Methodological Triangulation at the Bank of England: An Investigation

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Abstract: This paper investigates the extent to which triangulation takes place within the Monetary Policy Committee (MPC) process at the Bank of England. Triangulation is at its most basic, the mixing of two or more methods, investigators, theories, methodologies or data in a single investigation. More specifically, we argue for triangulation as a commitment in research design to the mixing of methods in the act of inference. The paper argues that there are many motivations for triangulation as well as types of triangulation. It is argued that there is evidence of extensive triangulation of different types within the MPC process. However, there is very little theoretical triangulation present; raising concerns about pluralism. Also, it is argued that the triangulation which occurs is mainly undertaken for pragmatic reasons and does not reflect other, coherent ontological and epistemological positions.

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INTRODUCTION

There has been a growing concern that one single method is inadequate for investigating complex social phenomena. Thus, there has been interest in several quarters, including in government, government agencies (such as research councils) and academic departments in the feasibility of mixing methods in a process of *triangulation*. In a series of papers, we have investigated the philosophical and methodological rationale for triangulation (Downward and Mearman, 2002, 2003, 2004, 2005); and we have attempted to show triangulation in action, particularly in investigating pricing (Downward and Mearman 2003, 2004). Specifically, we have argued that triangulation offers a potential solution to the impasse between the mainstream monist formalist 'deductivist' approach and the approach of critics – such as critical realists – who seem to imply rejection of mainstream methods. In this way, we work in the spirit of pluralism in economics as advocated by, for instance, Dow (1985 et passim).

This paper expands upon our earlier work, by investigating the nature of, and motivations for, triangulation. Most significantly, it investigates the always topical and – often controversial – process of the Monetary Policy Committee, and more specifically, the support for this process provided by the Bank of England, behind the setting of interest rates. Such an investigation is easier now given the greater transparency of the process following the independence of the Bank from other arms of government in 1997. The paper argues that there are many examples of triangulation within the MPC process; but that most of these are of a weak form, involving only data triangulation, mainly for pragmatic reasons.

TRIANGULATION

Triangulation as a concept has its applied origins in navigation and surveying whereupon taking measurements from two separate locations one can derive, or predict, a third measurement or location. In social research in its broadest sense triangulation implies combining together more than one set of insights in an investigation and there are many early implicit uses of triangulation. In this broad sense, it is clear that many of the most prominent economists, particularly Smith and Marshall, have engaged in triangulation, as they drew upon different evidential bases and arguments. Moreover, it can be argued that, as evidenced by Laidler (1993), a process of triangulation – in this case, the combination of methods and data types – led directly to the conclusion that the demand for money function is unstable. However, the vague basic definition above obscures a great range of types of triangulation and motives for its employment. It is the purpose of this section to briefly outline these elements and second, to outline the form of triangulation advocated by the authors. The first part creates a taxonomy by which the processes of

[1] We acknowledge comments received at a staff seminar at the University of the West of England in November 2004. In particular, we acknowledge detailed and helpful comments received from Peter Howells.

the Bank of England can be understood; the second part contributes to a framework for the evaluation of the Bank's work.

Types of Triangulation

This section presents a non-exhaustive classification of types of triangulation found in economics and in other areas of enquiry. The simplest form of triangulation is also the least extensive, and indeed may not at first appear to be triangulation. It is the combination of the tool with the user of the tool. For example, an economist might use an econometric model (which usually they have created) to produce an estimation. They could in principle, simply report this result and stop their investigation. If they apply their judgement to the result, perhaps to interpret the result in a specific way, they have engaged in a form of triangulation, however weak an example.

More effectively, triangulation will involve the combination of a number of insights. However, there are a number of types of insights which can be used. A common form is the triangulation of different subjects in different locations; this meaning reflects closely the traditional meaning of triangulation. Triangulation does not have to be spatial. It could also be chronological. Thus, the insights of a person at different times could be triangulated to make an inference about the whole time period. Clearly, also, different people could be asked once, but at different times. If they are also in different places, this adds another dimension of triangulation. The types of triangulation here combine what Denzin (1970) calls investigator triangulation and data triangulation. In the latter, different types of data might be used; for example, survey data might be used alongside time series data.

We can illustrate these forms of triangulation via the example of three men in the dark examining an elephant.[2] If one man feels what he decides is a tail, he might well infer that he is dealing with a donkey. If another man feels a thick upright rough surface, he might infer the presence of a tree, or umbrella stand. A third might feel ivory and infer that he is holding a horn (to be played). However, the combination of the insights leads the three men to the conclusion that they have an elephant. The three blind men can be viewed as either subjects, reporting their observations to an investigator, who then combines them; or they might themselves be investigators, whose insights are then combined, either in their group, or by a research co-ordinator. In the case of multiple investigators, it is also possible that each will have their own prior theory; and in some cases, the investigators have different theoretical paradigms, whose insights are then combined (in various different ways) to reach a collective conclusion. Such theoretical triangulation can also take place within an individual, who might try to interpret a finding from competing perspectives. In the literature this is known as theoretical triangulation (Denzin, 1970).

