Adjustment to the European single market: inferences from intra-industry trade patterns

Marius Brülhart
Department of Economics, University of Manchester, Manchester, UK and
Robert J.R. Elliott
Department of Economics, Manchester Metropolitan University, Manchester, UK

1. Introduction

During the negotiation and implementation stages of the "1992" single market programme, prominent economists anticipated that the pressures for industrial re-structuring among EU[1] countries would be considerably stronger than during previous episodes of European integration. Krugman (1987, p. 364) put it as follows: "The question now is whether the further expansion of trade in progress will be equally easy to cope with. The unfortunate answer is, probably not". Greenaway and Hine (1991, p. 620) suggested that "specialisation in Europe may have entered a new phase, and that this could pose greater problems for adjustment".

These expectations were based on two main developments, both of which were connected to the phenomenon of intra-industry trade (IIT), the two-way exchange of goods with similar production requirements. First, the discovery of high and growing IIT levels in the 1970s had produced a wave of new thinking by trade theorists, which shifted the emphasis of the models away from country-specific trade determinants, generically termed "comparative advantage", towards industry-specific factors such as increasing returns and external economies. Models of the "new trade theory", although explaining the existence of IIT, generally predicted that a fall in trade barriers would promote concentration and re-location of industries near their largest markets[2]. Second, a popular, albeit loosely defined, hypothesis has emerged in the literature, according to which high levels of IIT were indicative of relatively low trade-induced adjustment costs[3]. Some studies in the late 1980s found evidence of stagnating IIT growth, and therefore concluded that adjustment pressures were becoming more severe. The rapid growth of trade flows among EU countries (Table I) was therefore expected to result in growing factor-market friction

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Table I.
The post-war boom in intra-EU trade, 1961-1977, imports and exports

Country	1961			1967			1972			1977		
	Imports	Exports	Percentage EU	Imports	Exports	Percentage EU	Imports	Exports	Percentage EU	Imports	Exports	Percentage EU
Belgium-Luxembourg	20.3	20.1	61.4	23.3	25.3	67.8	31	33.4	74.3	34.3	34	70.1
Denmark	15.5	12.7	55.1	12.3	9.8	47.9	11.1	8.9	46.4	13.9	9.6	47.1
France	3.8	4.7	40.6	5.4	5.2	51.4	8.0	8.0	59.7	9.5	8.9	53.6
Germany	5.5	6.6	41.8	6.7	8.4	47.6	8.7	9.1	51.1	10.0	11.0	49.4
Greece	7.6	1.9	47.9	7.6	2.7	53.1	8.7	3.1	55.6	9.8	4.3	45.9
Ireland	24.5	20.9	72.1	22.8	19.8	72.8	25.6	21.4	73.8	36.2	33.1	72.9
Italy	4.5	4.0	39.7	5.1	5.4	45.4	7.2	7.4	52.8	8.8	9.4	48.0
The Netherlands	22.7	20.5	59.8	21.3	20.6	64.7	22.1	26.5	68.7	22.5	27.8	64.3
Portugal	13.8	4.8	50.6	12.3	6.6	49.2	13.3	7.5	50.3	14.7	6.7	50.2
Spain	2.9	3.1	44.4	5.3	2.1	46.8	5.3	3.4	48	5	4.1	51.9
United Kingdom	3.8	3.6	24.6	4.6	3.7	29.1	5.7	5	33.1	10.2	2.9	40.3
European Union	6.2	6.2	41.8	7.2	7.1	48.3	9.4	9.4	54.4	11.5	11.6	52.1

Country	1985			1990			1992			1995		
	Imports	Exports	Percentage EU	Imports	Exports	Percentage EU	Imports	Exports	Percentage EU	Imports	Exports	Percentage EU
Belgium-Luxembourg	46.5	44.7	74.4	43.6	44.0	74.4	39.6	39.8	74.4	36.8	41.5	70.5
Denmark	15.1	12.2	46.3	12.5	13.2	50.1	12.5	14.3	51.9	13.0	14.7	51.5
France	11.4	9.9	54.8	11.6	11.0	61.2	10.7	10.9	61.1	10.6	10.6	59.3
Germany	12.9	14.6	50.3	11.8	14.4	53.4	12.3	12.8	55.0	11.6	12.8	54.4
Greece	12.2	6.1	50.0	15.4	6.3	64.2	15.4	6.7	63.6	17.7	6.7	67.0
Ireland	33.9	36.6	67.6	30.7	39.7	71.0	29.2	41.2	70.8	26.8	42.6	61.5
Italy	10.0	8.9	48.2	9.4	9.0	58.0	9.0	8.4	58.7	9.4	10.3	54.1
The Netherlands	29.4	39.1	66.3	27.9	33.3	67.6	26.6	31.0	67.5	26.1	30.5	66.1
Portugal	16.9	17.2	52.8	29.2	20.03	70.9	26.6	16.5	74.3	27.0	18.7	73.4
Spain	6.6	7.6	43.5	10.6	7.8	63.2	10.5	7.9	64.7	12.3	11.7	63.8
United Kingdom	11.6	10.7	48.9	12.0	10	49.8	11	10.2	52.7	12.6	11.8	53.2
European Union	13.6	13.8	53.8	13.5	13.8	60.1	13	12.8	60.2	13.3	14	58.5

Notes: All goods, current market prices, in percentage of GDP; percentage EU: proportion of intra-EU trade in total trade
Source: EU Commission

which in turn could fuel protectionist sentiment and undermine the integration project.

This paper explores the validity of the second reason for the anticipation of growing adjustment pains in Europe[4]. Greenaway (1987) was first to find that "IIT may have declined in the EU countries during the late 1970s". These suspicions were confirmed by Globerman and Dean (1990), Greenaway and Hine (1991) and Mucchielli (1988), which all observed IIT trend reversals for several OECD countries based on relatively small data sets. No comprehensive and recent evidence, however, has as yet been produced to verify these suggestions.

Even if we did find confirmation of a generalised reversal in post-Second World War IIT trends, it might be misleading to draw direct inferences from such a discovery on adjustment costs. The traditional interpretation of IIT has been challenged recently by work on the measurement of changes in IIT, now commonly referred to as marginal IIT (MIIT). The traditional Grubel-Lloyd (GL) index of IIT is a static measure, in the sense that it describes trade patterns for one time period. Hamilton and Kniest (1991) have shown that the observation of a high proportion of IIT does not justify a priori any prediction of the likely pattern of change in trade flows. Industrial adjustment, however, is a dynamic concept, relating to the re-allocation of resources over time. Even an observed increase in static IIT levels between two periods could "hide" a very uneven change in trade flows, attendant with inter- rather than intra-industry adjustment, and with asymmetric rather than symmetric changes. Hence, it might be misleading to infer from rises/falls in IIT that trade expansion entails relatively low/high adjustment costs. We therefore complement the analysis of traditional IIT measures by a survey of MIIT patterns in the EU.

