Stock Returns and Monetary Policy under the MPC Framework: Do Inflation Targeting and Central Bank Communication Make a Difference?

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Abstract

We examine the impact of monetary policy on stock market returns for the period before and after the adoption of inflation targeting in the UK (1982-2010). The evidence we produce reveals that stock returns are negatively associated with monetary policy shocks before the inflation targeting period. This relationship is robust even after accounting for various asymmetric effects of interest rate policy in terms of direction and timing. The period following the introduction of the Monetary Policy Committee (MPC), however, differs as policy shocks and stock returns are positively related. In addition to the interest rate policy shocks we extract market-based monetary policy shocks from the publication of inflation reports and MPC minutes releases, finding that they affect not only the level of stock prices, but also the conditional volatility of stock returns.

JEL Codes: G14, E44, E52.

Keywords: Stock Market Returns, Monetary Policy Shocks, Inflation Targeting, Monetary Policy Committee, Central Bank Communication..

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1. Introduction

The period from the early 1990s to the early 2000s has been called the "nice" -non-inflationary consistently expansionary- decade in the UK (King, 2003) and this period overlaps with part of the "great moderation" (Bernanke, 2004b) in the US. Asset prices in general and stock market prices in particular, however, have not experienced the same degree of relative stability as goods and services prices. Asset price movements raise issues on whether and how monetary policy should react. This paper considers the more fundamental question of if and how asset markets react to monetary policy. We provide a complete characterization of the relationship between monetary policy and stock market returns in the UK focusing on the implications of the Monetary Policy Committee (MPC) framework and the Bank of England's communication.

Evidence on the effects of monetary policy on equities has been recently produced, mainly focusing on the US (Thorbecke, 1997; Rigobon and Sack, 2004; Bernake and Kuttner, 2005; Gürkaynak et al, 2005). In this paper we examine the contemporaneous relationship between monetary policy and Bank of England's communication on stock prices with emphasis on the period after 1997 when the Bank introduced the MPC framework. Our focus on the UK is motivated by a number of reasons. First, the UK experienced a distinct change in its monetary policy regime with the implementation of the Monetary Policy Committee (MPC) framework in the context of Inflation Targeting (IT). Inflation targeting has been adopted by an increasing number of central banks[1] of which the Bank of England's framework is considered as prototypical[2] and highly effective in anchoring inflation

[1] Currently at least twenty seven central banks in advanced and emerging economies are considered fully fledged inflation targeters.

[2] See the contributions in Bernanke and Woodford (2005).

expectations. We consider the implications of this policy regime switch for the UK equities market.

Second, a question that regularly (and naturally) emerges in the literature is whether policymakers' actions speak louder than words in financial markets. The monetary policy framework under the MPC in a country with highly developed financial markets, as is the UK, offers a unique laboratory for addressing such issues. The sine qua non of inflation targeting is the Bank of England's communications policy, which is characterized by a high degree of transparency. In particular, the regular publication of the Inflation Report (IR) and of the MPC minutes on fixed dates disseminate information relevant to the future monetary policy stance, and consequently can shape financial markets' expectations about future policy actions. The pursuing of an open and transparent communication policy is considered of key importance in containing expectations and affecting longer-term rates (e.g., King, 2005; Bernanke, 2004a). Finally, stock prices constitute a major channel of monetary policy transmission[3] and although recent papers consider this issue, a number of questions pertaining to the highly asymmetric nature of the monetary policy-stock returns relationship remain unexplored.

This paper contributes to the literature in three ways. First we provide a full characterization of the effects of monetary policy on equity returns in the UK. We use a benchmark model as in Bernanke and Kuttner (2005), which accounts for monetary policy surprises to establish a negative relationship between policy interest rates and stock market returns. This relationship, however, is subject to various asymmetries, which have been studied for the US but not for the UK, and the first analytical section explicitly address. The

[3] For example, Bernanke and Gertler (2000) suggest that the effects of monetary policy on asset prices might even overshadow inflation stability as the primary objective of central banks.

US evidence is inconclusive on the possible asymmetric effects of the interest rate change direction while our findings do not validate such an asymmetry for the UK. Another type of asymmetry concerns the effects of monetary policy on stock returns on MPC meetings that results to policy action versus MPC meetings that leave the interest rate unchanged ("announcement" versus "non-announcement dates")[4] and no such analysis exists for the UK characterizing the implications of MPC decisions. Asymmetric effects can emerge in considering the timing (the postponements or advancements of anticipated policy actions) versus level shocks.[5] Bernanke and Kuttner (2005) and Farka (2009) find that the impact of level shocks dominates the impact of timing shocks in the US stock market, while Gürkaynak et al. (2005) reach a somehow opposite conclusion finding that news about the expected path of the policy rate over the following year exert a larger impact on stock market returns than news about the current policy rate. Finally, we consider the asymmetric reaction of different book to market (Tobin's q) value portfolios and different size portfolios to monetary policy shocks. Perez-Quiros and Timmermann (2000) find that small portfolios are more vulnerable to monetary policy risk as compared to large portfolios in the US, while Erhmann and Fratzscher (2004) find that value stocks react stronger to monetary policy shocks as compared to growth stocks. Our results suggest the reaction of value stocks to monetary policy shocks is stronger in the UK. To our knowledge and with the exceptions noted above this is the first set of evidence for the UK on the types of asymmetries mentioned above and provides a robustness check on the relationship between monetary policy and equity returns.

The second contribution of the paper is the characterization of the monetary policy and equity returns relationship before and after the introduction of the MPC framework in the UK

[4] Evidence for the US exists shows that such effects are present in the US (e.g., Roley and Sellon, 1998; Bernake and Kuttner, 2005).

[5] The level/path shock refers to the future policy rates warranted by the short-term (3-month) interest rate (sterling) futures rate (e.g., Gürkaynak et. al. 2005).

(1997). We find that the impact of level shocks dominates the impact of timing shocks up to 1997 and then the situation reverses reflecting the increased predictability of monetary policy. Moreover, the sign of the both the timing and level shocks' reaction coefficients reverses after 1997. Before 1997 a postponement/advancement of a tightening shock is positively/negatively associated with stock returns, but after 1997 a postponement/advancement of tightening leads to a fall/rise in stock returns. This result reflects the anchoring of policy rate expectations and enhanced monetary policy predictability. In other words less uncertainty surrounds the expected policy actions for a given conjuncture.[6] We also consider how the anchoring of expectations after the introduction of MPC framework affects the relationship between interest rate differentials of different maturities and stock returns. Finally, we provide a preliminary analysis of the potential quantitative easing effects.

Thirdly, we analyze how central bank communication affects the equities markets. We find that the inflation report contains monetary policy news and on its publication dates stocks react to both timing and level shocks. We also consider the relative information content of policy actions versus communications. In particular, in the first MPC meeting after the inflation an increase in the rate decreases returns, in the following MPC meeting an increase in the rate increases returns, and in the subsequent meeting the impact on the stock market is diluted (as the next inflation report approaches). We do not find statistically significant effects on the days of MPC minutes publication on stock returns. The MPC meetings that follow a MPC minutes showing unanimity, however, lead to a market overreaction. Finally, we gauge the relative importance of the volatility-decreasing

[6] The only other analysis available for the UK is Gregoriou *et al.* (2009) who find a positive relationship between level shocks and stock returns only for the period 2007-2009 but a negative relationship for their full sample (1999-2009).

(uncertainty coordination factors) and volatility-increasing (news) effects of the inflation report and MPC minutes publications.

The following Section provides a selective literature survey. Section 3 introduces a benchmark model and examines the potentially asymmetric stock market's reaction to monetary policy. Section 4 considers the implications of inflation targeting and the MPC's introduction for the monetary policy's effects on stock returns. Section 5 analyzes the effects of central bank communication on stock returns and Section 6 focuses on the effects on conditional volatility. Finally, section 7 concludes.

2. Selective Literature Review

Ample empirical evidence exists on the effects of monetary policy on stock returns and the bulk of it finds that tightening (easing) monetary policy leads to higher (lower) stock prices (e.g, Bernanke and Kuttner, 2005; Ehrmann and Fratzscher, 2004; Rigobon and Sack, 2004). While most of this evidence is from the US, a number of studies provide international evidence (e.g. Honda and Kuroki, 2006). Moreover, Bredin *et al.* (2005), Lastrapes (1998) and Conover *et al.* (1999) provide evidence of an inverse relationship between monetary policy rates and stock returns in the UK. Nevertheless this relationship seems to be less pronounced as compared to the US.

The literature that investigates the relationship between stocks and monetary policy resorts to various empirical methodologies. Jensen and Johnson (1995) use an event-study analysis and find that interest rate drops (hikes) are followed by periods of higher (lower) average returns. Bomfim (2001) employs a GARCH-type model and shows that monetary policy announcements increase stock market returns' volatility. Vector Autoregression models allow to extract the impulse response of asset prices to orthogonalised monetary

policy shocks (Thorbecke, 1997; Patelis, 1997; Lastrapes, 1998). The bulk of this empirical evidence, however, emerges from "event-study like" methodologies which measure the impact of asset returns on monetary policy shocks on announcement days (e.g., Kuttner, 2001; Bernanke and Kuttner, 2005; Thorbecke, 1997, Rigobon and Sack, 2004; Angeloni and Ehrmann, 2003).