Denzin's (1970) fourth type of triangulation is methodological triangulation, which involves the combination of different methods. A weak form of methodological triangulation can be what Denzin calls *within method* triangulation, i.e., in which different varieties of the same method are combined. An example of this might the triangulation of VARs with different specifications; perhaps lag lengths. More

[2] In the original formulation, as in Ghauri, Grønhaug and Kristianslund (1995: 93-4), the somewhat unfortunate example is of three blind men examining an elephant.

adventurous is *between method* triangulation, which actually involves the use of different methods in combination. Between method triangulation is more interesting because it often involves the combination of different underlying methodolog*ies*: for example, the combination of an econometric study with a discourse analysis combines methods based on opposed philosophical bases.

In economics, generally it is the case that triangulation, beyond the weakest form, the interaction of modeller and model, is limited. As Downward & Mearman (2002: 410) note, "based on text such as: …'[e]stimation methods or estimators are a second important tool in our tool kit and…[are]…necessary but insufficient for solving the model discovery problem' [Hendry (1995: 16-17) might appear to advocate triangulation]…such appeals are made prior to, and in the aid of, purely econometric analysis". Econometric analysis remains primary and other methods are auxiliary to it. This is a form of methodological triangulation but is weaker than the form advocated by Downward & Mearman (2002, 2004).

The relative lack of triangulation might reflect positivist philosophical underpinnings (see Frankfort-Nachmias and Nachmias, 1996). More likely, the lack of triangulation results from the widely held belief that certain types of method necessarily have higher statistical power and that wherever possible, such methods should be used. Sophisticated developments of regression analysis are the best example, perhaps because of their claimed analogy to controlled experiments. In other social sciences there is more evidence of triangulation, of various types. Economists might claim that this fact illustrates that economics has a higher scientific status than other social sciences; however, there is also considerable evidence of triangulation in so-called natural sciences and in medicine. The recent advances in cell biology, particularly in the discovery of how cells move proteins through a specific pathway (present in nearly all cell types of all organisms) in order to be able to secrete them from the cell (see Pelham, 2001; Del Rio et al, 2004). In medicine, triangulation is widespread, for example, in the use of second opinions, repeated trials and the triangulation of insights derived from different perspectives.[3]

Motives for triangulation

There are many different motives for triangulation. One of the most common rationales for triangulation is that the world is too complex for one observer or observation to capture and that therefore there needs to be several observers/observations in different locations and/or times, so that a more complete picture can be built up. This rationale helps explain data triangulation and investigator triangulation. Adjunct to this rationale is the fact that often data are incomplete or inadequate, and that it is necessary to use different data types to fill the gaps in the original data set. An example of this is when gaps in time series are filled with estimates, which might be formulated in a variety of ways. In addition to data inadequacy is what might be called investigator or theory inadequacy. Often, it is recognised that no single theory, or more often, one single investigator, has the computational capacity to deal with the myriad facts in a complex environment. This is akin to a bounded rationality argument. This, in turn, relates to 'model uncertainty' arguments, under which the investigator is genuinely uncertain as to whether the

[3] We should like to thank Geoffrey Church of Fairfield College, New York for this information.

model they are using is a good one; to counteract this doubt, the investigator utilises other models and triangulates insights from them.

Moreover, the data inadequacy, complexity and theory inadequacy arguments can be combined. For example, the tactic of econometricians of re-estimating equations under different specifications is an appeal to all of the above arguments; however, estimating multiple equations can also be interpreted as an appeal to the law of large numbers. There is an implicit claim made that increased numbers of confirming estimations increases the validity of the estimation and/or underlying theory. However, such an argument makes verificationist assumptions, which followers of Popper in particular would be loathe to countenance. Diametrically opposite to such rationales for triangulation are arguments which eschew probabilistic methods and instead imply the need to triangulate other types of method. Frisch (1948) is perhaps the best exponent of such an approach (see Downward & Mearman, 2002).

Such arguments can also hint at epistemological fallibilism, which necessitates both caution in all claims and implies limits to all methods. Fallibilism is connected to the recognition of limited computational capacity, but is more of a commitment to the general uncertainty of knowledge. A commitment to fallibilism can also imply a commitment a priori to theoretical pluralism; this corresponds to Denzin's (1970) theoretical triangulation. This pluralism can take many forms and can in fact be quite narrow: for example, an industrial economist might examine an industry from the perspective of a traditional SCP approach and then from a contestability perspective. Alternatively, an economist might combine a neo-classical theory with insights from outside neo-classical economists. The most common example of this is arguably in policy analysis, for instance on privatisation, in which neo-classical analysis is combined with Austrian theory. In such cases, the combination of theories is done for pragmatic reasons, but it can also reflect political realities, for instance the need to enfranchise several members of a committee by giving them an input into the development of or inference from a model.

