An Econometric Model of Monetary Policy Decision-Making for the United Kingdom

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Abstract

We develop an econometric model of monetary policy committee decision-making. The model characterizes policy preferences of individual committee members and the aggregation of those preferences to produce a committee choice by majority voting. Using maximum simulated likelihood (MSL) methods, we estimate the model using data from the Bank of England (BOE) for the 1999-2007 period. Our results suggest that the Bank's Governor has substantial influence over other committee members. This is a finding that is mildly surprising, given the reputation of the Bank for operating in an "individualistic" manner; i.e., tolerating diversity rather than requiring consensus.

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An Econometric Model of Monetary Policy Decision-Making for the United Kingdom

This paper develops an econometric model of decision-making for the monetary policy committee (MPC) of the United Kingdom. The model describes the policy preferences of individual members of the committee and the aggregation of those preferences into a collective choice. In doing so, the model permits us to provide logically consistent microfoundations for statistical descriptions of monetary policy decisions. It also allows us to assess whether the collective choices reveal an especially powerful role for the committee chairman relative to other members and permits us to evaluate how changes in the composition of the committee might alter committee choices.

In several previous papers, we have examined committee decisions on monetary policy for the United States.[1] Although this paper investigates similar issues for the case of the UK, institutional arrangements and available data differ in important ways for the two countries. As we describe below, our econometric approach is designed to take advantage of special circumstances prevailing in the UK case.

I. Monetary Policymaking at the Bank of England

Current monetary policy institutions in the UK are prescribed by the 1998 Bank of England Act. The Bank of England (BOE) has independent authority to manage monetary policy through the setting of the official bank rate, a rate at which the Bank lends to financial institutions. The Bank is directed by the government to target inflation, with a current target of 2% per year as measured by the consumer price index.

Interest rate choices are made by a nine-member monetary policy committee (MPC) that meets every month and selects an interest rate by a majority vote. Since 1999, the interest rate targets of each committee member in each meeting have been publicly reported. Because decision-making is majoritarian, the selected interest rate is always the median of the individually reported desired rates.

While formally majoritarian, it is possible that the MPC chairman, the Governor, wields more power than other members of the committee. In the case of the US, it is widely believed that the Federal Reserve Chairman exerts more influence than other members of the Federal Open Market Committee (FOMC), and our previous work has provided some support for this view.[2] The BOE differs somewhat from the Federal Reserve both in terms of policymaking practices and in terms of data that are reported. At

[1] See Chappell, Havrilesky, and McGregor (1993) and Chappell, McGregor, and Vermilyea (2004, 2005).

[2] This is a difficult proposition to verify—conventional wisdom suggests that Alan Greenspan was a monetary policy dictator, but the data simply show that Greenspan and the committee routinely agreed. This is compatible with the hypothesis that Greenspan followed the committee's sentiment, as well as with the hypothesis that he led it.

the BOE, achieving consensus seems to be a less important objective than it is at the Fed. MPC members are encouraged to honestly reveal their policy preferences, and dissenting votes are tolerated and perhaps even encouraged.[3] The BOE's website provides this characterization of the committee's decision-making process:

> Each member of the MPC has expertise in the field of economics and monetary policy. Members do not represent individual groups or areas. They are independent. Each member of the Committee has a vote to set interest rates at the level they believe is consistent with meeting the inflation target. The MPC's decision is made on the basis of one-person, one vote. It is not based on a consensus of opinion. It reflects the votes of each individual member of the Committee. [4]

On the basis of these attributes, Blinder (2004, 2007) classifies the BOE's committee as an "individualistic" MPC. One apparent consequence of the BOE's tolerance for diversity is that committee records appear to be more revealing about the variety of policy preferences of members than comparable records from the Federal Reserve's FOMC.

Even though dissent is tolerated and choices are made by majority decision at the BOE, there nevertheless is evidence that the MPC chairman (the Bank's Governor) plays a role that is different from that of other members. In the 1999-2007 period, rank-and-file members recorded preferences that differed from the committee's outcome 15.6% of the time, but the Governor's position differed from the committee's choice only twice, or 1.8% of the time. This could mean that the Governor wields influence over his colleagues, or it could mean that the Governor follows the sentiment of the majority of his colleagues, but it clearly indicates that the behavior of the Governor is different from other committee members in a notable way.

Historical records from the BOE give us an opportunity to fruitfully explore this issue. When the Bank adopted its current procedures in 1998, Sir Edward George served as Governor. George voted with the majority in every meeting. At that time, Mervyn King served as Deputy Governor, and while serving in that capacity, King disagreed with the adopted policy in 9 of its 55 meetings, preferring a tighter policy (higher bank rate) than the committee in all of those cases. George left the committee in 2003, and King replaced him as Governor. Once he became Governor and MPC Chair, King voted with the minority only twice, both times preferring a higher rate than the majority.

