Monetary Transmission Lags and the Formulation of the Policy Decision on Interest Rates

By

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I. Introduction

(a) Lags and Optimal Control Methods of Setting Interest Rates

Although it is a generally accepted stylised fact that, as Milton Friedman noted, the monetary policy transmission mechanism has 'long and variable lags', most of the early theoretical work on these issues, e.g. the rules vs discretion debate, proceeded on the assumption that monetary policy measures were instantly transmitted to inflation, e.g. Barro-Gordon, Cukierman. Thus in his basic model (Chapter 3, p. 28), Cukierman (1992) states that "Abstracting from real shocks, growth and changes in velocity, the rate of inflation is equal to the rate of monetary growth m. Hence inflationary expectations are equal to expected money growth m^e, and the short-run Phillips relation …. can be restated as

$$N - Nn = \alpha (m - m^e),$$

where N is employment and Nn the natural rate of employment, p.28.

Since then analysis has become more realistic. Most theorists now accept that the policy instrument that Central Banks actually adjust is the short term rate of interest, and not a monetary aggregate, (though some still regret this fact). Moreover, the standard work-horse models now in current use, especially Rudebusch and Svensson, originally 1997, now 1999, do incorporate monetary transmission lags. The Monetary Policy Committee (MPC) addressed this issue, of the lags in the

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transmission mechanism, in its report on, 'The Transmission Mechanism of Monetary Policy', (Bank of England, 1999), a publication intended for an audience beyond academic experts in the subject. The existence of such lags raises questions about how interest rates should be set currently at time t in order to achieve future objectives at time t+n. Interest rates are typically supposed not to affect current goal variables instantaneously, and in so far as they can affect certain (intermediate) variables immediately, e.g. exchange rates, may only do so at the cost of destabilising other goal variables subsequently, e.g. output.

Academic studies of the way in which interest rates might be set in such a forward-looking context involve a number of dimensions. The minimum number of dimensions involves the choice of three such, i.e. the model, the structure of shocks and the loss function. In such cases, the optimal policy horizon over which inflation returns to target is determined endogenously within the model, as we will discuss subsequently when I report work by Batini and Nelson in the Bank of England.

In practice, however, very few Central Banks, or monetary authorities, set monetary policy by such optimal control methods. There are no doubt various reasons why this is so. As will be described in Section II, which reports work undertaken within the Bank, optimal control horizons appear very sensitive to the precise model/shock specification applied. Moreover, all the models on which such exercises have been attempted have been small and simplified. As will be discussed subsequently, it remains unclear how successfully, if at all, optimal control techniques could be applied in the context of the larger models used in practice for forecasting purposes.

Last, but not least, such an approach requires specification of a loss function, its arguments needing to include the appropriate discount rate. Because of the complexity and difficulty of such an exercise, governments have not been prepared to do so. Instead they have usually restricted themselves to giving primacy to the objective of price stability, while accepting that some conditions may exist in which the monetary authorities should not aim to return inflation to target excessively quickly, since that might impart undue volatility to output.

In the case of the UK, the Chancellor in his letter, 3 June 1998, to the Governor of the Bank of England setting out the proposed target wrote that,

> "[T]he operational target for monetary policy remains an underlying inflation rate (measured by the 12 month increase in the RPI excluding mortgage interest payments) of 2 ½ per cent. The inflation target is 2 ½ per cent at all times: that is the rate which the MPC is required to

> achieve and for which it is accountable. …….. The framework takes into account that any economy at some point can suffer from external events or temporary difficulties, often beyond its control. The framework is based on the recognition that the actual inflation rate will on occasions depart from its target as a result of shocks and disturbances. Attempts to keep inflation at the inflation target in these circumstances may cause undesirable volatility in output."

If the government is not prepared to define the loss function, a Central Bank without goal independence is not constitutionally in a strong position to do so on its own. So, for a combination of reasons Central Banks have generally given weight to a variety of operational procedures, which do not involve conscious optimisation conditional on an assumed loss function. This will involve another set of dimensions, i.e. which choice of operational technique, e.g. some kind of feedback rule, and what forecast horizon to set for operating this rule, (since the horizon now becomes a choice variable as well). This is discussed further in Section III.

(b) <u>The Rudebusch/Svensson Model and its findings on Alternative Policy Horizons</u>

In their excellent paper, Rudebusch and Svensson consider a variety of such operational techniques in the context of a simple calibrated two equation model of the US economy, and various alternative versions of their assumed loss function. Then they seek to compare the loss from each procedure with the loss from using the benchmark optimal control approach. The operational techniques that they examine include:- (i) the Taylor rule, (ii) a forward (8 quarter) looking Taylor rule, (iii) an instrument rule that responds to a rule-consistent inflation forecast, (iv) a strict inflation target (where output deviations are given no weight) and (v) a flexible inflation target (where such deviations are given weight). In all cases such techniques are examined both with, and without, interest rate smoothing.

In the case of the forward looking Taylor rule, the horizon was, somewhat arbitrarily, set at 8 quarters; while for instrument rule (iii) above and for the strict and flexible inflation targets (iv and v above), the horizons are again somewhat arbitrarily set at 8, 12 and 16 quarters respectively. R/S look at losses relative to the benchmark optimal control (OC) case in five tables (3-7) relating to various configurations of parameters in the loss function. Out of the 25 permutations (five techniques with differing horizons, five Tables with differing loss functions), the shortest horizon gave the worst outcome in 21 cases, and the best in 2; the 12 quarter horizon the worst in no cases, and the best in 8 cases; and the longest 4 year, 16 quarter, horizon was worst in 4 cases, and best in 15.

