

Intra-Industry Trade and Industrial Adjustment: The Irish Experience*

MARIUS BRÜLHART
DERMOT McALEESE
Trinity College, Dublin

Abstract: This paper updates and extends previous studies of Irish intra-industry trade (IIT). The reported IIT proportions are calculated from the most comprehensive Irish trade data set used in this context to date, both in terms of time coverage and of statistical detail. Even at a five-digit level of industry disaggregation, 38 per cent of all trade and 44 per cent of trade in manufactured goods were found to be IIT in 1990. The stabilisation and partial decline of IIT levels in the 1980s, detected by earlier studies, is confirmed by reference to Grubel-Lloyd and Aquino-adjusted measures. This decline reflects a pattern of increased inter-industry specialisation instead of the trend towards higher intra-industry specialisation observed at the earlier stages of Irish trade liberalisation. Between 1985 and 1990, Irish industry specialised out of labour-intensive sectors into capital-intensive, export-oriented industries. As a result, growth of manufacturing employment (3 per cent) was considerably smaller than the increases in output (27 per cent) and trade volumes (33 per cent). This process of adjustment is analysed in detail, applying new methods of measuring marginal IIT on a set of matching trade and production data for Irish manufacturing. IIT is found to be associated with lower adjustment costs than inter-industry trade.

I INTRODUCTION

The analysis of external trade patterns is of particular importance to the Irish economy. During the past 30 years, the combined value of Ireland's imports and exports has risen from around 60 per cent to over 105

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per cent of GDP, a level now surpassed in the EC¹ only by Belgium-Luxembourg. This rapid expansion of trade took place against a background of increasing trade liberalisation. Much research has been devoted to exploring the pattern of industrial adjustment associated with this more liberal trade environment.

Until recently, measurement of intra-industry trade indices suggested that trade-induced adjustment in the Irish manufacturing sector had taken the form of re-structuring *within* industries rather than *between* them. Research undertaken by the National Economic and Social Council (1989), however, found that the share of *intra*-industry trade (IIT) had ceased to rise and that trade flows of an *inter*-industry nature was becoming more important. This change in trade patterns was seen as significant for the Irish economy, because adjustment pressures associated with *inter*-industry trade are generally believed to be stronger than those associated with IIT. It was argued that Ireland could suffer adverse effects from industrial relocation pressures following both the EC Single Market programme and the process leading towards Economic and Monetary Union.

This paper has several features. First, we update and extend previous empirical research on Irish IIT using standard Grubel-Lloyd (GL) measures (McAleese (1976, 1979), NESC (1989)). IIT calculations are made for a number of years up to 1990 in order to test the validity of the NESC's central prediction that average Irish IIT levels were declining. The sensitivity of the results to statistical industry disaggregation is examined, using SITC four and five-digit trade data instead of the three-digit data used in the earlier studies. Thus, a longer, more consistent and more disaggregated time series has been employed. Second, various "dynamic" measures of *marginal* intra-industry trade (MIIT) are calculated. We thus analyse the structure of the *change* in trade flows, which is conceptually and, as our results will show, empirically different from comparing Grubel-Lloyd indices of different time periods.² Third, moving beyond the analysis of pure trade flows, we investigate the link between trade patterns and changes in the structure of Irish industry. The common assumption is examined that the higher the proportion of IIT, the less severe are the costs arising from trade-induced industrial re-structuring. This was made possible by the availability of a data set combining Irish trade and production figures under the same classification (NACE), albeit at a relatively high level of aggregation (70 product groups).

1. We choose the old term "European Community" (EC) rather than the new name "European Union", because the former expression was used during the late 1980s, which is the time period our study is mainly concerned with.

2. Cf. also Greenaway *et al.* (1994), and Brühlhart (1994).

The paper proceeds as follows. Section II summarises the long-term trend in Irish IIT. Section III is dedicated to a general analysis of the relationship between trade patterns and changes in the production structure, with a special focus on the new concept of marginal intra-industry trade (MIIT). In Section IV we study the relationship between MIIT and industrial specialisation at a more disaggregate level. Finally, Section V summarises our findings and draws some general conclusions.

II IRISH IIT TRENDS 1961-1990

Data Input

The calculations reported in this section are based on an extensive data set covering the 1961-1991 period. These calculations provide the most comprehensive set of IIT indicators for Ireland to date, both for their time coverage and the level of statistical disaggregation, thus complementing the three previously published studies of Irish IIT (McAleese (1976, 1979), NESC (1989)).

Table 1: *Structure of Trade Data Used*

<i>Year</i>	<i>Number of Product Groups Where Trade is Registered</i>	<i>Zero-import Product Groups</i>	<i>Zero-export Product Groups (in percent of total)</i>	<i>Product Groups Where GL Index > 0.75</i>
1961 ^a	419	7.4	43.9	8.1
1967 ^a	550	8.4	43.3	8.7
1972 ^b	788	8.4	47.5	9.1
1977 ^b	1,166	1.6	13.8	11.0
1985 ^b	1,780	1.0	12.5	12.5
1990 ^b	3,023	1.2	11.3	11.7

^aSITC four-digit, ^bSITC five-digit.

IIT was calculated from SITC five-digit OECD trade statistics on Ireland for the years 1961, 1967, 1972, 1985 and 1990, providing an indication of the long-term trends in Irish IIT. Our results differ from all previous calculations on Irish IIT in that they are based on five-digit rather than on three-digit trade data. Thus, the data sets used were formidable, as trade was reported for up to 3,023 product groups. This level of statistical detail was chosen because "industries" are generally more homogeneous at higher levels of disaggregation, and hence calculations from five-digit data are less likely to inflate IIT indices by what effectively constitutes *inter-industry* trade. IIT measures calculated from five-digit data are thus expected *a priori* to be

lower than indices based on three-digit figures.

Table 1 shows that the number of product groups ("industries") has grown substantially between 1961 and 1990. This development is due on one hand to statistical refinement (switch from four to five-digit groups between 1967 and 1972, and SITC revisions in 1978 and 1988), and on the other hand to the inclusion of formerly non-existent or non-traded products.³ Another striking feature of the Irish trade statistics is the decline in the relative number of product groups in which only imports were recorded. Up to 1972, zero exports were recorded in over 40 per cent of four and five-digit product groups; by 1990 this had fallen to 11 per cent. To some extent, this reflects the fact that Ireland's industrial base was relatively underdeveloped, as well as the more general tendency of small countries' exports to be less diversified than their imports. The main cause for this phenomenon appears to be, however, the relative lack of accuracy in export statistics due to problems of data collection. The marked decrease of zero-export industries between 1972 and 1977 indicates a great improvement in the product classification of export statistics.⁴

Irish IIT 1961-1991: General Trends

The main results of our calculations corroborate the broad findings of the previous studies. The development of overall Grubel-Lloyd indices,⁵ as represented in Table 2, is in line with (a) McAleese (1976) and (1979), who observed a rapid increase of the GL index in the 1960s and 1970s, (b) NESC (1989), where a reversal of the upward trend in the 1980s was detected, and (c) Globerman and Dean (1990), who found that the recent reversal in the growth of IIT applied to a considerable number of OECD countries.