The paper is organised as follows. In section two, we explore the theoretical link between IIT and adjustment costs. Section three presents the relevant measurements. A comprehensive and statistically disaggregated analysis of IIT and MIIT patterns among the countries of the EU is provided in section four. This survey covers the period from 1961-1992, the latter being the deadline for the implementation of the single market as well as the last year for which customs data on intra-EU trade flows are available. In section five, we report results of some exercises which examine explicitly the relationship between MIIT and structural change. Section six concludes by summarising and commenting on our main findings.

2. Intra-industry trade and adjustment

Some theoretical aspects

Definition of adjustment costs. Adjustment costs arise from temporary inefficiencies when markets fail to clear instantaneously in response to changes in demand or supply conditions. The type of adjustment this study examines is the welfare loss arising from trade-induced factor switching costs or unemployment.

Two important clarifications need to complement this definition. First, with respect to trade-induced unemployment, economic theory suggests that this is strictly temporary in nature. While the duration of the adjustment process cannot be determined a priori, the underlying expectation is that market forces tend towards full employment. The discussion of adjustment costs, therefore, does not contribute to the theory of permanent unemployment or the non-inflationary rate of unemployment. In practice, market rigidities combined with hysteresis effects may extend the duration of trade-induced unemployment. Hence, trade-induced unemployment could conceivably be long-term. The theory of adjustment, however, is firmly rooted in neo-classical thinking, where the market-based price mechanism is relentlessly driving the economy towards full employment[5].

Second, we need to explain how trade can be termed a cause for adjustment pressures. The size and composition of trade flows are not exogenous. Rather, they result from underlying factor endowments, consumer preferences, technologies, income levels and policy regimes of the trading countries. When we talk of "trade-induced" changes, we therefore implicitly allude to ulterior causes which are manifested in the structure of trade flows. This conception is easiest to grasp in a setting of trade liberalisation. In this case, any change that can be tracked to the change in the trade-policy regime is defined as "trade-induced".

Adjustment affects all production factors. Economists have devoted their attention mainly to adjustment in the labour market. The most accessible theoretical framework for a discussion of adjustment issues is the specific-factors model, which has been expounded concisely by Neary (1985). This model assumes a small open economy which produces and consumes an exportable and an importable good facing perfect competition in all markets and given world prices. Labour can move between the two sectors (but not between countries), all other factors are fixed (the "specific" factors), and there are diminishing returns to factor inputs. Imagine an export boom, which is equivalent to a fall in the relative demand for importables, triggered by some measure of trade liberalisation. If adjustment were perfectly smooth, the economy would instantly attain a new equilibrium where the unique economy-wide wage in terms of the exportable has fallen, and some workers have switched employment from the contracting import sector to the expanding export sector.

However, Neary (1985) has shown two potential sources of adjustment costs:

(1) imperfect substitutability of labour between the two sectors; or

(2) nominal wage rigidity.

In the first scenario, workers are temporarily tied to their sectors and cannot switch jobs without costs, but wages are perfectly flexible. Labour immobility may arise for various reasons, such as sector-specific skills, geographical immobility or firm loyalty. If, following an export boom, workers in the import sector are not able or willing to switch to the export sector, relative wages in the

import sector have to fall. Over time, as more and more workers are lured into producing exportables by higher wages, the economy is likely to move to the long-run equilibrium, but in the meantime, adjustment costs will become manifest through intersectoral wage differentials. Wage differentials *per se* are not an adjustment cost. They are, however, indicative of the need for resources to be used up in the transfer of labour from contracting to expanding activities. Such "adjustment services", comprising job searching, re-training and relocation, represent a cost to workers from switching occupations, and they make temporary wage differentials a necessary condition for factor-market adjustment (Baldwin *et al.*, 1980)[6].

In the second scenario, the wage rate is sticky in a downward direction and driven by the expanding sector. In this situation, the initial reaction to the export boom is a rise of the overall wage level, dictated by the higher demand for labour in the exportables sector. Since the wage level is above the market-clearing level, total demand for labour falls short of total supply, and a number of workers in the importables sector are left without jobs. Again, if market forces are allowed to operate over time, the unemployed can bargain down the wage rate, but in the meantime, adjustment costs will take the shape of involuntary unemployment.

The hypothesis of IIT and smooth adjustment. Numerous authors postulate that high or growing IIT implies low adjustment costs[7]. Yet, this hypothesis has not been defined rigorously. It is, however, possible to formulate the IIT-adjustment hypothesis in terms of the specific-factors model outlined above. According to the IIT literature, adjustment is smoother in terms of temporary wage disparities and unemployment if the expanding and contracting activities are contained within the same industry, than if they represent two different industries (Greenaway and Milner, 1986). This hypothesis implicitly makes at least one of the following two assumptions:

(1) the mobility of labour is greater within industries than between industries, *ceteris paribus*; or

(2) relative wages are more flexible within industries than between industries, *ceteris paribus*.

The first justification for the expectation of smooth intra-industry adjustment has great intuitive appeal. If we define IIT as the exchange of goods with similar production requirements, it is implied that labour requirements are more similar within than between industries. If the skills acquired by the workers and managers of a contracting firm can be applied without much re-training in an expanding firm of the same industry, then labour mobility may well be higher within industries than between them. Where IIT reflects intra-firm trade, workers can simply be transferred from one department to another. The problem is that we cannot assume a priori that the statistical product categories underlying empirical calculations of IIT actually correspond to this definition of industries. Some recent studies, for instance, suggest that a considerable proportion of reported IIT consists of exchanges of low quality products for

high-quality varieties of the same industries[8]. This phenomenon, termed vertical IIT (VIIT), casts doubt over the homogeneity of statistical product groups.

The second hypothesis seems less plausible. The main impediments to wage flexibility are minimum-wage legislation and contractual wage agreements between labour market institutions. Since such constraints generally apply at the level of the entire economy or of individual industries, they might actually be expected to allow greater wage flexibility between industries than within them. If temporary wage inflexibility through industry-wide centralised bargaining is the dominant cause of adjustment problems, then adjustment costs would be greater when trade shocks are intra-industry than when trade alters the relative positions between industries.