Although R/S do not focus strongly on the optimal horizon length, the implication of their finding appears to be that overall economic (adjustment) costs are reduced if the horizon for inflation targetry is considerably longer than normally practiced, at least in the UK, where the horizon for the inflation fan chart is two years. There may be several reasons for this difference between their US analytical results and UK practice. One might be that the monetary policy transmission lag to inflation is somewhat shorter in more open economies, since exchange rates typically adjust faster than real output in response to an interest rate change. Another reason could be that the R/S model is backwards-looking; in models with forward looking elements the transmission process is generally speedier.

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[1] The word 'horizon' looks simple enough, but, as Svensson has demonstrated in several papers, semantic complexities abound in this field. Horizon can just mean the end of the forecast; whereas 'policy horizon' is usually taken to imply the date at which the objectives of policy are approximately obtained, and 'forecast horizon' the future date at which the policy makers react to deviations of the objective(s) from their desired level. As described in more detail in Section IIc, the forecast and policy horizons often differ, and can obviously diverge, from the length of the published forecast. In the above case, the R/S paper is examining forecast horizons.

[2] As described further in Section IIa, the evidence suggests that this is the MPC's policy horizon, as well as the end-point of the published fan chart.

(c) The Structure of the Remainder of this Paper

Be that as it may, in Section II of this paper I shall review and summarise some current work being done in the Bank on this subject of the optimal horizon for monetary policy.

Another feature of UK procedures is that the inflation forecast is done on the basis of, (conditional on), the assumption that interest rates are held constant thereafter over the remaining two years. As R/S note, p. 13, this was originally done at the Bank because (before operational independence in 1997) it could not presuppose future policy changes by the government. That particular constraint has now gone. In Section III I shall offer a few speculative comments whether that procedure remains appropriate, or whether some alternative time-path might instead be adopted. So Section II will concentrate on Bank work on horizons, and then Section III on some less substantial personal musings on interest rate time-paths.

(d) A Digression on the Periodicity of Decision-making Meetings and Forecasts

Before moving on to these issues, I want, however, to digress for a moment on the subject of periodicity. The R/S model is a clever combination of annual averages and quarterly data points. The periodicity both of the forecasting process and of the decision-making process in their paper is implicitly assumed to be quarterly. In practice in almost all countries the periodicity of the decision-making process is higher (more frequent) than that of the forecasting process. This is partly because the decision-makers can subjectively update their own forecasts in the light of incoming news at less expense in terms of the use of skilled resources; so it is probably optimal to reconsider decisions with a higher frequency than formal, comprehensive forecasts. Nevertheless formal forecasts could be undertaken at almost any frequency, as also could policy decisions.

There seems, on the basis of casual empiricism, to be more international uniformity amongst developed nations on the preferred periodicity of formal forecasting processes for monetary policy purposes (quarterly) than on the preferred frequency for decision-making. FOMC meets 8 times a year, but can (and does) make inter-meeting policy changes; the Bank of England and the Bank of Japan meet once a month, (without inter-meeting changes so far, since the grant of operational independence); and the ECB meets twice a month, but will normally only consider the monetary policy decision in depth at one of these meetings.

Given that the frequency of both these processes can be chosen, and is not ineluctably and exogenously determined, there has been notably little analysis on what might be the optimal periodicity for either process. Instead, the frequencies seem to have evolved by practice, convention, and shared experience without much (any?) formal (e.g. cost/benefit) analysis. Presumably there needs to be some balance struck between the greater burden of work on both staff and decision-makers of more frequent forecasts and meetings against the likelihood of having quicker (and better?) decisions with higher frequency processes. To the best of my knowledge no formal analysis (indeed no analysis at all) of such a trade-off has ever been made.

II. Horizons

(a) The Horizon in the UK

The Chancellor's letters to the MPC, specifying the target (2½ % for RPIX) that the MPC is to seek to achieve, have not set any finite horizon for the achievement of that target, requiring it to be met indefinitely. Nevertheless the wording of these letters indicated that some short run flexibility, to allow for the occurrence of supply shocks and to limit excessive short-run volatility in output, would be both acceptable and desirable. The relevant wording in the letter of 3rd June 1998 was noted earlier in Section I.

In practice, the Monetary Policy Committee (MPC) has published inflation (and output) fan charts that extend two-years into the future. Moreover observers will have noted that, without exception, all the fan charts for inflation published since the MPC was established have shown the projected modal path for inflation very close to target in the quarters near to the terminal date, but deviating somewhat more (though rarely by much) in the prior quarters. The fan charts for inflation for the forecasts in February and May, 2000, are shown, Figures 1 & 2, at the end of the paper. The implication of this would seem to be that a horizon of about 18 to 24 months is also the policy horizon of the MPC.

In the meantime staff at the Bank of England have been exploring in a more formal analytic mode the factors that might determine the choice of an appropriate (perhaps optimal) horizon. The first of the two papers that I shall describe here is by Batini and Haldane (1999).

