Bank of England Interest Rate Announcements and the Foreign Exchange Market

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Abstract

Since 1997, the Bank of England Monetary Policy Committee (MPC) has met monthly to set the UK policy interest rate. We examine evidence of systematic patterns in exchange rate movements on MPC days over the first decade of operation of the MPC. Daily data reveal significant differences in volatility on the last of three meeting days when the interest rate announcement surprises the market. Intraday, five-minute return data are then used to provide a microscopic view. We use a Markov-switching framework that incorporates endogenous transition probabilities, which allows for an interesting alternative characterization of macroeconomic news effects on the foreign exchange market. We find evidence for non-linear regime switching between a high-volatility, informed-trading state and a low-volatility, liquidity-trading state. MPC surprise announcements are shown significantly to affect the probability that the market enters and remains within the informed trading regime, with some limited market positioning just prior to the announcement.

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1. INTRODUCTION

The Bank of England (BoE) was granted operational independence to set its key policy interest rate by the incoming UK Labour government in May 1997, with the goal of creating policy consistent with stable inflation and economic growth.[1] In practice, interest rate decisions are made by the Bank's Monetary Policy Committee (MPC), which meets for two days each month—as well as an additional pre-meeting briefing day—and issues a statement regarding interest rate decisions at noon on the second meeting day. This framework allows a natural laboratory setting for examining the impact of monetary policy decisions around a known time and date. Since market participants know that interest rate announcements arrive at noon on the second meeting day, there may be positioning prior to the announcement and news effects after the announcement that result in systematic patterns in exchange rate behavior on MPC meeting days that differ from other days. A stated aim of the new policy regime was that monetary policy should be more transparent than hitherto (King, 2000). The availability of the record of MPC decisions therefore affords us a rare opportunity to examine how the decisions of the key policy-setting committee are impounded into financial prices. In this paper, we concentrate on an examination of the pattern of exchange rate volatility surrounding the MPC's interest-rate decisions as well as the role played by the surprise content in the announcements.

Since activities directly related to each MPC meeting are spread over three different days (see Section 3, below), our analysis will include an examination of the pre-meeting briefing day, the first day of the meeting, and the second day of the meeting when the policy decision is made and publicised (as well as days unrelated to the meetings, to serve as controls). Both daily and high-frequency, intraday data are employed in the analysis. The daily data provide a bird's eye

[1] Prior to August 2006, policy decisions were framed in terms of the repurchase, or repo, rate. We use the names Bank rate and repo rate interchangeably.

view of market behavior around MPC meetings, using a generalised autoregressive heteroscedastic (GARCH) framework. Given the findings of this low-frequency analysis, a microscope is then taken to the data to examine exchange rate dynamics on days related to MPC meetings. The intraday econometric framework is provided by a Markov switching model where exchange rate returns switch between a high-volatility, informed-trading state, and a low-volatility, uninformed or liquidity trading state. A key difference from the usual Markov switching model employed in financial analysis is our incorporation of endogenous shifts in the transition probabilities, where these shifts are modeled as a function of variables related to the MPC meeting and policy outcomes.

We choose to employ a Markov switching framework in order to allow for an alternative characterization of macroeconomic news effects on the foreign exchange market. The underlying hypothesis is that macroeconomic news do not simply affect the market as shocks to otherwise continuous processes. On the contrary, news effects may change the entire data generating process for a financial variable. One reason is that "hot-potato" trades are likely to dominate the market to an unusual degree as dealers adjust their inventory and offload onto other dealers, effectively generating a multiplier effect on trades (Lyons, 1994). It is difficult to believe that this adjustment period is characterised by the same data generating process that governed the market prior to the news impact. An econometric specification allowing for regime switches therefore appears appropriate. Indeed, one particular benefit of applying such a model is that it facilitates a plausible interpretation of observed nonlinearities. Moreover, and in contrast to the deterministic models typically employed in similar analyses, the framework allows for a probabilistic and thus very flexible characterization of the data: financial markets. In particular, by modeling switching probabilities endogenously, we allow the *probability* of regime switching to vary at various points during MPC meeting days, rather than modelling the switch deterministically. Given the notoriously capricious nature of financial markets, our approach therefore provides an interesting alternative perspective on news effects on financial markets.

The next section provides a brief review of the literature on the financial effects of macroeconomic news announcements. In Section 3 we provide some background institutional details on the MPC and the UK monetary policy-setting process. Section 4 contains a discussion of our econometric methodology and the various hypotheses to be tested. Section 5 describes our data sets and contains our main empirical findings. Finally, Section 6 summarises our conclusions and discusses directions for future research.

2. EXCHANGE RATE AND ASSET PRICE EFFECTS OF MONETARY POLICY ANNOUNCEMENTS: A BRIEF REVIEW OF THE LITERATURE

Early intraday studies of macroeconomic news effects on exchange rates, such as Hakkio and Pearce (1985) and Ito and Roley (1987), tend to provide mixed results in terms of the significance of news announcements on exchange rate movements. One possible reason for this finding was the coarseness of the sampling intervals, with observations of exchange rates taken at opening, noon and closing. Clearly, if news effects work themselves out within periods less than several hours, then observing the market at three equally spaced points over the trading day will miss much of the action. The increased availability of high frequency intraday foreign exchange rate data during the 1990s considerably advanced research in this area.

Intraday exchange rate volatility effects of news announcements were first documented by Ederington and Lee (1993, 1995, 1996).[2] Ederington and Lee (1993) use 5-minute tick data from

[2] Taylor (1987, 1989) provides early, high-frequency studies of the foreign exchange market and finds some evidence of the impact of news on deviations from covered interest rate parity.

November 1988 to November 1991 for mark-dollar, as well as various interest rate futures, and report conclusions consistent with our findings below. They estimate a series of regressions of the deviation of the absolute value of exchange or interest rate returns in a given five minute period on day *j* from the average return during that period across the whole sample as a function of a series of dummy variables that designate the publication schedule of various US macroeconomic data series. Ederington and Lee (1993) conclude in favour of a significant change in intraday exchange and interest rate volatility upon publication of various macroeconomic series, including the monthly employment report, producer price inflation and trade data, with the standard deviation of five minute returns immediately after publication at least five times higher on announcement days than on non-announcement, or control, days. Ederington and Lee (1993) also find that although the greatest volatility impact occurs within one minute of publication, the standard deviation of returns remains significantly above normal for up to forty five minutes after publication for a number of macroeconomic series.

In an extension to their original paper, Ederington and Lee (1995) perform a similar analysis using 10-second data, and conclude that much of the price reaction to macroeconomic news is actually completed after only 40 seconds. They also find evidence of a pre-announcement volatility effect immediately ahead of key macroeconomic data releases, consistent with our findings below. Similarly, Ederington and Lee (1996) report significant volatility effects from macroeconomic data releases in the interest rate options market, although they find against any such effect in mark-dollar option volatility.

A number of papers have since reported findings similar to Ederington and Lee (1993), for both macroeconomic data releases and monetary policy announcements and statements. These include Andersen and Bollerslev (1998), in the context of a wider study of the determinants of mark-dollar volatility, and Goodhart, Hall, Henry and Pesaran (1993). Goodhart et. al. apply a GARCH-M methodology to sterling-dollar tick data over the period April to July 1989 to analyze the volatility impact of an announced BoE interest change and publication of US trade data, both of which occurred in May 1989. Their findings are generally consistent with ours reported below, in that they find significant evidence of a non-permanent volatility impact due to the monetary policy announcement and US trade data publication. They find this volatility effect to be more persistent than either our results or those of Ederington and Lee (1993), and suggest that it remains in the data during the subsequent 4-5 days. Almeida, Goodhart and Payne (1998) perform a similar high frequency analysis of the volatility impact of US and German macroeconomic data releases using five minute tick data for mark-dollar over the sample period January 1992 to December 1994. They, too, find evidence of non-permanent volatility effects. Their conclusion that these effects generally dissipate within fifteen minutes of publication for US data releases, and approximately three hours for German releases, are more consistent with our findings below. Although fewer German data releases examined by Almeida et. al. have a significant impact upon the volatility of exchange rate returns than US series, the number of significant German releases increases when the authors account for the proximity of the next Bundesbank policy meeting; the closer to this meeting, the more likely the Bundesbank will act upon any surprises contained in data releases.

Faust, Rogers, Swanson and Wright (2003) use intraday, daily and monthly data from 1994 to 2001 to estimate structural vector autoregressions (SVARs) incorporating current and future US and foreign short-term interest rates and exchange rate series in order to assess the contemporaneous effect of a US monetary policy shock on other variables in the SVAR.[3] Although

[3] Interest rates are measured using futures contracts for Eurodollar, Libor and Fibor/Euribor. Exchange rates included are sterling and mark/euro, both expressed in terms of the US dollar.

the results for future interest rates are mixed, the impact of the monetary shock on both exchange rates using high frequency data is positive (meaning that a surprise rate increase depreciates the value of the dollar) and statistically significant. In a similar vein, Harvey and Huang (2002) examine the impact of Federal Reserve open market operations on a range of interest and exchange rates using GMM estimation and intraday data - specifically, two-minute and hourly returns - over the period 1982 to 1988. In this case, though, while the authors find in favour of a significant increase in intraday interest rate futures volatility associated with so-called Fed Time, they conclude against any significant, generalised increase in exchange rate return volatility.[4]

In a complementary study, Andersen, Bollerslev, Diebold and Vega (2003) focus on detecting shifts in the conditional mean rather than the volatility of exchange rates. Using five-minute tick data for the Swiss franc, mark, sterling and yen, all expressed in terms of the US dollar. Andersen et. al. examine the impact of Federal Reserve policy announcements, as well as a variety of macroeconomic data series from the US and Germany, over the sample period January 1992 to December 1998. The authors find in favor of a significant, asymmetric jump effect associated with shocks due to policy announcements by the US Federal Open Market Committee (FOMC) and a number of US data releases immediately following publication of many data series; negative US data surprises often exhibited a larger impact upon exchange rates than positive surprises. By contrast, and yet consistent with the findings of Almeida et. al. (1998), only relatively few German data releases exert a statistically significant effect upon exchange rate levels.

A number of studies complementary to our research have analysed the volatility impact of monetary policy announcements, as well as statements and speeches by central bank officials,

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4 They also find evidence that interest rate volatility is actually greater when the Fed does not conduct operations during the allotted time than when it does.

using daily data. These include Gürkaynak, Sack and Swanson (2005), Reeves and Sawicki (2005), Kohn and Sack (2003), Ahn and Melvin (2007) and Ehrmann and Fratzscher (2007).