In conclusion, the homogeneity and adaptability of industries, as defined in trade statistics, can only be determined through empirical investigation. Particular attention should be paid to the conceptual difference between:

(1) the intra- and inter-industry similarity of products in terms of their production requirements; and

(2) the intra- and inter-industry flexibility of factor prices.

Most attention has so far been paid to the former aspect. However, it seems quite plausible that adjustment costs caused by inflexible relative wages – which have more serious implications in the context of traditional welfare analysis[9] – are more pronounced within industries than between them, since wage agreements are mostly made at the level of individual industries. Hence, the adjustment-smoothing effect of relative physical homogeneity of industries could be offset to some extent by relatively greater intra-industry wage rigidity. The traditional analysis of intra- and inter-industry differences in factor ratios should therefore be complemented by investigations of price adjustments.

Some indicative evidence on the link between IIT and adjustment is given in section five, but this brief discussion of the relevant issues highlights the importance of a more refined empirical examination, which would necessitate richer statistical information, ideally a firm-level panel of labour flows and wages.

3. Measuring intra-industry trade with relevance for adjustment

Traditional IIT analysis

The empirical literature of IIT uses almost exclusively an index proposed by Grubel and Lloyd (1975), which is given by:

$$GL_i = 1 - \frac{|X_i - M_i|}{(X_i + M_i)} \tag{1}$$

where X_i and M_i exports and imports of a particular industry in year t.

The statistical properties of this index have been analysed thoroughly (see Greenaway and Milner, 1986). Application of this measure involves some degree

of arbitrariness in the definition of an industry (the "categorical aggregation problem"). One way of minimising the categorical aggregation problem is to apply a very narrow industry definition, by resorting to highly disaggregated trade data. This maximises the likelihood that factor substitutability is greater within than between industries, as stipulated by the adjustment hypothesis. The results reported in section three are therefore calculated at the four and five-digit levels of the SITC classification, where up to 3,118 "industries" are distinguished. A second much-debated issue in IIT measurement lies in the choice of whether or not to adjust industry-level indices for aggregate trade imbalance. We have chosen to report unadjusted GL indices, based on the view that the case for adjusting these measures is weak both on economic and on statistical grounds (see Kol and Mennes, 1986).

Marginal intra-industry trade

Even though it is computed from trade flows, the GL index is a static measure in the sense that it captures the degree of sectoral trade overlap in one time period (usually a year). In so far as exports correlate with production, the GL index therefore contains information on the degree of intra-industry specialisation, which is equivalent to the degree of symmetry in industry structures across countries, in one particular period of time. Many writers have taken an intuitive leap from cross-country (a)symmetry of industry structures at a particular time to cross-country (a)symmetry of changes in these industry structures[10]. No formal case has yet been made to underpin this line of reasoning. Furthermore, empirical evidence suggests that country-specific determinants of cyclical fluctuations and structural change often dominate industry-specific factors, even among the highly integrated countries of the European Union[11]. Hence, the degree of cross-country symmetry of industry composition is a weak predictor of cross-country symmetry in changes of this composition. The a priori case for a direct inference from IIT to balanced change in trade, and from static (a)symmetry to dynamic (a)symmetry, is therefore weak.

Changes over time in the GL index were shown by Hamilton and Kniest (1991) not to be an adequate measure of the structure of trade changes. The juxtaposition of corresponding GL indices for different time periods conveys some information on the structure of trade in each of these time periods, but it does not allow conclusions on the structure of the change in trade flows. An analysis of trade changes can be conducted by reference to the concept of marginal IIT (MIIT), of which Hamilton and Kniest (1991) proposed a first index. This index was shown to be flawed by Greenaway *et al.* (1994b)[12]. Building on the suggestions of the latter analysis, some simple measures of MIIT were developed by Brülhart (1994).

The Brülhart (1994) A index is a transposition of the GL index to trade changes:

$$MIIT = A = 1 - \frac{|(X_t - X_{t-n}) - (M_t - M_{t-n})|}{|X_t - X_{t-n}| + |M_t - M_{t-n}|}, \quad (2)$$

where n stands for the number of years constituting the relevant adjustment period[13]. This is also written as:

$$A = 1 - \frac{|\Delta X - \Delta M|}{|\Delta X| + |\Delta M|}. \quad (3)$$

The A index, like the GL index, varies between 0 and 1, where 0 indicates marginal trade in the particular industry to be completely of the inter-industry type, and 1 represents marginal trade to be entirely of the intra-industry type.

Where a country's exports and imports in a particular industry grow or shrink at a similar absolute rate (high A), trade-induced adjustment is likely to occur at the intra-industry level, while the overall performance of the industry is determined by factors which tend to affect all countries symmetrically, such as global demand or technology changes. The A index therefore captures the degree of cross-country symmetry in trade changes. Conversely, where a country's exports and imports in a particular industry show diverging trends (low A), both the trade-induced asymmetrical forces for geographical inter-industry adjustment and the exogenous factors determining the fate of the industry across all countries are likely to be relevant.

The A index (like the GL index) can provide results which are relevant for multilateral studies by relating to overall adjustment pressures. Yet, it does not contain any information as to the relative trade performance of industries in particular countries. In terms of net exports, inter-industry adjustment can reflect trade specialisation into or out of particular industries. Hence, Brülhart (1994) suggested the following index:

$$B = \frac{\Delta X - \Delta M}{|\Delta X| + |\Delta M|}, \quad (4)$$

where

$$|B| = 1 - A. \quad (5)$$

This coefficient can take values ranging between –1 and 1. It is two-dimensional, containing information about both the proportion of MIIT and country-specific sectoral performance. First, the closer B is to zero, the higher is MIIT, whereas at both –1 and 1 it represents marginal trade to be entirely of the inter-industry type. Second, sectoral performance is defined as the change in exports and imports in relation to each other. When $B > 0$, ΔX was $> \Delta M$. The opposite holds for $B < 0$.

Measures of MIIT are designed to complement the GL index in analyses of trade change and adjustment. A priori reasoning suggests that MIIT relates more directly to structural adjustment than IIT, since high MIIT entails relatively low factor re-allocation between industries. This is the rationale behind the calculation of MIIT indices for the EU, reported in the following section. However, the link between MIIT and adjustment ultimately needs empirical verification. Some preliminary results of this kind are reported in section five.

4. A survey of intra-industry trade in the European Union

Post-Second World War economic integration in the EU contributed to an unprecedented growth of intra-European trade flows. Table I shows that, between 1961 and 1995, intra-EU trade grew from 12.4 per cent to 27.3 per cent of GDP, and the share of intra-EU flows in total trade rose from 41.8 per cent to 58.5 per cent. The relative expansion of intra-EU trade is particularly pronounced in the 1985-92 period, which coincides with the negotiation and implementation of the single market. These general patterns apply with remarkable consistency to the individual EU countries.