(b) The Batini/Haldane Study

In this study B/H establish, and calibrate, a five equation model for the UK; an IS curve with real interest rate and real exchange rate terms; an LM demand for money function; an uncovered interest parity condition for the nominal exchange rate; a supply side equation based on a staggered contracting model, and an equation in which overall inflation relates both to domestic and to imported inflation (import pass through). Against the background of this (numerically calibrated)

model, they then explore the (simulated) implications of imposing a class of relatively simple inflation forecast-based rules of the form: –

"$r_t=\tilde{a}\ r_{t-1} + (1-\tilde{a})r_t^* + \grave{e}\ [Å_t\ \eth_{t+j} - \eth^*]$

where r, denotes the short-term ex ante real rate of interest, $r \equiv i_t - Å_t\eth_{t+1}$, where i_t is the nominal interest rate; r_t^* denotes the equilibrium value of the real interest rate;
$Å_t(.)= Å(.|Ö_t)$, where $Ö_t$ is the information set available at time t and Å is the mathematical expectations operation; $\eth_t$ is inflation ($\eth_t \equiv p_{ct} - p_{ct-1}$ where p_{ct} is the log of the consumer price index); and $\eth^*$ is the inflation target.

According to the rule, the monetary authorities control deterministically the nominal interest rate (i_t) so as to hit a path for the short-term real interest rate (r_t). The short real rate is in turn set relative to some steady-state value, determined by a weighted combination of lagged and equilibrium real interest rates. The novel feature of the rule, however, is the feedback term. Deviations of expected inflation – the feedback- variable – from the inflation target – the policy goal – elicit remedial policy actions.

The policy choice variables for the authorities are the parameter triplet {j,è,ã}. The parameter ã measures the degree of interest rate smoothing (see Williams (1997)). So, for example, with ã=0 there is no instrument smoothing. è is a policy feedback parameter. Higher values of è imply a more aggressive policy response for a given deviation of the inflation forecast from its target. Finally, j is the targeting horizon of the central bank when forming its policy. For example, in the United Kingdom, the Bank of England feeds back from an inflation forecast around two years ahead (King (1997)). The horizon of the inflation forecast (j) and the size of the feedback coefficient (è), as well as the degree of instrument smoothing (ã), dictate the speed at which inflation is brought back to target following inflationary disturbances. Because they influence the transition path of inflation, these policy parameters clearly also have a bearing on output dynamics."

Of particular interest, both to the authors B/H and in this context, is what happens to the economy as the coefficient j, indicating the forecast horizon, is varied. One feature of the model, (and of the actual experience of open economies), is that the speed of effect of monetary policy on inflation is very sensitive to the impact of interest rates on exchange rates and thence on imported inflation. So B/H experiment with two versions, one "assuming full and immediate import-price pass-through (a shorter transmission lag); the other, no immediate pass-through (a longer transmission lag)." With the other two choice parameters, (ã, è) set at their assumed 0.5 base-line values, and the calibrated values for the equations in the model, B/H obtain the resulting outcomes for a output variability and inflation variability shown in their Chart 2, reproduced here as Figure 3.

As B/H state, p. 28,

> "Several points are clear from Chart 2. First, irrespective of the assumed degree of pass-through, the optimal forecast horizon is always positive and lies somewhere between three and six quarters ahead. This forecast horizon secures as good inflation performance as any other, while at the same time delivering lowest output variability. The latter result arises because three to six quarters is around the horizon at which monetary policy has its largest marginal impact. The integral of the real interest and exchange rate changes necessary to hit the inflation target is minimised at this horizon. So too, therefore, is the degree of output destabilisation (the integral of output losses). At shorter horizons than this, the adjustment in monetary policy necessary to return inflation to target is that much greater – the upshot of which is a destabilisation of output. Once we allow for the fact that central banks in practice feed back from annual inflation rates, whereas our model-based feedback variable is a quarterly inflation rate, then the optimal forecast horizon implied by our simulations (of three to six quarters) is rather similar to that used by inflation –targeting central banks in practice (of six to eight quarters).
>
> Second, taking either pass-through assumption, feeding back from a forecast horizon much beyond six quarters leads to worse outcomes for both inflation and output variability. This is the flip-side of the arguments used above. Just as short-horizon targeting implies 'too much' of a policy response to counteract shocks, long-horizon targeting can equally imply that policy does 'too little', thereby setting in train a destabilising expectational feedback."

They also note further, in their Conclusions p. 41, that

> "An i

[3] This comparison is also not exact, because the two definitions of horizon are different: the feedback horizon in the rule and the policy horizon in practice (the point at which expected inflation is in line with the inflation target) are distinct concepts.

optimal. B/H did not attempt to specify a loss function which the authorities might seek to minimize. It is, however, worth noting that a choice of horizon around 4-6 quarters, based on (annualized) quarterly – rather than average annual - inflation rates, minimised both output and inflation volatility. Using such a quarterly, rather than an annual, inflation measure tends to lead to a shorter implied lag measure.

(c) The Batini/Nelson Study

Since then Batini and Nelson have further extended this exercise in work in progress in the Bank, 'Optimal Horizons for Inflation Targeting', Draft July 1999. I hope that a revised version of this will be ready for circulation as a working paper reasonably soon. Unlike B/H, Batini and Nelson (B/N) do employ a loss function, in which deviations of the output gap and deviations of inflation from its target value respectively enter, in the benchmark case with equal weight, and which incorporates a specific discount factor. To explore the optimal horizon question, they then look at several small models, a one-lag four equation quarterly VAR and several variants of the calibrated model used in B/H.

They approach the question of appropriate horizons using two alternative criteria, first minimising the loss function to obtain an optimal policy horizon (OPH). Here the optimal horizon is not a choice variable, but is determined by the loss minimisation exercise. The second approach, rather more akin to B/H, is to examine a simpler feedback rule (i.e. simpler than the optimal control, OC, approach), where interest rates are set in relation to the deviation of forecast future inflation from the target at period k, thus,

$$i_t = Øp(E_{t-1}\, ð_{t+k} - ð^*),$$

(see B/N, p, 24).