3. Statistical refinement over time biases the IIT trend downwards. This aspect is of minor concern for the 1961-1985 period, when IIT was generally increasing (cf. last column in Table 1, and Figures 2-4), but it has to be given serious consideration when discussing the apparent trend reversal between 1985 and 1990.

4. Irish export statistics are still, as is well known, prone to distortions arising from transfer pricing and other practices by subsidiaries of multinational firms.

5. The standard GL index is defined as follows:

$$IIT = \frac{\sum_{i=1}^n [(X_i + M_i) - |X_i - M_i|]}{\sum_{i=1}^n (X_i + M_i)},$$

where X_i and M_i refer to a country's exports and imports of goods contained in industry i , and n is the number of industries considered. This index takes values between zero and one and is positively related to IIT. (See Grubel and Lloyd (1975), and Greenaway and Milner (1986) for a more detailed exposition.)

Table 2: *Irish IIT 1961-1990: Total Trade, by SITC Sections*

SITC Section	Description	Intra-industry Trade (Grubel-Lloyd Indices) ^a						Direction of Change	
		1961	1967	1972	1977	1985	1990	61-90	85-90
0	Food, live animals	0.24	0.16	0.17	0.20	0.24	0.22	-	-
1	Drink, tobacco	0.12	0.19	0.18	0.39	0.28	0.34	+	+
2	Raw materials	0.27	0.17	0.15	0.16	0.14	0.15	-	+
3	Mineral fuels	0.14	0.16	0.10	0.05	0.17	0.14	=	-
4	Animal /vegetable oils	0.32	0.26	0.30	0.28	0.14	0.13	-	-
5	Chemicals	0.08	0.17	0.40	0.40	0.37	0.37	+	=
6	Manufactures, classified by materials	0.35	0.34	0.38	0.49	0.40	0.37	+	-
7	Machinery, transport equipment	0.13	0.17	0.24	0.48	0.51	0.48	+	-
8	Miscellaneous manufactures	0.40	0.54	0.59	0.61	0.53	0.47	+	-
9	Commodities n.e.s.	0.82	0.78	0.75	0.62	0.53	0.43	-	-
0-9	All commodities	0.28	0.26	0.32	0.38	0.40	0.38	+	-
5-8	Manufactures	0.25	0.29	0.38	0.49	0.47	0.44	+	-

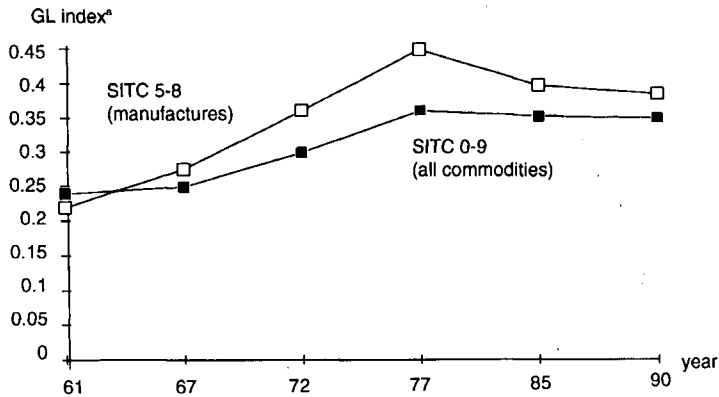
^acalculated from four-digit (1961, 1967) and from five-digit (1972, 1977, 1985, 1990) OECD data, weighted by current trade values in each year.

Table 2 shows that Irish IIT levels have generally been increasing over the last three decades.⁶ The direction of change in the GL index was positive for total trade and for trade in manufactured products in the 1961-90 period. The most recent sub-period, however, was characterised by the opposite pattern: IIT was decreasing both for total trade and for trade in manufactures between 1985 and 1990.

A rough geographical decomposition of Irish IIT into intra-EC trade⁷ (Figure 1) and extra-EC trade (Figure 2) also yields some interesting results. First, it emerges that IIT has generally been higher for Irish intra-EC trade than for Irish trade with non-EC countries. Second, the slowdown and reversal of IIT growth in the 1980s was more pronounced in the trading pattern between Ireland and EC Member States than between Ireland and the totality of its non-EC trading partners. This is an indication that the most recent stage of European integration may have generated relatively more *inter*-industry specialisation in Ireland than the initial phase of EC trade liberalisation.

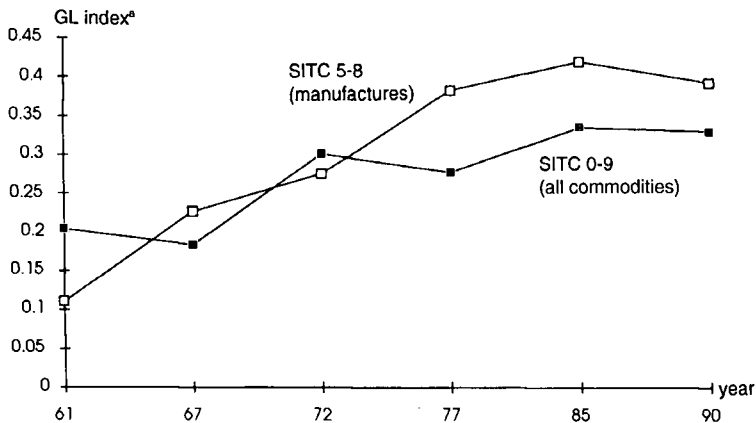
6. A more detailed summary of Irish GL indices is provided in the Appendix. Table 2 uses a format very similar to Table 6.3 in NESG (1989, p. 151), and the Appendix can be compared to NESG Table 6.2 (p. 148 ff.). While the absolute levels of the GL indices in the two studies cannot be compared, because our calculations are based on more disaggregated data, the emerging trends are remarkably similar. This is a first indication of the robustness of the trends in Irish IIT detected in this and the previous analyses.

7. Meaning the 12-nation Community.



a: calculated from 4-digit (1961, 1967) and from 5-digit (1972, 1977, 1985, 1990) OECD data

Figure 1: *Irish IIT 1961-1990: Intra-EC Trade*



a: calculated from 4-digit (1961, 1967) and from 5-digit (1972, 1977, 1985, 1990) OECD data

Figure 2: *Irish IIT 1961-1990: Trade with Non-EC Countries*

Irish IIT 1961-1991: Industry-Specific Trends

Table 2 shows that in all years of our sample, average IIT was markedly higher in the manufacturing product groups (SITC 5-8) than in SITC Sections 0-4. The initial trend and its reversal were also more pronounced and uniform in the manufacturing sectors than in primary sectors. IIT in all four manufacturing product groups follows the general pattern of an initial increase in IIT followed by a reversal. The stagnation of IIT growth occurred first in the Chemicals sector (SITC 5, after 1972) and last in the Machinery and

Transport Equipment industry (SITC 7, after 1985), which had previously witnessed the most pronounced increase in IIT of all product groups.