Cook and Hahn (1989), constitutes one of the first attempts to use such a methodology and this approach has been replicated in various different contexts. Relying on monetary policy shocks to gauge the impact of monetary policy announcements on asset prices is crucial in such studies, since it avoids an underestimation of the stock market reaction (Fatum and Scholnick, 2008). Another strand of research proposes further decomposition of monetary policy shocks into the unexpected developments in the future path of interest rates and a component attributed to shocks to the timing of an anticipated action, as each type of shocks might exert different impact on asset prices (Gürkaynak *et al.* 2005; Bernanke and Kuttner, 2005; Kearns and Manners, 2006).

The relationship between monetary policy actions and stock returns, however, might exhibit asymmetries, as each announcement can have a different impact on public's expectations. Bernanke and Kuttner (2005) and Kearns and Manners (2006) find that news about future policy rates affect significantly more asset prices as compared to news about the timing of future policy actions. Bomfim (2001), Jensen and Johnson (2005), and Lobo (2000) report that stock returns react in a stronger manner to tightening monetary policy actions, as compared to easing ones[7]. Empirical evidence also exist showing that small firms' stocks overreact to tightening shocks, as compared to large firms' stocks (Perez-Quiros and Timmermann, 2000; Thorbecke, 1997; Ehrmann and Fratzscher, 2004).

[7] Lobo *et al.* (2006) finds that tightening shocks exert a larger impact on currency prices than easing shocks.

Another, more recent, stream in the literature examines the impact of central banks' communication on stock returns. Transparency in monetary policy practice constitutes a key feature of inflation targeting (Bernanke, 2004a; King, 2007), as it can potentially contribute to the anchoring of expectations around the inflation target. One could even argue that transparency is the *modus operandi* of inflation targeting. This paper examines the effects of transparent central bank communication on equity returns, as manifested in the UK through the publication of the inflation report and the MPC minutes. If the BoE assigns to the publications of the inflation report and of the MPC minutes the task to "increase awareness and understanding of its activities", we should have a clear view as to how these channels of communication impact on financial market participants. This paper assesses the effects of these means of communication for the markets and identifies the way that their effects materialize.

A spate of recent papers produces empirical evidence on the effects of central bank communication on asset prices. An effective central bank communication, according to Ehrmann and Fratzscher (2007a), should not only improve predictability of future policy actions, but also it should influence asset prices in the intended way. There is empirical evidence indeed that communication can improve predictability. Fracasso *et al.* (2003) finds that muted responsiveness of stocks to monetary policy announcements can be attributed to high quality inflation reports. Ehrmann and Sondermann (2009) find that inflation reports' releases can contribute to public's beliefs coordination and subsequently reduce volatility in interest rates as well as the responsiveness of financial assets to specific macroeconomic announcements. Gerlach-Kristen (2004) finds that the MPC Minutes' releases help to predict future policy. Ehrmann and Fratzscher (2007a), however, find that the highly dispersed voting record in MPC meetings makes the Bank of England's policy less predictable as compared to that of the European Central Bank and the Fed.

Existing empirical evidence suggests that the various types of central bank communications can have significant effects on asset prices (Kohn and Sack, 2003; Reeves and Sawicki, 2007; Andersson *et al.* 2006; Ehrmann and Fratzscher, 2007a; Rosa and Verga, 2008). Reeves and Sawicki (2007) find that the releases of BoE's inflation reports and of the minutes of the MPC meetings increase volatility in financial assets. Andersson *et al.* 2006 find that inflation reports and minutes from monetary policy meetings influence Swedish interest rates, but less than the speeches and the policy rate changes. Empirical evidence from other types of communication by Kohn and Sack (2003) and Rosa and Verga (2008) suggests that FOMC and ECB statements following same-day policy decisions affect financial markets significantly.

Although central bank communications through publications, are typically treated as monetary policy actions (see indicatively Andersson *et al.*, 2006), they do not produce monetary policy shocks. Kohn and Sack (2003) and Reeves and Sawicki (2007), for example, assume that monetary policy shocks exist only on days of policy decisions, and they do not measure the sign of the impact that a communication has on asset prices. Ehrmann and Fratzscher (2007a) also assume that there are no policy shocks on days of communications, and choose judgemental methods to assess future economic and monetary policy inclination on days of communications. Andersson *et al.* (2006) measures the shock from inflation reports' releases as the difference between the inflation forecast and the target set by the Swedish central bank and the shock from the minutes' release by using a "minority view indicator". Monetary policy shocks on days when important acts of communication occur, however, encapsulate updates in market's beliefs about the future monetary policy stance; and their co-movement with equities can reveal how expectations about monetary policy change due to these publications. Extracting monetary policy shocks from communication publications is a natural extension to this literature when one considers that the role of

effective communication is to help investors "develop more accurate expectations of the likely future course of the [policy] rate" (Bernanke, 2004a).

3. Stock market reaction to monetary policy: Benchmark model and asymmetries

3.1 Benchmark model

As a benchmark for our analysis we examine the contemporaneous effects of monetary policy announcements on stock returns, following the methodology of Bernanke and Kuttner (2005). This approach implicitly assumes that monetary policy affects equities only on monetary policy rate change days and traces back to Cook and Hahn (1989). The specification used is as follows:

$$r_i = \alpha + \beta \Delta i_i^{UK} + \varepsilon_i, \qquad (1)$$

where r_i stands for daily returns on the FTSE All Share Index, Δi_i^{UK} is the raw changes in the UK official policy rate, and the subscript *i* denotes the policy rate change days.

Using raw changes in the policy rate as a gauge for monetary policy stance is likely to produce small reaction estimates. For this reason, we decompose the raw monetary policy actions into an expected (ex_i) and an unexpected element ($surp_i$), following the technique developed by Kuttner (2001). We calculate the unexpected element of a monetary policy action as the change in the 3-month sterling futures rate (f_i) on a policy decision day, while the expected element is the difference between the actual policy change and the unexpected component. The benchmark specification of policy shocks is extracted by the 3-month sterling futures rate, which is also the instrument used by two other studies in the UK (Bredin *et al.*, 2007 and Gregoriou *et al.*, 2009). Figure 1, plots the unexpected component of the monetary policy actions in our sample. The reduced volatility that this variable exhibits after

1997 stands supportive to King's (1997) assertion, that within a transparent system the news does not come from the MPC meetings. In addition, we use the 1- and 3-months Libor rate to calculate monetary policy shocks in a similar manner to Kearns and Manners (2006).

- Please insert Figure 1 here-

The expected and unexpected elements of a monetary policy action correspond to the following specifications:

$$\begin{aligned} surp_i &= f_i - f_{i-1} \\ ex_i &= \Delta i_i^{UK} - surp_i \end{aligned}, \tag{2}$$

so that the benchmark model of equation (1) can be written as:

$$r_i = a + \beta_1 ex_i + \beta_2 surp_i + \varepsilon_i . \tag{3}$$

The required orthogonality assumption of the error term ε_i, however, is violated when the model suffers from omitted variables and/or endogeneity problems. They are likely to emerge when other factors influence the stock prices during the estimation period and when developments in stock markets affect the policy rate respectively (see Rigobon and Sack, 2003). Using daily data addresses these issues. Firstly, the short (one-day) estimation period reduces the possibility that effects from other news enter the relationship. Secondly, on a policy decision day there is only one policy decision, and therefore this announcement cannot be significantly influenced by the stock market developments of that day[8].

Our full sample comprises of 241 observations and examines the period from the rate hike on the 26th of November 1982 until the MPC meeting on the 8th of April 2010. This

[8] There is evidence that studies using intra-day data yield larger reaction estimates than studies using daily data (Andersson, 2007; Gürkaynak *et al.* 2005).

sample includes, in a similar vein to Bernanke and Kuttner (2005), not only dates of policy rate changes, but also MPC meeting days when no policy rate change took place. This is consistent with King's (2005) statement that "market interest rates react to what the central bank is expected to do" and not only to policy rate changes. We exclude the observation on the 18th of September 2001 from the sample, because it refers to the policy meeting which came as BoE's response to the 9/11 events and thus our working sample contains 240 observations.

The first row of Table 1 reports the results from the regression in equation (1). We find that there is a negative impact of monetary policy actions on stock returns. Nevertheless, this effect is weak and statistically significant only when the observation of the extreme cut in the official rate in November 2008 is not included in the sample. The next three lines of Table 1, report the results from the linear regression of equation (3), where the expected and unexpected elements of the policy announcements replace the raw change in the policy rate. Under this specification stronger relationships emerge, as an 1% unexpected drop in the policy rate is associated with an almost 1.5% hike in stock prices. The choice of the market interest rate used to calculate the unexpected element of monetary policy actions does not affect the results significantly.

In addition to substantiating the presence of a negative relationship between monetary policy shocks and stock returns, these results also show that the actions of the BoE are to a great extent expected by the market. Moreover, as it is intuitively expected, the relationship between stock returns and the expected element of monetary policy actions is not significant, both numerically and statistically. The possibility of having some extreme observations which might conceal the real impact or exert disproportionate effects on the outcome of the estimation is typical in this type of studies. In the appendix we provide a detailed explanation

of how we treat outlier observations and Panel B of Table 1 reports the results after excluding them from the estimation; the results after the exclusion of the outliers show similar coefficient estimates.

