Bank of England

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Dear Harriett,

Bank of England inflation forecasts and models

Thank you for your letter of 13 June requesting further information about the Bank of England's inflation forecasts and models following my appearance at the Treasury Committee on 22 May.

In the intervening period, we have embarked on the monetary policy round culminating in the MPC's decision announced on 22 June, during which I have been subject to the restrictions of the quiet period surrounding MPC meetings. I hope this excuses my somewhat delayed reply.

In your letter, you raise a number of questions about the Bank of England's framework for producing the inflation forecast published quarterly in the MPC's *Monetary Policy Report*. This forecast is used as one of the main vehicles for the formulation and communication of monetary policy decisions.

In particular, following our discussions at the Treasury Committee, you ask whether the data sample underlying the estimation of some of the models underpinning the forecast framework should be extended backwards to encompass data from the 1970s and '80s. This was a period when the level of inflation was elevated, and therefore may

shed light on how the UK economy is behaving now, with inflation unfortunately well above target.

The role of macroeconomic forecasts in the monetary policy process

Before addressing that issue directly, as well as answering the specific questions you raise in your letter, it is helpful to outline briefly my assessment of the role played by macroeconomic forecasts within the MPC's policy process. I appreciate that this touches on issues that will be addressed by the forthcoming external review of the Bank's forecasting and related processes commissioned by the Bank's Court, as described in the Chair of Court David Roberts' recent reply to your letter to him also sent on 13 June. I do not want to anticipate that important exercise. On the contrary, I look forward to discussing opportunities to improve the monetary policy process at the Bank of England, both as part of that review and with the Treasury Committee. Nevertheless, it is useful to draw out four features of the character and role of macroeconomic forecasts as context for my subsequent replies.

First, in my view macroeconomic forecasts can and do play various roles in the monetary policy process. They can simply be used to anticipate future data outturns, of inflation and other macroeconomic variables at various horizons. They can help to develop a narrative for the evolution of the economy and the outlook for inflation that underpins monetary policy decisions. They form a basis for internal discussion among the members of the Monetary Policy Committee, offering a framework for reconciling the inevitable tension between developing a collective view of the inflation outlook and the individual accountability of MPC members to Parliament (including through hearings of the Treasury Committee). They represent a quantitative framework within which to assess the impact of disturbances to the economy on the inflation outlook and thus calibrate the appropriate monetary policy response. They are vehicles for the communication of monetary policy decisions and its rationale to the public and other external audiences, such as financial market participants and the media. And they are a means to shape, steer and anchor private sector inflation expectations, in financial markets and of households and firms, so as to influence behaviour in a way that supports the MPC's achievement of its remit.

In the more benign environment encountered by the MPC in earlier years of the inflation targeting regime, a case could be made that a single forecast could serve all of these roles simultaneously. However, in more recent times – in the face of what has been labelled 'radical' or significant uncertainty (and, in particular, in the aftermath of a significant inflationary external shock that pushed inflation well above target) – we have seen that a single forecast or forecast framework can struggle to serve all these roles at the same time. For example, a forecast that constitutes a good starting point for the difficult internal MPC discussions about the inflation and policy outlook may not be a

helpful vehicle to present to the public the rationale for the final monetary policy decision arrived at on that basis of the ensuing discussion.

In this more difficult environment, when assessing the quality of any individual forecast or forecast process, it becomes important to establish the criterion against which it is to be judged, recognising that different forecasts and analytical frameworks may serve different purposes. More than one model, forecast or scenario is likely to be required. I anticipate that this observation will play an important part in the forthcoming external review and hope that it helps frame my answers below.

Second, I would emphasise the richness of the analysis that underpins the MPC's policy decisions, which extends beyond a specific inflation forecast or fan chart.

A common characterisation of the formulation of monetary policy envisages a two-stage process. In the first step, all available information is embodied into a single forecast of inflation. And in the second step, monetary policy decisions (say on changes to Bank Rate) respond in a mechanical fashion to deviations of that forecast from the inflation target.

