



BANK OF ENGLAND

Speech

Forward guidance and its effects

Speech given by

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Introduction

Many thanks for inviting me to give this talk at the National Institute. As you know, the Bank of England, like the National Institute, has been under new management, albeit for less long. Following Mark Carney's arrival we introduced a policy of forward guidance. This itself came after the Chancellor of the Exchequer had asked the Bank, at the time of the March Budget, to assess the role of "explicit forward guidance". We produced a document on forward guidance in August (Monetary Policy Committee 2013a) and, at the same time adopted a policy whereby we said we would not consider raising Bank Rate until the unemployment rate had fallen to seven per cent. We qualified this by saying that the policy would be "knocked out" if significant risks arose with respect to either inflation or financial stability. At the same time we did not rule out further asset purchases, should they seem appropriate. Different members of the Committee may have had different views on whether the policy, as finally adopted, was likely to provide a stimulus to the economy by leading people to expect interest rates lower than might have otherwise been the case. But we all expected that forward guidance should make policy clearer and reduce the uncertainty surrounding future interest rates.

In this talk I would like to begin by discussing some of the theoretical issues around forward guidance. I will then present my own, very tentative thoughts on the impact that the policy may have had.

The forward guidance puzzle

The theoretical analysis of forward guidance has typically been carried out on the assumption that the guidance provided was a statement that the Bank Rate or its equivalent would remain fixed, and lower than people might have expected it to be, until at least a particular date¹. This reflects early forms of forward guidance. Thus the Bank of Canada stated in April 2009 that "the target overnight rate can be expected to remain at its current level until the end of the second quarter of 2010" and in the United States the Federal Open Market Committee stated in September 2012 that "exceptionally low levels for the federal funds rate are likely to be warranted at least through (sic) mid-2015." These can be described as *time-contingent* policies, notwithstanding that they may have included their own "knock-outs"; for example the Bank of Canada stated that the policy would be "conditional on the outlook for inflation" (see Carney, 2013a).

Our own forward guidance is, of course *state-contingent* rather than time-contingent; subject to the knock-outs we will review things when the unemployment rate has fallen to seven per cent, and not at any particular date. Nevertheless, many of the issues which arise with time-contingent guidance also apply to state-contingent guidance. So I will begin with a discussion of some of the issues which arise when exploring time-contingent guidance. I will then move on to show how this analysis can be extended to state-contingent forward guidance. I will conduct my analysis in the context of a simple New Keynesian framework. This is, of course, not because I expect you to believe that it, or any other model, represents the truth. Models are

¹ This section draws heavily on discussions with Andrew Blake who was a colleague of mine in Cambridge, and the National Institute and now at the Bank of England. I should say that I followed him to the last two of these institutions.

neither right nor wrong - they are simply tools for organising thoughts relevant to the question in hand, and the New Keynesian model provides a framework which is both simple enough to be easy to explain and rich enough to be able to understand some of the influences on the impact of forward guidance.

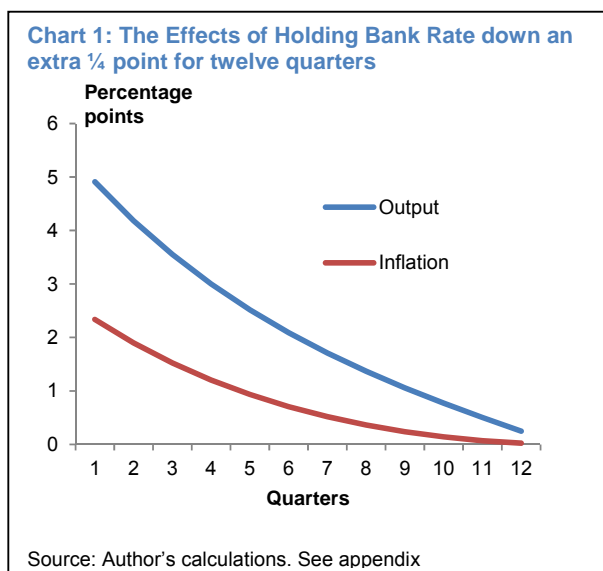
The attraction of the New Keynesian framework is that it summarises the evolution of the economy as resulting from the balance between demand and supply. Demand is represented by the assumption that spending growth depends on the interest rate. When interest rates are low people choose a path along which spending grows slowly, while when interest rates are high goods tomorrow seem cheap relative to goods today; as a consequence people shift spending into the future, so that spending is likely to grow rapidly between today and tomorrow. This may sound paradoxical; we associate low rates with high spending and high rates with low spending. But if, at the end of the day output is limited by the supply side, high interest rates mean that spending today is low but rising, while low interest rates mean that it is high but falling or rising only weakly. Supply is represented by a form of the celebrated Phillips curve. While the original Phillips curve described the relationship between wage inflation and unemployment (Phillips, 1958), the New Keynesian variant relates inflation to expected future inflation and to demand, relative to supply in the goods market². Normally these two relationships are combined with an additional one, which describes the assumed decision-making process of the body which sets interest rates. The Monetary Policy Committee is assumed to set the interest rate with reference to the inflation rate and the deviation of output from its apparently known long-run path. But of course, with time-contingent forward guidance, we would be assumed, apart from considering whether to increase our stock of asset purchases, to sit on our hands; the interest rate is simply assumed to take whatever is indicated by the forward guidance policy - in our case ½ per cent.