- Please insert Table 1 here-

To test the magnitude of the endogeneity bias and the omitted variables problems, we also employ the "identification through heteroscedasticity" methodology of Rigobon and Sack (2004). This uses an instrumental variables approach and extracts heteroscedasticity-based estimates for equities' reaction. The fifth row of Table 1 reports the coefficient estimate $\hat{\alpha}^{i}_{het}$ of Rigobon and Sack (2004), which is somehow larger in absolute terms than that extracted by the OLS estimation. We also calculate the Rigobon and Sack's (2004) test statistic $\hat{\delta}_{es,iv}$ to test whether the reaction estimates from the least squares and the identification through heteroscedasticity methodologies are equal. The F-test for this test statistic, reported in Table 1, rejects the equality hypothesis, especially when the extreme cases are not included in the estimations, leading to the conclusion that the reaction estimates from the OLS estimations are not significantly biased.

3.2 The asymmetric nature of the monetary policy shocks and stock returns nexus

The benchmark model used in the previous section implicitly assumes symmetric reactions to all policy actions. Thus, it may miss out important aspects of the relationship and produce misleading results. This section examines the robustness of the benchmark's model findings to the presence of asymmetric reactions, including the direction of the policy rate changes (tightening versus easing actions and change versus no change in policy rate), the sign of the surprises (tightening versus easing shocks), and content of the surprises (timing versus level shocks).

-Please insert Table 2 here-

Table 2 presents the results on the benchmark specification by the inclusion of interactive dummy variables in a similar manner to Bernanke and Kuttner (2005). The coefficient estimate of the interactive term which captures the additional impact of stocks on the 48 dates of tightening policy actions is statistically insignificant. Thus, we do not provide evidence that the direction of the policy rate change influences significantly the relationship between monetary policy shocks and stock prices. Nevertheless, the coefficient estimate of monetary policy shocks is significantly reduced in size after the inclusion of the interactive term, and this can be perceived as a preliminary indication that interest rate hikes trigger larger responses to stock returns than interest rate cuts.

The coefficient estimate of the interactive term capturing the additional impact of stocks on the 218 MPC meetings with no policy rate change is statistically insignificant, suggesting the absence of asymmetry on these days. This finding differs from the evidence produced on the US (e.g., Bernanke and Kuttner, 2005; Roley and Sellon, 1998). Table 2 also reports the results from the inclusion of an interactive term capturing the additional impact of monetary policy on stock returns on the 96 sample days when there are hawkish market expectations. The coefficient estimate of the interactive term is statistically insignificant; however the slope estimate of the stock market's reaction to monetary policy shocks is reduced after the inclusion of the interactive term, and this suggests the possibility that the UK stock market overreacts to the arrival of unexpected tightening shocks.

Rigobon and Sack (2004) suggest that the 3-month futures rate, as an instrument for calculating monetary policy shocks, captures mainly expectations about the future path of

official rates because longer term futures rates are less influenced by the timing of policy actions. To estimate the effects from the changes in the timing of expected policy actions on stock returns, we include in our model the variable timing shocks (*tim*), which is the difference between level shocks and daily changes in the 1-month Libor on policy announcement days.[9] This term captures the part of expectations about the future path of interest rates (extracted by the 3-month sterling futures rate) which is not reflected in current monetary policy shocks (extracted by the 1-month Libor). A timing shock of positive (negative) sign is indicative of postponements (advancements) in expected tightening policy actions.

The specification used to examine stocks' reaction to timing and level shocks is

$$r_i = a + \beta_1 ex_i + \beta_2 tim_i + \beta_3 surp_i + \varepsilon_i , \quad (4)$$

where β_2 shows the market's additional reaction when there are news about the timing of anticipated policy actions, and β_3 shows equities' reaction to information about the future path of interest rates (as if there are no timing shocks). Table 2 reveals that level shocks exhibit a larger coefficient estimate after the inclusion of the timing variable and that the coefficient estimate of the timing variable is statistically insignificant. Both results suggest that investors react mainly to news about the future trajectory of interest rates and not to news about the timing of policy actions.[10]

Finally, we examine whether the effects of monetary policy decisions are firm-specific and we extract the effects of monetary policy announcements on some suitably constructed

[9] This specification is in the spirit of Bernanke and Kuttner (2005). Nevertheless, in the absence of a current month policy rate futures instrument, we use 1-month Libor rates to gauge expectations about current monetary policy similarly to Kearns and Manners (2006).

[10] The two extreme cases in October-November 2008 account for the large and statistically significant coefficient estimate of the reaction to timing shocks in the full sample.

portfolios according to their market capitalisation and their book-to-market (B/M) ratios. We use the Fama and French (1993) approach to construct "small" and "large" portfolios and the results are provided in Table 3.[11] Existing empirical evidence and economic intuition suggest that smaller companies are more vulnerable to monetary policy risk and thus they respond stronger to monetary policy shocks. Regressing small and large portfolios' returns on timing and level shocks yields, however, different results, as small portfolio's reaction to level shocks on the day of the announcement is paradoxically smaller than that of the level shocks.

Focusing on the reactions of B/M portfolios, we find that the value portfolio, which consists of firms with higher B/M ratios and lower *q* values, is affected more than the growth portfolio, which consists of stocks with lower B/M ratios and higher *q* values. This finding suggests that firms with more favourable investment opportunities are more immune to monetary policy changes. This is because firms with assets of relatively higher value may find it easier to raise funds than those with assets of lower value. This result is intuitively consistent and accords with prior empirical evidence from the US (e.g., see Ehrmann and Fratzscher, 2004).

-Please insert Table 3 here-

4. Monetary Policy Regimes and Stock Market Returns: Inflation Targeting and the Monetary Policy Committee

4.1 Monetary policy, stock market returns, and the MPC framework.

[11] Table 3 provides more information on the construction of the portfolios.

This section focuses on the period of the MPC framework adopted by the BoE and examines the equities' reaction to monetary policy actions before and after May 1997. Moving to a regime that allows better anchoring of inflation expectations is likely to imply changes in the above relationship, since inflation expectations is the most "natural" way through which monetary policy affects asset prices (Cornell, 1983). Our analysis also includes timing shocks because during periods of relative stability in policy rates, news about changes in the timing of expected BoE's actions is likely to become more significant. To explore the reaction of stocks to timing and level shocks before and after June 1997 we estimate the equation

$$r_i = a + \beta_1 ex_i + \beta_2 tim_i + \beta_3 surp_i + \beta_4 (tim_i \times post-97_i) + \beta_5 (surp_i \times post-97_i) + \varepsilon_i , \qquad (5)$$

where *post-97*$_i$ is a binary dummy taking the value of 1 for the 155 observations after June 1997 and zero otherwise.

-Please insert Table 4 here-

The results, reported in Table 4, show that the coefficient estimates of the interactive terms have opposite signs from those of the timing and level shocks. Moreover, the timing shocks influence significantly stock prices after 1997, and this can be explained by the relative stability of policy rates expectations during this period. After the introduction of the MPC framework news about postponements (advancements) in future monetary policy actions is negatively (positively) related to stock prices. During this period, which is characterised by greater predictability of future policy actions, any postponement possibly raises the level of uncertainty in the market, and thus affects stocks negatively. On the contrary, market reacts to policy action advancements with the attitude "the sooner the better", as it probably sees that such tightening actions proactively resolve any growing uncertainty.

Moreover, the level shocks and stock returns are positively related on announcement days after 1997, as the coefficient estimate of the interactive term is positive, statistically significant and larger in absolute terms than that of the level shocks variable. A possible explanation for this reversal in the relationship could be the proactive nature of BoE's actions in the context of the inflation forecast targeting after 1997. Kaul (1987), for example, suggests that when monetary policy is pro-cyclical, the relationship between inflation and stock returns is positive because higher (lower) inflation is associated with higher (lower) money demand. Therefore, under a proactive monetary policy regime a tightening (expansionary) shock signifies the central bank's response to expectations about higher (lower) growth in order to retain inflation expectations close to the target; and the positive impact on stocks from news about higher growth offsets the negative impact from higher discount rates. Moreover, under the transparent MPC framework better predictability of future short-term rates reduces risk premia in capital markets, and this also reduces the negative impact of monetary policy shocks on stock returns (Bernanke, 2004a).[12]

Table 4 also reports results on the response of equities to monetary policy announcements when the last refer to a reversal in the direction of interest rates. Evidence from the US, for example, shows that the stock market overreacts to "interest rate reversals" (Bernanke and Kuttner, 2005). While our specification retains the post-97 interactive terms, we now include two additional interactive dummies in order to capture the impact of the 31 cases of interest rate reversals. The results show that on the days of interest rate reversals level shocks do not exert an additional impact on stocks; however, on these days there is an additional impact to the timing shocks, as the coefficient estimate of the interactive term is negative and

[12] Bernanke and Kuttner (2005) report that tightening monetary policy affects equity returns negatively, because it increases the equity premium. They also argue that this is likely to happen because tightening shocks are associated with higher inflation news.

statistically significant. The signs and the statistical significance of the coefficient estimates of the post-97 interactive terms remain essentially unaffected, and thus are robust to the inclusion of the reversal interactive terms.

4.2 Long-short interest rates and stock market returns in the UK

Expectations about future policy rates are updated continuously and these changes are reflected across the yield curve. Short-term interest rates reflect the current policy rate setting, while long-term interest rates incorporate market expectations about future short-term interest rates, and the improved predictability of monetary policy actions under a transparent framework (as the under the MPC) influences both short- and long-term interest rates (Bernanke, 2004a). Our focus here is on whether the switch to the MPC regime affects the relationship between interest rate differentials of shorter and longer maturities and stock returns.

