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The Geographical Pattern of Irish Foreign Trade: Test of a Gravity Model*

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Abstract: This article assesses the extent to which economic approaches to the geographical pattern of foreign trade explain the pattern of Irish merchandise imports and exports. The approach adopted is that of a "gravity" model of foreign trade flows. This hypothesises that the geographical pattern of a country's trade is determined by the economic size of trade partners and their distance apart. The "preference similarity" approach, which hypothesises that trade in manufactured goods is concentrated among countries with similar incomes and tastes, is also examined. The article finds evidence in favour of the gravity approach but not the preference similarity hypothesis.

I INTRODUCTION

The geographical concentration of Ireland's foreign trade on the industrialised countries in general, and on the UK in particular, is well recognised. In 1983 Ireland's EEC partners accounted for 69 per cent of its merchandise exports and 67 per cent of merchandise imports. This can be seen from Table 1. The UK shares in Irish exports and imports in 1983 were 37 per cent and 45 per cent, respectively. All developed countries had a combined share of 88 per cent of Ireland's exports in 1983, and a 92 per cent share of its imports. The counterpart of this dominance by the industrialised countries is the small share accounted for by the state trading and developing countries. The combined share of these two groups in Ireland's foreign trade in 1983 was 11 per cent in the case of exports and 7 per cent in the case of imports, both very low by international standards.

The geographical pattern of foreign trade is of interest for various reasons. It will, for example, help to determine the extent to which economic and other

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developments in individual overseas countries affect the Irish economy. Similarly it will affect the impact on the Irish economy of changes in exchange rates, in international trade regulations, and in international transport costs. However, the geographical pattern of Ireland's foreign trade has received relatively little attention in economic studies. Some attention has been paid to changes in the geographical pattern of this trade, in particular to the decline in the importance of the UK as a destination for Irish exports and to the role of EEC membership in this (see Matthews (1980), McAleese (1984)). However, no attempts have been made to examine the geographical pattern of Ireland's foreign trade on a cross-sectional basis or to offer a systematic explanation for this pattern. This situation contrasts with that of the product composition of Irish merchandise trade. A number of studies have tested the extent to which this product pattern complies with the expectations derived from international trade theory (see McGilvray and Simpson (1973), Farley (1972), Farley (1973), Farley (1981), McAleese and Carey (1981)).

Table 1: *Origin of Irish imports and destination of Irish exports,* 1962, 1970, 1977, *and* 1983 *(as % current value, rounded)*

	Imports				*Exports*			
	1962	1970	1977	1983	1962	1970	1977	1983
EEC	*66*	*69*	*68*	*67**	*80*	*75*	*76*	*69**
of which: UK	50	52	48	45	74	62	47	37
other EEC	16	17	20	22	6	13	29	32
Other developed countries	*18*	*17*	*19*	*25*	*11*	*18*	*14*	*19*
of which: EFTA	4	5	5	4	1	2	3	5
USA/Canada	10	9	9	16	9	14	8	9
Other	4	3	5	5	1	2	3	5
State trading countries	*2*	*2*	*2*	*2*	—	*1*	*1*	*1*
Less developed countries	11	9	8	5	3	3	8	10
Unclassified	*3*	*3*	*1*	*1*	*6*	*3*	*1*	*1*
Total	100	100	100	100	100	100	100	100

Source: CSO, *External Trade Statistics* 1965–66, 1972, and *Trade Statistics of Ireland,* December 1978, 1983.

*EEC (10), other years are EEC (9).

The purpose of the present article is to assess the extent to which one economic theory of the direction of trade helps to explain Ireland's foreign trade pattern. The theory examined is the "gravity" model. This is applied to Ireland's foreign trade in 1977. The article concentrates on merchandise trade only and trade in services is not considered.

II GRAVITY TRADE MODELS

Gravity models of international trade flows, associated with the work of Tinbergen (1962), Linnemann (1966), Poyhonen (1963) and Pulliainen (1963),

abstract from the detailed product content of foreign trade and examine the level of total trade between countries or groups of countries. Similar approaches are used in regional studies to explain flows such as migration, commuting, transport and tourism (see, for example, Richardson (1978, pp. 194–195)). Gravity models, in general, obtain their inspiration from physics and from the interplay of the forces of attraction and resistence. In the case of international trade the major "trade creating" force used in gravity models is economic size as measured by GNP, population or geographical area. The major "trade preventing" force is distance, representing both transport costs and other more psychological barriers (see Beckerman (1956)). The effect of commercial policy on trade flows has also been tested within the setting of gravity models by incorporating preferential trading arrangements as potentially trade creating variables (see Tinbergen (1962) and Linnemann (1966)).

