The Economic and Social Review, Vol. 34, No. 3, Winter, 2003, pp. 249–265

The Influence of Domestic and International Interest Rates on the ISEQ

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Abstract: We investigate the influence of international and domestic monetary policy shocks on the Irish stock market. Specifically, we analyse the impact of (un)expected changes in domestic, US, UK and German/euro area policy rates on the ISEQ between 1988 to 2002 in an event type study. Our decomposition of (un)expected changes in policy rates are based on futures markets and is akin to Kuttner (2001). In the absence of an Irish interest rate futures market, we use a more indirect method by appealing to the expectations theory of the term structure of interest rates. Overall, our results suggest that, with the exception of the US, unanticipated changes in domestic and international interest rates appear to have little significant influence on the Irish stock market.

I INTRODUCTION

The last decade has witnessed the primacy of monetary policy as the main instrument 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 values immediately. In addition, with the introduction of the

Paper presented at the Seventeenth Annual Conference of the Irish Economic Association, Limerick, 2003.
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single European currency and the recent behaviour of stock prices, increased attention has been paid to the relationship between monetary policy and asset prices (see *ECB Monthly Bulletin*, February 2002).

In this study, we investigate the impact of monetary policy changes on the Irish stock market in an event type study. Moreover, we analyse both international and domestic changes to monetary policy. First, we decompose policy rate changes for the US, UK and German/euro area into their expected and unexpected components on the day of the policy change based on information gleaned from futures interest rate contracts. Next, we regress these surprise and anticipated rate changes on the Irish stock returns on the day of the change in the respective policy rate.

We also examine the effect of changes in domestically controlled interest rates on the Irish stock market prior to the onset of EMU. The decomposition of Irish policy rate changes into (un)anticipated changes is complicated by the lack of a futures market. We sidestep this issue by appealing to the expectations hypothesis of the term structure of interest rates.

Recent research has investigated the influence of both domestic and foreign economic news on domestic stock market activity, e.g., Connolly and Wang (2002) and Flannery and Protopapadakis (2002). Given, Ireland is a small open economy, factors outside the country are likely to play a large role in determining economic conditions within the economy. Research, for example, by Gallagher (1995) and Gallagher and Twomey (1998) have investigated linkages between Irish and international stock markets. With greater global and European financial integration, it is likely that global monetary conditions have an important influence both on the Irish economy and stock market. Hence, our interest in examining the effect of international as well as domestic interest rate changes on the domestic stock market.

II LITERATURE REVIEW

A number of channels have been hypothesised regarding how monetary policy can influence stock market returns (see the reviews in Sellin, 2001; and the *ECB Monthly Bulletin*, February, 2002). 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 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.

There is a large literature that investigates the effect of US monetary policy changes on a broad range of US asset prices. Researchers have examined the influence of alternative instruments or proxies of monetary policy on interest rates and the stock market. Such instruments include various measures of the money supply, non-borrowed reserves, the discount rate and the federal funds target rate.[1]

The appropriateness of a particular measure of monetary policy is closely aligned to the monetary policy regime pursued by the central bank over the sample period in question. For example, the Fed has adopted alternative targeting procedures from the 1970s to the present day while most central banks have moved to targeting short-term interest rates in the 1990s (see Borio, 1997).[2]

Studies of the relationship between monetary policy and asset prices generally take one of three approaches:

1. event type or announcement studies using high frequency data;
2. vector autoregressions (VAR's); or
3. medium to long horizon 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. Two methodological considerations have had an important influence on research in this area:

1. the appropriate identification of monetary policy changes; and
2. the need to discriminate between anticipated and unanticipated changes in the policy instrument.

The appropriate identification of policy changes can be most clearly seen in early studies assessing the effects of changes in money supply on asset prices. Is the announcement of say a change in M1 truly exogenous? Changes

[1] For example, studies that use money supply announcements include Pearce and Roley (1983), discount rate changes, Jensen and Johnson (1995), changes in federal funds rate target Thorbecke (1997) and finally open market operations, Tahran (1995).

[2] In the US, from 1974 to October 1979, the Fed adopted an interest rate targeting approach, from October 1979 to October 1982 the Fed targeted non-borrowed reserves and from October 1982 to September 1987, it targeted borrowed reserves. Since September 1987 the Fed targeted the federal funds rate. See, Lange, Sack and Whitesell (2001) for a detailed discussion on the change in adopted procedures.