Gürkaynak, Sack and Swanson (2005) analyze the effect of Fed Funds rate changes and the accompanying FOMC policy statements on bond yields and stock prices using factor analysis. They find that two latent factors are necessary in order to capture the asset price effects of monetary policy, with the former associated with the interest rate change and the latter associated with the FOMC statements. The strong policy implication of this research is, therefore, that both monetary policy actions and statements may have important effects on asset prices.[5]

Reeves and Sawicki (2005) analyze the impact on three-month forward interest rates and long gilt futures of the publication of MPC minutes[6], the quarterly BoE Inflation Report, as well as MPC member speeches and regular testimonies to parliamentary committees. Using both daily and intra-day observations over the period June 1997 to December 2005, Reeves and Sawicki conclude in favour of a significant interest rate volatility effect due to the publication of MPC minutes and the Inflation Report (although in this case only using intra-day data). Kohn and Sack (2003) perform a similar analysis on the volatility impact of policy statements by the FOMC, as well as congressional testimony and speeches by former Chairman Greenspan for the trade-weighted dollar, a range of interest rates and S&P500 returns using daily data over the sample period January 1989 to April 2003. They find that FOMC statements generate a significant change in the volatility of interest rates, but no significant change in the volatility profile of either the dollar or S&P500 returns. This finding is consistent with the evidence that we present below using daily data.

[5] Gürkaynak, Sack and Swanson (2005) find, in fact, that policy statements have a much greater impact on longer-term Treasury bond yields.

[6] Since October 1998, MPC minutes are published thirteen days after the associated policy announcement that is the focus of our study.

Ahn and Melvin (2007) conduct an intradaily examination of exchange rate regime switching for Federal Reserve FOMC meeting days and find surprising evidence of switches to a high-volatility informed trading state during the time of the meeting rather than at meeting end when decisions are announced. An extensive search of public news suggests that this informed trading state cannot be explained as the response to public information. This is consistent with a market where informed traders are taking positions in advance of the meeting end based upon their expectations of the outcome.

Finally, Ehrmann and Fratzscher (2007) undertake an EGARCH study of Federal Reserve, BoE and ECB monetary policy announcements and broader statements regarding economic outlook using daily data over sample periods that begin in 1997 for the BoE, and 1999 for both the Federal Reserve and ECB; all sample periods run until 2004. Although evidence for exchange rates is mixed, Ehrmann and Fratzscher do conclude that policy announcements by all three central banks exert a significant impact upon the volatility of interest rates. In addition, the impact of BoE policy announcements is significantly larger than either the Federal Reserve or ECB. This second finding is consistent with the authors' hypothesis that the BoE combination of collegial communication strategy and individualistic voting strategy leads to more regular and significant policy announcement shocks than for either the Fed or ECB. The volatility impact of broader statements on economic outlook is only significant in the case of the Federal Reserve.

3. THE MONETARY POLICY COMMITTEE

In May 1997 Gordon Brown, then UK Chancellor of the Exchequer, announced that the BoE would be given operational responsibility for setting interest rates via the newly created MPC.[7]

[7] For institutional background on the MPC and the monetary policy process, see Bean (1999). Note that inflation targeting had been adopted in the UK since 1992.

The MPC was to focus on an inflation target of 2.5 percent on a two-year horizon for the retail price index excluding mortgage interest payments.[8] Conditional on maintenance of the inflation target, the MPC could also address fluctuations in economic growth and employment.

The MPC is comprised of nine members. Five are drawn from the BoE: the Governor, the two Deputy Governors, and two Executive Directors. The other four members are drawn from outside the Bank and are appointed by the Chancellor of the Exchequer. At the time this paper was written, the four external members included two academic economists and two business economists. The Governor serves as the Committee chair.

The Committee meets monthly, normally on the Wednesday and Thursday following the first Monday of each month. The meeting dates for each year are published well in advance of the meetings.[9] The timetable for a representative meeting is given in Figure 1. On the Friday morning prior to each meeting, the Committee meets for a briefing to prepare for the meeting. Summaries of important news and trends are provided by senior BoE staff. On the Monday and Tuesday prior to the meeting, the BoE staff prepares any additional background information and analysis required by the Committee. On these days MPC members receive written answers to any questions that arose at the Friday briefing along with any new data releases or important news.

The monthly MPC meeting typically begins at 3.00 pm on Wednesday afternoon with a review of the state of the UK and world economy. The BoE Chief Economist starts the meeting with a short summary of any major events since the Friday briefing.

On Thursday morning, the MPC reconvenes and the Governor begins with a summary of the major issues. Members are then invited to state their views of the appropriate policy to follow. The Deputy Governor responsible for monetary policy will usually speak first with the Governor

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[8] This policy goal was subsequently changed to 2.0 percent in December 2003, and is now defined in terms of the harmonized consumer price index.

[9] These are published at www.bankofengland.co.uk.

speaking last. Ultimately, the Governor offers a motion that he suspects will result in a majority vote and then calls for a vote. Members vote with a one-member, one-vote rule. Those in the minority are asked to state their preferred level of interest rates. Lastly, the press statement is developed. If the decision is to change interest rates or follow a policy that was not expected by the market, the press statement will include the reasons for the action taken. In other cases, simply the decision is reported. This decision is announced at noon, London time. Following the announcement, policy is implemented with open-market operations beginning at 12:15 pm.

4. METHODOLOGY

The focus of this paper is on inference regarding movements in the dollar-sterling exchange rate during MPC meetings. Given that the foreign exchange market knows when the MPC meets and when its decisions are announced, we want to examine evidence regarding any market positioning before and during the meeting and as to whether these effects are driven by the news content of the respective policy announcement.

A logical first step is to examine whether meeting days are different from other days as well as from one another in terms of systematic patterns in dollar-sterling exchange rate movements. As discussed above, given the multi-day structure of MPC deliberations, one may hypothesise that the foreign exchange market forms an opinion about the likely meeting outcome prior to the public announcement at noon on the second day of the meeting. This does not have to rest upon information leaks from the Committee. It may be that traders close down trade positions in advance of the interest rate decisions in order to limit their risk exposure precisely because they are unsure about the upcoming announcement. Furthermore, such behavior may be driven by astute MPC-watchers' informed opinions of the likely Committee vote. An analogy in the Federal

Reserve case is the often-cited story of how Fed-watchers at one time gauged the likely FOMC decision by the size of the briefcase that former Chairman Alan Greenspan carried to work. The idea was that a thick briefcase signaled a likely interest rate shift while a thin briefcase signaled a high probability of no change in policy. No doubt, there are many such stories one could gather from MPC watchers as well.

We explore the evidence in the data regarding briefing days, first meeting days, and second meeting days by initially analyzing daily returns for USD/GBP. We estimate simple linear models of daily exchange rate returns incorporating dummy variables for days of MPC briefings, first, and second meeting days as well as a variable indicating the size of the interest rate change:

$$\Delta e_t = a + b_0 Briefing_t + b_1 Day1_t + b_2 Day2_t + b_3 \Delta i_t + \varepsilon_t \qquad (1)$$

where Δe_t is the change in the logarithm of the exchange rate on day *t*, and *Briefing*, *Day1*, and *Day2* are dummy variables equal to *1* on the respective MPC meeting day and equal to zero otherwise. These dummy variables are subsequently incorporated into the conditional variance equation of a GARCH model. Following Andersen and Bollerslev (1997) and Jones, Lamont and Lumsdaine (1998), we allow the announcement effects to have a temporary impact on the conditional variance only, on the basis that announcement effects are likely to die out in less than a full day: [10]

$$\Delta e_t = \mu + c_1 \Delta e_{t-1} + \ldots + c_n \Delta e_{t-n} + \sqrt{s_t}\,\varepsilon_t \qquad (2)$$

$$\varepsilon_t \mid \Omega_{t-1} \sim N(0, h_t)$$

$$s_t = (1 + \delta_0 Briefing + \delta_1 Day1 + \delta_2 Day2)$$

$$h_t = \omega + \alpha \varepsilon_{t-1}^2 + \beta h_{t-1}$$

[10] We thank an anonomous referee for suggesting this specification.

where Ω_{t-1} denotes the information set at time *t-1*. The conditional variance on any given day *t* is therefore given by $s_t h_t$ and, e.g., by $(1+\delta_2)h_t$ on second meeting days. This implies that δ_2 captures the percentage increase in the conditional variance on second meeting days. Estimation of the model is carried out using quasi-maximum likelihood.

The results of this daily analysis can help inform us as to whether exchange rate returns and their volatility differ around the time of MPC meetings, or in between the various days of these meetings, and according to whether the respective policy announcements on second MPC meeting days came as a surprise to the market.

We then take a microscope to the data for second meeting days to examine the intraday behavior of returns on days when a policy decision is announced. Before turning to the questions to be examined, the econometric framework employed in our intraday analysis is introduced.

It is usual to think of high-frequency exchange rate data on any given day as bounded within a fairly narrow band and exhibiting first-order autocorrelation. By contrast, on MPC meeting days we may expect important news to be received by the market. We find it convincing to think of these news effects as changing, temporarily, the entire data generating process of the exchange rate – and other financial variables – rather than simply introducing a one-time shock to an otherwise continuous process. Intuitively, so-called "hot-potato" trades are likely to dominate the market to an unusual degree in the immediate aftermath of the news as dealers adjust their inventory and offload onto other dealers, effectively generating a multiplier effect on trades (Lyons, 1994). It is difficult to believe that this adjustment period is characterised by the same data generating process that governed the market prior to the news announcement. An econometric specification allowing for regime switches therefore appears appropriate. We chose to adopt the

Markov switching framework associated with Hamilton (1990, 1994), allowing the switching probabilities to be endogenously determined (Diebold, Lee and Weinbach, 1994).

An important advantage of this framework is that it facilitates a plausible interpretation of observed nonlinearities and allows for probabilistic rather than deterministic switching between regimes.[11]

A Markov-switching first-order autoregressive model for exchange rate returns is postulated as follows:

$$\Delta e_t = \mu(S_t) + \rho(S_t)[\Delta e_{t-1} - \mu(S_{t-1})] + \varepsilon_t \qquad (3)$$

$$\varepsilon_t \sim N[0, \sigma^2(S_t)]$$

where Δe_t is the change in the logarithm of the exchange rate at time t. Note that the mean of the exchange rate returns process, μ, the autocorrelation coefficient, ρ, and the variance of the innovation, ε_t, are allowed to take on one of two values depending on the realization of an unobserved state variable $S_t \in \{1, 2\}$. In our application, we assume a two-state Markov process. One of the states (say, state 2) may be thought of as reflecting the usual pattern of exchange rate returns with negative autocorrelation and a relatively small variance. This tranquil state is the normal state that would be associated with liquidity trading when no important information arrives in the market. The other state (say, state 1) may be thought of as the informed-trading state when volatility is high and realized returns much larger than normal (Easley and O'Hara, 1992; Lyons, 2001).

[11] Along with our hypothesis that intraday news does not generate a one-time shock to the distribution of variables, as discussed above, the opportunity to interpret nonlinearities is a principal motivation for employing the Markov switching framework in our intraday analysis rather than simply continuing with the GARCH analysis used at the daily frequency.

