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REACTION FUNCTIONS OF BANK OF ENGLAND MPC
MEMBERS: INSIDERS VERSUS OUTSIDERS

By

Christopher Spencer
(University of Surrey)

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# Reaction Functions of Bank of England MPC Members: Insiders versus Outsiders[*]

## Christopher Spencer[†]

### Department of Economics, University of Surrey

## Abstract

In 1997, the Bank of England was granted operational responsibility for setting interest rates to meet a Government inflation target of RPIX 2.5 percent. As part of the shift towards independence, operational decisions on monetary policy were delegated to a Monetary Policy Committee. Using voting data obtained from Minutes of Monetary Policy Committee Meetings, I show that as a group, internally appointed MPC members (*insiders*) on average prefer higher interest rates than external appointees (*outsiders*). Further, ordered logit analysis demonstrates that insiders and outsiders are motivated by different concerns when setting interest rates, with the interest rate setting behaviour of outsiders being less easy to predict than those of insiders.

**Keywords**: Monetary Policy Committee, insiders, outsiders, voting

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*"There shall be a committee of the Bank, to be known as the Monetary Policy Committee of the Bank of England, which shall have responsibility within the Bank for formulating monetary policy."* Bank of England Act 1998, Section 13(1)

# 1 Introduction

June 1997 witnessed a landmark change in the conduct of UK monetary policy. In a move towards independence, the Bank of England was granted operational responsibility for setting interest rates to meet a Government inflation target of RPIX 2.5 percent. As part of the shift towards independence, operational decisions on monetary policy were delegated to a nine member Monetary Policy Committee. It is the interest-rate setting behaviour of this committee[1] - more specifically, the policy preferences of individual members as revealed by the voting record - which forms the basis of this paper.[2] Since the inception of the MPC, the voting behaviour of its members is a subject which has received considerable attention in the financial press and news media - attention largely attributable to the publication of voting records shortly after a decision on the interest-rate is taken. Near split decisions often constitute stories in themselves. The *Financial Times* on $25^{th}$ January 2001 ran the headline 'Bank committee voted 5-4 to hold interest rates', reporting that only the use of the casting vote by the Governor of the Bank, Sir Edward George "prevented the MPC cutting [the] cost of borrowing by 0.25%". The story also featured an index ranking MPC members according to their degree of 'hawkishness', with higher numbers corresponding to a more hawkish voting record.[3,4] It is even a subject which has come to the attention of the House of Commons

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[1] Herafter referred to as the BoEMPC.

[2] The decision to shift to operational independence can be interpreted as a means of ameliorating the well known problem of *time-inconsistency*: taking the decision on the short-term interest rate out of the control of "politicians...who might bend it for their electoral ends" (*The Economist*, September 1997, pp.36-37) should in theory be instrumental in increasing the credibility of, and by implication the success of UK monetary policy. However, using the criteria for measuring the degree of independence of a central bank developed by Grilli, Masciandaro and Tabellini (1991) - hereafter referred to as GMT - it is possible to see that the shift to operational independence has not drastically increased what they define as the level of 'political' independence afforded to the Bank - a measure associated "with how the members of the central bank board are appointed, its relationship with government and its responsibilities" (see TABLE A.2 in the Appendix for clarification of this point). This is echoed in the words of Buiter (2002), for whom

> "Even operational independence is qualified in the case of the Bank of England...Any form of pressure by the government on the MPC to change its behaviour, other than a public, and properly enacted, change in its mandate, would violate both the spirit and the letter of operational independence. There has not been a single instance of such pressure in the first three years of the MPC's existence."

In other words, it is not implausible to suggest that the *operational* nature of the independence granted to the Bank is not in itself a guard against undue political influence. Indeed, commentators of more cynical leanings may, after close scruting of the Bank of England Act 1998, conclude that the monetary policy framework enjoyed by the Bank is potentially susceptible to political manipulation. This may be in spite of the relatively high degree of economic independence enjoyed by the bank, which to employ GMT's terminology concerns the ability of a central bank to use the instruments of monetary policy without interference from governmental bodies or institutions. In the case of Bank of England, this corresponds to the ability to pursue the inflation target unimpeded.

[3] It is also possible that changes in voting patterns may yield information about how interest rates will move in the future. This avenue of research is not pursued here. See Andersson *et al* (2001) and Gerlach-Kristen (2001) for applications to the Executive Board of the Swedish Riksbank and BoEMPC respectively.

[4] It is noteworthy to add that such interest in the voting record is not confined to the case of the Bank of England MPC. The composition and voting record of the United States Federal Open Markets Committee (FOMC) generates similar interest, where to quote Haubrich and Humpage (2001)

> "Newspapers and financial magazines can be counted on to count up the "hawks" and "doves" whenever a new member is appointed or the next batch of reserve bank presidents rotate on the committee."p.3

Treasury Select Committee, to which the MPC is partially accountable. The following exchange between George Palmer MP, Member of the House of Commons Treasury Select Committee, and Richard Lambert, external member of the MPC, reflects this assertion:

> **George Palmer**: "It is known that there has been widespread speculation over the years that the Bank staff are more hawkish on interest rates than the independent members of the MPC. In May [2003], the five Bank staff all voted to maintain rates and the four independent members all voted to reduce rates. The probability of this happening by chance 0.019%. Do you think that there was in fact a coincidence?"

> **Richard Lambert**: "I am not sure I really properly understand the question. It seems to me, looking at the minutes, that here were nine people: four came to one conclusion and five came to another. I did not get a sense from the minutes that their *internalness* or *externalness* had a bearing on the outcome."[5] (emphasis added)

In this paper, evidence is presented demonstrating that 'internalness' and 'externalness' *do* in fact have a significant bearing on the policy preferences of MPC members, and therefore policy outcomes. Amongst other things, the hypothesis that Bank *outsiders* prefer relatively lower interest rates than insiders is tested.[6] To summarise the results, it is shown that on average, insiders prefer relatively higher interest rates than outsiders. In light of this finding, insiders can clearly be construed as behaving more 'conservatively' than their externally appointed peers. Further, insiders display a greater propensity for leaving interest rates unchanged than outsiders. In this sense, outsiders may be described as being more *activist* than their internally appointed colleagues. All of the findings are based on voting data contained in the *Minutes of Monthly Meetings* for a period covering the first five years of the MPC.[7,8] This encompasses the entire spell for which the MPC was chaired by Sir Edward George[9], namely June $10^{th}$ 1997 – $6^{th}$ June 2003. In all, this amounts to 74 meetings,[10] a period over which MPC members cast 642 votes.

Having established significant differences in voting behaviour, reaction functions for both groups are estimated. To do this, limited dependent variable analysis is drawn upon. Using ordered logit analysis it is demonstrated that under a variety of different specifications, there exist differences in the policy preferences of insiders and outsiders.

## 2    Relationship to the Literature

Empirical studies of *insider-outsider* behaviour are relatively sparse, and the author is unaware of any other studies which estimate the reaction functions of Bank of England MPC members: indeed, what distinguishes this paper from other BoEMPC studies [for example Matthews (1999), Breedon, and Castle (2002), Gerlach-Kristen (2003)] is that in addition to providing a detailed examination of insider-outsider voting behaviour, reaction functions are estimated for *insiders* and *outsiders* under

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[5] Treasury Select Committee Minutes of Evidence (Q79), Monday $16^{th}$ June 2003.

[6] This may be construed as a test to see if *outsiders* have a predilection for monetary policy which leads to comparatively lower inflation and higher unemployment than that preferred by Bank *insiders*.

[7] Hereafter referred to as the *Minutes*. The *Minutes* are published 2 weeks after each MPC meeting.

[8] During this period, Sir Edward George also presided as Governor of the Bank of England.

[9] In July 2003 Sir Edward George was replaced by Mervyn King as both Governor of the Bank and chairman of the MPC.

[10] Also included are votes cast in the special MPC meeting held on September 18th 2001, which followed the terrorist attacks on the World Trade Centre.

a variety of alternative econometric specifications.[11]  The paper is related to a modest literature which is geared towards explaining the voting behaviour of members of the United States Federal Open Market Committee (FOMC), the body responsible for setting the US Federal Funds Rate. In this paper, as MPC votes are modelled as a function of the economic environment, it falls into what Meade and Sheets (2002) describe as the 'reaction function camp' [for example Tootell ($1991a, b$), Meade and Sheets (2002)], and not the 'partisan theory of politics' genus of studies [for example, Belden (1991)], which appeals to the career backgrounds and the appointments procedures of FOMC members to explain individual voting behaviour.

Unlike Tootell ($1991b$), who fails to find evidence to support the hypothesis that "FOMC policy votes of Federal Reserve Bank Presidents are more 'conservative' than those of their Board Governor counterparts", I find that the policy votes of insiders are more conservative than those of outsiders. A second difference should be highlighted. Tootell ($1991a$) and Meade and Sheets (2002), investigate the hypothesis that District Bank Presidents set policy according to *regional*, as opposed to *national* economic conditions. I do not pursue this hypothesis. This is because Bank Presidents can be viewed as providing regional representation on the FOMC. MPC members should not be seen as providing regional representation, unlike Bank Presidents (Tootell $1991a,b$) or members of the Governing Council of the ECB (Dornbusch *et al,* 1998). Thus whilst undoubtedly falling into the same genus as the FOMC, the MPC is a somewhat different animal to its US equivalent. Further, in this paper, the emphasis is emphatically *not* on the dissent voting behaviour of MPC members, which is the focus of Spencer ($2005b$).

## 3    The Monetary Policy Framework at the Bank of England

The framework determining the composition of the MPC and the means by which it reaches a decision is embodied in the *Bank of England Act* 1998 (hereafter referred to as the *Act*). It is the piece of legislation accountable for ($i$) granting *operational responsibility* for monetary policy to the Bank of England and ($ii$) establishing the Bank's nine member Monetary Policy Committee. The decision to shift to operational independence was taken by the British Labour Party, who announced their intentions in the period immediately following their general election victory on May $5^{th}$ 1997. By June 1997 a committee had been established, although not containing a full complement of members. Nevertheless, the monetary policy framework at the Bank had undergone a seismic shift.[12]

Acquaintance with the operational framework of UK monetary policy - particularly the structure of the BoEMPC - is useful in so far as it provides a background against which the interest-rate setting behaviour of the MPC can be rationalised. In light of this, analysis of the statutes of Bank of England with explicit reference to the *Act* is the focus of this section.[13] In what follows, attention is drawn to those statutes pertaining to the objectives of monetary policy, the formulation

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[11] The analysis of BoEMPC member only covers the period under which Sir Edward George presided as its Chairman. Mervyn King replaced Sir Edward George as Chairman of the MPC in July 2003. Restricting our sample to June 1997-June 2003 means that we do not have to control for the impact different chairmen on insider-outsider behaviour. This might be considered as an avenue for research in the more distant future.

[12] In the interim period between the Labour Party coming to power in May 1997 and the granting of Royal Assent for the Bank of England Act 1998 on June 1st 1998, the changes to the framework of UK monetary policy embodied in the *Act* operated *de facto* (Rodgers (1998)).

[13] Although no previous acquaintance with the *Act* is assumed, it is expedient here to only survey key clauses. More detailed accounts of the post-May 1997 framework for UK monetary policy are given in Budd (1998) and Rodgers (1997, 1998).

of monetary policy and voting arrangements on the MPC, and transparency.[14]

## 3.1 Objectives of Monetary Policy

Part II, Section 11 (Objectives) of the Bank of England Act 1998 explicates the objectives of the Bank vis-à-vis monetary policy as

> "(a) to maintain price stability, and
> (b) subject to that, to support the economic policy of her Majesty's Government, including its objectives for growth and employment." (Section 11)

In the context of the framework for UK monetary policy, price stability assumes the form of a government inflation target. Chosen by the Chancellor of the Exchequer, this stood as a 2.5% year on year increase in RPIX inflation for the period June 1997-December 2003. Thereafter, the Chancellor of the Exchequer, Gordon Brown announced a new target of 2% year on year CPI inflation. It is important here to stress that Section 11(b) should be viewed as a *secondary* objective: it is subject to the fulfilment of Section11(a). The inflation target represents the '(inflation) rate at which the MPC is required to achieve and for which it is accountable'.[15] It is worth noting here the symmetrical nature of the inflation target.[16] If inflation deviates by more than 1% either side of its target the Governor of the Bank is required to write an open letter to the Chancellor explaining "why inflation was adrift, how long the divergence was expected to last, and the action taken to bring it back on course."[17] The inflation target should not be interpreted as a range of values, as is the case with the European Central Bank. Instead, for the sample period used in this paper, "the inflation target is (RPIX) 2.5% at all times."[18]

## 3.2 The Monetary Policy Committee

Following the shift to operational independence, the responsibility for setting interest rates was not given to a single individual. The prerogative lay instead with the Monetary Policy Committee, or MPC, as it is more commonly known:

> "There shall be a committee of the Bank, to be known as the Monetary Policy Committee of the Bank of England, which shall have responsibility within the Bank for formulating monetary policy." Bank of England Act 1998, Section 13(1)

Comprising nine members, the precise form of the committee is as follows:

> "(a) the Governor and Deputy Governors of the Bank
> (b) 2 members appointed by the Governor of the Bank after consultation with the Chancellor of the Exchequer, and
> (c) 4 members appointed by the Chancellor of the Exchequer."

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[14] The extent to which the granting of operational independence has influenced the degree of political and economic independence of the Bank, as defined by Grilli, Masciandaro and Tabellini (1991), is expanded upon in the Appendix.

[15] Bank of England Act 1998, Part II.11 (Objectives)

[16] This is analogous to the loss function for the monetary authorities assuming the quadratic form $Z_t = \pi^2$. Assuming a zero inflation target, the squared term, $\pi^2$ indicates that a movement below or above the inflation target of like magnitude yields equal disutility.

[17] Rodgers (1997), p.3.

[18] "*Remit for the Monetary Policy Committee,*" letter from the Rt. Hon. Gordon Brown to Sir Edward George, 17th April 2002.

Five members – namely those referred to in clauses (a) and (b) - are chosen internally, from within the ranks of Bank staff, hence the name *insiders*. The *Act* requires three of the internal members to be the Governor and two Deputy Governors responsible for Financial Stability and Monetary Policy respectively. These members serve five year renewable terms. The remaining two internal appointees are chosen by the Governor following a discussion with the Chancellor, and serve three year terms. These members are usually directors of the Bank with executive responsibility for a given area of banking operations. Appointed directly by the Chancellor of the Exchequer, the remaining four members are chosen from outside the ranks of Bank staff, hence the name *outsiders*, or 'external' MPC members.[19] In this sense, outsiders cannot be viewed as Bank 'representatives', and are typically chosen from the private sector and academia. Outsiders serve renewable three year terms.[20] Given this institutional arrangement the Chancellor arguably still has a potentially significant bearing on the direction of UK monetary policy. In addition to powers to set and change the inflation target discussed earlier, the power of appointment represents an additional vehicle for influencing the direction of UK monetary policy.