This sequence of events offers us a natural experiment that presents an opportunity to assess the role of the Governor within the committee. On average, King preferred tighter policies than George had. When George departed, King dissented much less frequently, so either (1) King became consensual and followed the committee, or (2) King led the committee and its members followed him. If the committee followed King,

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[3] In the US, the Federal Reserve Chairman has never been in the minority in an FOMC vote on a monetary policy directive, but this has occurred on several occasions in the Bank of England's MPC. See Blinder (2004, 2007) for a discussion of collegial committees (the FOMC) versus individualistic committees (the MPC).

[4] See http://www.bankofengland.co.uk/monetarypolicy/overview.htm.

though, then detectable shifts in the stances of other members, as well as in the adopted policy stance, should also have occurred. Because members' reported policy preferences and committee choices are observable, we have an opportunity to quantitatively assess the extent of the Governor's influence.

In Section II, we describe an econometric model of committee decision-making that can exploit the opportunity provided by this natural experiment.[5] In Section III, we describe our estimation methodology, and in Section IV, we present results of that estimation. Conclusions follow in Section V.

II. The Econometric Model

Our model has the following elements:

1. *A specification of each individual committee member's "true" monetary policy preference* (in the form of a policy reaction function). We employ reaction functions of the Taylor rule form to characterize members' true interest rate preferences.

2. *A behavioral rule that describes an individual committee member's "reported" monetary policy preference*. If the model permits influence from the Governor to rank-and-file members, then a member's reported policy preference will be a function of both his true preference and the preference of the Governor. We further assume that reported preferences must move in 25 basis point increments; in each meeting, each individual must report either a status quo interest rate or a rate that is higher or lower by 25 basis points. Actual reported rate preferences generally do move in 25 basis point increments.[6]

3. *A mapping of reported preferences to a committee decision.* At the BOE, majority rule is employed, so the median reported preference becomes the adopted interest rate target.

4. *A behavioral rule that describes the reported preference for the Governor*. Once a committee decision is determined, the Governor can either report a policy preference that agrees or disagrees with that adopted rate. On

[5] Paul Volcker served on the FOMC before he became Chairman of the Board of Governors, suggesting that a similar natural experiment is available for the US case. However, Volcker rarely dissented when he was a rank-and-file member, so it is not obvious how adopted policy stances should have changed when he assumed the Chairmanship.

[6] There are cases of movements or desired movements in interest rates that exceed 25 basis points, but our model collapses the preference data to three discrete categories. Over the sample period, only 2% of all reported individual rate preferences specified moves larger than 25 basis points.

occasion, the Governor's true preference will differ from what is adopted, but he can choose to vote with the majority if he values consensus.

True Interest Rate Preferences

Individual members of the MPC are presumed to have "true" interest rate preferences governed by the following reaction function specification:

$$R_{it}^{*} = \alpha_i + \sum_{k=1}^{K} \beta_k X_{kt} + u_t + v_{it},$$

$$u_t \sim N(0, \sigma_u^2),$$

$$v_{it} \sim N(0, \sigma_v^2),$$

$$E(v_{it} v_{jt}) = 0 \text{ for } i \neq j.$$

Individual committee members are indexed by *i* (where $i = 1, 2, \ldots 9$); meeting dates are indexed by *t*; and explanatory variables in the reaction function are indexed by *k*.[7] Note that members share a time-specific error term, but each member also has an independent error term component in each meeting.[8] For simplicity, assume that the Governor, or MPC chairman, is indicated by the subscript $i = 1$. In this specification, reaction function intercepts vary across members, but other reaction function parameters do not.

Reported Interest Rate Preferences

Rank-and-file members' reported interest rate preferences, R_{it}, for $i \neq 1$, are determined in two steps. First, we calculate a weighted average of member *i*'s true preferred rate and the chairman's preferred rate (to capture deference to the chairman):

$$\overline{R}_{it} = \theta R_{1t}^{*} + (1 - \theta) R_{it}^{*}.$$

We then map that weighted average into a discrete interest rate choice, where choices differ by 25 basis point increments. Let R_t^{sq} be the status quo interest rate (expressed as a decimal number) coming into meeting *t*. Then the individual can choose either R_t^{sq}, $R_t^{sq} - 0.0025$, or $R_t^{sq} + 0.0025$. That is, an individual can choose the status quo rate or a

[7] The MPC has nine members at a moment in time; however, the identities of the individuals occupying these nine positions change over time. For simplicity, our notation indexes nine members, but our later econometric analysis will distinguish the individuals occupying the slots.