Thus far, our proposed methodology is similar to that employed, inter alia, in Engel and Hamilton (1990). However, we diverge from the traditional Markov approach by modelling the probability of switching from one regime to another endogenously. Denoting the transition probability of switching from regime *j* to regime *i* at time *t* as P_t^{ij} for $i, j \in \{1, 2\}$, we can write the postulated functions for the transition probabilities, conditional upon information at time *t*, I_t, and the previous state, as

$$P_t^{ii} = Pr[\,S_t = i \mid S_{t-1} = i, I_t\,] = \Phi[\,\alpha_{ii} + \beta_{ii}^{'} X_t\,] \tag{4}$$

for $i \in \{1, 2\}$, where $\Phi[\,]$ denotes the cumulative normal density function (in order to ensure that the probabilities lie in the unit interval) and where $X_t \in I_t$ is a vector of variables known at time *t* which may influence the transition probability according to the vector of loadings β_i. Given P_t^{11}, we implicitly have $P_t^{21} = 1 - P_t^{11}$. Similarly, given an estimate of P_t^{22}, we implicitly have $P_t^{12} = 1 - P_t^{22}$.

The Markov-switching framework is applied to intraday data to address several questions of interest in the intraday setting. First, c*an we identify endogenous regime switching? Are the transition probabilities driven by the news component in the policy announcements?*

To test if the MPC policy announcement released at noon on the second meeting day is price-relevant public news, we incorporate various dummy variables in the explanatory variable vector X_t. These dummies were set equal to one for a certain afternoon period, say noon to 13:00, and to zero otherwise.

A second question of interest is *whether evidence exists of positioning during the second meeting day prior to the policy announcement at noon?*

To address this question, we incorporate dummy variables equal to one for various time intervals prior to noon and zero otherwise. We explore alternative definitions over different morning time intervals as a sensitivity analysis.

5. DATA AND EMPIRICAL FINDINGS

Our data sample spans over a decade, running from the inception of the Monetary Policy Committee in June 1997 through to October 2007, and incorporates 126 MPC meetings. Table 1 lists the MPC meeting days in our sample and the associated interest rate decision for each meeting. We classify an MPC decision as a surprise to the market if it differs from the median expectation taken from a survey of market economists by Bloomberg.[12] The standard deviation of analysts' expectations is reported as a measure of forecast dispersion. Table 1 also provides a range of alternative surprise measures – based on 3 months short term interbank rates (IB) as well as 3 months sterling interest rate futures contracts on the London International Financial Futures Exchange (LIFFE) - to be used for robustness checks. [13]

Table 1 suggests that the Bank of England has succeeded in achieving its goal of improving monetary policy transparency. All surprise measures show a clear downward trend in the frequency of policy surprises. Interest rates were raised at 19 meetings and lowered at 17 meetings. Of the 36 meetings at which the Bank rate was changed—19 increases, 17 cuts—this policy action was expected by the market on 18 occasions, as measured by the Bloomberg survey. Of the remaining 18 instances, the market was either surprised that the MPC changed the policy rate or was surprised by the extent of the change. There were no instances where the market expected a change in the policy rate in the opposite direction to the change actually announced. Including the May 2000 meeting, at which the market expected a rate change but the MPC kept its repo rate constant, this adds up to a total number of 19 policy surprises according to the Bloomberg

[12] This survey is carried out on the Friday before each MPC meeting (i.e. on the same day as the pre-briefing of the MPC by staff members of the BoE) and asks respondents for the magnitude—if any—of the interest rate change that they expect to result from the upcoming meeting. In its current guise, the survey collates the expectations of up to 60 financial economists. Although the sample of economists is not necessarily the same from one month to the next, a core subset ensures continuity and the survey is in any case is designed to capture market expectations.

[13] The period *t* policy announcement is classified as a surprise to the market if the difference between the period t+1 (IB or Liffe) rate and the period t-1 rate is greater than 10 (15) basis points.

survey.[14] We therefore divide the meeting day sample into the 107 days when the change – including a change of zero basis points - in the policy rate was exactly as predicted —we term these 'No Unexpected Change Days'—and the 19 days when the rate changed by an amount different to market expectation—which we term 'Unexpected Change Days'.

5.1 Daily Data and Results

Daily observations of USD/GBP were obtained from the Federal Reserve Board. These are buying rates at noon New York time (17:00 London time). The daily data are sampled for the period May 1, 1997 to October 31, 2007.

Using daily data, we estimated the model represented by equation (1) above by OLS. The evidence indicates that the explanatory variables *Briefing, Day1, Day2,* and Δi have no power in explaining exchange returns. This is true whether the meeting-related variables encompassed all meeting days or just those on which the Bank rate was changed unexpectedly. But the regression results do indicate the presence of significant GARCH effects. We then estimated the GARCH specification for daily exchange rate returns outlined above in which the dummy variables related to MPC meetings enter the conditional variance equation multiplicatively. Estimation is carried out by quasi-maximum-likelihood estimation using a Gaussian likelihood function and robust standard errors. The results indicate no explanatory power for variables related to all meetings. However, letting the meeting day dummies take the value one on meetings with surprising interest rate changes only, our preferred specification generates the values reported in Table 2.1. In this specification, the dummy for meeting day 2, *Day2* is statistically significant at the 1% level. The coefficient indicates that the conditional variance increases by about 25% on second meeting days.

[14] According to 'IB10' ('IB15', 'LIFFE10', 'LIFFE15'), 21 (13, 19, 10) policy surprises can be identified during the sample period.

On briefing days, on the other hand, the conditional variance is about 11% lower than on non-meeting days.

Results regarding the *Day2* dummy were equivalent using all of our various alternative surprise measures based on 3-months short term interbank rates or 3-months sterling interest rate futures contracts (Tables 2.2 - 2.5), demonstrating the robustness of the results. So, although USD/GBP exchange rate returns appear to be unrelated to meeting day variables, exchange rate volatility is typically greater on days when policy surprises are announced.

5.2 Intraday Data and Results

The daily analysis indicates that second MPC meeting days are different from other days in volatility terms. We now take a microscopic look at these days in order to investigate systematic exchange rate movements and their determinants within a narrow window around the interest rate announcements. In this high-frequency setting, all references to MPC meeting days refer to second meeting days when the policy announcement is made. Tick data for USD/GBP were obtained from a major international bank for each of our 126 MPC meeting days and a set of 126 control days, defined as the same day of the week as the MPC exactly one week after the MPC meeting. Either no data or insufficient data could be made available to us for 14 out of the total of 252 days.[15]

We sample the last quotation of each 5-minute interval over the hours 7:00-17:00 London time to create a series of exchange rate returns, defined as the change in the logarithm of the 5-minute observations multiplied by 10,000.[16] The data for each day are stacked in serial order to

[15] We also do not include the extraordinary and unscheduled meeting of September 18, 2001, and the respective control day.

[16] Danielsson and Payne (2002) compare one week of indicative quote data with firm quotes from an electronic FX brokerage and find that the properties of returns for each series become quite similar at a 5-minute sampling frequency. At higher frequencies, the indicative quotes tend to lag firm quotes. We choose the 5-minute sampling

create a data set with 28,556 observations. For further reference, it is important to notice that the 12:05 observation on any given day is the last quotation from within the interval 12:00-12:05.

The Markov model represented by the set of equations (3) above was used to estimate the effect of MPC announcements on the transition probabilities. Estimation of the model was carried out using a modified version of the EM algorithm due to Diebold, Lee and Weinbach (1994). The two states are identified by significant shifts in the mean μ, the autocorrelation coefficicient ρ and the variance σ^2.[17] Recall that state 1 is the high-variance state associated with information-based trading and state 2 is the low-variance state associated with the normal market conditions of liquidity trading. The results in Table 3 show that the estimated state 1 variance is generally found to be about 3.5 times that of state 2. Statistically significant negative first-order autocorrelation was also found in all models. Negative autocorrelation is a common finding in high frequency exchange rate returns.

In Table 3 part A we report estimates of the constant transition probability model and then in part B we report the preferred model. The payoff from estimating the endogenous transition probabilities is demonstrated by the significant likelihood ratio statistic associated with comparing the constant transition probability model (part A) as the restricted estimate and the time-varying transition probability model (part B) as the unrestricted estimate.[18] In terms of the transition probabilities, P^{11} is the probability of remaining in the high-volatility state and P^{22} is the probability of remaining in the low-volatility state. Normally, we would expect $P^{22} > P^{11}$ and this is what the data reveal. Estimating a Markov-switching model with fixed transition probabilities

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strategy to ensure that our exchange rate returns are representative of market conditions. The raw data were referenced to Greenwich Mean Time, so time references were appropriately adjusted to account for British Summer Time.

17 Only in the case of the constant transition probability model are the means not significantly different from zero.

18 From the log-likelihood values reported in Table 3, this statistic is –2(-73022+71082)=3880 (p-value = 0.00). Notice that the means are not significantly different from zero in the specification with constant transition probabilities.

resulted in the following estimates: $P^{11}=\Phi(1.68)=0.95$ and $P^{22}=\Phi(1.74)=0.96$. The unconditional probability of being in state 2 associated with these transition probabilities is given as $\frac{(1-P^{11})}{(1-P^{11})+(1-P^{22})}=0.556$, so the unconditional probability of being in state 1 is 0.444.

Moving on to the time-varying probabilities model, it is first of all interesting to find that the mean return is significantly positive in the high-volatility state and significantly negative in the low-volatility state. This result might appear puzzling as it suggests that return volatility is high when the pound appreciates against the dollar and low when it depreciates. It is interesting to investigate, whether this result is driven by the interest rate announcement or whether it is simply an artefact of the data in the sample period considered. In order to further investigate this, we included additional intercept terms into the mean equation of our preferred specification as follows:

$$\Delta e_t = \mu(S_t) + \mu_{pos}(S_t) I(\Delta i > 0) + \mu_{neg}(S_t) I(\Delta i < 0) + \rho(S_t)[\Delta e_{t-1} - \mu(S_{t-1})] + \varepsilon_t \qquad (5)$$

where μ_{pos} and μ_{neg} are additional constant terms, $I(\Delta i > 0)$ is an indicator function that takes the value 1 on interest rate surprise days between 12:05-13:00 if the announced interest rate is higher than expected, and $I(\Delta i < 0)$ is an indicator function that takes the value 1 on interest rate surprise days between 12:05-13:00 if the announced interest rate is lower than expected. We chose this definition for the indicator function as the analysis will proceed to show that the impact of interest rate announcements on the market is by far the greatest between 12:05-13:00 on announcement days when the announcement comes as a surprise to the market. As Table 6 reveals, the coefficients on μ_{pos} are significantly positive in both states and the coefficients on μ_{neg} are significantly negative in both states, with none of the previous results changed in a substantive way. These results indicate that, as expected, a higher UK policy rate than expected yields a positive mean return to holding sterling during the main impact period of the announcement, implying that the pound appreciates. A lower policy rate than expected yields a negative mean return during the main impact period of the announcement, implying that the pound depreciates. The finding that the mean return is, on average, generally positive in the high-volatility state and negative in the low-volatility state is therefore unrelated to the effect of the policy announcements. It rather appears to be a general artefact of the data within the sample period considered in this study: during periods unrelated to surprising policy announcements, there is on average more volatility during times of appreciation than depreciation of the pound against the dollar.