The question then is which is the best value of k, i.e. the value which will minimise the loss function (when a simple rule of this kind is being followed). But the choice of k obviously depends onØ p,

[4] In assessing (optimal) policy horizons in such a model-based context, any stabilising rule for interest rate decisions will bring inflation close to, but not exactly equal to, a point target. Consequently B/N define the horizon in various ways, either as the period when inflation converges to within a specified range around a point target, or when a given fraction of the initial shock is permanently eliminated.

so that they term optimal feedback horizons (OFH) the choice of k when Øp is also optimal, and feedback horizons (FH) when Øp is not optimal.

The loss that will be suffered in the economy depends on the nature of the shock that disturbs it, e.g. whether a demand, supply, or exchange rate shock, and on the assumed model, in particular whether the economy is supposed to be backwards-looking, as in most VAR models, or forward looking, as in some variants of the calibrated B/H model. This means, unfortunately, that the OPH appears highly sensitive to shock-specific and model-specific factors, see for example their Table 4. By contrast the OFH works off the deviation of forecast from target inflation, (whatever may cause that deviation), and so is in a sense immune to the identification of the disturbing shock, though it too is highly sensitive to the specific model of the economy adopted. B/N then examine by what date (policy horizon or PH) the economy which follows an optimal feedback horizon will achieve a convergence of inflation to the target, using one of their earlier criteria for this. They find, Table 9, that the optimal feedback horizon (OFH) is, in all cases, shorter than the policy horizon (PH), or, in simpler terms, if you want inflation to converge to target at t+x you need, when using a simple rule adjusting for forecast deviations (from target), to work off deviations at t+x-q, where q>o.

It is <u>not</u>, however, also necessarily the case that the OFH is shorter than the <u>optimal</u> policy horizon (OPH). This (OPH) depends on the nature of the disturbing shock which has to be identified exactly to estimate an OPH, whereas in the estimation of the policy horizon (PH), B/N assume that the disturbance reflects the historical average of all the various shocks. The OPH depends both on the model and on the shock. In general, the OFH is again shorter than the OPH in the face of demand or supply shocks, but in three of the four models it is much longer in response to exchange rate shocks.

[5] Essentially, the criterion used for deriving the OFH makes B/N select optimal k in the presence of all three shocks simultaneously in stochastic simulations, with the importance of each shock depending both on how strongly it enters the model's structural equations and on the shock variance-covariance matrix.

(d) Preliminary Conclusions

My own reaction to this work included some concern at the multiplicity of variants, some of which, (e.g. whether or not interest rate smoothing might be adopted), have been glossed over here, and the extent to which the numerical results seemed sensitive to the precise specification, e.g. of model, shock, loss function, etc. This concern is not that the work is wrong, rather that it seems doubtful how much it can illuminate and ease the difficult decisions facing policy-makers. In practice it is rarely clear how far an actual forecast deviation of inflation from target is due to one, or other, shocks. How far such an exercise, whether to examine OPHs or OFHs, could be applied to the much larger and more complex models actually used in most real-life forecasting exercises, including those in the Bank, remains an open question. The first of the two exercises considered here, the B/H exercise, gave some comfort (to me at least) that the policy processes in the Bank were pretty much on course, because their calibrated model suggests that the optimal forecast horizon, that minimizes both output and inflation variability, is close to that which the MPC appears in practice to have chosen. The second exercise, however, i.e. the B/N paper, suggests (to me at least) that selection of (optimal) horizons is so model/context specific that little advance can be made unless such studies can be brought to apply to the specific model/context under consideration in practice by the MPC. Whether that can be done in practice has yet to be seen.

III. The Prospective Future Time Path of Interest Rates

(a) The Prima Facie Case against a Constant Time Path

As is well known, the MPC's forecast is conditioned on the assumption that, between the starting date of the forecast and the two-year horizon, the short-term nominal policy-determined interest rate will be held constant. Initially this assumption was adopted in some large part because the forecast was done by the Bank, but the future decisions were taken by the Chancellor, and the Bank could not be seen publicly to second-guess what the Chancellor might do in future.

But that quasi-constitutional constraint has gone. In formal constitutional terms the MPC can, if it so wishes, indicate its own future expectations. Meanwhile continuing to adopt a (formally non-binding) assumption might seem to limit artificially the range of possible alternative paths that could be considered, at least in public. It would only be by extraordinary accident that the best, optimal, plan would be to consider a change of interest rates today and then intend to hold rates constant at this (new) level for the next eight quarters.

Moreover, we know that holding nominal interest rates constant tends to lead to Wicksellian instability. In practice, the rate of change of most variables visible at the two-year horizon in the MPC forecast generally, (though not invariably), tends to persist, and on occasions to accelerate, in the third and subsequent years. Consequently any simulation, or other model exercise, with a horizon (much) beyond two years requires bolting on to the initial premise of rates unchanged for two years, an auxiliary assumption that at some point (after the two-year horizon) the unchanged interest rate starting-point is shifted to the adoption of some stabilising rule for nominal interest rates, (e.g. a Taylor rule with appropriately chosen coefficients). Such a joint system might be described as spatchcocked, or at least inelegant, (a term of some considerable opprobrium in academic circles!)

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[6] In the UK, government expenditure plans are specified in nominal terms. Hence any shift in inflation implies offsetting projections for real government expenditures. This conditioning assumption can strongly dampen any tendency towards Wicksellian instability.