It is therefore not surprising, that economists generally perceive integration-induced trade effects to be one of the main determinants of industrial adjustment in the EU. This is the context within which the IIT-adjustment hypothesis rose to its prominence.

This section provides a descriptive survey of IIT among 12 EU countries[14]. Unadjusted Grubel-Lloyd (GL) indices were calculated from SITC four-digit (1961, 1967) and five-digit (1972, 1977, 1985, 1988, 1990, 1992) trade data supplied by the OECD[15]. We chose such narrow industry definitions in order to minimise the "categorical aggregation problem" arising from intra-industry product heterogeneity. The combination of these results provides us with the most comprehensive and most disaggregated set of IIT indices compiled for the EU to date.

IIT by country

Figure 1 and Table II report GL indices for intra-EU trade in manufactured goods, which is the economic sector which generally exhibits the highest IIT levels.

Our results confirm a certain stagnation of intra-EU IIT between 1977 and 1990, but average IIT increased in ten of our 11 sample countries between 1990 and 1992. This result indicates that it is still premature to diagnose a generalised turnaround in the upward trend of IIT. Based on the standard interpretation of IIT, it would also suggest that, against early predictions, the implementation of the single market did not entail an increase in inter-industry adjustment.

The increase of IIT in the early 1990s applies to all EU countries, with the exception of Greece. Figure 1 also shows that IIT averages of the 11 EU countries have converged over the 30 years covered by the analysis, in the sense

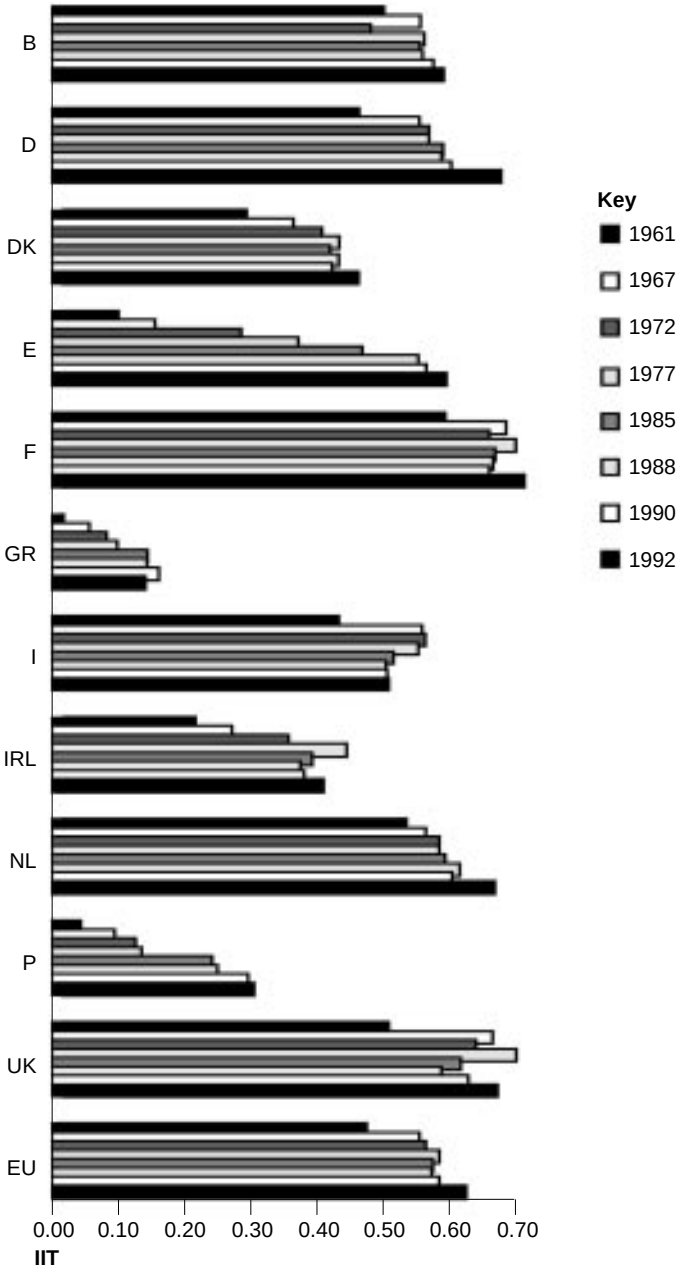

Figure 1.
Intra-industry trade within the EU by country, 1961-1992 (unadjusted Grubel-Lloyd indices, manufactured goods)

that IIT increased relatively more in countries with low initial IIT. To the extent that exports reflect production, this indicates a general trend of industrial dispersion, and also runs counter to fears of increased geographical concentration of industries subsequent to economic integration.

Country	1961	1967	1972	1977	1985	1988	1990	1992
Belgium-Luxembourg	0.51	0.56	0.49	0.57	0.56	0.57	0.58	0.60
Denmark	0.30	0.37	0.41	0.44	0.42	0.44	0.43	0.47
France	0.60	0.69	0.67	0.71	0.68	0.67	0.67	0.72
Germany	0.47	0.56	0.57	0.57	0.60	0.59	0.61	0.68
Greece	0.02	0.06	0.08	0.10	0.15	0.15	0.16	0.15
Ireland	0.22	0.28	0.36	0.45	0.40	0.38	0.38	0.41
Italy	0.44	0.56	0.57	0.56	0.52	0.51	0.51	0.51
The Netherlands	0.54	0.57	0.59	0.59	0.60	0.62	0.61	0.67
Portugal	0.04	0.10	0.13	0.14	0.24	0.25	0.30	0.31
Spain	0.10	0.16	0.29	0.38	0.47	0.56	0.57	0.60
United Kingdom	0.51	0.67	0.65	0.71	0.62	0.59	0.64	0.68
EU[a]	0.48	0.56	0.57	0.59	0.58	0.58	0.59	0.64

Notes: Unadjusted Grubel-Lloyd indices, calculated from SITC five-digit statistics from OECD, for SITC sections 5-8; [a]average of 11 countries, weighted by values of intra-EU manufactured imports and exports

Table II.
Intra-industry trade within the EU by country, 1961-1992

There is one empirical caveat which could qualify the validity of our strong finding that average IIT stagnated in the 1980s and rose in the latest sub-period. The SITC classification was revised and refined twice, in 1978 and in 1988. Thus, IIT could have been biased downwards by narrowed-down industry definitions[16]. This issue could only be conclusively resolved either by re-arranging all underlying trade data into a consistent classification over time and re-calculating IIT indices, or by computing IIT indices for the years immediately before and immediately after the SITC revisions, so as to arrive at an estimate of the impact of re-classification on measured IIT levels. However, IIT rose consistently between 1988 and 1992, when the industry classification remained unaltered. This suggests that the reversal of IIT trend, perceived by various authors in the 1980s, might have been influenced by changes in statistical collation and that, even if the IIT stagnation had been a real phenomenon, it did not extend into the 1988-92 period.