Transition probabilities are modeled as varying with dummy variables that switch to *1* at certain times of day and are equal to *0* otherwise. Preliminary estimates suggested that the preferred model has P^{11} a function of a constant and a dummy that is equal to one from 12:05-13:00 only on MPC meeting days when interest rates changed unexpectedly, a dummy equal to one from 12:05-13:00 on all MPC days, a dummy equal to one on all days between 12:05 and 13:45 and a dummy equal to one between 11:30 and 11:55 on all MPC days.[19] P^{22} is a function of a constant, a dummy equal to one on all days between 12:05 and 13:45, and a dummy equal to one on all MPC meeting days from 11:15-11:55.[20] Estimates are reported in Table 3, part B1, and indicate that each of the determinants of P^{11} and P^{22} differ significantly from zero with p-values of 0.01 or lower.

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[19] Notice that the observation for 12:05 on any given day is the last quotation within the interval 12:00-12:05—i.e. the first observation in our data set after the interest-rate announcement..

[20] As discussed above, interest rates were deemed to have been changed unexpectedly by the MPC when the rate change, including a zero change, was different from the median expectation according to the Bloomberg survey of market participants—Table 1.

The results indicate that the probability of remaining in the informed trading state P^{11} is significantly higher from 12:05-13:00 following news that the MPC has unexpectedly changed its Bank interest rate. Based upon our preferred model specification, the estimated value of P^{11} changes from 0.74 before 11:30 to 0.85 between 11:30-11:55 and to 0.98 during the hour immediately following the unexpected change in the Bank rate.[21] The probability of remaining in the tranquil state, P^{22}, falls significantly between 11:15-11:55 on MPC announcement days and between 12:05-13:45 on all days. But although statistically significant, one may argue that the implied change in P^{22} is not economically significant. Parts 2 to 5 of Table 3 report results from estimating the same specification but replacing the Bloomberg survey surprise measure with the alternative measures detailed above. The similarity of results is striking and suggests that our findings are robust. Accordingly, for the remainder of our analysis we concentrate on the Bloomberg survey surprise measure.

Following on from our baseline estimates, Table 3 part B assesses the sensitivity of transition probability estimates over alternative specifications using afternoon dummy variables. In each case, the baseline model is augmented by an additional explanatory variable. These additional dummy variables are defined according to the same time divisions as previously, but over more types of day—second MPC days with and without interest rate changes, and all days—than those incorporated in the preferred specification.[22]. For instance, the dummy 'Additional 1' takes the value one from 12:05-13:00 on all days. Adding this dummy to the specification for P^{11} and testing its significance yields a coefficient of -0.12 and a p-value of 0.26. Table 3 indicates that none of the added variables is statistically significant.

[21] The preferred model specification is determined for surprises defined according to the Bloomberg Survey of market Economists.
[22] Recall that this focused only on 2nd MPC days with surprise announcements.

One potential difficulty in this form of analysis is to ensure that estimated intraday state probabilities truly reflect the impact of MPC policy announcements, rather than the effect of other news or shocks. One obvious omitted variable candidate in this respect is the announcement calendar of other central banks. In particular, there are twenty-eight meetings in our sample where MPC announcement days coincided with policy announcements by the Governing Council of the European Central Bank (ECB). Announcements by the ECB occur at 12:45 GMT, which coincides with the reported significant increase in the probability of remaining in the informed trading state P^{11} following announcements of MPC policy decisions. To test whether significant volatility shifts in USD/GBP returns in part reflect a response to the publication of ECB interest rate decisions, we therefore included a set of dummy variables to proxy for these announcements. These dummies take the value one for time periods starting at 12:45 GMT on (a) all days on which MPC and ECB policy announcements coincided, (b) those coincident days on which the ECB announced an interest rate change, or (c) only those coincident days which involved an ECB policy surprise.[23]. As Table 3 part D reports, only the dummy representing the time period 12:45-17:00 on all coinciding days was significant, when included in the specification for P^{11}, with a p-value of 0.02 and a coefficient of -0.21.[24] Overall, though, our results are not altered in any substantive way by the inclusion of any of these ECB dummy variables.

We can conclude that the evidence in Table 3 presents a robust result: we have presented significant evidence of a systematic regime switch to a high-volatility informed trading state on MPC days when the BoE Bank rate is changed unexpectedly. This effect is highly significant for

[23] We define ECB surprise announcement days according to changes in the short term interbank rate (EURIBOR) using the same approach as for the BoE in Table 1.

[24] A priori, one would expect the coefficient on this dummy variable to have a positive sign, indicating that ECB policy announcements increase the probability of higher return volatility in USD/GBP market. Accordingly, the observed negative estimated sign may indicate that this dummy is capturing something other than the volatility impact of ECB policy announcements.

about an hour following the interest rate announcement. After this time, the probability of remaining in the informed trading state falls significantly. This result for MPC days with unexpected interest rate changes is clearly distinguished from other days and is not simply a "time of day" effect that exists in the market every day. In response to the questions posed above, *Can we identify endogenous regime switching? Are the transition probabilities driven by the news component in the policy announcements,* we can answer with a strong affirmation.

We now turn to the final question to be addressed using intraday data: *Is there evidence of positioning during MPC meetings prior to the policy announcement at noon on the second meeting day?*

The news anticipation effect is captured by the coefficients on the dummy variable for 11:30-11:55 on all MPC days in the P^{11} equation and the dummy variable for 11:15-11:55 on all MPC days in in the P^{22} equation. As reported in Table 3 part B, both dummy variables are indeed significant. The coefficients imply that from 11:30-11:55 there is an increase in the probability of remaining in the informed trading state—that is, state 1— and that from 11:15-11:55 there is a decrease in the probability of remaining in state 2, the liquidity trading state. The previous results summarized in Table 3 established that the noon announcement of unexpected interest rate changes were, indeed, price-relevant news as there is a switch to the high-volatility informed trading state immediately after the announcement. The current question requires that the pre-noon period receive a microscopic examination.

Parts A, B, and C of Table 4 incorporate alternative morning dummy variables into the preferred model as a further robustness check. This proceeds much like the analysis associated with the post-noon announcement effect. Starting with the baseline preferred model, we specify alternative dummy variables for the pre-noon period for our three different types of days: all days, all MPC meeting days, and MPC meeting days when an unexpected interest rate change was announced, and examine the sensitivity of the estimates to the additional variables. Part A includes dummy variables for all days over alternative times of the morning. For instance, the first row of part A includes a dummy equal to *1* from 11:45-11:55 in the P^{11} equation. The p-value indicates that this additional variable has no significant explanatory power. Our preferred model results are not altered by the inclusion of the variable. Similarly, the other variables added to the P^{11} and P^{22} equations have no significant explanatory power.

Part B of Table 4 incorporates additional morning dummy variables for all MPC days into the preferred model, and part C incorporates additional morning dummy variables on Unexpected Change Days. None of the dummies in part B are significant. By contrast, in part C dummies for the periods 11:45-11:55, 11:30-11:55 and 11:00-11:55 enter the P^{11} equation with significant p-values, and positive coefficients. In addition, the dummy for 9:00-11:55 in the P^{22} equation is borderline significant as well. This suggests that the probability of being in the high volatility state increases by to the interest rate announcement on days with unexpected interest rate changes as compared to days when the announcement is anticipated. This result could be interpreted as indicative of information leakages prior to the announcement. The results from our baseline specification are again not changed in a substantive way by the inclusion of these variables.

Taken as a whole, there is evidence of regime switching in terms of exchange rate volatility in the morning prior to the end of the MPC meetings. The evidence is strongest for the P^{11} equation for the 11:30-11:55 time period. During this interval, there is a statistically significant jump in the probability of remaining in the high-volatility state, from 0.74 to 0.85. Of course, since the meetings always end prior to the noon announcement and the MPC's policy decision is known by insiders, the regime switching could be a result of signals read by market participants. This is not to claim that there are deliberate information leaks emanating from the committee. It may be something much more subtle (recall the Greenspan briefcase story presented earlier). Furthermore, it may be that traders are simply closing down trade positions in order to limit their risk exposure precisely because they are unsure about the upcoming announcement. The evidence presented here indicates no particularly large probability shifts prior to the conclusion of MPC meetings. This is certainly true if one considers the probabilities of regime switching in the morning compared with the afternoon. The news impact of policy announcements appears to be much larger than any anticipation effect.

The implications of the intraday estimation results for the transition probabilities are summarized in Figure 2. The figure plots, the smoothed unconditional probability of being in state 1, for the three types of days in our sample as generated by the preferred model reported in Table 3. This probability is averaged across all observations for each type of day for each 5-minute interval. One can observe dramatic differences across types of days and time of day.

It is clear that non-MPC meeting days are characterized by low-volatility, liquidity trading as the probability of remaining in the informed trading state is quite low all throughout the day; fluctuating between 0.25 and 0.45. On MPC meeting days when no unexpected interest rate change occurs, there is an increase in the average unconditional probability of being in state 1 that begins modestly around 11:30 and continues until 12:05 when it jumps to about 0.53. After this peak, the probability quickly falls to about 0.40 by about 12:30 and then by 13:00 is quite similar to the afternoon pattern on non-MPC days.

On MPC meeting days when an unexpected interest rate change occurs, however, there is a dramatic jump at noon when the policy announcement is released, from about 0.55 to more than 0.90. The probability of being in the informed trading state subsequently remains above 0.70 until about 13:00 after which it continues to fall so that by about 13:30 it appears to follow a pattern much like other days. In Figure 3 we have plotted the same information as in Figure 2 but using alternative measures of policy surprises, as detailed above. **[Correct heading for Figure 3]** The overall pattern is strikingly similar, suggesting that the results are robust to the exact characterization of policy surprises.

An interesting feature of Figure 1 is that the probability of moving into the high-volatility state rises even on days when the interest rate decision was correctly anticipated. This is perhaps worthy of further investigation, since one might expect *anticipated* announcements to be discounted into the exchange rate prior to the announcement. One possible explanation of this finding may be related top the fact that we have used the median expectation from the Bloomberg survey and ignored any dispersion in expectations among survey participants: there will in general still be some people surveyed who are surprised by the announcement even when it coincides with the median view. If these people then initiate trades in response, this may then generate a series of "hot-potato" trades, although the multiplier effect on trades would be expected to be smaller than if the majority of the market were surprised.