When this framework is used to simulate the effects of forward guidance, it is typically found that there is a very powerful impact on both output and on inflation- a point first observed, to my knowledge by Carlstrom, Paustian and Fuerst (2012). Del Negro, Giannoni and Patterson (2012) demonstrate that this effect also occurs in the model developed for the Federal Reserve Board. A commitment to hold the Bank Rate lower than normal, even for a few quarters, seems to lead to a sharp, and indeed probably incredible, increase in both output and inflation.

I provide an example of this in Chart 1, which illustrates the impact on both inflation and output of a commitment to hold the Bank Rate one quarter of a percentage point lower than normal for twelve quarters. This is calculated using the structure described in the Appendix. You can think of the chart as showing the effects of holding the Bank Rate ¼ point lower than people would otherwise have expected given economic conditions. In that sense it is illustrative. I will come on later to the possible effects of actual policy. The path is based on the key assumptions, regarded by some economists as standard, that inflation today moves

² It is a very open question how far this is relevant to the British economy. There is a long-running debate about how far business margins are elevated at times of high demand. Indeed, a reason for defining a state-contingent policy with reference to unemployment rather than output is that unemployment is a better guide to the state of overall demand. Nevertheless, in order to simplify the exposition, I will stay with what has become the standard structure.

almost one for one with expected inflation and that a one point change in the real interest rate leads to a



change of one percentage point in the expected growth rate of output. With these assumptions, a passive policy leaves the economy highly unstable and holding the interest rate lower than people would have expected has a very powerful effect.

The effect is largest when the policy is announced. For that to be the case it is necessary that behaviour is not constrained by habit and that people fully understand the policy and its implications immediately. Use of the habit-formation framework similar to that suggested by Stone and Rowe³ (1958) would generate a lagged response as would the model of learning developed by Levine,

Pearlman, Perendia and Bo (2012). But even with the sort of lag which might result from habits and a learning process, the policy would still generate a powerful initial effect. No one would regard this as plausible. Indeed del Negro, Giannoni and Patterson describe it as the forward guidance puzzle. It certainly does not describe what has happened to the British economy since we adopted forward guidance and I think the same could be said of the other economies which have done so. What are the sorts of changes which would make the outcome rather more plausible?

I would like to consider two. The first is the way in which expectations of future inflation are determined. The standard model assumes that expectations are rational- that in the absence of shocks people expect the inflation rate which actually materialises. An alternative view is that many, perhaps most, people have an underlying confidence that the Monetary Policy Committee will do its job, so that, on average, expected inflation is only weakly sensitive to future out-turns. This might be expected to be a stabilising influence, as Committee members have periodically argued. In my alternative view expected inflation is based half on the outcome generated by the model simulation and half from the inflation target the Chancellor has set us.

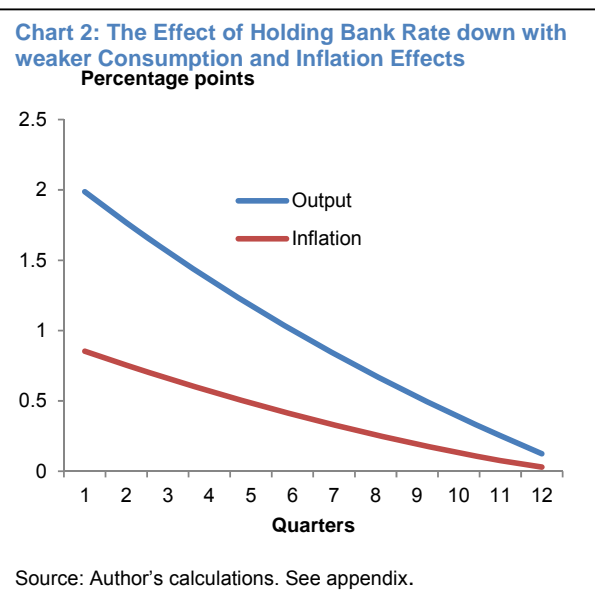
The second change that I make is to assume that a one percentage point change in the real interest rate leads to a change in the planned rate of growth of spending of only ½ per cent rather than one per cent. A ratio of one for one is often used in business cycle models. Lucas (1990) argues that a figure of much below a half would make it difficult to relate differences in consumption growth in different countries to the interest rate differentials between them⁴. But a meta-analysis (Havranek, Horvath, Irsova and Rusnak, 2013) of 242

³ Their analysis was applied to demands for individual goods. But their approach has subsequently been applied also to aggregate consumption.