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 counter intuitive 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 effect 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 (2002) attempt to control for this possibility. However, they find the impact of failing to take account of such endogenity 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).

In an attempt to control for the influence of other variables, many researchers have turned to an event study methodology. Relative to other approaches that use quarterly or monthly data, this approach uses higher frequency data. 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 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.[4] A typical early example using this approach is that of Cook and Hahn (1989). They examined the impact of changes in monetary policy on treasury securities and found that policy rate changes led to increases in treasury rates particularly at the short end of the market.

Empirical work that fails to decompose monetary policy changes into its expected and unexpected components are also likely to lead to biased results due to an error 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 unanticipated component 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 by market participants as 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

[3] See, Sellin (2001) for an overview of such problems.
[4] See Campbell, Lo and MacKinlay (1997) for a detailed discussion of the event study approach.

of policy rate changes and fail to decompose actual changes into these two components are liable to lead to biased results.

The decomposition of policy changes into anticipated and unanticipated components is a difficult problem. Fortunately, with the increasing use of future markets, it is potentially easier to derive market expectations of policy variables. In our study, we use such an approach to decompose expected and unexpected changes in policy rates and this is discussed in greater detail in the next section.

The vector autoregressive (VAR) approach has also been advanced as a panacea to circumvent some of the methodological problems previously mentioned. 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 functions over the short to medium term. Both Thorbecke (1997) and Patelis (1997) estimate VAR models and find a negative relationship between an interest rate shock and equity returns. International cross country evidence is provided by Neri (2001) 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.

In terms of a longer time horizon, Durham (2001) and Concover *et al.* (1999) have investigated the influence of monetary policy changes on stock returns at a monthly and quarterly time horizon. Both studies examine the influence of both domestic and US policy rate changes on domestic stock returns for 16 countries between 1956 and 2000. Durham's (2001) research is a sensitivity analysis of Concover *et al.*'s (1999) results. Durham (2001) finds that Concover *et al.*'s (1999) general finding of a significant inverse relationship between policy rate changes, in terms both of domestic and US rate changes, and domestic stock returns are less robust to the inclusion of other variables. In addition, Durham (2001) provides evidence that this relationship has weakened over time. However, these longer horizon studies, fail to distinguish between anticipated and unanticipated changes in policy rates. Durham (2001) also reports evidence suggesting that changes in Irish monetary policy had a significant negative effect on the stock market between

1956 to 1985 but was insignificant post-1985 while changes in US policy rate had a significant negative effect on the Irish stock market between 1971 and 1985, and between 1986 and 2000.[5]

III ANNOUNCEMENT EFFECTS AND THE FEDERAL FUNDS FUTURES CONTRACT

Early studies estimated the following model:

$$\Delta P_t = a + b(\Delta M_t^a - \Delta M_t^e) + \varepsilon_t \tag{1}$$

where ΔP_t is the percentage change in the stock price; $\Delta M^a{}_t$ is the announced change in the money stock; $\Delta M^e{}_t$ is the expected change in the money stock obtained from survey data; and ε_t is the error term. With the change in monetary policy regimes towards targeting short-term interest rates, more recent studies examine the impact of changes in the policy rate target on asset prices. It still begs the question of how to decompose policy rate changes into (un)anticipated changes.

With the advent of federal funds future contracts in the late 1980s researchers have focused on the information contained in the federal funds futures rate to identify expectations of changes in future policy. The settlement price of the contract is 100 minus the average of the daily overnight federal funds rate during the month of the contract. Hence, a forecast of the federal funds rate is implied by the price of the contract.[6] Gurkaynak, Sack and Swanson (2002) find the federal funds futures contract dominates other market instruments at forecasting the federal funds rate over horizons out to several months. Papers that examine the impact of unanticipated policy rate changes, as proxied by changes in the federal funds futures rate, on asset prices include Bernanke and Kuttner (2003), Guo (2002); Kuttner (2001); Poole and Rasche (2000); Bomfim and Reinhart (2000).