The high levels of IIT in the manufacturing industries relative to IIT in the primary sectors is a phenomenon observed in most developed countries. This robust empirical result is explained first by the fact that the location of industrial production is determined less by factors of (natural) comparative advantage than the location of production in the primary sectors, and second by the higher degree of product differentiation of industrial goods relative to primary products.

The interpretation of the *reversal* of Irish IIT growth in the manufacturing sectors is less straightforward. The main difficulty arises because falling IIT can indicate two diametrically opposed specialisation patterns from a one-country perspective. A falling GL index in a particular industry can reflect the widening either of a trade deficit or of a trade surplus in that industry. This important distinction was pointed out in NESC (1989): "Inter-industry trade and inter-industry specialisation are not a problem in and of themselves. It all depends on whether the country is specialising *in* or being specialised *out* of a particular industry."⁸ Sectoral declines in IIT observed both in this study and in NESC (1989) indicate further specialisation *in* various Irish industries, such as Organic Chemicals and Pharmaceuticals (SITC 51 and 54; see Appendix). On the other hand, in a number of industries IIT has fallen because Ireland was specialised *out* of these sectors. Such a development occurred, for instance, in the three industries Car Assembly, Clothing and Footwear (SITC 78, 84, 85). We further investigate this issue in the following two Sections.

The development of IIT levels in the *primary sectors* is much less uniform. None of Sections 0-4 showed a consistent IIT increase followed by a consistent decrease. The Drink and Tobacco industry (SITC 1) came closest to following the patterns predominant in the manufacturing sectors: a strong and consistent increase in IIT was reversed after 1977. However, the average GL index for this sector grew again quite considerably between 1985 and 1990. The IIT trends for the two sections Raw Materials (SITC 2) and Animal and Vegetable Oils (SITC 4) were diametrically opposed to the dominant pattern, as IIT was generally decreasing over the whole time period in both these sectors.

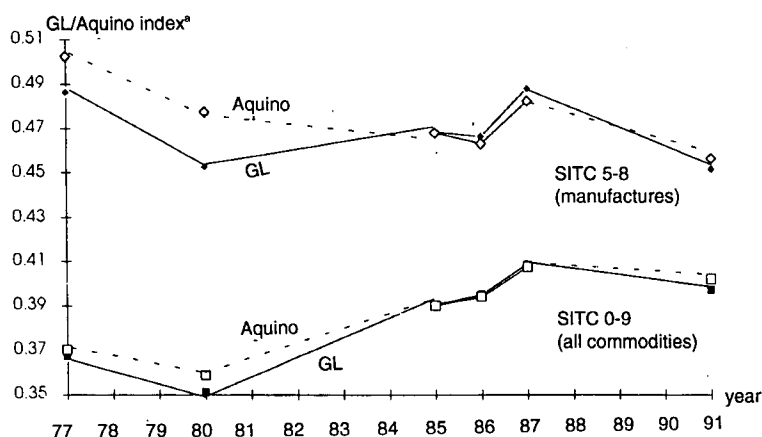
Elements of national comparative advantage appear to explain the generally low IIT levels in these product groups. It is obviously mainly due to natural comparative advantage that Irish IIT is very low in the meat and dairy sectors (SITC 01 and 02), where Ireland has a strong net exporting

8. NESC (1989), p. 152.

position, as well as in product groups such as rubber and coal (SITC 23 and 32), where Ireland is a net importer.

Irish IIT 1961-1991: Methodological Aspects

It could be argued that the stagnation of Irish IIT growth at least after the mid-1980s is due to rising trade balance surpluses, biasing the GL indices downward. Our calculations of Aquino-adjusted GL indices,⁹ however, suggest that aggregate trade imbalances do not explain the fluctuations of the unadjusted GL measures. Figure 3 shows that the Aquino adjustment leaves the broad level and trend of observed IIT unchanged. The increasing trade surplus therefore does not explain the levelling-off of Irish IIT.¹⁰



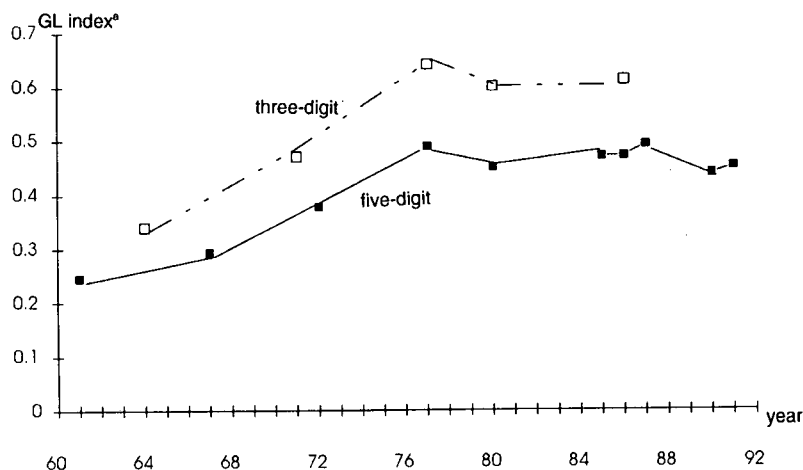
a: calculated from 5-digit CSO data.

Figure 3: *GL Unadjusted and Aquino-Adjusted Indices for Total Trade*

Figure 4 indicates that, in spite of the difference in the absolute index levels, the general trend in IIT as calculated at the third and at the fifth SITC digit is very similar. Hence, the observation of both a high level of IIT and a trend reversal in Irish IIT growth does not seem to stem from an arbitrary and misleading definition of what constitutes an "industry".

9. The adjustment to the GL index suggested by Aquino is designed to counteract the impact of overall trade imbalance on the measurement of IIT (see Greenaway and Milner (1986)).

10. The fact that changes in the overall trade balance do not significantly alter observed patterns of IIT also suggests that discretionary transfer pricing by multinational firms based in Ireland, which may affect the trade balance, does not distort IIT calculations, at least at the aggregate level.



a: GL unadjusted indices for manufactures; “three-digit” figures from McAleese (1979) and NESC (1979); “five-digit” figures based on CSO and OECD data (1961 and 1967 calculated from four-digit data).

