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European Monetary Policy Surprises: The Aggregate and Sectoral Stock Market Response

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Abstract

In this paper we investigate the stock market response to international monetary policy changes in the UK and Germany. Specifically, we analyse the impact of (un)expected changes in UK and German/euro area policy rates on UK and German aggregate and sectoral stock returns in an event study. The decomposition of the (un)expected changes in policy rates are based on futures markets. Overall, our results suggest that, UK monetary policy surprises have a significant negative influence on both aggregate and industry level stock returns in both the UK and Germany. The influence of German/Euro area monetary policy shocks appears insignificant for both countries.

1 Introduction

The last decade has witnessed the primacy of monetary policy as the main tool used by policymakers in the stabilisation of inflation and output. Concomitantly, commentators and analysts pay close attention to changes in policy rates in the belief that such changes, particularly unexpected changes, can influence stock market returns. Moreover, with increasingly integrated global markets, attention is paid not only to domestic policy changes but also to how foreign policy and foreign economic conditions can affect the domestic economy.

Reflecting these issues, greater attention has been paid to the qualitative and quantitative impact of monetary policy changes on other asset prices such as interest rates, exchange rates and stock returns. In terms of the US, examples of research that have examined the influence of monetary policy surprises on other interest rates include, Bomfim (2003), Kuttner (2001) and Poole and Rasche (2000). Andersen et al (2004) and Fatum and Solnik (2003) have explored the impact of surprise changes in the US policy rate on various exchange rates while Bernanke and Kuttner (2005), Ehrmann and Fratzscher (2004a) and Rigobon and Sack (2003) have all examined how US policy rate changes affect the US stock market.

In the first part of our study we investigate the impact of UK and German/Euro area monetary policy changes on domestic stock returns. In particular, we examine how both aggregate and sectoral level returns respond to domestic monetary policy changes in an event type study. While previously mentioned research addresses this issue for the US, there is an absence of such work for the UK and Germany.[1] Hypotheses of interest include whether aggregate stock returns respond significantly to domestic monetary surprises? Is it likely that all sectors in each economy react in a homogenous fashion to policy rate changes or are there differential effects across sectors in each economy? A recent study by Stevenson (2002) looks at the impact of German interest rate changes on European bank stocks and finds evidence of heterogenous response from country specific bank returns as a result of German policy shocks.[2]

With increasing financial integration, policy changes in one country are likely to impact

[1] Both Ganley and Salmon (1997) and Hayo and Uhlenbrock (2000) investigate the output effects of UK and German monetary policy shocks respectively at a sectoral level, using pre EMU data in a traditional VAR setting.

[2] The author, however, only looks at actual interest rates.

on stock returns in other countries. Recent work has just begun to address these issues. For example, Andersen et al (2004) and Ehrmann and Fratzscher (2004a) examine the influence of US macro variables including monetary policy on bond and foreign exchange markets both domestically and in other countries. In the second part of our study, we examine whether there are spillovers in terms of monetary policy changes in the German/Euro area or the UK respectively affecting aggregate or sectoral returns in the other economy. This raises a number of interesting questions. Do domestic and foreign monetary policy shocks affect different industries in different countries? Are there commonalities in how industries common to the two countries react to a domestic or foreign interest rate change? In addition, given the potential entry of the UK into EMU, how is the UK market affected by German/Euro area interest rates shocks.

Our results show that unanticipated changes in UK monetary policy have a significant impact on aggregate stock returns in both the UK and Germany. Moreover, UK monetary policy shocks have a significance impact on industrial returns in both the UK and Germany. We show that the response of UK industry to UK monetary policy shocks is similar to that observed for US industries to unanticipated changes in US monetary policy. However, surprisingly we observe that unexpected changes in German/Euro monetary policy has little impact on either aggregate returns or industry returns in the UK and Germany.

The outline of the rest of the paper is as follows. In section 2, we first review the related literature and discuss the appropriate identification of monetary policy. Section 3 presents the methodological approach adopted in this study while section 4 reports and discusses the results and relates them to the findings of other recent studies. Finally, Section 5 summarises our main conclusions and draws some policy implications.

2 Literature Review

A number of channels have been hypothesised regarding how monetary policy can influence stock market returns, see the reviews in Bernanke and Kuttner (2005) and Sellin (2001). For example, if markets are efficient and the value of equities are determined by the expected discounted present value of future cash flows, a change in monetary policy can influence stock returns in a number of different ways. First, via arbitrage, a change in the monetary authority's policy rate is likely to feed into the risk free rate and other market rates, hence, affecting the opportunity cost of holding such an asset. This will, in turn, have an inverse effect on the present value of future cash flows via its impact on the discount factor. Second,

given changes in monetary policy can potentially affect output in the short to medium term, expected future cash flows can also be influenced by changes in economic activity induced by such monetary policy changes.