While sometimes presented as an alternative to neo-classical trade theory (e.g., by Linnemann (1966)), the gravity approach is consistent with factor proportions trade theory. Gravity-type influences facilitate or prevent the realisation of trade flows as determined by comparative advantage. Following upon the early work, more recent studies have confirmed that gravity models have considerable explanatory power with regard to the geographical pattern of international trade (see Aitkin (1973), Hewett (1976), Gerachi and Prewo (1977), Weiss and Wolter (1979), and Sapir (1981)).

The gravity model also provides a convenient framework within which to test Linder's "preference similarity" hypothesis (Linder 1961). The preference similarity approach was developed in an attempt to explain the concentration of trade in manufactured goods among industrialised countries. Linder hypothesised that a majority of manufactured goods are designed and produced initially to satisfy domestic demand, and are exported only when firmly established on the home market. They are, therefore, most likely to be sold to other developed countries having similar income and tastes. Linder obtained empirically inconclusive results, but a number of more recent studies found evidence to support his hypothesis. This support consists of a negative relationship between the level of trade in manufactured goods and the size of the *per capita* income differential between trading partners (see Fortune (1971), Hirsch and Lev (1973), Sailors *et al* (1973)). In a gravity model, *per capita* income difference can be incorporated as an additional trade-preventing explanatory variable.

III TEST OF A GRAVITY MODEL FOR IRISH TRADE

The gravity model used here is derived from Tinbergen (1962) study. The overall hypothesis is that the level of trade between a pair of trading partners is

a positive function of the GNP of the trading countries and a negative function of the distance between them. The model tested is:

$$M, X = f(Y, D, K) \quad (1)$$

where M, X = the monetary value of Irish merchandise imports or exports,
Y = GNP of the trading partner,
D = distance to/from the trading partner,
K = various dummy variables.

This model is tested using cross-section data on Ireland's foreign trade with seventy countries in 1977.

The import and export statistics used are data on the current value of Irish merchandise trade published by Eurostat.[1] The seventy countries included are those with which Ireland had recorded imports and exports in 1977. They include 22 developed countries, 41 less developed countries and seven state trading countries. Regarding the independent variables, the GNP data used are World Bank statistics relating to 1977.[2] Data on distances are shipping distances from Dublin to the major port of the trading partner. The main source of these data are published marine distance tables augmented in some cases by estimates.[3]

Five dummy variables are incorporated in the model. These are intended to capture any qualitative differences in the operation of the gravity model with different country groups. In each case a value of 1 is attached to countries that are members of the designated groups and a value of zero is attached to non-members. The five dummy variables represent membership or non-membership of the following groups of countries:
K_1 = EEC countries, K_2 = ACP countries (less developed countries that are signatories of the Lomé Convention), K_3 = all developed countries, K_4 = state trading countries, K_5 = Middle Eastern oil producers.

1. Data from Eurostat, *EEC Trade by Commodity Classes and Main Countries: January to December* 1977, 5–1978 (Supplement to the Monthly External Trade Bulletin). This source was chosen because the classification methods used facilitated the analysis. The choice of year was dictated by Eurostat data availability at the time when the research was undertaken. There is no reason to suppose that the particular choice of year raises any difficulties of generalisation.

2. World Bank, *World Development Report* 1979, Washington: World Bank, Annex. This gives GNP data in US dollars converted at official exchange rates. A number of studies have experimented with GNP converted at purchasing power parity exchange rates but did not obtain superior results, see Tinbergen (1962) Table VI–4, Linnemann (1966) Table 5.3 and Gerachi and Prewo (1977), Annex Table 1. This may be because nominal GNP measures purchasing power in international markets.