[8] Inclusion of the shared error term component permits the model to account for the observed tendencies of members to agree on rates, without that agreement being a result of influence from the chairman.

rate that differs by 25 basis points in an upward or downward direction. Our model specifies that member *i* will choose that discrete rate closest to the weighted average calculated above, $\overline{R}_{it}$. We denote members' reported interest rate preferences by R_{it}.

The discussion above applies to rank-and-file committee members. Obviously, the chairman does not have to defer to himself, so we provisionally calculate his interest rate by selecting the discrete option that is closest to his true preferred rate. We denote the chairman's provisional discrete preferred rate as $\tilde{R}_{1t}$. As we describe below, after the committee choice is determined, our model permits the chairman to revise this rate for the voting record (hence our current usage of the term "provisional" in reference to the chairman).

The Committee's Selected Rate

The committee's adopted interest rate target is the median of members' chosen rates, including the chairman's provisionally selected rate:

$$R_t = median\left(\tilde{R}_{1t}, R_{2t}, ..., R_{9t}\right).$$

The Chairman's Reported Rate

After the median is determined, the chairman reconsiders a rate to report. If his provisional reported rate is different from the committee choice, then, in a spirit of consensus, he may modify his reported rate to match the committee. We specify that he first calculates a weighted average of his preferred rate, R_{1t}^{*}, and the adopted rate of the committee, R_t:

$$\overline{R}_{1t} = \omega R_{1t}^{*} + (1-\omega) R_t.$$

Following a logic similar to that described above for rank-and-file members, he then chooses to report a value for R_{1t} for the voting record. R_{1t} is equal to either R_t^{sq}, $R_t^{sq} - 0.0025$, or $R_t^{sq} + 0.0025$, depending upon which of these is closest to his weighted average rate, $\overline{R}_{1t}$.

III. Estimation of the Model

As we have noted, since 1999, the BOE has consistently reported the MPC's selected interest rate target and also rates for each committee member attending the meeting. Observed rates for individuals correspond to the R_{it} variable in our model. Recall that these reported rates measure desired targets after members have deferred to

the Chairman and made choices discrete; these are not the "true" personal preferences indicated by the R_{it}^{*} (which are not observed).

The BOE's records provide the data that we employ to estimate the model described in the preceding section. We treat each meeting of the MPC as an observation, and each observation produces an outcome in the form of a vector of discrete choices: each member either reports a vote for the status quo interest rate or for a rate that is higher or lower. Our purpose is to estimate all of the model parameters, which include the reaction function parameters (α_i and the β_k), the error term variances (σ_u^2, and σ_v^2), and the weighting parameters (θ and ω). To estimate, we employ a maximum simulated likelihood (MSL) estimator.[9] The model we have described is complex and nonlinear, and we are not able to derive an analytical form for the likelihood function. However, it is feasible to calculate the likelihood for an observation (and the sample) using simulation methods.

Let us suppose that we have a set of trial values for the parameters of the model. For a single observation (a meeting) in our sample, we can draw values of the random error terms, u_t and v_{it}. Given these simulated error terms, and given the reaction function parameters, we can calculate the simulated interest rate preferences of each member in a meeting. Next, using the parameter indicating the weight of the chairman, we recalculate members' desired rates after accounting for members' deference to the chairman. Again following our model, members' interest rate targets are made discrete, falling into categories favoring the status quo rate or rates higher or lower by 25 basis points. At this point, we can determine the committee median, which is the majority voting winner. Finally, the Chairman's reported position is recalculated, given the weight that he attaches to the committee choice. This simulation produces a vector of discrete interest rate preferences, one for each member in the meeting. Thus, the simulated output is comparable to historical data, which also record discrete rate preferences for each committee member.

Table 1 illustrates what a single meeting observation in our historical data set might look like, with the shaded cells indicating interest rate positions for each of nine committee members. We would like to calculate the value of the likelihood function for such an observation. The likelihood for such an observation is equal to the probability that this precise configuration of reported preferences will occur, given parameter values for the model. This probability can be determined via simulation. In the preceding paragraph, we described how to simulate a single meeting observation. Suppose that we now replicate that simulation repeatedly, perhaps one million times, drawing new realizations of the model's error terms in each simulated observation. We then calculate the frequency with which the simulated meeting outcome matches the outcome observed in the historical data. This provides us with an estimate of the likelihood for that observation, given the parameter values.

[9] This method is described by Train (2003).