IIT by industry

In Figure 2, we decompose IIT averages by SITC one-digit sections, in order to examine whether the perceived levels and trends in aggregate IIT where driven by specific economic sectors.

We find considerable differences in IIT developments among SITC sections. IIT has increased between 1990 and 1992 in each of the four industrial SITC sections (5-8). However, a trend reversal in the 1980s is evident in SITC Sections 5 (Chemicals) and 6 (Manufactures classified by materials). SITC section 6 is more important than section 5 in terms of trade volumes and comprises many traditional, resource-based and relatively declining industries. On the other hand, SITC section 7 (Machinery and transport equipment), which consists

mainly of knowledge-based expanding industries, displays the most strongly and consistently rising levels of intra-EU IIT. The results of Figure 2, therefore, indicate that some of the observed IIT trend changes were driven by an unevenly-spread relative contraction of resource-based industries, while expanding "modern" sectors still display growing IIT. The growth of booming sectors thus seems to be more balanced across the countries of the EU than the relative contraction of declining industries[17]. Nevertheless, the IIT increase in our last sample period, observed for all four manufacturing sections, could suggest that, rather than concentrating geographically, most traded

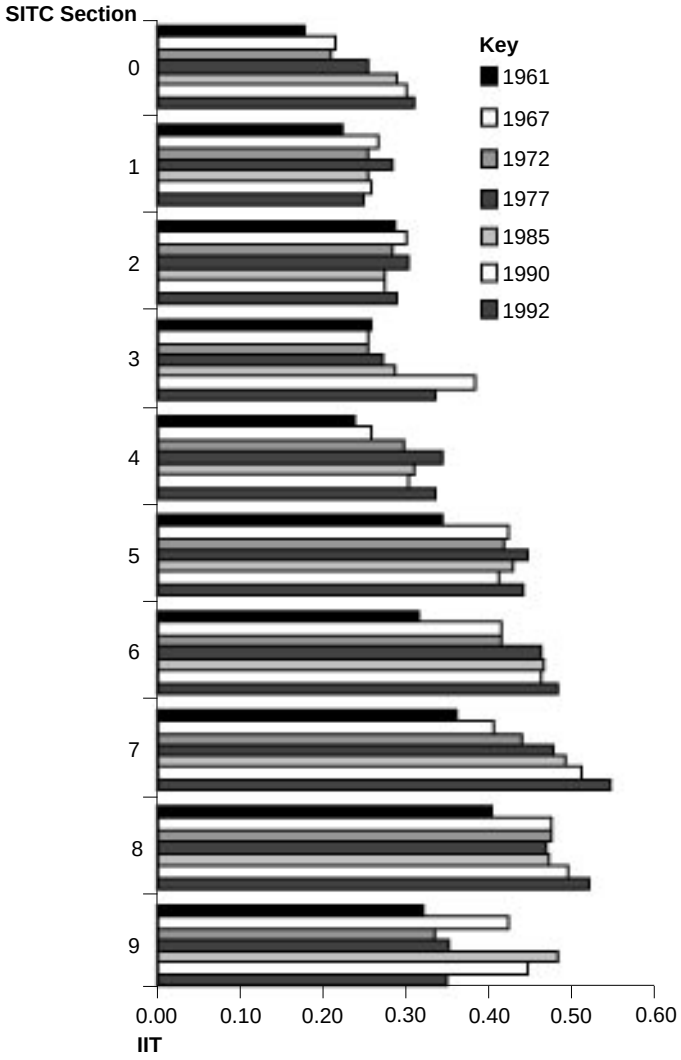

Figure 2.
Intra-industry trade within the EU by industry, 1961-1990 (unadjusted GL indices, weighted across industries, unweighted across countries)

manufacturing activities have become more dispersed during implementation of the single market.

Figure 3 confirms that IIT levels are still considerably higher for intra-EU trade than for trade between the EU and non-EU countries. This pattern holds consistently across SITC sections. The gap between intra-EU and extra-EU IIT is generally larger in sections 0 to 4 than in the manufacturing industries. It can be hypothesised that the EU's Common Agricultural Policy has counterbalanced pressures for inter-sectoral adjustment among the member states and thereby induced a relatively high proportion of IIT in exchanges of primary products among EU countries.

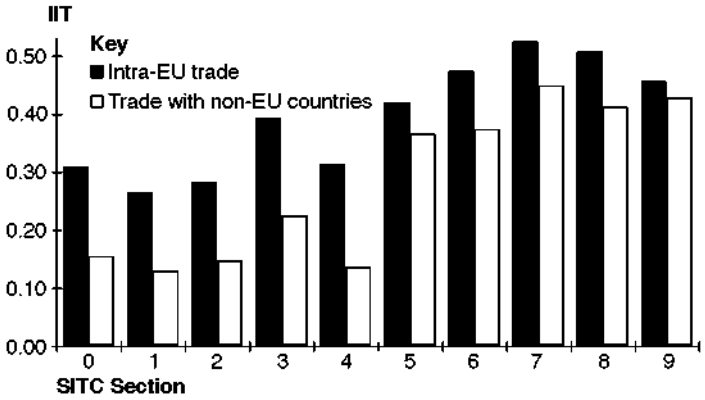

Figure 3. Intra-industry trade with EU and non-EU countries by industry, 1990 (unadjusted GL indices, weighted across industries, unweighted across countries)

MIIT by country

As argued in section three, changes over time in GL indices do not convey meaningful information on the symmetry of underlying trade changes. We therefore complement the calculation of GL coefficients with Table III, where we report the first comprehensive set of MIIT results computed to date, using the *A* index of Brülhart (1994). Seeking to avoid distortions from industry re-classifications while identifying periods of similar duration, we have chosen the time intervals 1979-1983, 1983-1987 and 1988-1992. The analysis was again conducted at the disaggregated SITC five-digit level of intra-EU trade data.

We note first that average MIIT was highest in the second of our three sub-periods and higher in the last sub-period than in the first one. This result broadly supports our inference from the IIT indices that trade-induced adjustment pressures have not increased in the run-up to the single market deadline.