## 3.3 Operational Independence

From the procedural standpoint, the Bank controls the short-term interest-rate as the key operating target of monetary policy. In this respect, and perhaps most significantly, Section 4(1) of the Bank of England Act 1946 has been amended to read:

> "The Treasury may from time to time give such directions to the Bank as, after consultation with the Governor of the Bank, they think necessary in the public interest, *except in relation to monetary policy.*" [words in italics added by Section 10 of the Bank of England Act 1998]

This amendment is clearly aimed at ensuring that "decision-making on monetary policy is more effective, open, accountable and free from short-term political manipulation".[21] In practice, Section 4(1) simply means that the Bank of England does not take instructions from the Chancellor with respect to the level of the short-term interest-rate. It is the embodiment of operational responsibility. The policy instrument used by the MPC is the rate on repurchase agreements, more commonly known as the *repo-rate*. This is the interest-rate at which the Bank of England lends to the money markets. The nature of the monetary transmission mechanism ensures that changes in the repo-rate propagate quickly to affect other short-term interest rates and ultimately long-term rates, which eventually feed through into inflation and GDP growth. It is estimated that changes in the repo-rate take two years to maximally impact inflation, and approximately one year for GDP (Bank of England, 1999).

## 3.4 Monetary Policy Formulation and Voting Arrangements at the Bank

Monetary policy is determined by simple majority rule, following a vote on the interest-rate tabled by the Governor of the Bank, who also chairs the MPC. In the event of a split decision, the Governor has a casting vote. This is in accordance with Schedule 3.11 clauses (2)-(6) which specify the form of MPC proceedings. Clauses (3)-(5) are of special relevance:

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[19] This does not preclude members who have previously worked at the Bank from becoming external appointees. Professor Charles Goodhart, for example, served on the MPC as an outsider, having previously been Chief Economist at the Bank.

[20] Under Sir Edward George, no external member had their term renewed. However, following the depature of Edward George from the MPC in July 2003, some outsiders appointed *during* his time as Chairman had their positions renewed, namely Professor Stephen Nickell and Kate Barker.
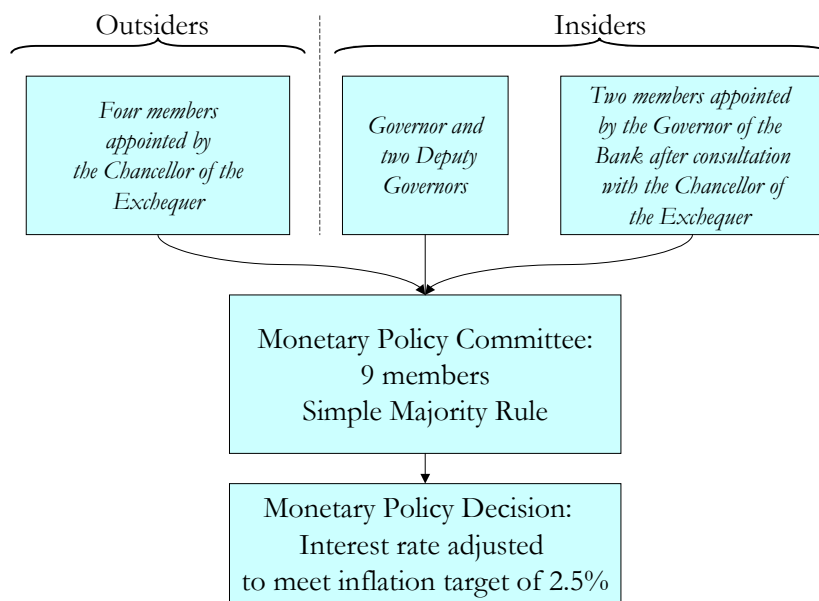
[21] Rodgers (1997), p.3.

FIGURE 1:
COMPOSITION OF THE BANK OF ENGLAND MONETARY POLICY COMMITTEE

"(3) The chair shall be taken by the Governor of the Bank or, if he is not present, the Deputy Governor of the Bank with executive responsibility for monetary policy.

(4) Decisions shall be taken by a vote of all those members present at the meeting.

(5) In the event of a tie, the chairman shall have a second casting vote."

Under the current operational monetary policy framework, the bank is required to publish a quarterly *Inflation Report, Minutes of MPC Meetings* and the individual votes of MPC members. The composition of the MPC is stylised in FIGURE 1.

## 3.5 The Decision on the interest-rate in Practice

Decisions on the interest-rate are taken on the first Thursday of the each month. Hosking (2000) describes how the decision on the interest-rate is made in practice:

"...the committee gathers before 9am and the Governor kicks off with a summary of what was discussed the day before. Members are free to chip in. Then comes the crux of the meeting. He invites every member to speak on where they should stand and what the policy decision should be. It is decision time...By 10.30am everyone has had their say. Unless the outcome is unanimous, the Governor will put a proposition and ask for a show of hands. Those voting in the minority are then given an opportunity to restate what they would do and why. The committee then decides to put out an accompanying statement. They tend to if they think their decision is likely to surprise the markets."[22]

The voting record is then published in the *Minutes of the Monetary Policy Committee Meeting*, released two weeks after the meeting.

# 4 MPC Performance Under Sir Edward George

Under the chairmanship of Sir Edward George, the MPC broadly met its objectives. FIGURE 2 shows that for the period covering June 1997-June 2003 the general trend was for interest rates to

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[22] Hosking (2000), p.47.

UK RPIX Inflation/Interest Rates, Jan 1996 -July 2003
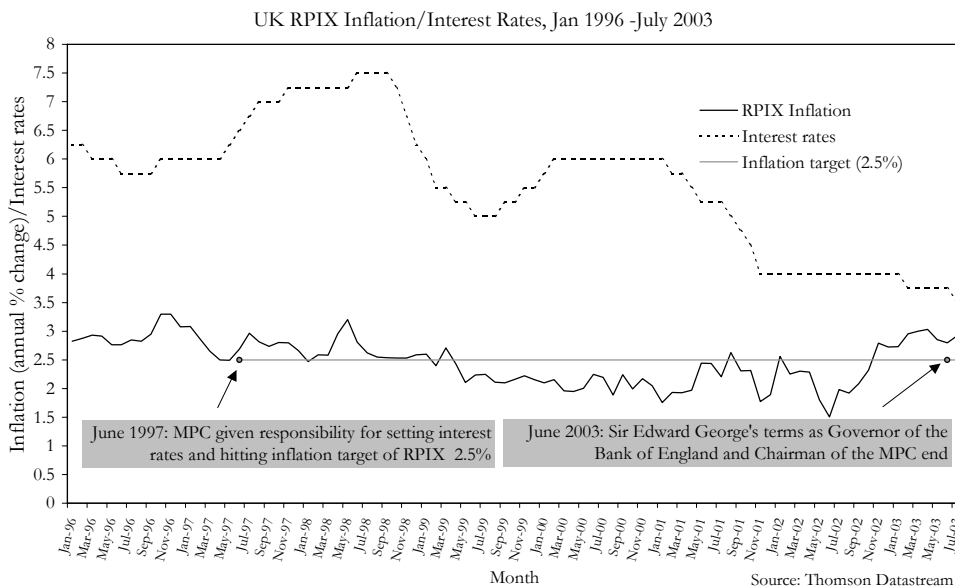
Month

Source: Thomson Datastream

FIGURE 2.
UK RPIX INFLATION, THE INTEREST RATE AND THE INFLATION TARGET

fall. RPIX inflation remained relatively stable and close to the target rate of 2.5%. A notable observation is that for a significant period (May 1999 - June 2002) inflation remained below target, which prompted some economists to speak of a *deflationary bias* inherent in monetary policy.[23] On no occasion did the rate of inflation deviate from its target rate sufficiently to require the Governor writing a letter of explanation to the Chancellor. In terms of the precise nature of the policy decision, the repo-rate was raised on 9 occasions, lowered on 15 occasions but left unchanged 50 times.[24] In this respect, FIGURE 2 also reveals the *inertial* nature of monetary policy under Sir Edward George.[25] However, when policy *did* change, it is hallmarked by what might be referred as *policy gradualism*.[26] Here, rates are gradually changed upwards or downwards in a series of small steps rather than fewer relatively larger steps.

## 5  What Data is the MPC using?

In addition to the macroeconomic projections at the heart of the quarterly *Inflation Report*, MPC members are presented with a wide range of data upon which to base a policy decision. This is reflected in the *Minutes*, which contains sections on the 'world economy', 'demand and output', 'money, credit and asset prices' and 'prices and costs'. Data on consumer confidence, changes in monetary aggregates (M0, M4), consensus forecasts of inflation and output, industrial production and exchange rates are invariably referred to in these sections. Of special importance is the role of the so-called '*pre*-MPC' meeting which takes place on the Friday before a decision is taken. At such meetings, bank staff present various data and analyses which pertain to regional, national and international economic developments. It is notable that not all of the information presented at *pre*-

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[23]Wallis (2002) sees this as stemming from a tendency for the Bank's suite of forecasting models to *overpredict* the level of future inflation. One might reasonably suppose that it in practice this would lead to MPC members prescribing higher interest rates than would be the case given a lower forecast.

[24]We also find that the likelihood of a decision to tighten, loosen or leave rates unchanged being followed a qualitatively identical decision is 33.3%, 46.6% and 70% respectively.

[25]Related to this point is Blinder's (1997) observation that a feature of monetary policy committees are policy decisions which "tend toward the mean and to be inertial". (p.21)

[26]Another name for this phenomenon is *interest rate smoothing*.

MPC meetings is in the public domain. For example, the monthly report on regional developments presented at pre-MPC meetings by the Bank of England's regional agencies is unavailable to the public at large.

# 6  Individual Policy Preferences

TABLE A shows (*i*) the individual members comprising the MPC for the sample period, (*ii*) their period of appointment and the corresponding number of votes cast and (*iii*) whether they are *insiders* or *outsiders*. This is complimented by PANELS 1 - 3, which display the interest-rate preferences of individual MPC members as revealed by their votes.[27] Interest-rate preferences (%) are given on the vertical axes. The fact that MPC members' terms are overlapping in combination with varying term lengths associated with different types of member - as reflected in TABLE A - accounts for the different interest rate paths. Inspection of the charts reveals that although policy preferences across members *do* differ, members interest-rate paths are broadly similar. Members who served for the longest periods - namely the Governor, Mervyn King, Ian Plenderleith and David Clementi are all insiders.[28]

# 7  Group Policy Preferences

FIGURE 3 plots the *average preferred interest rate* for insiders and outsiders at each MPC meeting. This is obtained by taking the arithmetic mean of interest rates cast by each group respectively at each MPC meeting. With the exception of a handful of MPC meetings between October 1997 and May 1998, FIGURE 3 shows that insiders preferred on average higher interest rates than outsiders. The extent of the differences is made clearer in the accompanying chart which plots the difference in mean interest rates preferred by insiders and outsiders.

## 7.1  Are Insider-Outsider Differences Statistically Significant?

I initially test to see if the differences illustrated in FIGURE 3 are statistically significant using paired *t*-tests. The null hypothesis of no difference in the *average preferred interest-rate* in meeting *t* for each group is tested against the alternative of the *average preferred interest-rate* in period *t* being greater for insiders. More formally it is expressed as

$$H_0 : \bar{\bar{i}}_{I,t} - \bar{\bar{i}}_{O,t} = 0 \tag{1}$$

against

$$H_1 : \bar{\bar{i}}_{I,t} - \bar{\bar{i}}_{O,t} > 0 \tag{2}$$

where $\bar{\bar{i}}_{I,t}$ and $\bar{\bar{i}}_{O,t}$ denote meeting *t* *average preferred interest rates* for insiders and outsiders respectively. A *t*-statistic of $t = 5.45$ with a corresponding *p*-value of 0.000 points to rejection of $H_0$ in favour of $H_1$: average preferred interest rates for outsiders are significantly higher for insiders than

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[27] The policy preferences of Howard Davies and Richard Lambert are not presented. Howard Davies left the MPC after the second meeting; Richard Lambert's appointment coincided with the final meeting in our sample, and so only voted once.

[28] Omitted from the panels are Howard Davies and Richard Lambert - it was felt that each of their series was insufficiently long to warrant graphing. Davies, an *insider*, stands as the shortest serving MPC member, attending only the first two MPC meetings; Lambert's appointment coincided with the final meeting in the sample in June 2003, and so only voted once.

**Members of the Bank of England Monetary Policy Committee, June 1997 - June 2003**

| Insiders | Period of Appointment | Votes Cast⌘ |
|---|---|---|
| Eddie George* | Jun 1997 - Jun 2003 | 74 |
| Howard Davies** | Jun 1997 - Jul 1997 | 2 |
| Ian Plenderleith**** | Jun 1997 - May 2002 | 61 |
| Mervyn King*** | Jun 1997 - Jun 2003 | 74 |
| David Clementi** | Sept 1997 - Aug 2002 | 61 |
| John Vickers**** | Jun 1998 - Sept 2000 | 28 |
| Charles Bean**** | Oct 2000 - Jun 2003 | 34 |
| Paul Tucker**** | Jun 2002 - May 2005 | 13 |
| Andrew Large** | Oct 2002 - Sept 2007 | 9 |

| Outsiders | | |
|---|---|---|
| Charles Goodhart | Jun 1997 - May 2000 | 36 |
| Willem Buiter | Jun 1997 - May 2000 | 36 |
| De Anne Julius | Sep 1997 - May 2001 | 45 |
| Sir Alan Budd | Dec 1997 - May 1999 | 18 |
| Sushil Wadhwani | Jun 1999 - May 2002 | 37 |
| Stephen Nickell♦ | Jun 2000 - May 2006 | 38 |
| Christopher Allsopp | Jun 2000 - May 2003 | 37 |
| Kate Barker♦♦ | Jun 2001 - May 2007 | 26 |
| Marian Bell | Jul 2002 - Jun 2005 | 12 |
| Richard Lambert | Jun 2003 - May 2006 | 1 |

⌘ The number of votes cast by each member is identical to the total number of meetings attended by each member. The emergency MPC meeting following the terrorist attacks on the World Trade Centre on September 11th 2001 are also included - an extra meeting was held in this month.