To consider the effects of the updating of future policy rates expectations on a daily basis we examine the relationship between changes in London interbank interest rates of various maturities and stock returns across the two sub-periods.[13] The London interbank interest rates move close to the policy rate and expectations about policy rates are reflected on them. Although our focus is only on the levels, we use a daily GARCH-type framework which is typical in studies examining the relationship between daily updates in monetary policy expectations and financial assets. This type of models can address the statistical problems of

[13] Henry (2009) also uses a Markov Switching EGARCH model to consider the relationship between Libor rate differentials and stock market returns in the UK, but this study's focus is on the impact of interest rate differentials on stock market returns' volatility, and finds that this relationship is regime dependent.

serial correlation and heteroscedasticity in the error term when using daily financial data (e.g. Fatum and Scholnick, 2006; Ehrmann and Fratzscher, 2007a; Ehrmann and Sondermann, 2009).

We use an EGARCH(1,1) framework as follows:

$$r_t = c + \beta_{1,m} \Delta i_{m,t} + \varepsilon_t \tag{6}$$

$$\log(\sigma_t^2) = \omega + \beta_1 \log(\sigma_{t-1}^2) + \alpha\left(\left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right| - \sqrt{\frac{2}{\pi}}\right) + \gamma \frac{\varepsilon_{t-1}}{\sigma_{t-1}}, \tag{7}$$

where $\Delta i_{m,t}$ stands for the daily change in London interbank interest rate of maturity m of 7-days, 1-month, 3-months, 6-months and 1-year.

-Please insert Table 5 here-

We split the sample in two periods, before and after June 1997, and we report the estimation results in Table 5. Before 1997 the UK stock returns are negatively related with interest rates of maturities longer than 3 months, while during the period afterwards the relationship with longer-term maturities disappears and stock returns are only related with short-term rates –seven days Libor. The more pronounced relationship between stock returns and longer-term interest rates before 1997 suggests that uncertainty about future policy rates and inflation is an important concern during this period. After 1997, however, only short term rates are related to stock returns. The lack of any reaction to changes in the long-term rates could be interpreted as reflecting the better anchoring of inflation expectations and the lower inflation premia implied.

4.3 Quantitative easing

The period after March 2009 is of particular interest for monetary policy since the BoE resorted to "quantitative easing" as a means of conducting monetary policy. Although during this period there is no change in policy rates, the MPC meeting announcements are likely to be informative as they can shape expectations about "the length of time the public expects interest rates to maintain at near zero levels" (Kobayashi *et al.* 2006). To gauge how monetary policy shocks and stocks are related during this period, we include along with the post-97 interactive terms, two more interactive terms aiming to capture the impact on equities of the 13 announcements during the quantitative easing period. The results from this estimation, reported in Table 4, show that stock market returns exhibit a particularly strong additional reaction to timing shocks during this period. News about postponements (advancements) in future tightening are strongly negatively (positively) related to stock returns because this news stand indicative of a delay (advancement) in the improvement of the economic environment.

In Table 5 we report evidence on the effects of the quantitative easing on the relationship between stock market returns and the short-long Libor interest rates.[14] The significant marginal impact of the 1-year Libor rate on stock returns during this period indicates the emergence of inflation expectations. This is not surprising considering that the objectives of quantitative easing imply the higher inflation expectations.

5. The Bank of England's Communication Framework and Stock Market Returns

This section explores the effects of BoE's communication on stock returns firstly by investigating the relationship between stock returns and monetary policy shocks on days of

[14] Equation (6) now becomes $r_t = c + \beta_{1,m}\Delta i_{m,t} + \beta_{2,m} eq_t \Delta i_{m,t} + \varepsilon_t$.

inflation reports' and of minutes of MPC meetings' publications. We use revisions in market interest rates to extract the monetary policy news on publication days, because one can fairly assume that any update in monetary policy expectations on these days can be attributed to the content of these publications. The empirical model we use is:

$$r_i = a + \beta_1 tim_i + \beta_2 surp_i + \varepsilon_i , \quad (8)$$

and *i* represents the days of either inflation reports' or minutes of MPC meetings' releases. *surp* is the daily change in 3-month sterling futures rate, and *tim* is the difference between *surp* and the daily change in 1-month LIBOR.

-Please insert Table 6 here-

Table 6 reports the results from the regression of daily stock returns on level and timing shocks when *i* coincides with the dates of inflation reports' publications. The quarterly schedule of the inflation reports' release leaves only 52 usable observations; the first one being on August 13th, 1997 and the last one being on May 12th, 2010. In order to control for outlier observations we use the same methodology as in the previous section and we identify two cases: November 12th, 2008 and May 13th, 2009. In the first instance there was a sizeable decrease in stock returns on the inflation report's publication day, as inflation report contained information about worse than expected economic slowdown and as a result led markets shaping expectations about lower stock prices. Moreover, at the inflation report press conference on May 13th 2009 the Governor announced that recovery would be slower than initially expected, and this news caused a more than 2% decline in stock prices.

Regressing stock returns on timing and level shocks on the dates of inflation reports' releases, indicates that such releases affect equities mainly when they reveal information about the timing of future policy actions. The coefficient estimate of the reaction to news

about the future level of interest rates is smaller than that to timing shocks and is only statistically significant at the 10% level of significance. Moreover stock returns are positively related to timing shocks and negatively related to level shocks, as is the case before the introduction of the MPC framework. The BoE states that the inflation report "sets out the detailed economic analysis and inflation projections on which the BoE's MPC bases its interest rate decisions". Therefore, tightening monetary policy shocks reflect expectations about higher inflation, and any news about postponements is good news as investors probably see a possibility of reversal. Since inflation expectations during this period are well anchored, it is not a surprise that news about timing of anticipated policy actions are priced more by investors. When we re-estimate the model for the shorter sample until the end of 2006, to avoid the effects of the global financial turbulence, the reaction coefficients are both of same signs and statistically significant at the 5% level of significance.[15]

The efficiency of inflation report as a means of communication depends not only on the quality of its content, but also on the timing of its release (Geraats, 2006; Ehrmann and Fratzscher, 2007b). This is because, all relevant information available to the central bank, reflecting any informational advantage, is likely to be incorporated in the policy decision itself. Ehrmann and Fratzscher (2007b), for example, find that financial markets react stronger to communications prior to policy decisions. Ehrmann and Sondermann (2009) argue that the inflation report is a public announcement which is likely to overshadow the information from other macroeconomic announcements.

To characterize the channel through which the central bank's communication acts influence the way MPC meetings' decisions are perceived by the market we produce some evidence on whether the timing of the publication affects the way stocks react to MPC

[15] Results are not reported here but are available on request from the authors.

meetings' announcements. In particular, we estimate the marginal impact of MPC meetings' announcements on stock returns on the first, second, and third MPC meetings following the release of an inflation report, using the following model:

$$r_i = a + \beta_1 ex_i + \beta_2 tim_i + \beta_3 surp_i + \beta_4 (post-97_i \times tim_i) + \beta_5 (post-97_i \times surp_i) + \beta_6 (\inf_i \times tim_i) + \beta_7 (\inf_i + surp_i) + \varepsilon_i \quad , \quad (9)$$

We use three alternative specifications for the binary dummy inf_i. Firstly, it takes the value of 1 for the first 52 MPC meetings following the release of the inflation report and zero otherwise. Secondly, it takes the value of 1 for the 52 second MPC meetings following the release of the inflation report and zero otherwise. Finally, it takes the value of 1 for the 52 MPC meetings preceding the inflation report releases and 0 otherwise. The sample includes the MPC meetings when no policy change took place. The specification also includes slope dummies for capturing the potential impact of the policy regime shift after 1997.

The above results indicate that the relationship between level shocks and stock returns presents differences based on the time distance of the MPC meeting from the publication of an inflation report. In the first policy meeting following the release of an inflation report, although the sign of the interactive term capturing the additional impact to level shocks is positive, it is also statistically insignificant; however statistically insignificant is also the coefficient estimate of the interactive term capturing equities' additional impact to level shocks during the period after 1997, and this indicates that on these days equities respond only to level shocks and negatively. One possible explanation for this reaction could come from the information about future output contained in the inflation report. The positive relationship between news about future interest rates and stock returns after 1997 is due to market's expectations about future growth under a proactive monetary policy regime.

Information contained in the inflation report can provide investors with relatively accurate forecasts about future output, and therefore stock markets on these MPC meetings days price only the higher discount rates.

The additional impact of both types of policy shocks on stock returns on the second MPC meeting following the release of the inflation report is larger in size than that on the first MPC meeting. In particular, the coefficient estimate of the interactive term capturing the additional impact to level shocks is positive and statistically significant but only at the 10% level of significance.[16] This result indicates that the positive relationship between level shocks and equities after 1997 is due to these announcement days. This MPC meeting decision reveals news about future output, as previous forecasts on growth included in inflation forecasts have become stall (Ehrmann and Sondermann, 2009). Finally, on the policy meeting one week before the publication of the inflation report we find an additional negative response of stocks to the level shocks which, however, is statistically significant only at the 10% level. On these days the response of equities to level shocks appears to be much smaller, or even muted, compared to that observed in the other two types of MPC meetings, as apparently the market is in anticipation of the inflation report release a few days later.

The publication of the minutes of the MPC meetings constitutes another major building block of the contemporary communication scheme of the BoE. MPC minutes are released almost two weeks after the policy decision date and reveal the voting records of the MPC members. In order to explore whether this publication has information content relevant for equity pricing we regress stock returns on timing and level shocks on days of minutes of

[16] Estimating the model until the end of 2006 results in a reaction coefficient of the same sign and magnitude, but with statistical significance at the 5% confidence level.

