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US Monetary Announcements and Irish Stockmarket Volatility

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Abstract

We investigate the influence of foreign monetary policy decisions on the volatility of the Irish stock market. Specifically, we examine the influence of US monetary policy announcements on the ISEQ. We find evidence of the so called *calm before the storm* i.e. there appears to be a decline in volatility on the day prior to an FOMC meeting and a subsequent increase in volatility after the results of such meetings are made known. We also find evidence to suggest that ISEQ volatility is influenced by surprise changes in US monetary policy. Moreover, US monetary surprises appear to affect Irish stock return volatility asymmetrically. In particular, higher than expected US federal funds, tend to increase Irish stock return volatility. This paper represents an important step in addressing the issues of spillover identification between the US and the Irish stock market.

1 Introduction

With increasing global financial integration, returns in markets tend to move in concert, with changes in one market leading to spillovers in others both in terms of returns and volatility. Moreover, asset market participants pay close attention to the release of both foreign and domestic economic news which may affect asset returns. In this paper, we examine the influence of US monetary policy decisions on both returns and volatility of the Irish stock market. In particular, we focus on three aspects of the transmission of news with respect of monetary policy.

Firstly, do regularly scheduled meetings of the Federal Open Market Committee (FOMC) have an influence on the volatility of the Irish stock market? In the financial press, there is anecdotal evidence to suggest that markets enter a lull prior to the release of important information. In the wake of an announcement, traders react to such information leading to an increase in activity. This pattern has been dubbed the *calm before the storm*. Secondly, markets react to new information, hence one would expect a greater response in terms of trading activity if there is an unanticipated element to any information revealed. How does ISEQ returns and volatility respond to surprises in US monetary policy? Finally, we investigate whether volatility of the ISEQ reacts differently depending on whether there is an unexpected increase or decrease in policy rates.

Our study represents to our knowledge the first attempt to address possible causes of volatility spillovers for the case of the ISEQ. Previous research has examined the relationship between various stock markets and the degree to which there are spillovers between markets, see for example, Gallagher (1995) and Gallagher & Twomey (1998) in an Irish context.[1] However, this begs the question, what is the driving force behind a change in one market leading to a spillover in another? We focus on one important source, US monetary policy announcements. In addition, our study is also motivated by recent findings which indicate that foreign news is an important factor in explaining stock market volatility, see for example, Connolly & Wang (1998).

The rest of the paper is structured as follows. The next section gives a brief description of some of the recent empirical work in the area and the key findings. Section 3 discusses the methodology adopted in the paper, while section 4 reports the empirical results. Finally,

[1] Gallagher & Twomey (1998) measure the impact of international spillovers on returns and volatility in the Irish stock market.

section 5 concludes the paper.

2 Literature Review

Recent research has explored the influence of economic news on asset prices, e.g. studies have examined the impact of official announcements of real and nominal variables on stock returns both in terms of their mean and volatility effects. Real variables examined include GDP and unemployment figures while nominal variables include inflation, money supply figures as well as interest rate decisions. Flannery & Protopapadkis (2002) focus on domestic news in the US, while Connolly & Wang (2003) focus on the impact of both domestic and foreign news between the US, UK and Japan respectively.

The influence of an announcement on an asset price needs to be separated into two components. Firstly, there is the institutional nature of the announcement i.e. many official announcements are fixed in the calendar and don't impart new information of their own accord. However, markets appear to be less volatile just prior to such announcements. The impact on volatility prior to the announcement, *the preannouncement effect* or the *calm before the storm*, has been described by Jones, Lamont and Lumsdaine (1998) and is both intuitively appealing and appears to be borne out by empirical evidence, see Li and Engle, (1998) and French, Schwert and Stambaugh (1989). Bomfim (2003) finds that there is a reduction in S&P volatility on the day prior to a FOMC meeting and an increase in volatility on the day of the meeting.

Secondly, the announcement may impart new information to market participants as it may differ from what had been anticipated. If markets are efficient, assets should react to the unanticipated element of the announcement rather than the announcement itself and hence market returns should not respond to the expected component of announcements. Theory has less to say about how the surprise element of an announcement affects volatility.