In order to investigate the validity of this argument, we use the measure of forecast dispersion introduced in Table 1 to distinguish days when analysts were unanimous in regarding their expectation of the policy announcement from MPC days when they were not. We construct a dummy that takes a value one from 12:05-13:00 on MPC days without policy surprises when the standard deviation of analysts' expectations is zero. We then construct a second dummy variable that takes the value one from 12:05-13:00 on MPC days without policy surprises on which the standard deviation is greater than zero. We include both of these variables in the P^{11} equation of our preferred specification and exclude 'Dummy 2', representing the time span 12:05-13:00 on all

MPC days. The data set is reduced to 24,683 observations due to a lack of data on analysts' expectations prior to October 1998.

Table 5 shows that only the variable indicating non-surprise MPC days with dispersion in expectations exhibits a significant influence on P^{11}, with a p-value of 0.001 and a coefficient of 0.4. This suggests that the rise in P^{11} at noon on MPC days without policy surprises is only significant when at least one individual deviated from the median market expectation. This finding gives support to the argument above that the increase in P^{11} at noon on MPC days without surprises is due to the use of the median individual analyst's expectation as a proxy for the entire market's expectation. In other words, even if the median expectation does not differ from the actual announcement, there are still market participants who are surprised by the announcement. This emphasizes the importance of investor heterogeneity in the foreign exchange market (Sager and Taylor, 2006).

Overall, the evidence in Figure 1 indicates that MPC days are, indeed, different from other days. The noon policy announcement appears to be price-relevant news, in particular when the announcement comes as a surprise to the market. There is some modest evidence of positioning in advance of the announcement on all MPC days, but for days when interest rates are changed unexpectedly, it appears that the market response comes immediately at noon with the news. It also appears that the market takes around an hour to digest the news component of an unanticipated announcement in terms of the average P^{11} dropping significantly back to around its previous level.

It should also be noted that our findings—in particular the evidence of a strong exchange rate reaction to the news announcement (which is much more marked on days when the interest rate announcement differs from the median market expectation) with little strong evidence of positioning during the morning period of the meeting—are qualitatively similar to those reported by Sager and Taylor (2004) in their high-frequency study of the exchange rate effects of interest-rate announcements by the Governing Council of the ECB, suggesting that the results are robust.[25]

It is also interesting to contrast our results with those of Evans and Lyons (2007). We conclude in favour of a significant but relatively short-lived impact upon the volatility of exchange rate returns for both unexpected and expected rate changes. By contrast, Evans and Lyons' analysis of proprietary order flow data concludes in favor of a very persistent relationship between order flow and exchange rate returns, with the former exhibiting out-of-sample predictive power for returns as much as one quarter ahead, but no significant impact in the short-term. This contrast reflects differences in the behaviour of market participants in the various segments of the foreign exchange market. In this paper, we have isolated the impact of knee-jerk trading on the volatility of returns around the time of MPC interest rate announcements, as inter-dealer positioning adjusts to reflect the arrival of this new information. This is an important and quick process, as befits a liquid and relatively efficient market as foreign exchange. But it is only part of the story. Evans and Lyons (2007) focus explicitly away from inter-dealers and on the customer segment of the market that accounts for more than 50% of market turnover.[26] [27] As Sager and Taylor (2006) discuss, other than smaller hedge funds the majority of foreign exchange market customers typically does not a similar exhibit knee-jerk reaction to news as the inter-dealer market. Although this behavior contradicts the Rational Expectations Hypothesis, it is rational—in the sense of being

[25] Likewise, Clare and Courtenay (2001) examine the response of interest and exchange rates to UK monetary policy announcements and macroeconomic data releases using 1-minute tick data in a sample that spans the introduction of operational independence at the BoE. They, too, find in favour of a significant volatility effect due to both types of new information, and for both interest and exchange rates, and also conclude that the implications of policy innovations are more quickly incorporated into interest and exchange rates in the post-independence era than previously was the case.

[26] For information on the share in foreign exchange market turnover of the various market segments, see BIS (2007).

[27] This segment includes asset management firms, such as mutual fund managers, as well as hedge funds, corporates and central banks.

profit-maximizing—and reflects both the size of assets under management, and associated transaction costs of trading, and that a large proportion of the trading activity of this market segment is not driven by news innovations, but benchmark adjustments (Lyons, 2001).

6. CONCLUSION

Following the granting of independence on the setting of interest rates to the Bank of England in 1997, the Monetary Policy Committee was created as its interest-rate setting committee, charged with fostering monetary policy consistent with stable inflation and economic growth. A stated aim of the new policy regime was that monetary policy should be more transparent than hitherto. The availability of MPC decisions affords us a rare opportunity to examine how the decisions of the key policy-setting committee are impounded into the foreign exchange market.

Since the MPC meets at regularly scheduled, pre-announced times and the policy decision is always announced at noon, the meetings provide a natural laboratory for examining exchange rate dynamics on days when monetary policy is formulated and announced. Our particular interest is with respect to the news content of the policy announcement and also whether there is any evidence of positioning in the foreign exchange market during the MPC meeting prior to the announcement.

We employed daily data on USD/GBP to analyze any differences that may exist in the behavior of exchange rate returns on the three kinds of days associated with MPC meetings: the pre-meeting briefing day; the first day of the meeting; and the second day of the meeting when the policy announcement is made. We estimated models of daily exchange rate returns to infer if information on MPC meeting days contains any explanatory power. Our estimation results suggest that daily exchange rate returns are well characterized by mean-zero changes and meeting day information has no explanatory power for returns. But modeling the conditional volatility of the daily returns revealed evidence of significantly greater volatility on second meeting days when interest rates are changed unexpectedly.

Given this result, we turned to a microscopic view of second meeting days using intraday exchange rate returns and an endogenous-probability Markov-switching framework. Our estimated model assumed that there exist two states: state 1, the high-volatility state associated with informed trading, and state 2, the low-volatility state associated with liquidity trading. We diverged from the usual non-linear regime-switching framework to model endogenous transition probabilities as a function of information regarding the meeting days. The transition probabilities were found to switch systematically and significantly on meeting days. The probability of remaining in the high volatility state was estimated to increase from 0.74 before 11:30 to 0.98 from 12:05-13:00 on MPC meeting days when interest rates are changed by an amount different from that expected by the market (or are not changed when the market expects a change).

The second day of MPC meetings, the day on which interest rate decisions are announced, is therefore best characterized as having a—statistically and economically—significant exchange rate reaction to the news announcement at noon with some evidence of positioning during the morning period of the meeting. These announcement effects last for around an hour to ninety minutes and are much more marked on days when the interest rate announcement differs from the ex ante median market expectation.

An interesting extension of these results would be to empirically test the ability of market participants to profitably exploit these announcement effects—that is, to validate the economic significance of our findings—through a profit-loss analysis of trading strategies that, say, introduce short-lived option structures in USD/GBP on the second day of MPC meetings around the time of the policy announcement. This is a task we leave to future research.

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Table 1: Monetary Policy Committee Meetings, Interest Decisions and Surprise Measures

The table contains all interest rate decisions of the Bank of England Monetary Policy Committee (MPC) for the period June 1997 – October 2007. 'Bloomberg Expectation' refers to the interest rate change predicted by the median expectation in a Bloomberg Survey of Market Economists. 'Forecast Dispersion' is the standard deviation calculated from individual analysts' forecasts. The final five columns in the table indicate, whether the interest rate announcement surprised the market according to the respective measure. The variable 'IB10' ('IB15') indicates, whether the change in the 3 months interbank rate from one day before the announcement to one day after the announcement was greater or equal to 10 (15) basis points. 'LIFFE10' and 'LIFFE15' are defined accordingly but based on Sterling 3 months interest rate futures contracts.

Date	Interest Rate Decision	Bloomberg Expectation	Forecast Dispersion	Bloomberg Surprise	IB10 Surprise	IB15 Surprise	Liffe10 Surprise	Liffe15 Surprise
6 Jun 97	0.25	0	Missing	Yes	No	No	No	No
10 Jul 97	0.25	0.25	Missing	No	No	No	No	No
7 Aug 97	0.25	0	Missing	Yes	No	No	No	No
11 Sep 97	0	0	Missing	No	Yes	No	No	No
9 Oct 97	0	0	Missing	No	No	No	No	No
6 Nov 97	0.25	0	Missing	Yes	No	No	Yes	Yes
4 Dec 97	0	0	Missing	No	No	No	No	No
8 Jan 98	0	0	Missing	No	No	No	No	No
5 Feb 98	0	0	Missing	No	No	No	No	No
5 Mar 98	0	0	Missing	No	No	No	No	No
9 Apr 98	0	0	Missing	No	Yes	No	No	No
7 May 98	0	0	Missing	No	No	No	No	No
4 Jun 98	0.25	0	Missing	Yes	Yes	Yes	Yes	Yes
9 Jul 98	0	0	Missing	No	Yes	No	Yes	No
6 Aug 98	0	0	Missing	No	No	No	No	No
10 Sep 98	0	0	Missing	No	Yes	No	No	No
8 Oct 98	-0.25	0	0.13	Yes	Yes	Yes	Yes	Yes
5 Nov 98	-0.5	-0.25	0.06	Yes	Yes	No	No	No
10 Dec 98	-0.5	-0.25	0.14	Yes	No	No	No	No
7 Jan 99	-0.25	0	0	Yes	Yes	Yes	No	No
4 Feb 99	-0.5	-0.25	0.13	Yes	Yes	Yes	Yes	Yes
3 Mar 99	0	-0.25	0.13	No	No	No	Yes	No
8 Apr 99	-0.25	-0.25	0.08	No	No	No	No	No
6 May 99	0	0	0.11	No	No	No	No	No
10 Jun 99	-0.25	0	0.11	Yes	Yes	No	Yes	No
8 Jul 99	0	0	0	No	No	No	No	No
5 Aug 99	0	0	0	No	No	No	No	No
8 Sep 99	0.25	0	0	Yes	Yes	Yes	Yes	Yes
7 Oct 99	0	0	0.1	No	Yes	No	Yes	No
4 Nov 99	0.25	0.25	0.11	No	Yes	Yes	Yes	Yes
9 Dec 99	0	0	0.06	No	No	No	No	No
13 Jan 00	0.25	0.25	Missing	No	No	No	No	No
10 Feb 00	0.25	0.25	0.07	No	No	No	No	No
9 Mar 00	0	0	0.09	No	No	No	No	No
6 Apr 00	0	0	0.13	No	No	No	No	No
4 May 00	0	0.25	0	Yes	No	No	No	No
7 Jun 00	0	0	0.07	No	No	No	No	No