MPC meetings publications. The full sample of this estimation contains 155 publications with the first being on July 16th 1997 and the last on May 19th 2010. We also calculate influence statistics for each observation in the estimation and we identify three cases which exert an unduly large impact on the reaction estimates. These are the publications of the MPC meeting minutes on September 19th, 2007, on September 17th, 2008, and on October 22nd, 2008.

The MPC meetings minutes published on September 19th 2007 revealed MPC members' views about receding inflation risks, and this was perceived as good news by the market during a period of high uncertainty as the subprime crisis was at its early stages at that point. The minutes published on September 17th 2008 triggered a significant drop in equity prices, as they boosted expectations about a rate cut amid news of high unemployment and during a period when UK was at the edge of recession. Finally, the minutes' publication of October 22nd 2008 coincided with in a sharp drop in equity prices, as they revealed the MPC members' assessments about the extent of the economic slowdown. The estimation results are presented in Table 7 and show that there is no significant relationship between monetary policy shocks and stock returns on these days. The lack of a significant reaction is in contrast to the findings of Gerlach-Kristen (2004) who report that the minutes of the MPC meetings are "informative for future policy". Instead, it stands supportive to King's (2007) assertion that this publication mainly reveals the way that MPC members perceive future economic conditions and does not contain monetary policy information.

-Please insert Table 7 here-

The minutes of the MPC meetings also include the voting pattern of the MPC members. Early debates following the adoption of the MPC framework in the UK and the creation of the European Central Bank focused on whether the central bank's board members' voting record should be published. More recent issues pertain to whether they facilitate or impair the

effectiveness of communication. Ehrmann and Fratzscher (2007a) for instance, raise some doubts regarding the effectiveness of MPC meetings' minutes releases, because there are many cases of dissent voting among the members of the MPC. We examine whether the voting pattern of the MPC members influences the relationship between monetary policy announcements and stock returns by identifying how markets perceive the strongest signal that a voting record can transmit; unanimity.

Firstly, we examine the additional impact that timing and level shocks have on stock returns on days of minutes' of MPC meetings releases when the voting record shows a unanimous decision. That is, when all members agree as to the sign and the size of the policy announcement. The results presented in Table 7 do not show any additional impact as the coefficient estimates of the interactive terms are statistically insignificant. In addition we examine whether releases of voting records influence the way the equity market reacts to MPC meetings decisions, as they reveal news about the way these decisions are made. To do so we use the empirical framework of the previous section with the 240 observations, augmented by two new interactive terms. These terms aim to capture the additional impact to timing and levels shocks on MPC meetings following news of a unanimous decision. That is,

$$r_i = a + \beta_1 ex_i + \beta_2 tim_i + \beta_3 surp_i + \beta_4 (tim_i \times post-97_i) + \beta_5 (surp_i \times post-97_i) + \beta_6 (tim_i \times una_i) + \beta_7 (surp_i \times una_i) + \varepsilon_i \quad , \quad (10)$$

where una_i is a binary dummy variable taking the value of 1 for the MPC meetings following the 63 releases of minutes of MPC meetings unanimous decisions, and zero otherwise.

The results from this estimation, reported in Table 7, show that on policy meeting days following news about a unanimous decision there is no reaction to timing shocks and there is

an additional negative reaction to level shocks.[17] A unanimous decision signifies that all members of the MPC perceive economic developments in a similar manner. Therefore, any news about revisions in expectations only two weeks after this news might be perceived as an indication of unexpected news, and thus raises market uncertainty.

6. The Effects of Bank of England's Communication on Stock Returns' Conditional Volatility

Central banks' communications might have an impact not only on the price of an asset, but also on its volatility because they can influence public's expectations about future monetary policy. The impact of central bank information releases on volatility can take two forms: on one hand, public announcements (including BoE's inflation report) can reduce market volatility as the announcement can shape public's beliefs. On the other hand, to the extent that the news contained in the announcement increase uncertainty market volatility rises (Ehrmann and Sondermann, 2009). Thus, central bank publications, apart from the volatility reducing effect due to the reduction in expectations' heterogeneity, might also have a volatility increasing effect because of the monetary policy news contained in them.

Ehrmann and Sondermann (2009) develop a framework for examining whether the financial markets reaction to public signals depends on the relative importance of private information in agents' information set. The authors consider the reaction of the UK short-term interest rates and their volatility to the inflation report and the macroeconomic

[17] This reaction appears similar to the one we report when we examine the additional impact of level shocks on policy meeting days preceding the release of an inflation report. It should be noted that these two interactive terms have in common only 19, out of the 63 MPC meetings following a unanimous decision and the 52 meetings preceding the inflation report release.

announcements. In this paper we use a similar methodology to test for the effects of the BoE communications on equities' conditional volatility.

The previous section established that the inflation report has information content, which contributes to the public's updating of beliefs about stock market prices. This section focuses on the monetary policy news incorporated in the BoE's publications, exploring how they affect market volatility. We consider the period from the introduction of the MPC framework (June 1st, 1997) until May 31st, 2010. As above, we calculate monetary policy shocks from market interest rates, but now we consider daily frequencies. We define level shocks ($surp_t$) as daily changes in the 3-month sterling futures rate. Figure 2 plots the time series evolution of monetary policy shocks from November 5th, 1982 to May 31st, 2010. Casual observation of the plots suggests that after 1997 the future trajectory of monetary policy appears more predictable.[18] Moreover, one can observe that expectations are updated on a daily basis, and not only when actual changes in policy rates occur. Thus, examining the impact of expectations updating on equities requires the use of a daily framework.[19]

-Please insert Figure 2 here-

The empirical implementation uses an EGARCH (1,1) model with dummies following the spirit of Ehrmann and Sondermann (2009). The EGARCH (1,1) specification is:

$$r_t = c + b_1 r_{t-1} + \sum_{j=1}^{2} d_j dum_t^j \; surp_t + \varepsilon_t \tag{11}$$

$$\log(\sigma_t^2) = \omega + \beta_1 \log(\sigma_{t-1}^2) + \alpha\left(\left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right| - \sqrt{\frac{2}{\pi}}\right) + \gamma \frac{\varepsilon_{t-1}}{\sigma_{t-1}} + \sum_{j=1}^{2} \delta_j dum_t^j + \sum_{j=1}^{2} s_j dum_t^j \mid surp_t \mid, \tag{12}$$

[18] This coincides with the period after the introduction of the MPC framework.

[19] Prior evidence from Fatum and Scholnick (2006), for example, shows that daily revisions in monetary policy expectations constitute a significant element of the daily determination of exchange rates.

which exhibits the best fit among the specifications under which the null of no ARCH is not rejected. The variable r_{t-1} is the lagged value of the stock returns, $surp_t$ stands for daily monetary policy news, and dum_t^j is a dummy variable which when $j=1$ it takes the value of 1 on days of inflation report releases and zero otherwise, and when $j=2$ it takes the value of 1 on days of minutes of MPC meetings releases and zero otherwise.

-Please insert Table 8 here-

The results, presented in Table 8, show on impact of the inflation report publication a decrease on stock returns' conditional volatility (coefficient δ_1), as it helps the public coordinate its expectations.[20] The release of the MPC meeting minutes does not trigger any significant decreasing effect on stock returns' conditional volatility (coefficient δ_2).[21] Monetary policy news contained in inflation reports and minutes of MPC meetings, however, exhibit significant volatility increasing effects in the UK stock market (coefficients s_1 and s_2). This result reinforces the general finding of the previous sections, that central bank communication can have significant information content about future monetary policy.

Moreover, it shows that this monetary policy news increases stock market volatility. Ehrmann and Sondermann (2009) attribute the volatility increasing effects on interest rates to the increase in heterogeneous beliefs among the public. When heterogeneous beliefs exist news can be perceived differently by different agents. This can potentially explain the lack of significant reactions to such monetary policy news, at least for the case of MPC meetings' minutes, as investors do not have an accurate indicator of monetary policy stance. Re-estimating the model for a smaller sample, that runs up to the end of 2006, we find that the

[20] Ehrmann and Sondermann (2009) also produce similar results for the impact on the UK short term interest rates' conditional volatility.

[21] Running the estimations with a dummy variable to capture only the 63 dates when a unanimous decision is announced, shows that still no significant impact exists.

volatility decreasing and increasing effects identified above become stronger in magnitude. This result has direct implications for policymakers as, at least in the UK, the volatility increasing effects overshadow the volatility decreasing effects. Failure to incorporate the effects from communication's monetary policy news might compromise communication's objective to achieve coordination of beliefs about future policy rates.

7. Conclusion

Both central banks and financial markets' participants (especially Fed/ECB/BoE watchers) are interested in the potential effects of monetary policy on the stock market. While the literature offers extensive evidence on this relationship for the US, scant work exists for the UK. This paper offers a characterization of UK's monetary policy effects on stock market returns. The UK's monetary policy experienced a distinct regime change with the adoption of inflation targeting where the MPC is responsible for setting policy rates. The explicit inflation target, the modus operandi of the MPC, and the Bank of England's communication framework aim anchoring inflation expectations. We consider if and how the changes in the monetary policy framework and the highly transparent communication policy of the Bank of England have affected the responses of equity market's participants to monetary policy. We also consider directly the effects of inflation report and MPC minutes publications on the market.