Kuttner (2001) and Poole and Rasche (2000) analyse the impact of unanticipated changes in the federal funds target rate on treasury bills, notes and bond yields:

$$\Delta R_t = \alpha + \beta_1 \Delta \tilde{r}_t^e + \beta_2 \Delta \tilde{r}_t^u + \varepsilon_t \tag{2}$$

[5] The significance of this relationship has declined somewhat in the latter sample period.
[6] See Thornton (1996) for a detailed discussion of the federal funds futures contract. One limitation of using the federal funds futures contract is that it was only established in 1988.

where $\Delta\tilde{r}_t^u$ is the one day surprise; and $\Delta\tilde{r}_t^e$ is the expected change in the target rate. The one day surprise is defined as $\Delta\tilde{r}_t^u = \frac{m}{m-t}(f^0_{s,t} - f^0_{s,t-1})$ where m is the number of days in the month, t is the day of the announcement, $f^0_{s,t}$ is the spot month federal funds future rate on day t of month s while $f^0_{s,t-1}$ is the previous day's value. Kuttner (2001) finds a very small insignificant relationship between interest rates and anticipated target rate changes, but a large and highly significant relationship for unanticipated target changes.[7] Guo (2002) and Rigobon and Sack (2002) examine the impact of unexpected changes in the federal funds target rate on a number of US stock indices with both studies finding a significant negative effect of surprise changes in the policy rate on asset prices. The latter use a somewhat different estimation methodology to the standard one used in Kuttner (2001).

IV METHODOLOGY

Drawing on Kuttner's (2001) approach, we initially run the following baseline regression:

$$\Delta ISEQ_t = \alpha_0 + \alpha_1 \Delta FF_t^e + \alpha_2 FF_t^u + \varepsilon_t \tag{3}$$

where, $\Delta ISEQ_t$ is the percentage change in the ISEQ index between t and $t+1$; ΔFF_t^u is the one day change in the federal funds futures rate on day t of a change in the federal funds target rate; and ΔFF_t^e is the expected change in the federal funds target at date t.

The expected change in the federal funds rate is calculated as the difference between the actual change in federal funds rate target and the change in the federal rate future on the day of the change, i.e., $\Delta FF_t^e = \Delta FF_t - \Delta FF_t^u$ where ΔFF_t is the change in federal funds target rate.[8]

We also study the impact of (un)anticipated changes in euro area, German and UK policy rates. There is no equivalent futures market instrument that tracks these policy rates as compared to the federal funds futures contract. 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.

[7] Poole and Rasche (2000) use the 1-month ahead federal funds future contract as compared to the current spot future contract used by Kuttner (2001). The rationale for using the former is that it is much easier to calculate unanticipated changes.

[8] Like Poole and Rasche (2000), we use the 1-month ahead federal funds futures contract.

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 3-month Euribor futures rate.[9] For the UK, our proxy for the unexpected change in the policy rate is the one day change in the 3-month sterling futures contract.

Finally, we also analyse the impact of Irish interest rate changes on the ISEQ. Given our methodology, an obvious problem is the lack of a futures market for Ireland.[10] We attempt to circumvent this problem by defining the unexpected change in monetary policy as the one day change in the 1-month Dublin inter-bank offer rate (DIBOR).[11] The DIBOR was closely related to the Short-term Lending Facility (STF), the rate at which the Central Bank lent to banks and changes in the latter were reflected in changes in rates on the Dublin wholesale market. The expected change is derived in the usual manner. Thus, we ran a version of Equation (3) with the sample period running from 1989 and 1998.[12]

V DATA AND EMPIRICAL RESULTS

Table 1 provides a brief description of the data and sample periods used in our subsequent analysis. In addition, the Appendix gives a more detailed explanation of the data and sources they were drawn from.

5.1 Empirical Results

We first examine the impact of (un)anticipated changes in US federal funds rate target on the ISEQ by running a regression similar to equation (3) with the results reported in Table 2.[13] For comparison sake, in Table 3, we also present results using the one day change in the 3-month eurodollar futures as an alternative proxy of the unanticipated change in federal funds target rate. Both regressions give rise to similar results.

In particular, we find that a surprise change in US monetary policy is

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

[10] Between 1989 and 1992 a futures market existed in Dublin and dealt with some interest rate products including a 3-month DIBOR future, but the sample period is too short for this study.

[11] The validity of such an approach is supported by the positive findings with respect to the expectations hypothesis of the term structure of interest rates for Ireland, see Cuthbertson and Bredin (2000).

