

National University of Ireland, Galway
Ollscoil na hÉireann, Gaillimh

An Empirical Analysis of Short-Run and Long-Run
Irish Export Functions:
Does Exchange Rate Volatility Matter?

Donal Bredin Stilianos Fountas Eithne Murphy

No. 22

April 1998

Department of Economics
Roinn na hEacnamaíochta

Working Paper Series

<http://www.ucc.ie/ecn/>

Abstract

We analyse the long-run and short-run relationship between merchandise export volume and its determinants, foreign income, relative prices and exchange rate variability, using the techniques of cointegration and error correction. The model was estimated for Irish exports and sectoral exports SITC 0–4 and SITC 5–8 to the European Union using quarterly data for the period 1979–1992. The sectoral classification corresponds to the exports of mainly indigenous Irish firms and multinationals, respectively. We find that exchange rate volatility has a negative effect on the exports of the multinational sector but no effect on the exports of the indigenous sector in the short run. In contrast, exchange rate volatility has no effect on the exports of the multinational sector but a positive effect on the exports of the indigenous sector and overall exports in the long run. This last result implies that Ireland's participation in the single European currency might have a negative impact on exports of indigenous firms and, as a consequence, overall exports.

Keywords: Exchange rate volatility, indigenous firms, multinationals.

JEL Classification: F1, F23

1 Introduction

The international trade performance of a small open economy (SOE), such as Ireland, plays a central role in the economic health of the country. The share of Irish merchandise exports in Gross Domestic Product (GDP) has grown dramatically in recent years (from 43% in 1979 to a forecast level of 75% in 1997), thus rendering the economy more open than before and more dependent on foreign markets. Hence, policies designed to enhance export performance are of increasing importance to national economic welfare. Good policy decisions are assisted by having relevant information on the factors that determine the level of exports and imports. In this paper, we examine long-run and short-run Irish export demand by the country's most important trading partners; that is to say, by the principal member states of the European Union (EU).

There have been different empirical studies of the determinants of Irish exports. A common feature of most of these studies is their use of traditional estimation methods; in other words, classical regression techniques (see, for example, O'Connell, 1978, Browne, 1982, Lynch, 1983, and Flynn, 1984). More recent studies by Caporale and Chui (1995) and McGettigan and Nugent (1995) adopted more advanced estimation techniques that recognise the non-stationarity of economic variables. The present paper continues in the recent tradition by treating exports and their determinants as potentially non-stationary variables. In contrast to all previous studies, the effect of exchange rate volatility on exports is explicitly considered. This is of immense contemporary policy significance on the eve of monetary union. Theory does not help us to determine the effect of exchange rate variability on trade flows. Volatility can increase trade or reduce trade depending, among other things, on the degree of risk aversion displayed by exporters. Risk aversion depends on, *inter-alia*, the resources of an enterprise, its profit margin and its strategic options. The tighter a firm's profit margin and more limited its strategic options, the more likely it is that its behaviour will be characterised by risk aversion. The Irish export sector is dualistic, in that it is characterised by two types of firms; small scale indigenous enterprises exporting low-technology goods and subsidiaries of multinationals, whose exports are characterised by their high technology. Given the dualistic character of the Irish export sector, it was considered appropriate to estimate separate export functions for these two types of enterprises (besides a general export function). In this, we were facilitated by the fact that sectors occupied by indigenous firms and multinationals are, in general, mutually exclusive. The determinants of exports often tend to have a lagged effect. We take this possibility into account by estimating both long-run and short-run export functions using the techniques of cointegration and

error-correction models (ECMs). Our sample period commences with Ireland's entry into the European Monetary System (EMS), which resulted in a reduction in exchange rate variability between the Irish pound and other EMS currencies.

The paper is organised as follows: section 2 surveys the literature and explains the theoretical background, section 3 presents the econometric methodology, while in section 4 data and results are presented and interpreted. Section 5 concludes.