This characterisation has the beauty of simplicity, but it also runs the risk of treating the much richer and more complex process of policy preparation in a simplistic way. Here I pick out two example from among the many shortcomings of this characterisation of the MPC process, which I choose as they have been discussed at recent Treasury Committee hearings. (1) As a practical matter, not all of the available and potentially relevant information is (or can be) embodied into the inflation forecast: there is thus a case for exploring that information (say in market measures or surveys of inflation expectations, or in monetary developments) in parallel with, and not just embedded within, an inflation forecast. (2) Effective policy decisions will be based on an assessment of their implications in adverse circumstances; in other words, on how much protection they offer against the worst possible outcomes. Such 'risk management' or 'robust control' approaches to monetary policy necessarily draws on more than an inflation forecast (or even its distribution) at a specific horizon.

In short, while an inflation forecast helps to summarise a large quantity of information into a digestible and communicable form, it is not a 'sufficient statistic' that, on its own, should govern or could be used to explain monetary policy decisions. Recognising that Bank Rate decisions should not follow in lockstep with changes in an inflation forecast at a particular horizon is key in understanding the role played by such forecasts in the policy process.

Third, while economic models are important tools in preparing monetary policy decisions, the macroeconomic forecasts used by the MPC always embody a degree –

often a large degree – of judgment, both of the part of Bank staff and of Committee members.

As my MPC colleague Catherine Mann remarked at our recent hearing before the Treasury Committee, employment of judgment is both standard practice in macroeconomic forecasting and a necessary element of converting model-based exercises into a narrative relevant for and useful to policymaking. By nature, economic models are simplifications of reality and capture economic developments imperfectly. Adding judgement makes those models more useful: it is the need for judgement that prompts the need for a Committee to assess the economy and formulate monetary policy rather than rely mechanically on model output. A good model will impose some discipline on that judgement – for example, ensuring that the implied outcomes respect accounting restrictions or agreed behavioural norms – to avoid that the policy discussion becomes unfocused.

Arguably, it is the forecast 'errors' made by those models that reveal where further analysis is required for monetary policy purposes. A forecast error either identifies a new economic disturbance to which monetary may need to respond or it reveals weaknesses in the existing conventional wisdom embodied in the underlying forecasts and judgements, which may require new and different judgements to be made that, in turn, also prompt monetary policy responses.

Paradoxically, it may be the forecast's errors that are more important than its predictions: it is those errors that trigger the necessary learning and corrective feedback that a well-functioning policy process should embody. The MPC has always evaluated, and is continuing to evaluate, forecast and model errors in this way, with the goal of deepening its understanding of the economy. As reflected in our current challenges, that learning takes time. The parameter estimates embodied in models will tend to evolve gradually.

Fourth (and reflecting the above points), when preparing monetary policy decisions and / or constructing macroeconomic forecasts, we do not rely on a single model or framework. Any single model would have struggled to capture the impact and propagation of the economic shocks we seen in recent years (the Covid-19 pandemic, the global financial crisis, the invasion of Ukraine and its consequences in international commodity markets), given their scale and unique characteristics.

As a result (and as you recognise in your own letter), the Bank employs a suite of models in developing its views on the UK economy. For example, a set of models for household consumption or wage developments are used on a systematic basis to evaluate and cross-check the judgemental forecasts produced for the baseline projection. The Bank staff are constantly refining and developing new models, in many cases to deal with bespoke questions.

Using a variety of models and cross-checking their implications among one another is an important mechanism for improving the robustness and reliability of conclusions drawn. Where models point in different directions, the implied uncertainties can also be highlighted to policy makers. Rather than relying on a single model or framework, a well-designed policy process will draw on a broader set of inputs.

Employing data from the 1970s and '80s

Having set out these broader framing points, I will now address your comments on the possibility of using data from the 1970s and '80s to support monetary policy decisions, in particular by extending the estimation period of some of the Bank's macro models back to that period.

As I remarked at the May Treasury Committee hearing, the modal view embodied in the MPC's latest macroeconomic forecast (as published in May 2023 *Monetary Policy Report*) relies mainly on empirical tools developed using the last three decades of UK economic data, which cover the period since the introduction of inflation targeting. As you point out, the published version of the Bank's COMPASS econometric model is also estimated using data from this period.