[12] Post 1998, Ireland became a member of the EMU.

[13] For all regressions, DW refers to the Durbin Watson statistic for serial correlation. Our test for heteroscedasticity is White's (1980) test.

Table 1: *Data Description*

Origin of Event	*Proxy for Unanticipated Change*	*Target*	*Sample*
Domestic	1-month DIBOR	Short-term lending facility (STF) rate	1988:04-1998:12
US	1-month ahead 30-day federal funds futures and 3-month eurodollar futures rate	Federal funds target rate	1988:10-2002:11
German/Euro	3-month euromark and euribor futures rate	Lombard rate and ECB main refinancing rate	1989:04-2002:12
UK	3-month sterling LIBOR futures rate	Bank of England repo/base rate	1993:01-2003:02

statistically significant with a negative sign, i.e., an unanticipated change in the US federal funds rate target has a negative effect on Irish equity returns. This result is in accordance with the predictions of theory. On the other hand, anticipated changes have a positive significant influence. Bernanke and Kuttner (2003) find similar results for the US with unanticipated changes giving rise to a negative significant impact on US stock returns but anticipated changes giving rise to a positive significant effect.

Table 2: *Expected and Unexpected Change in Federal Funds Rate on ISEQ Using Fed Funds Futures*

Variable	*Coefficient*	*T-Stat*
Constant	0.01	0.68
EXPECT	2.03	3.74
SHOCK	–2.38	–1.91
Diagnostics		
$R^2 = 0.18$	DW = 1.89	HET = 10.25[0.07]

Note: Using the one day change in 1-month ahead federal funds future contract as unanticipated change.

In all regressions reported DW stands for the Durbin Watson statistic, while HET is White's (1980) test for heteroscedasticity. The associated p value is in brackets.

Table 3: *Expected and Unexpected Change in Federal Funds Rate on ISEQ Using Eurodollar Futures*

Variable	*Coefficient*	*T-Stat*
Constant	0.04	0.31
EXPECT	1.95	3.83
SHOCK	–2.43	–2.02
Diagnostics		
R^2 = 0.19	DW = 1.81	HET = 3.85[0.57]

Note: Using the one day change in 3-month Eurodollar futures as proxy for unanticipated change in fed funds target rate.

Our results are robust to the inclusion of a number of outliers highlighted by Bernanke and Kuttner (2003) during this period including September 11th 2001. In fact, the most influential outlier was the rate cut of April 18th 2001, which was almost entirely unpredicted by the market. In this instance, the Federal Reserve cut the federal funds target rate by 50 basis points with an unanticipated decline of 42 basis points at an unscheduled FOMC meeting.[14] Excluding this observation increases the significance of the unexpected component and also raises the R^2.[15] Instead of rising in the face of a decline in the policy rate, Irish markets appear to have been spooked by such a move fearing that the economy was in much worse shape than they previously anticipated.

Our findings are somewhat different to those of Durham (2001) who found that actual US policy rate changes have a significant negative effect on the Irish stock market. In contrast, we find it is only the unanticipated component that has a negative impact on Irish stock returns. However, Durham does not differentiate between (un)anticipated changes and examines data at a monthly and quarterly frequency; his sample does not fully overlap with ours.

We also allow for the possibility that the ISEQ may not respond *per se* to a change in US monetary policy but instead to movements in US stock indices induced by such a change. In Table 4, we find that while changes in the Dow Jones can have a significant positive influence on ISEQ returns, controlling for this does not alter the significance of the coefficients on the (un)anticipated components.[16]

[14] This is the largest unanticipated change in U.S. monetary policy during the sample period.
[15] These results are available on request.
[16] Based on an extensive robustness analysis, we drop the outlier previously mentioned, April 18th 2001.

Table 4: *Expected and Unexpected Change in Federal Funds Rate on ISEQ Using Fed Funds Futures when US Stock Returns included*

Variable	*Coefficient*	*T-Stat*
Constant	0.07	0.57
EXPECT	2.02	3.88
SHOCK	–3.47	–2.67
DOW JONES	0.20	2.07
Diagnostics		
$R^2 = 0.29$	DW = 1.90	HET = 12.68[0.18]

Note: Using the one day change in 1-month ahead federal funds future contract as unanticipated change. Dow Jones is the composite index. Rate cut of the 18th April 2001 is excluded.