2 Theory and Literature Review

The empirical literature on the estimation of export functions uses the following long-run export function (see, e.g., Arize, 1995 and Chowdhury, 1993):

$$\ln X_t = \beta_0 + \beta_1 \ln Y_t + \beta_2 \ln P_t + \beta_3 V_t$$

where X_t = real exports
 Y_t = real foreign income (1)
 P_t = relative prices
(a measure of competitiveness)
 V_t = exchange rate volatility

Gotur (1985) shows that equation (1) is the long-run solution to a system of behavioural demand and supply functions for exports. Economic theory would suggest that the income level of the trading partners of the domestic country and a measure of competitiveness between the domestic country and its major trading partners should be included in an export function. Finally, a measure of exchange rate volatility would also be included in an export function. Traditional trade theory would suggest that exchange rate volatility would depress trade because exporters would view it as an increase in the uncertainty of profits on international transactions, under the assumption of risk aversion. The theoretical arguments that exchange rate volatility actually might benefit trade are examined by de Grauwe (1988), Franke (1991), Giovannini (1988), Sereu and Vanhulle (1992) and Viaene and de Vries (1992). Hence, the sign of β_3 is ambiguous from a theoretical point of view. De Grauwe's (1988) thesis is that higher exchange rate risk will raise the "expected marginal utility of export revenue and, therefore, induce them (i.e., exporters) to increase their export activity" (p. 66). Assuming a utility function with constant relative risk aversion, an increase in risk causes both a substitution and an income effect. The substitution effect shows how an

increase in exchange rate volatility will lead to a fall in exports. The income effect works in the opposite direction. The lower expected export revenue means that trade will increase in order to offset the loss in revenue. In the case where the income effect is greater than the substitution effect, higher exchange rate volatility will lead to more exports. Franke (1991) considers the optimal strategy facing a firm that incurs costs of entering the foreign market. A firm will increase exports in response to increased exchange rate volatility if the present value of expected cash flows from exports exceeds the sum of entry and exit costs. The theoretical model attributes the likely positive association between exchange rate volatility and exports to goods market imperfections. Higher exchange rate volatility makes it more likely that price differences across countries will develop and hence an increase in international trade will ensue to arbitrage away these differences. Finally, Bailey, Tavlas and Ulan (1986) see the ability of exporters to anticipate future exchange rates as a way to gain from any exchange rate volatility.

The international empirical evidence on the influence of volatility on exports is also mixed. De Grauwe (1987), Kenen and Rodrik (1986), Koray and Lastrapes (1988), Peree and Steinherr (1989), Pozo (1992), Chowdhury (1993), Arize (1995) and Holly (1995) find evidence of a negative relationship between exchange rate volatility and trade. Asseery and Peel (1991) and IMF (1984) show evidence of a positive relationship between exchange rate volatility and trade, while Gotur (1985), Bailey, Tavlas and Ulan (1986), Peree and Steinherr (1989), and Gagnon (1993) were unable to find evidence of any significant effect of exchange rate volatility on trade.

2.1 International Evidence

The literature on the international evidence on export functions can be split up into two groups¹: first, papers that use conventional estimation procedures and second, studies that recognise the nonstationary nature of real exports and its determinants. Studies which can be grouped into the former include Kenen and Rodrik (1986), Pozo (1992), Bailey, Tavlas, and Ulan (1986) and Peree and Steinherr (1989), while those included in the latter include Lastrapes and Koray (1990), Chowdhury (1993), Arize (1995) and Holly (1995). Kenen and Rodrik (1986), Chowdhury (1993), Caporale and Chui (1995) and Arize (1995) support the predictions of the theory concerning income and relative prices presented earlier. Exceptions are de Grauwe (1988), Pozo (1992) and Chowdhury (1993) who found mixed signs for relative prices.

¹A survey of the literature on the relation between exchange rate volatility and trade is given in Cote (1994).