7 Jun 00	0	0	0.07	No	No	No	No	No
6 Jul 00	0	0	0.11	No	No	No	No	No
3 Aug 00	0	0	0.1	No	No	No	No	No
7 Sep 00	0	0	0.07	No	No	No	No	No
5 Oct 00	0	0	0	No	No	No	No	No
9 Nov 00	0	0	0	No	No	No	No	No
7 Dec 00	0	0	0.39	No	No	No	No	No
11 Jan 01	0	0	0.08	No	No	No	No	No
8 Feb 01	-0.25	-0.25	0.07	No	No	No	No	No
8 Mar 01	0	0	0.12	No	No	No	No	No
5 Apr 01	-0.25	-0.25	0.05	No	No	No	No	No
10 May 01	-0.25	-0.25	0	No	No	No	No	No
6 Jun 01	0	0	Missing	No	No	No	No	No
5 Jul 01	0	0	0	No	No	No	Yes	No
2 Aug 01	-0.25	0	0	Yes	Yes	Yes	Yes	Yes
6 Sep 01	0	0	0.13	No	No	No	No	No
18 Sep 01	-0.25	Missing	0.11	Yes	Yes	No	No	No
4 Oct 01	-0.25	-0.25	0.1	No	No	No	No	No
8 Nov 01	-0.5	-0.25	0	Yes	Yes	Yes	Yes	No
5 Dec 01	0	0	0	No	No	No	Yes	No
10 Jan 02	0	0	0.07	No	No	No	No	No
7 Feb 02	0	0	0	No	No	No	No	No
7 Mar 02	0	0	0	No	No	No	No	No
4 Apr 02	0	0	0	No	No	No	No	No
9 May 02	0	0	0.07	No	No	No	No	No
6 Jun 02	0	0	0.04	No	No	No	No	No
4 Jul 02	0	0	0	No	No	No	No	No
1 Aug 02	0	0	0	No	No	No	No	No
5 Sep 02	0	0	0.07	No	No	No	No	No
10 Oct 02	0	0	0.13	No	No	No	Yes	No
7 Nov 02	0	0	0	No	No	No	No	No
5 Dec 02	0	0	0	No	No	No	No	No
9 Jan 03	0	0	0.05	No	No	No	No	No
6 Feb 03	-0.25	0	0	Yes	Yes	Yes	Yes	Yes
6 Mar 03	0	0	0.08	No	No	No	No	No
10 Apr 03	0	0	0.13	No	No	No	No	No
8 May 03	0	0	0.1	No	No	No	No	No
5 Jun 03	0	0	0.11	No	No	No	No	No
10 Jul 03	-0.25	0	0	Yes	Yes	Yes	No	No
7 Aug 03	0	0	0	No	No	No	No	No
4 Sep 03	0	0	0	No	No	No	No	No
9 Oct 03	0	0	0.04	No	Yes	Yes	No	No
6 Nov 03	0.25	0.25	0.04	No	No	No	No	No
9 Dec 03	0	0	0.04	No	No	No	No	No
8 Jan 04	0	0	0.04	No	No	No	No	No
5 Feb 04	0.25	0.25	0	No	No	No	No	No
4 Mar 04	0	0	0.12	No	No	No	No	No

8 Apr 04	0	0	0.05	No	No	No	No	No
6 May 04	0.25	0.25	0.13	No	No	No	No	No
10 Jun 04	0.25	0.25	0.05	No	No	No	No	No
8 Jul 04	0	0	0	No	No	No	No	No
5 Aug 04	0.25	0.25	0.04	No	No	No	No	No
9 Sep 04	0	0	0	No	No	No	No	No
7 Oct 04	0	0	0.05	No	No	No	No	No
4 Nov 04	0	0	0	No	No	No	No	No
9 Dec 04	0	0	0	No	No	No	No	No
12 Jan 05	0	0	0	No	No	No	No	No
10 Feb 05	0	0	0	No	No	No	No	No
10 Mar 05	0	0	0	No	No	No	No	No
7 Apr 05	0	0	0.04	No	No	No	No	No
9 May 05	0	0	0	No	No	No	No	No
9 Jun 05	0	0	0.07	No	No	No	No	No
7 Jul 05	0	0	0.08	No	No	No	Yes	No
4 Aug 05	-0.25	-0.25	0	No	No	No	No	No
8 Sep 05	0	0	0	No	No	No	No	No
6 Oct 05	0	0	0	No	No	No	No	No
10 Nov 05	0	0	0	No	No	No	No	No
8 Dec 05	0	0	0	No	No	No	No	No
12 Jan 06	0	0	0	No	No	No	No	No
9 Feb 06	0	0	0	No	No	No	No	No
9 Mar 06	0	0	0	No	No	No	No	No
6 Apr 06	0	0	0	No	No	No	No	No
4 May 06	0	0	0	No	No	No	No	No
8 Jun 06	0	0	0	No	No	No	No	No
6 Jul 06	0	0	0.1	No	No	No	No	No
3 Aug 06	0.25	0	0	Yes	Yes	Yes	Yes	Yes
7 Sep 06	0	0	0	No	No	No	No	No
5 Oct 06	0	0	0	No	No	No	No	No
9 Nov 06	0.25	0.25	0	No	No	No	No	No
7 Dec 06	0	0	0	No	No	No	No	No
11 Jan 07	0.25	0	0.09	Yes	Yes	Yes	Yes	Yes
8 Feb 07	0	0	0.09	No	No	No	No	No
8 Mar 07	0	0	0.09	No	No	No	No	No
5 Apr 07	0	0	0	No	No	No	No	No
10 May 07	0.25	0.25	0.06	No	No	No	No	No
7 Jun 07	0	0	0.08	No	No	No	No	No
5 Jul 07	0.25	0.25	0	No	No	No	No	No
2 Aug 07	0	0	0	No	No	No	No	No
6 Sep 07	0	0	0.03	No	No	No	No	No
4 Oct 07	0	0	0.05	No	No	No	No	No

Sources: Bank of England, Bloomberg and DataStream

Table 2: GARCH Model of Daily Exchange Rate Returns

The dependent variable in the mean equation is daily USD/GBP exchange rate returns over the period May 1, 1997 to October 31, 2007. Dummy variables related to MPC meetings when unexpected interest rate changes occur are incorporated in the variance equation. Dummies equal 1 on the day specified and zero otherwise. The GARCH model is specified such that the announcement effects impact the conditional variance only temporarily. The preferred specification of the mean equation is a third order autoregression. Estimation is carried out using robust standard errors.

$$\Delta e_t = \mu + c_1 \Delta e_{t-1} + ... + c_n \Delta e_{t-n} + \sqrt{s_t}\,\varepsilon_t$$

$$\varepsilon_t \sim N(0, h_t)$$

$$s_t = (1 + \delta_0 Briefing + \delta_1 Day1 + \delta_2 Day2)$$

$$h_t = \omega + \alpha \varepsilon_{t-1}^2 + \beta h_{t-1}$$

Table 2.1

Surprise if policy rate deviates from median Bloomberg expectation

Variable	Coefficient Estimate	p-value
Mean Equation		
Constant	1.13E-004	0.210
AR(1)	0.04	0.069
AR(2)	-8.27E-003	0.680
AR(3)	-0.04	0.039
Variance Equation		
Constant	3.81E-007	0.000
ARCH(1)	0.03	0.000
GARCH(1)	0.96	0.000
Briefing	-1.10E-001	0.036
Day1	-4.32E-002	0.492
Day2	2.54E-001	0.004
Log Likelihood	10624.28	

Table 2.2

Surprise if price change in interbank rates is greater than 9 basis point

Variable	Coefficient Estimate	p-value
Mean Equation		
Constant	1.02E-004	0.254
AR(1)	0.03	0.073
AR(2)	-8.42E-003	0.669
AR(3)	-0.04	0.034
Variance Equation		
Constant	3.36E-007	0.000
ARCH(1)	0.03	0.000
GARCH(1)	0.96	0.000
Briefing	-2.07E-001	0.020
Day1	-2.70E-001	0.027
Day2	5.50E-001	0.012
Log Likelihood	10628.09	

Table 2.3

Surprise if price change in interbank rates is greater than 14 basis point

Variable	Coefficient Estimate	p-value
Mean Equation		
Constant	1.05E-004	0.241
AR(1)	0.04	0.071
AR(2)	-7.98E-003	0.686
AR(3)	-0.04	0.032
Variance Equation		
Constant	3.38E-007	0.000
ARCH(1)	0.03	0.000
GARCH(1)	0.96	0.000
Briefing	-2.53E-001	0.045
Day1	-1.66E-001	0.300
Day2	4.34E-001	0.076
Log Likelihood	10625.74	

Table 2.4

Surprise if price change in futures contracts is greater than 9 basis point

Variable	Coefficient Estimate	p-value
Mean Equation		
Constant	1.16E-004	0.191
AR(1)	0.04	0.066
AR(2)	-9.16E-003	0.641
AR(3)	-0.04	0.041
Variance Equation		
Constant	3.42E-007	0.000
ARCH(1)	0.03	0.000
GARCH(1)	0.96	0.000
Briefing	-1.73E-001	0.207
Day1	-2.44E-001	0.063
Day2	4.38E-001	0.037
Log Likelihood	10626.74	

Table 2.5

Surprise if price change in futures contracts is greater than 14 basis point

Variable	Coefficient Estimate	p-value
Mean Equation		
Constant	1.13E-004	0.209
AR(1)	0.03	0.079
AR(2)	-7.22E-003	0.715
AR(3)	-0.04	0.033
Variance Equation		
Constant	3.59E-007	0.000
ARCH(1)	0.03	0.000
GARCH(1)	0.96	0.000
Briefing	-3.12E-001	0.013
Day1	-7.47E-002	0.556
Day2	4.94E-001	0.041
Log Likelihood	10625.98	

Table 3: Markov-Switching Model of MPC News and News Anticipation Effects

The table reports estimates of a Markov-switching model for USD/GBP exchange rate returns sampled at a frequency of 5-minutes over the London business day. The final, preferred specification was a first-order auto regression in returns with a regime-switching variance, a regime switching mean and a regime switching autocorrelation coefficient. Transition probabilities are modeled as switching endogenously as a function of MPC-related events as in (Φ denotes the cumulative normal density function):

$P^{11} = \Phi(\alpha_{11} + \sum_k \beta_{11,k} dum_k)$ and $P^{22} = \Phi(\alpha_{22} + \sum_k \beta_{22,k} dum_k)$.