* Governor of the Bank and Chairman of the MPC / ** Deputy Governor of the Bank for Financial Stability / *** Deputy Governor of the Bank for Monetary Policy / **** Executive Director of the Bank.

♦Reappointed for a second term commencing June 2003.

♦♦Reappointed for a second term commencing June 2004.

TABLE A.
MPC MEMBERS AND PERIODS OF APPOINTMENT

Policy Preferences of MPC members, June 1997-June 2003





GEORGE

BUITER





GOODHART

KING





PLENDERLEITH

CLEMENTI
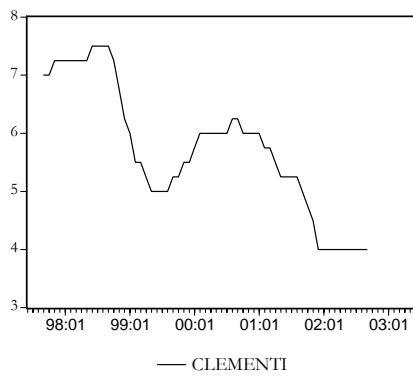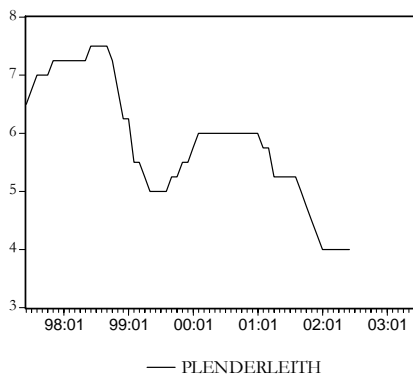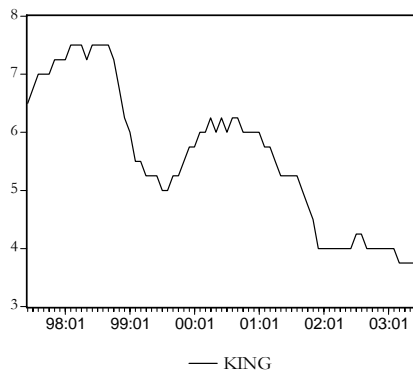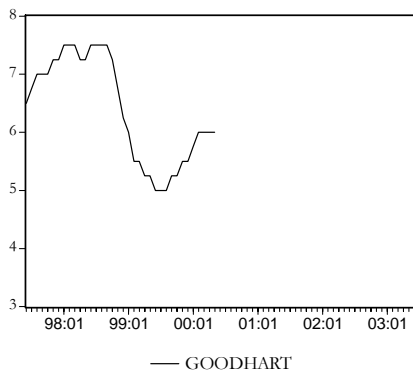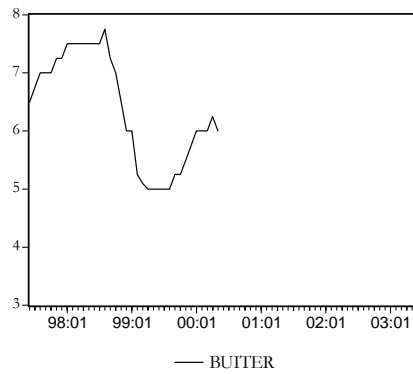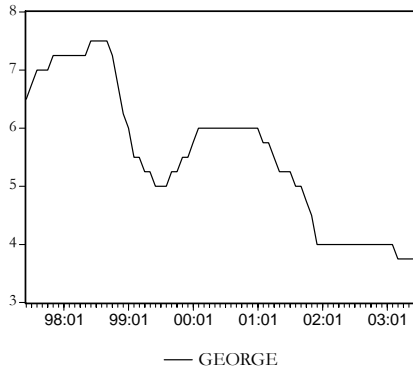
PANEL 1.
POLICY PREFERENCES OF MPC MEMBERS AS REVEALED BY THE VOTING RECORD

Policy Preferences of MPC members, June 1997 - June 2003
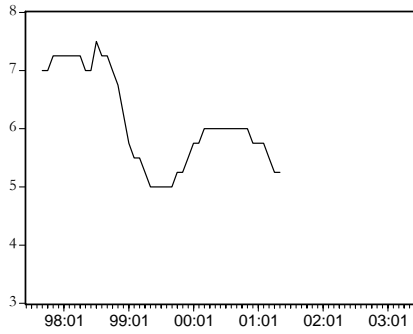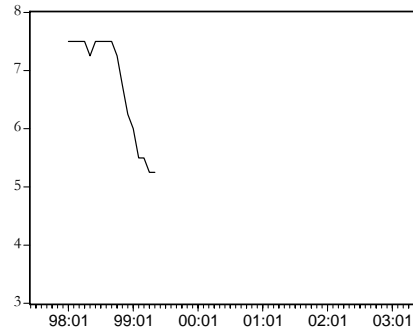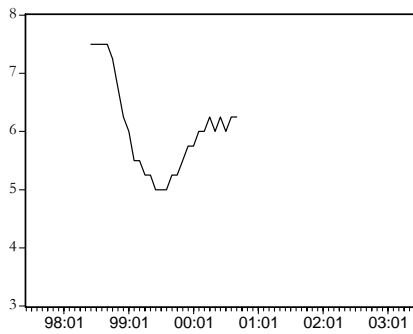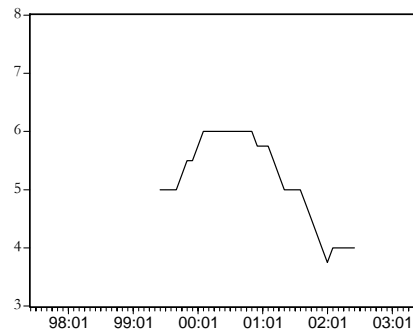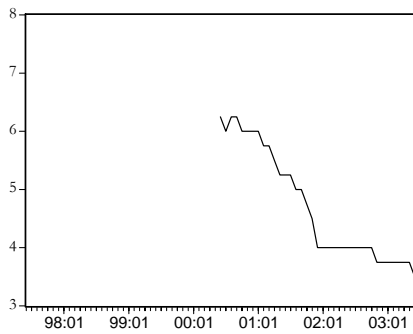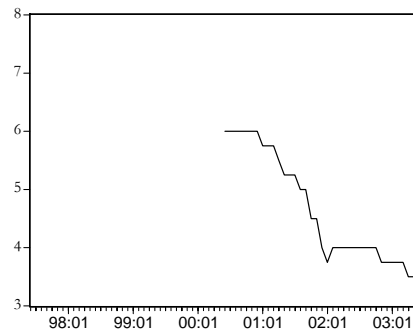


PANEL 2.
POLICY PREFERENCES OF MPC MEMBERS AS REVEALED BY THE VOTING RECORD

13

Policy Preferences of MPC members, June 1997 - June 2003
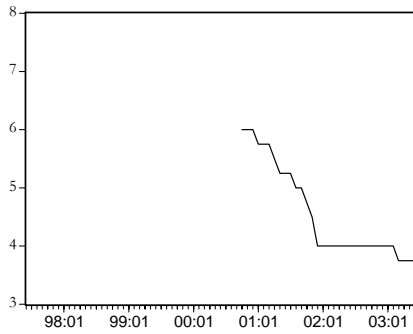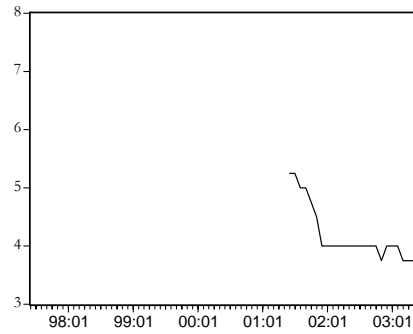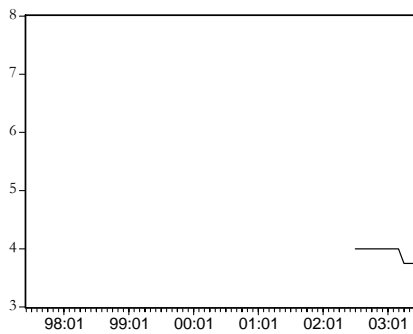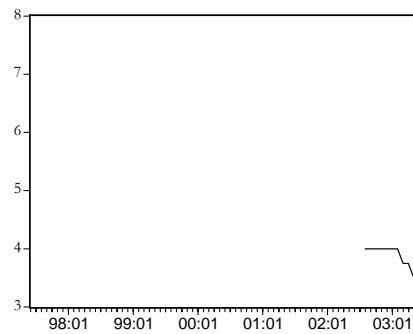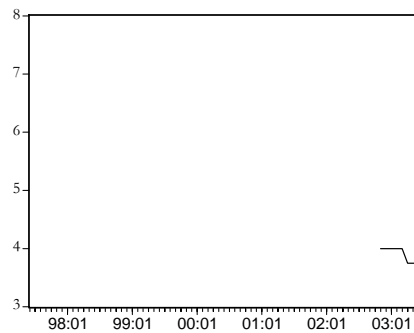


PANEL 3.
POLICY PREFERENCES OF MPC MEMBERS AS REVEALED BY THE VOTING RECORD

14

outsiders. This points to outsiders being more *dovish* than their internally appointed counterparts.

In the interests of completeness, further tests were conducted confirming that differences in insider-outsider voting behaviour are significantly different. Again, using paired *t*-tests[29] it was found that *internalness* and *externalness* have a statistically significant bearing on the voting behaviour of insiders and outsiders. The procedure was performed as follows. MPC members were categorised as falling into three groups - insiders, outsiders, and a third group consisting of all MPC members irrespective of type (**All members**). Then, for each meeting, the percentage of votes cast within each group for a change in the interest-rate (**All changes**), a tightening of the interest-rate (**Tighter policy only**) and an easing of the interest-rate (**Looser policy only**) was calculated. Results are shown in TABLE 4. Section A.1 catalogues the differences in voting behaviour between insider and outsiders in each category. At an *average MPC meeting* - calculated by summing the percentages corresponding to the type of vote cast in each category across all meetings and dividing by the total number of meetings - insiders voted to change the interest-rate 36.15% of the time, compared to 50% for outsiders. This difference is significant at the 1% level. Correspondingly, the difference is not significant for decisions to tighten the rate, but highly significant when it come to voting to loosen policy. At an *average MPC meeting*, outsiders chose to vote for looser policy 33.45% of the time, compared with a rate of 19.19% for insiders. This difference is significant at the 1% level. **Section B.1** compares each group's propensity to vote for a change in the interest-rate on the side of tightness or looseness. Across the 'All member' category, outsiders vote for looser policy significantly more than for tighter policy. This finding makes sense, as for the sample period interest rates on average fell. Although insiders are just as likely to vote for a change in tighter policy as a change in looser policy, for outsiders this difference is significant at the 1% level. In short, FIGURE 3 and TABLE 4 demonstrate that insiders are more hawkish and less activist than outsiders. These differences are statistically significant.

## 7.2 Measures of Agreement

An equally compelling finding is that *insiders* were in agreement with each other more so than *outsiders*. To quote Edmonds (1999) insiders behaved as if they were a "cohesive homogeneous group."[30] To substantiate this claim, I develop the following measure, $\Theta_j$, which corresponds degree of agreement between *insiders* and *outsiders* respectively, at the average MPC meeting. Let this be expressed as

$$\Theta_j = \frac{1}{T} \sum_{t=1}^{T} \frac{\sigma_{j,t}}{\bar{i}_{j,t}}, \qquad j = I, O \qquad (3)$$

where $I$ and $O$ denote insiders and outsiders respectively, $\sigma_{j,t}$ denotes the standard deviation of the desired interest-rate for members of group $j$ in meeting $t$, and $\bar{i}_{j,t}$ the corresponding mean interest-rate for each group in meeting $t$. The term $\frac{\sigma_{j,t}}{\bar{i}_{j,t}}$ is no more than the coefficient of variation in meeting $t$. Lastly, let $T$ stand for the total number of meetings included in the sample. Essentially, I calculate the *coefficient of variation* of interest rate preferences for each group at each meeting, and then take the group average across *all* meetings in the sample, to proxy for the measure of agreement within each group *at the average meeting.*. Accordingly, the smaller the value of $\Theta_j$, the lower the level of variability in interest-rate preferences expressed by members at each meeting. A value of $\Theta_I = 0$ would suggest that insiders were on average in perfect agreement with each other in every MPC meeting. The coefficient of variation associated with outsider preferences over the interest-rate - $\Theta_O = 1.508$ - is somewhat higher than those of insiders, for whom $\Theta_I = 0.563$. The

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[29] All calculations were performed using STATA 8.

[30] Edmonds (1999), p.3.