2.2 Irish Evidence

Papers which look at the determinants of Irish exports using traditional estimation techniques include O'Connell (1978), Browne (1982), Lynch (1983), and Flynn (1984). O'Connell (1978) is one of the first attempts to provide econometric evidence on the determinants of Irish exports. The author estimates a single-equation model that is unreliable as the assumption of infinitely elastic supply is unrealistic for a SOE. O'Connell (1978) also estimates the equilibrium and disequilibrium versions of a two-equation model and derives price elasticities of export demand and supply equal to -1.44 and 2.33 , respectively. According to O'Connell, the price elasticity of demand estimate is small for a SOE, when compared to the Goldstein and Kahn (1978) results for Belgium and Netherlands. Browne (1982) estimates the SOE version of the Goldstein-Kahn model. He obtains estimates of the price elasticity of supply that are lower and demand that are higher than in O'Connell (1978) and hence more consistent with the SOE assumption. Lynch (1983) estimates a single-equation model for Irish manufacturing exports using quarterly data from 1963 to 1981. He includes both supply and demand side determinants in order to get a more complete picture of export demand and uses a 2SLS procedure to account for simultaneity between prices and quantities. He obtains estimates of the income elasticity of exports in the range 1.10 to 2.69 and estimates of the price elasticity of exports in the range -1.23 to -0.26 . Flynn (1984) analyses the determinants of both manufacturing and industrial exports. His approach differs from Lynch (1983) in his variable choice and the choice of a dynamic set up. Since exports of foreign multinationals (MNEs) in Ireland accounted for 70% of total exports in 1980, Flynn (1984) drops the relative price variable from the estimated equation because of the way in which these firms make their decisions. Flynn's (1984) estimates for the income elasticity are 0.59 and 0.49 for manufacturing and industrial exports, respectively, and are much smaller than those obtained by O'Connell (1978) and Browne (1982). Flynn (1984) speculates that this is due to transfer pricing.

Caporale and Chui (1995) pursue a multicountry time series study that includes Ireland. Using annual data for the period 1960–1992 the authors estimate income and price elasticities of exports using cointegration techniques. Employing the Dynamic OLS (DOLS) procedure, the authors derive estimates of the income and relative price elasticities equal to 2.97 and -0.34 , respectively. Quite similar elasticities are obtained for Belgium, another SOE. In a recent study, McGettigan and Nugent (1995) attempt to estimate short-run and long-run export functions using ECMs and cointegration techniques, respectively. Using quarterly data for the period 1975 to 1994, the authors obtain long-run income elasticities in the range 1.78 (for

merchandise exports) to 2.04 (for manufacturing exports). The estimates of the relative price elasticity are -4.33 and -7.58 , respectively. The latter value appears to be very large.

Fountas and Bredin (1997) estimate short-run and long-run functions for Irish exports to the UK over the 1979–1993 period, i.e., since the collapse of the sterling link. The authors obtain long-run income and relative price elasticities equal to 5.75 and -4.73 , respectively. The evidence provided indicates a negative relationship between exchange rate volatility and exports in the short run but no relationship in the long run. Hence, a future monetary union that includes both Ireland and the UK might not lead to a long-run boost of Irish exports to the UK as a result of the elimination of exchange rate volatility.

3 Econometric Methodology

The mixed results obtained by most of the previous studies using classical regression analysis may be due to the non-stationarity of real exports and its determinants. Variables such as real exports and real income are by their nature potentially nonstationary. In this paper cointegration analysis is used to test for a long-run export function of Irish exports to the EU. Tests for cointegration require nonstationary time series of the same order of integration. Therefore, we first test for the presence of a unit root in both the level and the first difference of the four variables in equation 1, using the Dickey-Fuller (DF) and the Augmented Dickey-Fuller (ADF) tests (Fuller, 1976 and Dickey and Fuller, 1979). The method used to test for cointegration is the Johansen procedure introduced in Johansen (1988) and extended in Johansen and Juselius (1990). Provided that cointegration exists among our variables, the cointegrating vector is normalised on exports to give the long-run elasticities for export demand.

We also estimate the short-run export equation using the ECM;

$$\begin{aligned} \Delta \ln X_t = & \alpha_0 + \alpha_1 R_{t-1} + \sum_{i=1}^n \gamma_i \Delta \ln X_{t-i} + \sum_{i=1}^n \delta_i \Delta \ln Y_{t-i} + \\ & \sum_{i=1}^n \epsilon_i \Delta \ln P_{t-i} + \sum_{i=1}^n \zeta_i \Delta V_{t-i} + e_t \end{aligned} \quad (2)$$

If our variables are cointegrated, then the ECM will be of the above form, where R_{t-1} is the error-correction term (ECT) i.e., the lagged residual from the cointegration regression.

4 Data and Empirical Results

4.1 Data and the exchange rate volatility proxy

Our sample covers the period 1979Q2–1992Q4. As mentioned earlier, our aim is to estimate the short-run and long-run function for Ireland's exports to the EU, since the launch of the EMS in March 1979. To accomplish this objective, our sample period starts in the second quarter of 1979 and our analysis covers Irish exports to the EU alone. As shown in Diagram 1, these exports make up the majority of Irish exports.