Turning next to the influence of European monetary policy changes on the Irish market, we report the impact of UK and German/euro interest rate changes on the ISEQ in Tables 5 and 6, respectively. For the UK, we find that neither anticipated nor surprise changes in UK policy rates have a significant influence on same day Irish stock returns. Prior to 1999, German monetary authorities controlled its own monetary policy but with the onset of EMU, the policy rate for the whole of the euro area was determined collectively by member states. We splice together the series for German and euro policy rate changes. Similar to the UK, we find that neither (un)anticipated elements of policy rate changes have a significant effect on Irish stock returns. Separating euro policy rate changes from the German rate changes does not qualitatively alter our conclusions, see Table 7.

Table 5: *Expected and Unexpected Change in UK Discount Rate on ISEQ*

Variable	*Coefficient*	*T-Stat*
Constant	-0.02	-0.07
EXPECT	0.50	0.69
SHOCK	0.27	0.18
Diagnostics		
$R^2 = 0.02$	DW = 1.58	HET = 4.59[0.47]

Note: Using the one day change in the 3-month sterling futures contract.

Table 6: *Expected and Unexpected Change in German and Euro Policy Rate on ISEQ*

Variable	*Coefficient*	*T-Stat*
Constant	–0.03	–0.12
EXPECT	–0.19	–0.45
SHOCK	–0.13	–0.51
Diagnostics		
R^2 = 0.01	DW = 1.52	HET = 1.68[0.90]

Note: Using the one day change in 3-month euromark to proxy unanticipated change in German policy rate and the one day change in the 3-month euro libor for unanticipated change in the Euro policy rate.

Overall, our results suggest that monetary policy conditions in the UK, German and euro area appear to have had little influence on Irish stock market returns. This result may initially seem surprising. However, during this period, Irish economic growth was more akin to that of the US than any of its European neighbours with growth prospects in the US acting as a good barometer for economic activity in Ireland. This was due in part to the large influx of US multinationals and the concomitant decline in traditional firms who mainly exported to our European neighbours. In addition, there was an increased expansion of the major players in the Irish stock market in the US market.[17] Seen in this context, it is less surprising that monetary conditions in the US appear to play a much larger role in determining prospects on the Irish stock market than European monetary policy. Also, Gallagher (1995) finds no long-run relationship between returns on the ISEQ and returns on the UK or German stock market.

Finally, we look at the influence of domestic interest rate changes on the ISEQ. We find that the unexpected component has the predicted theoretical sign and is borderline significant while the expected component is insignificant.[18] However, based on a robustness analysis, one observation seems to drive the finding of a significant negative coefficient on the unanticipated change in the policy rate. In particular, the increase in the STF by 300 basis points on September 28th 1992, had a large unanticipated element. If this observation is excluded, as seen in Table 8, the unanticipated component still has the predicted theoretical sign but is highly insignificant.

[17] CRH, Kerry Group, IAWS, Elan and the two major banks expanded in the US during this period.

[18] These results are available on request.

Table 7: *Separating Expected and Unexpected Change in German and Euro Policy Rates on ISEQ*

Variable	*Coefficient*	*T-Stat*
Constant	–0.03	–0.13
EXPECT	–0.63	–1.11
SHOCK	–3.52	–0.77
EXPECT98	0.92	1.08
SHOCK98	2.36	0.43
Diagnostics		
R^2 = 0.06	DW = 1.72	HET = 8.59[0.86]

Note: EXPECT98 and SHOCK98 are dummies for post EMU Shocks.

Table 8: *Expected and Unexpected Change in Irish Interest Rates on ISEQ Omitting September 28th 1992*

Variable	*Coefficient*	*T-Stat*
Constant	0.11	0.49
EXPECT	–0.44	–1.18
SHOCK	–0.22	–0.13
Diagnostics		
R^2 = 0.04	DW = 1.70	HET = 8.96[0.11]

The insignificance of domestic interest changes during this period is in accordance with the findings of Durham (2001).

We conducted a number of further robustness checks on our results. In a number of cases, policy rates in a number of countries changed on the same day. However, controlling for such changes does not qualitatively affect our results. We next pooled our data across all policy rate changes for Ireland, the US, the UK, German and the euro area. On running the baseline regression, we find the unexpected component is significant and negative while the expected component is insignificant. However, our subsequent robustness analysis points to September 28th 1992 as an outlier. Once this observation is excluded the surprise component in policy rate changes becomes insignificant.