While average IIT rose significantly between 1988 and 1992, MIIT in that interval was generally lower than in the mid-1980s. Thus, our data confirm that a rise in IIT levels actually corresponds to a change of trade flows which is necessarily inter-industry in nature. However, it should be noted that average

Country	All product groups (SITC 0-9)			Manufacturers (SITC 5-8)		
	1979-1983	1983-1987	1988-1992	1979-1983	1983-1987	1988-1992
Belgium-Luxembourg	0.39	0.40	0.35	0.35	0.41	0.36
Denmark	0.24	0.26	0.24	0.23	0.30	0.27
France	0.28	0.39	0.43	0.32	0.44	0.48
Germany	0.41	0.44	0.36	0.43	0.47	0.39
Greece	0.10	0.11	0.08	0.12	0.13	0.08
Ireland	0.17	0.19	0.30	0.21	0.22	0.30
Italy	0.22	0.36	0.24	0.27	0.40	0.27
The Netherlands	0.26	0.37	0.36	0.33	0.46	0.40
Portugal	0.20	0.19	0.17	0.20	0.20	0.18
Spain	0.24	0.41	0.34	0.28	0.46	0.38
United Kingdom	0.20	0.43	0.24	0.28	0.51	0.24
EU[b]	0.29	0.37	0.33	0.32	0.41	0.36

Table III. Marginal intra-industry trade in the EU by country, 1979-1992 (*A* indices[a])

Notes: [a]Calculated from SITC five-digit statistics from OECD (1979, 1983, 1987) and Eurostat (1988, 1992), converted into national currencies using year-average market exchange rates. End-year values deflated using national GDP deflators (on data transformation for MIIT calculations, see Greenaway *et al.*, 1994b); [b]averages weighted by values of end-year intra-EU manufactured imports and exports

MIIT was still higher in 1988-1992 than in 1979-1983, and that we therefore detect no extraordinary inter-industry trade changes in the run-up to the single market.

MIIT by industry

MIIT patterns resemble those of IIT in so far as manufacturing industries exhibit consistently higher average index values than primary sectors (Table IV). The highest levels of MIIT are found for all three sub-periods in SITC sections 7 and 8, which comprise most relatively advanced, R&D intensive industries. This is a further indication that inter-industry adjustment pressures among EU countries were rather modest, given that the most evenly spread expansion of trade has occurred in those sectors which are often considered to be "strategic", owing to their skill intensity.

5. Marginal intra-industry trade and adjustment: some empirical evidence

In section three, we have outlined the limitations of IIT analysis for inferences on adjustment and presented the alternative concept of MIIT. MIIT was argued to be more closely linked to the incidence of adjustment costs than "static" IIT, and this motivates the calculation of MIIT coefficients reported in section four. However, the negative link between MIIT and adjustment remains to be substantiated through empirical verification.

SITC section	1979-1983	1983-1987	1988-1992
0 (food and live animals)	0.14	0.19	0.21
1 (drink and tobacco)	0.16	0.13	0.18
2 (raw materials, except fuels)	0.15	0.17	0.17
3 (minerals, fuels, lubricants etc.)	0.20	0.22	0.20
4 (animal and vegetable oils)	0.17	0.25	0.17
5 (chemicals)	0.26	0.30	0.27
6 (manufactures, by material)	0.24	0.31	0.25
7 (machinery and transport)	0.31	0.40	0.33
8 (miscellaneous manufactures)	0.27	0.40	0.34
9 (goods n.e.s.)	0.38	0.36	0.25
0-9 (total trade)[a]	0.25	0.34	0.28
5-8 (manufactures)[a]	0.28	0.37	0.30

Notes: *A* indices, unweighted averages of 11 countries, for data sources and transformations, see Table III; [a]weighted across SITC sections by absolute size of trade changes ($\Delta X + \Delta M$). Note that these figures differ from the bottom row in Table III, since no weighting is applied across countries

Table IV.
Marginal intra-industry trade within the EU by industry, 1979-1992

Correlation analysis

A number of studies have already been conducted exploring the links between IIT, MIIT and adjustment. The simplest method is to calculate Pearson coefficients of correlation between variables representing different types of trade structure and variables of sectoral employment change. Table V lists the studies which have performed such exercises, covering the manufacturing sectors of eight European countries for various time periods in the 1980s.

Table VI summarises the results of these studies. It is apparent that most of the correlation coefficients are relatively low and statistically insignificant. This should not be a surprise, since employment changes in industry are determined

Study	Country	Initial year (t–n)	End year (t)	Number of industries
Brülhart (1995)	Ireland	1980	1990	70
Brülhart and McAleese (1995)	Ireland	1985	1990	70
Burratoni and Rossini (1998)	Italy	1979	1987	36
Harfi and Montet (1998)	France	1979	1990	201
Hine *et al.* (1998)	United Kingdom	1979	1987	182
Porto and Costa (1998)	Portugal	1986	1989	81
Sarris *et al.* (1998)	Greece	1978	1985	64
Smeets and Reker (1998)	Germany	1980	1987	65
Tharakan and Calfat (1988)	Belgium	1980	1990	77

Table V.
Correlation studies of trade and adjustment: coverage

Studies	Correlation coefficients between percentage employment changes in each industry and various trade variables						
	ΔX[a]	ΔM[a]	GL_{t-n}	GL_t	ΔGL	A	B
Brülhart (1995)	0.25*	0.14	0.28*	0.38*	0.09	0.38*	–0.03
Brülhart and McAleese (1995)	0.32*	0.17	0.13	0.12	–0.03	0.19	0.31*
Burattoni and Rossini (1998)	–0.02	0.16	–0.13	–0.08	0.13	0.05	–0.16
Harfi and Montet (1998)	0.18*	0.13*	0.04	0.06	0.02	0.14*	0.30*
Hine *et al.* (1998)	0.29*	0.19*	0.04	0.03	0.02	0.24*	0.15*
Porto and Costa (1998)	0.56[b]	0.03[b]	0.20*	0.25*	0.06	0.27*	
Sarris *et al.* (1998)			–0.03		0.03	0.28*	
Smeets and Reker (1998)	0.12	–0.17	0.09	0.02	–0.16	0.01	–0.13
Tharakan and Calfat (1998)	0.08	0.09	–0.02	–0.02	0.00	–0.05	0.15

Notes: *statistically significant at 95 per cent level of confidence (t tests); [a]percentage changes; [b]absolute trade and employment changes

Table VI. Correlation studies of trade and adjustment: results

by many other factors and only indirectly by trade patterns. More surprisingly, the evidence suggests that growth in imports relates positively to employment gains. Increased imports do not seem mainly to have crowded out domestic jobs, but they seem to accompany booming sectors, where either intermediate goods are imported to sustain growing domestic production, or the growth in domestic demand is such that it can absorb both higher imports and greater domestic production. Obviously, this conforms with the typical IIT scenario, where both domestic and foreign producers carve out their separate market niches through differentiated products.