The export variable is taken from the Trade Statistics Series of the CSO publication, and was divided by Ireland's unit export value to obtain the real exports figure. The aggregate figure of Ireland's exports to the EU is split up into SITC (Standard Industry Trade Classification) divisions 0–4 and 5–8. Division 5–8 is the standard definition of manufacturing exports. However, 5–8 is also the division where MNEs are very prominent. Murphy (1994) and Walsh (1996) argue that a large percentage of Irish output and export growth may be traced to the activities of MNEs in three specific areas; computer and related areas, chemicals (including pharmaceuticals) and cola concentrates. We can, therefore, distinguish between exports of SITC 0–4 (dominated by indigenous industries) and exports of SITC 5–8 (dominated by the MNEs). We also employ the total figure SITC 0–8 in our empirical analysis.

Our first explanatory variable in the export function is foreign income. This series is constructed by taking the weighted average of the GDP series of Ireland's five most important EU trading partners². The EU5 are in order of importance, UK, Germany, France, Netherlands and Italy. The trade weights are calculated by aggregating the export and import figure for each particular country and then dividing by the aggregate figure for exports and imports for all countries. These weights are given in Diagram 2. The quarterly GDP data were obtained from the International Financial Statistics (IFS) tape, and was then converted to a common currency (Irish pound). The exchange rate was obtained from the Central Bank Bulletin.

The second right-hand side variable in equation (1) is a measure of competitiveness. It is defined as the ratio of the exchange rate-adjusted price of Irish exports to the price of exports of Ireland's major trading partners, as defined above. Hence, it is the ratio of the Irish unit export value to the weighted average of the unit export values of the EU5, denominated in Irish

²Choosing the weighted average of the income levels of the most important trading partners is standard procedure in the literature (see Lynch, 1983 and Chowdhury, 1993).

pounds. The weights are identical to those used in the construction of the income variable. Data for the export unit value was again obtained from the IFS tape³.

Finally, as a measure of time-varying exchange rate volatility we use the moving standard deviation of the growth rate of the real effective exchange rate:

$$V_t = \left[(1/m) \sum_{i=1}^m (\ln Z_{t+i-1} - \ln Z_{t+i-2})^2 \right]^{\frac{1}{2}} \quad (3)$$

where Z is the real effective exchange rate and m , the order of the moving average, is set equal to 8. The real effective exchange rate is calculated by the weighted average of the exchange rate-adjusted relative prices (unit export values) where the trade weights are the ones used in creating foreign income and relative prices⁴. This measure of exchange rate volatility is adopted by Kenen and Rodrik (1986), Koray and Lastrapes (1989) and Chowdhury (1993).

4.2 Results

The first step in our analysis is to establish the order of integration of the variables in equation (1). This is done using the DF and ADF tests, including up to four lagged differences. The unit root test results, both with and without a trend, are shown in Table 1. We choose the order of the ADF test, k , as the minimum lag for white errors in the unit root regression. As can be seen all variables are integrated of order one, $I(1)$. Therefore, we can now proceed to the cointegration tests. The results of these tests are shown in Table 2. The appropriate lag length in the VAR was chosen on the basis of the minimum lag with robust results. As our objective is to estimate a long-run export function, what is important is that cointegration takes place and not the number of cointegrating vectors. As shown in Table 2, cointegration takes place for all three groups. The first (corresponding to the highest eigenvalue) cointegration vector is taken and normalised on exports.

The cointegration vectors and likelihood ratio (LR) test statistics are given in Table 3. The cointegration coefficients can be interpreted as long-run

³Unit export value data were not available in disaggregated form and, therefore, the same aggregate figure was used for both divisions 0-4 and 5-8.

⁴Although we use real exchange rates to calculate our volatility measure, Thursby and Thursby (1987) and Lastrapes and Koray (1990) obtain similar results when using nominal exchange rates instead.

export elasticities. The relationship between Irish exports and foreign economic activity is positive, large and statistically significant, especially on those sectors (SITC 5–8) dominated by MNEs. The latter is to be expected, as exports of foreign corporations located in Ireland are generally high-technology products, which tend to be highly income elastic. The figures for income elasticity also serve to highlight the extent to which the economic health of a small open economy, such as Ireland, is positively dependent on economic growth in our main EU partner countries.