Combination of theoretical perspectives can also imply the combination of different data types. This follows because each theoretical perspective has its own underlying epistemology and ontology, which might imply that certain data types are valid while others are not. The most obvious example is the mainstream insistence on quantitative data, which is based in positivism and empiricism. The combination of ontologies and epistemologies, however, is clearly not straightforward.

Our position is twofold. First, triangulation, defined as the combination of methods in the act of inference, should be committed to in the process of research design, rather than being some default pragmatic position. Second, we argue that there are clear ontological and epistemological reasons for triangulation which move beyond pragmatism; and that these reasons are deeper and more significant motives for triangulation than those offered by pragmatism; and they are more coherent and thereby have greater power. Specifically, we hold that an ontology of complex, open and structured social systems and its epistemological implications, including and in addition to the notion of fallibilism, are the grounds for triangulation (see Downward and Mearman, 2002, 2003, 2004, 2005).

TRIANGULATION AT THE BANK OF ENGLAND

A leading candidate for existing practices of triangulation is the Bank of England, specifically the process surrounding the meetings of the Monetary Policy Committee (MPC). The Bank, aiming for transparency, has published an extensive set of papers laying out the process of the MPC's decision regarding interest rates (see, for example, Whitley, 1997; Britton, Fisher and Whitley, 1998; Budd, 1998; Bean, 1998; Britton, Cutler and Wardlow, 1999; King, 1999; Kohn, 2000; Bank of England, 1999, 2000, 2003; Bean and Jenkinson, 2001; Pagan, 2003). The Bank's publications show a complex process involving many different models, methods, data types and people, both MPC members and Bank staff. Within this complex process there is considerable evidence of some form(s) of triangulation.

The well-publicised and much-anticipated MPC monthly meetings are the end result of a month-long (and in some cases, for example the production of the Inflation Report, longer than this) process of data collection, analysis, presentation and interpretation. The process involves Bank staff and its agents collecting and manipulating data to be presented to the MPC, which then considers the information and makes its decision. The principal tool for decision-making is the projection of inflation. Every quarter this projection generates the lengthy official Inflation Report, but in other months, a projection is still required. The processes by which the Report and the monthly projections are arrived at are rather similar and their differences will not be considered here (cf. Britton, Fisher and Whitley, 1998; Bean and Jenkinson, 2001). They both are iterative processes, involving a series of meetings, both with and apart from the MPC members, consideration of past projections, reconsideration of the projection model, and a consideration of relevant events or data which have occurred during the relevant period. In both cases, the process begins with analysis and then moves forward, culminating in the production of a numerical projection of inflation. Several examples of triangulation can be seen in the process. These are grouped into three main categories: the triangulation of people and models, triangulation of model types, and the triangulation of data types. In all three cases, the triangulation appears to be extensive; but on further analysis, it tends to be fairly superficial, driven by pragmatic concerns.

Triangulation via Interaction of People with Models and Other People

The first issue to consider is the role of people and their interaction in the production of the projection. The Bank's own literature emphasises strongly the role of judgement in the generation of forecasts: Whitley (1997: 165) cites approvingly Higgins' comments on Bryant et al (1988), that "a formal and quantified framework is an irreplaceable adjunct to the process of policy thought". This is an interesting quotation because it makes quantitative methods an adjunct to thought, as if thought has primacy. This is not always obvious in the Bank's processes, as is argued below. Budd (1998) argues that a decision-maker's mood will always affect the interpretation of a model; interaction between the model and the modeller is inevitable, both in the construction and interpretation of the model. Moreover, the projections made by the Bank's models are subject to interrogation and interpretation by both Bank staff and the MPC. The process is one of judgement and formal modelling working in tandem.

Is this interaction of modeller and model an example of triangulation? It is; but in a rather weak sense. However, it is clearly more triangulated than the mere repetition of

a mechanical calculation. Various reasons for eschewing mechanical imposition of this sort are given by the Bank. Partly it results from the perceived failure of large-scale models in the 1980s (Whitley, 1997). This is triangulation because of pragmatic reasons of poor past performance. Another stated reason for using judgement is that there is uncertainty about the underlying structure of the economy (see below) and therefore about the appropriateness of the model (Whitley, 1997). This reasoning suggests triangulation as a response to fallibilism. This is a strong form of triangulation. Relatedly, the Bank expresses concern about the ability of its models to capture the complex reality (Whitley, 1997; Bean and Jenkinson, 2001; Bank of England, 2003). This argument suggests triangulation as a concern about the inherent incompleteness of models. It could be argued that this suggests a concern with open-systems, but the general tenor of Bank language does not support this, except for one reference by to the "model closure problem", acknowledged by Whitley (1997: 167) as being where one is unable to "prevent unstable outcomes" (Whitley: 167).