Our main concern, however, is to investigate the usefulness of various trade measures for the analysis of adjustment. The results on traditional IIT measures support the doubts formulated on theoretical grounds. None of the correlations between employment change and changes in the GL index is statistically significant. Statistical significance is found in only two studies in the correlations base-year or end-year GL indices. Some more encouraging results emerge if we look at measures of MIIT. The A index produces positive coefficients in eight out of the nine studies, and statistical significance is found in five of these. The B index has produced statistically significant positive correlations in three studies, but in four other studies it has given rise to negative though not statistically significant correlations.

These findings provide some empirical confirmation that MIIT measures relate more closely to structural change than static or "comparative-static" IIT indices. However, these results should be interpreted cautiously for two reasons.

First, the dependent variable, representing adjustment costs, needs to be specified more adequately. Most correlation and regression analyses use percentage employment changes as an inverse proxy for adjustment costs: the stronger the growth of an industry, the higher are the expected pressures for

factor-reallocation. This is not strictly consistent with the theoretical definition of adjustment, which encompasses frictional unemployment arising from both inter- and intra-sectoral labour movements as well as wage differentials, not net increases or decreases in total sectoral employment. Percentage employment changes are a measure of net employment performance rather than of adjustment costs[18].

Regression analysis

The second shortcoming of the correlation methodology arises from its one-dimensional nature. Bi-variate analysis cannot take into account multiple determinants of adjustment. Regression analysis using (M)IIT as one of several regressors and a measure of adjustment as the dependent variable can overcome this problem.

We carry out an exploratory analysis on data for the Irish manufacturing sector in the 1980s. Two models of employment change are estimated[19]. The first assumes productivity changes to be exogenous and independent of demand changes. The estimated equation thus takes the form:

$$\Delta EMPL_i = \beta_1 + \beta_2 \Delta PROD_i + \beta_3 \Delta DCON_i + \beta_4 TPER_i + \beta_5 MIIT_i + u\,, \qquad (6)$$

where $\Delta EMPL_i$ is the change in employment in the *i*th industry, *PROD* is labour productivity (output per worker), and *DCON* is domestic consumption. *TPER* stands for a dummy variable of trade performance derived from the *B* index. It takes the value 1 if the sectoral trade balance has improved and zero otherwise. *MIIT* stands for matched trade change as measured by the *A* index. In a second model, we assume productivity changes to be determined endogenously by changes in domestic consumption and trade patterns. Thus, we drop the regressor $\Delta PROD$ from equation (6) and re-estimate the reduced equation.

The OLS results for the 1980-1990 and 1985-1990 periods are reported in Table VII. All coefficients have the expected signs. Not surprisingly, the regression coefficients on changes in productivity and domestic demand are significant throughout – demand growth implies employment growth, whereas productivity increases relate negatively to employment growth. We also find a weak but positive impact of MIIT for the 1985-1990 period. A closer look at the data shows that MIIT is significantly correlated with domestic consumption. The correlation coefficients between the *A* index and C_i are 0.36 for 1980-1990 and 0.33 for 1985-1990. Matched trade expansion (or contraction) was thus associated with increases (decreases) in domestic demand. Statistically, therefore, we do find a positive link between MIIT and employment growth, but we are also reminded of the need for a formal model capturing the entire causal nexus between employment changes and the multiplicity of its determinants, be they trade-related or not. Until we avail of such a model, econometric exercises will inevitably rely on *ad hoc* specifications.

Time period	1980-1990	1980-1990	1985-1990	1985-1990
Regressors[b]				
CONST	–0.33	–0.55	–0.12	–0.21
	(–4.39)***	(–7.48***)	(–2.35)**	(–4.21)***
ΔPROD	–0.72		–0.54	
	(–5.36)***		(–3.76)***	
ΔDCON	0.81	0.63	0.61	0.46
	(10.04)***	(7.17)***	(7.97)***	(6.38)***
TPER	0.48	0.41	0.19	0.16
	(6.98)***	(5.02)***	(3.99)***	(3.06)***
MIIT	0.08	0.00	0.09	0.13
	(0.76)	(0.02)	(1.40)*	(1.74)**
Number of observations[c]	68	68	66	66
R^2	0.68	0.54	0.58	0.48
Adjusted R^2	0.66	0.52	0.55	0.46
F	F (4, 63) = 34.2	F (3, 64) = 25.2	F (4, 61) = 21.2	F (3, 62) = 19.5
Diagnostics[d]				
Autocorrelation	χ^2 (1) = 1.38	χ^2 (1) = 1.10	χ^2 (1) = 0.11	χ^2 (1) = 1.58
	F (1, 62) = 1.29	F (1, 63) = 1.04	F (1, 60) = 0.10	F (1, 61) = 1.50
Functional form	χ^2 (1) = 1.99	χ^2 (1) = 0.04	χ^2 (1) = 8.36	χ^2 (1) = 2.31
	F (1, 62) = 1.87	F (1, 63) = 0.04	F (1, 60) = 8.71	F (1, 61) = 2.21
Normality	χ^2 (2) = 4.42	χ^2 (2) = 4.37	χ^2 (2) = 3.60	χ^2 (2) = 1.52
Heteroscedasticity	χ^2 (1) = 1.77	χ^2 (1) = 0.05	χ^2 (1) = 4.07	χ^2 (1) = 0.48
	F (1, 66) = 1.77	F (1, 66) = 0.05	F (1, 64) = 4.21	F (1, 64) = 0.46

Notes: Dependent variables = ΔEMPL[a]; industry data from annual Census of Industrial Production (Irish Central Statistics Office), trade data from Eurostat, all data classified by NACE categories; [a]$\Delta EMPL$ = change in sectoral employment = $(E_t - e_{(t-n)})/(0.5\{E_t + E_{(t-n)}\})$; [b]$\Delta PROD$ = change in sectoral productivity; $\Delta DCON$ = change in domestic consumption; $TPER$ = 1 where B ≥ 0, otherwise $TPER$ = 0; $MIIT$ = A index; $\Delta PROD$ and $\Delta DCON$ are weighted like $\Delta EMPL$; statistical significance (one-tail *t*-tests): 1 per cent***, 2 per cent **, 10 per cent *. [c]Two industries are excluded from our 70-sector NACE data set for 1980-1990, and four for 1985-1990, because the correspondence between trade and output figures is clearly correct. [d]Autocorrelation: LM test of residual serial correlation; functional form: Ramsey RESET test; normality: skewness and kurtosis of residuals; heterscedasticity: regression of squared residuals on squared fitted values

