# Equity returns, Mispricing, and Monetary Policy in the UK

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**Abstract**

This paper examines the impact of the decisions of the Bank of England on the equity returns of the UK and the channels through which these effects are transmitted to the stock market. We employ a number of alternative approaches including an event study framework to measure the impact of monetary policy surprises both on aggregate and sectoral indices and a methodology developed by Bernanke and Kuttner (2005). Our results from the first approach conform to theoretical priors but also reveal that monetary policy decisions affect equity returns asymmetrically not only with regards to the direction of the decision, but also with the size of the portfolio examined. Predictability of the future actions of the Bank of England has increased after the institutional reform that took place in 1997. We find that monetary policy is transmitted to the stock market post-97 mainly through its effects on expectations of future earnings prospects. Finally, we find that changes in the institutional design of monetary policy such as the establishment of the Monetary Policy Committee and the improved communication framework may have contributed to the increased correlation between monetary policy shocks and equity returns.

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## 1. Introduction

The impact of monetary policy on the equity market is a topic which has seen much attention lately in the financial literature and concentrates much attention not only from policymakers but also from investors. The superfluous effects of excessive financial volatility on the macroeconomy made major policymakers proclaim that the upcoming challenge for central bankers should be the control of the asset bubbles (Bernanke and Gertler, 2000). Moreover, investors are interested in the identification of those factors which are likely to explain the time-varying behaviour of excess returns and monetary policy is an ideal candidate since it is considered the major source of business cycle conditions. However, any discussion about the role of monetary policy in the stock market should be based on a solid characterization of the effects of central banks' actions on the stock market.

This paper is an empirical investigation of the impact of monetary policy shocks on the equity returns in the United Kingdom and of the channels through which this impact is materialized. What makes the UK an interesting case to consider is that it has a well-defined institutional framework for the conduct of monetary policy whose structure allows efficient communication of policy targets and measures to market agents (and which many other countries have recently adopted). Moreover, this framework is a relatively recent one and this allows comparisons with earlier monetary policy regimes. Finally, the existing evidence for the UK is scant and this fact constitutes an additional motivation by itself since it can be used as means of comparison with other countries as well.

Since the 1997 the monetary policy of the UK has entered a new phase which is characterized by greater transparency, better communication of the central banks' incentives and stable inflation. The Monetary Policy Committee (MPC) has taken over the responsibility for conducting monetary policy which in the UK has an inflation targeting orientation. Inflation targeting, which is in operation since 1993, constitutes a relatively new trend in the central banking and is characterised by commitment to an explicitly stated level of inflation. Theory and experience associate inflation with many unwanted events for the financial markets. For this reason it would be of great interest to examine the changes that the inflation targeting has triggered to the relationship between monetary policy and asset prices.

The majority of the existing empirical work on this issue reports a statistically and numerically significant negative relationship between equity returns and monetary policy as would be expected by theory. The literature has employed a number of variables as identification for monetary policy. Bernanke and Kuttner (2005) introduce the surprise component of monetary policy actions of Kuttner (2001) in an event study framework and they find a strong negative response of stock markets to contractionary monetary policy shocks. A similar market based measure of the surprise to the policy action but a different statistical method is used by Rigobon and Sack (2004) but the conclusions are the same. The discount rate and the raw changes in the target rate have also been used as an alternative identification for monetary policy but still the results are in accordance with theoretical priors (Jensen and Johnson, 1995; Jensen, Mercer and Johnson, 1996; Thorbecke, 1997).

A distinctive and popular approach for the identification of a monetary policy shock is used by Christiano *et al* (1994), who extract monetary policy shocks as orthogonalized innovations from unrestricted Vector Autoregression models (VARs). This approach has been applied by some influential on the topic papers like Thorbecke (1997), Lastrapes (1998), and Patelis (1997), and the main results remain unchanged and suggest that a tightening shock results in a drop in equity returns.

The methodologies and statistical methods employed to investigate the issue are numerous. Indicatively, some of the methodologies that have been employed in the literature are the factor model of Craine and Martin (2003), the descriptive research of Fair (2002), and the identification procedure of D'Amico and Farka (2003) based on proxy and IV variables, and still the results conform to theory and produce more or the less the same results.

Research on this relationship also aims at reporting asymmetries in the effects of monetary policy. Thorbecke (1997) finds that monetary policy shocks affect small companies stronger than the bigger ones. Lobo (2000) and Bomfim (2001) report an overreaction in the arrival of bad news. Bernanke and Kuttner (2005) examine whether a reverse in monetary policy affects differently equity returns. Another much tested asymmetry in the transmission of monetary policy involves the identification of the effects of monetary policy across different periods and industrial sectors (Bernanke and Kuttner, 2005; Thorbecke, 1997; Patelis, 1997; Ehrmann and Fratzscher, 2004).

Although the bulk of evidence in the literature is in line with the predictions of the theory, it is important to note the existence of evidence from some event studies that conclude otherwise. A number of papers suggest that monetary policy is neutral for stock markets. In particular, Durham (2003) and Bomfim and Reinhart (2000) report no significant response of US equity indices to monetary policy actions. Darrat (1990) also supports monetary policy neutrality in the stock markets for the Canadian stock market.

There exists a relatively wide agreement in the literature that stock markets respond to changes in the monetary policy. There is, however, much less research on the issue of how is this influence exerted and ultimately how is monetary policy transmitted to the real economy. Papers which attempt to decode this transmission channel include Bernanke and Kuttner (2005) and Patelis (1997). The results of Bernanke and Kuttner (2005) indicate that monetary policy affects stock prices mainly through its effects on future excess returns while those of Patelis (1997) that the future cash flow component holds the major role. Surprisingly, both researches suggest future expected interest rates do not seem to play an important role in the expected stock market return volatility. In this paper we endeavour to identify the channels of monetary policy transmission in the UK and we draw special focus on the effects of the inflation targeting regime post-97 on the reported results.

The next section of this paper concerns the identification of the response of the UK equity market to monetary policy shocks. To estimate this we use an event study analysis and we also examine a number of asymmetries and the role of the inflation report. Section 3 concerns the methodology of Bernanke and Kuttner (2005) for the UK, with a particular focus to highlight the differences between the periods prior to and post-97.

## 2. The Impact of Monetary Policy Shocks on the Equity Returns.

### A. An estimate of the response of stock markets to monetary policy.

In this section we report the results of an event-study analysis which aims at isolating the response of UK stock market to a monetary policy decision of the Bank of England. Stock markets are likely to respond to information that is not expected and for this reason, it is a commonplace now in the academic literature to extract the unexpected component of the policy announcement. In this paper a methodology similar to that of Kuttner (2001) is employed to extract the unexpected component of the policy decision of the Bank of England.

The surprise element ($surp_i$), which is depicted in Figure 1, is defined as the one day change in the three month sterling futures contract rate ($f_i$) traded in Euronext.liffe on the day of a policy decision, and the expected component ($ex_i$) as the difference between the surprise component and the actual change in the interest rate:

$$surp_i = f_i - f_{i-1}$$
$$ex_i = surp_i - \Delta i_i^{UK} \quad (1)$$

The three month sterling futures contract, which has also been used by Bredin *et al* (2007) in a study resembling ours, reveals market's expectation about the interest rates at the time of the maturity of the contract. Thus, on the day prior to the announcement, the price of the contract incorporates among other things also the expectations about the stance of the Bank of England which will be revealed to the public the next day. Any change in the futures rate after the policy announcement indicates those expectations of the market about interest rates that were not anticipated.