Flannery & Protopapadkis (2002) focus on the impact of the unanticipated component in 17 macroeconomic announcements (both nominal and real variables) on US stock returns and their volatility. They find that only money supply surprises affect both the mean and variance of returns. In terms of cross country spillovers, Connolly & Wang (1998,2003) examine the influence of the surprise element in six macro series on stock returns between the US, Japan and the UK. They find that macroeconomic news plays a larger part in explaining volatility linkages than return linkages. They also find evidence which suggests

that foreign news is likely to be more important than domestic news in explaining domestic stock market volatility.

Finally, there is the possibility of asymmetry, i.e. the impact of an unexpected negative announcement has a larger impact on volatility than an unexpected positive announcement. This is consistent with the leverage effect (Black, 1976) and the volatility feedback hypothesis, French, Schwert and Stambaugh (1989).[2] Bomfim (2003) found that unanticipated rises in the Fed funds target rate tend to have a larger effect on S&P volatility than unanticipated declines. Connolly & Wang (1998) found that volatility spillovers between US, UK and Japan depend on whether the announcement was good or bad news. In particular, bad news from the UK and US was found to lead to significant increases in volatility in Japan.[3]

Our study is closest in spirit to that of Bomfim (2003). We examine the impact of FOMC announcements and their surprise element on the mean and volatility of Irish stock index. Our measure of the surprise element of monetary policy is derived from the one-day change in the US fed funds futures contract.[4] In contrast to studies such as Connolly & Wang (1998,2003) and Flannery & Protopapadkis (2002), we believe our measure of the surprise element of monetary policy decisions is superior as it is closely related to the fed funds rate i.e. the rate targeted by the US monetary authorities. Research by Gurkaynak, Sack & Swansom (2002) suggests that the fed funds futures contract dominates other market instruments at forecasting the fed funds rate. Previously mentioned studies have used an inappropriate instrument such as the growth rate of the money supply and(or) their measure of expectations is more problematic as it is not available at a daily frequency.

3 Methodology

Our methodology draws on the recent work of Bonfim (2003), Jones et al. (1998) and Anderson and Bollerslev (1998). Our model is as follows;

$$ISEQ_{t+1} = \beta_0 + \beta_1 \Delta FFF_t + \beta_2 ISEQ_t + \beta_3 S\&P_t + u_{t+1} \quad (1)$$

[2]The leverage effect reflects the fact that a fall in the value of stock price of a firm causes its debt-equity ratio to rise. The perception by shareholders is that their future cash flows are now more risky.

[3]Flannery & Protopapadkis (2002) did not investigate asymmetric responses.

[4]A number of authors such as Bomfim (2003), Kuttner (2001), Poole & Rasche (2000) have used this contract to proxy the unexpected component of monetary policy changes.

$$u_{t+1} = e_{t+1}\sqrt{s_{t+1}} \tag{2}$$

$$e_{t+1} = v_{t+1}\sqrt{h_{t+1}} \tag{3}$$

$$E(e_{t+1}|\Omega_t) = 0 \; and \; E(e_{t+1}^2|\Omega_t) = h_{t+1} \; and \; E(u_{t+1}^2|\Omega_t) = s_{t+1}h_{t+1} \tag{4}$$

$$h_{t+1} = \alpha_0 + \alpha_1 h_t + \alpha_2 e_t^2 \tag{5}$$

The dependent variable in the conditional mean equation is the 1-day percentage change in the Irish market, $\Delta ISEQ$, while the independent variables include the 1 day change in both the federal funds futures, (ΔFFF), and the S&P 500 ($\Delta S\&P$), as well as the lagged one day percentage change in the ISEQ while u_{t+1} is the unexplained element of Irish stock returns. The unexplained element can be thought of as comprising a non-normal stochastic element, e_{t+1}, whose conditional variance is time varying and s_{t+1} a dummy to indicate the impact of particular day effects. The s_{t+1} dummy can be written as;

$$s_{t+1} = 1 + \delta_0 I_t^{(F)} + \delta_1 I_{t-1}^{(F)} + \delta_2 I_{t+1}^{(F)} \tag{6}$$

where $I_t^{(F)}$ is a dummy variable set to one on days when there is a regularly scheduled US Federal Reserve policy meeting and zero elsewhere.

We focus on three issues. Firstly, does ISEQ volatility follow a pattern which is consistent with the *calm before the storm*, i.e. is volatility lower on days prior to FOMC meeting and higher on the day of the announcement. In equation (6), a finding of a *calm before the storm* would be evident if the coefficient δ_1 was negative and statistically significant, while δ_0 was positive and statistically significant.

