The Irish Accounting Review (2001), Vol. 8, No. 1, 33-53

EXCHANGE CONTROL DEREGULATION AND RELATIONSHIPS BETWEEN UK AND IRISH EQUITY MARKETS

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Abstract

This research examines causal relationships between the United Kingdom stock market and the smaller Irish market over three periods coinciding with the reduction and removal of currency controls on Irish investors. As a major world market, the UK is the most likely alternative for Irish investors. UK index futures are included because of growing evidence that futures markets impact on their respective cash markets. After controls are removed, there is evidence that the UK equities market impacts on Irish shares. There is also evidence that UK futures impact on Irish equities. A separate investigation of financials sectors in UK and Irish equity markets also confirms the establishment of a causal relationship when exchange controls are removed.

INTRODUCTION

As controls on capital have been reduced, there is increasing evidence that world financial markets are becoming more closely linked. This linkage between major national stock markets has received increasing attention. Early research identified considerable levels of segmentation (Makridakis and Wheelwright, 1974; Hilliard, 1979). A likely explanation is the lack of capital mobility, due to exchange controls and the costs associated with international investment. Since the mid-80s, there is growing evidence of international market interdependencies, as national markets have deregulated. Eun and Shim (1989), Meric and Meric (1989), and Cheung and Ho (1991) find stronger relationships between international exchanges. Jeon and Von Furstenberg (1990) and Le (1991)

explore relationships between major capital markets over the periods before and after the 1987 market crisis, and report a significant increase in international co-movements. In contrast, Malliaris and Urrutia (1992) report no evidence of lead-lag relationships before or after the crisis period. They do, however, find evidence of feedback relations during the crash period. Najand (1996) finds evidence of substantially increased interaction among Asian stock markets.

As derivatives markets become increasingly important, it is desirable that they be included in studies on interrelationships between markets. New information may firstly have an impact on futures prices, so index futures can lead cash prices. They are more liquid than shares, and there is also evidence that transaction costs are lower.

In an early study, Zeckhauser and Niederhoffer (1983) compare returns on the S&P 500 Index with its nearest futures contract. Kawaller, Koch and Koch (1987), Herbst, McCormack and West (1987), and Finnerty and Park (1987) report evidence that futures contracts tend to lead cash indices. Using high frequency data, Stoll and Whaley (1990), Koch (1993), Koutmos and Tucker (1996), Pizzi, Economopoulos and O'Neill (1998), Brooks, Garrett and Hinch (1999), and others also compare index returns with their respective futures contracts. A common finding is that futures markets tend to lead their cash equivalents. Arshanapalli and Doukas (1997) report increased linkages between cash and futures markets during the 1987 crash.

This paper presents a study of the relationship between Irish and United Kingdom equity markets. This is an extension on previous research, as it examines the degree of integration between a major equity market in London and a considerably smaller national market in Dublin. It may therefore provide an insight into the relationship between major world markets and smaller regional exchanges. Although the Dublin stock market is a major source of equity finance for Irish firms, it can also be considered a regional market, as a number of Irish firms also raise equity capital in London. The nature of the relationship may differ from that between two markets of similar size and influence. Data from the equity futures market in London is included. As no index futures contracts are traded in Dublin, it is possible that trading on UK futures contracts may lead the Irish equity market. Traders seeking a signal of future market behaviour may look to UK futures, as no Irish contracts are available.

Also, as UK futures market performance may impact on the UK equities market, it in turn may offer a signal of future performance on the Irish market. The study examines this relationship, so it offers evidence on the impact of futures markets in an international perspective.

In response to EC policy, the Irish Government has been engaged in a policy of deregulation of capital markets. Prior to this, exchange controls had restricted the ability of Irish-based investors to diversify their investments abroad. Deregulation has greatly increased potential levels of both inward and outward capital flows. As UK capital markets provide the most likely alternative source for Irish investors, the degree of integration between these two markets is examined over the period before, during, and after deregulation.