-Figure 1 somewhere here-

The dataset spans from 15/01/1986 to 09/11/2006, and includes 168 “events”, out of which 86 concern actual changes in interest rates and the rest are days when MPC meetings took place. Before 1997 only dates when monetary policy shifts took place will be included in the sample, whereas for the period after 1997 when the MPC was established, also the dates of the meetings of the MPC will be included. The MPC meets once every month to set the interest rate. The monthly MPC meeting is a two-day affair and the interest rate decision is announced at 12 noon of the second date. Hence, in the sample the second day date will be included, because before that time no information about the stance of the Bank of England is publicly available. The UK stock market index which is used in this section is the FTSE All Share.

Event studies are likely to produce misleading results due to the existence of some observations which affect disproportionately the value of the coefficient estimate. To control for the dependence of the result to some outlier observations we compute the influence statistics for each observation and we exclude from the sample those with a value larger than 0.3. In particular, following Bernanke and Kuttner (2005), we calculate the influence statistics by utilizing the relationship $\Delta\hat{\beta}_i^{'}\hat{\Sigma}^{-1}\Delta\hat{\beta}_i$, where $\Sigma$ is the estimated covariance matrix and $\Delta\beta_i$ is the coefficient vector after excluding observation *i*. The observations identified as outliers this way are those on the 23rd of October 1987, and on the 8th of October 1990 with influence statistics of 1.39 and 0.57 respectively while the rest are smaller than 0.25 and the vast majority smaller than 0.05.

Three more observations where stock market response is not likely to be due to monetary policy actions are those on the 8th of August 1988, 18th September 2001, and 6th of February 2003. On the 8th of August 1988 although there was a significant rate hike of 0.5% the stock market did not respond. The effects of the policy action may had been outweighed by the good news coming from the truce between Iraq and Iran war and the reduction of the oil prices due to the increase of oil production by Kuwait. The 18th of September 2001 is a policy decision driven by the 9/11 events and lastly the rate cut of the 6th of February 2003 is attributed by the financial press to the future inflationary pressures by the imminent invasion to Iraq.

An initial attempt to structure the relationship between the stance of the Bank of England and the stock market returns involves a simple regression of aggregate stock market returns on the raw change in the interest rate set by the Bank of England, a specification initially employed by Cook and Hahn (1989):

$$r_t = \alpha + \beta\Delta i_t^{UK} + \varepsilon_t \quad (2)$$

where $r_t$ is the daily return on the stock market, $\Delta i_t^{UK}$ is the raw change in the base rate set by the Bank of England, and $\varepsilon_t$ is the error term which is assumed to be orthogonal to the regressors. The coefficient estimate, printed in column (a) of Table 1, although it has the expected by theory sign, it is only marginally statistically significant for the 10%

level of significance and it is numerically insignificant reflecting the fact that the movements of the Bank of England are to some extent expected by the market.

The effects of monetary policy decisions are depicted in a more clear way by the estimation of the following model which has been popularized by Bernanke and Kuttner (2005) and it involves the regression of equity returns on the unexpected component of monetary policy decision:

$$r_i = a + \beta_1 ex_i + \beta_2 surp_i + u_i \quad (3)$$

where $ex_i$ is the expected component of monetary policy announcement defined as the difference between the actual change and the surprise component, $surp_i$ is the surprise element, and $u_i$ is the error term which is assumed to be orthogonal to the regressors.

The estimated response of the stock market on the surprise element of monetary policy under this specification is negative and highly significant. Monetary policy actions exert a significant but of small magnitude, compared to that in the US (Bernanke and Kuttner, 2005). The $R^2$ values although they are increased, compared to the previous specification when no unexpected component was introduced into the model, are still low, indicating that unexpected monetary policy actions do not account for more than 9% of the stock market variability. All regressions are also run after the exclusion of the outliers and the coefficient values appear statistically more significant, although the qualitative characteristics do not change. For this reason the results that will be presented subsequently will be estimated after the exclusion of the outliers, keeping although in mind that this way the statistical significance is presented slightly more improved.

- Table 1 somewhere here -

## B. Asymmetries

The interaction of our event study framework with slope dummies in a similar vein to Bernanke and Kuttner (2005) allows us to examine a number of asymmetries in the stock market response and this way a more structured view about the effects of monetary policy on equity returns and the sources of these effects can be extracted. Initially, the stability of the parameters of model (3) will be examined across the two subperiods before and after 1997. It is interesting to note the differences that the establishment of the independence of the Bank of England brought to the relationship between the equity markets and monetary policy. Although the inflation targeting period in the UK has officially commenced in 1993, we use the year 1997 as the starting point, when the independence of the BoE has been established, because a prerequisite of inflation targeting is central bank independence and hence our results will provide more clear evidence this way. A more structured view on this issue can be obtained by interactive our baseline model (3) with a slope dummy variable which captures the impact of monetary policy surprises on returns for the period post 1997.

The results which are printed in column (a) of Table 2 indicate that the negative response of the stock market to monetary policy can be attributed exclusively to the period prior to 1997, since the coefficient estimate of the surprise element retains its size and statistical significance. The surprise element for the period post 1997 has a marginally statistically significant positive effect whose magnitude outweighs the negative impact reported suggesting that monetary policy surprises occurred after the 1997 breakpoint have no impact to the UK stock market. This result is somehow expected when one observes the significant reduction in the volatility of the surprise variable post-97 as can be seen in Figure 1.

A major characteristic of the period post-97 is the publication of the inflation report. The Bank of England issues every quarter the inflation report which among other things reports the projections about future inflation and includes some comments about equity prices. The monetary policy decision on the month of the inflation report precedes its release. In order to assess the impact that the contents of the inflation report have to the stock market we include in our baseline model along with the post 1997 dummy also another dummy which captures the response of the market to the policy decision prior to the publication. The size and statistical significance of the surprise element remain unchanged however policy shocks on the same month as the release of the inflation cause an overreaction to the market probably because the market perceives them as a forerunner of the inflation report.

Another kind of asymmetry examined is the one which seeks to identify the differing response of the UK stock market across the direction of the monetary policy action. It makes sense to examine whether market responds differently to “bad news” as depicted by a rate hike, than to a rate drop. The coefficient estimate of the slope dummy, printed in column (c) of Table 2, which captures the response of the equity market on dates of a rate hike is small in size and statistically significant, suggesting that the market exhibits signs of a weak overreaction to surprises associated with rate hikes. This is consistent with what Lobo (2000) found for the US market.

Column (d) of Table 2 reports the non-announcement effects of the UK monetary policy. The coefficient estimate of the slope dummy which captures the response of the UK stock market to policy shocks when no rate change took place is strongly positive and statistically significant. Policy shocks are positively associated with stock returns on these dates suggesting that no action by the BoE although there is an upward revision in the expectations about the future trajectory of the base rate suggests good news for the market and the opposite. This positive effect contradicts the findings of Roley and Sellon (1998) and Bernanke and Kuttner (2005) for the US, which generally find no non-announcement effects.

The proxies for the monetary policy shocks that are used throughout our research are extracted by market based measures and essentially they constitute forecast errors. An upward revision to the expectations about the base rate is associated with the arrival of unexpected "bad news" about future inflation (since the BoE targets inflation) while a negative one generally indicates "good news". An obvious question to be raised is whether the direction of the forecast error exerts different effects on the equity market and we test this hypothesis by following the methodology of Bernanke and Kuttner (2005). Moreover, the size of these errors depends on the transparency of the communication of the BoE, and as we have seen above the size is reduced during the post-97 period. Since the bank is committed to maintaining inflation stability, its own forecasts indicating deviations from the target are likely to signal its future actions in the best way. To explicitly model the role of the inflation report we extract the impact of a monetary policy shock to a decision following the release of the inflation report.