There are good reasons to focus on this span of data. The time series are sufficiently long to allow estimation of the models. And the sample is sufficiently recent to make it relevant for conjunctural analysis. Moreover, using an empirical framework that draws on data from the prevailing monetary policy regime has the advantage – at least in principle – that key features of that regime, which remain relevant today, are captured in the empirical framework. By nature, models estimated using data from other, earlier regimes (such as those involving exchange rate or monetary targets) may not capture those features so well.

More specifically, to the extent that economic decisions are driven by expectations and the way households, firms and financial market participants form their expectations is influenced by the monetary policy regime, economic behaviour can vary from one monetary policy regime to another, creating an instability in estimated empirical models as the relationships between macro variables change. (There is ample evidence of the model instabilities created by these 'regime shifts' in the history of UK monetary policy, e.g. in the breakdown of money demand relationships in the early 1980s as intermediate monetary targets based on those relationships were introduced.)

This is a restatement of the so-called 'Lucas critique' of macroeconomic models: while structural behavioural relationships should in principle be stable through policy regime changes, in practice macroeconomic models are based largely on 'reduced-form' estimated relationships which are vulnerable to instability as the policy regime – and the expectation formation process – change. Relying on an empirical framework

estimated within the same monetary policy regime offers the best hope of estimating stable (and thus more reliable) empirical models. Restricting estimation samples to specific monetary policy regimes is standard practice in the research literature.

Of course, this argument assumes that the expectation formation process has remained stable throughout the entire inflation targeting regime to date. Implicit in your question is the suggestion that expectations formation has changed in recent times owing to the exceptionally high rates of headline inflation seen over the past two years. That is a possibility that cannot be dismissed out of hand since, as I recognised at the Treasury Committee hearing and has been acknowledged in recent MPC communication, we have seen greater persistence in inflation developments in recent months than characterised the earlier part of the inflation targeting era, even as longer-term inflation expectations have remained anchored close to target.

As you suggest, one response to that challenge is to use models and analysis from a different monetary policy regime where inflation was both more elevated and more persistent to shed light on recent developments. This is one approach Bank staff have adopted. In particular, the staff have revisited models of wage and price determination published in the academic literature in the 1980s, which explored the surge in inflation in the UK from the mid-1970s (in particular following the oil price shocks of 1973 and 1979). In doing so, my colleagues on the staff have both re-estimated those models using recent data and taken model estimates from that period to develop frameworks that can explore and evaluate recent wage and price developments. In a recent speech to the International Centre for Monetary and Banking Studies, I used these frameworks to discuss how the deterioration in the UK's terms of trade associated with the rise in imported natural gas prices led to a squeeze on UK national income and, in concert with efforts by UK residents to sustain their real spending power, prompted greater inflation persistence. This mechanism draws directly from the experience and modelling of the 1970s and '80s.

Such exercises can therefore shed helpful light on the current situation. In my case at least, they represent one element underpinning my concern that inflation may prove more persistent in the aftermath of the recent, exceptionally large inflationary impulse generated by the invasion of Ukraine than experience during the prior inflation targeting era alone would suggest. This helps motivate both the importance I attach to the upside skew in the MPC's most recent inflation projections and my recent votes to raise Bank Rate.

Yet there are a number of reasons for caution in relying on evidence from or models developed in the 1970s and '80s. These reasons are the mirror image of the arguments in favour of focusing on estimates developed using data under inflation targeting. The structure of the UK economy has changed dramatically over the past half century: the

manufacturing sector has declined; the economy is more open to international trade and finance; labour markets and the wage bargaining process have been transformed by a decline in unionisation and deregulation; debt burdens and their distribution across and within sectors have evolved. And the change of monetary policy regime has influenced expectations and thus behaviour: based on developments in long-term nominal interest rates, UK inflation appears much better anchored to low levels today than was the case in the 1970s.

In line with my general framing comments, I want to emphasise that the analysis underlying the MPC's assessment and monetary policy decisions is not limited to any one specific model, forecast or data sample. As I have emphasised, the analysis draws on all available and relevant information, and views it through the lens of a variety of models and analytical tools.

In particular, analysis of data from the 1970s and '80s has been explored to develop deeper insight into recent experience of greater-than-expected inflation persistence. But this exploration is a complement to, rather than a substitute for, models and analysis based on data from the inflation targeting era. And the insights from the 1970s and '80s are only one part of the MPC's wider assessment of inflation persistence, which also draws on information from (*inter alia*) surveys of businesses and households, new non-linear theoretical and empirical models and cross-country experience.