If the interaction between modeller and model is a very weak form of triangulation, another possibility arises when examining the interaction of people within the process. As Dunne (1991) and Smith (1994) note, economic modelling has traditionally been done in teams; there is a clear collective element to the MPC process. First, Bank staff are arranged into departments (such as *Monetary Analysis*) responsible for specific areas of study and for the production of specific data. One of the functions of these teams is to evaluate their models and their performance in providing accurate projections. In consultation with the MPC, the staff amend their models *ad hoc*, according to their past performance (Budd, 1998; Pagan, 2003). Furthermore, models are amended according to current economic news and the other data presented by Bank staff to the MPC. Finally, the projections are amended collectively to take into account this other data (see below). This form of triangulation is an example of triangulation of locations and perspectives (not necessarily theoretical). Another example of this is the collective decision-making of the MPC itself.

The most obvious way in which a triangulation of sorts takes place is in the MPC meeting itself. The MPC listens to the evidence presented to them; each member presents their assessment of the evidence and their subsequent recommendations; and eventually they vote. The final projection arrived at is therefore the product of negotiation and discussion amongst the committee. The committee might not reach a unanimous decision – very often it does not – but its decision can be said to be "collegiate" (Whitley, 1997: 170), re-emphasising the ethos of teamwork which characterises the process. Furthermore, the Inflation Report is a "collective examination of forces shaping the outlook to come to a conclusion that belongs to most of the [MPC]" (Kohn, 2000: 24-25). This collective approach is clearly a form of triangulation. MPC members come from various constituencies, including the Bank, government, business and academia, and will therefore have different views on economic matters. MPC meetings "explore all possible views on the cause and significance of recent economic developments" (Budd: 1789). This is again triangulation of locations and interpretations. It is motivated by pragmatism and fallibilism, as above; but it is clearly also necessary for political stakeholding reasons.

Depending on the exact composition of the committee, discussion could be fractious; this would particularly be the case if the members represented strongly conflicting parties, such as the CBI versus the TUC; however, thus far this has not been the case.

However, the fact that the MPC is a group of experts from various backgrounds throws up the possibility that a triangulation of theoretical perspectives operates. This might only operate subconsciously for many members of the group, the vast majority of whom are non-academics, and for whom boundaries between paradigms and the associated academic struggles are less (if at all) relevant.

However, it seems that in practice, there is little variance on the types of theoretical perspectives adopted. To some extent the main model and some of the auxiliary models (see below) are a melange of approaches: it is much more difficult to neatly categorise the Bank's approach into, for example Keynesian, camps than it used to be: Cambridge models were resolutely Keynesian, while the Liverpool, London Business School and City University Business School models were strictly monetarist or New Classical (Dunne, 1991). Whilst the Bank's model is much broader than the old Demand-side Keynesian models (Whitley, 1997), it incorporates many of those elements in combination with supply-side considerations. Within the modelling process, there is scope for alternative assumptions to be made, but the alterations tend to be of a fairly minor nature. Indeed, aside from the fact that the Bank's model tries to encompass previous modelling paradigms, the extent of theoretical diversity is small. Additionally, it seems that the transcendence of the previous extremes was done for pragmatic reasons: it is difficult to find evidence of a commitment to theoretical pluralism.

According to Arestis and Sawyer (2002), the Bank's model has a number of key features: long run equilibrium, with short run dynamics captured by ECMs (see also Pagan, 2003); Cobb-Douglas production functions; vertical Phillips curve at the NAIRU; sluggish adjustment of nominal and real variables; and significantly, money supply endogeneity. This final point emphasises the "new consensus" present in modelling of money and macroeconomics. It is clear also that the models are market-clearing by assumption and that event regularities are expected to arise under ideal conditions. Moreover, Sawyer (private) suggests that there have been shifts in more subtle ways, for example in the movement from investment functions which were more Kaleckian (emphasising profits as well as capacity utilisation) to neo-classical (where investment depends on the price of capital as well as capacity utilisation) formulations. Expectations play a minimal role in the medium term macroeconomic model, although that might be for practical reasons of data unavailability. Expectations are considered, for instance, in the transmission mechanism from interest rates (Bank of England, 1999); however, they mainly play a role in creating inertia in nominal and real variables (Arestis and Sawyer: 532) or (implicitly) as bringing about equilibrium. This deployment of expectations has a very classical flavour to it. In contrast, for Keynesians, confidence plays a crucial role, for example as a determinant of investment.[4] Overall, therefore, there seems to be little evidence of theoretical pluralism.

[4] Bank of England (2004: 189) notes that the new quarterly model (BEQM) does incorporate short term expectations of demand to affect investment; however, the main determinants of investment remain the cost of capital and expected return. Indeed, there seems to be a greater role for expectations in the BEQM than in the medium term macroeconomic model. However, the theory of expectations within that model is somewhat unclear. It is acknowledged that agents have neither perfect foresight nor full information (191); but the model falls short of rejecting rational expectations.