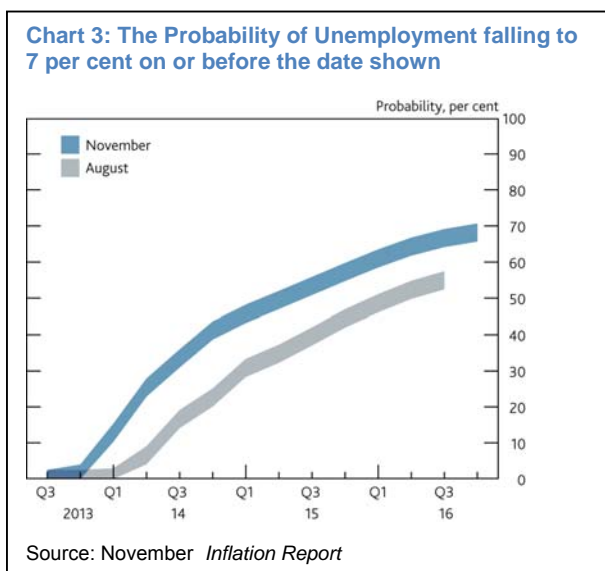
⁴ He says "If two countries have growth rates differing by one percentage point, then their interest rates must differ by s percentage points" where s is the inverse of the ratio we are discussing. He points out that on this basis a figure of two is at the upper limit of what is likely.

studies of the UK gives a mean value of 0.487 with standard error of 1.09. So this analysis points to a good case for using a figure at the bottom of Lucas' range.

The impact of these changes is shown in Chart 2. You can see that these changes suggest much smaller effects of time-contingent forward guidance. But the effects are still, in absolute terms, large. The forward guidance puzzle remains. Furthermore, the fact that the outcome is so sensitive to parameters which are not known with any degree of certainty, suggests to me that time-contingent forward guidance is very uncertain, at least in the absence of any qualification.



State-contingent forward guidance, of course, can avoid this problem (Campbell, Evans, Fisher and Justiano, 2012). If the policy provides a stimulus much stronger than we have assumed in our recent *Inflation Report*, unemployment will fall to the threshold of seven per cent earlier than we expect. We will be able to respond without needing to break a promise so as to avoid a ride to disaster. Equally, if supply conditions are different from what we regard as most likely, perhaps because productivity growth is different from what we have assumed, then we will be able to react appropriately. But what are the implications of the policy being state-contingent rather than time-contingent for the effects of the policy itself?



As many people have pointed out, a distinguishing feature of a state-contingent policy is that people cannot be certain about the date at which the relevant state, in our case unemployment of seven per cent, will be reached. Some of the MPC's critics have suggested that this is a weakness of the policy. I should say that I regard it as a strength. The future is uncertain and no one can change that. What is important is that the MPC reacts appropriately to events as they evolve. Anyway, I can address the same issue, exploring the impact of holding the Bank Rate lower than people would otherwise have expected with the additional assumption that people are

uncertain how long this policy will be pursued

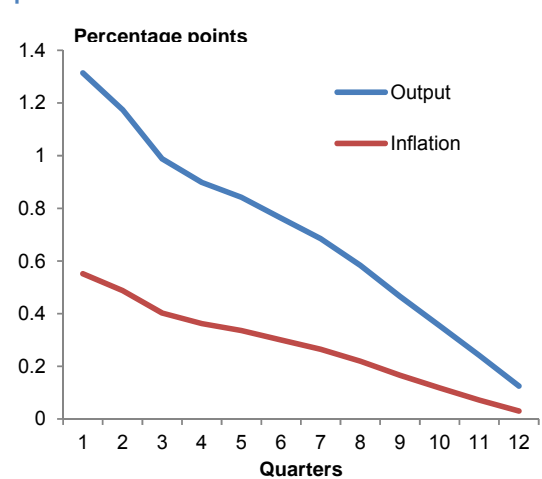
(Carlstrom, Paustian and Fuerst, 2013). The *Inflation Report* provides a reference point for quantifying this uncertainty.