3. The distance tables used are *Reed's Marine Distance Tables,* London: Thomas Reed, 1976, and *Marine Distance and Speed Tables,* Mobile, Ala.: Waterman Steamship Company (no date). The additional estimates were provided by Irish Shipping Ltd. In certain instances the choice of major port is somewhat arbitrary. However, it is not a frequent problem. In the case of land-locked countries the estimated distance from the nearest port to the land-border is added to the shipping distance. Only three such countries (Switzerland, Austria and Zaire) are included in the regression. In some cases the choice of sea route has a large effect on shipping distance. This is particularly true of the choice between the Panama and Suez Canal routes to the Far East and Oceania. Where such alternatives exist the shortest route is chosen.

No *a priori* mathematical formulation of the relationship between the variables exists. However, previous gravity studies using regression analysis have found the best results with a log-linear equation. This form is also used here and the model is tested using OLS regression. The expected sign on the GNP variable (Y) is positive and that on distance (D) negative. The expected signs on the preferential trade arrangement dummies (K_1 and K_2) are also positive. Expectations regarding the other dummy variables are indeterminate on *a priori* grounds.

The model is tested for six dependent variables. These are total merchandise imports (M_1), imports of raw materials and foodstuffs (M_2), imports of other manufactured goods (M_3), total merchandise exports (X_1), exports of raw materials and foodstuffs (X_2) and exports of other manufactures (X_3).[4]

IV RESULTS

The results are presented in Table 2. For all six equations the F-statistics are significant at the 1 per cent level. R^2 range from .39 to .82 and the two main explanatory variables, GNP (Y) and distance (D), have the expected signs. The model performs consistently better for exports than for imports. One possible explanation for this is that exports are valued f.o.b., that is free of insurance and freight, whereas imports are valued at c.i.f. prices which include these elements. Thus export prices may be a more precise measure of trade levels. There may also be a greater tendency for imports originating in developing

Table 2: *Results of regression analysis of a gravity model of Irish trade flows,* 1977

Dependent Variable	Y	D	K_1	K_2	K_3	K_4	K_5	$\bar{R}^2$	F	*No. Observations*
M_1	+0.5	−0.2	+1.5*	+0.7	+1.1*	−1.4**	+1.6**	.60	15.5**	70
M_2	+0.4*	−0.1	+1.1	+0.9	+1.1	−1.1	+2.2**	.39	6.0**	56
M_3	+0.5**	−0.4**	+1.7**	−0.6	+1.1*	−1.4*	−2.1**	.73	22.4**	65
X_1	+0.5**	−0.3	+1.6**	−0.4	+1.1*	−2.3**	+0.8	.77	28.8**	69
X_2	+0.7**	−0.2	+2.5**	+0.3	−0.3	−2.3**	−0.2	.66	14.4**	59
X_3	+0.5**	−0.2*	+1.3**	+0.7	+1.4**	−1.9**	+1.2**	.82	36.5**	62

* = significant at 95% confidence interval. ** = significant at 99% confidence interval.

Dependent Variables: M_1 = total imports, M_2 = raw material and food imports, M_3 = manufactured imports, X_1 = total exports, X_2 = raw material and food exports, X_3 = manufactured exports.

Independent Variables: Y = GNP of trading partner, D = shipping distance to trading partner, K_1 to K_5 = dummy variables representing EEC, ACP, non-LDC, state trading and Middle East oil producer country groups, respectively.

4. Raw materials/foodstuffs and manufactures (excluding food) are defined as products in SITC Classes 0–4 and 5–8, respectively. In some instances the absence of recorded trade in a particular category reduced the number of observations.

countries to be imported in processed form from third countries, in which case the gravity model would lose some of its explanatory power. The fact that the model explains manufactured imports (M_3) much better than it explains imports of raw materials and foodstuffs (M_2) is consistent with this conclusion.

Of the independent variables, GNP of the trading partner (Y) performs consistently best. Since a log-linear function is used, the estimated coefficient can be interpreted as an elasticity. Across the countries with which Ireland had recorded trade in 1977, a doubling of GNP size is associated with an increase of just over half in the level of merchandise trade. However, elasticities for a cross-section model must be treated cautiously. They are clearly not automatically applicable to time-series observations, i.e., the model does not imply that a doubling of any trade partner's GNP would result in a 50 per cent increase in Ireland's level of trade with that country. Indeed, casual observation shows that in many cases Ireland's trade levels have been rising rapidly relative to increases in its trading partners' GNP.