[7] A minor variant of the same criticism is that the inflation/output fan charts are misleadingly wide, especially in the second year. If inflation did appear to be diverging from target so much, surely the MPC would respond, and such response would dampen the divergence (e.g. Flemming, 1999)? That criticism could, in principle, be met by applying a 'rule'-based response to divergences (beyond a certain range).

Finally, it is not surprising that market expectations are often for a future time path of interest rates that is far from constant. Not only will an assumed future constant path in the MPC forecast often not be seen as the most likely, or highly credible outcome, but it also causes internal complications for the MPC's own forecasting process. Wherever current behaviour depends on future expectations of interest rates, as is the case notably with exchange rates, (e.g. under any form of the uncovered interest rate parity (UIP) hypothesis), then the MPC's forecast involves the prediction that the market's expectations will be systematically falsified, on the assumption that short-term interest rates do remain constant. That means that the MPC forecast must contain a tricky assumption about how the market would react to a (systematic) string of falsified expectations, (not an easy matter).

Since the MPC is fully aware that its conditioning assumption of constant future interest rates does not accord, most of the time, with the implicit forward rate expectations of the market, as for example derivable from a market yield curve, it also publishes a fan chart of the projected inflation and output outcomes that it forecasts would result, if the markets' (calculated) expected time path for interest rates was to take place, e.g. as shown in the February 2000 Inflation Forecast, figure 4. Casual observation will, however, show that the deviation of forecast inflation in the MPC's own forecasts from its (2½%) target is generally wider, at the 18/24 month horizon, for the forecast with (calculated) market rates than with the MPC forecast conditioned on constant rates. The implication is that policy making rests on the MPC's conditioned forecast, with the market rate forecast presented also to help inform outside observers of what might happen if the market's implied predictions were to occur.

So the forecast, conditioned on constant interest rates, is the more important for UK policy-making purposes. The case against the constant interest rate assumption is that it is unnecessary, would seem often to imply, if taken as a binding constraint rather than as conditioning assumption, a probably sub-optimal decision, is often hardly credible as the most likely outcome, and involves various forecasting and simulation problems.

But again such a combination of a constant-path assumption for the modal (most likely) projection and a rule-based path for divergences could also be described as spatch-cocked and inelegant.
There are, however, other reasons to wonder whether the width of the fan charts is quite correct, (e.g. it is based largely on averages from past history). My own feeling is that, whereas the above criticism is formally valid, it is not a matter of great significance. I could happily live with it.

As the first draft of this paper was being written, this criticism surfaced in an IMF Working Paper, by Martijn and Samiei, (1999). They argue that:-

> "The problem [of the credibility of the Bank's inflation forecast] is compounded by the absence of an explicit assessment of the likely future path of the interest rate in the Report. While more recently there has been an effort to emphasize alternative views held by MPC members, the primary inflation forecasts are made under the assumption of unchanged interest rates. In principle, there are many interest rate profiles that could deliver an inflation of 2.5 percent two years ahead. Clearly, and as discussed in the previous section, there is no reason to suppose that a policy that holds interest rates unchanged and delivers a two-year ahead inflation of 2.5 percent is necessarily superior to other policies.
>
> The Inflation Report, therefore, appears to lack transparency and credibility in relation to its inflation forecast. It is not obvious to what extent the inflation forecast based on constant interest rates is an expositional or an operational construct. If it is the latter, the MPC indeed does not intend to smooth interest rates, and consistently expects to hit the target at the newly set rate. In that case the framework is transparent, but, given a history of interest rate smoothing, it is not considered credible by market participants, as is evidenced by the deviating market forecasts..... On the other hand, the constant interest rate assumption may merely be an expositional tool. In this case, the MPC in fact considers that further interest changes are likely to be necessary, even in the absence of news, implying that the MPC's forecasts lacks transparency as well as credibility."

(b) <u>But What Alternative Procedure would be Better?</u>

While the constant rate assumption undoubtedly has certain shortcomings, the question then becomes what are the alternatives that might be proposed, and are they preferable?

One alternative would be to have the MPC decide, and vote, not just on the change in interest rates this month, but also on the whole prospective path up to some (arbitrary) horizon in a discretionary mode. But there is a virtually infinite set of possible time paths, delivering convergence to the inflation target at a wide range of policy horizons. The space of choice becomes so great that it is hard to see how a Committee could ever reach a majority for any particular time path. A great advantage of restricting the choice, to what to do now this month, is that it makes the decision relatively simple, even stark. Given the difficulties involved already in achieving majority agreement in the MPC on this simple decision, the idea of trying to choose a complete time path by discretionary choice seems entirely fanciful and counterproductive.

That means that the future time path would have to be determined in some other fashion. A standard academic approach would be by optimal control procedures, i.e. minimising a loss function applied to the forecast. There are a variety of problems with this. First, formally establishing such a loss function, unless it was agreed by the Chancellor, might be seen as the MPC abrogating to itself the right to select its own (short-term) goals; it could be thought to involve a 'democratic deficit'. Against that, it could be argued that the Chancellor's letter, as outlined in the Introduction, with its recognition that "the actual inflation rate will on occasions depart from its target as a result of shocks and disturbances. Attempts to keep inflation at the inflation target in these circumstances may cause undesirable volatility in output", does already provide some tightly limited room for discretion by the MPC to apply a (short-run) loss function. That discretion is limited by the requirement to write a letter to the Chancellor, if inflation deviates from target by more than 1%. If, in such circumstances, the MPC proposed to return inflation to target more or less rapidly (than the Chancellor wished), given the projected effects of that on the prospective path of output, the Chancellor could tell the MPC to adjust its plans, according to his own preferences.