This paper is set out as follows. The next section presents a discussion of tests for integration and a justification for the methodology employed. The third section defines the variables and data sets, the fourth section offers the empirical results, and a final section concludes.

METHODOLOGY

Much of the research on capital market integration involves an application of statistical regression techniques or extensions of an asset pricing model. Capital markets may be segmented along national lines as a result of either investors' inhibitions or official restrictions, so a low correlation between market returns will indicate segmentation, assuming that integrated markets tend to fluctuate together. Adler and Dumas (1983) note, however, that as rates of return are not stationary, a correlation or regression analysis is not legitimate. They also note that as output mixes vary among countries, random shocks affecting specific industry sectors will have a disproportionate impact on markets where these sectors are significant. A low correlation may not therefore indicate market segmentation. An international asset pricing model offers an alternative approach, as it tests whether domestic factors as opposed to international factors have sole explanatory power. Jorion and Schwartz (1986) adopt this approach. A development is the application of an international version of Arbitrage Pricing Theory (e.g. Cho, Eun and Senbet, 1986), or a Multifactor Asset Pricing Model (e.g. Gultekin, Gultekin, and Penati, 1989). Wheatley (1988) notes, however, that tests of international market

integration are generally joint tests of the asset pricing model and of market integration. Rejection of the joint hypothesis may be because markets are not integrated, or because the model does not apply. As market inefficiencies are a matter of serious concern when dealing with small markets such as the Dublin Stock Exchange, many assumptions associated with asset pricing models will not apply, so these models may not be appropriate.

Taylor and Tonks (1989) propose an alternative framework of investigation, requiring an application of cointegrated time series, as advanced by Engle and Granger (1987). This approach is adopted. A potential criticism is that it may not cope successfully with markets in which the balance of sectors differs radically. A causal relationship may not be identified, as a random shock could have a relatively greater impact on one market. As the financials sector represents 40 per cent of total value of the Dublin exchange, the balance of sectors differs considerably from London. To cope with this potential for a type one error, a separate analysis is performed on the financials sector of both markets, as Irish traders in financial shares may consider UK financials as an alternative investment.

An application of cointegrated time series requires a number of stages. An initial inquiry determines if any index values under investigation exhibit a trend. Economic growth can, for example, generate a trend. First differencing will induce stationarity, assuming the series is integrated of order one, or $I(1)$. It also provides a measure of return. For any market index x, return in period t is defined as:

$$R_{xt} = Ln(P_{x,t}) - Ln(P_{x,t-1}) \qquad (1)$$

where $P_{x,t}$, $P_{x,t-1}$ are index values for periods t and $t-1$. Logarithms of the market indices are therefore tested to see if they are $I(1)$, by testing for unit roots. If this hypothesis cannot be rejected, the analysis proceeds.

A second stage of enquiry requires an examination of the relationship between each index time series. Any two series P_x and P_y, index values for markets x and y, are integrated in the long term if there is a

linear relationship between $Ln(P_x)$ and $Ln(P_y)$. Assuming the two series are $I(1)$, they are cointegrated if they form a linear combination (e) that is stationary, or $I(0)$. In other words:

$$Ln(P_x) = a + bLn(P_y) + e \qquad (2)$$

where $(1,-b)$ is the cointegrating vector. This cointegrating regression is estimated by ordinary least squares, and the residuals are tested to see if they are $I(0)$, and are therefore stationary. Stationarity is evidence of cointegration between P_x and P_y, and of market integration. In other words, if the difference between two series is stable, both are moving upwards at approximately the same rate and share a long-run equilibrium.

