains from getting the calibration of these new instruments right but much work remains to be done.

5. The Interaction of Government Debt, Monetary policy and Financial Policy

In some senses the classical monetary model places a lot of the action off stage and so brings into focus the heroic role of the monetary policy maker. Actually there at least two key interactions that both limit and channel the actions of the monetary policy maker: fiscal policy and the operations of the financial sector. A further interaction concerns that between the financial sector and the fiscal policy maker, as we consider the role that public sector purchases of financial institutions played in stabilising the financial sector and also the extent to which financial sectors liabilities are hedged with government IOUs of one sort or another. We must have a happy triumvirate.

The fiscal policy maker is typically charged with respecting the government's present value budget constraint, which means establishing plans for expenditure and taxes that mean the level of debt is expected to be (low and) stable under likely states of nature. The financial sector operates to translate savings into stable returns by intermediating between current investors and consumers and future investors and consumers, otherwise known as savers. The stable income streams offered by the government sector may be of value to the private sector as it seeks nominal or real payments that are stable in the face of business cycle shocks. And may provide a benchmark for the construction of other market interest rates. The monetary policy maker sets the costs of funding for the financial sector and also has a huge influence on the costs of funding government debt. The level of economic activity depends to a large degree on the financial and fiscal sector so it is an outcome of the central

bank's responses to the behaviour of these two sectors.

And I am not necessarily arguing that there is a need for explicit co-ordination. But the Nordhaus (1994) example of monetary-fiscal interactions may be instructive if not completely comparable to that of the financial sector and our triumvirate. Consider a y-axis representing economic activity and the x-axis interest rates, R. Also accept that a conservative bank chooses a preferred level of interest rates for every level of activity on a path that will tend to drive the economy to its preferred point. The financial sector (let us put the fiscal sector aside for the moment), may be stabilising and act to drive up activity when it is below the socially preferred point and help bear down on it when activity is above the socially preferred point. This is because asset prices and market interest rates may act to generate levels of activity that act as a conduit from monetary policy to the overall level of activity back to some notion of long run equilibrium.

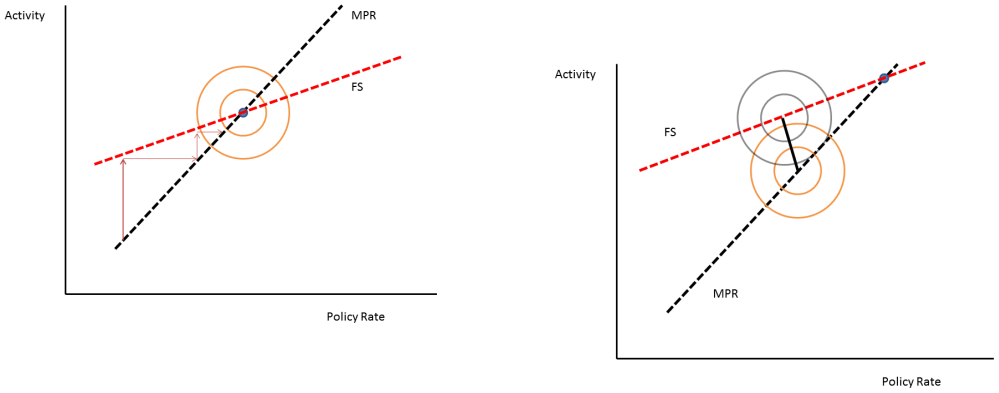

Figure 3: Monetary-Financial Co-operation

Monetary-Financial Tension

So in normal times, the central bank relies on the financial sector to be stabilising and carry out a large part of the stabilising response. But in times of boom and bust it may stoke up excessive fluctuations in activity. Which begs the question of why any financial

agent pursue plans that differ from those the central bank might choose? One, because it has different preferences, two, because it has different information and three because it will not bear the consequences of its choices. As a result without any co-ordination, the Nash equilibrium may imply high interest rates. But the respective bliss points for monetary policy, MPC, and for the financial sector, FS, imply a contract curve along which losses for each policy maker will be less than under the Nash equilibrium, which means that some form of co-operation is to be preferred.

Whether that co-operation can be constructed in a manner that brings us firmly back to our preferred equilibrium is the key question for the economic settlement after the crisis.