Studies of the relationship between monetary policy and asset prices generally take one of two approaches; vector autoregressions (VAR's) or event studies. The rationale for using one or other approach depends on a number of considerations including the time horizon of interest and the variables one wishes to control for and we will discuss both approaches.

2.1 Identification of Monetary Policy

There are a number of methodological issues that need to be addressed in studying the influence of monetary policy changes on stock market returns. These can be grouped into three main categories 1) endogeneity, 2) omitted variable bias, 3) isolating the surprise component of policy rate change. We will address each of these in turn.

The appropriate identification of policy changes can be most clearly seen in early studies assessing the impact of changes in money supply on asset prices. Is the announcement of say a change in M1 truly exogenous? Changes in this measure could equally reflect changes in money demand or money supply. A failure to properly identify monetary supply changes has led some researchers to find counterintuitive results.[3] The issue of identification becomes somewhat more subtle when one focuses on short term rates as the central bank's main policy variable. In particular, a researcher wishing to isolate the influence of a change in the monetary authority's policy rate on asset prices needs also to be aware that causation may run in the opposite direction, with changes in asset prices leading the monetary authority to change policy rates. Rigobon and Sack (2003) attempt to control for this possibility. However, they find the impact of failing to take account of such endogeneity appears quite small in practice. Moreover, many central bank practitioners argue that central banks have little role in responding to asset prices per se, see for example, Vickers (1999).

Stock returns and policy rates could also change due to movements in some other variable. In an attempt to control for the influence of other variables, many researchers have turned to an event study methodology. An event study attempts to control the effect of other information that may influence asset prices by examining a narrow time interval surrounding the policy action or piece of news under consideration. In particular, the day of

[3] See, Sellin (2001) for an overview of such problems.

the event is chosen, *announcement day*, and the impact on the announcement day and/or subsequent days, *event window*, are analysed. Clearly, the smaller the window, the less other factors can influence the results and in addition the less likely there will be an issue of endogeneity.[4]

Empirical work that fails to decompose monetary policy changes into its expected and unexpected components is also likely to lead to biased results due to an errors in variables problem. In particular, a number of theories based on the assumption of efficient markets would suggest that only unanticipated changes in policy should influence asset prices immediately, i.e., on the announcement day of a monetary policy change asset prices should respond only to the surprise element of such a change.

On the other hand, anticipated changes in policy should not affect asset prices on the announcement day but instead such information should have already been priced into the asset value by market participants when they became aware of it, i.e., prior to the announcement day. Otherwise, arbitrage opportunities would exist and markets would be deemed inefficient. Studies that examine the influence of policy rate changes and fail to decompose actual changes into these two components are liable to lead to biased results. For example, Cook and Hahn (1989) failed to take account of expected and unexpected changes in monetary policy and so their results are subject to biases as a result of the errors in variables problems. Other longer-term horizon studies that suffer from this problem include Concover, Mitchell and Johnson (1999) and Durham (2001).

Recent research has attempted to distinguish between surprise and anticipated changes in monetary policy rates using one of three main approaches. These are 1) directly survey market participants, 2) using future markets data, 3) derive expectations based on forecasts from regression analysis. Probably the most popular method is the second approach. Its popularity stems from the fact that in recent times futures markets have dramatically increased both their liquidity and the range of instruments on offer. Hence, one can derive a measure of the surprise element on a continual basis and this is the approach adopted in this paper.

The vector autoregressive (VAR) approach has been advocated as a panacea to the problems of endogeneity and need to isolate surprise changes in monetary policy from actual changes. In particular, an unanticipated exogenous change in the policy instrument is identified and its effects on various asset prices can then be examined via impulse response

[4]See Campbell, Lo and McKinlay (1997) for a detailed discussion of the event study approach.

functions over the short to medium term. Both Thorbecke (1997) and Patelis (1997) estimate VAR models for the US and find a negative relationship between an interest rate shock and equity returns. International cross country evidence is provided by Neri (2004) who examines policy rate shocks while Lastrapes (1998) looks at the impact of a monetary supply shock on stock returns for the G7. Both authors find that a one quarter exogenous unanticipated monetary contraction leads to a temporary decline in stock returns.