Chart 3 shows the MPC's estimate of the probability that the unemployment rate will have fallen to the seven per cent threshold at any time in the next three years. It should be stressed that this does not give the probability of the Bank Rate being raised at each of these dates, for two reasons. First of all, whatever is the probability of one of the three knock-outs arising and MPC deciding to end the guidance, it must be greater than zero. This suggests that the probability of raising the rate at any time ought to be higher than Chart 3 suggests. But, conversely, as my colleagues and I have pointed out (see e.g. Carney, 2013b) the MPC is not committed to raising Bank Rate when unemployment falls to seven per cent: it has merely said that it will review the position. So the mapping from Chart 3 to the probability of a rise in Bank Rate by a given date is by no means obvious.

My own view is that if unemployment is falling rapidly at the time that it drops to seven per cent, that will be an indication that demand is strong relative to supply, strengthening the case for an early rate rise. But if, for example, wage pressures appear very weak and unit labour costs are at most growing only very slightly, that will weaken the case. Obviously I cannot judge now what the situation will be when unemployment does fall to seven per cent. Our forecasts rightly stress the fact that the future is uncertain.

But, to return to my primary focus, for the purposes of illustrating the effects of uncertainty on forward guidance, I will assume that the probabilities are those shown by the Chart 3. Chart 4 shows the simulated profile for output and inflation with this uncertainty, computed again with the modified parameters which give the profiles of Chart 2 rather than Chart 1. It can be seen that uncertainty, or more correctly the possibility of an earlier rise in Bank Rate, further dampens the impact of the policy.

Chart 4: The Effect of a Bank Rate reduction of ¼ point of uncertain duration.



Source: Authors calculations. See appendix

Alternative estimates of the probability that the Bank Rate will have risen by any particular date can be obtained from the prices of options on LIBOR. The immediate impact of state-contingent forward guidance might be thought to depend not on the MPC's views of future economic prospects but on the market's view as expressed through these option prices. The market view of the probability of Bank Rate being raised by any given date is not, however, very different from Chart 3. So the effect on the simulations is not material. It remains the case that the strongest impact of the policy should be seen at the start of the period of forward guidance,

although once again we should remember that habit formation and learning would delay the peak impact somewhat.

The key to this analysis is the assumption that the interest rate would be held a quarter point below where it would otherwise have been, for at most twelve quarters. Our forward guidance implies that the probability of Bank Rate being held at its current level for longer than this is substantial. Chart 3 shows that the probability of the unemployment rate falling to seven per cent within three years is only about two-thirds. Simulations which gave a significant probability to Bank Rate staying low beyond twelve quarters would show much more powerful effects, provided of course that the policy was indeed to hold Bank Rate $\frac{1}{4}$ point below where it would otherwise have been and what people regarded as normal.

Resolution of the forward guidance puzzle

These large responses are a consequence of the assumption that the Bank Rate is $\frac{1}{4}$ point below where it otherwise would have been for up to three years. This is, to say the least, questionable. I find it inconceivable that, without forward guidance, I, or any of my colleagues, would have already voted to raise Bank Rate and that the only thing that has stopped us is forward guidance. To the extent that the policy simply represents the way the MPC had behaved before it was announced, then, while Bank Rate might well stay at $\frac{1}{2}$ per cent into 2016 or beyond, it would do that in circumstances where, broadly speaking, it would have done it anyway. In that case the impact of the policy might be negligible. If forward guidance has done no more than to codify what people had expected the Monetary Policy Committee to do anyway, then its effects on the profile of expected future rates, and thus on output and inflation, should be expected to be small. The policy should be assessed on a counter-factual basis, as far as possible, and not with reference to an absolute change in Bank Rate.

My own view, when the Committee discussed forward guidance last summer, was that the framework implied some easing of policy and thus probably did offer some support to output and inflation. I thought that it implied a greater tolerance of inflation eighteen to twenty-four months ahead than I felt was consistent with our remit. Fortunately the sharp and unexpected fall in actual inflation since the summer makes it considerably less likely that this aspect of the policy will be tested. Nevertheless, my view of the policy certainly implies that there would have been some effect on expected interest rates. I would now like to discuss two pieces of evidence on the effect of guidance on expected future rates. The first is based on expected rates and the uncertainty surrounding them, as derived from financial markets and the second is derived from an informal survey of dealers.