Secondly, we examine whether there is any news effect i.e. whether a surprise change in the federal funds rate target has an effect on ISEQ returns. This would be reflected in a negative statistically significant value of β_1.

Finally, we also test whether the news effect has any influence on ISEQ volatility and whether positive and negative shocks in the US have an asymmetric effect on the volatility of Irish stock returns.

4 Data and Empirical Results

We use daily data from June 1989 to June 2003.[5] The data used is taken from Datastream and Bloomberg. The study uses closing prices for the ISEQ index and the S&P 500 index. The actual change in the federal funds target rate is obtained from the Federal Reserve Board of Governors. The unanticipated change in the federal funds target rate is proxied by the 1-day change in the price of the 1-month ahead 30-day Federal Funds futures contract, as traded on the Chicago Board of Trade (CBOT).[6] We use the one month ahead contract as suggested by Poole & Rasche (2000) given it is easier to calculate and is less influenced by liquidity issues around FOMC meetings.[7]

4.1 Empirical Results

All models are estimated using the quasi maximum likelihood procedure outlined in Bollerslev & Wooldridge (1992). We also include day of the week dummies in all specifications.[8]

In terms of our proxy for surprise element in monetary policy decisions included in the mean equation, ΔFFF_t, we restrict attention to days when a monetary policy decision was made. This is done in order to control for the influence of other variables that may affect asset returns.[9] In particular, we examine both the one day change in the fed funds futures on FOMC meeting days (Bredin et al 2003) and the the one day change in fed funds futures on FOMC meetings days and days of unscheduled rate changes (Bernanke & Kuttner 2003).[10] The results are shown for each measure in tables 1 & 2 respectively. As

[5]The following two periods are dropped from the sample. The 18^{th} of April 2001, which was associated with largest surprise change in the Fed funds rate during the sample period and the 11^{th} to the 17^{th} of September 2001 when the US stock market was closed as a result of the terrorist attack. See Bernanke & Kuttner (2003) for a detailed discussion of the data.

[6]The change is $F_t - F_{t-1}$, where t is the day of the policy announcement. The change in the ISEQ index (data taken from Datastream) must take account of the time difference between the US and Ireland and hence is calculated as $(P_{t+1} - P_t)/P_t$, where t is the day of the policy announcement.

[7]Kuttner (2001) uses the current month contract while Bonfim (2003) uses both the current and one month ahead contract.

[8]The results for the days of the week dummies are not reported in the results section, but are available from the authors.

[9]This is based on an event study methodology where by focusing on a small window one hopes to reduce the impact of other factors affecting the results. However, all other variable are measured at a daily frequency for the full sample period.

[10]Bernanke & Kuttner (2003) use this to determine their sample in their event study of the effect of US monetary policy changes on US stock returns.

can be seen in both cases the coefficient on the shock in the mean equation is negative and insignificant i.e. it would appear that the shock to US monetary policy does not significantly influence ISEQ returns.

We next address the question of whether volatility in Irish stock returns follows a pattern which is consistent with the *calm before the storm*, in other words, we test whether there are any pre-announcement effects. As discussed earlier, the pre-announcement effect if present is independent of the actual policy decision. As can be seen from table 1 to 2, there is distinct evidence in favor of a *calm before the storm* effect. Volatility is lower on the day prior to the announcement (δ_1) and higher on the day of the announcement (δ_0).[11]

However, to properly assess the importance of such pre-announcement effects it is useful to distinguish between scheduled meeting days and days where there was an unscheduled change in rates. In the latter, since by definition, they are unscheduled one may not expect to see a calm in the market prior to such a change. On the other hand, markets are fully aware of scheduled FOMC meetings. Moreover, for our sample period there is a large proportion of unscheduled rate changes.[12]

To take account of this we modify our variance equation

$$s_{t+1} = 1 + \delta_0 I_t^{(F)} + \delta_1 I_{t-1}^{(F)} + \delta_2 I_{t+1}^{(F)} + \delta_3 I_t^{(UC)} + \delta_4 I_{t-1}^{(UC)} + \delta_5 I_{t+1}^{(UC)} \tag{7}$$

to distinguish between scheduled and unscheduled meeting days where I^F is a dummy variable which is equal to one for scheduled FOMC meetings and I^{UC} is a dummy variable which equals one when there was an unscheduled rate change. In table 3, we report the results for such a specification and find there is a reduction in volatility prior to scheduled meetings i.e. δ_1 is significantly negative while there is an absence of such an effect prior to an unscheduled rate change, δ_4 is insignificant. However, for both scheduled and unscheduled meetings we do witness a significant increase in volatility on the day of a meeting, i.e. δ_0 and δ_3 are positive and significant.