The distance variable (D), while having the expected sign throughout, is statistically significant for trade in manufactures only. The dummy variables give mixed results. The EEC dummy (K_1) is statistically significant for total imports, for manufactured imports, and for all of exports, with the expected positive sign in each case. This indicates that, with the exception of raw material imports, Irelands trade with its EEC partners is higher than trade with non-EEC countries having otherwise similar features. The existence of preferential trade arrangements can be expected to explain this result, as would traditional business ties and similar influences.

An important question arising here is whether trade with the UK, which constitutes such a large proportion of all Irish trade, is largely responsible for the significance of the EEC dummy variable. A repeat of the regression without the UK did not support this and the level of significance of the EEC dummy variable was maintained.

The other trade preference dummy, representing the ACP countries, is not significant. The dummy representing all developed countries is statistically significant for total trade and for trade in manufactured goods with a positive sign throughout. This suggests that in these cases, (but not for trade in primary products and foodstuffs) Ireland tends to trade more with developed countries than with developing countries with otherwise similar characteristics. It also suggests that there are influences at work, in addition to those incorporated in the model, hindering Irish trade with developing countries. A similar conclusion emerges regarding state trading countries. The dummy variable representing Middle Eastern oil producers is highly significant for imports. This shows a tendency to import more from these countries than from other similar countries elsewhere. However, the contrasting signs in the raw material and foodstuff case (M_2) and the manufactured goods case (M_3) shows that this is due to trade in the former products only. The explanation thus lies in oil

imports from these countries. On the export side, the results point to a tendency to export more manufactured goods to these countries than to others, *ceteris paribus*.

Table 3: *Results of gravity model of Irish trade with developed countries (DC) and with less developed countries (LDC) 1977*

Dependent Variable	*Group*	Y	D	$\bar{R}^2$	F	*No. Observations*
M_1	LDC	+0.7**	−0.1	.13	2.96*	41
	DC	+1.0**	−0.6**	.71	18.78**	22
M_2	LDC	+0.7*	−0.2	.08	1.96	33
	DC	+0.5	−0.7**	.50	1.82	20
M_3	LDC	+0.5	+0.3	.07	1.87	36
	DC	+1.5**	−0.7**	.74	20.84**	22
X_1	LDC	+0.7**	−0.1	.19	4.08*	40
	DC	+1.2**	−0.5**	.74	21.02**	22
X_2	LDC	+0.4	−0.2	.11	2.35	33
	DC	+1.3**	−0.7**	.59	11.08**	22
X_3	LDC	+0.7**	−0.1	.21	3.98	34
	DC	+1.1**	−0.5**	.80	29.12**	22

* = significant at 95% confidence interval, ** = significant at 99% confidence interval

Dependent and Independent variables as in Table 2.

The gravity model can also be used to analyse Irish trade patterns within groups of countries. For this purpose the model is re-estimated for trade with developed and developing countries separately. In this case the dummy variables are omitted leaving the two independent variables, Y and D, and the same six dependent variables as in Table 2. The results are shown in Table 3. It is evident that the model is considerably more successful in explaining the geographical pattern of Irish trade within the developed country group than within the less developed country group. It is also clear that this is due mainly to the failure of the distance variable to have any significant explanatory power in trade with developing countries. The distance variable in gravity trade models is generally regarded as capturing both transport costs and other cultural or psychological factors which would militate against trade. It is likely that it does so less successfully in a sample containing developing countries only than across a wider range of countries. There are a number of possible reasons for this. First, ocean freight rates are less related to shipping distance in the case of trade with developing countries than with other countries (see Yeats (1979)). Second, social and cultural influences on trade may not be very closely related to distance in the case of developing countries. For example, Ireland could be expected to have more business ties with former British colonies than with Francophone countries.

V DISCUSSION

This section discusses the relevance of the gravity model to Irish trade flows with reference to some variations on the basis model. These variations involve two changes in the model as specified in Equation (1) above. First, transport costs (T) are substituted for distance (D). Second, two additional independant variables are added to the model. These are "preferance similarity" (S) and population of the trading partner (P).