Mean interest rates preferred by insiders and outsiders at consecutive MPC meetings, June
1997- June 2003



Difference in mean interest rates preferred by insiders and outsiders
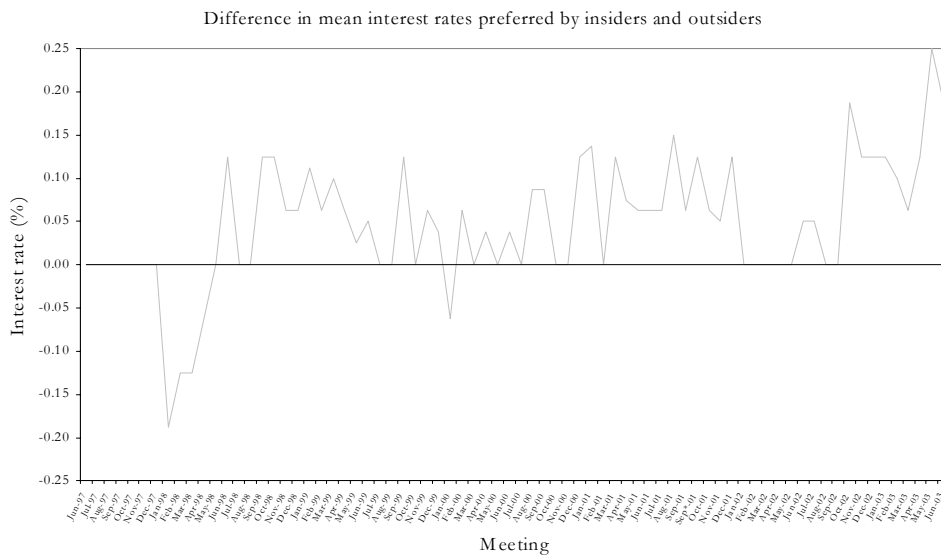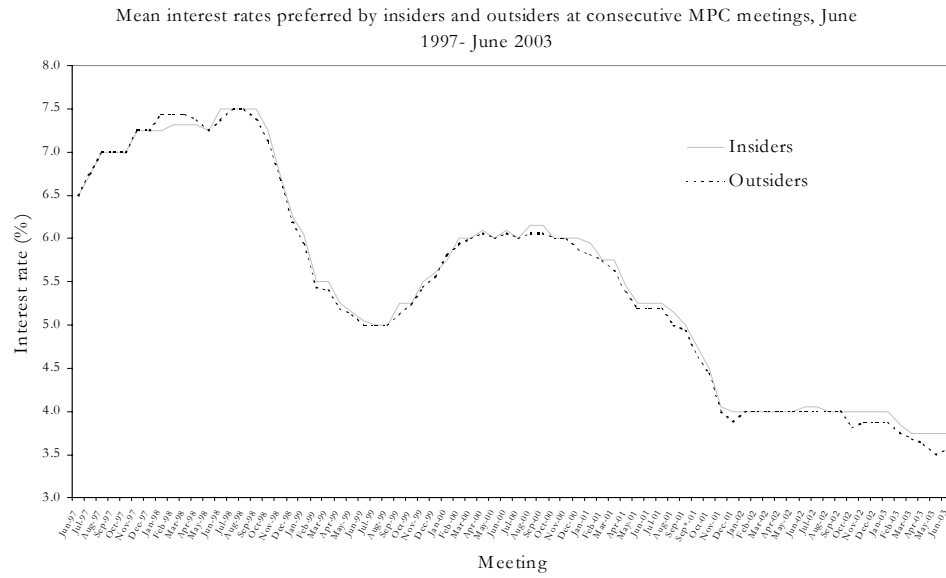


FIGURE 3.
MEAN INTEREST RATES FOR INSIDERS AND OUTSIDERS AND ASSOCIATED DIFFERENCES

16

**Mean Percentage of votes for looser and tighter policy given the prevailing interest rate including Governor**

**Section A.1 - Insiders versus Outsiders**

|  | Insiders | Outsiders | Significance level of Difference* |
|---|---|---|---|
| All Changes | 36.1 | 50 | 1% |
| Tighter Policy Only | 17.0 | 16.6 | NS |
| Looser Policy Only | 19.2 | 33.4 | 1% |

**Section B.1 - Tighter versus Looser Policy**

|  | Tighter | Looser |  |
|---|---|---|---|
| All Members | 17.0 | 25.5 | 10% |
| Insiders | 17.0 | 19.2 | NS |
| Outsiders | 16.6 | 33.4 | 1% |

**Mean Percentage of votes for looser and tighter policy given the prevailing interest rate excluding Governor**

**Section A.2 - Insiders versus Outsiders**

|  | Insiders | Outsiders | Significance level of Difference* |
|---|---|---|---|
| All Changes | 37.2 | 50.0 | 1% |
| Tighter Policy Only | 18.2 | 16.6 | NS |
| Looser Policy Only | 18.9 | 33.4 | 1% |

**Section B.2 - Tighter versus Looser Policy**

|  | Tighter | Looser |  |
|---|---|---|---|
| All Members | 17.6 | 26.2 | NS |
| Insiders | 18.2 | 18.9 | 1% |
| Outsiders | 16.6 | 33.4 | 1% |

Notes: *Significant differences are indicated for 1 percent, 5 percent and 10 percent levels.

NS indicates that the difference is not significant at the 10 percent level of significance

All percentages rounded to 1 decimal place.

TABLE 4.
TESTING FOR SIGNIFICANT DIFFERENCES IN THE PROPENSITY FOR INSIDERS AND OUTSIDERS TO CHANGE THE REPO-RATE USING PAIRED $t$-TESTS

policy preferences of outsiders at the average meeting are more diverse that those of *insiders*, who on average, have more of a tendency to agree with each other at each MPC meeting.[31] Indeed, insiders were in total agreement with each other in 56 out of 74 meetings (i.e. when $\frac{\sigma_{I,t}}{\bar{i}_{I,t}} = 0$). For outsiders, the number was in only 31 meetings (i.e. when $\frac{\sigma_{O,t}}{\bar{i}_{O,t}} = 0$). These results are plotted in FIGURE 4.
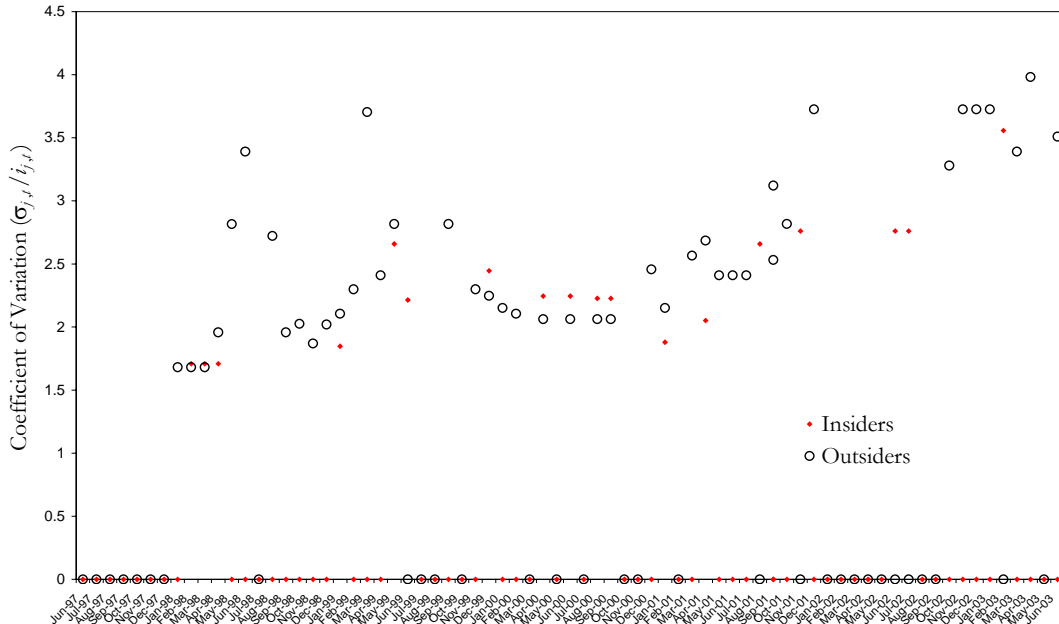


FIGURE 4.
COEFFICIENT OF VARIATION FOR INTEREST RATE PREFERENCES OF INSIDERS AND OUTSIDERS AT
EACH MONTHLY MPC MEETING, JUNE 1997 - JUNE 2003

Whereas insiders may be seen to have well defined goals and form a homogeneous cohesive group, outsiders form more of a disparate grouping. I suggest that such observed voting behaviour arises due to *insiders* being incentivised to pay more attention to each other than outsiders. In the context of the model, this leads to insiders only weighting the policy preferences of fellow insiders in the course of MPC deliberations, which can be explained by the presence of career concerns.[32,33] As insiders have a 5-4 in-built majority over outsiders one might reasonably posit that if *insiders* voted together as a group - essentially weighting only the opinions of other insiders - they would dominate decisions on the MPC, regardless of any opposition from their externally appointed counterparts. *This is what is seen in practice.*

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[31]Further, the finding that *insiders* are more likely to agree with each other more than *outsiders* has important ramifications for the way the MPC is perceived. It is commonplace in the financial press and media to portray insiders and outsiders as two distinct groups, each with well defined objectives and goals. These result serve to partially dispel this myth.

[32]This may be because, as Buiter (1999) points out, the appointment of *insiders* to the MPC emanates from their positions in the hierarchy of the Bank. Given the fact that insiders enjoy a numerical majority on the MPC, it is reasonable to suppose that were an 'institutional consensus' to develop - which is likely in an organisation like the Bank, which has a strong internal culture and sense of 'corporate identity' - *insiders* would dominate MPC decisions by dint of their inbuilt majority. Put another way,

'...every organisation develops, in short order, an in-house view, an orthodoxy, a conventional wisdom, which it becomes increasingly difficult to challenge' (Buiter (1999), p.13.)

For this reason Buiter suggests that it would be apposite for the committee to have a majority of *outsiders*, or rather, individuals who do not hail from a single organisation.

[33]In the event of a split decision, the Governor of the Bank in his role as Chairman of the MPC has a casting vote.

Some studies of FOMC voting behaviour (i.e., Havrilesky and Schweitzer (1991)) suggest that when differences in opinion arise with respect to the interest rate, the presence of career concerns leads members to 'revise' their view and subsequently vote with individuals who are perceived to have a bearing on their career path. Lawrence Roos, president of the St. Louis Federal Reserve Bank pays testament to this view, forging a clear link between dissent voting behaviour and career concerns:

> "If one is a young, career oriented president who's got a family to feed he tends to be more moderate in his opposition to governors." $cf.$ Havrilesky and Schweitzer (1990), p.3

Also consider the opinion of Henry Wallich, a member of the Board of Governors:

> "It is not a pleasant thing to have to keep dissenting...One dissents less often than you would think. After all you are a member of a group and you want to get along with the other members." $cf.$ Havrilesky and Schweitzer (1990), p.3

The message here seems to be that even when views on the interest-rate are divergent, social forces come into play thus bringing about agreement amongst committee members. Accordingly, members are more likely to pay attention to members of a similar type as they may have to work with them in the future - perhaps even long after their time on serving on the committee has ended. Disagreement *now* may hamper future prospects of promotion, and although members care about the *objectives* of the committee, they also care about future *career advancement*. In this sense, the way a member 'performs' on an MPC is not just measured as their ability to hit an inflation target, so to speak, but judged according to a their propensity to agree with members of his or her type. This may be particularly applicable to *insiders* serving on the Bank of England MPC. The voting record for the first five years of the MPC, demonstrates that approximately $16\frac{1}{2}\%$ of members' votes were dissents. Although MPC members are twice as likely to dissent as are FOMC members, Bank *insiders* were on the winning side of a monetary policy decision 93.6% of the time, compared with outsiders for whom the figure was 73.9%. In other words, insiders are far less likely to dissent than outsiders, although when insiders dissent, they do so on the side of monetary tightness, whereas outsiders do so on the side of monetary ease.

# 8   Estimating Members' Reaction Functions

In this section I identify the determinants of *insider* and *outsider* voting behaviour using *ordered logit analysis*.[34] Reaction functions are independently estimated for insiders and outsiders using a variety of econometric specifications. As mentioned previously, voting data obtained from Bank of England *Minutes of Monthly Meetings* from between July $10^{th}$ $1997 - 6^{th}$ June 2003 is used. Three types of vote are identified

1. *No change*: A vote for no change is defined as where an MPC member prefers to maintain the interest-rate set in the previous period.

2. *Tightening*: This is defined as where a member votes to raise the interest-rate set in the previous period.

3. *Loosening*: This is defined as where a member votes to lower the interest-rate set in the previous period.

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[34]Details of the procedures used in all estimations can be found in the Appendix.

A vote for *Looser policy* is coded $-1$, *No change* coded 0 and a vote for a *Tightening* of policy is assigned a value of 1. Specifications are geared towards competing ideas of how the monetary authorities set interest rates, reflecting views espoused in the recent literature on monetary policy making. Further, all explanatory variables are lagged by one month to take into account the data available to the MPC at the time of a decision. This reflects a methodological concern raised by Orphanides (1998) and Tchaidze (2001) originally proposed for the estimation of reaction functions in the monetary policy rules literature. From a methodological perspective, it is best practice to use what Orphanides (1998) defines as *real time* data - namely the *actual* data which the MPC was presented with and based its policy decision upon at each meeting. Clearly, it is a reasonable to assume that MPC reaction functions are best estimated using covariates in real time, and not estimates of macroeconomic variables which have been revised after a meeting has taken place. In this paper, as real time data is not available, lagged data is used to proxy for what might be referred to as 'real time' data - *contemporaneous* covariates are not used. Tchaidze (2001) identifies three key problems which should be avoided when estimating a monetary policy reaction function, namely:

> "...(i) the employment of contemporaneous rather than lagged variables as indicators of a state of the economy; (ii) the use of cleaned up, revised data; and finally (iii) a reliance on data which were not available at the moment of policy designing. The first ignores the so called "information lag",while the last two add (or in fact, subtract) substantial noise to (from) the fundamentals...*reliance on the information actually available to policy-makers in real time is essential for the analysis of monetary policy rules*"[35](emphasis added)

Similarly, Orphanides (1998) shows that using data which has undergone substantial revision distorts understanding of past monetary policy decisions. This rule naturally extends to the estimation of reaction functions using *voting data*. Accordingly, any analysis should be based on the data available to MPC members at each meeting. Given the recency of the period under scrutiny, it is plausible to suppose revised estimates will not differ too greatly from the originals. The econometric specifications are as follows:

## 8.1 The 'Blinder' Rule

The first specification is rooted in Alan Blinder's (1998) observation that

> "Central banks are often tempted to 'follow the markets,' that is to deliver the interest path that the markets have embedded in asset prices."[36]

The reasons for such behavior are not difficult to comprehend:

> "Central bankers are only human; they want to earn high marks - from whomever is handing out the grades. While the only verdict that really matters is the verdict of history, it takes an amazingly strong constitution to wait that long. In stark contrast, the markets provide a kind of giant biofeedback machine that monitors and publicly evaluates the central bank's performance in real time. So central bankers naturally turn to the markets - or rather, they have that evaluation constantly thrown back in their faces."[37]

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[35] p.1.

[36] Blinder (1998), p.60.

[37] Ibid.

The argument here is not, for instance, based on MPC members following the markets due to their faith in the *efficient markets hypothesis*.[38] MPC members might not necessarily subscribe to the view that all information regarding future inflation and output will be fully embedded in asset and securities prices. Rather, the implications of Blinder's argument is that when setting the interest-rate, the MPC follows the market knowing that a positive appraisal of policy from market participants greatly cements their reputation as a responsible and credible monetary authority. The view from the Bank is that market expectations *do* play an important role in shaping monetary policy, as asserted by Brook, Cooper and Scholtes (2000):

> "The Bank's Monetary Policy Committee (MPC) *is* interested in financial market partici-pants' expectations if future interest rates. Knowledge of such expectations helps the MPC to predict whether a particular policy decision is likely to surprise market participants, and what their short-term response is likely to be to a given decision. Expectations of future levels of offi-cial rates also play a key role in determining the current stance of monetary policy."[39](*emphasis added*)

In light of the previous assertions, a members' decision to loosen, tighten or leave rates unchanged is regressed on a variable which can be reasonably supposed to capture market expectations of the future level of interest rates, a specification which referred to as the **Blinder Rule**. The chosen instrument is a measure of *implied inflation* based on the difference between yield curve estimates of UK zero coupon nominal and index linked bonds at the 60 month horizon.[40] The series is constructed by calculating monthly averages of daily estimates originally calculated by Anderson and Sleath (2002). A 60 month - as opposed to a shorter horizon is used as for reasons attested by Anderson and Sleath (2002):

> "For maturities of less than two years, estimates of both the real and nominal yield curves have not been thought reliable, and as a result have not been used by the Bank's Monetary Policy Committee, nor published in the Inflation Report or Quarterly Bulletin."[41]

For completeness, FIGURE 5 plots the behaviour of 2 year nominal yields and implied inflation on a 60 month horizon. It can be readily observed that both series move very closely together. The series used in **Blinder Rule** estimations corresponds with the dotted black line.