Specific questions

Where do you think the Bank's modelling platform for inflation is performing well? Where, in particular, is it underperforming?

Based on the assessment developed above, I would emphasise the success of the forecasting framework in developing a clear, internally consistent and intelligible modal macroeconomic forecast that represents a common basis for the discussion of monetary policy at the MPC. MPC members are then able to articulate their own views, judgements and assessments against this common and transparent benchmark, which in turn supports a healthy and constructive dialogue leading to policy decisions. Such an approach avoids MPC members approaching the anyway difficult policy discussion from very different starting points, which would risk an unstructured and unproductive debate.

The greatest weakness of the current forecasting framework is the difficulty it faces in explaining the greater-than-expected persistence in UK inflation following the large – one could say unprecedented – external inflationary shock following the invasion of Ukraine. In part, this weakness reflects the challenge of making real-time forecasts at a time of considerable uncertainty: modelling the greater persistence of inflation empirically is inevitably challenging since the data reflecting that behaviour is only just

emerging. While the Bank staff have developed tools that give insight into the persistence of inflation, the weight to accord these models in the overall assessment of the economy is uncertain. As I have discussed, this is therefore an area where further broadening the multi-model approach and drawing from the experience of the past, from across countries and from new potentially non-linear theoretical and empirical techniques can support the robustness of our analysis.

One important aspect of the modelling process to keep in mind in this context is the reliance of forecasts on conditioning assumptions. When making forecasts, the MPC conditions on paths for key variables: the path of Bank Rate, the stance of fiscal policy, asset price developments (including the sterling exchange rate), and the evolution of commodity prices (including for energy prices, which have fluctuated significantly of late). When interpreting the MPC's macroeconomic forecasts and their implications for monetary policy, the importance of these conditioning assumptions and the sensitivity of the forecast inflation outlook to variations in them always needs to be emphasised.

Whether, in using an economic model that is estimated primarily or solely over the last 30 years of data, the Bank has not given due weight to earlier periods that would have provided information about the behaviour of inflation expectations and the persistence of inflation in conditions of major supply shocks and double-digit inflation? Or whether changes in the national and global economy since the 1970s make incorporating such longer-term historic data unhelpful?

As I have discussed, I would not view the potential benefit of drawing on experience from the 1970s and '80s in such black-or-white terms.

Given the challenge of understanding the greater inflation persistence that has emerged of late, it is natural that the Bank's analysis revisits and re-evaluates a previous period of elevated and persistent inflation. That is precisely what Bank staff have done, and the results of those exercises have been reflected in both the communication of MPC members and in the discussions and votes at the Committee.

But relying solely on evidence from the 1970s and '80s runs into the challenges you list and which I have discussed above. The structure of the UK economy is quite different from half a century ago. Using insights from the 1970s has the danger of neglecting those significant differences. That approach can only represent one element of a broader range of analytical explorations and evaluations of inflation persistence to underpin the MPC's decision.

This is where the use of a variety of models and analyses to develop robust insights rather than relying on a single model or framework and/or quasi-mechanical relationships between analysis and monetary policy decisions becomes important.

In focusing on the last 30 years, what assumptions, implicit or otherwise, the Bank's model makes about the anchoring of inflation expectations and inflation persistence?

Before coming to the specifics of your question, I should recognise that the COMPASS model (which I understand you to label 'the Bank's model' in your question) is not currently used as a core instrument in the Bank's inflation forecasting process. Rather a set of models and other analytical instruments are employed, among which numbers COMPASS.

It is not possible to house all shocks and all transmission channels in a single model. Events unforeseen at the time of a model's construction will invariably involve economic disturbances and channels of policy transmission that were not included in the original model formulation. The forecasting framework of the Bank acknowledges this: for example, that framework now embodies roles for financial frictions, energy prices and international trade that were not originally included in COMPASS, but have become central to policy discussions and thus need to be addressed through other analytical tools embedded in the Bank's model suite.