6. Forward Guidance and Nominal Regimes

The challenges posed by the consequences of the financial crisis and specifically from the need to manage the exit from an ultra-loose monetary stance and return to normalcy have led to further improvements in the way central banks speak to the market and the wider economy. Forward guidance about the future path of policy has become a staple of central bank communication although the world's major central banks are yet to adopt the fuller disclosure model pioneered by the trailblazing Reserve Bank of New Zealand and subsequently in Scandinavia. There is a case for completing the forward guidance provided by those major central banks: we believe central banks should describe how they expect policy to evolve in the future in the form of probabilistic statements which both reflect and explain their understanding of the scale of uncertainty about the future and, correspondingly, in terms of density functions that encompass their likely responses.

Back to basics: distributions matter

The idea that distributions should take centre stage in the internal policy debate is not controversial and so neither should be the suggestion that central banks ought to publish probabilistic statements about the current and future stance of policy. There is a near-universal consensus in the academic literature that the stance of monetary policy should reflect the range of possible outcomes, not just the single most likely outcome (the mode).

Under certain strong assumptions it is quite proper for the central bank to act as if it is certain about the future - that the economy will follow the path implied by the mean. But even then, to calculate the mean we need to know the entire distribution, and if we relax those strong assumption, richer features of the distribution - the spread and the skew - start to matter too. In short, central banks may need to look at the distributions of possible outcomes when setting policy, and for a given view about the optimal strategic response to particular circumstances, that implies a distribution of outcomes for the policy rate. That internal analysis allows policymakers to reach a conclusion on how the optimal policy stance is most likely to evolve, but it also quantifies the uncertainty around that path. By focusing on the range of possible outcomes policymakers would be better placed to design a state contingent strategy - how policy should respond in various off-central case scenarios - which could then feed back into the calibration of the current stance. The question for policy makers is the extent to which this internal debate should be open to scrutiny.

Mission possible: Forecasting distributions

Seasoned economic forecasters may have a reasonable idea about the most likely conditional path for any particular macroeconomic variable. What is required is a model of how key macroeconomic variables behave jointly and some forecasts for the most likely outcome for the exogenous inputs to that model that can then be judiciously combined with expert judgement on where the economy is heading. Forecasting distributions - constructing density functions for the future value of macroeconomic variables - is a rather more complex task because we have to take our uncertainty and ignorance about how the economy behaves much more seriously.

The process of building coherent forecasts of the range of possible outcomes would inevitably involve combining outputs from a wide variety of sources and methods. Analysis of the data and forecast errors provides a crude guide to the potential variance of individual series and the scale of uncertainty around projections. Theoretical models can provide a guide to the likelihood of different scenarios (the joint occurrence of particular outcomes for a range of variables) given repeated simulations based on assumptions about the range of

possible outcomes for those exogenous inputs. However, one would have to average across a diverse suite of theoretical models, covering different features of the economy (and diverse calibrations of each particular model), to capture our uncertainty about how the economy behaves. Likewise, empirical models can be used to generate forecasts for joint distributions, again using a suite of models approach (Wallis, 2005).

The output of these models can also be supplemented with information extracted from options markets, where prices reveal the views of market participants about the distribution of possible outcomes. Last, but by no means least, the producers (central bank staff) and consumers (the policymakers) can apply judgement to these distributions to address the limitations of the forecast process - instances where the past is unlikely to provide a reliable guide to the future. To give just one example, one might reasonably expect to observe a structural break in the dynamics of the financial cycle after the financial crisis, given that the rule book of microprudential regulation has been re-written and that a new macroprudential policy regime has been created to damp the financial cycle, and that will have implications for the future dynamics of the variables that tend to dominate the monetary policy debate, as well as the transmission mechanism of monetary policy.

One critical point is that the information used to calibrate these distributional forecasts implicitly or explicitly assume that the stance of monetary policy will respond in some fashion to changing economic circumstances, which in turn should stabilise the system at least to some extent. The data used to train theoretical and empirical models will incorporate those previous monetary policy response and as long as market participants anticipate a policy response in the future, then so too will financial market prices. It is actually much harder to construct distributional forecasts of what could happen to output and inflation in the future on the extreme assumption that policy will not respond, given the lack of theory and data on what would happen to the economy when the nominal anchor is removed.

Of course, the implicit policy response embedded in these distributional forecasts of output and inflation may not accord with policymakers understanding of their loss function and hence their views of what constitutes optimal policy, which is how they should and

would respond over a set of given circumstances. But that is the ultimate prize of this work agenda as it forces policymakers to take a stand on monetary strategy, they can arrive at internal consistent statements about the range of possible outcomes for the macroeconomy and the policy stance and then present these to the outside world for examination.