A test of Granger causality is then performed, as it provides evidence of the direction of causality and of feedback relationships between markets. The format is a Vector Autoregression (VAR) model, as lagged values of every set of index returns are regressed on each individual market return. Sims (1980) proposes that VAR models are appropriate for a range of empirical studies in finance. In a test of causal relationships between two markets, two test equations are required, and first differences are employed. The appropriate test equations for markets x and y will be:

$$R_{xt} = \sum_{i=1}^{n} \alpha_{1,i} R_{x,t-i} + \sum_{j=1}^{n} \alpha_{2,j} R_{y,t-j} \qquad (3)$$

$$R_{yt} = \sum_{i=1}^{n} \alpha_{3,i} R_{x,t-i} + \sum_{j=1}^{n} \alpha_{4,j} R_{y,t-j}$$

The amount of lagging in R_x and R_y is indicated by i and j respectively. The number of lags varies, ranging from one to n, and is determined by a measure of significance. Coefficients of the lag variables in each equation are represented by $\alpha_{1,i}$, $\alpha_{2,j}$, $\alpha_{3,i}$, and $\alpha_{4,j}$, and significance tests will indicate the presence of a causal relationship. Extra test equations, and lagged independent variables, are introduced with the inclusion of every new market index in the causality tests. In the pres-

ence of cointegration between markets, an error term is required to balance the model (Engle and Granger, 1987). Residuals from the relevant static cointegration test must be included as an explanatory variable.

DATA

Three time periods are identified, coinciding with the gradual relaxation of exchange controls on Irish-based investors. A first relaxation occurred on 1 January 1989, when the Irish Central Bank removed all restrictions on the purchase of medium and long-term foreign securities by Irish residents. On 1 January 1992, in a further relaxation, all limitations on foreign currency borrowing by residents were removed, as were any limitations on the financing of investments outside the state.

The study periods are[1]:
1 January 1987 to 31 December 1988: Fully regulated capital markets.
1 January 1989 to 31 December 1991: Partial regulation of markets.
1 January 1992 to 31 December 1994: Markets de-regulated.

The ISEQ Index covers all shares quoted on the Irish stock market. It is used in this study, and is designated as ISEQ. Closing values of the FTSE 100 Index represent the London stock market, and are designated as FTSE. The FTSE 100-Index Future is now the most liquid equity instrument traded in the UK. It is included, and is designated as FTFU. Index futures contracts are traded on LIFFE. Delivery months are March, June, September and December. Last trading day is the third Friday in the delivery month, and settlement occurs on the following business day. Daily closing values of the nearby futures contract are used, as it is the most actively traded. Analysis shifts to the next nearest contract on the first day of the delivery month, to avoid the impact of expiration effects during the last two weeks of a contract life. Care is taken to allow for possible price jumps when futures values shift from one contract to the next, as all returns are estimated using values from the same contract. The ISEQ Financials Index covers all Irish quoted firms from this sector, and is designated as ISEQ(f). The FTSE UK Financials Index covers financial industry sector firms in the top 350, and is designated FTSE(f). No futures contract on UK or Irish financials indices is traded, so the derivatives market cannot be included in this section of the research. All indices are value weighted.

Values of FTSE, FTFU and FTSE(f) are adjusted by the Irish pound exchange rate. A mid point between bid and ask closing values provides the adjustment rate. As the study is conducted from the point of view of Irish investors, it is desirable that all returns be designated in Irish pounds. This does raise the issue of exchange rate risk, but this is considered a separate factor, as the focus is on linkages between markets.

An increase in the number of shares listed on both exchanges could, in itself, result in greater linkages between the two markets. Listings data was examined for evidence of an increase in the number of Irish equities quoted in London. A number of Irish companies did acquire UK quotations during the study period, but all are relatively small and would not impact on the relationship between the markets[2]. It is highly unlikely, therefore, that any evidence of greater linkages between the markets is the result of an increase in the number of cross-listings. When considering the financials sectors, no company forming part of ISEQ(f) has, to date, been included in FTSE(f).

Trading activity is concurrent in the Irish and UK financial markets. Dublin and London are in the same time zone, and trading hours traditionally are the same in both countries. Timing differences should not impact on causal relationships, as closing values are recorded at the same time. The Dublin Stock Exchange has provided the Irish index values, and all other data comes from Datastream.