The competitiveness variable (price elasticity) is negative and significant for Irish exports in general and, more particularly, for Irish exports in sectors dominated by multinationals (SITC 5–8). The relative price variable is insignificant in sectors where indigenous firms are prominent (SITC 0–4). These results are at first glance surprising, when one recalls that Flynn (1984) dropped relative prices from his estimation because of the way in which MNEs make decisions. However, if the Irish real exchange rate falls, then Ireland becomes a relatively lower cost location, which would make it more attractive as a site for MNE activity and vice versa. This would explain the long-run negative price elasticity in sectors 5–8 and for the economy generally (given the prominence of MNE exports in overall exports). The insensitivity of indigenous exports to relative prices is harder to rationalise. Our data sample covers a period characterised by poor performance by the indigenous sector as a whole (notwithstanding a depreciation of the Irish pound against sterling). This has been attributed to other factors, such as poor quality products and a lack of marketing expertise.

The volatility measure is positive for overall exports and for the exports of indigenous firms (SITC 0–4), while it is insignificant for the exports of MNEs (SITC 5–8). The former result indicates extreme risk aversion, while the latter indicates the irrelevance of exchange rate volatility to long-run MNE activity. When firms are very risk averse, an increase in volatility should lead to an increase in exports. Irish indigenous firms tend to be relatively small and they operate on tight margins. They would satisfy the profile of very risk averse firms. MNEs that locate in Ireland do so to export to countries of the EU. The Irish market is too small to be a determining factor in their location decisions. One would expect that, in the long run, an increase in output and exports would be positively correlated with increased MNE presence, while a decrease in output and exports would be associated with MNE decisions to relocate elsewhere. The entry and exit decisions of MNEs (and consequently their long-run output/export plans) are unlikely to be affected by volatility in the exchange rate. Real cost considerations and expected demand are the important factors determining location and output decisions.

The estimation of the ECM gives us information on the short-run export function. The results are shown in Table 4. To decide on the final form of the ECM, we initially started with four lagged differences of each variable and then deleted the insignificant lagged variables. Variables were not deleted if this introduced autocorrelation. The ECT shows the adjustment speed towards the elimination of disequilibrium and is expected to be negative. The coefficient is statistically significant in all cases but the expected negative sign applies only for exports in SITC 0–4. The positive signs for MNE’s exports and aggregate exports show that exports do not restore the long-run equilibrium. A possible explanation for the positive signs is that MNEs which make up a large part of exports in SITC 5–8 (and, therefore, SITC 0–8) are price setters and so the adjustment towards the long-run equilibrium takes place through the competitiveness measure and not exports.

The income and price elasticities for overall Irish exports are positive and negative, respectively, while the magnitudes are less in the short run compared to the long run. These results are as one would expect. The short-run income elasticity of export demand is higher for the output of MNEs than for the output of indigenous firms. Apart from the differing nature of the products in both classifications (which also explains the differences in long-run income elasticities), a larger short-run income elasticity for the MNE sector, compared to the indigenous sector, indicates a greater ability to respond to changes in demand. This would be consistent with the existence of horizontally integrated plants in different countries operating at under-capacity. Relative prices are again insignificant in the determination of the exports of the indigenous sector. By contrast with the long-run results, the short-run volatility measure is negative and statistically significant for overall Irish exports and for the exports of the MNE-dominated sectors, while it is statistically insignificant for indigenous exports. We would not expect MNEs to react to exchange rate volatility by engaging in market switching, in the sense of favouring the domestic market in times of increased exchange rate volatility. However, international plant switching is a viable option, when plants are not operating at full capacity. In other words, a short-run response to increased exchange rate volatility could result in increased servicing of a market from plants located in that country or in countries whose exchange rate exhibits less variability with respect to the currency of the destination country market. The short-run exports of indigenous firms may be insensitive to exchange rate variability because of (i) pre-existing contracts that have to be honoured and (ii) the hedging activities of such firms when they enter into such contracts.