The impact of forward guidance on interest rates: event studies using financial markets

The financial markets provide a continuous stream of data and the range of contracts makes it possible to infer both expected future rates and the uncertainty surrounding them. One means of examining the effects

of a policy change on interest rates or related variables is to look at their movements in the immediate aftermath of the policy announcement. I do that with forward guidance, looking at the changes in the variables of interest between their closing values on the day before the policy was announced and their closing values on the day after the policy was announced. I compare these effects with the analogous changes which took place when the Funding for Lending Scheme was introduced. Care is needed in interpreting the results. The absence of a visible impact on announcement may be because the policy had been anticipated rather than because it had no impact. So event studies of this type can provide evidence that a policy intervention has had an effect. But, because such interventions may be anticipated, they cannot show that it did not have an effect.

i) Immediate effects on levels

When exploring the effects of forward guidance, the mechanism by which output and inflation were raised during the period of guidance was through a reduction in the expected path of the interest rate. So there is an obvious question whether the expected interest rate path was affected by the announcement of forward guidance. As noted above, one important reason why it might not be, would be that the guidance did little more than confirm what people, or at least the people involved in trading interest rate futures, believed anyway.

A wide range of data makes it possible to look at the effects of forward guidance in the near term. Table 1 shows the movement in the implied three-month future LIBOR rate at various horizons associated with the Funding for Lending Scheme and forward guidance announcements. The table attempts to indicate the statistical significance of the movements by showing whether the movements fell outside the ninetieth, the ninety-fifth or the ninety-ninth percentile of daily movements⁵.

The FLS was intended to provide banks with a cheaper alternative to the inter-bank market and it is, to say the least, not surprising that it was associated with a sharp decline in expected future LIBOR rates⁶⁷, and also on rates on unsecured bank debt although these are outside the scope of the present analysis. The policy reduced funding pressures and the fall in market rates can be seen as a response to this. In contrast, forward guidance did not have material effects on interest rates at the time of its announcement.

The FLS was introduced at a time when the economy needed further support. I certainly did not think this was the case when we introduced forward guidance. There had been substantial discussion of the policy

⁵ When computing the percentiles, the daily movements are computed as proportions of initial values. These proportionate errors are much more stable than are errors measured in basis points.

⁶ It also had a favourable impact on other measures of bank funding costs, such as yields on unsecured debt. These were probably also influenced by Sig. Draghi's promise to do "whatever it takes" to hold the euro together. But since this table shows only the effect on the day following the evening announcement of FLS, an event which preceded Sig. Draghi's speech, we can be reasonably confident that the movement reflects the immediate response to the FLS announcement.

⁷ Throughout we use interest rate futures based on LIBOR, as opposed to the OIS (overnight index swap) rate. This is because futures are not available on OIS rates, which means that it is not possible to obtain implied, and hence normalised, volatilities. Our analysis is therefore subject to the caveat that, unlike the OIS rate, LIBOR can also move as a result of credit and liquidity risk in the banking system, though it is unlikely that such movements had a big effect on LIBOR during the period of interest.

ahead of its introduction and forward guidance may have already been reflected in market expectations of future interest rates. Anyway, given the market curve as it was at the start of August, I was relieved that there was no obvious further impact on expected future rates from the announcement of the policy in August of this year.

Table 1: Libor futures: level reaction to monetary policy announcements (percentage points)

Event	Date	1m	3m	6m	12m	24m	36m
FLS – Mansion house speech	14/06/2012		-0.31***	-0.31***	-0.28***	-0.35***	-0.33***
Forward Guidance – IR Publication	07/08/2013	0.01	0.01	-0.02	-0.02	0.00	0.02

Significant at ***1%, **5%, *10%. Percentiles of the empirical distribution.

Taking a longer-term perspective, expected future rates are now, of course, appreciably higher than they were before forward guidance was announced. But I fully share Bean’s (2013) view that this reflects sharply improved growth prospects. It does not tell us anything about the effects of forward guidance.

ii) Immediate effects on uncertainty

The analysis so far has been in a world in which the focus is on expected future interest rates. While the theoretical discussion looked at a situation in which people were assumed to be uncertain about the date at which the normal working of policy would be expected to be resumed, the rate of output growth was not assumed to be influenced directly by uncertainty. Economic theory tells us that changes in uncertainty about both future interest rates and future growth in output⁸ have effects similar to changes in the rate of interest and, as I noted, forward guidance was intended to reduce uncertainty about future interest rates by making clearer the criteria by which the MPC set policy. Thinking in terms of the IS curve which relates demand to the interest rate, a reduction in uncertainty leads to an upward move in the IS curve and thus to greater demand at any given interest rate. So, to the extent that the policy affected uncertainty it should be expected to have at least some influence on demand.

Options on LIBOR are widely traded. The prices associated with these allow us to measure not only the three-month LIBOR rate which is expected to hold at various points in the future, but also the uncertainty surrounding these expectations. I show, in Table 2 the changes in measures of uncertainty⁹ following those policy announcements identified in Table 1.