The VAR approach is, however, dependent on the data frequency used, variables included and the ordering of the variables. Moreover, VAR studies generally use monthly data or quarterly data and hence may lose some of the effects of interest rate changes on asset prices due to aggregation and timing concerns. In addition, Rudebusch (1998) among others, has questioned the nature of the shock to the policy variable generated from a VAR on the grounds that it is somewhat artificial and meaningless.

3 Methodology

Given our study is akin in methodology to Bernanke and Kuttner (2005) it is useful first to outline their method and results in more detail. Bernanke and Kuttner (2005) adopt an event study approach when addressing the impact of US monetary policy surprises on US stock returns. They run the following baseline regression,

$$\Delta R_t = \alpha_0 + \alpha_1 \Delta r_t^e + \alpha_2 \Delta r_t^u + \epsilon_t \tag{1}$$

where,

ΔR_t is the one-day percentage change in the stock index of interest between t and $t+1$,

Δr_t^u is the surprise change in the policy rate,

Δr_t^e is expected change in policy rate, i.e., the difference between the actual change in the policy rate and the surprise change, $\Delta r_t^e = \Delta r_t - \Delta r_t^u$.

An important element in the above specification is the need to derive a proxy for the unanticipated component of the policy rate change. In the US, the policy rate target is the federal funds rate (an interbank market rate trading excess reserves between commercial banks) with the target rate set after each FOMC meeting. Moreover, there is a futures

market interest rate based on the average monthly federal funds rate and this is called the federal funds futures rate. Differences between its value and the federal funds rate generally reflect expectations of an interest rate change. In the Bernanke and Kuttner (2005) study, they use a scaled version of the one-day change in current month federal funds future rate as a proxy for the unanticipated component on the day of the policy rate change.[5,6]

Bernanke and Kuttner (2005) find that a surprise change in US monetary policy is statistically significant with a negative sign, i.e., an unanticipated change in the US federal funds rate target has a negative effect on US stock returns. On the other hand, they find that anticipated changes have a positive significant influence over the full sample.[7] Similar results have been found for the US by Ehrmann and Fratzscher (2004), Rigobon and Sack (2004) and Gurkaynak, Sack and Swanson (2002) using an event study methodology.

Since we are investigating the impact of (un)anticipated changes in German/Euro area and UK policy rates, we need measures of the surprise component in each respective policy rate. For both the UK and German(Euro area), there are no equivalent futures market instruments that tracks the UK or the German(Euro area) policy rate. However, there are interest rate futures contracts that can act as close substitutes since they are likely to be strongly influenced by current expectations of future policy rates. Our proxy for the unanticipated change in the German policy rate between 1989 and 1998 is the one-day change in the 3-month Euromark futures rate. With the introduction of the euro in January 1999, we proxy surprise changes in the ECB policy rate by the one-day change in the three-month Euribor futures rate. Bernoth and Von Hagen (2004) find that the three-month Euribor futures rate is an unbiased predictor of Euro area policy rate changes.[8]

For the UK, the policy rate is the two-week repo rate. Our proxy for the unexpected change in the policy rate is the one-day change in the 3-month sterling futures contract. This is one of the instruments used by the Bank of England to infer market expectations about the likely course of monetary policy, see Brook, Cooper and Scholtes (2000).

One concern with using futures rates of a longer maturity than the policy rate, i.e.,

[5] Gurkaynak, Sack and Swanson (2002) find that the fed funds future market is the best predictor of Federal funds target rates of all interest rate instruments.

[6] The scaling occurs because the value of Fed fund futures contract depends on the average over the month in question rather than at the end of the month.

[7] They also highlight a number of outliers and once these are accounted for the unexpected influence remains statistically significant while the expected change is not statistically significant.

[8] Euribor stands for Euro-Interbank Offer Rate.

for the UK we use the three-month sterling futures contract when the policy instrument is the two-week repo rate, is that changes in the former may reflect changes that the market anticipates in the future and not in the immediate horizon. However, Rigobon and Sack (2004) argue that a longer maturity forward contract is more likely to catch a genuine surprise element in the policy rate change rather than a change in timing, i.e., markets are more likely to react to a surprise change in the policy rate relative to when markets had factored in a policy rate change but simply got the timing wrong.[9]

4 Data and Empirical Results

The sample period when investigating German monetary policy shocks runs from the beginning of May 1989 to the end of May 2004. In terms of UK interest rate changes we examine the period from the start of January 1993 to the end of May 2004. The later starting period for the UK was dictated by the UK leaving the ERM in early September 1992. The Bank of England base rate is used as the policy rate. The unanticipated change in the UK base rate is proxied by the one-day change in the price of the three-month sterling LIBOR futures contract as traded on LIFFE.[10] The data are obtained from the Bank of England and Bloomberg respectively.