Revealed preference and the costs and benefits of clarity

For a central bank that is trying to implement optimal policy the question is simply whether to publish this information and explicitly communicate how the stance of policy might evolve in the future. There are three standard arguments against publishing this information, all of which relate to the risk that private sector agents will misinterpret a probabilistic statement about the future path of rates as a promise to deliver the most likely path. First, agents may take rash decisions leading to financial instability at the micro and perhaps macro level because they will not understand the scale of rate uncertainty. Second, the central bank's reputation (and hence its capacity to perform its core functions) may be damaged when rates deviate from the perceived 'promise'. Third, agents will herd on the signal in an environment in which beliefs about others' beliefs, so-called higher order beliefs, matter (Morris and Shin, 2000).

These concerns apply to all forms of central bank communication about the future path of policy. By revealed preference, central bankers do not find these arguments over-powering given their increased use of forward guidance, including narrow ranges for the level of the neutral rate and point estimates for the future path of rates. It is therefore the case that complete forward guidance, which nests statements about the future path of policy within a rigorous depiction of the uncertainty about that path, should be less vulnerable to these concerns than the current mode of communication. Emphasising the uncertainty should discourage agents from treating the modal optimal path as a promise.

Once you have taken the decision to start talking about the future - which the major central banks clearly have done so - emphasising the range of possible outcomes is the best defence against being seen to make promises or encouraging herds to form. Better still central banks may wish to encourage the revelation of information from the private sector

by explicitly saying that published forecasts do not have a clear understanding of the risks to Factor X or Factor Y. Unsubtle hints, narrow interval estimates and certainly point forecasts are far more prone to misunderstanding and herding.

If we can dismiss the costs of complete forward guidance, what are the benefits? Communicating the extent and sources of the uncertainty around the future path of policy should help to remove the sources of volatility in asset prices in markets and behaviour in the real economy that reflect Knightian, unmeasured, uncertainty about the central bank's strategy. Internally consistent and transparent distributional statements about the outlook and the policy response would reveal the central bank's assessment of the economy and reaction function. It is then up to private sector agents to optimise - to spend or save, and how to allocate their portfolios - given their private information and beliefs based on this comprehensive description of the central bank's strategy.

In addition to this timeless case for complete forward guidance, there is a more powerful case for enhanced communication about the future path of policy at the current juncture given the heightened uncertainty about the exit strategy from emergency policy settings. The considerations which that will shape the normalisation of policy rates and the likely end point of that process are unclear. To make matters worse it is unclear how that process will interact with the unwinding of the asset purchase programmes that some central banks undertook during the crisis. Finally, there is the added complexity created by the scope for micro- and macroprudential interventions during the exit process which might have macroeconomic consequences and should therefore be reflected in the stance of monetary policy. All things considered, the outlook for policy, and in particular the underlying strategy of central banks, is unusually uncertain as we approach exit. In the absence of a clear statement of how policy could evolve along different paths for the economy there is a risk that seemingly trivial comments or decisions by policymakers or pieces of economic news (e.g. the so-called Taper Tantrum in Spring 2013) could have a disproportionate impact on markets, as investors radically revise their priors on the central bank's strategy, and therefore indirectly the real economy too.

To fix ideas let us explain the communication reforms that could be undertaken, where the Bank of England has already made considerable progress on this front of late. At present the Bank publishes fan charts (which illustrate the range of possible outcomes for each quarter of the forecast) for key macro variables (i.e., GDP growth and inflation) which that are conditional on a particular assumption about the policy stance (i.e., the path of Bank Rate and stock of purchased assets). The Bank might instead publish a set of internally consistent fan charts for both key macro variables and the policy stance (Bank Rate and the stock of purchased assets) which are conditioned on the Committee's view of the monetary policy reaction function over the forecast horizon.

These new fan charts would provide the Monetary Policy Committee's best estimate of both how Bank Rate and the stock of purchased assets are likely to evolve and the uncertainty around those paths that reflect the Committee's assessment of the economic outlook and the optimal response. The nature of that uncertainty could be explained by incorporating scenario analysis into the communication strategy. To be fair, the Bank has started to do precisely this: describing the sensitivity of the economic forecasts to particular assumptions, but the all-important policy response in these scenarios is absent. What we have in mind is a detailed discussion of precisely how policy responds in these scenarios to demystify monetary strategy and earlier work by Chadha and Nolan (2001) does not suggest that such attempts increase market perceptions of volatility. Indeed, these fan charts could form the basis of a broader discussion about central bank strategy. Consider the following two examples.