Figure 4: *GL Indices Based on Three and Five-digit Trade Data*

The definition of an “industry” is much narrower for the present study, which uses five-digit trade data, than in previously published analyses, based on two and three-digit product groups. As was to be expected, GL indices are generally lower when calculated from five-digit data than when based on three-digit figures. Thus, using three-digit trade data, NESC (1989) found that in 1986, 61 per cent of Irish manufacturing trade was intra-industry, while our five-digit calculations for 1986 show an IIT proportion of 47 per cent. The latter is still large in an absolute sense, indicating a high involvement in IIT by Irish industry.

The only remaining doubt as to the economic relevance of the calculated IIT *decrease* for Irish manufactures trade stems from the possibility that the steadily increased number of product groups distinguished at the fifth digit of Irish trade statistics was at the source of this observation. However, due to increasing product diversity and statistical precision, the number of product groups had been growing at a similarly fast rate previous to the 1980s, when GL indices had been *rising* rapidly (cf. Table 1).¹¹ Increasing statistical disaggregation did not halt the rise of Irish IIT in the 1960s and 1970s. It thus seems an unlikely explanation of the trend reversal of the 1980s.

11. The number of product categories has also increased at the three-digit level, though at a much slower rate. In 1961, Irish trade had been recorded in 170 three-digit industries, and in 1990, trade was recorded in 257 such product groups. This further underlines the independence of the detected IIT trend from varying definitions of what constitutes an “industry”.

III MARGINAL IIT AND INDUSTRIAL ADJUSTMENT 1985-1990

Data Input

In order to establish a link between the analysis of trade patterns and other economic variables such as industrial output and employment, appropriate matching data are required. Since, in Ireland, no statistics other than trade figures are published according to the SITC classification, and since none can be adequately re-grouped into SITC product categories, different data sources had to be employed.

All calculations reported below are performed on three-digit NACE data. The trade figures are taken from the Eurostat microfiche data bank, where Irish intra-EC trade is reported for 126 different three-digit NACE groups. This data set is re-arranged so as to match the sectors distinguished in the Irish Census of Industrial Production (CIP) statistics.¹² The CIP product classification is based on the NACE code, but some three-digit NACE groups are left out, because they do not refer to industry, and some are amalgamated because of their small size or to protect confidentiality. We thus availed of a data set distinguishing 70 industrial product groups which comprised figures for both trade and production.

This analysis concentrates on the post-1985 period, thus focusing on the changes which have occurred since the time period covered by NESC (1989). We choose 1990 as our second point of reference, as it is the last year for which all the relevant data are available at the time of writing. The comparison of 1985 and 1990 data has the further advantage of covering the period when the average Irish IIT index was stabilising. Since this pattern was most pronounced for Ireland's trade in manufactures with its EC partners (see Figure 1), our data set seems to be of particular relevance.

Marginal Intra-Industry Trade: Conceptual Outline

In order to link the analysis of trade flows to changes in the structure of Irish industry, a recent methodological advance in the study of IIT must be considered. A paper by Hamilton and Kniest (1991) has revealed a new and potentially challenging dimension to the empirical analysis of IIT. Previously, empirical investigation of IIT had been confined to "static" indicators such as the Grubel-Lloyd index, which measure IIT for one particular point in time.¹³ It had been implicitly assumed that the IIT index would be negatively related to adjustment pressures. In other words, an industry with a high IIT index

12. CSO (1985, 1990).

13. Even though the GL index relates to *flows* of goods and is thus not a static measure in the strict sense, it will be referred to in this paper as being of a "static" nature, in contrast to measures of MIIT, which are "dynamic", since they relate to the *change* in these flows between two years.

was expected to respond to trade liberalisation by reallocating its product mix rather than by increasing or decreasing its absolute production level. It was also assumed that a rise in the IIT index between two periods reflected a predominantly intra-industry *change* in trade flows and relatively low adjustment pressures. As Hamilton and Kniest (1991) and others have subsequently shown, the second assumption is erroneous and misleading. To circumvent the difficulty, they proposed the concept of *marginal* intra-industry trade (MIIT).

Various measures of MIIT measures have been suggested to date.¹⁴ In this paper we shall retain the measures summarised in Table 3, as developed by Brühlhart (1994) (A and B indices), in addition to the difference over time between GL indices (ΔGL). The A and B indices measure the proportion of matched trade *change* relative to total trade change and thus reflect the importance of MIIT within each industry. While the A index reports the absolute proportion of MIIT, thus relating to adjustment costs, the B index also indicates whether a sectoral trade change took the form of an improved export performance or of greater import penetration, hence incorporating information on the emerging pattern of specialisation. In order to retain only *real* changes in trade flows, all 1990 trade figures are converted into 1985 prices.¹⁵

We have shown in the previous Section (Table 2) that, over the 1985-90 period, the weighted IIT average for Sections 5-8 declined from 0.47 to 0.44. Calculations based on the NACE figures provide a similar result, namely a decline of the aggregate GL index from 0.63 in 1985 to 0.61 in 1990, whence the negative value of ΔGL , reported in the first row of Table 3. We have thus found further corroboration of the IIT trend reversal of the 1980s. The decline in IIT observed on the base of the NACE data set is of particular significance, as it cannot be attributed to an increase in statistical product groups between 1985 and 1990, since trade was classified identically in both years.

The summary A index being smaller than 0.5 ($A = 0.43$) suggests that *new* trade with the EC was more of the *inter*-industry than of the *intra*-industry type.¹⁶ Thus, this analysis confirms that 1985-1990 has been a period of relatively strong *inter*-industry changes in trade flows to and from Irish industry.

14. Namely by Hamilton and Kniest (1991), Greenaway *et al.* (1994) and Brühlhart (1994).

15. As a deflator, we chose the Irish index of manufacturing output prices, since no export or import price index is available for Ireland. The disaggregated results for the 70 industries can be obtained from the authors.

16. Cf. Brühlhart (1994), Section III.

Table 3: *Marginal Intra-Industry Trade: Measures and Results for Irish Intra-EC Trade 1985-1990*

<i>Name of Measure</i>	<i>Formula</i>	<i>Result^a</i>
Difference between GL indices	$\Delta GL = \left(1 - \frac{ M - X }{(M + X)}\right)_t - \left(1 - \frac{ M - X }{(M + X)}\right)_{t-n}$	-0.023
"A index"	$A = 1 - \frac{ \Delta X - \Delta M }{ \Delta X + \Delta M }$	0.432
"B index"	$B = \frac{\Delta X - \Delta M}{ \Delta X + \Delta M }$	(n.a.)

^aIntra-EC trade, for total manufacturing sector (weighted averages).

Structure of Trade Flows and Industrial Adjustment in Ireland

We now consider the relationship between trade patterns and the structure of Irish *production*. As Greenaway and Milner (1986) point out, "the exchange of differentiated products (IIT) by a country with the rest of the world can change without any change in its production structure".¹⁷ In this sub-section, we will thus study whether and how the patterns of Irish intra-EC trade have affected the structure of Irish industry.