We document a strong negative relationship between monetary policy rates and stock returns. Our results remain robust when we test for endogeneity, using three different instruments for the calculation of monetary policy shocks. The size of the reaction is also robust after accounting for direction, size and timing of actions asymmetries. The size of the

response depends on firm characteristics, but on balance the direction of the does not change significantly. In all cases the reaction's size is large enough to suggest that central banks' actions constitute an important input in asset pricing models, but also validate the existence of a stock market channel of monetary policy transmission in the UK.

After the introduction of the MPC framework the stock market's reaction to monetary policy changes. In particular, we find that stock returns are positively related to future policy rates and negatively related to news about postponements, which can be explained by the proactive monetary policy conduct under this new regime. Higher future interest rates reflect monetary policy's response to news about higher growth, which cause higher stock prices, while delays in tightening increase uncertainty about the containment of future inflation. We also consider the effects of monetary policy decisions on stock returns during the quantitative easing period and we find that the timing of future policy actions is an important determinant of stock prices.

To consider directly the effects of the Bank of England's communication on the (level and conditional volatility) of stock returns we focus the publication of the inflation report and the MPC minutes. We find that a strong relationship between monetary policy shocks and stock returns emerges on the days of inflation report publication. Moreover, we present empirical evidence that stock market overreacts to MPC meetings following news about a unanimous decision as reported by the MPC minutes. Finally, inflation reports and MPC minutes releases have information content and their volatility increasing effect of news dominates the volatility decreasing (coordination) effect.

The findings have direct implications not only for countries that have adopted (or consider adopting) fully fledged inflating targeting regimes but also for central banks that implement (or consider to implement) elements of the above frameworks (e.g., changes in the

communications policy without necessarily adopting explicit inflation targets). In addition, any potential response of monetary policy to financial markets developments should have gauged the potential reaction of financial markets to policy shocks. Finally, being aware of monetary policy's effects on the financial markets can be of key importance in assessing alternative policy paths during periods of financial market instability and sensitivity.

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Figure 1
The unexpected component of monetary policy actions.

This graph plots the monetary policy shocks on the 240 monetary policy decision days from November, 26th 1982 until April, 8th 2010. The unexpected element of a monetary policy action is extracted, following the methodology of Kuttner (2001), as the daily revision in 3-month sterling futures rate on the day of a policy decision. The observation on the 18th of September 2001 is not included in the sample.

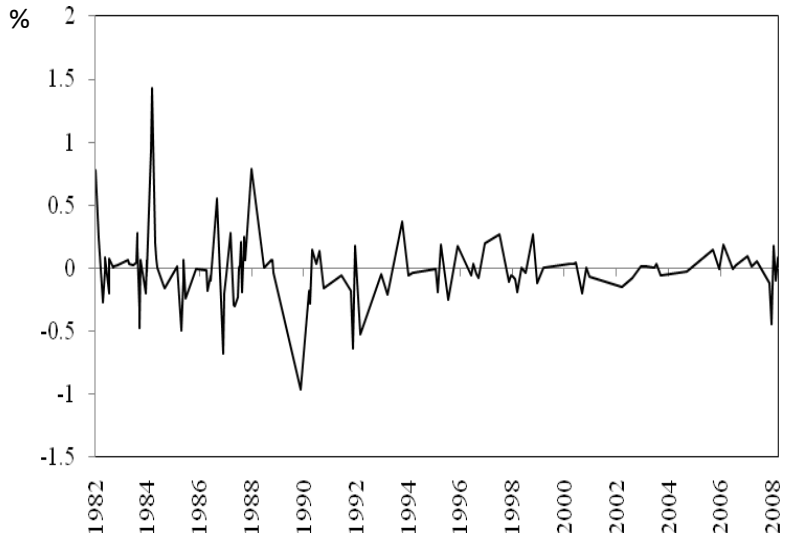

Figure 2
Daily Monetary Policy Shocks

This Figure plots the daily evolution of monetary policy shocks for the period from November 26th, 1982 to the May 31st, 2010. Monetary policy shocks are defined as the daily change in the 3-month sterling futures rate.

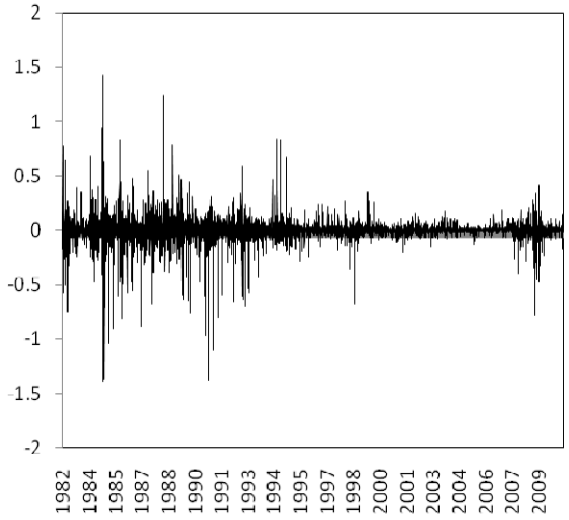

Table 1
The reaction of UK stock prices to monetary policy changes.

The first row of the Table presents the results from the linear regression of daily FTSE ALL Share Index returns on raw changes in the policy rate of the BoE. The next three rows present the results from regressing daily stock returns on the expected and unexpected elements of monetary policy announcements. To calculate the monetary policy shocks we consider three alternative market interest rates: the 1-month Libor, the 3-month Libor and the 3-month sterling futures rate. The fifth row reports the reaction of stocks to monetary policy shocks estimated by the "identification through heteroscedasticity" methodology of Rigobon and Sack (2004), and $\hat{\delta}_{es,iv}$ is the test-statistic testing the equality of the OLS with the heteroscedasticity-based estimate. The sample comprises of 240 observations including both dates when policy rate changes were announced and dates of MPC meetings when no policy rate change was announced. Panel B reports the results from the same estimations after excluding the outlier observations, as identified in the Appendix.

	a	Δi_i^{UK}	ex_i	$surp_i$ (1m Libor)	$surp_i$ (3m Libor)	$surp_i$ (3m ster.)	R^2
Panel A							
Full sample: November, 26th 1982 - April, 8th 2010							
r_i	-0.17 *(-1.86)**	-0.35 *(-1.28)*	-	-	-	-	0.02
r_i	*-0.13 (-1.62)*	-	0.72 (1.34)	-1.91 *(-4.76)****	-	-	0.10
r_i	-0.14 *(-1.71)**	-	0.52 *(1.23)*	-	-1.99 *(-6.56)****		0.10
r_i	-0.17 *(-1.86)**	-	0.05 *(0.18)*	-	-	-1.33 *(-2.93)****	0.05
r_i	-0.12 *(-2.05)***	-	-	-	-	-1.57 *(-2.82)****	0.02
F-stat [p-value] $\hat{\delta}_{es,iv}$	-2.72[0.10]						
Panel B							
Excluding outliers							
r_i	-0.12 *(-1.51)*	-0.55 *(-4.26)****	-	-	-	-	0.06
r_i	-0.09 *(-1.24)*	-	0.09 *(0.33)*	-1.50 *(-4.51)****	-	-	0.09
r_i	-0.09 *(-1.24)*	-	0.05 *(0.31)*	-	-1.74 *(-6.71)****	-	0.10
r_i	-0.10 *(-1.41)*	-	-0.14 *(-0.77)*	-	-	-1.69 *(-6.26)****	0.11
r_i	-0.07 *(-1.72)**	-	-	-	-	-2.11 *(-2.41)***	0.05
F-stat [p-value] $\hat{\delta}_{es,iv}$	0.26[0.61]						

Notes: (.) *t*-statistics calculated using Newey-West estimates of standard errors.
*/**/*** denote significance at 90%, 95%, and 99% respectively.
[.] p-value.

Table 2
Asymmetries in the relationship between Monetary Policy shocks and Equities.

The first row presents the results from the regression of FTSE All Share Price Index returns on the expected (ex_i) and unexpected component ($surp_i$) of a monetary policy announcement on the 240 sample days described in the main body of the text. The binary dummy variable (inc_i) takes the value of 1 when there is an interest rate increase and zero otherwise. The binary dummy (noc_i) takes the value of 1 on days of MPC meetings when no policy rate change took place and zero otherwise. The binary dummy (pos_i) takes the value of 1 on days when the unexpected component of monetary policy announcements is greater than 0, and zero otherwise. (tim_i) are the timing shocks defined as the difference between level shocks and the daily change in 1-month LIBOR. Panel B reports the results from the same estimations excluding the outlier observations, as identified in the Appendix.

	a	ex_i	$surp_i$	$(inc_i x\ surp_i)$	$(noc_i x\ surp_i)$	$(pos_i x\ surp_i)$	tim_i	R^2
Panel A *Full sample: November, 26th 1982 - April, 8th 2010*								
r_i	-0.17 *(-1.86)**	0.05 *(0.18)*	-1.33 *(-2.93)****	-	-		-	0.05
r_i	-0.17 *(-1.72)**	0.05 *(0.18)*	-1.38 *(-1.42)*	0.08 *(0.06)*	-		-	0.05
r_i	-0.16 *(-1.75)*	0.08 *(0.28)*	-1.40 *(-3.02)****	-	2.46 *(0.90)*		-	0.06
r_i	-0.10 *(-1.22)*	0.06 *(0.20)*	-0.57 *(-0.44)*	-	-	-1.31 *(-0.91)*	-	0.06
r_i	-0.13 *(-1.72)**	0.72 *(1.37)*	-2.00 *(-6.23)****	-	-	-	2.44 *(1.90)**	0.10
Panel B *Excluding outliers*								
r_i	-0.10 *(-1.41)*	-0.14 *(-0.77)*	-1.69 *(-6.26)****	-	-	-	-	0.11
r_i	-0.09 *(-1.18)*	-0.12 *(-0.69)*	-1.28 *(-2.04)***	-0.63 *(-0.85)*	-	-	-	0.11
r_i	-0.10 *(-1.31)*	-0.11 *(-0.61)*	-1.76 *(-6.59)****	-	2.08 *(0.80)*	-	-	0.11
r_i	-0.08 *(-1.05)*	-0.14 *(-0.79)*	-1.36 *(-2.01)***	-	-	-0.47 *(0.80)*	-	0.11
r_i	-0.09 *(-1.33)*	0.09 *(0.31)*	-1.90 *(-6.12)****				0.79 *(1.07)*	0.11

Notes: (.) *t*-statistics calculated using Newey-West estimates of standard errors.
*/**/*** denote significance at 90%, 95%, and 99% respectively.