⁸ More correctly, a precisely-defined combination of the two. See Deaton (1992, p. 64)

⁹ The numbers in the table are based on normalised volatilities calculated on options which are closest to the ‘money’ (strike price) on any given day. Since the type of contracts and hence distance to the strike price can vary across days, this introduces a potential source of bias. When the exercise is repeated with normalised volatilities, calculated on options, which are exactly at the money, we find similar movements. This suggests that the conclusions about the forward guidance announcement are robust to this concern.

Table 2: Libor futures: volatility reaction to monetary policy announcements

Event	Date	1m	3m	6m	12m	24m	36m
FLS – Mansion house speech	14/06/2012		21.40%	3.16%	-28.74%***	-7.29%**	-9.98%***
Forward Guidance – IR Publication	07/08/2013	-16.25%	-29.52%***	-22.61%***	-6.61%	-1.68%	-1.27%

Significant at ***1%, **5%, *10%. Percentiles of the empirical distribution.

Both FLS and forward guidance affected uncertainty. FLS had the effect of increasing uncertainty in the short term, immediately after its announcement, perhaps because people were not sure of its short-term impact. But at twelve months and beyond it led to sharp and statistically significant reductions in uncertainty, perhaps because it convinced people that the Bank was keen to see a more stable inter-bank market. The impact of forward guidance on uncertainty has, in contrast been at the shorter end of the market. It had little impact on immediate uncertainty, probably because very few people were expecting an immediate change to the Bank Rate. But at three to six months it led to a marked reduction in uncertainty. The effect is attenuated at longer horizons. This reduction in uncertainty, which has persisted to the end of November, suggests that the policy achieved the aim of reducing uncertainty. This is likely to have provided some stimulus to the economy, but given that only near-term uncertainty has been affected, it is difficult to believe the effect is large.

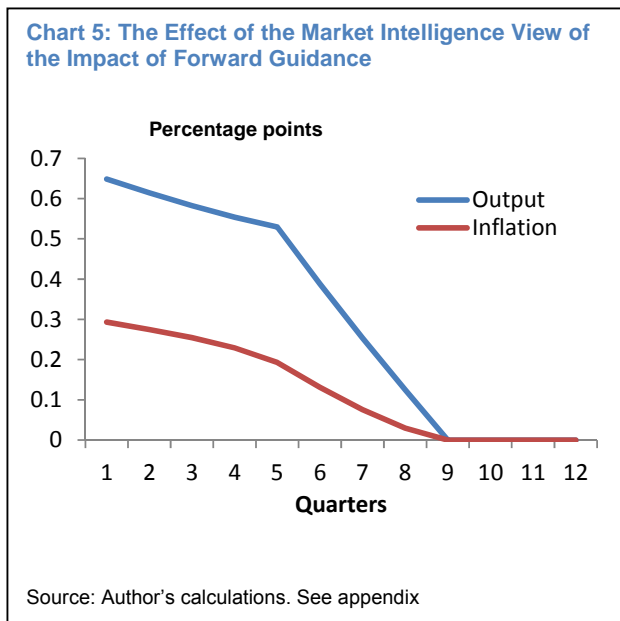
Market intelligence on forward guidance

The ease with which the LIBOR curve can be used to indicate expected future rates and volatility should not lead to the neglect of other indicators of the effects of forward guidance. A good detective looks at everything that is relevant and not just where the light is brightest. There is a second piece of evidence for the effects of forward guidance on interest rates which I would like to mention.

Market intelligence suggests that, while there is obviously a range of views, in broad terms market participants believe that the profile of expected future rates is about ¼ percentage point lower than it would be in the absence of forward guidance up to two years ahead. It is, of course, possible to produce arguments that the effect is larger than this, but they may well hinge on the argument that the MPC, without forward guidance, would have been expected to react early on to strong economic growth, even though inflation is close to target and there is considerable slack in the labour market.

It seems to me unlikely that market participants believe that, in the absence of forward guidance we would have already raised rates or that they would have expected a rate rise to be imminent. But it is possible that

people believe interest rates are a $\frac{1}{4}$ point lower between say one and two years ahead. As I noted earlier, a feature of the theoretical model I used to assess the impact of forward guidance implied that guidance in the future has more impact on the present than does guidance today. The assumed cumulative instability of the economy means that an expectation that rates will be held down for one quarter longer than the market's previous view of "normal" in a year's time has a much bigger impact than if an imminent rate rise is delayed from the present to the next quarter. So delaying a rate rise from one year ahead to two years ahead has a substantial impact at the present. Chart 5 suggests that output is raised by about $\frac{1}{2}$ to $\frac{3}{4}$ per cent and the inflation rate raised just over $\frac{1}{4}$ percentage points.