Some might argue that any decision must be based on <u>some</u> implicit loss function, so that it would be more transparent if the MPC made this explicit. But, given individual responsibility, can one give any meaning to a <u>collective</u> loss function? I believe that I could, more or less, interpret my own loss function when I was on the MPC, (symmetrically linear in the deviation of inflation from target at the six to eight quarter horizon), but I believe that other members had differing loss functions, and my own was conditional on the absence of any large (supply) shocks during my period on the MPC.

Second, it might be difficult for a Committee to agree on any formal functional representation. The coefficients in the function would be somewhat arbitrary, (and what would be done about the standard Central Bank practice of interest rate smoothing?). Moreover, membership of the Committee is time-varying, and existing members may find that their views about the (short-run) loss function shift as the context changes. In short, choosing a formal loss function might need to be revisited on each relevant occasion, running into exactly the same problems of complexity for decision-making that was outlined above.

Third, it is not clear that optimal control procedures could be applied in practice to larger, messy forecasting models incorporating a wide variety of subjective assumptions, residual adjustments and such other discretionary adjustments as the MPC applies to its own forecast. It is far from clear that such techniques can make the large jump from small (two to six) equation models with often styilized shocks to real live forecasting models with a much messier context. That still has to be seen.

Fourth, if such optimal control procedures were applied to the forecast, the resulting outcome of time paths for interest rates, inflation, etc., would become a hideously complex interaction of forecast and OC procedure. It is already difficult enough for MPC members to understand all the nuances of their own forecast, even when conditioned on relatively simple assumptions. Introducing OC procedures in addition might well lead MPC members to regard the whole exercise as a mysterious 'black box' whose entrails were only comprehensible to a tiny number of staff academic specialists. Against this it could be argued that outsiders, as contrasted with MPC members, would find judgmental models even more of a `black box' than those undertaken on the basis of some (clearly) specified rule. Yes, but it is the MPC members who are individually responsible for the policy decision, and the primary purpose of the forecast must surely be to help them do so.

Fifth, if MPC should find it more difficult to understand how the resultant outcome for the relevant variables had been determined, how would it be possible to explain it to the public, or to justify the decisions that would hang in part from it? To say that the MPC had done what the model told them was best to do is not very convincing, especially given the track record of fancy economic models.

Those considerations suggest that, at any rate for the time being, a no-change assumption for interest rates could <u>not</u> be replaced by a full optimal control exercise, but would need to be replaced by some simpler rule, e.g. a forward-looking Taylor rule. That runs into the difficulty that there are a plethora of such potential rules. The R/S paper, described in Section 1, mentions at least six types of rule (inflation deviation; Taylor rule; forward-looking Taylor-rule; an instrument rule working off a rule-consistent inflation forecast; strict inflation target; flexible inflation target). Each rule would need auxiliary decisions on parameters, including interest-rate smoothing, and horizon. The optimality of any rule is almost certainly model dependent. R/S have done some work on what might be the best buy amongst such rules using a simplified model in the US. What might be the best choice of rule for the UK in the context of our actual forecasting model is far from clear. Much more work

on how the time paths of the relevant variables (including interest rates) might look if various alternative rules were to be adopted would seem to be required before one could be confident that one was not jumping out of the frying pan into the fire, if one was to replace the constant assumption by a future ‘rule’.

Of course, it would be possible to show both the time path of inflation and output implied by some particular rule as well as the time path implied by the constant assumption. But which `rule'? And that would lead to at least three projections for inflation and output, conditioned on constant, market and `rule based' interest rate paths.

Some commentators, for example Flemming (1999), argue that the present form of the inflation fan chart is relatively uninformative, since the MPC's remit implies that it is bound to try to drive forecast inflation back to target at the policy horizon date. So, they would regard a projection of alternative possible interest rate paths, to achieve that remit, as being more useful public information. While that argument has some substance, it would require a large amount of additional research work to make it operational. Whether such an approach could also be easily communicated to the general public, and would provide any clear message, would need to be considered.

Moreover the adoption of any ‘rule’, or set of `rules’, would not eliminate some of the criticisms applied to the constant interest rate assumption. For example, the ‘rule’ related interest rate path would still normally deviate from market expectations, so requiring some kind of expectation correction mechanism to be applied to the exchange rate forecast. Second, in some circumstances a ‘rule’ based forecast for the time path of interest rates might have as little, or less, credibility as a constant forecast, e.g. in the aftermath of an asset price shock; consider for example whether a ‘rule’ based forecast would have given a credible projection in Autumn 1998 in the aftermath of the Russian default, LTCM and the weakening of business confidence.

Moreover a ‘rule’ based forecast shares some of the potential faults of an optimal control forecast. It adds to the complexity of the forecast, and makes the outcome less transparent to all concerned. It thereby makes it harder to explain and to justify to the general public.

(c) Flexibility and Commitment

If one adopts a 'rule', there is some implication that one will follow that path. The constant, no change, assumption is clearly exactly that, an assumption not a rule. Nobody regards there as being any commitment for the MPC to abide in future by that assumption, nor is the credibility of the MPC damaged when, having made this assumption in a forecast one month, it decides to change interest rates even in the next month, if the 'news' that month should appear to warrant that.

There is something special about zero, no change. Any indication that the MPC is formally indicating a future specific change in rates, e.g. as driven by a 'rule'-based formula, would be taken to indicate some degree of commitment. It is my view that the few experiences in the past where the MPC has given any measure of commitment, e.g. in August 1997 (Inflation Report, p. 50), were soon felt to be burdensome and unhappy.