Nonetheless, the wider multi-model framework underpinning the MPC's forecasts is similarly based on empirical evidence from the inflation targeting regime and thus shares the features you identify with the estimation of the COMPASS model.

As I discussed above, the Bank's COMPASS model was estimated using data from 1993. It thus captures experience during the inflation targeting era, which is a period where long-term inflation expectations have been well-anchored close to the inflation target and inflation persistence has been low. These features are both a goal and a product of the inflation targeting framework within which the MPC has operated. Through its impact on private expectations, that framework has influenced economic behaviour in such a way that pricing decisions are supportive of the achievement of the inflation target. Within this model, the characterisation of inflation expectations and inflation persistence I have described is partly an assumption built into the structure of the model and partly an implication of the empirical estimation of that model using post-1993 data subject to the constraints implied by these assumptions.

Given recent experience, should the Bank now incorporate the "alternative approach" using a longer sample period discussed in the 2013 working paper and quoted above, and what would the pros and cons of such an approach be?

As discussed above, the broad set of analysis underpinning monetary policy decisions already encompasses a variety of approaches, including an assessment of wage and pricing behaviour using models and data from the 1970s and '80s. There are conceptual and practical problems with extending the data sample used to estimate COMPASS-like models back to the 1970s and '80s, since arguably the behaviour of inflation in that period was not consistent with the assumptions underpinning the structure of the model. Nonetheless, information from that period can be used to calibrate scenarios that have been developed within the Bank's suite of forecasting and analytical models.

To illustrate these efforts, in the Bank of England paper 'Evaluating and estimating a DSGE model for the United Kingdom' Harrison and Oomen (2010) use UK data from the 1960s and account for regime shifts – likely monetary policy regime shifts – by using deterministic breaks in the trends for nominal variables. That exercise demonstrates the difficulties involved in producing a set of consistently measured UK macroeconomic data, even for a small number of series. Moreover, a research paper published by Bank staff presents estimates of COMPASS over a longer sample (1975-2014) using a time-varying parameter approach in an attempt to explore the implications of incorporating information from the 1970s and '80s.

How can the Bank's main model, its further suite of models, and their interactions, be made more transparent at each forecast, to allow comment and critique from outside the Bank?

The Bank published its COMPASS model in the form of a staff working paper, albeit now some time ago. More generally, the research community at the Bank is very active in publishing its outputs in the working paper series and ultimately in research publications. This work includes many of the models and frameworks used in the preparation of monetary policy. Such publication exposes the models and underlying research to expert scrutiny and they are validated on the basis of peer review.

To illustrate, recent examples of published working papers that embody analysis used in policy preparation include work on the responsiveness of firms' inflation expectations to monetary policy, on the transmission of QE and the implications of long-term unemployment on inflation.

The analysis underpinning specific forecasts and policy decisions is presented in the MPC's *Monetary Policy Report*. That analysis includes a discussion of the construction of the forecast and the behavioural interactions underlying the forecasts. In the May *Monetary Policy Report*, models explaining wage developments (Chart 3.6) and exploring potential non-linearities in the Phillips curve relationship between wages and labour market slack (Chart 3.9) were shown. Deeper dives into the analysis are offered in the form of boxes that showcase specific analytical work and a topical In Focus

section. The format of the *Monetary Policy Report* was revamped a few years ago to make the analysis more readable and accessible.

The Bank has also published early analytical results prepared by staff via the *Bank Underground* blog, which appears on the Bank of England website. Analysis using the Decision Maker Panel survey, including insights into corporate pricing behaviour, is also regularly disseminated through releases on the website.

The Bank is always seeking ways to improve the accessibility of its policy analysis. The forthcoming review of the role of forecasts in the preparation of monetary policy decisions as well as the opportunities offered by technological advances will create scope for further improvements in presenting the analysis underpinning the MPC's decisions.

To summarise my response to your questions, I would conclude by paraphrasing the famous British statistician Prof. George E.P. Box: *"All (economic) models are wrong, but some are useful."* In addressing the significant challenges facing monetary policy at present, the Bank is seeking to ensure that it considers a broad set of useful – even if imperfect – models and forecasts, to support development of a robust MPC response to those challenges.

I look forward to discussing these issues with you and your fellow TSC members in forthcoming hearings of the Committee.

Yours sincerely,

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