Example 1: The Bank could publish fan charts for policy variables which stretch over a longer time horizon than the economic forecasts (three years) to provide information about the entirety of the exit strategy. For example, the Bank could publish fan charts for the level of Bank Rate further into the future, to shed light on the uncertainty around the level of the neutral rate, the time taken to get there and the distance Bank Rate might be from neutral at that point given the potential for shocks to hit the economy at any point. Likewise, the Bank could publish fan charts illustrating the uncertainty around the expected run-off date

for the stock of purchased assets to provide information to the gilt market on the net supply of bonds.

Example 2: The Bank could use the fan charts as a vehicle to explain the interaction between macroprudential and monetary policy in a possible future upswing of the financial cycle - for example, the emergence of a bubble in the residential property market. The macroprudential remit has been drawn to allow policymakers to intervene in the pursuit of broader economic stability, beyond safeguarding the resilience of core financial institutions. Exactly how policymakers will intervene, with what instruments, to what effect, and to what end is less clear given the absence of clear framework for macroprudential policy. That in turn leads to uncertainty around the circumstances in which monetary policy will be used as a first, intermediate or last line of defence to tame the financial cycle.

Communication by a Committee of Experts

Institutional arrangements for the conduct of monetary policy vary from country to country. In almost all cases, policy is set by committee, and in most of those cases, the members of those committees are encouraged to express their individual view. Many central banks already publish the pattern of votes within the policy committee, albeit with a lag. (Any delay creates needless speculation and volatility; the case for publication of votes alongside the decision is strong.) However, from time to time members of those committees are likely to disagree about more than just the current policy stance. Differences of view about the overall strategy - for example the relative merits of an early but gradual exit from the lower bound versus late and rapid - and the potential for those views to evolve are a genuine source of uncertainty about the outlook for policy and therefore the system. This is information which could, and we think should, be put into the public domain alongside the fan charts representing the views of the committee as a whole. Rather than asking policymakers to make point forecasts of the policy stance several years into the future (the FOMC dots) we propose publication of probabilistic statements which reflect and respect uncertainty. Given that uncertainty or news itself is increasingly thought to be a possible driver of the business cycle (see, for example, Schmitt-Grohe and Uribe, 2012), it is time

for central banks to come clean on the various interest rate strategies that are under active consideration.

7. Concluding Remarks

I am not sure that wisdom and foresight has necessarily been lost in the search for a simple, credible monetary policy. The ultimate decisions of any policy rely on judgement and that can, unfortunately remain faulty even in the presence of wisdom and foresight. Whilst both judgement and intuition are often formed with reference to the experience of working with models. But because no model can provide a perfect guide to the menu of choices, we must learn not only to choose which ones are useful and for policy makers but also to think through the implications of our models being wrong. The robustification of policy may mean working through the implications, however unpalatable, of the unlikely as well as the preferred circumstances.

Some difficult lessons have been learnt over this crisis that bear repeating. First and rather obviously, inflation targeting alone cannot prevent boom and bust and needs to augmented with more instruments and better judgement. The operations of the financial sector through the creation of various elements of broad money and also at the lower zero bound, as it changes its demand for central bank money, complicates choices about the path and long run level of Bank Rate. Policy rates are not being ever so slightly perturbed near their long run normal level but the duration of rates at very low levels is stretching patience. MPC members did not take on the job to set interest rates in order never to move them over the duration of their appointments.

Not only do financial frictions complicate the choices of policy makers because changes in the financial settlement may make the transmission of policy hard to gauge act but they have always acted through the both traditional supply and demand side. This means that they make capacity judgements very hard and it is probably the case, the key monetary policy judgement involves that on working out the current and likely future levels of spare capacity in any economy. The sensible application of liquidity and capital targets via macro-

prudential policy may seem likely to reduce business cycle variance albeit at some cost of permanent output and so transitional judgements will have to be even more careful than usual not to treat the permanent as the temporary and *vice versa*.

The interactions between fiscal, financial and monetary policy not withstanding. We also now accept that fiscal policy as well as underpinning aggregate demand also supports can provide support to fragile financial institutions, if and only if the private sector wishes to hold government IOUs. This further contingent role for government debt make the case for slightly more conservative fiscal policy than aggregate demand considerations would themselves imply. During the long and lonely march back to normality, public debt will take 10-15 years to get back to 'normal' and as long as demand remains inelastic, positive or negative changes in net supply will impact on price and complicate choices on Bank Rate. And so it would seem that plotting the policy path will be considerably more complicated during recovery and normality and so requires significantly more explanation than we have had in the past.

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