So far we have not taken into account how the Fed has communicated its decisions to the market place. Prior to February 1994, the Fed did not announce its policy rate decisions directly. Instead the market would glean the Fed's intentions by the actions of the Open Market Desk on the day after a meeting. Since 1994 the Fed publicly announces

[11] Although not reported here, significant days of the week effects were found. Volatility appears to be higher on both Mondays and Fridays.

[12] Over the full sample there are 24 unscheduled rate changes.

its decisions immediately after each FOMC meeting. Bonfim (2003) found evidence of pre-announcement effects restricted to the post 1993 period for the US. Moreover, post 1993, there has been very few unscheduled rate changes with most rate changes occurring at scheduled FOMC meetings, see table 4.

Based on these two observations we restrict our sample to post 1993 and focus on scheduled FOMC meetings. A natural question then to ask is whether there is a difference in market participants reaction to a scheduled FOMC meeting where rates were changed or when they stayed the same. In particular, we re-specify the variance equation to

$$s_{t+1} = 1 + \delta_0 I_t^{(SC)} + \delta_1 I_{t-1}^{(SC)} + \delta_2 I_{t+1}^{(SC)} + \delta_3 I_t^{(SN)} + \delta_4 I_{t-1}^{(SN)} + \delta_5 I_{t+1}^{(SN)} \tag{8}$$

where I^{SC} and I^{SN} are dummy variables that take the value of one when there was a rate change or no rate change respectively and zero otherwise. These results are reported in table 5. In the case of scheduled rate changes we find a statistically significant calm and storm effect. Moreover, we also see that the coefficient on the storm for a scheduled rate change is considerably larger than that in previous results. However, there appears to be lack of statistical evidence in favour of either a calm or storm when there was no change in the policy rate.

We next investigate both the impact of the surprise element of policy rate decisions on volatility and following the work of Black (1976) whether positive and negative policy shocks have a symmetric impact on volatility. Turning to the first element, does volatility respond to the surprise element of a monetary policy decision or does it merely respond to the decision to change rates. The variance equation is modified

$$s_{t+1} = 1 + \delta_0 I_t^{(SC)} + \delta_1 I_{t-1}^{(SC)} + \delta_2 I_{t+1}^{(SC)} + \phi \Delta FFF_t^{SC} \tag{9}$$

such that we include an addition term which captures the surprise element of any interest rate decision. ΔFFF^{SC} captures the extent to which markets are surprised by a policy rate change at scheduled FOMC meeting. A non zero value for this variable indicates that markets hadn't fully anticipated the interest rate change.

We report the results of this specification in table 6 and find that the surprise element of US monetary has a positive statistically significant effect on ISEQ volatility which is above and beyond the fact that the policy rate has changed. The surprise element clearly imparts new information to market participants which affects volatility.

Finally, recent empirical evidence has found that negative surprise announcements have a greater impact on volatility, see French et al, (1989) and Nelson (1991). This is consistent with the leverage effect (Black, 1976) and the volatility feedback hypothesis, French, Schwert and Stambaugh (1989). To account for this possibility we modify the volatility equation such that

$$s_{t+1} = 1 + \delta_0 I_t^{(SC)} + \delta_1 I_{t-1}^{(SC)} + \delta_2 I_{t+1}^{(SC)} + \phi^{+} \Delta FFF_t^{+SC} + \phi^{-} \Delta FFF_t^{-SC} \qquad (10)$$

where we separate out positive and negative surprises in the change in the fed funds rate These results are reported in table 7. As can be seen, positive and negative shocks do not have a symmetric impact on volatility. A positive policy surprise, i.e. a higher than anticipated rise in the policy rate, increases stock market volatility by significantly more than negative surprises. The Wald test with a null of no asymmetry in volatility is comfortably rejected. This finding is consistent with the studies of Bonfim (2003) and Connolly & Wang (1998).[13]