5 Conclusions

The paper analyses the long-run and short-run relationship between export volume and its determinants; namely relative prices, foreign income and exchange rate variability, using the techniques of cointegration and error-correction methods. The model was estimated for Irish exports and sectoral exports SITC 0–4 and SITC 5–8 to the EU. The sectoral classification corresponds to the exports of mainly indigenous Irish firms and multinationals, respectively. The sample period extends from the second quarter of 1979 to the fourth quarter of 1992; from the launch of the EMS to its effective disintegration. Our findings are interesting in that exchange rate volatility is shown to have a negative effect on the exports of the multinational sector but no effect on the exports of the indigenous sector in the short run. Hence, the short-run effect of exchange rate volatility on overall exports is negative and substantial. By contrast, long-run volatility has no effect on the exports of the multinational sector but a positive effect on the exports of the indigenous sector, the latter being consistent with very risk averse behaviour by indigenous firms. Overall, exports are also shown to respond positively to exchange rate variability in the long run.

These results allow us to tentatively conclude that the long-run export behaviour of multinationals will not change if Ireland becomes a member of the single currency club but that exports of indigenous firms and, as a consequence, overall exports may fall.

ADF(k) Tests

(a) Level Data

	τ_μ	k	τ_τ	k
lnX (SITC 0-4)	-0.44	1	-3.21	1
lnX (SITC 5-8)	0.49	3	-2.22	3
lnX (SITC 0-8)	0.66	1	-2.60	1
lnY	-1.72	0	-0.84	0
lnP	-2.44	1	-2.95	1
V	-2.79	1	-2.88	1

(b) Differenced Data

	τ_μ	k	τ_τ	k
lnX (SITC 0-4)	-3.43**	3	-3.74**	3
lnX (SITC 5-8)	-11.59**	2	-11.55**	2
lnX (SITC 0-8)	-17.89**	0	-17.98**	0
lnY	-5.22**	0	-5.37**	0
lnP	-5.94**	0	-5.90**	0
V	-3.79**	0	-3.82**	0

Note: ** denotes significance at 5%. The critical values given by Microfit, for the no trend and trend models are -2.91 and -3.49, respectively.

Table 2

Cointegration Test Results

Maximum Eigenvalue Test				
H ₀ :	r = 0	r ≤ 1	r ≤ 2	r ≤ 3
SITC 0-4	51.31**	27.55**	14.47**	2.94
SITC 5-8	34.74**	24.82**	5.43	1.20
SITC 0-8	49.94**	21.72**	6.16	2.39

Trace Test				
H ₀ :	r = 0	r ≤ 1	r ≤ 2	r ≤ 3
SITC 0-4	96.26**	44.95**	17.40**	2.94
SITC 5-8	66.20**	31.45**	6.63	1.20
SITC 0-8	80.21**	30.27**	8.55	2.39

Note: ** Denotes significance at 5 %.

Table 3

Cointegration Vectors and Likelihood Ratio Tests

Export Divisions	Normalised Cointegration Vectors	H ₀ : β ₁ = 0	H ₀ : β ₂ = 0	H ₀ : β ₃ = 0
SITC 0-4	$X_t = 2.51Y_t + 0.09P_t + 8.38V_t$	7.89**	0.03	7.18**
SITC 5-8	$X_t = 4.73Y_t - 2.80P_t - 0.22V_t$	9.58**	9.89**	0.00
SITC 0-8	$X_t = 4.09Y_t - 2.00P_t + 4.48V_t$	25.01**	23.43*	4.39**

Note: The test H₀: β₁=0 for the equation $X_t = \beta_0 + \beta_1 Y_t + \beta_2 P_t + \beta_3 V_t$ has a $\chi^2(1)$ distribution under the null hypothesis. * and ** denote significance at the 10% and 5% levels, respectively.