Table 1: Summary Statistics For Return Series

	No.	Mean	Std. Dev.	Autocorrelation at lags: 1	2	3	4	5	Q(5)
Period 1									
ISEQ	521	4.54×10^{-4}	1.50×10^{-2}	0.20	0.04	0.04	0.04	0.09	26.65*
FTSE	521	3.97×10^{-4}	1.48×10^{-2}	0.01	0.00	0.06	0.01	0.08	5.81
FTFU	521	4.05×10^{-2}	1.68×10^{-2}	0.04	-0.06	0.06	0.02	-0.02	5.32
ISEQ(f)	260	1.13×10^{-3}	1.22×10^{-2}	0.03	0.05	0.09	0.05	-0.05	4.52
FTSE(f)	260	6.02×10^{-2}	8.86×10^{-3}	0.07	-0.012	-0.09	-0.07	0.06	9.26
Period 2									
ISEQ	781	2.02×10^{-6}	9.35×10^{-3}	0.11	0.07	0.06	0.05	0.03	17.99*
FTSE	781	2.76×10^{-4}	1.01×10^{-2}	0.03	-0.01	0.02	0.07	-0.02	5.34
FTFU	781	2.81×10^{-4}	1.20×10^{-2}	-0.02	-0.02	0.00	0.08	-0.01	5.59
ISEQ(f)	781	2.79×10^{-5}	1.27×10^{-2}	0.10	0.00	0.00	0.07	-0.02	12.01*
FTSE(f)	781	4.23×10^{-5}	1.11×10^{-2}	0.06	0.01	0.03	0.08	-0.03	9.74
Period 3									
ISEQ	782	3.75×10^{-4}	8.39×10^{-3}	0.19	0.04	0.08	0.04	-0.04	38.41*
FTSE	782	1.93×10^{-4}	1.02×10^{-2}	0.00	0.00	0.01	-0.04	0.08	6.02
FTFU	782	1.73×10^{-4}	1.14×10^{-2}	-0.03	0.01	-0.01	-0.05	0.06	5.46
ISEQ(f)	782	4.12×10^{-4}	1.13×10^{-2}	0.05	-0.03	0.06	0.01	-0.05	7.09
FTSE(f)	782	4.03×10^{-4}	1.19×10^{-2}	0.05	0.01	0.02	-0.04	0.03	4.22

Notes to Table 1:

ISEQ, FTSE, FTFU are daily Irish stock market, UK stock market, and UK index futures returns. ISEQ(f) and FTSE(f) are daily Irish financials market and UK financials market returns. All are estimated by taking first differences of logs of index values. FTSE, FTFU, and FTSE(f) are adjusted by the appropriate Irish pound exchange rate. Q(5) represents the Box-Pierce-Ljung Portmanteau Test for Autocorrelation, * corresponds to the 5 per cent significance level.

Summary statistics from all daily return series are presented in **Table 1**. Significant autocorrelations in ISEQ returns are probably due to thin trading in some shares that make up the index. A lack of significant autocorrelation in ISEQ(f) returns, with the exception of period two, is because this index is dominated by large actively traded firms. Variability on all markets is marginally higher during period one. This can be expected as it coincides with the 1987 crash. Neither financial index exhibits high volatility, as they do not cover the crash period. Dublin offers marginally lower variability in periods two and three. In period two, average returns on the ISEQ index are lower than those available on either UK market; however, it does outperform them in the third period, when both financial sector indices indicate a good performance. A better relative Irish performance may be because the financials sector represents a larger proportion of the Irish market.

EMPIRICAL RESULTS

Overall Markets

C.anger's (1969) causality concept investigates the relationship between Irish equity markets and the cash and futures markets in London. Stationarity is assessed using the augmented Dickey-Fuller test. Level series and returns series are tested for a unit root. Results are outlined in **Table 2**. For all indices, a null hypothesis that they do not contain a unit root is not rejected, so they are non-stationary. All returns series are found to be $I(0)$, as a null hypothesis of non-stationarity is rejected in all cases.