## 8.2 Taylor Rule

In this approach lagged *forecasts* of GDP and RPIX inflation are used to explain the voting behaviour of MPC members. These specifications are chosen as they, to quote Clarida *et al* (2000),

> "...allow the central bank to consider a broad array of information (beyond lagged information and output) to form beliefs about the future condition of the economy, a feature which...[is] highly realistic."[42]

The choice of covariates thus comprise a forward-looking Taylor Rule information set. Forward looking variables for GDP growth and RPIX inflation are obtained from HM Treasury's *Forecasts for the UK Economy*. Published monthly, this is a compendium of forecasts produced by city

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[38] The seminal contribution is Fama (1965).
[39] p.392.
[40] These calculations have a basis in the Fisher equation.
[41] Anderson and Sleath (2002), p.9.
[42] p.151.

UK Nominal Yields and Implied Inflation, Jan 1997 - Jan 2004
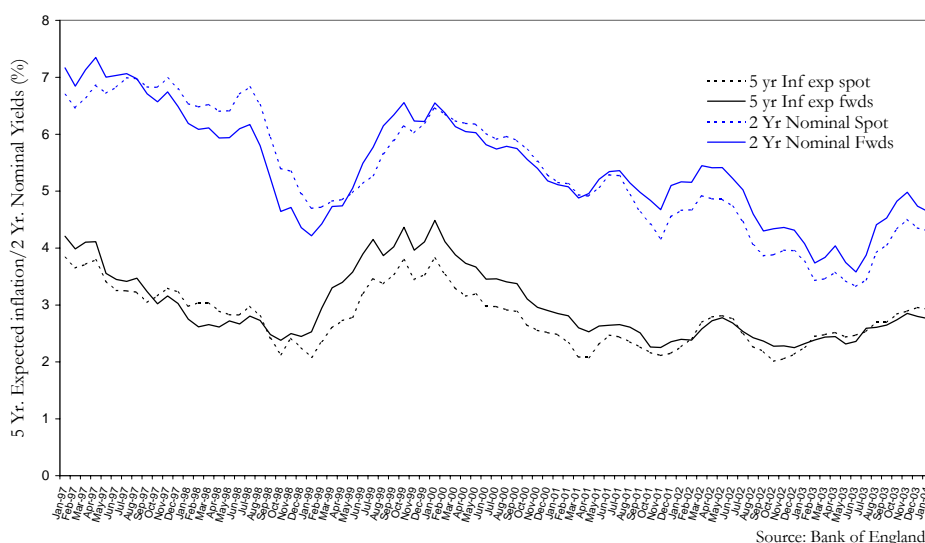


FIGURE 5.
UK NOMINAL YIELDS AND IMPLIED INFLATION

and independent forecasters.[43] For the sample period, forecasts from 47 city institutions and 19 independent forecasters are used. Each month city and independent organisations reported an average of 19 new forecasts and 6 new forecasts respectively. Two specifications are estimated. The first, labelled **Taylor Rule**$_C$, uses the following variables:

- Consensus forecasts of RPIX growth for the current calendar year as a percentage change on the previous calendar year (**RPIX**$_C$)

- Consensus forecasts of GDP growth for the current calendar year as a percentage change on the previous calendar year (**GDP**$_C$)

The second specification, denoted **Taylor Rule**$_F$ uses forecast data on a longer time horizon, namely

- Consensus forecasts of RPIX growth for the next calendar year as a percentage change on the current calendar year (**RPIX**$_F$)

- Consensus forecasts of GDP growth for the next calendar year as a percentage change on the current calendar year (**GDP**$_F$)

Consensus forecasts of GDP growth and RPIX inflation are referred to in the *Minutes,* in addition to being reported in the Bank's *Inflation Report.* If members of the MPC use 'simple' rules to

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[43]City forecasters included *Abn Amro Hoare Govett, Bank of America, Barclays Bank, Barclays Capital, Bridgewell, BZW, Capital Economics, Charterhouse, Chase Manhattan, Citigroup, Credit Lyonnais, Credit Suisse First Boston, Daiwa Europe Ltd/DIR, D M Grenfell, Deutsche Bank, Dresdner Kleinwort Benson, Economic Perspectives, Friends, Ivory and Sime, Fortis Bank, Goldman Sachs, Greenwich Natwest, Hermes, HSBC Economics & Strategy, ING Financial Markets, ISIS Asset Management Plc, James Capel, J P Morgan, Lehman Brothers, Lombard Street, Merrill Lynch, Morgan Stanley, Natwest Group, Natwest Markets, Nikko Europe, Norwich Union IM, Panmure Gordon, RBSFM, Royal & Sun Alliance Investments, Salomon Brothers, Schroders, Societe Generale, S C B Warburg, Standard Chartered, UBS, Warburg Dillon Read, WestLB, Panmure Gordon* and *Williams de Broe.* Independent forecasing organisations included *BSL, Cambridge Econometrics, CBI, CEBR, DRI, Economy.com, London Business School, EIU, Global Insight, Henley, ITEM Club, LBS, Liverpool University, NIESR, Oxford Economic Forecasting, WEFA, EC, OECD* and *IMF.*

determine interest rates, then either specification may both explain and predict MPC voting behaviour. I note that Tootell ($1991a, b$) also uses forward looking variables in the form of Greenbook estimates of GDP growth and inflation as covariates - this is because

> "...monetary policy affects the economy only with lags, the FOMC's expectations of GNP growth and inflation can be used to determine its votes."

As noted previously, purportedly central to the decisions on interest rates are the Bank of England's quarterly forecasts of inflation and GDP, which are published in the *Inflation Report*. However, the quarterly nature of these forecasts make it difficult to incorporate into the econometric framework as the MPC make a decision on interest rates on a *monthly* basis. Even if the quarterly GDP and RPIX forecasts contained in the inflation report are interpolated to form monthly variables, they have *very* low explanatory power in explaining MPC voting behaviour. These regressions are therefore not included.[44] A comparison of Bank versus Consensus forecasts for GDP and inflation are presented in PANEL 4. Current consensus forecasts of GDP and RPIX clearly exhibit more volatility than forecasts on a longer term horizon. The same applies to the quarterly Bank forecasts. Also, visual inspection reveals that consensus forecasts for $GDP_F$ track the Bank's quarterly forecasts on the 12 month horizon more closely than for the 24 month horizon. This applies to $RPIX_F$ forecasts too.

## 8.3 Broad Information Set

Prior to each MPC meeting, its members are presented with of a wide range of data upon which to base a policy decision. This is reflected in the *Minutes*, which contains sections on the 'world economy', 'demand and output', 'money, credit and asset prices' and 'prices and costs'.[45] Accordingly, it is conjectured that MPC votes may be explained better by a using a broad data set. The final specification uses the variables from the **Blinder Rule** and the **Taylor Rule**$_F$ information set *in addition to* the following variables:

- 3 period moving average of the monthly annual change in the effective exchange rate (**EER**)

- Quarterly growth rate in industrial production (**Industrial production**)

- Monthly unemployment rate (**Unemployment**)

- Monthly annual change in retail sales (**Retail sales**)

- Monthly annual % change in narrow money growth (**M0**)

- Consumer confidence indicator, monthly levels (**Consumer confidence**)

The additional variables are chosen as they represent potential sources of inflationary pressure which the MPC may take into account when setting the interest-rate.[46] The behaviour of the variables used across all specifications is presented in PANEL 5. When contrasting the rules in proceeding sections I find it useful class the Blinder Rule, Taylor Rule$_C$ and Taylor Rule$_F$ specifications - as 'simple' rules for monetary policy. In contrast, the Broad Information Set is an example of an 'eclectic' rule, as it draws upon a wide and rich set of information variables.[47]

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[44]Even if the quarterly GDP and RPIX forecasts contained in the inflation report are interpolated to form monthly variables (through using a HP filter, $\lambda = 5$), they have very low explanatory power in explaining MPC voting behaviour.

[45]Full details of the variables used are provided in the appendix.

[46]This list is by no means exhaustive - for example, not included here are statistics related to the growth of input prices, M4, average earnings and house prices. Estimations were carried out using these variables, but many proved to be insignificant.

[47]Details fo the variables used are given in the Appendix, TABLE A.1.

**UK RPIX Inflationary Expectations, Jun 97 - Jun 03: Bank vs. Consensus**



Source: HMT Treasury/Bank of England
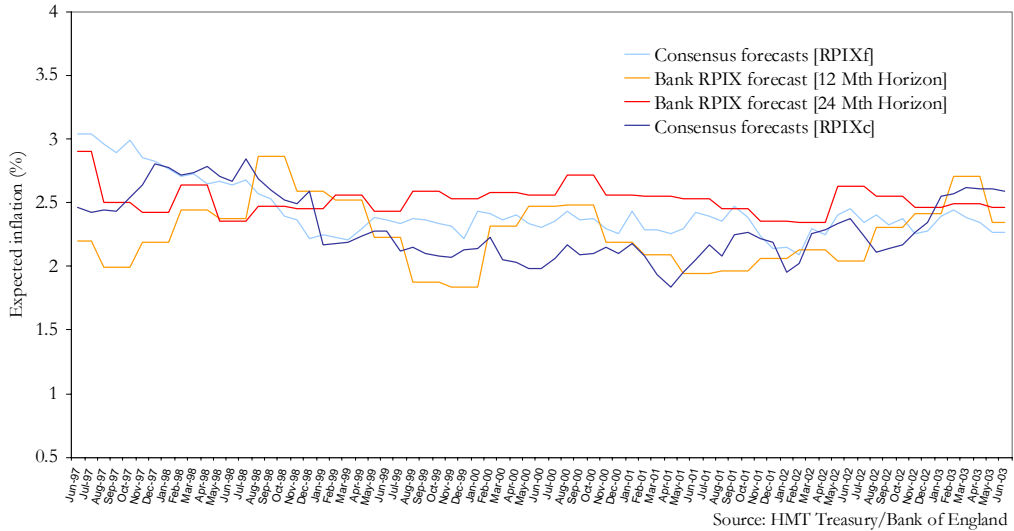
**Expectations of UK GDP Growth, Jun 97 - Jun 03: Bank vs. Consensus**



Source: HMT Treasury/Bank of England
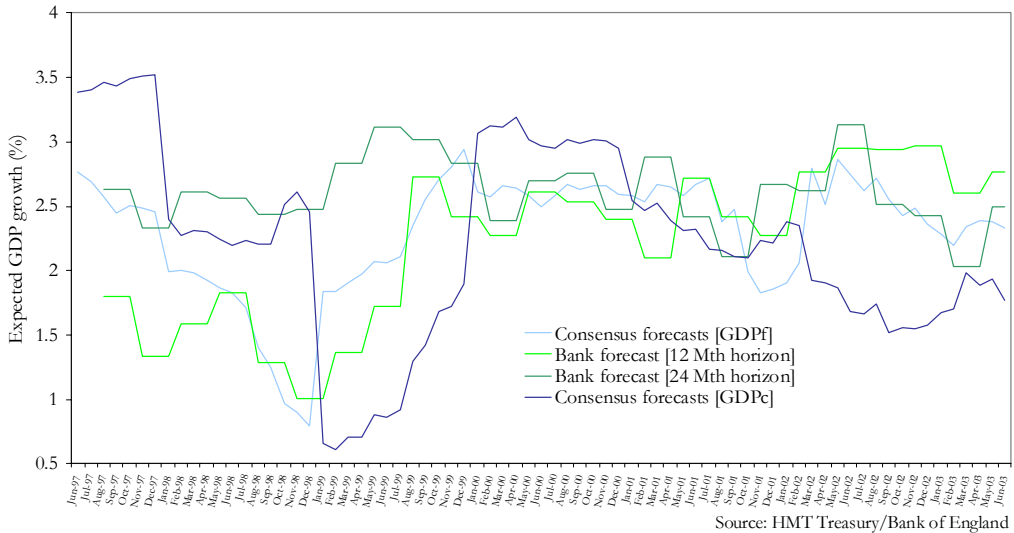
PANEL 4.
EXPECTATIONS OF UK RPIX INFLATION AND GDP GROWTH: BANK VS. CONSENSUS
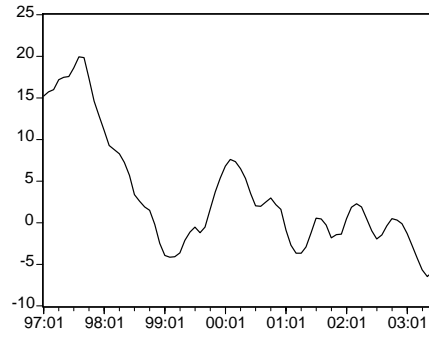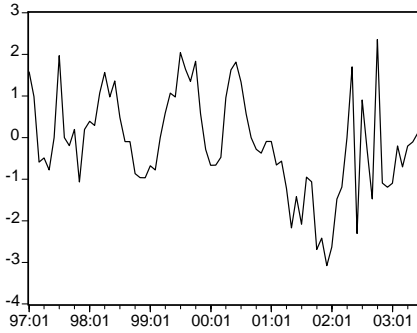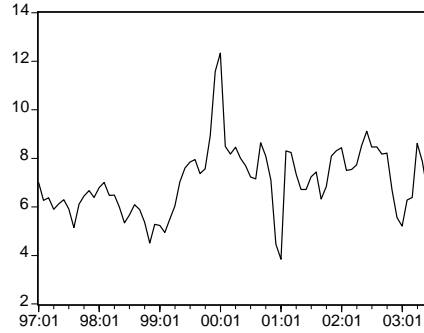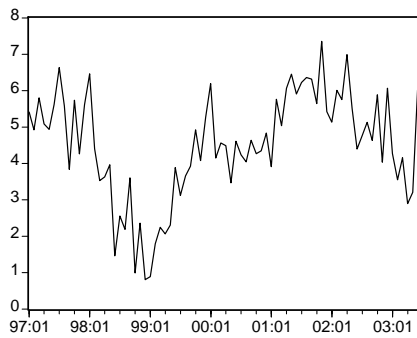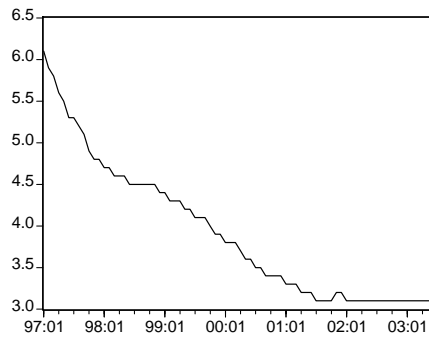
PANEL 5.
ADDITIONAL VARIABLES USED IN THE BROAD INFORMATION SET