Between 1985 and 1990, the inflation-adjusted value of total Irish trade in manufactures grew by 32.8 per cent. Yet, the real value of domestic production only increased by 27.2 per cent, industrial employment grew by a mere 3.3 per cent and the number of establishments even shrank by 1.5 per cent. By 1990, combined global imports and exports amounted to 125.4 per cent of Irish manufacturing output in value terms. Irish intra-EC trade was particularly buoyant. It had grown by 41.1 per cent in real terms and amounted to 72.9 per cent of total manufactures trade in 1990. Without further examination, these figures indicate the high and growing trade dependency of Irish industry, increasingly geared towards the European Community. At a first glance, they also suggest a trade-induced rationalisation process, yielding considerable productivity gains at the expense of employment growth.

In order to investigate the trade-production relationship, correlation coefficients were calculated between, on the one hand, various indicators of trading patterns (trade-related variables) and, on the other hand, two measures of change in industrial structure, namely output and employment (production-related variables). These results are reported in Table 4. Columns (A)

17. Greenaway and Milner (1986), p. 80.

and (B) report correlations between trade and percentage changes in employment and production. Columns (C) and (D) relate trade to the *absolute values* of percentage changes in employment and production. The absolute changes correspond more closely to the concept of adjustment costs as referred to in most theoretical trade models.¹⁸

Adjustment is a dynamic phenomenon since it describes the adaptive process of a country's productive structure following a change in its trading conditions. If there are any market rigidities, this process involves at least temporarily an inefficient use of resources. Therefore, trade theory generally calls "adjustment costs" any trade-induced change in a country's structure of production, irrespective of the sign of this change. The sign of such a change, however, is what matters most from a unilateral perspective, since it indicates whether the adjustment process leads to a specialisation *into* or *out* of particular economic activities. Intuition suggests that MIIT is related negatively to adjustment costs. Measures of trade performance are expected to be correlated positively with industrial performance, since changes in exports and the B index reflect trade specialisation *into* the affected sectors.

Table 4: *Changes in Intra-EC Manufactures Trade and Industrial Performance 1985-1990: Correlation Coefficients, all Sectors*

Trade-related Variables	Production-related Variables			
	Employment Change ^a	Production Change ^a	Absolute Employment Change ^b	Absolute Production Change ^b
<i>Trade Performance:</i>				
Δ Exports	0.25	0.23	-0.04	-0.08
Δ Imports	0.14	0.29	-0.16	-0.05
B index	-0.03	-0.08	0.33	0.35
<i>Trade Structure:</i>				
GL index 1985	0.28	0.28	-0.13	-0.01
GL index 1990	0.39	0.36	-0.25	-0.13
ΔGL	0.09	0.05	-0.12	-0.15
A index	0.38	0.36	-0.28	-0.08

^aEmployment change = $\Delta E = (E_{1990} - E_{1985}) / ((E_{1990} + E_{1985}) * 0.5) * 100$, likewise for production change.

^bAbsolute employment change = $|\Delta E|$, likewise for production change.

Table 4 shows that, while the relationship between trade performance and

18. A recent survey on the IIT-adjustment link is provided by Greenaway and Hine (1991), p. 604 ff.

changes in the production structure was found to be surprisingly weak, a strong association was detected between trade *structure* and the pattern of production. Thus, the assumption that IIT generates relatively small adjustment costs because trade-induced changes in a country's production structure occur *within* sectors and firms rather than *between* them, is confirmed by these results. The GL indices correlate negatively with absolute changes in production and employment. The level of MIIT, measured by the A index and reflecting the *change* in trade patterns, shows an even stronger negative correlation with absolute employment change. On the other hand, the figures reported in Table 4 confirm that the *change* in IIT indices (ΔGL) is of little use as an indicator of adjustment pressures.

While the concepts of IIT and MIIT are shown to be of considerable relevance to the performance of Irish industry, it has to be borne in mind that the calculated correlations are generally rather weak, the highest coefficient reaching 0.39.¹⁹ This reflects the fact that changes in the pattern of trade flows are by no means the only determinant of Irish industrial structure, in spite of Ireland's high trade orientation. Other factors such as changes in demand, technology and industrial policy are also important shaping forces of adjustment.²⁰

IV SECTORAL TRADE PERFORMANCE AND INDUSTRIAL SPECIALISATION 1985-1990

Overview

Simple correlation analysis suggests that Irish IIT with the EC was generally accompanied by less industrial adjustment than *inter*-industry trade. This, however, does not necessarily imply that the considerable amount of inter-industry trade that took place during the period 1985-90 has worked to Ireland's disadvantage. Ireland could have specialised *into* or *out of* industrial sectors — both these patterns indicating a process of *inter*-industry adjustment. This distinction is captured by the values of the B index which is positive where exports grew more than imports and negative in the reverse case.²¹

Based on the B index, we have performed a grouped analysis, allocating

19. The minimum coefficient value for rejection of the null-hypothesis that

$$\rho = 0,$$

where ρ is the true correlation, given our sample size of 70 observations, is 0.23 at the 0.05 confidence level and 0.31 at the 0.01 confidence level (t test).

20. Barry (1991, p. 110) has attributed the recent decline of certain traditional industries and the concomitant inter-industry adjustment to a fall in domestic demand. This indicates that the causal nexus between macroeconomic changes, changes in industrial performance and changes in trading patterns is a complex and unresolved issue.

21. Cf. Brühlhart (1994), Section IV.

our 70 industries to four categories, as defined in Table 5. Average changes in employment, production and aggregate trade values were calculated for each category. The results of these calculations, reported in Table 6, allow a separate analysis of sectors with high and with low MIIT.

First, however, we ignore the level of MIIT and concentrate on the distinction between specialisation *into* a sector (Categories III and IV) and *out of* a sector (Categories I and II). We have calculated the ratio of the number of industries with positive Bs relative to the number of industries with negative Bs using various different weights.²² The *unweighted* ratio of industries with positive Bs to industries with negative Bs is 1.12 (37 positive and 33 negative NACE Groups). Weighting NACE Groups according to 1985 *trade volumes*, we obtain a ratio of 1.61; weighting according to 1985 levels of *production*, the ratio is 1.43; but weighting according to 1985 levels of *employment*, it stands at 0.74. This result indicates that the predominantly inter-industry change in Irish trade flows mostly worked to the economy's

Table 5: *Industry Categories According to MIIT Patterns*

<i>Categories</i>	<i>Definition</i>	<i>MIIT</i>	<i>Specialisation</i>
I	$B < -0.5$	<i>low</i>	<i>out</i>
II	$-0.5 \leq B < 0$	<i>high</i>	<i>out</i>
III	$0 \leq B \leq 0.5$	<i>high</i>	<i>in</i>
IV	$B > 0.5$	<i>low</i>	<i>in</i>