Table 2: Cointegration Tests for Overall Markets

Panel A: Test Statistics for Stationarity of Time Series.

	Period 1		Period 2		Period 3	
	Index	Returns	Index	Returns	Index	Returns
ISEQ	-1.93	-3.74	-2.62	-4.80	-1.93	-4.87
FTSE	-2.88	-5.41	-2.46	-6.33	-1.56	-5.83
FTFU	-2.58	-4.91	-2.47	-6.62	-1.64	-5.36

Notes:
ISEQ, FTSE, and FTFU are daily Irish stock market, UK stock market, and UK index futures series. All indices are logarithms of the index values, and all returns series are first differences of the log index values. Augmented Dickey-Fuller tests for stationarity of time series are presented. Critical value for all test statistics, at the 5 per cent level, is -3.41.

Panel B: Results of the Cointegration Tests.

Dep. Var.	Independent Variable								
	Period 1			Period 2			Period 3		
	ISEQ	FTSE	FTFU	ISEQ	FTSE	FTFU	ISEQ	FTSE	FTFU
ISEQ	-	-2.6772	-2.8733	-	-2.2136	-2.0589	-	-3.1142	-3.0927
FTSE	-3.1975	-	-4.4418*	-2.1093	-	-4.7672*	-3.0764	-	-3.8210*
FTFU	-3.2683	-4.5613*	-	-2.1272	-4.9397*	-	-3.0683	-3.8944*	-

Notes:
ISEQ, FTSE, and FTFU variables are natural logs of the daily Irish stock market, UK stock market, and UK index futures series. Test values are augmented Dickey-Fuller statistics on residuals of the cointegrating regressions. *indicates lack of significance at a 5 per cent level; the critical value is -3.78 in all cases. Acceptance of a null hypothesis of stationarity in the residuals indicates evidence of cointegration.

A regression equation is fitted to the level series, and an augmented Dickey-Fuller test on the residuals provides the necessary evidence of cointegration. An exchange of dependent and independent variables in the regression equation provides a further test. **Table 2** offers the test results. A null hypothesis of cointegration is rejected, when ISEQ is compared with either

FTSE or FTFU. This is maintained over all time periods, and it is immaterial which is selected as the dependent or independent variable, as both specifications provide the same result. In contrast, there is evidence that FTSE and FTFU are cointegrated. Results are significant in all periods, regardless of which is specified as an independent variable. An error correction term is therefore required when testing causality between FTSE and FTFU. The two time series share a common long-term trend, which may be wrongly identified in causality tests.

Following Huag (1996), further tests of cointegration are advisable. An augmented Dickey-Fuller test on residuals from a cointegrating regression may have low power in certain circumstances. Phillips and Ouliaris (1990) test statistics are constructed, using a non-parametric correction for serial correlation. Davidson and MacKinnon (1993) provide the critical values. They confirm that FTSE and FTFU are cointegrated in all three periods, and that there is no evidence of cointegration between ISEQ and either other market. The Johansen and Juselius (1990) trace test procedure for cointegrating vectors is also applied, using critical values that they tabulate. A null hypothesis of a cointegrating vector is rejected at the 5 per cent level of significance, when ISEQ is tested with either FTSE or FTFU; however, it may not be rejected in a test of FTSE and FTFU. This occurs in all periods, and again confirms the original augmented Dickey-Fuller results[3].

A VAR format is employed to examine Granger causality. As three markets are included, a regression estimate is required for each. They are estimated iteratively, using seemingly unrelated regression analysis[4]. An initial step is to determine a proper lag length for all explanatory variables. Autoregressive equations are estimated for each, and the number of lags is incrementally increased. A minimum value of Akaike's Final Prediction Error indicates an optimum number of lags[5]. Two lagged values of ISEQ are optimum in all periods, whereas one lag is appropriate for FTSE and FTFU. Period three is an exception, as two lags are required for FTSE.