5 Conclusion

In this study we examine the influence of US monetary policy decisions on the volatility of the Irish stock market. In particular, we examine the influence of announcement effects of the FOMC meetings on ISEQ returns and volatility. We find clear evidence of announcement effects. There is a decline in volatility of the ISEQ on the day prior to a FOMC meeting and a rise in volatility when the results of the meeting are made known and hence we find evidence in favour of the *calm before the storm* effect. We test the impact of the news effect of US policy on both Irish returns and volatility. Irish stock return volatility do appear to be influenced by the US shock and the response is asymmetric. A negative policy surprise, lower than expected policy rate change, reduces stock market volatility by significantly more than positive surprises.

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Table 1: Impact of US Monetary Policy Shocks on Volatility on Irish Stock Returns (F=FOMC Meetings only)

$$ISEQ_{t+1} = \beta_0 + \beta_1 \Delta FFF_t^F + \beta_2 ISEQ_t + \beta_3 S\&P_t + u_{t+1}$$

$$s_{t+1} = 1 + \delta_0 I_t^{(F)} + \delta_1 I_{t-1}^{(F)} + \delta_2 I_{t+1}^{(F)}$$

Variable	Coeff	T-Stat
Mean Equation		
β_0	0.05	2.14
β_1	-0.72	-0.52
β_2	0.08	5.54
β_3	0.39	38.92
Variance Equation		
α_0	0.01	5.42
α_1	0.05	11.43
α_2	0.78	17.63
δ_0	0.43	2.93
δ_1	-0.40	-3.62
δ_2	0.07	0.63

Using one day change in 1 month ahead federal funds future contract as unanticipated change. The t statistics are robust using the procedure from Bollerslev & Wooldridge (1992).

Table 2: Impact of US Monetary Policy Shocks on Volatility on Irish Stock Returns (Union = FOMC Meetings plus unscheduled rate changes)

$$ISEQ_{t+1} = \beta_0 + \beta_1 \Delta FFF_t^{union} + \beta_2 ISEQ_t + \beta_3 S\&P_t + u_{t+1}$$

$$s_{t+1} = 1 + \delta_0 I_t^{(F)} + \delta_1 I_{t-1}^{(F)} + \delta_2 I_{t+1}^{(F)}$$

Variable	Coeff	T-Stat
Mean Equation		
β_0	0.05	2.14
β_1	-0.83	-1.28
β_2	0.08	5.57
β_3	0.39	38.56
Variance Equation		
α_0	0.01	5.36
α_1	0.05	11.38
α_2	0.78	17.64
δ_0	0.43	2.90
δ_1	-0.40	-3.62
δ_2	0.07	0.63

Using one day change in 1 month ahead federal funds future contract as unanticipated change. The t statistics are robust using the procedure from Bollerslev & Wooldridge (1992).

Table 3: Impact of US Monetary Policy Shocks on Volatility on Irish Stock Returns (Using Union, FOMC Meetings and un-scheduled changes)

$$ISEQ_{t+1} = \beta_0 + \beta_1 \Delta FFF_t^{union} + \beta_2 ISEQ_t + \beta_3 S\&P_t + u_{t+1}$$

$$s_{t+1} = 1 + \delta_0 I_t^{(F)} + \delta_1 I_{t-1}^{(F)} + \delta_2 I_{t+1}^{(F)} + \delta_3 I_t^{(UC)} + \delta_4 I_{t-1}^{(UC)} + \delta_5 I_{t+1}^{(UC)}$$

Variable	Coeff	T-Stat
Mean Equation		
β_0	0.06	2.17
β_1	-0.86	-0.89
β_2	0.08	5.63
β_3	0.39	38.00
Variance Equation		
α_0	0.01	5.29
α_1	0.06	11.33
α_2	0.78	17.53
δ_0	0.43	2.88
δ_1	-0.41	-3.71
δ_2	0.07	0.63
δ_3	0.54	1.36
δ_4	-0.36	-1.29
δ_5	-0.27	-0.93
Hypothesis test (P-values for Wald statistics)		
δ_1=δ_4=0		0.00

Using one day change in 1 month ahead federal funds future contract as unanticipated change. The t statistics are robust using the procedure from Bollerslev & Wooldridge (1992).