The results printed in column (e) of Table 2 indicate that the stock market responds very little to surprises taking place on the month following the release of the inflation report suggesting that the BoE communicates clearly its intentions through the inflation report and exerts this way influence on the short run market expectations. Moreover, the negative statistically significant coefficient estimate of the positive surprise dummy suggests surprises with a positive surprise appear to have a small supplementary effect on the stock market.

-Table 2 somewhere here -

**C. Size and Sectoral Effects.**

A topic of importance both for policy and for investing purposes would be to chart the effects of monetary policy across different industry and size portfolios. Policymakers would want to know whether a policy decision affects symmetrically or not the market, because this way they would be able to conduct monetary policy more effectively and according to their particular intentions. On the other hand, investors, given the impact of monetary policy on equity returns that is shown above, would want to hedge their portfolios against monetary policy risk.

In order to test for asymmetry in the transmission of monetary policy to the different industries a system of unrelated regressions (SUR) model will be employed similar to that of Angeloni and Ehrmann (2003). Table 3 presents the results of a SUR model which extracts the impact of monetary policy shocks to the industry portfolios of the UK stock market as taken by DataStream along with the critical values of a Chow breakpoint test for parameter instability before and after the institutional reform. The results suggest a relatively symmetric reaction in line with theoretical priors. All the models present a breakpoint at 1997, significant differences however, are reported in the magnitude and the statistical significance of the coefficient estimates. A Wald test including all the sectors under investigation can easily reject the hypothesis of equality across the sectors.

*- Table 3 somewhere here -*

Table 4 reports the results of a regression of a small and a large portfolio on an unexpected component of monetary policy. The response of the small portfolio numerically is less significant suggesting that small firms are more flexible to ameliorate the effects from bad news, and also less capable of recovering after the arrival of good news. The large portfolio follows a pattern more or less similar to that of the market.

*- Table 4 somewhere here -*

**2. Equity Returns Components and Monetary factors.**

The results presented so far indicate that monetary policy actions exert an impact on equity returns which is in line with theoretical expectations and previous empirical work and whose magnitude differs for the period prior to and post the establishment of the MPC. In this section the analysis will focus on the identification of the channels through which this effect materializes. Fundamental financial theory suggests that equity returns can be affected either by changing the expectations regarding the economic fundamentals (dividends), the interest rate used to discount them, and the expectations of the realised risk premium on the equity. An innovative technique which identifies the channels through which monetary policy affects equity returns is developed by Bernanke and Kuttner (2005), whose methodology we closely follow in this part.

Bernanke and Kuttner (2005) initially decompose stock returns by using the acclaimed variance decomposition methodology popularised by Campbell (1991) and Campbell and Ammer (1993) and subsequently they estimate the effects of monetary policy actions on each component of the stock returns. Essentially, this methodology manages to decipher the transmission channel of monetary policy by extracting the effects of monetary policy surprises on the expectations of future cash flows (dividends), the future real interest rates used to discount these future cash flows, and the future excess equity returns (equity risk premium).

Campbell and Shiller (1988) and Campbell (1991) develop a log-linear accounting identity which postulates that the unexpected excess stock market returns can be approximated by components denoting revisions in the expectations of the discounted future cash flows, the real interest rates, and the future excess returns. The derivation of this relationship is given in detail in the above cited articles however, more compactly this log linear identity can be written as follows:

$$e_{t+1}^{r} = e_{t+1}^{d} - e_{t+1}^{i} - e_{t+1}^{e} \qquad (4)$$

where $e_{t+1}^{r}$ represents the unexpected excess equity returns, $e_{t+1}^{d}$ represents revisions in expectations of discounted future dividends, $e_{t+1}^{i}$ represents revisions in expectations of discounted real interest rates, and $e_{t+1}^{e}$ represents revisions in expectations of the discounted future excess returns.

The empirical estimation of the components of the linear decomposition requires the calculation at the beginning of period $t$ of the conditional expectation of the unexpected excess return, the future dividends, the future real interest rate, and the future excess returns one period ahead (at the beginning of period $t+1$). Allowing for autocorrelation between the components in equation (4) the relationship which shows what part of the variance in the excess equity returns is attributed to changes in the three components and their covariances can be written in the following form:

$$\mathrm{var}(e^r_{t+1}) = \begin{matrix} \mathrm{var}(e^d_{t+1}) + \mathrm{var}(e^e_{t+1}) + \mathrm{var}(e^i_{t+1}) - 2Cov(e^d_{t+1}, e^i_{t+1}) \\ -2Cov(e^d_{t+1}, e^e_{t+1}) + 2Cov(e^e_{t+1}, e^i_{t+1}) \end{matrix} \quad (5)$$

Following Campbell (1991) and Campbell and Ammer (1993) the empirical proxies for the expectations can be inferred by forecasts produced by an unrestricted first order VAR model. The VAR takes the following form:

$$\chi_{t+1} = \mathrm{A}\chi_t + \varepsilon_{t+1} \quad (6)$$

where $\chi_t$ stands for the vector of state variables, A is the coefficient matrix and $\varepsilon_{t+1}$ is the vector of the shocks to the model. This methodology postulates that the components of the stock returns can be represented as non-linear combinations between the error vector and the parameters of the VAR model. In particular, if the stability condition holds ($\lim_{n\to\infty} \mathrm{A}_1^n = 0$), then by the following relationship

$$(\mathrm{E}_{t+1} - \mathrm{E}_t)\chi_{t+1+j} = \mathrm{A}^j \varepsilon_{t+1} \qquad (7)$$

the components of the stock returns are estimated by the following relationships

$$
\begin{aligned}
e_{t+1}^{r} &= e1'\varepsilon_{t+1} \\
e_{t+1}^{e} &= e1'\rho\mathrm{A}\left(\mathrm{I}-\rho\mathrm{A}\right)^{-1}\varepsilon_{t+1} \\
e_{t+1}^{i} &= e2'\left(\mathrm{I}-\rho\mathrm{A}\right)^{-1}\varepsilon_{t+1} \\
e_{t+1}^{d} &= e_{t+1}^{r}+e_{t+1}^{e}+e_{t+1}^{i}
\end{aligned}
\qquad (8)
$$

where *e1* and *e2* are vectors of zeros except for the first and second element respectively, and $\rho$ is the discount factor which is set to 0.9962 as in Campbell and Ammer (1993).

The VAR model which is used to extract the projections of the forecast error vector holds a central role in the methodology of Campbell (1991) and Campbell and Ammer (1993). The first step is to stack the state variables that are used to forecast the excess equity returns into the vector denoted as $\chi_t$. The vector $\chi_t$ includes 5 state variables which enter in our VAR model in the following order:

1. The excess returns ($r_t$) on FTSE All which are calculated on the last day of each month as the total return (price change + dividends) minus the risk free rate which is taken by the three-month T-bill rate.
2. The short term interest rate ($rir_t$), which is calculated as the risk free T-bill rate deflated by the 1 year moving average of the log difference of the non-seasonally adjusted UK CPI incorporating both backward and forward looking expectations.
3. The log normalized dividend price ratio ($dp_t$) which is calculated as the ratio of the total dividends paid over the year to the year end stock price.
4. The spread of long-short treasury yields ($sp_t$) calculated as the difference between the log yield on the benchmark 10 year note and the log yield on the 3 month Treasury bill in monthly percentage points.

5. The inflation rate ( $inf_t$ ) which is based on the Retail Price Index (RPI)[1].

The first two variables are the excess return and the interest rate. The log dividend price ratio constitutes an integral part of the variance decomposition methodology, and its use can be justified by the great forecasting power it possesses as can be seen in some of the most influential on the topic papers (Campbell, 1991 and Campbell and Ammer, 1993). The inclusion of the yield spread also has met wide acceptance among researchers which consider it as a good predictor of the business cycle (Patelis, 1997 and Campbell and Vuolteenaho, 2004b).