Breusch-Pagan (1979) offers a diagnostic test for heteroscedasticity. Using a chi-square distribution, test statistics indicate that, in all three periods, a null hypothesis of homoscedasticity was rejected. Each regression is therefore estimated separately, using White's (1980) heteroscedastic consistent covariance matrix to determine standard errors and t statistics[6].

Table 3: Estimates of VAR Models, White's Adjustment

Indep. Vars.	Dependent Variables								
	Period 1			Period 2			Period 3		
	$ISEQ_t$	$FTSE_t$	$FTFU_t$	$ISEQ_t$	$FTSE_t$	$FTFU_t$	$ISEQ_t$	$FTSE_t$	$FTFU_t$
$ISEQ_{t-1}$	-0.1019	-0.0475	-0.0736	-0.0558	0.0458	0.0293	0.0066	-0.0733	0.0904
	(-0.87)	(-0.52)	(-0.81)	(-1.19)	(1.00)	(0.60)	(0.16)	(-1.47)	(1.49)
$ISEQ_{t-2}$	-0.0869	-0.0478	0.0463	0.0024	0.0333	0.0494	-0.0164	0.0456	0.0497
	(-0.92)	(-0.58)	(0.48)	(0.06)	(0.79)	(1.07)	(-0.47)	(1.05)	(1.03)
$FTFU_{t-1}$	0.2963	0.3359	0.1269	0.0539	0.2207	0.0193	0.4545	0.5735	0.3615
	(1.00)	(1.44)	(0.55)	(0.47)	(2.61)*	(0.21)	(4.32)*	(3.43)*	(1.95)*
$FTSE_{t-1}$	-0.2018	-0.2913	-0.0563	-0.0021	-0.2646	-0.0472	-0.4595	-0.6420	-0.4451
	(-0.81)	(-1.57)	(-0.28)	(-0.02)	(-2.70)*	(-0.43)	(-3.83)*	(-3.73)	(-2.33)*
$FTSE_{t-2}$							-0.1316	-0.4388	-0.3531
							(-1.08)	(-2.32)*	(-1.59)
E_{t-1}		-0.2561	0.0642		0.0245	-0.1462		0.0979	-0.2414
		(-2.68)	(0.66)		(0.52)	(-2.63)		(1.27)	(-2.79)*

Notes:
$ISEQ_t$, $FTSE_t$, and $FTFU_t$ represent daily returns on the Irish stock market, the UK stock market, and the UK index futures market. E_t is the error correction term. Coefficients of independent variables are presented. Figures in parentheses are relevant t statistics, and * indicates significance at the 5 per cent level.

Table 3 offers the corrected results. Significant coefficients establish the presence of causality, and its direction. A comparison over the study periods indicates whether the nature of this relationship has altered. In the latter two periods, there is evidence of a causal relationship from index futures to the equities market in London. This is not unexpected, as levels of trading activity in futures have increased very considerably. Futures traders have greater arbitrage opportunities, and can react more rapidly to the arrival of new information. Further, thin trading in some shares may cause cash markets to react more slowly than futures markets. Index futures therefore tend to lead equity index values.

Evidence indicates that, from period three onward, a causal relationship is established from UK to Irish equity markets. There is no evidence of a relationship in the opposite direction. In the final period, there is also evidence of a significant causal relationship from UK index futures to the Irish market, and no indication of causality in the opposite direction. A changing relationship between the UK and Irish markets is implied, as trading in UK equities and futures has an increasing impact on equity returns in Dublin. The removal of exchange controls coincides with the establishment of this causal relationship.

Financials Sectors

Table 4 offers evidence on the relationship between the financials sectors in the Irish and UK stock markets. Initial tests indicate that, in all periods, both index series are $I(1)$, and that a null hypothesis of non-stationarity is rejected for all returns series. **Table 4** also provides test results for cointegration between the two time series. Results are as expected, in all periods. An augmented Dickey-Fuller test on residuals indicates that a null hypothesis of cointegration is rejected, regardless of which index is selected as the dependent variable. This result is confirmed when Phillips and Ouliaris (1990) test statistics are employed, and when the Johansen and Juselius (1990) test procedure for cointegrating vectors is applied[7].