The distance variable in gravity models is designed to capture both transport costs and other aspects of "psychic distance" between countries. However, since the relative importance of these two elements is unclear, and since transport costs and shipping distances may not be always closely related, it is worthwhile to test a direct measure of transport costs as a substitute for distance. As with distance, the expectation is that this will be negatively associated with trade levels. Preference similarity is incorporated in order to test the extent to which Linder's hypothesis provides an explanation of Ireland's geographical trade pattern. It is tested by adding as an independant variable the difference between the *per capita* income of Ireland and that of its trading partners. It should be noted that it is the absolute size of this difference which is important and not its sign. The variable incorporated in the model is:

$$S = \frac{Y_i}{P_i} - \frac{Y_j}{P_j}$$

where S = preference similarity, Y = GNP, P = population and the subscripts i and j refer to Ireland and the trading partner, respectively. Thus specified, the hypothesis is that S will be negatively correlated with the level of trade. Regarding population, a number of studies have added this to Tinbergen's trade model as an explanatory variable. These have hypothesised a negative relationship between population levels and trade flows. Results have been mixed (see Linnemann (1966) and Sapir (1981)). There are two possible reasons for this. First, the underlying rationale is ambiguous and has varied from author to author (on this see Leamer and Stern (1970, pp. 152–153)). Second, in a cross-sample of countries, population and GNP are positively correlated so that regression equations incorporating both have a multicollinearity problem. Population is therefore incorporated in the model here on an experimental basis.

The GNP *per capita* and the population data are World Bank data for 1977[5]. Data on transport costs present greater difficulty. The measure used is the average quoted mid-1980 outward freight rate from Dublin to the major port of the trading partner for a standard (20 cubic feet) shipping container.[6] This is

5. The source is as in footnote No. 2.

6. Quotations were provided by Celtic Forwarding Ltd., Dublin. In theory, the difference between f.o.b. and c.i.f. prices for particular commodities could be used. However, in practice these have been found to be unreliable (see Yeats (1979) Chapter 7). The present analysis also requires an "average" rate representative of trade in different products.

a rather crude measure and is not representative of bulk cargo rates. However, it appears to be the most appropriate one that can be obtained. Since outward shipping rates are used, the model is tested for exports only. The model is therefore as follows:

$$X = f(Y, S, T, P, K) \tag{2}$$

where X = the value of Irish merchandise exports in 1977,
Y = GNP of the trading partner,
S = "preference similarity" as defined above,
T = transport costs,
P = population of the trading partner,
K = dummy variables as in Equation (1).

The sample used is the same as that for Equation (1) and the results are presented in Table 4. Comparison with Table 2 shows that this equation performs similarly to the basic gravity model.

Table 4: *Results of gravity model of Irish trade with preference similarity, transport cost and population variables,* 1977

Dependent Variable	Y	S	T	P	K_1	K_2	K_3	K_4	K_5	$\bar{R}^2$	F	*No. observations*
X_1	+0.8**	−0.1	−1.5*	−0.2	+0.4	+0.8	+0.2	−1.4*	+0.6	.79	21.1**	50
X_2	+0.6	−0.1	−1.3	+0.1	+1.8	+0.3	−0.8	−1.3	−0.2	.62	8.9**	44
X_3	+0.9**	+0.1	−0.9*	−0.3*	+0.5	+1.0*	+0.7	−1.2*	+0.7	.84	26.4**	44

* = significant at 95% confidence interval, ** = significant at 99% confidence interval.

Variables as in Table 2 except S = preference similarity, T = transport costs.

The transport variable has the correct sign and is significant at the 5 per cent level for total and for manufactured exports. This indicates a somewhat better performance than the distance variable. The population variable is significant, with a negative sign, in the case of manufactured exports. This result is consistent with other findings but the interpretation problems remain. Regarding preference similarity (S), this has the expected negative sign for total exports and for exports of raw material and food. In the case of manufactured goods to which the theory is more correctly applicable, it has a positive sign. In no case is it statistically significant so that as an explanation for the geographical pattern of Irish trade the preference similarity hypothesis is not supported by the evidence. The most likely explanation for this lies in the predominance of foreign-owned subsidiary companies in Ireland's manufactured exports. As a result of this, only a relatively small proportion of these exports has grown through a Linder process of satisfying home demand first and then progressing on to export markets. The relatively small size of the domestic Irish market also limits the relevance of Linders's approach in the case