Table 3
Monetary Policy on Size and Book to Market Portfolios

This table presents the results of regression $r_i = \alpha + \beta_1 ex_i + \beta_2 tim_i + \beta_3 surp_i + \varepsilon_i$ which examines the effects of timing and level monetary policy shocks on UK equity portfolios. The portfolios are constructed on the basis of their market capitalisation values and their book-to-market ratios similarly to Fama and French (1993). r_i^{small} is the daily returns from a portfolio containing the *FTSE All Share* index constituent stocks which are included in the first decile after sorting on market capitalisation. r_i^{large} is the daily returns from a portfolio containing the *FTSE All Share* index constituent stocks which are included in the 10th decile after sorting on market capitalisation. r_i^{growth} is the daily returns from a portfolio containing the *FTSE All Share* index constituent stocks which are included in the first decile after sorting on B/M ratios. r_i^{value} is the daily returns from a portfolio containing the *FTSE All Share* index constituent stocks which are included in the 10th decile after sorting on B/M ratios. Panel B reports the results from the same estimations excluding the outlier observations, as identified in the Appendix.

Panel A *Full sample: November, 26th 1982 - April, 8th 2010*					
	a	ex_i	tim_i	$surp_i$	R^2
r_i^{small}	0.16 *(2.82)***	0.25 *(0.70)*	1.39 *(1.47)*	-1.34 *(-3.90)***	0.07
r_i^{large}	-0.15 *(-1.73)**	0.80 *(1.26)*	2.29 *(1.60)*	-1.87 *(-5.90)***	0.07
r_i^{value}	-0.07 *(-1.11)*	-0.04 *(-0.13)*	1.06 *(1.48)*	-2.28 *(-4.05)***	0.14
r_i^{growth}	-0.19 *(-2.36)***	0.81 *(1.54)*	3.02 *(2.01)***	-1.49 *(-2.73)***	0.07
Panel B *Excluding Outliers*					
	a	ex_i	tim_i	$surp_i$	R^2
r_i^{small}	0.16 *(3.00)***	-0.09 *(-0.30)*	0.47 *(0.56)*	-1.09 *(-4.02)***	0.06
r_i^{large}	-0.10 *(-1.27)*	0.06 *(0.21)*	0.49 *(0.65)*	-1.80 *(-4.96)***	0.08
r_i^{value}	-0.06 *(-0.86)*	-0.31 *(-1.33)*	0.43 *(0.66)*	-2.02 *(-3.75)***	0.13
r_i^{growth}	-0.16 *(-2.11)***	0.12 *(0.42)*	0.98 *(1.13)*	-1.33 *(-2.61)***	0.05

Notes: (.) *t*-statistics calculated using Newey-West estimates of standard errors.*/**/*** denote significance at 90%, 95%, and 99% respectively.

Table 4
The MPC framework and the relationship between Monetary Policy and Equities.

In this table we present the results from the regression of FTSE All Share Price Index returns on the expected component (ex_i), the timing shocks (tim_i), and the level shocks ($surp_i$) of monetary policy announcements on the 240 sample days described in the main body of the text. Levels shocks are calculated as the daily change in the 3-month sterling futures rate and timings shocks are defined as the difference between level shocks and the daily change in 1-month LIBOR. The first row repeats the results from Table 2. $post\text{-}97_i$ is a dummy variable taking the value of 1 for the observations after May 1997, and zero otherwise. The rev_i is a dummy variable taking the value of 1 for the observations coinciding with interest rate reversals, and zero otherwise. The qe_i is a dummy variable taking the value of 1 for the observations after March 2009, and zero otherwise. Panel B reports the results from the same estimations excluding the outlier observations, as identified in the Appendix.

	α	ex_i	tim_i	$surp_i$	$(tim_i x\ post\text{-}97_i)$	$(surp_i x\ post\text{-}97_i)$	$(tim_i x\ rev_i)$	$(surp_i x\ rev_i)$	$(tim_i x\ qe_i)$	$(surp_i x\ qe_i)$	R^2
Panel A Full sample: November, 26th 1982 - April, 8th 2010											
r_i	-0.13 *(-1.72)**	0.72 *(1.37)*	2.44 *(1.90)**	-2.00 *(-6.23)****	-	-	-	-	-	-	0.10
r_i	-0.11 *(-1.53)*	0.50 *(1.29)*	2.06 *(1.89)**	-2.23 *(-6.19)****	-5.32 *(-2.94)****	7.91 *(2.92)****	-	-	-	-	0.17
r_i	-0.11 *(-1.53)*	0.51 *(1.31)*	2.27 *(2.34)***	-2.24 *(-6.33)****	-5.50 *(-3.13)****	7.93 *(2.93)****	-0.47 *(-0.44)*	-0.02 *(-0.04)*	-	-	0.17
r_i	-0.11 *(-1.54)*	0.49 *(1.28)*	2.05 *(1.88)*	*-2.22* *(-6.16)****	-5.16 *(-2.86)****	8.01 *(2.92)****	-	-	*-8.12* *(-2.44)***	-3.66 *(-0.84)*	0.18
Panel B: Excluding outliers											
r_i	-0.09 *(-1.33)*	0.09 *(0.31)*	0.79 *(1.07)*	-1.90 *(-6.12)****	-	-	-	-	-	-	0.11
r_i	-0.08 *(-1.22)*	0.04 *(0.14)*	0.87 *(1.15)*	*-2.00* *(-6.13)****	-3.87 *(-2.07)***	4.33 *(1.97)***	-	-	-	-	0.14
r_i	-0.08 *(-1.18)*	0.06 *(0.22)*	1.43 *(1.76)**	-2.00 *(-5.91)****	-4.39 *(-2.37)***	4.54 *(2.11)***	-1.59 *(-2.22)***	-0.50 *(-1.07)*	-	-	0.15
r_i	-0.08 *(-1.23)*	0.04 *(0.15)*	0.87 *(1.15)*	-2.00 *(-6.10)****	-3.76 *(-2.02)***	4.45 *(1.99)***	-	-	*-9.49* *(-2.86)****	*0.43* *(0.11)*	0.14

Notes: (.) *t*-statistics calculated using Newey-West estimates of standard errors.
*/**/*** denote significance at 90%, 95%, and 99% respectively.

Table 5
LIBOR Rates and the FTSE All Share index

This table reports the results from the estimations of the EGARCH (1,1) model (Equations (6)-(7) in the main body of the text). The $\Delta i_{m,t}$ stands for $i_{m,t} - i_{m,t-1}$ and i_m is the London interbank rates with maturity m = 7-days, 1-month, 3-months, 6-moths, and 1-year. The third column show the results from including a binary dummy variable (qe_t), in equation (6), which takes the value of 1 on days after March 2009 and zero otherwise.

	Daily Data: November 5th 1982- May 31st 1997	Daily Data: June 1st 1997- May 31st 2010	Daily Data: June 1st 1997- May 31st 2010 (quantitative easing)
	r_t	r_t	r_t
c	0.06 *(0.06)*	0.02 *(0.02)*	0.01 *(0.01)*
7-day	0.03 *(0.02)*	-0.43 *(0.11)***	-0.44 *(0.11)*
1-month	0.28 *(0.07)***	-0.49 *(0.37)*	-0.52 *(0.37)*
3-months	-0.62 *(0.15)***	-0.71 *(0.43)*	-0.67 *(0.43)*
6-months	-0.62 *(0.15)***	-0.09 *(0.36)*	-0.08 *(0.36)*
1-year	-1.07 *(0.11)***	0.25 *(0.30)*	0.30 *(1.02)*
qe_t(7-day)	-	-	1.40 *(4.16)*
qe_t(*1-month*)	-	-	4.59 *(4.44)*
qe_t(*3-months*)	-	-	-2.15 *(2.99)*
qe_t *(6-months)*	-	-	2.47 *(3.95)*
qe_t *(1-year)*	-	-	-7.02 *(3.74)**
R^2	0.05	-0.00	0.00
Durbin-Watson stat	1.90	2.04	2.04
ARCH-F-stat (5)	0.72 [0.73]	1.71 [0.13]	1.66 [0.14]
LM test (5)	8.64 [0.73]	8.52 [0.13]	8.30 [0.14]
ω	-0.18 *(0.01)***	-0.09 *(0.01)***	-0.09 *(0.01)***
β_1	0.95 *(0.01)***	0.98 *(0.00)***	0.98 *(0.00)***
α	0.20 *(0.01)*	0.11 *(0.01)*	0.11 *(0.01)***
γ	-0.04 *(0.01)*	-0.11 *(0.01)***	-0.11 *(0.01)***

Notes: St. Errors are displayed as (.). p-values are displayed as [.] */**/*** denote significance at 90%, 95%, and 99% respectively.