Table 6: *Industrial Specialisation in Ireland 1985-1990, by MIIT Categories*

<i>Category</i>	<i>No. of Industries</i>	<i>Empl. 1985</i>	<i>Prod. 1985 (IR£ bn)</i>	<i>Intra-EC Trade (IR£ bn)</i>	<i>Average Δ Empl.^a (%)</i>	<i>Average Δ Prod.^a (%)</i>	<i>Average Δ Trade^a (%)</i>
I	19	66,163	4.05	1.93	-7.7	14.3	25.3
II	14	43,627	2.00	2.72	12.5	34.3	85.8
III	19	40,405	2.65	2.56	11.2	41.9	94.4
IV	18	40,726	5.99	4.90	3.4	27.1	83.2
Total	70	190,921	14.69	12.10	3.3 ^b	27.2 ^b	41.1 ^b

^aReal changes in per cent of 1985 values, unweighted averages.

^bWeighted averages.

22. The reason why we resorted to the calculation of these ratios is that, by definition, any average of B over several product groups will yield invalid results. No summary B can thus be reported in Table 5. The ratios can be calculated from Table 6, columns (A) to (D).

advantage in terms of pure trade performance and production, but not in terms of employment. The sectors which improved their trade performance were the ones which were already highly trade-oriented and productive in 1985, whereas the trade performance of sectors with above-average employment levels generally worsened. Ireland seems to be specialising *out of* low-productivity labour-intensive industries and *into* highly productive and less labour-intensive sectors.²³

If we limit these calculations to the sectors exhibiting low MIIT (Categories I and IV) the ratios of sectors Ireland specialised *into* over sectors Ireland specialised *out of* are as follows: 2.54 (weighted by trade volumes), 1.48 (weighted by value of production) and 0.62 (weighted by employment). These ratios diverge even more strongly from unity than the ratios for total industry. Thus, in the sectors where MIIT was low and marginal *inter*-industry trade prevailed, the detected changes in output and employment were particularly marked.

This development is mirrored by the average changes in industry variables reported in Table 6. As expected, increases in employment and production are greater in the sectors which Ireland specialised *into* (Categories III and IV) than in the industries which Ireland was specialised *out of*.²⁴ However, in terms of employment and production effects, the improvement or deterioration of sectoral trade balances was less important than the distinction between high and low MIIT. On average, industries of Category II, whose sectoral trade balances deteriorated while displaying a high level of MIIT, performed better on all counts than the sectors contained in Category IV, which had experienced pronounced improvements of their sectoral balances. This result confirms our inferences from Table 4, namely that the distinction between (marginal) *intra*- and *inter*-industry trade is more relevant for industrial adjustment and specialisation in Ireland than the distinction between sectors with improved or deteriorated trade performance.

Some Selected Sectors

In order to illustrate the findings relating to Irish manufacturing as a whole, we outline the changes that have occurred in a selected set of industries. Table 7 lists some examples of sectors which showed pronounced

23. This result is in line with the findings of a recent comprehensive study of structural change in Irish industry for the 1987-1990 period by Gray (1993).

24. Note that a country can specialise out of an industry without necessarily suffering an absolute decline in employment (as happened, for instance, in Category II). Specialising out means that imports are expanding more (or contracting less) rapidly than exports. If domestic demand is growing strongly, this could compensate for bad trade performance and prevent a decrease in the sector's employment. An example of such an industry is Printing and Publishing (see Table 7).

changes in their trading performances. The first seven industries are sectors which strongly expanded their exports relative to competing imports, hence showing high levels of the B index. The bottom half of the table lists some industries at the opposite end of the performance scale, Ireland's relative trading position with the EC having markedly deteriorated in these sectors.

Table 7: *Some Industries Showing Pronounced Patterns of Adjustment, 1985-90*

NACE	Description	Em. ¹	Pr./Em. ¹	X/Pr. ¹	ΔEm. ¹	ΔM ¹	ΔX ¹	B-index
		1990	1990	1990	85-90	85-90	85-90	
			(IR£)	(%)	(%)	(%)	(%)	
<i>Industries with improved trade balance</i>								
330	Office, data process. machines	7,423	279,663	96.6	22.3	14.1	53.4	0.86
257	Pharmaceuticals	6,220	236,525	22.6	44.5	41.7	145.3	0.54
345	Radio/TV/sound equipment	3,625	229,334	66.0	24.9	218.3	917.8	0.49
421	Cocoa, sweets	3,235	93,335	53.3	1.8	6.8	61.0	0.83
417/8, 423	Misc. processed foodstuffs	2,540	358,541	43.1	22.0	9.6	213.7	0.91
259/60	Domest. chem., man-m. fibres	1,545	93,623	150.7 ²	2.7	13.6	23.6	0.62
424	Spirit distilling, compounding	547	425,928	50.6	-22.7	8.4	134.6	0.94
<i>Industries with deteriorated trade balance</i>								
473/4	Printing and publishing	11,040	47,984	9.5	11.4	54.6	19.2	-0.67
453/4	Clothing	10,944	24,689	38.7	-9.1	21.7	12.5	-0.57
413	Milk and dairy products	7,640	270,670	18.4	-7.9	66.2	-14.6	-1
419	Bread, biscuits, pastry	5,445	39,541	7.0	-28.3	53.9	-0.7	-1
247	Glass, glassware	3,941	39,037	29.5	-16.7	46.9	7.0	-0.76
351-3	Motor vehicles, parts	3,082	45,717	46.9	-0.7	89.8	24.6	-0.88
463	Carpentry, joinery	1,959	43,351	7.0	3.7	102.0	7.0	-0.90

All trade figures relate to intra-EC trade.

¹Em.: *Employment*; Pr.: *Production* (current prices); M: *Imports*; X: *Exports*.

²This result points to data imperfections due to factors such as statistical misclassification, differences in production and export pricing, time inconsistencies and re-export trade in certain industries.

This presentation serves to illustrate the broader-based findings reported above. In Table 7, the industries with strong trading performance all show high productivity levels and strong export orientation relative to the sectors with negative performance. Highly labour-intensive industries thus seem to have lost international competitiveness, while Ireland was specialising into more capital-intensive activities.