Table 4: Cointegration Tests for Financials

Panel A: Test Statistics for Stationarity of Time Series						
	Period 1		Period 2		Period 3	
	Index	Returns	Index	Returns	Index	Returns
ISEQ(f)	-2.02	-3.78	-2.38	-5.34	-1.37	-4.94
FTSE(f)	-2.24	-4.17	-2.81	-6.42	-1.19	-4.83

Notes:
ISEQ(f) and FTSE(f) are daily Irish financials market, and UK financials market index series. All indices are logarithms of the index values, and all returns series are first differences of the log index values. Augmented Dickey-Fuller tests for stationarity of time series are presented. Critical value for all test statistics, at the 5 per cent level, is -3.41.

Panel B: Results of the Cointegration Tests.			
Dependent → Independent Variable	**Period 1**	**Period 2**	**Period 3**
ISEQ(f) → FTSE(f)	-2.7890	-1.7283	-3.2868
FTSE(f) → ISEQ(f)	-3.0487	-2.0307	-3.0722

Notes:
ISEQ(f) and FTSE(f) are natural logs of the daily Irish financials market, and UK financials market index series. Test values are augmented Dickey-Fuller statistics on residuals of the cointegrating regressions. *indicates lack of significance at a 5 per cent level, the critical value is -3.78 in all cases. Acceptance of a null hypothesis of stationarity in the residuals would indicate evidence of cointegration.

Causality is determined by a regression test. As there are two markets, two regression estimates are required. There is no evidence of cointegration, so an error correction term is not included. Minimum values of Akaike's Final Prediction Error indicate that two lags are required for ISEQ(f) and FTSE(f) in period one. One lag is sufficient for both series in periods two and three. A Breusch-Pagan (1979) test establishes the possible presence of heteroscedasiticity, so each regression is estimated

using White's (1980) heteroscedastic consistent covariance matrix to determine standard errors.

Table 5: Estimates of VAR models, Financial Index Series, White's Adjustment

Indep. Vars.	Dependent Variables					
	Period 1		Period 2		Period 3	
	$ISEQ(f)_t$	$FTSE(f)_t$	$ISEQ(f)_t$	$FTSE(f)_t$	$ISEQ(f)_t$	$FTSE(f)_t$
$ISEQ(f)_{t-1}$	-0.0876 (-1.39)	-0.0125 (-0.32)	-0.0321 (-0.87)	-0.0062 (-0.15)	-0.1048 (-2.41)*	-0.0079 (-0.19)
$ISEQ(f)_{t-2}$	0.0019 (0.04)	0.0357 (1.18)				
$FTSE(f)_{t-1}$	0.1279 (1.49)	0.0222 (0.39)	-0.0443 (0.82)	0.0089 (0.15)	0.1574 (2.47)*	0.0129 (0.21)
$FTSE(f)_{t-2}$	0.0037 (0.05)	-0.459 (-1.04)				

Notes:
$ISEQ_t$ and $FTSE_t$ represent daily returns on the Irish and UK financials market indices. Coefficients of independent variables are presented. Figures in parentheses are relevant t statistics, and * indicates significance at the 5 per cent level.

Table 5 presents the regression estimates. Results confirm causality tests on the overall markets. There is evidence of a growing causal relationship from the UK to the Irish equity market. A highly significant coefficient in the final period suggests an established relationship from UK financials to Irish financials. An implication is that trading in UK financials has an increasing impact on rates of return on Irish financials. Again, this alteration coincides with the removal of exchange controls by the Irish Central Bank.