A. Constant Transition Probability Model

Coefficient Estimates (p-values)

ρ(1)	-0.13 (0.000)	σ²(1)	5.51 (0.000)
ρ(2)	-0.15 (0.000)	σ²(2)	1.61 (0.000)

	Constant
P^{11}	1.68 (0.000)
P^{22}	1.74 (0.000)

LogL=-73022

B. Preferred Time-Varying Transition Probability Model
B1. Surprise Measure Based on Bloomberg Survey of Market Economists

Coefficient Estimates (p-values) of Regime Switching AR(1) Model

μ(1)	0.44 (0.000)	ρ(1)	-0.12 (0.000)	σ²(1)	6.11 (0.000)
μ(2)	-0.28 (0.000)	ρ(2)	-0.11 (0.000)	σ²(2)	1.64 (0.000)

Coefficient Estimates (p-values) for Endogenous Transition Probabilities

	Constant	Dummy 1	Dummy 2	Dummy 3	Dummy 4	Dummy 5
Type of Day		Surprise	MPC	All	MPC	MPC
Time		12:05-13:00	12:05-13:00	12:05-13:45	11:30-11:55	11:15-11:55
P^{11}	0.74 (0.000)	0.96 (0.000)	0.31 (0.000)	-0.01 (0.000)	0.31 (0.019)	
P^{22}	7.15 (0.000)			-2.34 (0.000)		-0.87 (0.002)

LogL=-71082

B2. Surprise if Change in 3 Months Interbank Rate is Greater Than 9

Coefficient Estimates (p-values) of Regime Switching AR(1) Model

$\mu(1)$	0.44 (0.000)	$\rho(1)$	-0.12 (0.000)	$\sigma^2(1)$	6.11 (0.000)
$\mu(2)$	-0.29 (0.000)	$\rho(2)$	-0.11 (0.000)	$\sigma^2(2)$	1.64 (0.000)

Coefficient Estimates (p-values) for Endogenous Transition Probabilities

	Constant	Dummy 1	Dummy 2	Dummy 3	Dummy 4	Dummy 5
Type of Day		Surprise	MPC	All	MPC	MPC
Time		12:05-13:00	12:05-13:00	12:05-13:45	11:30-11:55	11:15-11:55
P^{11}	0.74 (0.000)	0.86 (0.000)	0.33 (0.000)	-0.01 (0.000)	0.31 (0.019)	
P^{22}	7.15 (0.000)			-2.34 (0.000)		-0.87 (0.003)

LogL=-71084

B3. Surprise if Change in 3 Months Interbank Rate is Greater Than 14

Coefficient Estimates (p-values) of Regime Switching AR(1) Model

$\mu(1)$	0.44 (0.000)	$\rho(1)$	-0.12 (0.000)	$\sigma^2(1)$	6.11 (0.000)
$\mu(2)$	-0.28 (0.000)	$\rho(2)$	-0.11 (0.000)	$\sigma^2(2)$	1.64 (0.000)

Coefficient Estimates (p-values) for Endogenous Transition Probabilities

	Constant	Dummy 1	Dummy 2	Dummy 3	Dummy 4	Dummy 5
Type of Day		Surprise	MPC	All	MPC	MPC
Time		12:05-13:00	12:05-13:00	12:05-13:45	11:30-11:55	11:15-11:55
P^{11}	0.74 (0.000)	0.51 (0.061)	0.43 (0.000)	-0.01 (0.000)	0.31 (0.019)	
P^{22}	7.14 (0.000)			-2.34 (0.000)		-0.86 (0.001)

LogL=-71082

B4. Surprise if Change in Price of 3 Months Interest Rate Futures is Greater Than 9

Coefficient Estimates (p-values) of Regime Switching AR(1) Model

$\mu(1)$	0.44 (0.000)	$\rho(1)$	-0.12 (0.000)	$\sigma^2(1)$	6.11 (0.000)
$\mu(2)$	-0.28 (0.000)	$\rho(2)$	-0.11 (0.000)	$\sigma^2(2)$	1.64 (0.000)

Coefficient Estimates (p-values) for Endogenous Transition Probabilities

	Constant	Dummy 1	Dummy 2	Dummy 3	Dummy 4	Dummy 5
Type of Day		Surprise	MPC	All	MPC	MPC
Time		12:05-13:00	12:05-13:00	12:05-13:45	11:30-11:55	11:15-11:55
P^{11}	0.74 (0.000)	0.62 (0.011)	0.39 (0.000)	-0.01 (0.000)	0.31 (0.019)	
P^{22}	7.15 (0.000)			-2.34 (0.000)		-0.87 (0.000)

LogL=-71082

B5. Surprise if Change in Price of 3 Months Interest Rate Futures is Greater Than 14

Coefficient Estimates (p-values) of Regime Switching AR(1) Model

$\mu(1)$	0.44 (0.000)	$\rho(1)$	-0.12 (0.000)	$\sigma^2(1)$	6.11 (0.000)
$\mu(2)$	-0.28 (0.000)	$\rho(2)$	-0.11 (0.000)	$\sigma^2(2)$	1.64 (0.000)

Coefficient Estimates (p-values) for Endogenous Transition Probabilities

	Constant	Dummy 1	Dummy 2	Dummy 3	Dummy 4	Dummy 5
Type of Day		Surprise	MPC	All	MPC	MPC
Time		12:05-13:00	12:05-13:00	12:05-13:45	11:30-11:55	11:15-11:55
P^{11}	0.74 (0.000)	0.67 (0.048)	0.44 (0.000)	-0.01 (0.000)	0.30 (0.020)	
P^{22}	7.15 (0.000)			-2.34 (0.000)		-0.87 (0.001)

LogL=-71082

Table 4: Markov-Switching Model of MPC News Anticipation Effects

The table reports estimates and tests of alternative specifications of the Markov-switching model for USD/GBP exchange rate returns, using the model reported in Table 3 part B as the baseline model. Only the estimated coefficients (p-values) for the additional dummy in the transition probability equations are reported here.

A. Alternative Specifications (morning dummies for all days)

Additional variables added to the preferred model specification

Equation	Variable	Coefficient (p-value)	Log Likelihood
P^{11}	11:45-11:55	-0.169 (0.300)	-71082
P^{11}	11:30-11:55	-0.08 (0.564)	-71082
P^{11}	11:15-11:55	-0.07 (0.500)	-71082
P^{11}	11:00-11:55	-0.000 (0.999)	-71082
P^{11}	9:00-11:55	-0.000 (0.999)	-71082
P^{22}	11:45-11:55	0.10 (0.862)	-71082
P^{22}	11:30-11:55	0.32 (0.459)	-71082
P^{22}	11:15-11:55	0.12 (0.769)	-71082
P^{22}	11:00-11:55	0.000 (0.999)	-71082
P^{22}	9:00-11:55	0.000 (0.999)	-71082

B. Alternative Specifications (morning dummies for all MPC days)

Additional variables added to the preferred model specification

Equation	Variable	Coefficient (p-value)	Log Likelihood
P^{11}	11:45-11:55	-0.02 (0.933)	-71082
P^{11}	11:15-11:55	-0.03 (0.879)	-71082
P^{11}	11:00-11:55	0.01 (0.930)	-71082
P^{11}	9:00-11:55	0.04 (0.530)	-71082
P^{22}	11:45-11:55	-0.44 (0.51)	-71082
P^{22}	11:30-11:55	0.53 (0.445)	-71082
P^{22}	11:00-11:55	0.66 (0.291)	-71082
P^{22}	9:00-11:55	0.18 (0.460)	-71082

C. Alternative Specifications (morning dummies for days with Surprise Announcements)

Additional variables added to the preferred model specification

Equation	Variable	Coefficient (p-value)	Log Likelihood
P^{11}	11:45-11:55	0.27 (0.047)	-71080
P^{11}	11:30-11:55	0.65 (0.038)	-71080
P^{11}	11:00-11:55	0.93 (0.041)	-71079
P^{11}	11:00-11:15	1.051 (0.161)	-71082
P^{11}	9:00-11:55	4.65 (0.953)	-71082
P^{22}	11:45-11:55	-0.28 (0.552)	-71082
P^{22}	11:30-11:55	-0.07 (0.935)	-71082
P^{22}	11:15-11:55	0.05 (0.964)	-71082
P^{22}	11:00-11:55	0.28 (0.828)	-71082
P^{22}	9:00-11:55	-1.88 (0.056)	-71082

Table 5: Markov-Switching Model Taking Account of Forecast Dispersion

The table reports estimates of the preferred model in Table 3 part B excluding Dummy 2 representing the time span 12:05-13:30 on MPC days. Instead, Dummies 6 and 7 are included which represent the same time span on MPC days without surprise announcements. They are distinguished by representing days without (Dummy 7) and with (Dummy 6) forecast dispersion respectively. Forecast dispersion is defined as a standard deviation greater than zero in individual analysts' forecasts on a given MPC day on which the median Bloomberg expectation is in line with the actual interest rate announcement.

Coefficient Estimates (p-values) of Regime Switching AR(1) Model

$\mu(1)$	0.38 (0.0009	$\rho(1)$	-0.13 (0.000)	$\sigma^2(1)$	5.90 (0.000)
$\mu(2)$	-0.25 (0.000)	$\rho(2)$	-0.11 (0.000)	$\sigma^2(2)$	1.55 (0.000)

The number of observations is reduced to 24683 for this regression due to lack of data on Individual analysts' expectations prior to October 1998.

	Constant	Dummy 1	Dummy 2	Dummy 3	Dummy 4	Dummy 5
Type of Day		Surprise	MPC	All	MPC	MPC
Time		12:05-13:00	12:05-13:00	12:05-13:45	11:30-11:55	11:15-11:55
P^{11}	1.14 (0.000)	1.14 (0.000)	Excluded	-0.01 (0.000)	0.17 (0.240)	
P^{22}	7.20 (0.000)			-2.45 (0.000)		-1.02 (0.003)

New Dummies

	Dummy 6	Dummy 7
Type of Day	MPC	MPC
Surprise	No	No
Dispersion	Yes	No
Time	12:05-13:00	12:05-13:00
P^{11}	0.40 (0.001)	-0.12 (0.478)

LogL=-59477

Table 6: Markov-Switching Model Including Additional Constant Terms

The table reports estimates from the preferred specification when we include additional constant terms in the mean equation. The mean equation is now defined as $\Delta e_t = \mu(S_t) + (S_t)I(\Delta i > 0) + \mu_{neg}(S_t)I(\Delta i < 0) + \rho(S_t)[\Delta e_{t-1} - \mu(S_{t-1})] + \varepsilon_t$ where μ_{pos} and μ_{neg} are additional constant terms, $I(\Delta i > 0)$ is an indicator function that takes the value 1 on interest rate surprise days between 12:05-13:00 if the announced interest rate is higher than expected, and $I(\Delta i < 0)$ is an indicator function that takes the value 1 on interest rate surprise days between 12:05-13:00 if the announced interest rate is lower than expected.