The last variable which is included in the model is the annualized inflation rate. The inclusion of that variable differentiates our VAR from the specification of Campbell and Ammer (1993), and a similar one is also used by an earlier version of Bernanke and Kuttner (2005), and we do so not only because we are interested in investigating the effects of that variable, but also because this way we enjoy increased $R^2$ values especially for our last sub-sample. Moreover, inflation is reported to be a significant factor in equity pricing and is often used by researchers as a predictor of equity returns (Campbell and Vuolteenaho, 2004a, Campbell and Mei, 1993, and Boudoukh, Richardson and Whitelaw, 1994).

All the data included in this VAR are monthly, enter the model demeaned as it is popular in this kind of research, and are expressed in percentage points except for the dividend price ratio. We examine the relationship for the full sample and for the two subsamples since the results so far indicate a change in the relationship between monetary policy and stock returns after the policy reform. The full sample spans from

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[1] The results do not change neither quantitatively nor qualitatively if instead of the RPI we use the CPI inflation rate.

March 1975 to November 2006, and the two sub samples include observations from March 1975 to May 1997 and from June 1997 to November 2006. The observation of October 1987 is excluded from the sample as an outlier since the equity return approaches the -31% and could produce misleading results. Summary statistics for the data used are given in Table 5.

- *Table 5 somewhere here* -

We estimate our VAR model by GMM because it produces heteroscedasticity consistent covariance matrix of the regression coefficients. The variables in the right hand side are the same for all the equations and so the numerical estimates of the parameters will be identical to the OLS estimates. We run Augmented Dickey Fuller tests for stationarity with four lags and we can reject the null of non stationarity for less than 10% confidence interval for all our variables and samples. Moreover, our VAR passes the diagnostic test of stability since the largest eigenvalue of the coefficient matrix reported is 0.98. There is some evidence that the model exerts additional forecasting power by the inclusion of one more lag, however we opt for parsimony to avoid overfitting and we choose one lag following Campbell and Ammer (1993).

The predictive variables of the equity returns for the full sample are jointly significant for the 10% level of confidence as printed in Table 6, and although they exhibit a modest $R^2$ value our model possesses adequate forecasting power to produce accurate results, since it is comparable to that used by other researchers. The future equity premium accounts for the majority of the variability in the excess returns for all sub-samples result which compatible not only with that for the US, but also for similar research for the UK (Bredin *et al*, 2007). The forecasting power of the model during the period post-97 is very large as can be seen by the $R^2$ value and the $x^2$ statistic and future equity premium accounts for 79% of the variability of the excess returns.

The parameter estimates of our VAR model are likely to suffer from bias which arises because the state variables are persistent AR(1) series, and because predictive regressors whose innovations exhibit high correlation with returns innovations induce bias in the return regression relative to the sign of the correlation coefficient (Stambaugh, 1999). This bias in the estimation of the coefficients is likely to impair the reliability of our results and for this reason we undertake a simple Monte Carlo experiment similar to that of Campbell and Vuolteenaho (2004b) to examine the magnitude of this bias. Using our VAR model as the data generating process we estimate the bias of the variance decomposition components. The size of the bias for each statistic printed in Table 6 suggests that although there is some bias, it is not likely to alter the qualitative characteristics of our results. The results of our Monte Carlo experiment although they are contingent on the choice of the data generating process, they are indicative of the small sample bias problem of our analysis.

Table 7 summarizes the behaviour of the correlations between the VAR innovations. Innovations to excess returns with innovations to the inflation rate exhibit a significant, numerically and statistically, negative correlation coefficient during the period post-97, result which is not a surprise when one considers that any deviation from a closely controlled variable (inflation targeting) is likely to reveal more information to the market than before. Moreover, the reduced volatility of the inflation rate shocks during the period post-97 is likely to be due to the successful conduct of the inflation targeting monetary policy by the BoE, which achieved better control over inflation.

The innovations to the inflation rate exhibit a positive statistically significant association with the innovations to the short term real interest rate during the post-97 period. This result indicates that the BoE has achieved a better use of its monetary policy "tools", since the main tool for policy making by a central bank is to stimulate the short term interest rates which in turn will affect the inflation rate. Furthermore, the innovations to the real interest rate exhibit for all samples negative correlation with the spread underpinning the fact that long term rates are smoother than short term ones (Campbell and Ammer, 1993). The larger magnitude of this association for the period 1997-2006 nests to the larger correlations between shocks to inflation and short term real rates observed.

- *Table 7 somewhere here* -

Table 8 reports the correlations between the return components and the state variable innovations. The innovations to the inflation rate are strongly positively associated with real interest rates during the post-97 period whereas this association is not existent for the period before. In a similar manner, although unexpected information about future inflation strongly impairs the capability of the market for future earning prospects during the period post-97, they do not seem to be significant for the period before. The latter can be perceived as a sign that the increased importance of inflation shocks for the stock market post-97 originates from the fact that the market perceives any inconsistency from the inflation forecasts as an unexpected change in the underlying economic conditions and as such it impinges on the market fundamentals.

- *Table 8 somewhere here* -

The subsequent part of this section concerns the identification of that part of each component of the equity returns which is attributed to the policy shocks. In order to achieve this we employ the methodology developed by Bernanke and Kuttner (2005). This methodology involves the regression of the one-step ahead forecast errors of the VAR model on the surprise element measured monthly this time. The product of this regression is the 5-element vector $\varphi$ which represents the contemporaneous effects of the monetary policy shocks on the VAR forecast errors. Vector $\varphi$ can also be used to estimate the dynamic multipliers of the state variables to a 1% shock in the monetary policy surprise since the new error vector after the regressions is by construction orthogonal to the monetary policy surprises. Table (9) depicts the impulse responses of the excess returns and the inflation rate to a 1% shock to monetary policy. The inflation rate and the equity returns responses are in line with theoretical priors and seem to be significant both numerically and statistically only for the last sample. The increased correlation between the monetary policy and its outcomes is likely due to the increased transparency of the monetary policy after the institutional reform of the 1997.

- *Table 9 somewhere here* -

Now let us return to the impact of monetary policy shocks to the components of monetary policy as estimated by employing the methodology of Bernanke and Kuttner (2005). The impact of the surprises in monetary policy on the future equity premium is given by $e1'\rho A(I-\rho A)^{-1}\phi$, the impact monetary policy shocks on the future real interest rates is given by $e2'(I-\rho A)^{-1}\phi$, and finally the impact of the monetary policy shocks on the future dividends is given by $(e1'+e2')(I-\rho A)^{-1}\phi$.

Results from this methodology are printed in Table 10 and indicate that under the contemporary institutional setting monetary policy shocks affect the equity market essentially through their impact on the future dividends. Our results are comparable to that of Patelis (1997) for the US, and of Bredin *et al* (2007) for the UK which also reaches to a similar conclusion, but there the magnitude of the response is much weaker. The effect of policy shocks on the interest rate component is stable and highly, numerically and statistically, significant across all periods under examination contradicting this way the evidence produced by Bernanke and Kuttner (2005) and Patelis (1997) for the US, and by Bredin *et al* (2007) for the UK. The difference in our specification from that of Bredin *et al* (2007) lies in the inclusion of the inflation rate in our VAR model instead of the effective exchange rate which increases the forecasting ability of the returns equation.

*- Table 10 somewhere here -*

Although this methodology can not produce economic reasoning for the reported results some preliminary conclusions can be drawn. The BoE's actions seem to be more correlated with the fundamentals since they affect equity market by changing expectations about the future economic prospects of the firms, whereas the Fed's actions, as presented in Bernanke and Kuttner (2005), seem to increase the uncertainty of the market. One possible explanation for this difference could be that the BoE follows an inflation targeting with an explicit nominal anchor whereas the Fed with an implicit nominal anchor. Our results suggest that explicitly stated inflation targets seem to result in greater transparency and reduction of unnecessary uncertainty in the equity market which according to Mishkin (2007) are the main disadvantages of the Fed's monetary policy.