Finally, we have also examined whether asymmetries exist with respect to an (un)anticipated rise or fall in policy rates. In particular, we run the following regression:

$$\Delta ISEQ_t = \alpha_0 + \alpha_1 \Delta r_t{}^e + \alpha_2 \Delta r_t{}^u + \alpha_3 \delta \Delta r_t{}^e + \alpha_4 \gamma \Delta r_t{}^u + \varepsilon_t \quad (4)$$

where

if $\Delta r^u > 0$, $\gamma = 1$, *otherwise* $\gamma = 0$; *or*
if $\Delta r^e > 0$, $\delta = 1$, *otherwise* $\delta = 0$

However, once we again control for September 28th 1992, we find no statistically significant evidence of an asymmetric response of the ISEQ with respect to (un)expected rise or fall in the policy rate.

VI CONCLUSIONS

In this study, we have examined the impact of both domestic and foreign interest rate changes on same day returns of the Irish stock market. A central part of the study was the decomposition of policy rate changes into their expected and unexpected components using interest rate futures contract. Apart from the US, we find that neither unanticipated nor anticipated changes in policy rates seem to impact significantly on the Irish stock market. For the US, unanticipated changes in the federal funds target rate give rise to a negative impact on ISEQ returns. Our results represent an important first step in assessing the degree to which the Irish market is open to international monetary shocks. Further work in this area might examine the impact of interest rate changes on individual stock prices or examine intra-day data.

APPENDIX

The data series are daily and the time period varies with the event examined. The data series are detailed below and are summarised in Table 1. In analysing the impact of US monetary policy on the ISEQ index, the data runs from October 1988 to November 2002. The unanticipated change, in the federal funds target rate, is proxied by both the one 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) and the one day change in the price of the 3-month eurodollar interest rate futures contract, as traded on the Chicago Mercantile Exchange (CME). These data series are taken from Datastream and Bloomberg, respectively.

The value of the federal funds futures contract is equal to 100-r, where r is the average effective federal funds rate for the expiration month. The unanticipated change in the federal funds rate is, therefore, calculated as the one day change in the future's price on the day of the policy announcement. Eurodollar futures are priced using the same convention. The federal funds target rate is the monetary policy instrument of the Federal Reserve and the actual change is the change as announced by the FOMC. These data are obtained from the Federal Reserve Board of Governors. The one day percentage 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 $\frac{P_{t+1} - P_t}{P_t} * 100$, where t is the day of the policy announcement.

The impact of changes in the German and euro area interest rates on the ISEQ index are examined for the period April 1989 to December 2002. Actual changes in policy rate are 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 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 3-month Euro-DM futures contract as traded on the London International Financial Futures and Options Exchange (LIFFE). The unanticipated change in the ECB refinancing rate is proxied by the one day change in the price of the EUX 3-month Euribor futures contract as traded on Eurex, Frankfurt. Both of these contracts are priced in a similar way to the federal funds futures contract, where 100 minus the contract price equals the futures rate and 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. The one day percentage change in the ISEQ index in this instance is calculated as $\frac{P_t - P_{t-1}}{P_{t-1}} * 100$.

The impact of changes in the Bank of England repo/base rate on the ISEQ index are examined for the period January 1993 to February 2003. The shorter period examined here in terms of UK monetary policy is a consequence of the suspension of trading in sterling LIBOR contracts while the UK was a member of the European Monetary System. The unanticipated change in the base rate is proxied by the one day change in the price of the 3-month sterling LIBOR futures contract as traded on LIFFE. The data are obtained from Bloomberg. The unanticipated change in the policy rate and the one day change in the ISEQ are calculated in the same way as in the German event study. The study of the impact of Irish monetary policy changes on the ISEQ index uses the STF as a measure of the policy rate for the period April 1988 to December 1998. The one day change in the 1-month DIBOR rate is the proxy for the unanticipated change in monetary policy, and is calculated as $r_t - r_{t-1}$, where t is the day of the policy announcement. This data was obtained from the Central Bank of Ireland. The one day percentage change in the ISEQ index is calculated for the same time period.

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