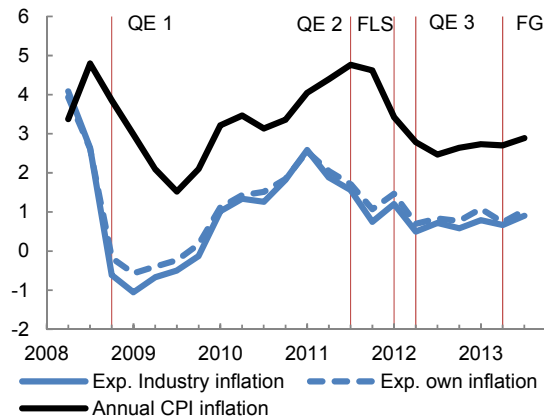
For the movement to be as large as this would require households and businesses to understand the implications of the policy reasonably well; without that, the effects may be considerably smaller. We do not, as yet, have any firm information on how well the policy has been understood. But, unless people have taken an unusual interest in what my colleagues and I have said about policy, it seems to me likely that the initial effects will be appreciably smaller than the numbers above. To the extent to which understanding of the policy does build up, its impact may well rise over time. More generally, of course, these rough calculations, which are mine rather than the Bank's, should not be seen as the last word on the matter.

The effects of forward guidance on inflation expectations

As the earlier analysis shows, if the policy is a direct stimulus to output, it should, if the New Keynesian model is to be believed, also lead to higher expected future inflation. Indeed Eggertson and Woodford (2003) writing about the United States, see the rise in expectations of inflation as a benefit of the policy or a least part of the route through which it works. In the context of the United Kingdom, with inflation above target for five years, the Committee was keen to implement forward guidance in a way which did not take risks with inflation expectations. Since then we have noted a modest elevation in medium-term inflation expectations which I think none of the Committee members regard as significant (Weale, 2013, Monetary Policy Committee 2013b); the position nevertheless needs to be monitored carefully.

The question I would like to focus on here is whether the policy had any impact on the expectations of inflation over the next year formed by businesses. Fortunately the CBI has collected data on this since 2008 Q2; their data are a great help to policy-makers like myself. Chart 6 shows that expectations held by

Chart 6: Business Expectations of Growth in Industrial Output Prices



Source: Author's calculation from CBI survey.

businesses of increases in both their own prices (own inflation) and the prices in their industry (industry inflation) picked up somewhat in the third quarter of this year, after our announcement of forward guidance. Nevertheless, the distinction between *post hoc* and *propter hoc* may be important. As the chart makes clear, inflation expectations have moved round a lot over the past few years, probably as a result of factors such as movements in oil and commodity prices. It is certainly not possible to draw conclusions from Chart 6.

An econometric analysis confirms for once the impression given by Chart 6. Controlling for

movements in oil prices and other input costs leads to the conclusion that, in the third quarter of this year, expectations of both own inflation and industry inflation were lower than normal rather than above normal. But the impact was not statistically significant. Likewise, if we look at the second quarter, on the grounds that businesses, like financial markets, might have anticipated the policy, there is no evidence that expectations were raised. From the perspective of someone who has been repeatedly concerned about inflation expectations being above the inflation target, I must say that this is rather a relief, notwithstanding my earlier comments on medium term expectations. It is also, of course, consistent with the earlier observation that, even if forward guidance had been fully understood its impact on inflation would probably have been only just over $\frac{1}{4}$ percentage point and that, in reality, the effect was likely to be appreciably smaller than this.

Conclusions

This attempt to assess the impact of forward guidance so far has presented a number of different pieces of evidence which point in different directions. A theory-based analysis suggests that the effect should be powerful, provided that the policy leads to markedly lower expectations of the future path of interest rates and thus on the date of the first increase in Bank Rate. The magnitude of the effect is nevertheless very sensitive to the precise assumptions made about the workings of the economy. But, if, the policy simply clarifies what policy-makers would have done anyway, the impact on the date of the first expected rise in Bank Rate is not likely to be large. In any case, since the policy is state dependent rather than time-dependent, the MPC can respond to the actual impact of the policy; we do not need a precise estimate of this in advance.

There was no immediate effect on expected future interest rates when the policy was announced, suggesting that, immediately following the announcement, expectations of interest rates were not much altered. One possible explanation of this is that the policy had been widely anticipated. Indicators of uncertainty surrounding future near-term interest rates fell, however, in the immediate aftermath of the announcement, and this decline has persisted. This decline in uncertainty probably provides some stimulus to the economy but the effect is almost certainly very small.