The remaining part concerns some industry specific effects of the monetary policy. In particular, Table 11 reports the channels through which monetary policy affects some major industry and size stock market portfolios. These results can be of use to the investors since they are indicative of the monetary risk inherent in investing in each industry portfolio. The results suggest that the way monetary policy is affected to the industry sectors differ according to the distinctive characteristics of each sector, and this should be taken into account both by portfolio managers if they want their portfolios to be tailor-made to the specific needs of their clients.

The results for the size portfolios can also help us draw insights into the monetary policy transmission channel. The larger effects of monetary policy shocks on the small portfolios indicate similarly to a large stream of research for the US that monetary policy affects the market through the so-called balance sheet channel. The cash flow statements of large firms appear to be not so contingent on changes in the short term interest rates, in contrast to small firms who are in greater need for cash and hence depend more strongly on short term financing.

## 3. Conclusions.

This paper in the first section has reported that monetary policy surprises, as extracted by futures market instruments following the method of Kuttner (2001), exhibit a negative relationship with equity returns. In particular, the event study framework that we employ reports that a 1% unexpected drop in the base rate of the Bank of England exerts a numerically weak downward impact on equity returns of almost 2%. The monetary policy exerts this impact on UK stock markets for the period until the establishment of the MPC, whereas for the period post 1997 it is reported a relative silence to the response of the equity market. Moreover, evidence is produced that stock market overreacts by a small amount to tightening actions and shocks and that the inaction of the Bank of England for the period post 1997 is perceived by the market as good news. Another hypothesis that our research examines is the role of the inflation report. We find that the release of the inflation report affects the stock market by helping investors infer future policy actions.

In section 2 initially we examine whether the behaviour of the inflation rate in the stock market has changed prior to and after the institutional reform of 1997. In particular, we reported that the inflation rate which is included in the VAR model exhibits a higher association both with innovations to short term interest rates and stock returns. Moreover, we have shown that monetary policy shocks are more closely correlated with the future excess returns and future inflation.

Finally, we employed the Bernanke and Kuttner (2005) methodology and we tried to investigate the channels through which monetary policy affects the equity returns. Our main finding is that monetary policy is transmitted to the monetary policy mainly by altering expectations about the future economic prospects of the UK stock market. Moreover, we also report a statistically significant interest rate channel. However, by closing we should say that our results should not be perceived as conclusive results rather as a starting point of a discussion.

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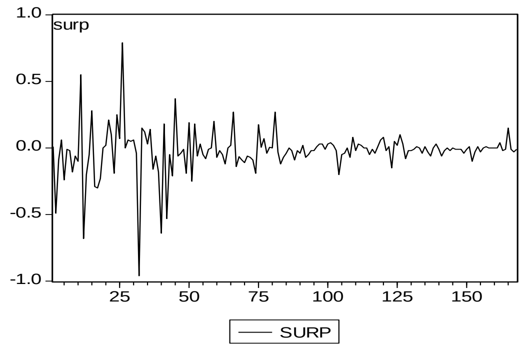
**Figure 1**
**The surprise component of monetary policy decisions**

This graph depicts the surprise component of monetary policy as calculated by the methodology developed by Kuttner (2001). The surprise component is defined as the daily difference in the three-month sterling futures contract on the day of a policy decision.



## Table 1
## The response of the UK equity returns to raw monetary policy changes.

This table reports the results of a regression of the form $r_t = \alpha + \beta \Delta i_t^{UK} + \varepsilon_t$ which returns the response of stock market returns to raw monetary policy changes. $r_t$ is the daily return on the stock market index, $\Delta i_t^{UK}$ is the raw change in the repo rate of the Bank of England on the day of the policy announcement and $\varepsilon_t$ is the error term which is assumed to be orthogonal to the regressors. The full sample includes 168 observations out of which 86 are actual changes and the rest are dates of MPC meetings when no monetary policy change took place. Under the column with heading $r_t$ (outliers) the results of the regression after the exclusion of the outliers are reported. The *t* statistics which are reported in parentheses are calculated using the White heteroscedasticity-consistent estimates of standard errors.

| | (a) | | (b) | |
|---|---|---|---|---|
| | 01/1986 to 11/2006 (86 observations) | | 01/1986 to 11/2006 (168 observations) | |
| | $r_t$ | $r_t$ (outliers) | $r_t$ | $r_t$ (outliers) |
| *Intercept* | -0.09 *(-1.13)* | -0.09 *(-1.13)* | -0.12 *(-1.51)* | -0.11 *(-1.41)* |
| $\beta$ | -0.43 *(-1.70)** | -0.40 *(-1.67)** | - | - |
| $ex_t$ | - | - | -0.05 *(-0.22)* | -0.01 *(-0.06)* |
| $surp_t$ | - | - | -1.73 *(-2.62)**** | -2.09 *(-5.07)**** |
| *DW stat* | 1.68 | 1.68 | 1.64 | 1.69 |
| $R^2$ | 0.025 | 0.022 | 0.074 | 0.084 |

(*/** means that *t* statistics are significant at the 10%/ 5%level)

# Table 2
## Period and Direction Asymmetries and the role of the Inflation Report

This table reports the results for the tests for asymmetries in the transmission of monetary policy to stock markets. The first column reports the results of our baseline model with the inclusion of a slope dummy post-97, which is defined as the product of a binary dummy which takes the value of 1 for the observations post-97 and zero otherwise. The second column reports the results of our baseline model interacting both with the period dummy and the $infr_i$ dummy which is defined as the product of a binary dummy which takes the value of 1 for the observations which correspond to the month of the publication of the inflation report and zero otherwise. In the third column we report the results of non-announcement effects where the no policy change dummy ($noc_i$) is defined as the product of a binary dummy variable which takes the value of 1 when no change took place and zero otherwise with the surprise element of monetary policy actions. The slope dummy $inc_i$ captures the response of the stock market on dates of a rate hike, and is defined as the product of a dummy variable which takes the value of 1 when there is an increase in the base rate and zero otherwise with the surprise element of monetary policy actions. The slope dummy $inff_i$ captures the response of the stock market to a policy surprise taking place at an MPC meeting following the release of the inflation report. The slope dummy $pos_i$ captures the effects of surprises of positive sign on the stock market. The values in the parentheses are $t$ statistics calculated using White heteroscedasticity consistent estimates of standard errors. All variables are expressed in percentage points.

| | *(a)* | *(b)* | *(c)* | *(d)* | *(e)* |
|---|---|---|---|---|---|
| | $r_t$ | $r_t$ | $r_t$ | $r_t$ | $r_t$ |
| *a* | -0.10<br>*(-1.28)* | -0.10<br>*(-1.28)* | -0.06<br>*(-0.77)* | -0.08<br>*(-1.12)* | -0.05<br>*(-0.55)* |
| $ex_i$ | 0.03<br>*(0.14)* | 0.03<br>*(0.17)* | 0.03<br>*(0.15)* | 0.07<br>*(0.34)* | -0.04<br>*(-0.17)* |
| $surp_i$ | -2.51<br>*(-5.96)**** | -2.51<br>*(-5.96)**** | -1.82<br>*(-2.75)**** | -2.41<br>*(-6.12)* | -1.51<br>*(-2.03)*** |
| *post-97* | 2.68<br>*(1.90)** | *4.83*<br>*(2.29)**** | 4.94<br>*(2.50)*** | - | - |
| $infr_i$ | - | -5.30<br>*(-1.99)*** | -5.39<br>*(-2.12)*** | - | - |
| $noc_i$ | - | - | - | 6.36<br>*(2.29)**** | - |
| $inc_i$ | - | - | -1.55<br>*(-1.87)** | - | - |
| $pos_i$ | - | - | - | - | -1.66<br>*(-1.73)** |
| $inff_i$ | - | - | - | - | 3.73<br>*(1.85)** |
| $R^2$ | 0.10 | 0.12 | 0.13 | 0.12 | 0.11 |
| DW-stat | 1.71 | 1.70 | 1.71 | 1.65 | 1.69 |