Moreover, the extent of any such commitment may be interpreted differently between the market and even by different members of the monetary authority itself (Thornton, forthcoming paper). It appeared, from a distance, to be a problem for the FOMC in the Summer of 1999 that its statements about bias were at times misinterpreted by the market, requiring subsequent speeches by the Chairman to try to rectify. It was for reasons such as this that the MPC responded to the Treasury

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[8] This was underlined, even as the first draft of this paper was being written, by a report that the 'Fed [was] to examine policy bias announcements' in the Financial Times, Tues. December 14, by S. Fidler in Washington who reported, p. 11, as follows:-

"A policy step taken by the Federal Reserve earlier this year aimed at increasing the openness about its decision-making has confused financial markets, the central bank has admitted. ……
Despite the aim to increase transparency about the Fed's activities, and therefore to calm market volatility, the bias statement is widely acknowledged to have had the opposite effect. Critics have suggested that this is because of widespread confusion about what the bias statement means, confusion that appears to be shared by some Fed officials.

Some observers also say the fact that the Fed is not required to announce the bias at the end of each meeting has led the markets to interpret excessively the importance of the decision to announce bias. Economists say the statement has almost no utility as a predictive device since it is likely to give an indication of the next move in interest rates only 30 to 50 per cent of the time."

Select Committee of the House of Commons that it had no wish to publish a statement about future bias.

A bias statement is, I would suggest, much less binding on future decisions than a quantified projection for a future path of interest rates. Unforeseen events (shocks) are likely to make the MPC depart from any such pre-figured path. This may well be seen by markets as reneging on a prior commitment, and lead to accusations of misleading the market. It would be quite difficult for the MPC either to decide, or to explain to the markets, just what extent of commitment was involved in following a rule-based path. The authors of the IMF Working Paper (op cit) are aware of this problem, but do not, in my view, give it sufficient weight; they assume this difficulty away when they state (p. 16) that:-

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[9] In any case the arguments in the Minutes of the MPC meetings and the recorded individual votes give a considered view of the current inclinations of the MPC. For example the Minutes of the April, 2000 meeting report, Paras (29-32) the differing views of the members of the MPC. For example Para 31 states that

"On one view, it would be better not to raise rates this month. The news over the month as a whole was inconclusive, with falls in manufacturing production, retail sales and consumer confidence, and oil prices, but with the determinants of domestic demand, both private and public, remaining robust, Against that background other factors were also important. First, the extent of price pressures stemming from the labour market required further analysis, not least in disentangling the effects of bonuses and other elements of wage drift from that of settlements. Second, the analysis undertaken for the Inflation Report, and the opportunity this provided to set out the Committee's thinking in detail, were valid reasons not to move this month unless there was a strong case to do so. Third, for some, the volatility in equity markets introduced a possible downside risk which might mean that any increase in rates this month would need to be reversed soon afterwards. Finally, the imbalances in the economy, manifested in another fall in manufacturing production, seemed to have worsened. An increase might exacerbate these imbalances and it was possible that the weakness in some sectors might feed through into the rest of the economy. With inflation running below target, and expected to continue to do so for a while, there was no pressing reason to raise rates straightaway. For these members, no change in the repo rate was needed this month, although for some of them it was more likely than not that there would need to be an increase in rates in due course.

10 In New Zealand, however, the Reserve Bank has indicated the future path that it projects for its monetary instruments. Initially this may have been less problematical since they published a path for a Monetary Conditions Index (MCI) which involved a complex combination of future developments for interest rates and exchange rates. Subsequently, however, after an unhappy episode during the Asian crisis, the RBNZ abandoned this procedure; it now does publish a projection for interest (and exchange) rates separately, see their Monetary Policy Statement, May 2000, p. 4. Whether, or not, markets will accuse the Governor, Mr. D. Brash, and the RBNZ, of `reneging' when actual interest rates deviate from their previously projected path has yet to be seen.

> "Obviously, the Bank would have to make it clear it was not committing itself to a particular path, so that without loss of credibility it might revise its projection at a later date as new information becomes available."

By contrast, a constant interest rate assumption is generally perceived as involving no forward commitment whatsoever. So it imposes no constraints on the MPC's future decisions, leaving the MPC to respond with maximum flexibility to unforeseen events as they occur.

There is, however, a clear division of views about the degree of forward signalling of, and market preparation for, future interest rate changes that (independent) Central Banks regard as suitable. The MPC certainly wants the market to be able to predict its future moves - and I believe that its members were not unhappy by a report that a computer had been programmed on an in-sample basis successfully to do so, (the programme's out-of-sample subsequent predictive ability was less good!). Indeed the MPC wants monetary policy to be seen as `boring'. But the MPC wants the basis of such predictability to be a considered assessment of its `reaction function' based on published accounts of members' actual votes and detailed Minutes of the reasons for such votes, rather than more speculative comments in advance of the actual decision-making meetings of how (individual) members might vote. Given the large weight placed on individual accountability in the MPC and the inherent unpredictability of economic `shocks', any attempt to foreshadow in individual comments the prospective future decisions of the MPC as a whole would be seen as potentially embarrassing hostages to fortune.