of manufactured exports by indigenous Irish firms. Minimum efficient plant size in many modern industries necessitates immediate product launch on to export markets. The relevance of preference similarity to Ireland's manufactured imports is not examined here. It would appear, *a priori,* to have application to imports of manufactured consumer goods but not neccessarily so to capital equipment imports or to manufactured components. Another factor that may lower the explanatory power of the preference similarity hypothesis in the Irish context is Ireland's mid-position on the international income *per capita* scale (see Fitzpatrick (1983)). The major developed countries with whom the strongest gravity-type trade creating forces are at play have *per capita* incomes considerably greater than Ireland. Trade with other middle income countries faces trade preventing factors in the form of distance, language and other barriers, and an absence of preferential trade arrangements.

VI CONCLUSIONS

As described in the introduction, Ireland's foreign trade is heavily concentrated on a small number of industrialised countries. This article has examined the extent to which a gravity model of international trade flows can explain this. The analysis suggests three main conclusions:

(i) The three main explanatory variables used in gravity models, namely the GNP of trading partners, their distance apart or transport costs, and the presence or absence of preferential trade arrangements, have considerable explanatory power regarding the large share of a relatively small number of countries in Ireland's overseas trade. The dominance of the UK and other EEC countries in Irish merchandise imports and exports can, to a large extent, be explained in this way. So too can the converse of these countries' dominance of Irish trade, that is the relatively small share of the majority of the countries of the world in Irish trade. The low level of GNP of many of these countries, notably less developed countries, and their distance from Ireland provide a systematic explanation of much of their low share in Irish foreign trade. With regard to this latter point, however, an important aspect of the method used in the article should be noted. As described earlier, the model was tested for those countries with which Ireland had recorded imports and exports in 1977. The sample did not include countries with whom Ireland had either no trade, or trade so small as to be unrecorded.[7] Out of a total of some 150 less developed countries, Ireland had recorded trade in both directions with only 41 such countries

7. The Eurostat trade data used are in millions of European Units of Account (EUA) rounded to the first decimal place. This means that only trade valued at 50,000 EUA and above in 1977 was recorded. Trade below this level was recorded as zero.

in 1977. Consequently, the large number of such countries with whom Ireland has no trade at all is another reason for the low share of less developed countries in Irish trade. The situation could be thought of in terms of a trade threshold. As applied here, the gravity model is used to explain trade levels after the initial threshold is crossed. Another question, not analysed here, is why the threshold is crossed in some cases and not in others.

(ii) Unlike the conventional gravity approach, the preference similarity hypothesis does not appear to contribute to explaining the geographical pattern of Ireland's merchandise exports. Irish manufactured exports do not appear to have developed through a Linder-type process of spillover on to overseas markets from the home market. The role of foreign-owned subsidiary firms in these exports is the most likely explanation for this.

(iii) An important aspect of the geographical pattern of foreign trade is change in this pattern over time. In Ireland's case the main example of this, as shown in Table 1, has been the declining importance of the UK as a trading partner and a corresponding increase in the importance of other EEC countries. This is generally seen as resulting from EEC entry in 1973. The present article has concentrated on the geographical pattern of Ireland's trade in a single year, 1977. It has not examined the relevance of the gravity model to changes in the geographical pattern of trade nor has it tested the extent to which the model's explanatory power might alter from one period to another. Nevertheless, it does suggest that alongside trade arrangements, economic size of the trading partner may help explain changing geographical trade patterns. The relative economic decline of the UK can therefore be seen as contributing to its reduction in importance as an Irish trading partner. The fact that its decline as a destination for Irish exports preceded 1973 is consistent with this.

REFERENCES

AITKEN, N.D., 1973. "The Effect of the EEC and EFTA on European Trade: A Temporal Cross-Section Analysis", *American Economic Review,* Vol. 63, No. 4, pp. 881–882.

BECKERMAN, W., 1956. "Distance and the Pattern of Intra-European Trade", *Review of Economics and Statistics,* Vol. 28, No. 1, pp. 31–40.

FARLEY, N.J.J., 1972. "Explanatory Hypotheses for Irish Trade in Manufactured Goods in the mid 1960s", *The Economic and Social Review,* Vol. 1, No. 4, pp. 5–33.