(*/**/*** means that $t$ statistics are significant at the 10%/ 5%/1%level)

## Table 3
## Effects of Monetary Policy on Stock Market Sectors.

This table presents the results of the a SUR model of 12 regressions of the form $r_t = a + \beta_1 ex_t + \beta_2 sur_t + u_t$, where $r_t$ stands for the returns on the sectoral index under consideration and $u_t$ is the error term which is assumed to be orthogonal to the regressors. The sample consists of 168 observations on event days as defined above. The values in parentheses are *t* statistics calculated using White heteroscedasticity consistent estimates of standard errors. All variables are expressed in percentage points.

| | ***Intercept*** | $\beta_1$ | $\beta_2$ | **Chow breakpoint Test** | ***DW-stat*** | ***Adj. $R^2$*** |
|---|---|---|---|---|---|---|
| **Aeronautics and Defence** | -0.26<br>*(-2.24)*** | 0.20<br>*(0.58)* | -1.08<br>*(-1.59)* | 0.58 | 1.75 | **0.004** |
| **Banks** | -0.16<br>*(-1.41)* | 0.05<br>*(0.14)* | -2.35<br>*(-3.49)**** | 0.22 | 1.92 | **0.060** |
| **Basic Materials** | -0.08<br>*(-0.86)* | -0.22<br>*(-0.78)* | -2.08<br>*(-3.79)**** | 0.54 | 1.60 | **0.078** |
| **Consumer Goods** | -0.15<br>*(-1.26)* | -0.26<br>*(-0.72)* | -0.48<br>*(-0.68)* | 0.47 | 1.78 | **-0.006** |
| **Consumer Services** | -0.11<br>*(-1.20)* | -0.13<br>*(-0.45)* | -1.91<br>*(-3.54)**** | 0.40 | 1.56 | **0.064** |
| **Financial** | -0.17<br>*(-1.61)* | -0.02<br>*(-0.06)* | -1.93<br>*(-3.16)**** | 0.26 | 1.71 | **0.048** |
| **Health** | -0.19<br>*(-2.11)*** | 0.18<br>*(0.67)* | -1.16<br>*(-2.16)*** | 0.42 | 1.53 | **0.017** |
| **Industrial** | -0.16<br>*(-1.44)* | -0.08<br>*(-0.23)* | -1.32<br>*(-2.01)*** | 0.08 | 1.72 | **0.013** |
| **Life Insurance** | -0.21<br>*(-1.51)* | 0.02<br>*(0.06)* | -1.87<br>*(-2.33)*** | 0.14 | 1.64 | **0.022** |
| **Media** | -0.12<br>*(-0.89)* | -0.25<br>*(-0.62)* | -0.75<br>*(-0.97)* | 0.79 | 1.58 | **-0.003** |
| **Oil and Gas** | -0.04<br>*(0.32)* | -0.11<br>*(-0.34)* | -1.18<br>*(-1.77)** | 0.26 | 1.81 | **0.008** |
| **Telecommunications** | -0.007<br>*(-0.57)* | -0.07<br>*(-0.17)* | -2.19<br>*(-2.78)**** | 0.54 | 1.93 | **0.035** |
| **Leisure and Travel** | -0.13<br>*(-1.32)* | -0.07<br>*(-0.26)* | -2.24<br>*(-3.91)**** | 0.45 | 1.72 | **0.078** |
| **Real Estate** | -0.09<br>*(-1.21)* | -0.42<br>*(-1.80)** | -1.73<br>*(-3.79)**** | 0.43 | 1.54 | **0.096** |
| **F-test** | **-** | **-** | **26.39***<br>p-value:0.0057** | **-** | **-** | **-** |

(*/**/*** means that *t* statistics are significant at the 10%/ 5%/1%level)

## Table 4
## Size Portfolios

This table presents the results of the regression of the size portfolios on the expected and an unexpected part of monetary policy. The *small portfolio* depicts the returns of decile 1 firms of the constituent firms of the FTSE All Share which is rebalanced according the market value on June of every year. The *large portfolio* is the decile 10 and is estimated the same way. The values in parentheses are *t* statistics calculated using White heteroscedasticity consistent estimates of standard errors. All variables are expressed in percentage points.

| | (a) Small Portfolio | (b) Large Portfolio |
|---|---|---|
| $\alpha$ | 0.20 | -0.07 |
| | *(2.68)**** | *(-0.82)* |
| $ex_i$ | -0.17 | 0.14 |
| | *(-0.79)* | *(0.68)* |
| $surp_i$ | -1.58 | -2.24 |
| | *(-3.42)**** | *(-7.00)**** |
| $R^2$ | 0.08 | 0.11 |
| *DW*-stat | 1.72 | 1.70 |

(*/**/*** means that *t* statistics are significant at the 10%/ 5%/1%level)

## Table 5
## Descriptive Statistics

This table reports the summary statistics for the data that are included in the VAR model. The ρ1 and the ρ12 are the first order and the 12th month autocorrelation of the series respectively. Panel B reports the correlation matrix of the state variables.

| | Mean | St. dev. | Median | Min | Max | $\rho_1$ | $\rho_{12}$ |
|---|---|---|---|---|---|---|---|
| $r_t$ | 0.286 | 4.099 | 0.781 | -12.833 | 12.028 | 0.048 | -0.019 |
| $rir_t$ | 0.293 | 0.148 | 0.274 | 0.044 | 0.696 | 0.964 | 0.563 |
| $dp_t$ | -0.393 | 0.103 | -0.378 | -0.602 | -0.183 | 0.981 | 0.767 |
| $sp_t$ | 0.613 | 0.095 | 0.596 | 0.416 | 0.849 | 0.966 | 0.481 |
| $inf_t$ | 3.58 | 2.158 | 3.02 | 0.7 | 10.89 | 0.987 | 0.604 |

| | $r_t$ | $rir_t$ | $dp_t$ | $sp_t$ | $inf_t$ |
|---|---|---|---|---|---|
| $r_t$ | 1 | | | | |
| $rir_t$ | -0.051 | 1 | | | |
| $dp_t$ | -0.046 | 0.497 | 1 | | |
| $sp_t$ | 0.022 | -0.497 | 0.126 | 1 | |
| $inf_t$ | -0.015 | 0.62 | 0.555 | -0.591 | 1 |

**Table 6**
**Variance decomposition**

This table presents the results of the variance decomposition of excess stock returns. The estimation is based on a monthly first order VAR which includes excess returns ( $r_t$ ), the real interest rate ( $rir_t$ ), the log dividend price ratio ( $dp_t$ ), the spread of long-short treasury yields ( $sp_t$ ), and the inflation rate ( $inf_t$ ). The components of the variance decomposition of the unexpected excess equity returns $(e^r_{t+1})$ are the expectations about discounted future dividends $(e^d_{t+1})$, real interest rates $(e^i_{t+1})$, and equity premium $(e^e_{t+1})$. The results are presented as a share of the unexpected equity returns. The last two rows of each column present the $R^2$ value and the $x^2$ statistic of the overall significance test of all state variables included in the regression of the excess stock market returns in the VAR model. The values in the brackets report the bias of the estimates which are calculated by simulating the VAR model 2500 times. The values in the parentheses are the standard errors derived by 2500 replications of the VAR model.