Over the past few months, as the policy has bedded down, there has been a substantial change in people's expectations of Britain's growth prospects. This good news has led to rising expectations of future interest rates. Markets have an understanding that policy can remain very supportive of the economy even if Bank Rate is, at some point, slightly higher than it is now. I do not want to speculate on when that might happen and limit myself to the obvious point that, other things being equal, good news on underlying inflation reduces the case for tightening while rapid economic growth and, more especially, rapidly-falling unemployment strengthens it. This sharp and favourable change in Britain's economic outlook does, however, mean that I cannot, by looking at movements in market interest rates over the last few months, infer what has been the effect of forward guidance on future rates (Bean, 2013).

An informal survey of market traders suggests that they believe that, up to two years ahead, expected rates are about $\frac{1}{4}$ point lower than they would have been without forward guidance. If such views were held throughout the economy, it is possible that output would be raised by $\frac{1}{2}$ - $\frac{3}{4}$ per cent with an effect on inflation of just over $\frac{1}{4}$ per cent. But, if the policy has not yet been understood by households, the initial impact is likely to be lower, perhaps appreciably lower than this. That in turn may explain why, so far, there is no evidence of an impact from the policy on businesses expectations of price increases.

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Appendix

The Standard Neo-Keynesian model (Gali, 2008) is made up of these simple equations:

$$(1) \quad y_t = -\frac{1}{\sigma}(i_t - E_t\pi_{t+1}) + E_t y_{t+1} + \varepsilon_t^{AD}$$

$$(2) \quad \pi_t = \beta(E_t\pi_{t+1}) + \kappa y_t + \varepsilon_t^{AS}$$

$$(3) \quad i_t = \phi^\pi \pi_t + \phi^y y_t + \varepsilon_t^{MP}$$

$$\text{Where } \kappa = \frac{(1-\alpha)(1-\alpha\beta)(\omega+\sigma)}{\alpha(1+\omega\theta)}$$

Equation 3 disappears in a model with an interest rate peg. The above model can then be written as

$$\begin{bmatrix} y_t \\ \pi_t \end{bmatrix} = A \begin{bmatrix} y_{t+1} \\ \pi_{t+1} \end{bmatrix} + B i_t$$

where

$$A = \begin{bmatrix} 1 & \frac{1}{\sigma} \\ \kappa & (\beta + \frac{\kappa}{\sigma}) \end{bmatrix}, B = \begin{bmatrix} -\frac{1}{\sigma} \\ -\frac{\kappa}{\sigma} \end{bmatrix}$$

The solution for the impact multiplier, under the assumption that people know ahead of time when the peg will end (if it is deterministic) is:

$$\begin{bmatrix} y_{1,T} \\ \pi_{1,T} \end{bmatrix} = (I - A)^{-1}(I - A^T)B i^* \quad (1)$$

From the above expression it becomes quite clear that the parameters in B, and hence β and σ are crucial for the impact of an interest rate peg in the model.

One can also generate impulse responses in this model, following the approach in Blake (2013). This can be done by subtracting the change in the multiplier the further one goes out each period:

$$\begin{bmatrix} y_{1,T} - y_{1,T-1} \\ \pi_{1,T} - \pi_{1,T-1} \end{bmatrix} = A^{T-1}B i^* \quad (2)$$

But, with state-contingent guidance people are likely to have their own beliefs about the exit from the peg. So the stochastic case, where there is a probability of remaining in the peg, could be more appropriate. This is explored in Carlstrom, Fuerst and Paustian (2013). In particular, assume that there is a probability p of staying the pegged regime each period. That is, it is uncertain when the monetary policy authority will exit the peg, and agents assign a probability p to staying in the current regime. In that case, the expected duration of the interest rate peg is $E(T) = \frac{1}{1-p}$ and the formula for the impact response is given by

$$\begin{bmatrix} y_{1,T} \\ \pi_{1,T} \end{bmatrix} = (I - pA)^{-1}B i^*$$

In this framework, the response will be constant each period. This is not a desirable feature of the model. So instead, we adopt the hybrid case: There is uncertainty about the exit, but it is known with certainty that there will be an exit after T periods. In that case, the impact is

$$\begin{bmatrix} y_{1,T} \\ \pi_{1,T} \end{bmatrix} = (I - pA)^{-1}(I - pA^T)B i^* \quad (3)$$

From which it can be clearly seen that the impact responses rise in p . Meaning that the greater the probability of staying in a regime, the larger the impact response. To generate the impulse responses in Chart 1, we use the following parameterisation of the model:

Table 1 – Model Parametrisation

Variable	Value
α – Price Stickiness	.66
β – Discount Rate	.99
ω – Frisch Elasticity of Labour Supply	2
Θ - Elasticity of Substitution	11
σ – Intertemporal Elasticity of Substitution	1

To replicate Chart 2, set $\beta=1/2$ and $\sigma=2$. Finally, to replicate Chart 4, use the parameterisation from Chart 2 and formula **(3)**.