In the case of German (Euro Area) shocks, actual changes in the policy rate were proxied by changes in the Bundesbank base rate (Lombard rate) until December 1998 and the ECB main refinancing rate for the remainder of the sample. These rates are taken from the Deutsche Bundesbank and the ECB, respectively. The unanticipated change in the Bundesbank base rate is proxied by the one-day change in the price of the three-month EuroDM futures contract as traded on the LIFFE while the unanticipated change in the ECB policy rate is proxied by the one-day change in the price of the three-month Euribor futures contract as traded on Eurex, Frankfurt. In both cases the unanticipated change is calculated as the one-day change on the date of the policy announcement. The data are taken from Datastream and Bloomberg, respectively. A summary of the monetary policy shock indicators is given in Table 1.

The stock market data comprise daily stock returns on 16 (Level 4) industry-based

[9] Rigobon and Sack (2003) use the three-month euro dollar rather than the one-month Fed funds futures contract in their study of the US.

[10] LIFFE stands for London International Financial Futures and Options Exchange.

portfolios for the UK and Germany, obtained from Datastream.[11] The industrial sector portfolios are selected on the basis of data availability for the two indices over the entire sample period. The summary statistics for the full set of daily returns on each of the sectors and the benchmark index for the UK and Germany are reported in Table 2 and 3 respectively. There is considerable variation in sector returns in each of the two countries.

4.1 Empirical Results

We first examine the impact of domestic monetary policy shocks on domestic aggregate and sectoral returns.

4.1.1 Influence of UK Monetary Policy on UK Returns

In table 4, we report the impact of (un)anticipated changes in the UK policy rate on the FTSE and UK sectoral returns by running a regression similar to equation (1).[12] At an aggregate level, the surprise element in UK policy rate changes gives rise to a negative significant effect on FTSE returns. In addition, anticipated changes are not statistically significant and hence consistent with the efficient markets hypothesis. Quantitatively, the results imply that a surprise 25 basis point increase in the UK policy rate is associated with roughly a 0.2 percent decline in the FTSE return. These results are qualitatively similar to Bernanke and Kuttner (2005), although they find a greater quantitative impact on US stock returns with respect to a surprise change in the Fed funds target rate.[13]

At a sectoral level, we find similar qualitative results as those found at the aggregate level. Nearly all sectors have a significant negative response to a surprise change in monetary policy while expected policy changes give rise to an insignificant response. The exceptions to this are food processing, household, pharmacy and utilities who respond negatively but not significantly to a surprise change in monetary policy. Despite the use of an event study methodology, other variables on the day of a policy change could be driving our results. For example, if say UK stock returns respond significantly to US stock returns, a spike in US

[11] All the sectors are classified as Level 4 and the portfolios are constructed by Datastream. Although the exact constituents will differ between countries, Level 4 portfolios are broad enough to warrant meaningful comparison across countries.

[12] For all regressions, the t-statistics reported below coefficient values are based on White (1980) consistent standard errors.

[13] They find that a surprise 25 basis point increase in US rates leads to a one per cent decline in returns on broad US stock indices.

returns on day of the monetary announcement could bias our estimate of the response of UK returns due to omitted variable bias. We can control for this by including any variables which may have such an effect.

Thus, our baseline specification in equation (1) is augmented to include any other variable which may affect stock returns on the day;

$$\Delta R_t = \alpha_0 + \alpha_1 \Delta r_t^e + \alpha_2 \Delta r_t^u + \gamma y_t + \epsilon_t \tag{2}$$

where y_t is any omitted variable which may potentially bias estimates of the reaction of stock returns to monetary policy changes. Variables we have considered include, same day aggregate stock returns of US, German, Italy and France, sterling exchange rates as well as sectoral indices for the four above mentioned countries.[14] We find the significance of the coefficients associated with the expected and surprise elements of a policy rate change in table 3 are robust to the inclusion of any of these additional variables. Hence, it appears that nearly all UK sectoral returns examined appear to respond negatively and significantly to a surprise in UK policy rates while expected changes do not appear to affect sectoral stock returns.

4.1.2 Influence of German(Euro) Area Monetary Policy on German Returns

Next we examine the influence of German (Euro area) monetary policy on German stock returns both at an aggregate and sectoral level with these results reported in table 5. Neither the Dax nor the sectoral indices respond significantly to an (un)expected change in German (Euro Area) rates. These results are robust to the inclusion of potentially omitted variables.[15] Hence, domestic monetary policy changes do not seem to impact on German stock returns. These results stand in stark contrast to those for the UK. A potential explanation for the lack of impact of German monetary policy on German stock returns is that capital markets in Germany are more long term in nature than in the UK, hence, surprise changes in the policy rate may have only a small effect on long rates unless such a change is viewed as persistent. In addition, Ehrmann (2000) reports evidence to suggest

[14] For the US we actually used the day before return, since this is most relevant given time lag between markets, although using a two day window does not change our results.