## Ordered logit Comparison of different econometric specifications

Column groups — **Cutpoints:** $\gamma_i$, $\gamma_1$, $\gamma_2$ · **Variable parameters:** Implied inflation, $GDP_C$, $RPIX_C$, $GDP_F$, $RPIX_F$, M0, Consumer confidence, Retail sales, EER, Unemp., Industrial production · **Diagnostics:** $R^2$ (C-U), $R^2$ (M), LR($k$), $p$

| Specification | | $\gamma_i$ | $\gamma_1$ | $\gamma_2$ | Implied inflation | $GDP_C$ | $RPIX_C$ | $GDP_F$ | $RPIX_F$ | M0 | Consumer confidence | Retail sales | EER | Unemp. | Industrial production | $R^2$ (C-U) | $R^2$ (M) | LR($k$) | $p$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blinder Rule** | **Insiders** | | 8.15 | 12.92 | 3.80* | | | | | | | | | | | 0.45 | 0.26 | 165.17 | 0.000 |
| | **Outsiders** | | 8.76 | 12.53 | 3.62* | | | | | | | | | | | 0.46 | 0.25 | 144.60 | 0.000 |
| *Marginal effects* | *Insiders* | -1 | | | -0.62* | | | | | | | | | | | | | | |
| | | 0 | | | 0.51* | | | | | | | | | | | | | | |
| | | 1 | | | 0.11* | | | | | | | | | | | | | | |
| | *Outsiders* | -1 | | | -0.68* | | | | | | | | | | | | | | |
| | | 0 | | | 0.47*** | | | | | | | | | | | | | | |
| | | 1 | | | 0.22* | | | | | | | | | | | | | | |
| **Taylor Rule$_C$** | **Insiders** | | 0.44 | 3.64 | | 0.67* | 0.19 | | | | | | | | | 0.07 | 0.03 | 20.58 | 0.000 |
| | **Outsiders** | | 2.02 | 4.57 | | 0.72* | 0.49 | | | | | | | | | 0.09 | 0.04 | 22.67 | 0.000 |
| *Marginal effects* | *Insiders* | -1 | | | | -0.10* | -0.03 | | | | | | | | | | | | |
| | | 0 | | | | 0.01 | 0.00 | | | | | | | | | | | | |
| | | 1 | | | | 0.09* | 0.02 | | | | | | | | | | | | |
| | *Outsiders* | -1 | | | | -0.15* | -0.10 | | | | | | | | | | | | |
| | | 0 | | | | 0.06* | 0.04 | | | | | | | | | | | | |
| | | 1 | | | | 0.09 | 0.06 | | | | | | | | | | | | |
| **Taylor Rule$_F$** | **Insiders** | | 11.28 | 15.12 | | | | 2.20* | 3.30* | | | | | | | 0.32 | 0.17 | 111.48 | 0.000 |
| | **Outsiders** | | 12.94 | 15.89 | | | | 1.54* | 4.23* | | | | | | | 0.28 | 0.14 | 80.37 | 0.000 |
| *Marginal effects* | *Insiders* | -1 | | | | | | -0.26* | -0.40* | | | | | | | | | | |
| | | 0 | | | | | | 0.03 | 0.05 | | | | | | | | | | |
| | | 1 | | | | | | 0.23* | 0.34* | | | | | | | | | | |
| | *Outsiders* | -1 | | | | | | -0.30* | -0.82* | | | | | | | | | | |
| | | 0 | | | | | | 0.13* | 0.36* | | | | | | | | | | |
| | | 1 | | | | | | 0.17* | 0.47* | | | | | | | | | | |
| **Broad Information Set** | **Insiders** | | 9.24 | 15.26 | 3.55* | | | 1.89 | -1.27* | 0.54* | 0.15* | 0.12 | 0.10*** | -1.38** | 0.28*** | 0.61 | 0.39 | 251.5 | 0.000 |
| | **Outsiders** | | 5.90 | 10.63 | 3.38* | | | | 0.46 | 0.43* | 0.16* | 0.43* | 0.19** | -0.69 | 0.24*** | 0.62 | 0.38 | 218.4 | 0.000 |
| *Marginal effects* | *Insiders* | -1 | | | -0.19* | | | | | 0.03 | 0.03* | 0.03* | -0.01** | 0.07** | -0.01*** | | | | |
| | | 0 | | | 0.06*** | | | | | 0.01 | 0.002** | 0.002 | 0.002 | -0.02 | 0.004 | | | | |
| | | 1 | | | 0.13* | | | | | 0.01 | 0.01* | 0.005 | 0.004* | -0.05** | 0.01*** | | | | |
| | *Outsiders* | -1 | | | -0.49* | | | | | -0.03 | -0.03* | -0.03* | -0.01** | 0.07** | -0.01*** | | | | |
| | | 0 | | | 0.38* | | | | | 0.02 | 0.02** | 0.02 | 0.01** | 0.10* | 0.03 | | | | |
| | | 1 | | | 0.11* | | | | | -0.06 | -0.02* | -0.06* | -0.02* | -0.08 | -0.02 | | | | |

*/**/*** Denotes significance at the 1%/5%/10% level

TABLE 5.
ORDERED LOGIT ESTIMATION RESULTS:
BLINDER RULE, TAYLOR RULE AND BROAD INFORMATION SET

| | log-likelihood values | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Rule type* | **Both groups** | **Insiders only** | **Outsiders only** | **LR test statistic** | **df** | **5 % critical value** | **Reject H0?** | **Conclusion** |
| **Blinder** | -461.8 | -237.9 | -211.8 | 24.3 | 2 | 5.99 | yes | Estimate both groups separately |
| **Taylor$_C$** | -592.2 | -310.2 | -272.8 | 18.5 | 3 | 7.81 | yes | Estimate both groups separately |
| **Taylor$_F$** | -521.6 | -264.7 | -243.9 | 26.0 | 3 | 7.81 | yes | Estimate both groups separately |
| **Broad** | -389.2 | -194.7 | -174.9 | 39.2 | 10 | 18.3 | yes | Estimate both groups separately |

Should equations for insiders and outsiders be estimated separately?  Yes

**H$_0$**: Both groups should not be estimated separately

**H$_1$**: Both groups should be estimated separately

LR *test statistic calculated as c = -2(L(R) -L(UR)) where L(R) is the log likelihood value for the restricted model (both groups estimated together) and L(UR) is the sum of the log -likelihood values for both groups estimated separately.*

TABLE 6:
LIKELIHOOD RATIO TESTS FOR ORDERED LOGIT ESTIMATIONS

# 9    Econometric Results

TABLE 5 reports the estimates and diagnostics for the four specifications outlined above, all of which are estimated separately for insiders and outsiders.  At this juncture it is worth noting that a characteristic common to limited dependent variable analysis - particularly ordered logit estimation - is a difficulty in directly interpreting parameter estimates. This is because unlike estimation procedures such as OLS, coefficients cannot be directly interpreted as marginal effects.  Ultimately, this is a consequence of imposing the constraint that the sum of probabilities across all categories are non-negative and sum to unity.  The marginal effects associated with each category do not remain constant as the values of respective independent variables change, but vary instead.  It is hence commonplace to provide estimates of marginal effects *holding independent variables at their means.*

Rather than adopt this approach - which produces rather unfriendly mean values - and to make the results between groups directly comparable (to correct for differences in sample means caused by the different sample sizes associated with both groups), marginal effects are calculated for all specifications through holding independent variables constant at the following predetermined values: **Implied inflation** = 2.5%; **M0** = 7%; **RPIX$_C$** = **RPIX$_F$** = 2.5%; **GDP$_C$** = **GDP$_F$** = 2.2%; **Consumer confidence** = 0; **Unemployment** = 3.5%; **EER** = 2%; **Industrial production** = −1%; **Retail sales** = 5%.  In comparing two identical specifications for insiders and outsiders, the reported marginal effects show the effect of a change in an independent variable at a given point.[48]  It provides a good general guide to the extent to which changes in explanatory variables drive members' propensity to change the interest rate for a given category.  Full details of the estimation procedure are provided in the appendix to this paper.

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[48] From a *practical* perspective, a caveat of holding independent variables at their means, or indeed any other values is that (*i*) marginal effects are typically *unique* to those values and (*ii*) the calculated *change* in probability associated with voting to loosen, tighten or leave the interest rate unchanged is at best only accurate for very (ideally infinitesimally) small changes in an independent variable.   Indeed, as the magnitude of a given change, $\delta$, in an independent variable becomes larger, so too does the inaccuracy of the estimated change in probability associated with a given category.  One cannot therefore be confident, for example that a given change in an independent variable $\delta$ multiplied by the marginal effects associated with a particular category will provide good approximations to changes in probability.

Starting with the Blinder Rule, the effect of implied inflation is highly significant for both insiders and outsiders. Marginal effects show that an increase in **implied inflation** reduces the probability that both insiders and outsiders will lower interest rates, but raises the likelihood of leaving rates unchanged or tightening policy. However, the reduction in probability associated with a loosening of policy is larger for outsiders than for insiders (marginal effects of 0.68 vs. 0.62). According to this specification, outsiders are *more* likely to lower interest rates than insiders for a given change in implied inflation. The marginal effects for tightening show the reverse - insiders are *more* likely to raise interest rates than outsiders for a corresponding change in implied inflation. This specification therefore points to asymmetries in policy preferences between the two groups. Insiders are comparatively more hawkish than their externally appointed counterparts, a finding which confirms the analyses of previous sections. All of the marginal effects are significant, although both the Cragg-Uhler and McFadden measures or $R^2$ (denoted $R^2$ (**C-U**) and $R^2$ (**M**) respectively) are only moderately high. However, under both goodness-of-fit criteria, the Blinder Rule specification still performs better than either of the Taylor Rule specifications, to which I now turn.

In Taylor Rule$_C$, consensus forecasts of RPIX growth for the current calendar year as a percentage change on the previous calendar year (**RPIX**$_C$) are insignificant across both groups, although forecasts of current GDP growth do seem to play a role. Marginal effects indicate that increases in **RPIX**$_C$ decrease the probability that both insiders and outsiders will lower interest rates (0.10 vs. 0.15), but raise the probability of leaving rates unchanged or tightening policy. The same applies to GDP$_F$. Nevertheless, although the marginal effects across all categories are qualitatively similar to those in the Blinder Rule, they are *far* less pronounced. Further, some of the marginal effects are not statistically different to zero. The final Taylor Rule specification, Taylor Rule$_F$, which uses forecasts on a longer (12 month) horizon performs better than Taylor Rule$_C$, with respect to both the significance and size of the marginal effects, and measures of pseudo $R^2$. This result may indicate that MPC members are quite forward looking when setting policy, and use longer as opposed to relatively shorter forecasting horizons.[49] In both groups, the coefficients and marginal effects are generally highly significant, although for insiders, the marginal effects for *no change* are not significantly different from zero for **RPIX**$_F$ and **GDP**$_F$. For outsiders, the marginal effects seem to be more pronounced than for insiders for changes in GDP$_F$. This suggests that the behaviour of GDP plays more of an influential role in setting the interest rate for outsiders.

In the case of the Broad Information Set the diagnostics suggest that it performs best in explaining the voting behaviour of MPC members. Both measures of $R^2$ are moderate to high, and significantly higher than those under simple rules. However, although for both groups, **EER** and **GDP**$_F$ have the wrong signs. **Unemployment**, although statistically significant for insiders is not significant for outsiders. In both groups, the marginal effects are *clearly* dominated by the effect of **Implied inflation**, where clear asymmetries in policy can be seen as emerging. The nature of the asymmetry again points to outsiders being more dovish than insiders. The only variable other than **Implied inflation** which has statistically significant coefficients and marginal effects across both groups is **M0**, which also has the expected signs. TABLE 6 displays the results of likelihood ratio tests conducted to test the hypothesis that each specification should be estimated separately for insiders and outsiders. The hypothesis was accepted in every case.

All specifications evidence a very strong link between **implied inflation** and interest rates. However, it might be the case that decisions on the interest-rate are not driven by **implied infla-**

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[49]This suggests that policymakers practice inflation *forecast* targetting as opposed to just inflation targetting.

**tion**, but vice versa. Market participants may just be extremely good at predicting future monetary policy decisions. Using data on the actual policy decisions taken by the MPC and rates of implied inflation, Granger causality tests suggest that the direction of causality runs from implied inflation to the repo-rate. Full results are shown in TABLE A.3 in the Appendix. Using up to seven lags, the null hypothesis that the repo-rate does not Granger-cause changes in inflation is accepted in every instance. Conversely, the null hypothesis that implied-inflation does not Granger-cause changes in the repo-rate cannot be rejected for every lag. This result strengthens the case for a Blinder Rule, namely that the MPC merely looks to the markets to set the interest rates.

## 10   Predicting the Votes of MPC Members

In this section the ability of each specification to predict the votes of *insiders* and *outsiders* is analysed. This procedure is implemented by calculating the fitted values in each category for each vote, and choosing the category associated with the highest value for each vote. As the fitted values are probabilities, this process merely involves choosing the category with the *highest probability*. Following Chevapatrakul *et al* (2001), *directional* predictions are formally stated as

$$z_l = m \;\; if \;\; P_j = \max(P_0, P_1, P_2) \tag{4}$$

where no change in policy is predicted if $P_0 = \max(P_0, P_1, P_2)$, a tightening of policy is predicted if $P_1 = \max(P_0, P_1, P_2)$ and looser policy is predicted if $P_2 = \max(P_0, P_1, P_2)$. In other words, the prediction is given by choosing the probability with the *highest* value.