Coefficient Estimates (p-values) of Regime Switching AR(1) Model

μ(1)	0.43 (0.000)	ρ(1)	-0.13 (0.000)	σ²(1)	6.09 (0.000)
μ(2)	-0.28 (0.000)	ρ(2)	-0.11 (0.000)	σ²(2)	1.64 (0.000)

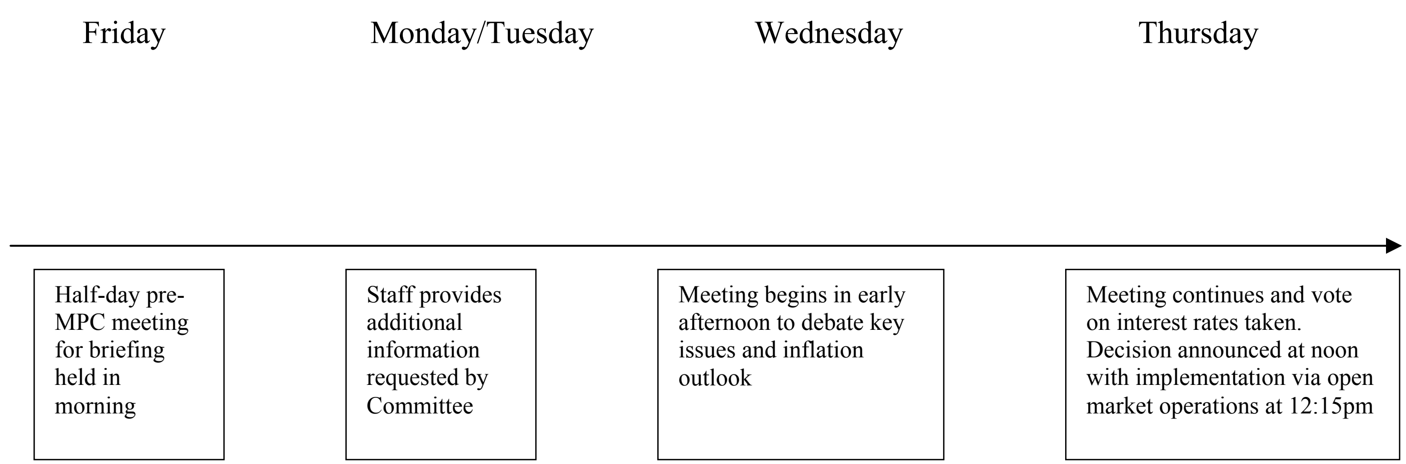
$\mu_{pos}(1)$	3.27 (0.000)	$\mu_{neg}(1)$	-0.98 (0.093)
$\mu_{pos}(2)$	0.53 (0.047)	$\mu_{neg}(2)$	-2.54 (0.000)

Coefficient Estimates (p-values) for Endogenous Transition Probabilities

	Constant	Dummy 1	Dummy 2	Dummy 3	Dummy 4	Dummy 5
Type of Day		Surprise	MPC	All	MPC	MPC
Time		12:05-13:00	12:05-13:00	12:05-13:45	11:30-11:55	11:15-11:55
P^{11}	0.75 (0.000)	0.86 (0.000)	0.31 (0.000)	-0.01 (0.000)	0.30 (0.031)	
P^{22}	7.24 (0.000)			-2.37 (0.000)		-0.89 (0.008)

LogL=-71064.25

Figure 1: Timetable for a Representative Monetary Policy Committee Meeting



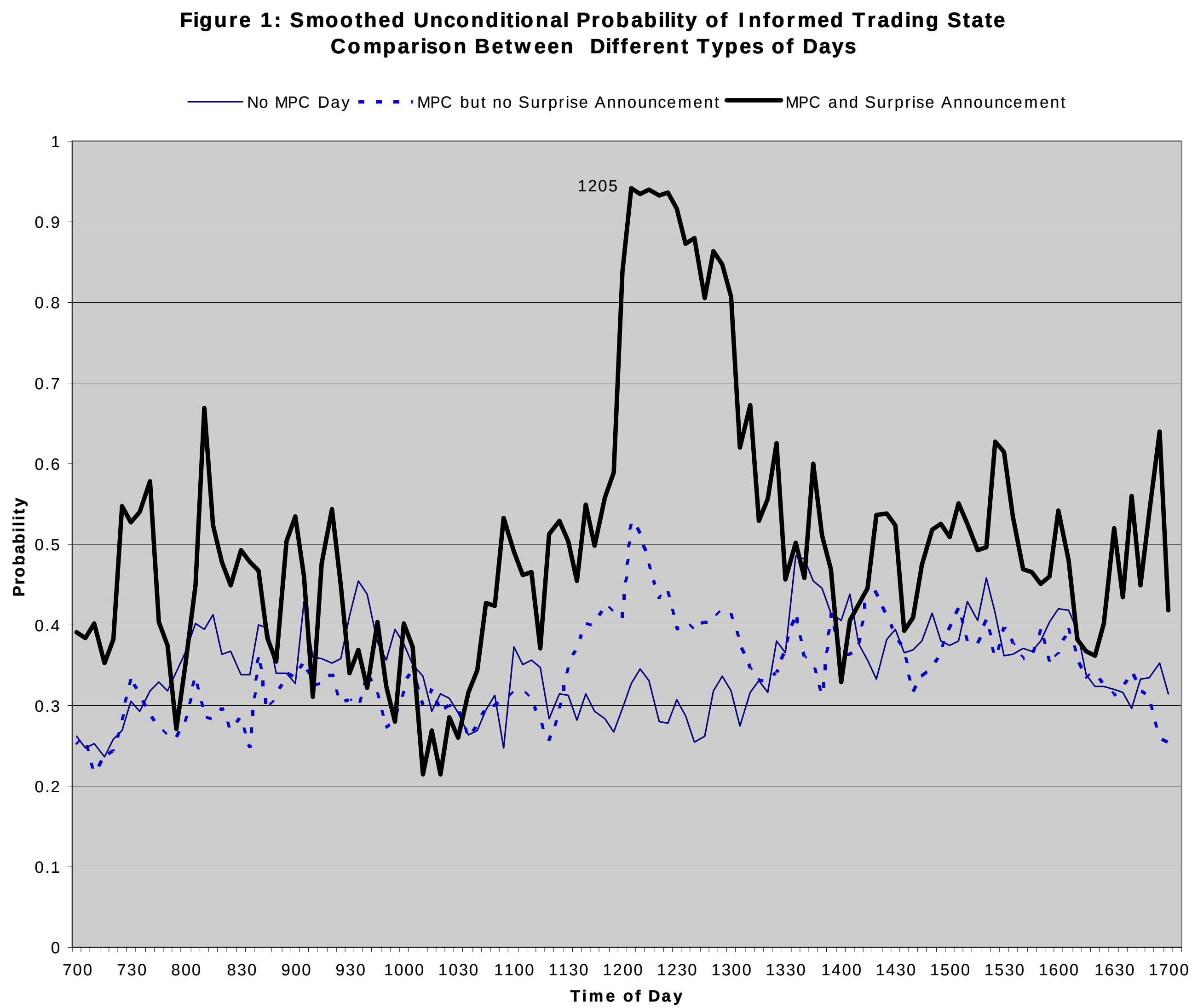
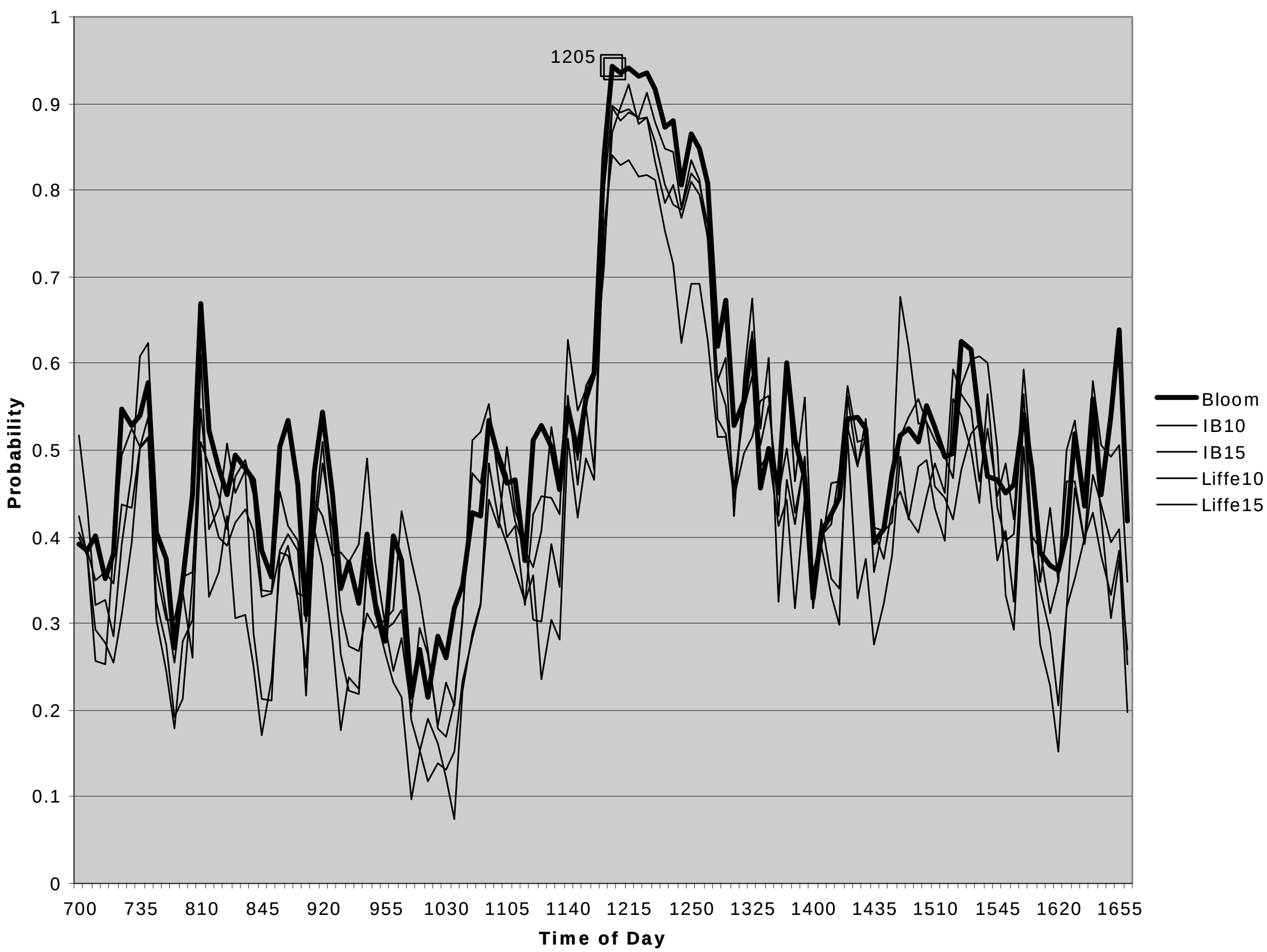


Figure 1: Smoothed Unconditional Probability of Informed Trading State
Comparison Between Different Types of Days
No MPC Day
MPC but no Surprise Announcement
MPC and Surprise Announcement
1205
Probability
Time of Day
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
700
730
800
830
900
930
1000
1030
1100
1130
1200
1230
1300
1330
1400
1430
1500
1530
1600
1630
1700

Figure 2: Smoothed Unconditional Probability of Informed Trading State
MPC Days with Surprise Announcements
(Alternative Surprise Measures)



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