[15] Variables considered include, same day aggregate stock returns of US, UK, Italy and France, Mark (Euro) exchange rates as well as sectoral indices for the four above mentioned countries.

that output at an aggregate level responses more to a domestic interest rate tightening in the UK than in the Germany.[16]

4.2 Spillovers of Monetary Policy on Stock Returns

In this section we explore whether there are spillovers with respect to changes in monetary policy in one country affecting stock returns in another country. In particular, we examine the influence of (un)anticipated changes in UK and German/euro area monetary policy on the respective German and UK aggregate and industry level returns. Recent studies have highlighted the importance of economic news spillovers, in terms of their influence on aggregate stock returns, see Connolly and Wang (2003).[17] Ehrmann, Fratzscher and Rigobon (2005) find evidence of spillovers from the US to the Euro area, but find less evidence of spillovers in the opposite direction. However, the literature is silent on the industrial response to spillovers of monetary policy shocks and whether this response, if any, is homogeneous.[18]

4.2.1 Influence of UK Monetary Policy on German Returns

In table 6, we report the influence of (un)anticipated changes in the UK policy rate on same day returns of German aggregate and sectoral returns. In terms of the DAX, we find that it responds negatively and significantly to a surprise change in the UK policy rate using a one tail test. This is in stark contrast to the lack of influence of German(Euro) area policy on German stock returns. In quantitative terms, the response of both the DAX and the FTSE to an unanticipated change in UK rates is similar.

At a sectoral level, 10 out of the 16 German sectors have a negative significant response to a surprise change in UK rates. Once again this is at odds with the effect of German(Euro) area monetary policy on German returns. The sectors that respond significantly are in the main closely aligned to those UK sectors that responded significantly to the UK monetary policy surprise suggesting commonalities across industries located in the two countries.

[16] Ehrmann uses a structural VAR approach.

[17] Connolly and Wang (2003) test for economic news spillovers between the US, UK and Japan and find evidence of significant spillovers, particularly from the US to Japan.

[18] An exception is Stevenson (2002) who looks at the impact of German interest rate changes on European bank stocks.

4.2.2 Influence of German(Euro Area) Policy on UK Returns

In table 7, we report the impact of (un)anticipated changes in the German (Euro area) policy rate on both aggregate and sectoral returns in the UK. We find that at an aggregate and sectoral level surprise changes in German(Euro area) monetary policy have an insignificant effect on UK returns.[19] This result is robust across a number of different specifications.

4.3 Interpretation of Results

To summarise, our results suggest that the impact of UK monetary policy on both UK aggregate and sectoral stock returns are consistent with the predictions of theory. However, German monetary policy shocks appear to have no influence on German aggregate stocks returns or industry level returns. Finally, we find evidence of spillovers from UK policy to both German aggregate and sectoral returns. The results suggest that industries common to both locations, UK and Germany, react in a similar fashion to UK monetary policy shock. How is this result interpreted, given our findings for German monetary policy shocks?

In order to shed some light on this issue we study the impact of US monetary policy shocks on US stock returns. In table 8, we report the response of US aggregate and sectoral returns to (un)expected changes in US monetary policy. Comparing the sectoral response in US relative to the UK with respect to changes in domestic monetary policy, we find that there is a close correspondence in terms of sectors which are significantly influenced by domestic monetary policy. The exceptions are the chemical sector which responds significantly to changes in UK monetary policy but not in US while insurance, oil & gas respond significantly in the UK but not in the US. Quantitatively it does however, appear that sectors in US respond either with a larger coefficient or a more significant response compared to those in the UK.

The results reported here for the US are broadly consistent with the results reported in Bernanke and Kuttner (2005).[20] Given the domestic industry response in the UK and US are consistent, is it likely to be the case that US policy shocks will influence UK and/or German industry returns. We have examined the influence of US monetary policy surprises on both UK and German returns but found very little evidence that US monetary surprises

[19] The results here are in contrast to those reported in Stevenson (2002) for European bank returns. This may as already highlighted be as a result of the decomposition of interest rate changes into expected and unexpected.