It seems too that there is a broad consensus among those involved behind this model as the main tool for policymaking. Budd (1998) claims that alternative assumptions, when used, are deployed to explore why forecasts have been inaccurate. Ideally, it seems, a single effective paradigm, on which everyone agrees, would simplify the process of projection considerably (Whitley, 1997; Pagan, 2003: 16). Having said that, the Bank seems to recognise that theoretical coherence (as found in the 1980s model) can conflict with empirical coherence (the ability to provide good forecasts) and that a balance must be struck (Britton et al, 1998; Pagan, 2003; Bank of England, 2003). Again, though, this triangulation occurs for pragmatic reasons, particularly concerning poor past performance. Overall, there seems to be considerable theoretical coherence around a new macroeconomics consensus. Whilst alternative paradigms might sneak in – for instance via the forecasts of outside economists (Bean and Jenkinson, 2001), who do not necessarily share the Bank's views, are used as a comparison for the Bank's forecast – there is no commitment to theoretical pluralism or to theoretical triangulation. What triangulation does occur between actors in the process seems to occur for largely pragmatic reasons, occasionally buttressed by hints of fallibilism.

Triangulation of Model Types

Given the argument of the previous section, it should be clear that if there is triangulation of models, it does not include (at least inside the Bank) models derived from different theoretical paradigms. Where different assumptions are made, this occurs within the confines of the main model and usually involves changing model parameters or values of variables. These changes of assumption most often in order to produce new forecasts (Kohn, 2000) which can be incorporated into the fan chart (Budd, 1998). The changes occur because of model uncertainty (Whitley, 1997), which in turn hints at fallibilism: Whitley (1997) claims that the Bank is more cautious in its claims partly because modellers in the 1980s contributed to the mistrust about models by making too strong claims about their models and by refusing to acknowledge the limitations of the models. Relatedly, as mentioned above, the Bank is cognisant that all models are abstractions from the complex reality which cannot possibly capture all the relevant features of the economy; consequently, they are careful not to rely too heavily on models (Bean and Jenkinson, 2001; Bank of England, 2003): for example, Whitley (1997) acknowledges that expectations cannot be captured in the model. To combat this, the Bank uses survey data (see below; Britton, et al 1999). One slight concern with the Bank's position on the limitations of modelling is Whitley's (1997) claim that empirical models cannot capture the rigour of theoretical models. If this means that the Bank's models are inevitably simpler than theoretical models, or that theoretical models require data which is unavailable in practice, this is a reasonable claim. However, if instead Whitley believes that theoretical models are complete, this is problematic: it is the nature of models that they are incomplete; theoretical models too.

A main consequence of the admission of the fallibility of models is that the Bank does not rely on one model: rather, it has a "suite of models" approach. This is common practice in central banks (Kohn, 2000; Pagan, 2003). The suite of models includes small 'analytical' models, such as a Real Business Cycle model and a labour market model are used. These models are most commonly based on optimising assumptions: more evidence of limited use of competing perspectives. According to Whitley

(1997), the analytical models provide qualitative data into the other models. This suggests triangulation of methods and data; however, as argued below, that impression is slightly misleading. However, it remains the case that a broad range of models are employed. For example, a small, five-equation macroeconomic forecasting model is employed (Whitley, 1997), in order to supplement the main model. Other simple, stylised macroeconomic models are used, to provide an overall picture of the economy. Simple two equation output gap models are also used (Whitley, 1997). Moreover, a range of types of model are used, including time-varying component models, structural VARs, Bayesian VARs and factor models (Whitley, 1997; Budd, 1998; Pagan, 2003). Thus, each model category contains variants, some more theoretical and others more data-driven.

Much of the above suggests considerable triangulation. The uncertainty over model specification, and over the reliability of one single model – all pragmatic concerns about past poor performance, but also hints at fallibilism – have led to an "eclectic" approach (Whitley, 1997), in which models are combined. Smaller models are used to fill the vacuum – partly in confidence – left by the large-scale models of the 1980s (Whitley). Moreover, there is some evidence of strategic deployment of models: Pagan (2003) claims that different models are used for different purposes. One such example is the use of VARs for assigning the probabilities of shocks (Whitley, 1997). Auxiliary models – of which the Bank employs a large number (as many as thirty-two; Pagan, 2003) – are used to model special events or sectors. Final estimates and forecasts would seem, therefore, to result from a combination of inferences from these other models. This would be a strong form of triangulation.

This impression is reinforced somewhat by examining the process of constructing the so-called "fan chart" of projections of inflation (and GDP) (see Britton et al, 1998). The fan chart is a probability distribution of projections (Britton et al, 1998; Bank of England, 2000). For each estimate of inflation (or GDP) which is produced, a probability weight is added, according to the MPC's assessment of it (Budd, 1998). The whole fan chart therefore plots the range of outcomes considered possible by the MPC, together with their subjective assessment of the likelihood of those outcomes. The final projection is thus an average of those offered in the discussion during the various stages of meetings and data analysis, as described above. The Bank's desire for a range of projections reflects their caution about making firm predictions. This reflexiveness is also evident in the comparison of forecasts with the actual reality. The range of forecasts within the fan chart is based on the previous ten years' forecast errors (Britton et al, 1998). The range of the chart also embodies the inherent uncertainty in the forecasting process (Kohn, 2000). This level of uncertainty increases and decreases with the current period's economic news; however, even in a period of relative economic stability (as was the case in particular prior to 11th September, 2001), the Bank pays heed to fallibilism and also to the ever-present possibility of unanticipated shocks to the economy by using the fan chart.