Table 4: FED Announcement Procedure

Event	Full Sample (1989-2003)	Sample 1 (1989-1993)	Sample 2 (1994-2003)
FOMC Meeting days	114	37	77
Scheduled Rate Change	33	5	28
Unscheduled Rate Change	24	20	4
Total Announcements	57	25	32

Table 5: Impact of US Monetary Policy Shocks on Volatility on Irish Stock Returns: Post 1994 (FOMC Meetings and Scheduled (No)Change)

$$ISEQ_{t+1} = \beta_0 + \beta_1 \Delta FFF_t^F + \beta_2 ISEQ_t + \beta_3 S\&P_t + u_{t+1}$$

$$s_{t+1} = 1 + \delta_0 I_t^{(SC)} + \delta_1 I_{t-1}^{(SC)} + \delta_2 I_{t+1}^{(SC)} + \delta_3 I_t^{(SN)} + \delta_4 I_{t-1}^{(SN)} + \delta_5 I_{t+1}^{(SN)}$$

Variable	Coeff	T-Stat
Mean Equation		
β_0	0.06	1.93
β_1	-2.61	-1.37
β_2	0.04	2.14
β_3	0.39	29.99
Variance Equation		
α_0	0.01	2.50
α_1	0.05	8.11
α_2	0.91	13.17
δ_0	1.38	3.43
δ_1	-0.77	-2.57
δ_2	-0.51	1.87
δ_3	0.27	1.10
δ_4	-0.27	-1.25
δ_5	0.18	1.23

Using one day change in 1 month ahead federal funds future contract as unanticipated change. The t statistics are robust using the procedure from Bollerslev & Wooldridge (1992).

Table 6: Impact of US Monetary Policy Shocks on Volatility on Irish Stock Returns: Post 1994 (FOMC Meetings and Scheduled Change)

$$ISEQ_{t+1} = \beta_0 + \beta_1 \Delta FFF_t^F + \beta_2 ISEQ_t + \beta_3 S\&P_t + u_{t+1}$$

$$s_{t+1} = 1 + \delta_0 I_t^{(SC)} + \delta_1 I_{t-1}^{(SC)} + \delta_2 I_{t+1}^{(SC)} + \phi \Delta FFF_t^{SC}$$

Variable	Coeff	T-Stat
Mean Equation		
β_0	0.06	2.05
β_1	-3.44	-2.01
β_2	0.04	2.28
β_3	0.38	29.61
Variance Equation		
α_0	0.01	2.58
α_1	0.05	8.62
α_2	0.91	13.66
δ_0	1.33	3.01
δ_1	-0.80	-2.33
δ_2	-0.53	-1.92
ϕ	2.98	2.53

Using one day change in 1 month ahead federal funds future contract as unanticipated change. The t statistics are robust using the procedure from Bollerslev & Wooldridge (1992).

Table 7: Impact of US Monetary Policy Shocks on Volatility on Irish Stock Returns - Testing for Asymmetry (SA): Post 1994 (FOMC Meetings and Scheduled Change)

$$ISEQ_{t+1} = \beta_0 + \beta_1 \Delta FFF_t^F + \beta_2 ISEQ_t + \beta_3 S\&P_t + u_{t+1}$$

$$s_{t+1} = 1 + \delta_0 I_t^{(SC)} + \delta_1 I_{t-1}^{(SC)} + \delta_2 I_{t+1}^{(SC)} + \phi^+ \Delta FFF_t^{+SC} + \phi^- \Delta FFF_t^{-SC}$$

Variable	Coeff	T-Stat
Mean Equation		
β_0	0.06	2.05
β_1	-3.48	-2.05
β_2	0.04	2.24
β_3	0.38	29.36
Variance Equation		
α_0	0.01	2.66
α_1	0.05	8.23
α_2	0.89	13.56
δ_1	-0.83	-2.45
δ_2	-0.54	-1.93
ϕ^+	1.61	3.67
ϕ^-	1.05	2.35
Hypothesis test (P-values for Wald statistics)		
ϕ^+=ϕ^-=0		0.00

Using one day change in 1 month ahead federal funds future contract as unanticipated change. The t statistics are robust using the procedure from Bollerslev & Wooldridge (1992).