[20] Bernanke and Kuttner (2005) use the Fama-French disaggregated data in their study.

or expected changes in rates influenced next day UK or German returns both at either an aggregate or sectoral level.[21]

5 Conclusions

In this study, we have examined the impact of UK & German/Euro area monetary policy shocks on aggregate and industrial level stock returns. A central part of the study was the decomposition of policy rate changes into their expected and unexpected components using an interest rate futures contract. Our results show that UK monetary policy shocks have a statistically significant impact on both UK aggregate and UK industry stock returns. This finding complements the previous literature on US monetary policy shocks and the US results presented here. We observe that there is a similarity in the sectors which show significant responses. However, the UK response is of much smaller magnitude than that observed in the US.

We also observe important spillover effects since unanticipated changes in UK monetary policy have significant impacts on German aggregate and industrial level stock returns. The sensitivity to the shock is dependent on the particular industry, e.g. autoparts and households are extremely sensitive to the shock. However, the results for German/Euro area monetary policy shocks are dramatically different in relation to the importance of the shock on both German and UK aggregate and industrial level returns. Both expected and unexpected changes in German/Euro area monetary policy have an insignificant impact on stock returns in Germany and the UK.

[21] Results not reported. Results are available from the authors on request.

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Table 1: German/euro & UK Monetary Policy Indicators

Origin of Event	Proxy for Unanticipated Change	Target	Sample
German/euro	3-month euromark & euribor futures rate	Lombard rate & ECB main refinancing rate	1989:04 - 2004:5
UK	3-month sterling LIBOR futures rate	Bank of England repo/base rate	1993:01 - 2004:05

Table 2: Summary Statistics for UK Industry Returns

	Mean	Standard Error	Minimum	Maximum
FTSE	0.03	0.98	-5.36	5.10
Autoparts	0.05	1.54	-9.92	12.93
Banks	0.06	1.54	-10.15	7.33
Chemicals	0.02	1.13	-7.78	5.32
Consbuild	0.03	0.94	-4.72	5.75
Elec	0.01	1.89	-23.50	16.85
Engineering	0.02	1.13	-7.39	8.55
Foodproc	0.03	1.10	-7.21	6.10
Household	0.01	1.39	-8.93	17.79
Insurance	0.01	1.62	-13.63	9.79
Media	0.03	1.42	-6.97	9.33
Oil & Gas	0.05	1.50	-8.34	9.28
Pharmacy	0.03	1.57	-10.51	13.15
Retail	0.03	1.11	-6.71	6.24
Steel	0.01	3.86	-102.97	37.46
Transport	0.01	0.93	-7.88	4.34
Utilities	0.04	1.07	-5.32	4.75

The sectors in full are the following; auto and parts, banks, chemicals, construction and building materials, electricity, engineering and machinery, food production and producers, household goods and textiles, insurance, media and entertainment, oil and gas, pharmacy and biotechnology, retail, steel and other metals, transport and utilities.

Table 3: Summary Statistics for German Industry Returns

	Mean	Standard Error	Minimum	Maximum
DAX	0.03	1.17	-12.13	5.55
Autoparts	0.02	1.51	-11.84	7.49
Banks	0.02	1.41	-10.69	8.30
Chemicals	0.03	1.41	-9.46	11.81
Consbuild	0.01	1.28	-12.50	7.87
Elec	0.05	0.66	-8.38	5.01
Engineering	0.02	1.23	-16.29	7.88
Foodproc	0.04	1.11	-11.75	10.34
Household	0.03	1.27	-11.84	7.76
Insurance	0.02	1.54	-13.02	11.46
Media	0.01	1.80	-21.66	19.27
Oil & Gas	0.03	1.70	-12.30	12.79
Pharmacy	0.04	1.32	-9.78	7.72
Retail	0.02	1.48	-16.87	11.30
Steel	0.02	1.69	-14.83	14.10
Transport	0.03	1.85	-14.80	20.37
Utilities	0.04	1.22	-13.01	7.78

The sectors in full are the following; auto and parts, banks, chemicals, construction and building materials, electricity, engineering and machinery, food production and producers, household goods and textiles, insurance, media and entertainment, oil and gas, pharmacy and biotechnology, retail, steel and other metals, transport and utilities.

Table 4: Influence of UK monetary policy change on UK aggregate and sectoral stock returns. Unanticipated change in policy rate proxied by 1-day change in 3-month sterling futures contract.