TABLE 7 looks at the predictive performance of each specification. Part **A** details the in-sample voting predictions for insiders and outsiders based on ordered logit estimations. Numbers in brackets (.) show the number of correct voting predictions within each category. Consider the Blinder Rule where insiders voted for looser policy 71 times (**Actual Outcomes**). The Blinder Rule specification predicted 40 votes for looser policy, of which 20 were correct. What immediately becomes apparent is the tendency inherent in all specifications to *over-predict* no change in policy. This comes at the expense of under-predicting decisions to loosen or tighten interest rates, an outcome which obtains for both insiders and outsiders. The Taylor Rule$_C$ specification performs particularly poorly, and predicts that *all* votes for insiders will be to leave policy unchanged.

Parts **B** and **C** allow for the identification of the model which performs best in predicting the voting behaviour of insiders and outsiders. Part **B** shows the number of correct decisions expressed as a percentage of actual decisions. Consider the Blinder Rule for *insiders* again, and recall that part **A** shows that of 40 predictions for loosed policy, only 20 were correct. The Blinder Rule thus has a $\frac{20}{71} \times 100 = 28.2\%$ success rate in predicting a vote cast for looser policy. Under this criteria, the Broad Information Set performs best. Further, it seems more able to predict votes for change for insiders than outsiders. The Blinder Rule is better at predicting votes cast for looser for outsiders than insiders, with the reverse being true for votes for tighter policy. However, some care should be taken when interpreting these results. Note that although the Taylor Rule$_C$ enjoys a $64\%$ success rate in predicting votes for *no change* in policy for insiders, it does not predict *any* votes in favour of changing the interest rate, in either direction. *All* votes predict no change in policy.

Numbers in square brackets [.] show the conditional probability (expressed as a percentage) of a prediction made within a particular category being correct. This is calculated by dividing the number of *correct* predictions within each category by the total number of predictions for that

## A. Voting Predictions

| | Direction of Decision | Actual Outcomes | Information Set | | | |
|---|---|---|---|---|---|---|
| | | | Blinder Rule | Taylor Rule$_C$ | Taylor Rule$_F$ | Broad Information Set |
| **Insiders** | Loosen | **71** | 40* (20)** | 0 (0) | 30 (19) | 45 (32) |
| | No change | **228** | 277 (190) | 356 (228) | 307 (213) | 280 (210) |
| | Tighten | **57** | 39 (21) | 0 (0) | 19 (15) | 31 (26) |
| **Outsiders** | Loosen | **99** | 96 (60) | 44 (18) | 56 (35) | 100 (75) |
| | No change | **145** | 162 (92) | 242 (119) | 211 (114) | 153 (112) |
| | Tighten | **42** | 28 (11) | 0 (0) | 19 (9) | 33 (25) |

## B. Associated Percentages

| | Direction of Decision | Actual Outcomes | Information Set | | | |
|---|---|---|---|---|---|---|
| | | | Blinder Rule | Taylor Rule$_C$ | Taylor Rule$_F$ | Broad Information Set |
| **Insiders** | Loosen | **71** | 28.2★ [50]★★ | 0 [0] | 26.8 [63.3] | 45.1 [71.1] |
| | No change | **228** | 83.3 [68.6] | 100 [64.0] | 93.4 [69.4] | 92.1 [75] |
| | Tighten | **57** | 36.8 [53.8] | 0 [0] | 26.3 [78.9] | 45.6 [83.9] |
| **Outsiders** | Loosen | **99** | 60.6 [62.5] | 18.2 [40.9] | 35.4 [62.5] | 75.8 [75] |
| | No change | **145** | 63.4 [56.8] | 82.1 [49.2] | 78.6 [54.0] | 77.2 [73.2] |
| | Tighten | **42** | 26.2 [39.3] | 0 [0] | 21.4 [47.4] | 59.5 [75.8] |

## C. All Votes♦

| | Direction of Decision | Actual Outcomes | Information Set | | | |
|---|---|---|---|---|---|---|
| | | | Blinder Rule | Taylor Rule$_C$ | Taylor Rule$_F$ | Broad Information Set |
| **Insiders** | Prediction | **356** | 231 | 228 | 247 | 268 |
| | Percentage (%) | | 64.9 | 64.0 | 69.4 | 75.3 |
| | Ranking | | 3 | 4 | 2 | 1 |
| **Outsiders** | Prediction | **286** | 163 | 137 | 158 | 212 |
| | Percentage (%) | | 57.0 | 47.9 | 55.2 | 74.1 |
| | Ranking | | 2 | 4 | 3 | 1 |

*Notes*: **Actual Outcomes** refers to the total number of votes cast by Insiders and Outsiders to loosen, leave unchanged or tighten the repo-rate. As an example, the total number of votes cast by insiders to *loosen* the interest rate over the sample period is 71. *In **A. Voting Predictions**, numbers in columns show the number of in-sample predictions under each rule. ** Figures in round brackets (.) show the number of *correct* voting predictions within each category (Loosen/No Change/Tighten)). For instance, consider the Blinder Rule where insiders voted for looser policy 71 times (**Actual Outcomes**). The Blinder Rule specification predicts 40 votes for looser policy, of which 20 were correct.

★ Part B shows the number of correct decisions expressed as a percentage of actual decisions. For example, consider the Blinder rule for *insiders* again, recalling that part A shows that of 40 predictions for looser policy, only 20 were correct. The Blinder rule thus has a $((20)/(71))\times100=28.2\%$ success rate in predicting a vote cast for looser policy. ★★ Figures in square brackets [.] show the conditional probability (expressed as a percentage) of a prediction made within a particular category being correct. This is calculated by dividing the number of correct predictions within each category by the total number of predictions for that category. For instance, to use the Blinder rule for insiders again, the likelihood of a prediction for looser policy being correct given that the prediction is for looser policy is calculated as Prob(Correct|Loosen)$\times100=(20/40)\times100=50\%$.

♦ Part C pools all of the correct predictions together for each group (insiders and outsiders) irrespective of category (Loosen/No Change/Tighten) and divides this number by the total number of votes cast by each group. For instance, the Blinder Rule specification for insiders predicts 231out of 356 votes correctly, which corresponds to a $(231/356)*100=64.9\%$ success rate. These percentages are then used as a ranking criterion for each specification, where a 1 denotes the best specification and a 4 the worst.

TABLE 7.
IN-SAMPLE VOTING PREDICTIONS BASED ON ORDERED LOGIT ESTIMATES

category. Again, the Broad Information Set performs best - for example, the results show that a prediction by the model to tighten interest rates has an 83.9% chance of being correct. Finally, part C pools all of the correct predictions together for each group *irrespective of category* and divides this number by the total number of votes cast by each group. The Broad Information Set out-performs the other categories. For insiders, 75.3% of predicted votes were correct; for outsiders the figure was comparable at 74.1%. The more parsimonious specifications are very bad at correctly predicting the votes of outsiders; for insiders this is not necessarily the case. This may be attributable to the finding that at any given MPC meeting, the interest rate preferences of outsiders are more widely dispersed than for insiders (see FIGURE 4). A conclusion that might be drawn from this is that outsiders are more 'eclectic' in their approach to setting monetary policy - the additional variables used in the Broad Information Set are relatively more important to outsiders than insiders. This may for example explain why the marginal effects for the extra variables are, with the exception of **Unemployment**, higher for outsiders across all categories.

## 11    Concluding Remarks

In this paper I have demonstrated that *internalness* and *externalness* is a significant factor is explaining the voting behaviour of MPC members. Insiders are shown to be more hawkish than their externally appointed counterparts, preferring *ceteris paribus* higher interest rates than outsiders. Further, insiders have a greater propensity for leaving interest rates unchanged. On a more general level, preliminary analysis of the timing of MPC decisions also demonstrates that if the interest rate is going to change, it is more likely to be changed in an *Inflation Report* month than at any other time.

The results of ordered logit analysis provide insight into the economic factors driving members' voting decisions. A first conclusion is the seemingly crucial role of *forward looking* variables in setting interest rates for insiders *and* outsiders. Both the Blinder Rule and Taylor Rule$_F$ specification out-perform the Taylor Rule$_C$ specification by a significant margin. This is reflected in the associated measures of pseudo-$R^2$ and in-sample predictions presented in TABLE 7. Further, it is notable that whereas all parameters in the Blinder Rule and and Taylor Rule$_F$ are statistically significant, this is not the case for the Taylor Rule$_C$. Marginal effects in the 'simple' rule specifications have the expected signs with respect to theoretical priors for both groups. Yet compared to the simple rules, the Broad Information Set specification is *clearly* superior, a finding which applies to both insiders and outsiders. Each group appears to use a broad array of variables when setting interest rates, which has implications for the view that the Bank merely follows the market or uses Taylor Rules. However, when one looks to the parameter estimates for **implied inflation** in the Broad Information Set, it is clearly seen to be the most influential variable. This suggests that although MPC members use an eclectic rule when setting monetary policy, market expectations of inflation play a dominant role.

Based on the results presented in this paper, further research in this area is has the potential to be both fruitful and policy relevant. An key finding is that outsiders prefer systematically lower interest rates than insiders. This begs the question of whether the appointments procedure is open to political manipulation by the Chancellor of the Exchequer - does he, for example choose external MPC members on the basis of their being doves, or are such dovish tendencies attributable to chance? A further finding is the extent to which monetary policy would differ if outsiders formed the majority of members. Under such a regime, it is not implausible to suppose that monetary policy would be characterised by lower interest rates with a correspondingly higher rate of economic growth. It must be emphasised however that the approach adopted in this paper approach lies

well within the 'reaction function' genre. Put another way, the focus has been on determining how MPC members respond to changes in economic conditions. Other lines of investigation such as the propensity of MPC members to *dissent* and the effects of career backgrounds on such behaviour - lines of investigation associated with the 'partisan theory of politics' literature - is discussed in Spencer (2005*b*).

# 12 Appendix

## 12.A The Ordered Logit Model

A common thread running through studies of monetary policy decision making is the use of limited dependent variable models in the estimation of reaction functions. From the mathematical perspective, the logit model has the advantage being computationally less burdensome than the probit model, which is based on the cumulative normal distribution. This section provides a rudimentary treatment of the ordered logit model geared specifically to the case of 3 outcomes, reflecting the choice faced by members of an MPC to tighten, loosen or leave interest rates unchanged. For more complete expositions of the ordered logit model see Maddala (1983), Hosmer and Lemeshow (1989), Cramer (1991) and Greene (1992).

For the ordered logit model the choice between $M$ mutually exclusive alternatives has an *implicitly logical ordering*.[50],[51] For members of an MPC faced with 3 choices, the ordered logit model may be expressed as

$$y_i^* = x_i'\beta + \varepsilon_i \tag{7}$$

$$y_i = -1 \text{ if } y_i^* \leq \gamma_1$$

$$y_i = 0 \text{ if } \gamma_1 < y_i^* \leq \gamma_2 \tag{8}$$

$$y_i = 1 \text{ if } y_i^* > \gamma_2$$

where $y_i^*$ is a stacked $m \times 1$ vector of $-1^s$, $0^s$ and $1^s$ corresponding to members' votes to tighten, loosen or leave interest rates unchanged given the rate set in the previous period. $x_i$ is a $m \times h$ matrix containing $h$ independent variables capturing the information sets of MPC members at the time each vote was cast, and $\beta$ is a $1 \times h$ vector parameter estimates.[52] The specification given above has likelihood and log likelihood functions given by

$$L(\beta) = \prod_{i=1}^{m} \prod_{j=0}^{2} [\Phi(\gamma_j - x_i'\beta) - \Phi(\gamma_{j-1} - x_i'\beta)]^{Z_{i,j}} \tag{9}$$

and

$$\ln L(\beta) = \sum_{i=1}^{m} \sum_{j=0}^{2} Z_{i,j} [\Phi(\gamma_j - x_i'\beta) - \Phi(\gamma_{j-1} - x_i'\beta)] \tag{10}$$

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[50] This model is also referred to as the *proportional odds model*. It recently came to the attention of the author that it is possible in STATA to estimate a *generalised* version of the ordered logit model, which relaxes the proportional odds assumption. Created by Vincent Kang Fu of the Department of Sociology, University of Utah, it is available as the gologit module and can be installed from *within* STATA by typing "ssc install gologit".

[51] It is important to note here the difference between ordered logit model and the ordered probit model. In the case of probit estimation, the cumulative density function, $\Lambda$, is normal, implying

$$\Lambda(\gamma_j - x_i'\beta) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{(\gamma_j - x_i'\beta)} e^{\frac{s^2}{2}} ds \tag{5}$$

where $s$ is a randon variable such that $s = N(0,1)$. However, the cumulative logistic density, $\Phi$, is given as

$$\Phi(\gamma_j - x_i'\beta) = \frac{1}{1 + e^{-(\gamma_j - x_i'\beta)}} \tag{6}$$

[52] The ordered logit model is a more *parsimonious* specification than the multinomial logit model, given there are fewer parameters to be estimated.

where $Z_{i,j} = 1$ if the $i^{th}$ vote falls in the $j^{th}$ category, and $Z_{i,j} = 0$ if not, across the $j = \{0, 1, 2\}$ outcomes. Letting $\Phi$ denote the *cumulative standard logistic* function it follows that

$$\Pr(Z_{i,j} = 1) = [\Phi(\gamma_j - x_i'\beta) - \Phi(\gamma_{j-1} - x_i'\beta)] \tag{11}$$

In the case of three ordered outcomes, the probability that $y_i^*$ assumes a particular value for the three categories is defined as:

*Looser policy*:

$$P(Z_i = -1) = \Phi(\gamma_1 - x_i'\beta) = \frac{1}{1 + e^{\beta' x_i - \gamma_1}} \tag{12}$$

*No change in policy:*

$$\begin{aligned} P(Z_i &= 0) = [\Phi(\gamma_2 - x_i'\beta) - \Phi(\gamma_1 - x_i'\beta)] \\ &= \frac{1}{1 + e^{\beta' x_i - \gamma_2}} - \frac{1}{1 + e^{\beta' x_i - \gamma_1}} \end{aligned} \tag{13}$$

*Tighter policy:*

$$P(Z_i = 1) = 1 - \Phi(\gamma_2 - x_i'\beta) = 1 - \frac{1}{1 + e^{\beta' x_i - \gamma_2}} \tag{14}$$

where $\gamma_1$ and $\gamma_2$ are embody the lower and upper cut off points respectively.