Table 6
Inflation Report releases and the FTSE All Share index

The first row of the table presents the results from the regression of daily FTSE All Share Index returns on timing and level shocks on the 52 days of inflation reports' publications. The following rows present the results from the regression of FTSE All Share Price Index returns on the expected component (ex_i), the timing shocks (tim_i), and the level shocks ($surp_i$) of monetary policy announcements on the 240 sample days described in Section 2. The level shocks are calculated as the daily change in the 3-month sterling futures rate and timing shocks are defined as the difference between level shocks and the daily change in 1-month LIBOR. The $post\text{-}97_i$ is a dummy variable taking the value of 1 for observations after May 1997, and zero otherwise. In the second (third/fourth) row of this Table inf_i takes the value of 1 for the first (second/third) MPC meeting following the release of an inflation report and zero otherwise. Panel B reports the results from the same estimations excluding the outlier observations, as identified in the main body of the text and the Appendix.

	a	ex_i	tim_i	$surp_i$	$(tim_i x\ post\text{-}97_i)$	$(surp_i x\ post\text{-}97_i)$	$(tim_i x\ inf_i)$	$(surp_i x\ inf_i)$	R^2
Panel A: Full sample: November, 26th 1982 - April, 8th 2010									
r_i	-0.03 *(-0.25)*	-	1.61 *(0.45)*	2.36 *(0.75)*	-	-	-	-	0.06
r_i	-0.11 *(-1.53)*	0.50 *(1.29)*	2.06 *(1.89)**	-2.23 *(-6.19)****	-5.32 *(-2.94)****	7.91 *(2.92)****	-	-	0.17
r_i	-0.10 *(-1.43)*	0.47 *(1.28)*	2.01 *(1.87)**	-2.21 *(-6.34)****	-4.90 *(-1.76)**	8.54 *(2.53)***	-0.09 *(-0.02)*	-2.71 *(-0.52)*	0.18
r_i	-0.11 *(-1.49)*	0.50 *(1.30)*	2.06 *(1.89)**	-2.23 *(-6.23)****	-5.57 *(-2.68)****	7.63 *(2.36)***	1.25 *(0.28)*	1.69 *(0.38)*	0.18
r_i	-0.11 *(-1.53)*	0.48 *(1.29)*	2.03 *(1.88)**	-2.21 *(-6.26)****	-4.56 *(-1.99)***	7.04 *(2.51)***	-2.43 *(-0.57)*	2.11 *(0.42)*	0.17
Panel B: Excluding outliers									
r_i	-0.01 *(-0.06)*	-	5.34 *(2.49)***	-4.60 *(-1.77)**	-	-	-	-	0.05
r_i	-0.08 *(-1.22)*	0.04 *(0.14)*	0.87 *(1.15)*	*-2.00* *(-6.13)****	-3.87 *(-2.07)***	4.33 *(1.97)***	-	-	0.14
r_i	-0.06 *(-0.94)*	0.04 *(0.15)*	0.88 *(1.16)*	-2.01 *(6.18)****	-5.51 *(-1.75)**	3.06 *(1.04)*	0.68 *(0.14)*	2.86 *(0.63)*	0.14
r_i	-0.04 *(-0.57)*	0.90 *(1.16)*	0.90 *(1.16)*	-2.01 *(-6.19)**	-4.17 *(-1.79)**	2.57 *(1.22)*	-2.36 *(-0.72)*	5.70 *(1.67)**	0.15
r_i	-0.06 *(-0.94)*	0.05 *(0.16)*	0.91 *(1.19)*	-2.00 *(-6.21)****	-4.99 *(-2.45)***	6.52 *(2.46)***	-0.55 *(-0.14)*	-5.98 *(-1.79)**	0.16

Notes: (.) *t*-statistics calculated using Newey-West estimates of standard errors.
*/**/*** denote significance at 90%, 95%, and 99% respectively.

Table 7
The MPC meetings' minutes releases and the FTSE All Share index.

The first column of this Table presents the results from the regression of FTSE All Share index returns on timing and levels shocks on days of MPC meetings minutes releases. The level shocks are calculated as the daily change in the 3-month sterling futures rate and timings shocks are defined as the difference between level shocks and the daily change in 1-month LIBOR. The full sample of this estimation contains 155 publications with the first being on July 16th, 1997 and the last on May 9th, 2010. In the second column una_i is a dummy variable taking the value of 1 on days of MPC meetings minutes releases revealing a unanimous decision by the members of MPC. In the third column of this Table we present the results from regression of *FTSE All Share index* returns on timing and level shocks on the 240 sample days of monetary policy announcements described in Section 2. The dummy variable $post\text{-}97_i$ takes the value of 1 for the observations after May 1997, and zero otherwise. The binary dummy una_i takes the value of 1 at an MPC meeting that follows the release of MPC meetings minutes indicating a unanimous decision of the MPC. The Panel under the title *excluding outliers* reports the results from the same estimations after excluding the outlier observations.

	Full Sample November, 26th 1982 - April, 8th 2010			*Excluding Outliers*		
	r_i	r_i	r_i	r_i	r_i	r_i
a	-0.26 *(-2.44)***	-0.26 *(-2.47)****	-0.10 *(-1.43)*	-0.23 *(-2.44)***	-0.23 *(-2.42)****	-0.04 *(-0.55)*
ex_i	-	-	0.56 *(1.42)*	-	-	0.04 *(0.13)*
tim_i	3.53 *(1.68)**	5.44 *(1.62)*	2.16 *(1.97)**	2.55 *(1.19)*	4.34 *(1.38)*	0.89 *(1.18)*
$surp_i$	-3.18 *(-1.34)*	-4.60 *(-1.29)*	-2.27 *(-6.32)****	0.16 *(0.08)*	-0.30 *(-0.08)*	-2.01 *(-6.37)****
$(tim_i x\ post\text{-}97_i)$	-	-	-7.85 *(-2.76)****	-	-	-7.48 *(-3.03)****
$(surp_i x\ post\text{-}97_i)$	-	-	10.27 *(3.33)****	-	-	8.96 *(3.46)****
$(tim_i x\ una_i)$	-	-4.61 *(-1.24)*	5.79 *(1.58)*	-	-4.85 *(-1.18)*	7.35 *(2.26)***
$(surp_i x\ una_i)$	-	2.87 *(0.55)*	-5.17 *(-1.00)*	-	1.18 *(0.33)*	-12.81 *(-3.53)****
R^2	0.01	0.02	0.18	0.01	0.02	0.19

Notes: (.) *t*-statistics calculated using Newey-West estimates of standard errors.
*/**/*** denote significance at 90%, 95%, and 99% respectively.

Table 8
Impact of Bank of England's communications on the conditional variance of the UK stock returns.

This table reports the estimation results from the EGARCH (1,1) model (Equations (11)-(12) in the main body of the text).

	Daily Data: June 1st 1997-May 31st 2010
	r_t
c	0.01 (0.01)
b_1	0.01 (0.02)
d_1	-0.45 (3.56)
d_2	-0.83 (1.51)
R^2	0.00
Durbin-Watson stat	2.06
ARCH-F-stat (5)	1.56 [0.17]
LM test (5)	7.79 [0.17]
ω	-0.08 (0.01)***
β_1	0.98 (0.01)***
α	0.11 (0.01)***
γ	-0.11 (0.01)***
δ_1	-0.19 (0.08)**
δ_2	-0.05 (0.08)
s_1	4.01 (1.65)**
s_2	1.36 (0.67)**

Notes: St. Errors are displayed as (.). P-values are displayed as [.].*/**/*** denote significance at 90%, 95%, and 99% respectively.

Appendix

Figure A.1, plots the equity returns and the surprise element along with a trendline. Apart from the negative relationship between them, one can observe some significant departures from the general trend. To remedy any sample selection problems and ensure that outlier observations will not dominate the results, we use the approach of Bernanke and Kuttner (2005) to control for the presence of outliers. More specifically we estimate the relative effect of each observation using the formula $\Delta\beta_i^T \Sigma \Delta\beta_i$, where Σ is the estimated covariance matrix and $\Delta\beta_i$ is the change in the estimated coefficient vector after excluding observation i. The observations identified as outliers are those on the 23rd of October 1987, the 8th of October 1990, the 1st of August 2002, the 8th of October 2008, and the 6th of November 2008 with influence statistics larger than 0.35 whereas the vast majority of observations have statistics smaller than 0.02.

All the five outlier observations detected refer to periods characterised by economic turbulence. The rate cut of October 1987 follows the “Black Monday” on the 19th of October 1987 and is associated with a large drop in equity prices. The rate cut of October 1990 was met very euphorically by the market, as it signified a measure against the economic slowdown, when the UK’s entrance to the Exchange Rate Mechanism had naturally hampered its flexibility. The drop in equities' price by more than 4% on the 1st of August 2002 can be mostly attributed to the broader economic environment in international stock markets, during a period when the "internet-bubble" was at its final stages. Finally, the observations in October-November 2008 coincide with extreme equity drops following the collapse of Lehman Brothers.

Figure A.1
Monetary Policy Shocks and FTSE ALL Share Returns.

This Figure presents a scatterplot of the UK stock returns and the monetary policy shocks which includes the 240 observations described in Section 2. The highlighted observations are those which have been identified as outliers using the methodology of Bernanke and Kuttner (2005).