	Expected	Surprise	R^2	S.E.
Ftse	0.166	-0.752	0.127	0.093
	(-0.879)	(-1.965)		
Autoparts	0.101	-1.222	0.184	0.140
	(0.417)	(-3.024)		
Banks	0.272	-1.132	0.112	0.252
	(0.875)	(-1.694)		
Chemicals	-0.073	-0.608	0.350	0.016
	(-0.973)	(-5.344)		
Consbuld	-0.015	-0.433	0.075	0.050
	(-0.142)	(-2.113)		
Electequip	0.161	-0.678	0.072	0.145
	(0.792)	(-2.234)		
Engineering	-0.064	-0.726	0.342	0.023
	(-0.635)	(-5.694)		
Foodproc	0.181	-0.478	0.114	0.057
	(1.336)	(-1.587)		
Household	-0.247	0.056	0.047	0.122
	(-1.444)	(0.156)		
Insurance	0.374	-0.723	0.215	0.082
	(2.374)	(-2.165)		
Media	0.064	-0.898	0.137	0.107
	(0.320)	(-2.582)		
Oil & Gas	0.133	-1.069	0.142	0.149
	(0.563)	(-2.071)		
Pharmacy	0.435	-0.912	0.125	0.230
	(1.497)	(-1.531)		
Retail	0.074	-0.640	0.212	0.033
	(0.626)	(-3.318)		
Steel	-0.229	-1.063	0.140	0.192
	(-1.364)	(-3.719)		
Transport	0.085	-0.515	0.113	0.046
	(0.747)	(-2.163)		
Utilities	0.279	-0.494	0.075	0.144
	(1.410)	(-0.967)		

White consistent t-statistics reported below coefficient values in parenthesis.
R^2 and S.E. refer to R squared and the standard error of estimate.

Table 5: Influence of German(Euro area) monetary policy change on German aggregate and sectoral stock returns. Unanticipated change in policy rate proxied by 1-day change in 3-month DMibor and Euribor futures contract

	Expected	Surprise	R^2	S.E.
Dax	-0.013	0.632	0.009	0.321
	(-0.065)	(0.467)		
Autoparts	0.052	0.922	0.033	0.193
	(0.319)	(0.866)		
Banks	0.010	0.604	0.011	0.228
	(0.062)	(0.531)		
Chemicals	0.098	1.097	0.027	0.393
	(0.486)	(0.736)		
Consbuld	-0.013	-0.321	0.012	0.064
	(-0.219)	(-0.755)		
Electequip	-0.162	0.164	0.019	0.385
	(-0.747)	(0.113)		
Engineering	-0.022	0.658	0.036	0.089
	(-0.205)	(0.910)		
Foodproc	0.219	0.554	0.137	0.092
	(2.683)	(0.873)		
Household	-0.050	0.560	0.029	0.101
	(-0.484)	(0.856)		
Insurance	0.017	0.879	0.015	0.377
	(0.082)	(0.616)		
Media	-0.336	-0.147	0.056	0.506
	(-1.224)	(-0.096)		
Oil & Gas	0.037	-0.260	0.025	0.035
	(0.610)	(-0.981)		
Pharmacy	0.194	1.009	0.044	0.361
	(1.085)	(0.736)		
Retail	0.055	0.773	0.069	0.066
	(0.484)	(1.309)		
Steel	-0.057	0.665	0.044	0.091
	(-0.629)	(1.047)		
Transport	0.011	0.620	0.007	0.396
	(0.053)	(0.401)		
Utilities	0.212	0.893	0.066	0.241
	(1.369)	(0.757)		

White consistent t-statistics reported below coefficient values in parenthesis.
R^2 and S.E. refer to R squared and the standard error of estimate.

Table 6: Influence of UK monetary policy changes on German aggregate and sectoral stock returns. Unanticipated change in policy rate proxied by 1-day change in 3-month sterling futures contract

	Expected	Surprise	R^2	S.E.
Dax	0.106	-0.794	0.098	0.126
	(0.508)	(-1.8300		
Autoparts	0.005	-0.829	0.106	0.123
	(0.023)	(-1.898)		
Banks	0.087	-0.783	0.116	0.100
	(0.497)	(-2.150)		
Chemicals	0.061	-1.001	0.123	0.151
	(0.250)	(-2.165)		
Consbuld	-0.320	-0.112	0.188	0.046
	(-3.621)	(-0.441)		
Electequip	0.024	-0.734	0.063	0.169
	(0.100)	(-1.872)		
Engineering	-0.182	-0.609	0.219	0.043
	(-1.544)	(-2.596)		
Foodproc	-0.055	-0.371	0.050	0.065
	(-0.432)	(-1.214)		
Household	-0.157	-1.010	0.228	0.086
	(-0.884)	(-2.917)		
Insurance	0.400	-0.744	0.120	0.183
	(1.828)	(-1.361)		
Media	-0.056	-1.089	0.077	0.311
	(-0.201)	(-3.061)		
Oil & Gas	-0.404	-0.322	0.183	0.087
	(-2.920)	(-1.876)		
Pharmacy	0.137	-0.753	0.081	0.148
	(0.618)	(-1.468)		
Retail	0.202	-0.369	0.078	0.074
	(1.603)	(-1.023)		
Steel	0.027	-0.321	0.025	0.084
	(0.186)	(-0.883)		
Transport	-0.094	-0.981	0.133	0.144
	(-0.443)	(-2.052)		
Utilities	0.137	-0.794	0.137	0.090
	(0.753)	(-1.978)		