Table 4

Regression Results for Error-Correction Models

Export Divisions	lag	R(-1)	ΔX	ΔY	ΔP	ΔV	Summary Statistics
SITC 0-4	1	-0.38 (3.08)**		0.35 (0.40)	-0.52 (0.90)	-1.01 (0.23)	$\bar{R}^2 = 0.59$ AR= 9.46 (0.05) ARCH = 2.72 (0.61)
	2						
	3						
	4		0.60 (5.95)**				
SITC 5-8	1	0.17 (3.00)**	-1.07 (8.13)**	0.85 (1.81)*	-0.80 (2.61)**		$\bar{R}^2 = 0.73$ AR = 7.86 (0.10) ARCH = 1.48 (0.8)
	2		-0.87 (6.31)**	0.93 (2.26)**		-6.81 (2.51)**	
	3		-0.79 (6.64)**	1.25 (2.94)**			
SITC 0-8	1	0.35 (3.85)**	-1.25 (6.97)**	1.45 (2.92)**	-1.08 (3.67)**		$\bar{R}^2 = 0.74$ AR=1.78 (0.78) ARCH=1.54 (0.82)
	2		-0.74 (3.72)**	1.35 (2.94)**		-6.31 (2.40)**	
	3		-0.56 (3.93)**	1.29 (3.15)**			
	4			0.86 (2.15)**			

Note: Figures in parentheses are the absolute t-statistics. * and ** denote significance at the 10% and 5% levels, respectively. The LM(4) test statistic for autocorrelation (AR) and the LM(4) test statistic for autoregressive conditional heteroskedasticity (ARCH) are reported. P-values are given in parentheses.

Diagram 1
Total Irish Exports

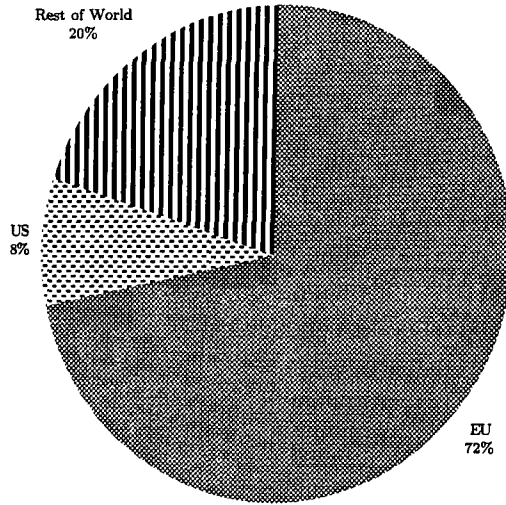
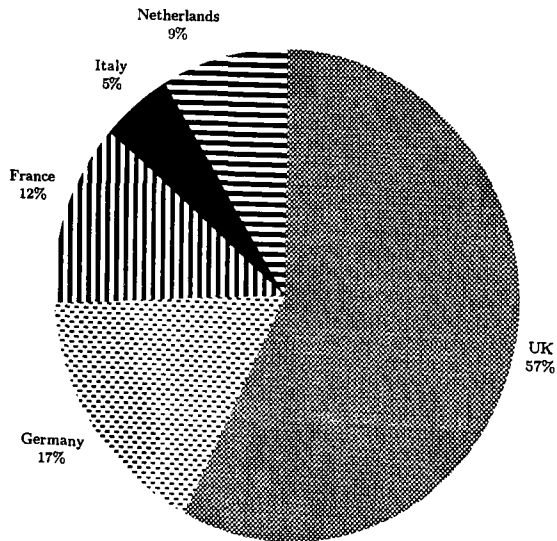


Diagram 2
Ireland's Trade Weights



References

- Arize, A. C.**, "The Effects of Exchange Rate Volatility on U.S. Exports: An Empirical Investigation," *Southern Economic Journal*, 1995, 62, 34-43.
- Asseery, A. and D. A. Peel**, "The Effects of Exchange Rate Volatility on Exports—Some New Estimates," *Economics Letters*, 1991, 37, 173-177.
- Bailey, M. I., G. S. Tavlas, and M. Ulan**, "Exchange Rate Variability and Trade Performance: Evidence for the Big Seven Industrial Countries," *Weltwirtschaftliches Archiv*, 1986, 122, 466-477.
- Browne, F. X.**, "Modelling Export Prices and Quantities in a Small Open Economy," *Review of Economics and Statistics*, 1982, 64, 346-347.
- Caporale, G. M. and M. Chui**, "Estimating Income and Price Elasticities of Trade in a Cointegration Framework," London Business School, Centre for Economic Forecasting, Discussion Paper No. 34-95 1995.
- Chowdhury, A. R.**, "Does Exchange Rate Volatility Depress Trade Flows? Evidence from Error-Correction Models," *Review of Economics and Statistics*, 1993, 75, 700-706.
- Cote, A.**, "Exchange Rate Volatility and Trade," Bank of Canada Working Paper 5 1994.
- De Grauwe, P.**, "International Trade and Economic Growth in the European Monetary System," *European Economic Review*, 1987, 31, 389-398.
- , "Exchange Rate Variability and the Slowdown in Growth of International Trade," *IMF Staff Papers*, 1988, 35, 63-84.
- Dickey, D. A. and W. A. Fuller**, "Distribution of Estimates of Autoregressive Times Series with a Unit Root," *Journal of the American Statistical Association*, 1979, 74, 427-431.
- Flynn, J.**, "Forecasting Manufactured and Industrial Exports," Central Bank of Ireland Technical Paper 9/RT/84 1984.
- Fountas, S. and D. Bredin**, "Exchange Rate Volatility and Exports: the Case of Ireland," *Applied Economics Letters*, 1997, forthcoming.
- Franke, G.**, "Exchange Rate Volatility and International Trading Strategy," *Journal of International Money and Finance*, 1991, 10, 292-307.