Moreover, the general level of uncertainty is augmented by paying attention to specific risks (Whitley, 1997; Britton et al, 1998). While the general uncertainty is embodied in the spread of the distribution, specific risks can lead to the mean of the distribution shifting. An integral part of the process is that structural changes and/or specific events are assessed, *a priori* and consequently, *ad hoc*, the centre of the fan chart can shift up or down, depending on the assessment. For example, news of house

price increases often lead to a shift upwards in the central projection of inflation. This process of adjustment of the fan chart is therefore an iterative one (Britton, et al, 1998), incorporating learning from past forecasting errors and the *a priori* assessment of the likely quantitative effect of specific changes in the economy. Whitley (1997) therefore claims that the process has a Bayesian tenor.

Overall, there would be seem to be considerable triangulation of methods. A range of models are used, and within each type a range of modelling techniques is utilised. Different alternative assumptions are made, as a test of the robustness of the central projection. A large number of auxiliary models add considerable specific detail to the information set available to the MPC. The fan chart embodies reflexivity, fallibilism and general uncertainty about the projections produced by the modelling process. These reasons indicate a strong form of triangulation. However, this assessment must be tempered considerably. It was already argued that there is little theoretical pluralism in the projection process, or in the assessment by the Bank and MPC. There is clearly no commitment to triangulation based on pluralism. The fallibilism which appears to inform the process is the result of pragmatic concerns about poor past performance. There is some evidence that models are perceived as inherently flawed, unless they were considerably broader; but even the General Equilibrium models often employed by the Bank have been criticised for their (lack of) predictive power (Pagan, 2003).

Furthermore, the treatment of the models used by the Bank suggests that a fairly clear hierarchy of models exists and that the projection process is geared around those models at the top of the hierarchy. Specifically, the main, twenty-equation macroeconomic model (Arestis and Sawyer, 2002, reduced the model to eighteen equations) is the driver of the process. It is the main model which provides the initial average projection of inflation, based on the average response of the model to average shocks (Whitley, 1997). The main model provides the 'big picture'. The auxiliary models (their name is significant), which provide more specific sectoral or regional information, add detail which allows the projections of the model to be tweaked.

This approach is clearly problematic from the perspective of triangulation in two main ways. First, the triangulation we advocate is based on the notion that inference should take place via multiple methods, models, data types and theoretical perspectives; whereas, the Bank's approach effectively engages in inference from a single model, supported by other models. For example, the Bank of England (2004: 188) states that: "the new Bank of England Quarterly Model is…the main tool in the suite of models used by its staff and the [MPC]" in its deliberations. Second, in the Bank's process there is an implicit faith in the main model, which undermines the impression of fallibilism discussed earlier. There is insufficient recognition that the main model might be inherently – fundamentally – flawed, and that its initial central projection might be seriously misleading. That is problematic because of the inevitable path dependency in the final formulation of the inflation projection, given that the other models are used only to tweak the projection of the main model. Moreover, there is an overriding desire that the process be geared towards one effective model (Pagan), if only one could be found. Thus, the concern underpinning triangulation – as outlined in the first section – that all methods are flawed and must be combined with other methods – is absent. That impression can be reinforced by the examination of the Bank's triangulation of data types.

Triangulation of Data Types

It should already be apparent that the MPC analyses a vast array of information via the variety of models used by the Bank. In addition to the data produced by models, at the series of meetings preceding the main meeting, the MPC undertakes a complete reassessment of all the relevant evidence, and peruses data on, for example, labour markets, monetary conditions, Demand, output, prices, and financial markets. Much of it is basically descriptive. Some of this is what might be termed "historical" (Bank, 2004 Minutes), whilst other data is much more recent (Budd, 1998). The MPC has the opportunity to analyse sectoral, regional and international data which the Bank deems relevant (Kohn, 2000; Bank 2004 Minutes). Much of this data is on emerging trends. This is significant, because the main data source for the MPC remains the National Accounts. The main model of the economy, referred to above, first of all tries to create a current picture of the economy, based on National Accounts data. However, this data is somewhat out of date, given the lag in the collection and collation of the raw data, and this leads to gaps in the data available (Bean and Jenkinson, 2001; Pagan, 2003). Thus, for the most current information on existing conditions and trends, other data are required. This opens the door to triangulation, albeit based on data deficiency rather than any other grounds.