Table 1. A Hypothetical Meeting Observation

Policy/Member	1	2	3	4	5	6	7	8	9
Rate Up									
Status Quo									
Rate Down									

We can use this method to calculate the likelihood for each observation in the sample, which in turn permits us to calculate the likelihood for the sample. Finally, in order to estimate the model, we must find parameter values that maximize the likelihood for the sample. We employ the ML PROC routine in TSP for this purpose.[10]

IV. Estimation Results

Our reaction function follows a Taylor rule specification, including inflation and the output gap as explanatory variables. Our inflation measure is based on the retail price index, which the Bank targeted from 1999 until December 2003 at a rate of 2.5%. At that time, the Bank switched its target to the consumer price index, and the target rate for that index was set at 2%. According to the Bank, this change was not intended to change the stance of monetary policy on average; essentially, the difference in targets reflected differences in average inflation as measured by the respective indices. If this is the case, then an empirical specification using either measure should be satisfactory.[11] The variable included in our model is an average of the inflation rate over the three months preceding the current MPC meeting. We have calculated an estimate of the output gap by decomposing real GDP into trend and deviation components using the Hodrick-Prescott filter. To account for possible inertia in policymaking, we also include the lagged target interest rate as an explanatory variable. Our specification does not impose any long-run restrictions or specific values for the inflation target.

The UK economy was remarkably stable over the 1999–2007 period that we investigate. Inflation was low and steady, rarely deviating from the established target values. The estimated output gap never exceeded 1.0% in absolute value. This stability, while desirable for the UK economy, may make it more difficult to estimate Taylor rule parameters. If the BOE truly targets the inflation rate at 2.0%, then the expected inflation rate at any time should also be 2.0%. Moreover, there should be little variation in actual inflation, making it difficult to econometrically estimate how the MPC would respond if

[10] For a nine-member committee voting on a discrete outcome with three options, there are 19,683 possible configurations of preferences that might result for a given meeting outcome. Some of these configurations will not occur frequently in our simulations, which requires us to use large simulated samples. As a practical matter, we have used a procedure that varies the number of simulated observations over meetings, using more simulations when estimated probabilities are low.

[11] Riboni and Ruge-Murcia (2008) use the retail price index for their entire sample (June 1997 through June 2006) and model the change in the inflation target by allowing for a break in the reaction function intercept after December 2003. They indicate that they get results similar to those they report if they instead use the retail price index until December 2003 and the consumer price index after that. We plan additional analysis to test the sensitivity of results to our modeling of the inflation target.

inflation were different. Similarly, because the sample period was characterized by unusual real stability, it may be difficult to accurately estimate responses to real fluctuations. This may be why estimates of UK reaction function coefficients reported by Cobham (2006) and Riboni and Ruge-Murcia (2008) appear to deviate substantially from those of a prescriptive Taylor rule. While this remains an issue of some concern for our study, our primary focus is not on the Taylor rule coefficient estimates, but on the parameters that characterize the committee decision process.

Table 2. Parameter Estimates

Parameter	Estimate
$\beta_{\dot{P}}$	0.0061
β_{gap}	0.1715
$\beta_{R_{sq}}$	0.9381
σ_u	0.1222
σ_v	0.1277
θ	0.6270
ω	0.6250
Individual Intercepts	
Andrew Sentence	0.7096
Tim Besley	0.6722
John Vickers	0.2680
Andrew Large	0.4416
Mervyn King	0.3640
Paul Tucker	0.3252
David Clementi	0.1858
Ian Plenderleith	0.1912
John Gieve	0.2826
Eddie George	0.2668
David Walton	0.2975
Richard Lambert	0.2287
Alan Budd	0.2568
Charles Goodhart	0.1505
Willem Buiter	0.1928
Rachel Lomax	0.2359
Kate Barker	0.2267
Charles Bean	0.2032
Stephen Nickell	0.1262
Marian Bell	0.1233
Christopher Allsop	-0.0199
DeAnne Julius	-0.0997
Sushil Wadhwani	0.0148
David Blanchflower	0.0140

Results of our estimation are provided in Table 2. Because we have iterated over parameter estimates one coefficient at a time, our TSP implementation of the optimization does not provide correct estimates of standard errors for the coefficients, so none are reported in the table. It is possible, however, to carry out likelihood ratio tests of hypotheses of interest. The table shows that the inflation and gap measures are correctly (positively) signed, although the inflation coefficient is close to zero. This suggests a very modest response of policy to recent observed inflation. The coefficient on the output gap is larger and (probably) statistically significant. There is considerable inertia in policymaking, as the coefficient on the lagged interest rate suggests. Variances of the two error term components are comparable in size. The substantial variance for the shared error term component indicates that common unobserved shocks can account for some of the agreement across members in a meeting.