- Fuller, W. A.**, *Introduction to Statistical Time Series*, New York: Wiley, 1976.
- Gagnon, J.**, "Exchange Rate Variability and the Level of International Trade," *Journal of International Economics*, 1993, 34, 269–287.
- Giovannini, A.**, "Exchange Rates and Traded Goods Prices," *Journal of International Economics*, 1988, 24, 45–68.
- Goldstein, M. and M. S. Khan**, "The Supply and Demand for Exports: A Simultaneous Equation Approach," *Review of Economics and Statistics*, 1978, 60, 275–286.
- Gotur, P.**, "Effects of Exchange Rate Volatility on Trade: Some Further Evidence," *IMF Staff Papers*, 1985, 32, 475–512.
- Holly, S.**, "Exchange Rate Uncertainty and Export Performance: Supply and Demand Effects," *Scottish Journal of Political Economy*, 1995, 42, 381–391.
- International Monetary Fund**, "Exchange Rate Volatility and World Trade," IMF Occasional Paper No. 28 1984.
- Johansen, S.**, "Statistical Analysis of Cointegration Vectors," *Journal of Economic Dynamics and Control*, 1988, 12, 231–254.
- and **K. Juselius**, "Maximum Likelihood Estimation and Inference on Cointegration—With Application to the Demand for Money," *Oxford Bulletin of Economics and Statistics*, 1990, 52, 169–210.
- Kenen, P. and D. Rodrik**, "Measuring and Analyzing the Effects of Short-term Volatility in Real Exchange Rates," *Review of Economics and Statistics*, 1986, 68, 311–315.
- Koray, F. and W. Lastrapes**, "Real Exchange Rate Volatility and US Bilateral Trade: a VAR Approach," *Review of Economics and Statistics*, 1989, 71, 708–712.
- Lastrapes, W. D. and F. Koray**, "Real Exchange Rate Volatility and US Multilateral Trade Flows," *Journal of Macroeconomics*, 1990, 12, 341–362.
- Lynch, D.**, "Modelling Irish Manufacturing Exports," Central Bank of Ireland Technical Paper 1/RT/83 1983.
- McGettigan, D. and J. Nugent**, "Competitiveness Measures for Ireland: An Assessment," Central Bank of Ireland Technical Paper 6/RT/95 1995.

- Murphy, A.**, "The Irish Economy: Celtic Tiger or Tortoise?," Money Markets International 1994.
- O'Connell, T.**, "Demand and Supply Functions for Irish Exports of Manufactures," *Economic and Social Review*, 1978, 8, 257–278.
- Pere, F. and A. Steinherr**, "Exchange Rate Uncertainty and Foreign Trade," *European Economic Review*, 1989, 33, 1241–1264.
- Pozo, S.**, "Conditional Exchange Rate Volatility and the Volume of International Trade: Evidence from the Early 1900s," *Review of Economics and Statistics*, 1992, 74, 325–329.
- Sereu, P. and C. Vanhulle**, "Exchange Rate Volatility, Exposure and the Value of Exporting Firms," *Journal of Banking and Finance*, 1992, 16, 155–182.
- Walsh, B.**, "The Real Exchange Rate, Fiscal Policy and the Current Account: Interpreting Recent Irish Experience," University College, Dublin, Centre for Economic Research WP96/10 1996.