In contrast, the Fed and the European Central Bank (ECB) appear to consider the preparation of the market for future interest rate changes, for example by public statements by the Chairman, to be often desirable. This may reflect in part a tendency of the Fed and the ECB to have a more collegiate, consensual bias to decision-making, whereas the MPC places more weight on individual responsibility. It would be an interesting exercise to try to ascertain whether there are significant differences between the propensity to signal future interest moves between Central Banks, and, if

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[11] In their next sentence they state that "The Bank could also include outside projections of inflation in the Inflation Report." The MPC already does so, and the Inflation Report is the responsibility of the MPC, not of the Bank alone; the coverage of the two differs.

so, what might be the causes, and consequences, of such differences, but that exercise has not yet been done. In the absence of such an exercise, further discussion of `signalling' would take me beyond the self-imposed limits of this paper.

(d) What are the Consequential Incentives for Behaviour?

The combination of a published forecast for inflation, together with the assumption of constant interest rates from the forecast date to the horizon, has the effect of inducing the MPC to act now to adjust expected inflation at the appropriate horizon into line with the target. The MPC would not, in my view, feel comfortable with publishing a central projection for inflation deviating significantly at its focus horizon, of six to eight quarters, from its target. Since the MPC adopts a conditioning assumption of future constant interest rates, the logical implication is that interest rates have to be varied now in order to drive inflation back into line with forecast inflation at the policy horizon. If the MPC could choose a time-varying path for interest rates, it might be more inclined to defer interest rate changes until it was possible to learn more about evolving conditions.

There is a developing debate in the academic literature between those who suggest gradual changes in interest rates, (for example because of uncertainty about key parameters in the model (Brainard uncertainty), about possible errors in the data, and about opportunities for learning), and those who argue for more aggressive and pre-emptive action, (e.g. the need for robust policy responses and minimising potentially large errors). It is my conjecture that the choice of a constant versus a time-varying interest rate path has similar implications. The assumption of a constant interest rate path (plus a published forecast) may be thought to induce the MPC into early pre-emptive action. Whether, or not, ‘gradualism’ or ‘pre-emptive’ action is generally preferable is too large a subject to enter into here. My conjecture is that the MPC’s procedure tilts it in the direction of early, pre-emptive actions, and my personal viewpoint is that this is desirable.

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12 If so, one might have expected short-term interest rates to follow, at least to a reasonable approximation, a random walk process. In practice changes in interest rates appear to have been as serially correlated and gradual so far under the MPC as in previous regimes and in other countries. I want to reflect on the reasons for this outcome in my future work.

The Working Paper from the IMF (op cit) is less than appreciative, or fair, in this respect. The authors do not seem to realise that publishing the forecast in this way forces the MPC to act now on interest rates in order to drive inflation to its target level 18/24 months hence. Instead they question whether the forecasts are "credible". Thus they state, p. 15,

> "Since the MPC took over the job of monetary policy decision making, the analysis and the inflation forecasts reported in the Inflation Report cannot be treated as those of an independent reviewer: the body that makes interest rate decisions also assesses these decisions. As a result, it would be difficult to envisage a situation where the forecasts suggest that the two-year ahead inflation, on which public scrutiny tends to focus, would (in probabilistic terms) be missed, because then the report would in fact be questioning the committee's own policy decisions. Indeed, since the Bank became independent, two-year ahead inflation has always been around the target. While this is possible logically, it raises questions as to the credibility of the Bank's inflation forecast."

In so far as this suggests that, rather than adjust interest rates to hit the target, the MPC manipulates the forecast to appear to be hitting the target, it is a slur which members of the MPC would find offensive. Moreover in the large scale exercise involved in such a forecast, involving many Bank staff as well as all the MPC, such cosmetic manipulation could not get done without notice and huge risk of becoming publicly known.

One syndrome that I sometimes seem to perceive (both in myself and occasionally also in others) is the belief that the quantum of uncertainty (fog) will be reduced by waiting (e.g. to make a decision). Current shocks, implausible data points and unintelligible anomalies are always very clear. But the mean expectation of future shocks is zero; hence some of us may tend to assume implicitly that they will actually turn out to be zero. If that were so, uncertainty would indeed reduce over time. But, of course subject to a qualification below, the distribution of shocks is constant over time, so the best expectation of the future quantum of uncertainty is that it will be constant. If, as I believe, uncertainty myopia exists, then a procedure forcing an early decision may well be desirable.

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[13] There may be some seasonal patterns in uncertainty. There is some tendency in the UK for large negatively correlated movements in consumption in December and January, so assessment of consumption trends may be better left till late Winter. Again, wage settlements and bonus payments tend to be concentrated in the Winter and Spring, so there is more uncertainty in December-June than in July-November. There are other instances of time-varying uncertainty relating to holidays, Budget dates, etc. More research could be done to ascertain whether such seasonal patterns in uncertainty really do exist; it would be a nice simple exercise.

(e) Conclusion

In so far as the assumption of a constant time-path for interest rates was taken as an effective constraint, rather than just a conditioning assumption, it would have the effect of inducing the monetary authority to choose a probably sub-optimal and often non credible path. But if correctly interpreted just as a conditioning assumption, it simplifies the decision-making process, making it easier to understand and to explain publicly; provides the greatest flexibility, minimum forward constraint on the MPC's future actions; and encourages the MPC to act in a robust, pre-emptive fashion.

It will certainly be desirable to do further research on what either an optimal control, or assorted rule-based, models would imply in the context of UK forecasting systems. But that should initially be for internal use only. Whether, or not, such further research might lead the MPC to change its forecasting assumption about a constant interest rate path is far from clear. Until such time, for the reasons set out above there seem to me to be good grounds for maintaining present procedures in this respect.

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