FARLEY, N.J.J., 1973. "Outward-Looking Policies and Industrialisation in a Small Economy: Some Notes on the Irish Case", *Economic Development and Cultural Change,* Vol. 21, No. 4, pp. 610–628.

FARLEY, N.J.J., 1981. "Outward-Looking Policies and the Changing Basis of Ireland's Foreign Trade", *The Economic and Social Review,* Vol. 12, No. 2, pp. 73–95.

FITZPATRICK, J., 1983. "Trade between Newly Industrialised and Newly Industrialising Countries: the Case of Ireland", *Administration,* Vol. 31, No. 2, pp. 200–216.

FORTUNE, J.N., 1971. "Some Determinants of Trade in Finished Manufactures", *Swedish Journal of Economics,* Vol. 73, No. 3, pp. 311–317.

GERACHI, V.J. and W. PREWO, 1977. "Bilateral Trade Flows and Transportation Costs", *Review of Economics and Statistics,* Vol. 59, No. 1, pp. 67–74.

HEWETT, E., 1976. "A Gravity Model of CMEA Trade" in J.C. Brada, (ed), *Quantitative and Analytical Studies in East-West Economic Relations,* Bloomington: International Development Institute.

HIRSCH, S. and B. LEV, 1973. "Trade and Per Capita Income Differentials: A Test of the Burenstam-Linder Hypothesis", *World Development,* Vol. 1, No. 9, pp. 11–17.

LEAMER, E.E. and R.M. STERN, 1970. *Quantitative International Economics,* Chicago: Aldine.

LINDER, S.B., 1961. *An Essay on Trade and Transformation,* Stockholm: Almqvist and Wiksell.

LINNEMANN, H., 1966. *An Econometric Study of International Trade Flows,* Amsterdam: North Holland.

MATTHEWS, A., 1980. *The European Community's External Trade Policy: Implications for Ireland,* Dublin: European League for Economic Co-operation and Irish Council of the European Movement.

McALEESE, D., 1984. "Ireland and the European Community: The Changing Pattern of Trade" in P.J. Drudy, and D. McAleese, (eds.), *Ireland and the European Community,* Cambridge: Cambridge University Press.

McALEESE, D. and P. CAREY, 1981. "Employment Coefficients for Irish Trade with extra-EEC Countries: Measurement and Implications", *The Economic and Social Review,* Vol. 12, No. 2, pp. 115–132.

McGILVRAY, J. and D. SIMPSON, 1973. "The Commodity Structure of Anglo-Irish Trade", *Review of Economics and Statistics,* Vol. 55, No. 4, pp. 452–458.

POYHONEN, P., 1963. "A Tentative Model for the Volume of Trade Between Countries", *Weltwirtschaftliches Archiv,* Vol. 90, No. 1, pp. 93–99.

PULLIAINEN, K., 1963. "A World Trade Study: An Econometric Model of the Pattern of Commodity Flows in International Trade in 1948–1960", *Ekonomiska Sandfundis Tidskrift,* Vol. 17, No. 2, pp. 78–91.

RICHARDSON, H.W., 1978. *Regional and Urban Economics,* Harmondsworth: Penguin.

SAILORS, J.W. *et al,* 1973. "Empirical Verification of Linders Trade Thesis", *Southern Economic Journal,* Vol. 40, pp. 262–268.

SAPIR, A., 1981. "Trade Benefits Under the EEC Generalised System of Preferences", *European Economic Review,* Vol. 15, No. 3, pp. 339–355.

STERN, R.M., 1975. "Testing Trade Theories" in P.B. Kenen, (ed), *International Trade and Finance, Frontiers for Research,* Cambridge: Cambridge University Press.

TINBERGEN, J., 1962. *Shaping the World Economy: Suggestions for an International Economic Policy,* New York: Twentieth Century Fund.

WEISS, F.D. and F. WOLTER, 1979. "Testing Hypotheses for the Volume and Commodity Composition of East-West Trade" in H. Giersch, (ed), *International Economic Development and Resource Transfer, Workshop* 1978. Tubingen: J.C.B. Mohr (Paul Siebeck).

YEATS, A.J., 1979. *Trade Barriers Facing Developing Countries, Commercial Policy Measures and Shipping,* London: Macmillan.