| | *(a)* | *(b)* | *(c)* | *(d)* | *(e)* |
|---|---|---|---|---|---|
| | *75:03 – 06:06* | *75:03-92:12* | *75:03-97:05* | *93:01 – 06:06* | *97:06 – 06:06* |
| $\text{var}(e^e_{t+1})$ | 1.048 | *0.41* | 0.44 | 0.959 | 0.79 |
| | (1.00) | *(0.17)* | (0.17) | (0.63) | (1.30) |
| | {-0.001} | *{-0.11}* | {-0.10} | {-0.07} | {-0.16} |
| $\text{var}(e^i_{t+1})$ | 0.076 | *0.079* | 0.08 | 0.008 | 0.01 |
| | (0.12) | *(0.05)* | (0.04) | (0.01) | (0.14) |
| | {0.012} | *{0.004}* | {0.009} | {-0.00} | {-0.006} |
| $\text{var}(e^d_{t+1})$ | 0.158 | *0.26* | 0.24 | 0.095 | 0.09 |
| | (0.41) | *(0.12)* | (0.10) | (0.39) | (1.04) |
| | {-0.032} | *{-0.007}* | {-0.007} | {-0.02} | {-0.06} |
| $\text{cov}\,ar(e^d_{t+1}, e^i_{t+1})$ | 0.046 | *0.05* | 0.06 | -0.015 | -0.018 |
| | (0.17) | *(0.06)* | (0.05) | (0.04) | (0.28) |
| | {0.01} | *{-0.001}* | {0.007} | {0.07} | {0.004} |
| $\text{cov}\,ar(e^d_{t+1}, e^e_{t+1})$ | 0.144 | *-0.21* | -0.19 | 0.06 | -0.056 |
| | (0.62) | *(0.08)* | (0.09) | (0.49) | (1.11) |
| | {-0.003} | *{-0.061}* | {-0.05} | {-0.036} | {-0.10} |
| $\text{cov}\,ar(e^e_{t+1}, e^i_{t+1})$ | 0.049 | *-0.03* | -0.016 | 0.018 | -0.02 |
| | (0.32) | *(0.065)* | (0.06) | (0.06) | (0.36) |
| | {0.018} | *{-0.005}* | {0.002} | {0.013} | {0.01} |
| $R^2$ | 0.025 | 0.027 | 0.025 | 0.11 | 0.084 |
| $\chi^2$*(significance)* | (0.09) | (0.33) | (0.23) | (0.00) | (0.09) |

**Table 7**
**Innovation Correlations**

*This table reports the correlations of the innovations of the VAR model and on the main diagonal it is the standard deviation of each shock. The numbers in the parentheses are the standard errors estimated by 2500 bootstrap samples generated by our VAR model.*

*A: Full Sample 1975 Mar – 2006 Jun*

| Innovations of | $r_t$ | $rir_t$ | $dp_t$ | $sp_t$ | $inf_t$ |
|---|---|---|---|---|---|
| $r_t$ | ***4.65*** ***(0.21)*** | | | | |
| $rir_t$ | *-0.21* *(0.07)* | ***0.064*** ***(0.004)*** | | | |
| $dp_t$ | *-0.94* *(0.04)* | *0.14* *(0.09)* | ***0.022*** ***(0.002)*** | | |
| $sp_t$ | *0.14* *(0.05)* | *-0.54* *(0.05)* | *-0.11* *(0.06)* | ***0.024*** ***(0.002)*** | |
| $inf_t$ | *-0.06* *(0.05)* | *-0.04* *(0.06)* | *0.07* *(0.05)* | *0.02* *(0.06)* | ***0.55*** ***(0.05)*** |

*B: Sample A: 1975 Mar –1997 May*

| Innovations of | $r_t$ | $rir_t$ | $dp_t$ | $sp_t$ | $inf_t$ |
|---|---|---|---|---|---|
| $r_t$ | ***4.82*** ***(0.27)*** | | | | |
| $rir_t$ | *-0.24* *(0.08)* | ***0.07*** ***(0.005)*** | | | |
| $dp_t$ | *-0.93* *(0.05)* | *0.16* *(0.10)* | ***0.02*** ***(0.003)*** | | |
| $sp_t$ | *0.17* *(0.06)* | *-0.58* *(0.05)* | *-0.14* *(0.06)* | ***0.03*** ***(0.002)*** | |
| $inf_t$ | *-0.02* *(0.06)* | *-0.06* *(0.06)* | *0.03* *(0.06)* | *0.05* *(0.06)* | ***0.62*** ***(0.06)*** |

*C: Sample B: 1997 June –2006 November*

| Innovations of | $r_t$ | $rir_t$ | $dp_t$ | $sp_t$ | $inf_t$ |
|---|---|---|---|---|---|
| $r_t$ | ***4.01*** ***(0.36)*** | | | | |
| $rir_t$ | *0.03* *(0.10)* | ***0.02*** ***(0.001)*** | | | |
| $dp_t$ | *-0.99* *(0.01)* | *-0.07* *(0.10)* | ***0.02*** ***(0.001)*** | | |
| $sp_t$ | *-0.01* *(0.12)* | *-0.17* *(0.10)* | *0.04* *(0.12)* | ***0.02*** ***(0.001)*** | |
| $inf_t$ | *-0.17* *(0.08)* | *0.09* *(0.05)* | *0.13* *(0.08)* | *-0.13* *(0.09)* | ***0.23*** ***(0.02)*** |

## Table 8

## Components and innovations

This table prints the correlations of each state variable innovation with the estimated returns components. The numbers in the parentheses are the standard errors estimated by 2500 bootstrap samples generated by our VAR model.

*(a) Full Sample 1986 June – 2006 November*

| | $e^d_{t+1}$ | $e^e_{t+1}$ | $e^i_{t+1}$ |
|---|---|---|---|
| $r_t$ | *0.00* | *-0.017* | *-0.008* |
| | *(0.049)* | *(0.048)* | *(0.05)* |
| $rir_t$ | *0.08* | *-0.025* | *0.13* |
| | *(0.051)* | *(0.051)* | *(0.051)* |
| $dp_t$ | *0.03* | *-0.000* | *-0.01* |
| | *(0.047)* | *(0.047)* | *(0.049)* |
| $sp_t$ | *-0.03* | *0.025* | *-0.05* |
| | *(0.05)* | *(0.051)* | *(0.051)* |
| $inf_t$ | *0.07* | *0.037* | *-0.01* |
| | *(0.051)* | *(0.05)* | *(0.051)* |

*(b) A: 1975 June –1997 May*

| | $e^d_{t+1}$ | $e^e_{t+1}$ | $e^i_{t+1}$ |
|---|---|---|---|
| $r_t$ | *0.03* | *-0.02* | *-0.00* |
| | *(0.056)* | *(0.055)* | *(0.055)* |
| $rir_t$ | *0.08* | *-0.01* | *0.14* |
| | *(0.06)* | *(0.06)* | *(0.058)* |
| $dp_t$ | *0.01* | *-0.01* | *-0.01* |
| | *(0.056)* | *(0.054)* | *(0.055)* |
| $sp_t$ | *-0.06* | *0.045* | *-0.03* |
| | *(0.059)* | *(0.059)* | *(0.058)* |
| $inf_t$ | *0.01* | *-0.014* | *-0.04* |
| | *(0.061)* | *(0.06)* | *(0.06)* |