There seems to exist a positive relationship between trade performance

and employment *growth*,²⁵ since employment grew in most sectors with positive performance and shrank in most sectors with negative performance. However, this link does not seem to be as strong as could have been expected. The Distilling industry, for instance, more than doubled its exports, while competing imports grew only slightly. Yet, employment in this sector fell by over a fifth. Export growth does thus not necessarily imply employment growth, since increased exports can be achieved through productivity gains and an unchanged or even reduced workforce. In all sectors with improved trade balances listed in Table 7, the proportional changes in exports were several times higher than the corresponding increases in employment. On the other hand, the Printing and Publishing sector experienced a worsening of its sectoral trade balance, while employment in this industry increased by 11.4 per cent. Growth of domestic demand appears to have more than compensated losses of international performance.²⁶

In conclusion, the 1985-1990 period was, to a considerable extent, a time of continuing *intra*-industry adjustment for Irish manufacturing. IIT levels remained high and 43 per cent of intra-EC trade expansion (or contraction) was *intra*-industry. However, a significant and novel feature was the increase in *inter*-industry trade and specialisation. Ireland specialised into highly trade-oriented and highly productive sectors, with positive effects on the national accounts but less favourable consequences for the country's employment situation. This confirms the finding of the previous Section (Table 4) that IIT and MIIT are positively correlated with industrial performance. Sectors with high levels of IIT have fared particularly well in terms of relative growth in employment and production.²⁷

V SUMMARY AND CONCLUSIONS

The findings of this paper confirm the existence of considerable amounts of *intra*-industry trade (IIT) in Ireland's external trade, particularly in the

25. This does not contradict the finding of an apparent specialisation away from labour-intensive industries. It merely confirms the intuitively plausible hypothesis that, even in sectors with low labour requirements, increased exports tend to be accompanied by rising employment.

26. Another interesting sector is the Dairy industry. While in our table it appears among the industries having displayed a negative *intra*-EC trade performance between 1985 and 1990, it has nevertheless to be ranked among Ireland's internationally competitive sectors, considering the high level of output per head and the fact that dairy exports exceeded imports by a ratio of 9 to 1 in 1990. In this particular industry, specialising *out* thus signifies a relative, and maybe temporary, deterioration of the trade performance in a sector which Ireland had previously specialised *into* and in which it is still maintaining a strong position.

27. While care must be taken to avoid reading too much into two annual observations, the general thrust of the results is unlikely to be sensitive to the particular years chosen, as they are remarkably similar to the findings of NESC (1989), even though obtained for a different time period and based on a different methodology.

manufacturing sectors. This applies even at a very high level of statistical disaggregation. At the five-digit level of the SITC classification, where over 3,000 product groups were distinguished in 1990, we found that 38 per cent of total Irish trade and 44 per cent of trade in manufactured goods involved the simultaneous import and export of products within the same group. In 12 per cent of all product groups, the IIT index was even above 0.75.

In analysing the trend of IIT over time, further evidence was produced suggesting a reversal in the 1980s of the tendency towards ever-higher levels of IIT. This reversal was particularly pronounced for Irish intra-EC trade. While Irish industry kept increasing its trade orientation throughout the 1980s, this increase in trade flows led to proportionately more shifts *between* industries than *within* them. Indices of marginal intra-industry trade (MIIT) show that incremental trade flows in the late 1980s were predominantly *inter*-industry in character.

The analysis of recent Irish specialisation patterns, based on a NACE data set combining trade and production figures, indicates that the predominantly *inter*-industry change in Irish trade flows was accompanied by considerable adjustment in terms of production and employment. Ireland specialised *into* highly trade-oriented and highly productive sectors and *out* of relatively employment-intensive industries. This type of adjustment was consistent with the negative correlations found in our calculations between IIT and MIIT, on the one hand, and structural change on the other. The new measures of MIIT proved to be more relevant for the analysis of trade-induced adjustment and specialisation than the traditional comparison of IIT indices over time.

While inter-industry specialisation involved shifts out of labour-intensive sectors, a net increase in manufacturing employment was recorded for the 1985-1990 period, reflecting the fact that new jobs were created in the sectors Ireland was specialising *into*. However, since those sectors were generally characterised by high labour productivity, the net growth of employment (3 per cent) was considerably smaller than the real increases in production (27 per cent) and exports (33 per cent).

We found that, somewhat surprisingly, the proportions of IIT and MIIT have shown a stronger relationship with Irish industrial performance than sectoral changes in exports or trade balances. In other words, imports increase at similar rates to exports in successful Irish industries. This phenomenon is only partly supported by the predictions of modern trade theory. We hypothesise that (M)IIT shows such a strong link with industrial performance because, in many Irish industries, (M)IIT is generated by the processing of imported inputs and their subsequent export in modified form by multinational corporations. And, as is well known, multinationals have

played a key role in the expansion of certain manufacturing sectors in recent years.

As well as explaining the correlation between MIIT and industrial performance, the rise of foreign-owned industry in Ireland might also underlie a considerable part of the growth in Irish IIT indices up to the mid-1980s. In industries such as chemicals, pharmaceuticals and machinery, where Ireland was once almost exclusively an importer, multinational firms have led to a surge in exports, so that these sectors now exhibit comparatively high levels of IIT. These hypotheses on the role of multinational firms might constitute an interesting starting point for further analysis.

The above conclusions are subject to various limitations. Calculations relating trade flows to changes in the structure of Irish industry are based on an aggregated set of trade and production figures, covering only two years, 1985 and 1990. In due course it should be possible to extend this exercise on the Irish case to cover a longer time span. Moreover, the generalised causes underlying the re-emergence of inter-industry specialisation and the decline in IIT still remain to be explained. Our analysis captures only a small number of the many interacting domestic as well as international forces shaping Irish economic structure. The relationship between increasing trade liberalisation and changing trade patterns, as well as the causal nexus between trade patterns and industrial specialisation, are important subjects for further research.