White consistent t-statistics reported below coefficient values in parenthesis.
R^2 and S.E. refer to R squared and the standard error of estimate.

Table 7: Influence of German(Euro Area) monetary policy changes on UK aggregate and sectoral stock returns. Unanticipated change in policy rate proxied by 1-day change in 3-month EuroDM and Euribor futures contract

	Expected	Surprise	R^2	S.E.
FTSE	0.276	0.744	0.068	0.321
	(1.555)	(0.546)		
Autoparts	0.342	0.928	0.070	0.486
	(1.586)	(0.539)		
Banks	0.642	1.572	0.128	0.843
	(2.304)	(0.735)		
Chemicals	0.216	0.269	0.122	0.093
	(2.002)	(0.397)		
Consbuld	0.214	0.570	0.163	0.072
	(2.507)	(0.968)		
Electequip	0.052	-0.022	0.002	0.493
	(0.237)	(-0.014)		
Engineering	0.284	0.338	0.153	0.123
	(2.508)	(0.406)		
Foodproc	0.331	0.645	0.202	0.126
	(3.248)	(0.777)		
Household	0.276	-0.677	0.227	0.086
	(1.535)	(-1.383)		
Insurance	0.239	0.880	0.095	0.190
	(1.827)	(0.807)		
Media	0.206	0.428	0.025	0.493
	(0.963)	(0.263)		
Oil & Gas	0.235	0.903	0.042	0.452
	(1.175)	(0.572)		
Pharmacy	0.378	1.437	0.073	0.639
	(1.499)	(0.750)		
Retail	0.398	0.600	0.292	0.108
	(3.697)	(0.704)		
Steel	-0.058	0.393	0.009	0.237
	(-0.462)	(0.489)		
Transport	0.274	0.550	0.171	0.106
	(2.568)	(0.659)		
Utilities	0.446	0.809	0.135	0.366
	(2.361)	(0.586)		

White consistent t-statistics reported below coefficient values in parenthesis.
R^2 and S.E. refer to R squared and the standard error of estimate.

Table 8: Influence of US monetary policy changes on US aggregate and sectoral stock returns. Unanticipated change in policy rate proxied by 1-day change in Fed Funds Future Rate contract

	Expected	Surprise	R^2	S.E.
S&P	1.714	-5.609	0.224	1.639
	(2.912)	(-3.059)		
Autoparts	2.575	-6.879	0.121	5.855
	(2.211)	(-2.314)		
Banks	1.490	-7.403	0.226	2.459
	(1.870)	(-3.999)		
Chemicals	0.507	-2.094	0.020	2.934
	(0.633)	(-1.102)		
Consbuld	0.346	-5.273	0.110	2.929
	(0.450)	(-2.913)		
Electequip	2.633	-10.728	0.230	5.283
	(2.387)	(-2.641)		
Engineering	1.547	-5.546	0.140	2.712
	(1.812)	(-2.240)		
Foodproc	0.150	0.803	0.011	1.140
	(0.326)	(0.507)		
Household	1.235	-4.494	0.088	3.001
	(1.395)	(-2.233)		
Insurance	1.018	-1.641	0.047	1.651
	(1.517)	(-1.397)		
Media	1.202	-4.901	0.122	2.364
	(1.856)	(-2.256)		
Oil & Gas	0.001	0.761	0.005	1.682
	(0.001)	(0.425)		
Pharmacy	1.111	-1.841	0.055	1.669
	(1.460)	(-1.337)		
Retail	1.842	-9.026	0.173	5.128
	(1.681)	(-2.492)		
Steel	0.810	-4.141	0.045	4.805
	(0.711)	(-1.997)		
Transport	1.438	-3.893	0.047	5.250
	(1.268)	(-1.975)		
Utilities	-0.473	0.906	0.013	1.547
	(-0.816)	(0.548)		

White consistent t-statistics reported below coefficient values in parenthesis.
R^2 and S.E. refer to R squared and the standard error of estimate.