Consequently, the MPC does see many different kinds of data. For example, the fan chart reflects many data types. Reports by the Bank's staff utilise a wide range of sources, including press news reports, which focus on current specific significant events. A recent past example is the demutualization of the building societies. These events can affect the degree of uncertainty of the Bank's forecasts and can bias the fan chart in one way or another (Budd, 1998; Britton, et al, 1999). These current events also assist the staff in choosing which data should be presented to the MPC and thereby which issues should be discussed (Budd, 1998). These presentations are supplemented by data collected from other organisations, such as building societies, the Royal Institute of Chartered Surveyors (RICS), research institutes, trades unions and economists from academic and commercial organisations (Bean and Jenkinson, 2001). These data sources show other examples of triangulation of opinions and people. Moreover, the data from different organisations are often of different types: the RICS data tends to be on recent house price data, and is often based on recent surveys by RICS members; building societies draw on recent mortgage completions. On the other hand, data from other economists is of a more conventional type, often being competing forecasts with which the Bank's forecasts are compared. Particular attention is paid to forecasts and other data from other central banks (Bean and Jenkinson, 2001).

Reference above to data from other bodies hints at the important role of survey data in the decision-making process (Budd, 1998; Whitley, 1997). Typically, the Bank uses surveys on business (state of trade surveys: Britton, et al, 1999) and consumer confidence and sentiment (Bean and Jenkinson, 2001). For example, the Bank employs the CBI Industrial Trends survey, which is used to ascertain position of the economy in its cycle (Britton, et al, 1999). The Michigan Consumer Sentiment survey can capture some of the trends in consumer spending (Bank 2004 Minutes). As already stated, survey data such as these are useful because they help to plug gaps in the other sources; but it also useful because it is forward looking, whereas the

National Accounts tend to be capturing past conditions (Britton, et al, 1999). So, surveys are used because they allow gaps to be filled in the main model; but also because the data produced from them has its own merit. This is clearly an example of triangulation of data. Moreover, the Bank and MPC are making inferences from the combined weight of the different data types.

A similar role in the decision-making process is played by reports from the Bank's agents around the UK. The agents' principle task (in this context) is to visit UK firms (they make 7000 such visits each year: King, 1999: 10) to gather information. The information they collect is valued by the Bank in the same way as survey data: it is timely and fills gaps which would otherwise exist (King, 1999). Indeed, because it tends to be more anecdotal (Budd, 1998; Bank, 2004 Minutes), it is the most recent data at the Bank's disposal on current economic conditions. Firms can report to agents their stock levels, recent changes in demand, their expectations of inflation and above all, their confidence about the economy and their subsequent intentions for investment. Typically, in each MPC meeting round, data from 150-200 agents' reports are presented for consideration (King, 1999; Bean and Jenkinson, 2001).

Different types of data seem to be triangulated in the process of decision-making in the MPC. Moreover, there is some suggestion that triangulation occurs in the process of inference, in the way in which forecasts are adjusted to reflect the other data. There is some evidence, then, that the Bank triangulates in exactly the way suggested above and in Downward and Mearman (2002, 2004). However, as was the case with the triangulation of model types, the conclusion must be tempered.

A crucial question regarding triangulation is how the triangulated data (or models, etc.) are to be combined. There is no easy formula for this. The Bank has no stated formula for combining data types, so one must be inferred. This absence of a firm strategy is not surprising, but also acts as evidence against the presence of triangulation. As argued above, however, the Bank seems to hold a hierarchy of models and data types, and the process of data collection and analysis is driven by the models and data types at the top of the hierarchy. The main model – the multi-equation macroeconometric model – is the driver; other models are utilised to assist it. Analytical models are largely adjuncts to the main model (Whitley, 1997). As a corollary, the data type preferred by the Bank is a time series of official quantitative data, collected in the usual way. Other data types are adjuncts to the preferred data. These supplementary data would not, ideally, be used, but the lags and gaps in official data necessitate a search for other, less reliable data. Overall, while the Bank would prefer to use only regularly quantified official data, they are forced to take into account other data types, partly because of data inadequacy and also for pragmatic reasons of poor past performance.

A few examples illustrate the point. The quarterly forecast is "explicitly quantitative" (Bean and Jenkinson, 2001: 438) as is the fan chart. Admittedly, the initial modal forecast from the model can be adjusted in the light of other information. However, only information which will have a "quantitatively significant" effect on the forecast is considered by the MPC (Bean and Jenkinson, 2001: 439).[5] These statements

[5] In light of Ziliak and McCloskey's (2004) arguments against "statistical significance" as a measure of economic significance, it is worth asking what the correct interpretation of 'significance' here is.

suggest a clear hierarchy of data and models, with the quantitative macro models at the top. In this light, Higgins' comment on Bryant et al, quoted above, that quantitative and formal analyses are an "irreplaceable adjunct to the process of policy thought" (Whitley, 1997: 165) looks rather different. Rather, policy thought is based around quantitative analysis; the thought almost looks like an adjunct to the quantitative analysis, in spite of the many stresses in Bank literature on the role of judgement. As Whitley notes, only quantifiable shocks can be included in models.