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APPENDIX

Irish IIT 1961-1990, Total Trade, by SITC Divisions

SITC Section / Division	Description	Intra-industry Trade (Grubel-Lloyd Indices) ^a						Direction of Change	
		1961	1967	1972	1977	1985	1990	61-90	85-90
0	Food, live animals	0.24	0.16	0.17	0.20	0.24	0.22	-	-
00	Live animals	0.36	0.35	0.32	0.38	0.39	0.41	+	+
01	Meat, m. preparations	0.00	0.00	0.01	0.04	0.15	0.18	+	+
02	Dairy produce, eggs	0.02	0.03	0.02	0.09	0.08	0.12	+	+
03	Fish, f. preparations	0.28	0.37	0.28	0.25	0.23	0.32	+	+
04	Cereals, c. preparations	0.45	0.10	0.17	0.24	0.25	0.28	-	+
05	Vegetables, fruit	0.34	0.16	0.23	0.38	0.30	0.22	-	-
06	Sugar, s. prep., honey	0.52	0.16	0.34	0.38	0.57	0.46	-	-
07	Coffee, tea, cocoa	0.06	0.03	0.06	0.26	0.46	0.32	+	-
08	Animal feeding stuffs	0.17	0.26	0.19	0.31	0.33	0.29	+	-
09	Misc. edible products	0.55	0.62	0.67	0.26	0.15	0.15	-	=
1	Drink, tobacco	0.12	0.19	0.18	0.39	0.28	0.34	+	+
11	Beverages	0.15	0.20	0.27	0.46	0.23	0.30	+	+
12	Tobacco, etc.	0.04	0.17	0.04	0.30	0.47	0.63	+	+
2	Raw materials	0.27	0.17	0.15	0.16	0.14	0.15	-	+
21	Raw hides, skins, fur	0.59	0.32	0.49	0.39	0.08	0.07	-	-
22	Oilseeds	0.00	0.00	0.00	0.03	0.07	0.14	+	+
23	Crude rubber	0.02	0.01	0.02	0.05	0.07	0.14	+	+
24	Cork, wood	0.05	0.01	0.00	0.12	0.31	0.37	+	+
25	Pulp, waste paper	0.01	0.06	0.07	0.13	0.03	0.10	+	+
26	Textile fibres, wastes	0.41	0.29	0.30	0.19	0.11	0.15	-	+
27	Crude fertilisers, minerals	0.13	0.17	0.09	0.20	0.30	0.35	+	+
28	Metal ores, scrap	0.02	0.04	0.03	0.03	0.04	0.02	=	-
29	Crude animal, vegetable materials	0.40	0.31	0.20	0.24	0.24	0.28	-	+
3	Mineral fuels	0.14	0.16	0.10	0.05	0.17	0.14	=	-
32	Coal, coke, briquettes	0.13	0.04	0.06	0.09	0.02	0.03	-	+
33	Petroleum, etc.	0.14	0.18	0.10	0.05	0.20	0.16	+	-
34	Gas, natural and manuf.	0.00	0.89	0.01	0.01	0.13	0.35	+	+

(Appendix 1 cont.)

SITC Section / Division	Description	Intra-industry Trade (Grubel-Lloyd Indices) ^a						Direction of Change	
		1961	1967	1972	1977	1985	1990	61-90	85-90
4	Animal/vegetable oils	0.32	0.26	0.30	0.28	0.14	0.13	-	-
41	Animal oils, fats	0.36	0.43	0.71	0.41	0.39	0.32	-	-
42	Fixed vegetable oils, fats	0.36	0.20	0.04	0.19	0.03	0.04	-	+
43	Processed vegetable oils, fats, waxes	0.01	0.19	0.27	0.22	0.12	0.12	+	=
5	Chemicals	0.08	0.17	0.40	0.40	0.37	0.37	+	=
51	Organic chemicals	0.06	0.14	0.74	0.37	0.27	0.28	+	+
52	Inorganic chemicals	0.26	0.30	0.14	0.09	0.24	0.23		
53	Dying, tanning, colouring materials	0.04	0.09	0.15	0.30	0.54	0.41	+	-
54	Medical, pharmac. prod.	0.14	0.33	0.30	0.58	0.60	0.55	+	-
55	Oils, perfume, cleansing p.	0.16	0.30	0.53	0.41	0.56	0.44	+	-
56	Manufactured fertilisers	0.01	0.00	0.25	0.13	0.16	0.20	+	+
57	Plastics in primary forms	0.00	0.00	0.00	0.60	0.72	0.16	+	-
58	Resins, plastic materials, cellulose	0.04	0.00	0.26	0.41	0.33	0.53	+	+
59	Chemical materials	0.17	0.27	0.32	0.41	0.41	0.32	+	-
6	Manufactures, classified by materials	0.35	0.34	0.38	0.49	0.40	0.37	+	-
61	Leather, etc.	0.67	0.36	0.38	0.58	0.68	0.20	-	-
62	Rubber manufactures	0.20	0.30	0.55	0.66	0.57	0.43	+	-
63	Wood, cork manufactures (except furniture)	0.33	0.34	0.28	0.53	0.42	0.31	-	-
64	Paper, etc.	0.36	0.35	0.36	0.34	0.22	0.28	-	+
65	Textiles, yarn, fabrics, etc.	0.47	0.39	0.48	0.60	0.47	0.39	-	-
66	Non-metallic mineral manufactures	0.37	0.41	0.38	0.37	0.41	0.46	+	+
67	Iron, steel	0.15	0.07	0.19	0.19	0.24	0.21	+	-
68	Non-ferrous materials	0.18	0.40	0.21	0.34	0.17	0.21	+	+
69	Steel manufactures	0.17	0.35	0.33	0.54	0.50	0.53	+	+
7	Machinery, transport equipment	0.13	0.17	0.24	0.48	0.51	0.48	+	-
71	Power gen. machinery					0.47	0.72	n.a.	+
72	Machinery specialised for particular industries	0.18 ^b	0.11 ^b	0.18 ^b	0.48 ^b	0.41	0.39	n.a.	-
73	Metal working mach.					0.43	0.37	n.a.	-
74	Gen. ind. machin., parts					0.53	0.45	n.a.	-
75	Office, data processing					0.53	0.53	n.a.	=
76	Telecom, sound recording					0.69	0.57	n.a.	-
77	Electrical mach., parts	0.22	0.46	0.42	0.69	0.59	0.50	+	-
78	Road vehicles, parts	0.02	0.01	0.18	0.26	0.26	0.18	+	-
79	Other transport equipment					0.62	0.33	n.a.	-
8	Miscellaneous manufactures	0.40	0.54	0.59	0.61	0.53	0.47	+	-
81	Sanitary, plumbing, heating, lighting	0.19	0.16	0.29	0.58	0.46	0.34	+	-
82	Furniture, parts	0.68	0.58	0.38	0.61	0.67	0.70	+	+

(Appendix 1 cont.)

SITC Section / Division	Description	Intra-industry Trade (Grubel-Lloyd Indices) ^a						Direction of Change	
		1961	1967	1972	1977	1985	1990	61-90	85-90
83	Travel goods, bags, etc.	0.98	0.89	0.75	0.36	0.68	0.61	-	-
84	Clothing	0.37	0.51	0.71	0.80	0.60	0.59	+	-
85	Footwear	0.40	0.39	0.61	0.86	0.34	0.26	-	-
87	Prof., scientif. apparatus		0.77	0.65	0.32	0.48	0.54	n.a.	+
88	Photographic, optical, watches, clocks					0.38	0.38	n.a.	=
89	Other manuf. articles	0.51	0.53	0.49	0.57	0.55	0.39	-	-
9	Commodities n.e.s.	0.82	0.78	0.75	0.62	0.53	0.43	-	-
0-9	All Products	0.28	0.26	0.32	0.38	0.40	0.38	+	-
5-8	Manufactures	0.25	0.29	0.38	0.49	0.47	0.44	+	-

^acalculated from four-digit (1961, 1967) and from five-digit (1972, 1977, 1985, 1990) OECD data.^bcurrent SITC Sections 71-76 were amalgamated in one two-digit group previous to 1978.