We are particularly interested in the estimate of θ, which indicates the weight that rank-and-file MPC members attach to the chairman's desired rate. This estimate, at 0.6270, indicates substantial influence from the chairman, perhaps more than would have been expected given the "individualistic" character of the proceedings. A likelihood ratio test confirms that the chairman's coefficient is significantly different from zero at better than the 0.0001 significance level. Our estimates also imply that once a committee decision is made, the chairman shows a willingness to modify his true preferred stance in a consensual manner. The parameter ω, with an estimated value of 0.6250, is the weight that the chairman gives to his private preferences, implying that the weight attached to the committee median, $1-\omega$, is equal to 0.3750.

Estimated reaction function intercepts vary notably across members, and members' coefficients vary in ways that would be expected, given their voting records. Table 3 compares estimated intercepts with simple dissent frequencies based on the voting history. In Table 3, we define the "net tightness frequency" as the number of times a member prefers a tighter policy (than the one adopted by the committee) less the number of times he prefers a looser policy, expressed as a percentage of total votes. As the table reveals, estimated intercepts are closely, though not perfectly, related to the net tightness frequency—the correlation between the two measures is 0.95. For purposes of illustration, we note that Andrew Sentence dissented more frequently in favor of tighter policies than any other member, and he also has the highest reaction function intercept. Also note that Governor Mervyn King has a higher intercept than his predecessor, Governor Eddie George, as we would have expected from his pattern of dissenting positions while serving under George.

Table 3. Reaction Function Intercepts and the Net Tightness Frequency

Individual	Net Tightness Frequency	Intercept	Rank by Net Tightness Frequency	Rank by Intercept
Andrew Sentence	0.5333	0.7096	1	1
Tim Besley	0.5000	0.6722	2	2
John Vickers	0.2381	0.2680	3	8
Andrew Large	0.2250	0.4416	4	3
Mervyn King	0.1009	0.3640	5	4
Paul Tucker	0.0746	0.3252	6	5
David Clementi	0.0444	0.1858	7	17
Ian Plenderleith	0.0238	0.1912	8	16
John Gieve	0.0000	0.2826	9	7
Eddie George	0.0000	0.2668	10	9
David Walton	0.0000	0.2975	11	6
Richard Lambert	0.0000	0.2287	12	12
Alan Budd	0.0000	0.2568	13	10
Charles Goodhart	0.0000	0.1505	14	18
Willem Buiter	0.0000	0.1928	15	15
Rachel Lomax	-0.0185	0.2359	16	11
Kate Barker	-0.0375	0.2267	17	13
Charles Bean	-0.0581	0.2032	18	14
Stephen Nickell	-0.1233	0.1262	19	19
Marian Bell	-0.1389	0.1233	20	20
Christopher Allsop	-0.2973	-0.0199	21	23
DeAnne Julius	-0.3103	-0.0997	22	24
Sushil Wadhwani	-0.3514	0.0148	23	21
David Blanchflower	-0.3684	0.0140	24	22

V. Conclusions

We have developed an econometric model of monetary policy committee decisions and have estimated that model using historical data on decisions made by the Bank of England. Our approach is unique in its modeling of collective choices. The model first specifies the preferences and behavior of individual committee members, and then it explicitly aggregates from individual choices to the determination of collective outcomes. The model assumes that the committee chairman may exert influence over other members of the committee before majority voting determines the policy outcome in a meeting. The parameter characterizing the weight that rank-and-file committee members attach to the chairman's preference can be estimated, along with parameters

characterizing the policy preferences of the committee. Maximum simulated likelihood methods are employed in estimation.

Our results indicate that the BOE's Governor, who chairs the monetary policy committee, has considerable influence over other members of the committee. Specifically, when reporting a vote on the interest rate target, committee members' attach a weight of 0.63 to the Governor's preferences and a weight of only 0.37 to their own private preferences. This implies a surprisingly large role for the Governor, given that observers have suggested that the BOE's policy committee is "individualistic" in character. Other results confirm that Governor Mervyn King preferred tighter policies than his predecessor, Governor Eddie George, and that estimated reaction function parameters for individual committee members are generally congruent with simple frequency statistics characterizing their policy voting choices.

Our model offers an opportunity to evaluate how changes in the membership of an MPC might affect policy choices. Given parameter values, our model could be simulated under counterfactual assumptions regarding the composition of the committee, and historical (or future) policy outcomes could be forecasted. This is possible because of our explicit modeling of the process by which committee member preferences are transformed into committee choices. This task is currently left for future research.

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