Thus, while the merits of surveys per se are acknowledged by the Bank, in the end they are subsumed under the main, quantitative model: survey data is turned into quantitative data or used as proxies for unavailable data (Britton, et al, 1999). Indeed, this is necessary, for survey data to be put to its "best use" (Britton et al: 179). Survey data kept in a time series and compared with other time series data (Britton et al). Quantification occurs via correlation and regression with other quantitative data (Britton et al). Similarly, the CBI Business Optimism Balance, a measure of business confidence, is regressed against lags of itself and other variables (e.g. GDP). The purpose of doing so is to try to explain expectations (Britton et al, 1999). It is significant however, that the survey data is seen as something to be *explained by other data*: in realist accounts, data are always the *explanandum* and never the *explanans*, of course; but it seems that the survey data have to be subordinated to the quantitative methods, which are apparently superior and more powerful. Such an approach is consistent with the way in which methods are used throughout economics: certain methods have a higher power and intrinsically more value; and therefore, studies conducted with those methods consequently also have a higher value. However, the open-systems arguments underpinning triangulation suggest that this is not the case: methods only have power if they are appropriate to their object.

Moreover, the process of projection undertaken by the Bank is very much of an event-predictive type. The effectiveness of the prediction is assessed by its accuracy according to subsequent events: it is an "event-truth" assessment (Dow, 1990). While qualitative data could be used to make predictions about processes underlying data, without making specific event projections (even acknowledging the range of the fan chart), it is instead employed as a tool for adjusting the event-prediction generated by the formal quantitative models. While this is a move towards triangulation of the type advocated here, it is still far away from it. This outcome might simply be a result of practical or political compromise: the formation of the MPC is part of the independence of the Bank; independence requires transparency; transparency requires that the Bank's decision-making be clear to those examining it; the majority of observers will use primarily quantitative tools; therefore, the Bank is restricted to orthodox tools. However, we can find no evidence within the Bank's literature of a desire to move away from the conventional tools, methods and means of understanding and predicting the economy. This might of course simply be determined by the views of staff at the Bank at a specific point in time: as Smith (1994) notes, as modelling teams change, models can change.

Conclusions

This paper has considered the process of data generation at the Bank of England, principally that designed to serve the needs of the Monetary Policy Committee. The Bank's processes of data generation have been analysed in terms of their use of

triangulation. Triangulation can take many forms and have many motivations. The Bank's processes do indeed exhibit triangulation of three main types: the triangulation of views of various actors in the process; the triangulation of types of models; and the triangulation of data types. Some of this triangulation is rather trivial: for example, the interaction of modeller and model is an inevitable element of modelling. Other practices, however, particularly the use of a suite of models and the use of anecdotal and survey evidence, are examples of much stronger triangulation. However, the triangulation is based mostly on pragmatic considerations, such as data absences or lags, the failure of theoretically coherent (single, narrow paradigm) models in earlier eras, the inferior predictive performance of the Bank's models in previous periods, and the need to reach credible forecasts which largely conform with those produced by external agencies. There is only very limited evidence that triangulation is adopted for reasons such as fallibilism, or because of concerns based on an open-systems ontology. For instance, where other data types are utilised, this appears to be a compromise necessitated by circumstances, rather than a commitment to the notion that quantitative models are inherently flawed because there might be a disjuncture between the methods and the reality they are attempting to capture (either now or into the future).

Several practical recommendations follow for the creation of projections for and by the MPC. First, just as methods are fallible and subject to disjuncture with an open-systems reality, so are theoretical perspectives. There is little evidence of theoretical pluralism within the Bank's approach. The Bank's main model is essentially a New Keynesian-orthodox hybrid, emphasising optimisation but market clearing inhibited by real and nominal sluggishness, plus elements such as money supply endogeneity and a NAIRU (Arestis and Sawyer, 2002). While there is an awareness of the failure of past single-paradigm models, there is no commitment to theoretical pluralism per se: deviations from a theoretical norm are permitted only where this leads to greater empirical coherence (Pagan, 2003) in the form of better predictions. Second, whilst the use of suites of models and data types other than the conventional quantitative is to be applauded from the perspective of triangulation, the Bank's approach remains one in which quantitative modelling has primacy. Where qualitative data is used, for instance in affecting the mean forecast of inflation, it is first quantified and then inputted into the model. This final step is unnecessary and, from the perspective of triangulation informed by open systems, it is potentially damaging. Third, the Bank should engage in more pre-testing of the data. As Keynes (1939) argued, if underlying conditions are unstable, quantitative modelling is extremely unreliable. Modern techniques have of course dealt with this criticism to some extent, but by no means have eradicated it, as the open systems critique points out. Qualitative data can be used to assist pre-testing and furthermore, if appropriate, to supersede quantitative data.

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