SUMMARY AND CONCLUSIONS

This paper presents evidence on the changing relationship between UK and Irish equity markets. Returns on UK stock index futures are included to test for evidence of their impact on equity returns in Dublin. Three time periods are considered, to coincide with the gradual relaxation of capital controls on Irish investors. An application of cointegration and causality presents evidence of segmentation, and of relationships between the markets. Results indicate that returns on the Dublin equity market do follow returns in London. A significant causal relationship is established in period three, from UK to Irish equity markets. A separate examination of financials sectors in both markets confirms this result. This causal relationship coincides with the deregulation of Irish capital markets, and with the growing integration of international capital markets. Following the removal of exchange controls, Irish financial institutions can now freely transfer funds to and from the UK markets, facilitating an investor reaction to information emanating from London. For example, investors who identify better prospects in the UK market can react by transferring funds to that market. This could impact on Irish markets. Also, as Irish investors expand their holdings of foreign equity, growing numbers of Irish equities are being purchased by foreign institutions. These investors will also react to external information, which again will impact on Irish investments. There is no evidence of the Irish market having a causal impact on equities or futures trading in the UK. This is because of the relative size of each market. As a group, Irish investors will have minimal impact on UK markets. Also, the scale of investment in Ireland by UK institutions is an insignificant proportion of their total investment. Any information from Irish markets should have no significant impact on UK markets.

A causal relationship is also established between UK index futures and Irish equity returns in the final period. Results indicate that trading in index futures does impact on Irish equity returns. It is likely that this relationship is indirect. There is evidence that index futures lead their local cash markets, and therefore offer a signal to equity traders, causing a market response. This response may then induce a reaction in the smaller overseas Irish market. Trading in UK index futures might therefore offer an indirect signal to Irish equity markets, and there is evidence that this relationship has been established.

It is possible that thin trading in Irish markets may result in a delayed response, giving the impression of a causal relationship from the UK to Ireland. As is previously noted, returns on the ISEQ index exhibit significant levels of autocorrelation, due to thin trading in some shares that make up the index. However, research results indicate a causal relationship only in the final study period, whereas ISEQ returns exhibit significant autocorrelation in all periods. It is unlikely, therefore, that a thin trading effect is largely responsible for the findings regarding causality. Further, thin trading cannot account for a causal relationship from FTSE(f) to ISEQ(f), as there is no significant autocorrelation in ISEQ(f) returns during period three.

London and Dublin are in the same time zone, and trading hours are similar. There is no possibility of closing values in one market providing new information to the other before close of trading on the same day. Only closing index values are available in Dublin, so it is not possible to determine the extent to which Irish traders react, on the same day, to new information from London. As information exchange is immediate, a more rapid reaction is highly likely. All that can be confirmed is that there is now evidence of a causal relationship occurring within a day of trading.

ACKNOWLEDGEMENTS

The author wishes to thank Philip McIlkenny, Kwaku Opong, and the anonymous referees for their comments on earlier versions of this paper.

NOTES

[1] Daily index data is available from the Dublin exchange only since January 1987. The first study period is therefore somewhat shorter than the latter two. As a daily financials index has been computed since January 1988, the first study period must be reduced to one year when examining causal relationships between the Irish and UK financial sectors.

[2] Over the eight year study period, 31 Irish quoted companies acquired a UK market quotation. All are relatively small, the largest representing

less than 2.5 per cent of the ISEQ index. An overwhelming majority are exploration companies, and are not included in either index. During the study period, four UK companies acquired an Irish quotation. All are relatively small, and would not have a significant impact. Further details are available from the author.

[3] Results of these tests are available from the author.

[4] See Zellner (1962).

[5]For each variable (R), the following autoregressive equation is estimated: $R_t = \alpha_0 + \alpha_{11}(L)R + \varepsilon_t$ $\alpha_{11}(L)$ is a distributed lag polynomial, and ε_t should be white noise. Akaike's Final Prediction Error is calculated. Values are available from the author.

[6] SUR results are available from the author.

[7] Results of these tests are available from the author.

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