### 12.A.1 Marginal Effects for the Ordered Logit Model

Marginal effects are typically computed by holding regressors at their mean values, and are given by:

*Looser policy*:

$$\begin{aligned} \frac{\partial P(Z_i = -1 | x)}{\partial x} &= \frac{\partial \Phi(\gamma_1 - x_i'\beta)}{\partial x} = \Phi(\gamma_1 - x_i'\beta)[1 - (\gamma_1 - x_i'\beta)]\beta_i \\ &= \frac{1}{1 + e^{\beta' x_i - \gamma_1}}\left[1 - \frac{1}{1 + e^{\beta' x_i - \gamma_1}}\right]\beta_i \\ &= \frac{e^{\beta' x_i - \gamma_1}}{(1 + e^{\beta' x_i - \gamma_1})^2}\beta_i \end{aligned} \tag{15}$$

*No change in policy:*

$$\begin{aligned} \frac{\partial P(Z_i = 0 | x)}{\partial x} &= \frac{\partial[\Phi(\gamma_2 - x_i'\beta) - \Phi(\gamma_1 - x_i'\beta)]}{\partial x} \\ &= \Phi(\gamma_2 - x_i'\beta)[1 - (\gamma_2 - x_i'\beta)]\beta_i - \\ &\quad \Phi(\gamma_1 - x_i'\beta)[1 - (\gamma_1 - x_i'\beta)]\beta_i \\ &= \left(\begin{array}{c} \frac{1}{1+e^{\beta_1' x_i - \gamma_2}}\left[1 - \frac{1}{1+e^{\beta' x_i - \gamma_2}}\right] - \\ \frac{1}{1+e^{\beta_1' x_i - \gamma_1}}\left[1 - \frac{1}{1+e^{\beta' x_i - \gamma_1}}\right] \end{array}\right)\beta_i \\ &= \left(\frac{e^{\beta' x_i - \gamma_2}}{(1 + e^{\beta' x_i - \gamma_2})^2} - \frac{e^{\beta' x_i - \gamma_1}}{(1 + e^{\beta' x_i - \gamma_1})^2}\right)\beta_i \end{aligned} \tag{16}$$

*Tighter policy:*

$$\frac{\partial P(Z_i = 1 | x)}{\partial x} = \frac{\partial \left(1 - \Phi(\gamma_2 - x_i'\beta)\right)}{\partial x}$$

$$= \frac{1}{1 + e^{-(\beta' x_i - \gamma_2)}} \left[1 - \frac{1}{1 + e^{-(\beta' x_i - \gamma_2)}}\right] \beta_i$$

$$= \frac{e^{-(\beta' x_i - \gamma_2)}}{\left(1 + e^{-(\beta' x_i - \gamma_2)}\right)^2} \beta_i \tag{17}$$

Unlike the linear probability model, marginal effects vary across probabilities, and sum to zero across categories.[53]

## 12.A.2  Measuring the Goodness of Fit

Following Maddala (1983), define

$$R^2 = 1 - \left(\frac{L(\gamma_1, \gamma_2)}{L(\beta_1, \beta_2)}\right)^{\frac{2}{m}} \tag{18}$$

where $L(\beta_1, \beta_2)$ is the likelihood function maximized with respect to all of the parameters in the model, $\beta_1, \beta_2$, *including the constant terms*[54], $\gamma_1$ and $\gamma_2$, and $L(\gamma_1, \gamma_2)$ denoting the maximum of the likelihood function maximized with respect to the *constant terms only*.[55] The term $m$ denotes the total number of observations. However, this measure of fit suffers from severely underestimating the measure of fit of the regression: even if the model has perfect fit, $R^2$ may be well below 1. For this reason, it is apposite to employ McFadden's (1974) measure of goodness-of-fit, *pseudo-$R^2$*, denoted $\rho_M$. This is defined as[56]

$$\rho_M = 1 - \frac{\ln L(\gamma_1, \gamma_2)}{\ln L(\beta_1, \beta_2)} \tag{19}$$

An alternative measure of goodness of fit, also referred to as *pseudo-$R^2$* is provided by Cragg-Uhler (1970), and given as

$$\rho_{CU} = \frac{[L(\beta_1, \beta_2)]^{\frac{2}{m}} - [L(\gamma_1, \gamma_2)]^{\frac{2}{m}}}{1 - [L(\gamma_1, \gamma_2)]^{\frac{2}{m}}} \tag{20}$$

where the same notational definitions used for McFadden's (1974) measure of $R^2$, $\rho_M$ are employed.

An alternative approach is to conduct a *likelihood ratio* test. To test for the *joint* significance of all explanatory variables in each model, calculate

$$\chi^2_{q,\delta} = -2 \left(\frac{\ln L(\gamma_1, \gamma_2)}{\ln L(\beta_1, \beta_2)}\right) \tag{21}$$

which is distributed as a *Chi-squared* variate with $q$ degrees of freedom and $\delta$ restrictions. This formula lends itself to a more general setting, with the maximized log likelihood values for *unrestricted* and *restricted* versions of the model corresponding to the denominator and the numerator

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[53]These results also apply to the multinomial logit model.

[54]In the case of the ordered logit model the constant terms can be interpreted as *cutoff points*.

[55]This implies restricting the values of all explanatory variables to zero. In the ordered logit model this is equivalent to just estimating cutoff points.

[56]This measure is also referred to as McFadden's *likelihood ratio index*.

respectively. As one might expect, the null of no joint significance against the alternative hypothesis that at least one explanatory variable is significant is tested.

## 12.B The GMT index

To provide the reader with an appreciation of the *extent to which* the shift to operational independence has increased the degree of independence enjoyed by the Bank I use the definitions provided by Grilli, Masciandaro and Tabellini (1991).[57],[58] Specifically, I compare the levels of independence before and after the *Act*. Gauging the degree of independence of a monetary institution is not an exact science, and indices measuring the degree of central bank independence typically rely on what one author has termed 'the statute reading methodology'.[59] That is, one largely determines the independence of a central bank with explicit reference to its statutes. GMT delineate between two types of independence which a monetary institution may enjoy - *political independence* and *economic independence*.[60] The *political independence* of a central bank is associated "with how the members of the central bank board are appointed, its relationship with government and its responsibilities". So-called *economic independence* concerns the ability of a central bank to use the instruments of monetary policy without interference from governmental bodies or institutions. To see how the degree of independence has changed pre and post the shift to operational independence, refer to TABLE A.1. *Prima face*, the Bank has retained a low level of political independence, in spite of the shift to operational independence. For example, the maximum term length an MPC member may be appointed for is five years. Further, the Government is still responsible for appointing the Governor. Institutional and regulatory changes with regard to UK banking supervision and debt management have increased the level of economic independence enjoyed by the Bank. The creation of the Financial Services Authority (FSA) - a body independent of the Bank of England responsible for UK banking supervision – coincided with the shift to operational independence in 1997,[61] and the establishment of the UK Debt Management Office (DMO) followed shortly afterwards.

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[57] Hereafter GMT.

[58] I do not propose to provide a complete discussion of the GMT index. The interested reader is referred their original paper. Alternatively, for an updated GMT index the reader is referred to Hudson *et al* (2001).

[59] See Forder (1995). Although highly critical of many methodologies used to contruct central bank indices, Forder fails to offer an alternative method for measuring the degree of autonomy of monetary institutions.

[60] The introduction of the Act is notable in as far as it redefines the status of the Bank *vis-à-vis* goal and instrument independence. The Bank has instrument independence in that it sets short-term and key interest rates without interference from any other institutions; conversely, it does not have goal independence as the main objective of maintaining price stability set out in the Act can only be changed at the discretion of the Chancellor of the Exchequer. For an exegesis of the distinction between goal and instrument independence see Debelle and Fisher (1994). We however, use the criteria used by GMT.

[61] Essentially, *Banking supervision* is no longer entrusted to the Bank of England. This move eliminates a possible conflict of interest emanating from when a central bank has the responsibility to set the discount rate *and is also* responsible for banking supervision. Hudson *et al* (2001) bring this point home:

> "If banking failures could be triggered by an increase in the interest-rate, central bank might be unwilling to undertake monetary policy which is required at the macroeconomic level." p.5.

Furthermore,

> "...if banking failures did occur, the central bank might be regarded as responsible, and this could undermine its reputation." (Ibid)

**Political Independence of the Bank of England**

| | Appointments | | | | Relationship with Government | | Constitution | | Index of political independence |
|---|---|---|---|---|---|---|---|---|---|
| | [1] | [2] | [3] | [4] | [5] | [6] | [7] | [8] | [9] |
| Pre-1998 Act | | | | | * | | | | 1 |
| Post-1998 Act | | | | | * | * | * | | 3 |

Notes: (1) Governor not appointed by government; (2) Governor appointed for >5 years; (3) All the board not appointed by the government; (4) Board appointed for >5 years; (5) No mandatory participation of government representative in the board; (6) No government approval of monetary policy formulation is required; (7) Statutory requirements that central bank pursues monetary stability amongst its goals; (8) Legal provisions that strengthen the central bank's position in conflicts with the government are present; (9) Overall index of political independence calculated by summing the number of stars in each row through (1) - (8)

**Economic Independence of the Bank of England**

| | Monetary financing of budget deficit | | | | | Monetary instruments | | Index of economic independence |
|---|---|---|---|---|---|---|---|---|
| | [1] | [2] | [3] | [4] | [5] | [6] | [7] | [8] |
| Pre-1998 Act | * | * | * | * | | * | | 5 |
| Post-1998 Act | * | * | * | * | * | * | * * | 8 |

Notes: (1) Direct credit facility: not automatic; (2) Direct credit facility: market interest rate; (3) Direct credit facility: temporary; (4) Direct credit facility: limited amount (5) Central bank does not participate in primary market for public debt; (6) Discount rate set by central bank; (7)Banking supervision *not* entrusted to the central bank (**) or not entrusted to the central bank alone (*); (8) Overall index of economic independence calculated by summing the number of stars in each row through (1) - (7).

*Source*: Table adapted from Grilli, Masciandaro and Tabellini (1991). Pre-1998 Act levels of independence based on those given in Grilli, Masciandaro and Tabellini (1991). Post-1998 Act levels of independence based on Hudson, Pearlman and Sarantis (2001).

TABLE A.1.
GMT INDEX OF BANK OF ENGLAND POLITICAL AND ECONOMIC INDEPENDENCE

# 12.C   List of Variables

**Constructed variables**

| Name | Description | Constructed from: | Source | Mnemonic |
|---|---|---|---|---|
| **EER** | 3 period moving average of the monthly annual change in the effective exchange rate. | UK sterling (£) effective exchange rate index, not seasonally adjusted. | Datastream | UKXTW..NF |
| **Industrial production** | Quarterly growth rate in industrial production. | UK Industrial production volume index, seasonally adjusted. | Datastream | UKIPTOT.G |
| **Unemployment** | Lagged monthly unemployment rate. | UK unemployment rate, seasonally adjusted. | Datastream | UKUN%TOTQ |
| **Retail sales** | Monthly annual change in retail sales. | UK retail sales volume index, seasonally adjusted. | Datastream | UKODD015G |
| **M0** | Monthly annual % change in narrow money growth. | UK M0 money supply monthly calendar levels, current prices, seasonally adjusted. | Datastream | UKM0....B |
| **Consumer confidence** | Consumer confidence indicator, monthly levels. | UK consumer confidence indicator, seasonally adjusted. | Datastream | UKCNFCONQ |
| **RPIX$_C$** | Consensus forecasts of RPIX growth for the current calendar year as a percentage change on the previous calendar year. | Average of new monthly forecasts for RPIX growth provided by City and Independent forecasters. | HMT Treasury's '*Forecasts for the UK Economy*'. | No mnemonic. Forecasters' projections of movements is series ABMI, found in National Accounts Table C2. |
| **GDP$_C$** | Consensus forecasts of GDP growth for the curent calendar year as a percentage change on the previous calendar year. | Average of new monthly estimates of current GDP growth provided by City and Independent forecasters. | HMT Treasury's '*Forecasts for the UK Economy*'. | No mnemonic. Forecasters' projections of movements is series CDKQ, found in ONS *Consumer Prices* release, Table 1. |
| **RPIX$_F$** | Consensus forecasts of RPIX growth for the next calendar year as a percentage change on the current calendar year. | Average of new monthly estimates of future RPIX growth provided by City and Independent forecasters. | HMT Treasury's '*Forecasts for the UK Economy*'. | No mnemonic. Forecasters' projections of movements is series ABMI, found in National Accounts Table C2. |
| **GDP$_F$** | Consensus forecasts of GDP growth for the next calendar year as a percentage change on the current calendar year. | Average of new monthly estimates of future GDP growth provided by City and Independent forecasters. | HMT Treasury's '*Forecasts for the UK Economy*'. | No mnemonic. Forecasters' projections of movements is series CDKQ, found in ONS *Consumer Prices* release, Table 1. |
| **Implied inflation** | Implied RPI inflation based on nominal spot rates at 60 months maturity. | Estimates of implied RPI inflation using yield curve data based on calculations by Anderson and Sleath (2002). | Bank of England | No mnemomic. |

TABLE A.2.
DESCRIPTION OF VARIABLES USED IN ECONOMETRIC ESTIMATION

## 12.D   Results for Granger Causality Tests

Causality between the repo rate and market expectations of inflation*

$H_0$: *The repo rate does not Granger Cause changes in implied inflation*

| Lags | Obs | F-Statistic | p-value |
|------|-----|-------------|---------|
| 1 | 72 | 1.61 | 0.21 |
| 2 | 71 | 0.18 | 0.83 |
| 3 | 70 | 1.24 | 0.30 |
| 4 | 69 | 1.19 | 0.33 |
| 5 | 68 | 2.11 | 0.08 |
| 6 | 67 | 2.00 | 0.08 |
| 7 | 66 | 1.76 | 0.12 |

$H_0$: *Implied inflation does not Granger Cause changes in the repo rate*

| Lags | Obs | F-Statistic | p-value |
|------|-----|-------------|---------|
| 1 | 72 | 44.33 | 0.00 |
| 2 | 71 | 11.65 | 0.00 |
| 3 | 70 | 6.06 | 0.00 |
| 4 | 69 | 4.49 | 0.00 |
| 5 | 68 | 3.44 | 0.01 |
| 6 | 67 | 5.21 | 0.00 |
| 7 | 66 | 5.21 | 0.00 |

*5 year market expectations of implied inflation based on nominal zero coupon yields for UK government bonds. Source: Bank of England

TABLE A.3.
GRANGER CAUSALITY TESTS: REPO-RATE VS. IMPLIED INFLATION

# 13  Bibliography

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