*(c) B: 1997 June –2006 November*

| | $e^d_{t+1}$ | $e^e_{t+1}$ | $e^i_{t+1}$ |
|---|---|---|---|
| $r_t$ | *-0.00* | *0.00* | *-0.00* |
| | *(0.088)* | *(0.09)* | *(0.088)* |
| $rir_t$ | *-0.19* | *-0.10* | *0.08* |
| | *(0.098)* | *(0.095)* | *(0.098)* |
| $dp_t$ | *0.08* | *0.01* | *-0.025* |
| | *(0.088)* | *(0.087)* | *(0.087)* |
| $sp_t$ | *0.24* | *-0.06* | *-0.15* |
| | *(0.09)* | *(0.09)* | *(0.092)* |
| $inf_t$ | *-0.24* | *-0.01* | *0.23* |
| | *(0.096)* | *(0.094)* | *(0.096)* |

**Table 9**
**Impulse responses of excess returns and inflation to monetary policy shocks.**

This table reports the results of matrix product $A^k\varphi$ which calculates the response of the state variables of our VAR model to 1% monetary policy shock. The values in the parentheses are standard errors estimated by 2500 bootstrap replications.

| | Impulse to a monetary policy shock of | 1-period | 2-periods | 3-periods | 12-periods |
|---|---|---|---|---|---|
| *75:03-06:06* | $r_t$ | -0.59<br>*(0.35)* | -0.01<br>*(0.02)* | -0.00<br>*(0.001)* | -0.00<br>*(0.00)* |
| | $inf_t$ | 0.11<br>*(0.04)* | 0.10<br>*(0.06)* | 0.14<br>*(0.06)* | 0.02<br>*(0.01)* |
| *75:03-97:06* | $r_t$ | -0.43<br>*(0.36)* | -0.02<br>*(0.03)* | -0.00<br>*(0.003)* | -0.00<br>*(0.001)* |
| | $inf_t$ | 0.08<br>*(0.05)* | 0.11<br>*(0.08)* | 0.10<br>*(0.07)* | -0.01<br>*(0.02)* |
| *97:06-06:06* | $r_t$ | -1.99<br>*(1.13)* | 0.29<br>*(0.21)* | -0.00<br>*(0.03)* | 0.00<br>*(0.001)* |
| | $inf_t$ | 0.19<br>*(0.09)* | 0.18<br>*(0.25)* | 0.15<br>*(0.25)* | -0.04<br>*(0.36)* |

**Table 10**
**The Impact of Monetary Policy**

This table presents the impact of monetary policy on the components of the variance decomposition of excess stock returns. The results are based on a monthly first order VAR which includes excess returns ($r_t$), the real interest rate ($rir_t$), the log dividend price ratio ($dp_t$), the spread of long-short treasury yields ($sp_t$), and the inflation rate ($inf_t$). The estimation of the impact of monetary policy on the components of the variance decomposition is based on the formulas derived by Bernanke and Kuttner (2005) and are calculated as the following dot products: for the future equity premium $e1'\rho A(I-\rho A)^{-1}\phi$, for the future real interest rate $e2'(I-\rho A)^{-1}\phi$, and for the future dividends $(e1'+e2')(I-\rho A)^{-1}\phi$. The values in the parentheses are standard errors estimated by 2500 bootstrap replications.

| | *75:03-06:06* | *75:03-97:06* | *97:07-06:05* | *75:03-93:01* | *93:02-06:06* |
|---|---|---|---|---|---|
| Excess Returns | -0.59<br>(0.35) | -0.42<br>(0.36) | -1.99<br>(1.67) | -0.42<br>(0.39) | -1.41<br>(1.17) |
| Future equity premium | 0.29<br>(0.37) | 0.09<br>(0.27) | 0.42<br>(1.62) | -0.005<br>(0.28) | 0.57<br>(1.16) |
| Real interest rate | 0.62<br>(0.09) | 0.54<br>(0.10) | 0.42<br>(0.19) | 0.51<br>(0.10) | 0.21<br>(0.11) |
| Dividends | 0.33<br>(0.14) | 0.20<br>(0.l8) | -1.14<br>(0.66) | 0.08<br>(0.20) | -0.63<br>(0.38) |

(*/**/*** means that *t* statistics are significant at the 10%/ 5%/1%level)

## Table 11
## The Sectoral Impact of Monetary Policy

This table presents the channels through which monetary policy affects some important industries of the UK economy. These effects are estimated using the methodology developed by Bernanke and Kuttner (2005) for the sample posy-97. The values in the parentheses are bootstrapped standard errors by using 2500 replications.

| | $e^d$ | $e^e$ | $e^i$ | $e^r$ |
|---|---|---|---|---|
| **Small Portfolio** | -9.13 | -4.79 | 0.40 | **-4.73** |
| | *(4.47)* | *(3.1)* | *(0.17)* | ***(2.5)*** |
| **Large Portfolio** | 0.34 | 1.67 | 0.43 | **-1.76** |
| | *(0.65)* | *(0.89)* | *(0.23)* | ***(1.31)*** |
| **FTSE100** | -0.57 | 0.42 | 0.36 | **-1.35** |
| | (1.66) | (2.61) | (0.41) | **(1.56)** |
| **FTSE 250** | -1.00 | -0.01 | 0.36 | **-1.36** |
| | (1.07) | (1.43) | (0.13) | **(1.88)** |
| **FTSE350** | -0.51 | 0.44 | 0.36 | **-1.31** |
| | (0.53) | (1.64) | (0.13) | **(1.59)** |
| **FTSE smallcap** | -1.43 | 0.69 | 0.29 | **-2.41** |
| | (1.39) | (1.67) | (0.14) | **(1.98)** |
| **Aeronautics and Defence** | 0.21 | 2.41 | 0.15 | **-2.34** |
| | *(0.55)* | (2.87) | (0.19) | **(3.00)** |
| **Banks** | 0.51 | 2.33 | 0.26 | **-2.07** |
| | (0.58) | (2.30) | (0.19) | **(2.51)** |
| **Basic Materials** | 0.28 | 2.04 | 0.40 | **-2.15** |
| | (7.43) | (8.00) | (0.49) | **(2.39)** |
| **Consumer Goods** | -3.04 | -1.86 | 0.38 | **-1.56** |
| | (2.65) | (2.77) | (0.14) | **(2.85)** |
| **Consumer Services** | -0.76 | 1.77 | 0.32 | **-2.86** |
| | (0.46) | (1.83) | (0.13) | **(1.88)** |
| **Financial** | -1.68 | -0.77 | 0.32 | **-1.23** |
| | (2.53) | (1.43) | (0.13) | **(2.25)** |
| **Health** | -0.71 | -0.00 | 0.35 | **-1.06** |
| | (0.42) | (1.43) | (0.12) | **(1.58)** |
| **Industrial** | -2.08 | -0.44 | *0.20* | **-1.84** |
| | (8.98) | (8.83) | *(0.30)* | **(2.81)** |
| **Life Insurance** | 2.43 | -0.04 | 0.30 | **2.18** |
| | (3.21) | (3.57) | (0.45) | **(2.95)** |
| **Media** | 0.25 | 2.60 | 0.35 | **-2.70** |
| | (0.74) | (3.11) | (0.16) | **(2.92)** |
| **Oil and Gas** | 0.82 | -0.50 | 0.38 | **0.95** |
| | (1.00) | (1.85) | (0.19) | **(2.42)** |
| **Telecommunications** | -1.73 | 0.62 | 0.38 | **-2.74** |
| | (8.32) | (9.01) | (0.16) | **(2.61)** |
| **Leisure and Travel** | -3.00 | 1.43 | 0.30 | **-4.74** |
| | (1.16) | (1.82) | (0.13) | **(2.15)** |
| **Real Estate** | **-2.95** | **-2.79** | **0.43** | **-0.59** |
| | **(5.18)** | **(5.48)** | **(0.33)** | **(1.81)** |