Table VII.
OLS results for determinants change in Irish manufacturing employment

6. Conclusions

This paper has examined the proposition that industrial adjustment pressures among EU countries have increased in the run-up to the 1992 single market deadline, after three decades of surprisingly smooth adaptation to a continuously more integrated European economy. A protracted post-Second World War rise in intra-industry trade (IIT) had been invoked by numerous economists as the main reason for the relatively frictionless nature of industrial adjustment in Europe. We have scrutinised the assumption that IIT entails low

adjustment costs and computed the patterns of intra-EU IIT before and during the implementation stages of the single market.

We show that the widely accepted hypothesis that IIT relates negatively to adjustment costs is still awaiting formalisation and therefore lacks in intellectual rigour. We point out that there are two principal sources of adjustment costs, namely factor specificity and wage rigidity. The IIT-adjustment hypothesis has been formulated solely in terms of factor specificity. If we take account of wage rigidity, however, intuition would suggest that IIT relates positively to adjustment costs, manifested in frictional unemployment. This negative result is complemented by two positive findings. First, we point to the recent literature on marginal IIT (MIIT) for the definition of an IIT measure which a priori promises to be more relevant to adjustment issues than traditional indices. Second, we produce some empirical evidence which supports this premise.

The incidence of adjustment pressures during the completion of the single market is examined in a comprehensive survey of IIT and MIIT patterns in 12 EU countries, calculated from highly disaggregated data. We find some support for earlier results that the continuous rise of average IIT among EU members has come to a halt in the 1980s. However, IIT shares have resumed their upward trend in the 1988-1992 period. It must be suspected that at least part of the detected stagnation in IIT growth had been caused by changes in the compilation of trade statistics. It would certainly be premature to diagnose a general reversal of the upward trend in IIT.

The analysis of MIIT does not suggest that trade-induced inter-industry adjustment pressures were particularly strong in the years preceding 1992. On aggregate, therefore, we find no evidence that the pattern of industrial adjustment differed significantly in the run-up to the single market deadline compared to earlier stages of European integration.

Averages of IIT and MIIT, however, hide a considerable amount of cross-industry diversity. We find some evidence that growing, advanced industries tend to exhibit higher levels of both IIT and MIIT than more mature, relatively declining sectors. This suggests that inter-industry adjustment is more prevalent in sectors which are in relative decline, whereas the expansion of booming sectors shows comparatively greater cross-country symmetry[20].

Our explorations have laid bare the need for a further strengthening of the foundation which underpins the IIT-adjustment hypothesis. Future empirical work could benefit greatly from the development of a formal framework disentangling the causal nexus among determinants of industrial adjustment. The new paradigm that MIIT is of greater relevance to adjustment issues than IIT could be investigated through such formal analysis as well as through more elaborate empirical scrutiny, particularly if micro-data became available to identify both intra- and inter-industry factor movements and wage differentials.

One limiting aspect of this study is its exclusive recourse to trade data. Ideally, industrial specialisation and adjustment should be measured on the basis of sectoral employment or output data. Based on relevant employment

statistics for the EU, Brülhart (1996) found that industrial specialisation of EU countries, measured by locational Gini indices, has increased between 1980 and 1990, which is in line with the predictions of the "new economic geography" (Krugman, 1991). This result seems at odds with our findings based on trade statistics, but differences in industry classifications and time coverage make direct comparison impossible. Further work based on employment or production data is clearly warranted.

Notes

1. For simplicity, we use the term European Union (EU) throughout this paper, meaning the pre-1995 Union of 12 member states.
2. For a comprehensive survey, see Helpman and Krugman (1985). The integration-induced adjustment problem is treated explicitly by Krugman and Venables (1996).
3. For a survey, see Greenaway and Milner (1986).
4. The first aspect, namely the relevance of various theoretical approaches for the explanation of intra-EU trade flows and industry location is explored in Brülhart (1996).
5. Greenaway and Milner (1986, p. 161f.) have supported this conception of adjustment in the IIT context: "The contention that agents fail to respond fully to price changes in the long run is intuitively implausible, and empirically insupportable. Adjustment problems are therefore associated with the short and medium run, a period over which the supply of some factors of production is realistically inelastic".
6. It has been shown that outlays for such "adjustment services" can be compensated with lump-sum taxes and do not outweigh the conventional gains from trade (Feenstra and Lewis, 1994).
7. For a list of references, see Brülhart (1995).
8. See Greenaway *et al.* (1994a, 1995). Some sceptics have denounced IIT as a "statistical artefact", generated by inadequate industry definitions in trade classifications (Finger, 1975). This study calculates IIT at the five-digit level of the SITC classification, with over 3,000 different "industries", and finds that roughly half of intra-EU trade in manufacture is IIT. It seems impossible that misclassification of activities in the sense of Finger (1975) drives these results.
9. See Brecher and Choudhri (1994).
10. See, for instance, Krugman (1993).
11. See Caballero and Lyons (1990) and Helg *et al.* (1995).
12. The main shortcoming of the Hamilton-Kniest measure is that it censors data, since it cannot be calculated for industries with negative changes in imports and/or exports.
13. There exists no consensus on the appropriate choice of n. Oliveras and Terra (1997) have shown that there is no general relationship between the A index of a certain period and the corresponding indices of the constituent subperiods. An intuitive case could be made for a medium-term interval of, say, two to five years, which is likely to be a realistic time span for intra- and inter-sectoral re-employment of redundant workers.
14. Our data identify 11 trading entities, since Belgium and Luxembourg publish joint trade statistics. Given that the period of our survey ends in 1992, trade of Austria, Finland and Sweden was not taken into consideration.
15. As pointed out by a referee, it would clearly be more desirable to have an annual series of data points. Our selection of a more restricted data set was guided entirely by computational time constraints, since, at the high level of disaggregation chosen for this study, data preparation and calculation of results for each sample year took several days.

16. The two SITC revisions both resulted in an increase in the number of separate five-digit industries. This inherently lowers the expected GL index, since a narrower industry definition reduces the number of differentiated goods contained within an industry and hence also the potential for IIT flows (see Grubel and Lloyd, 1975, p. 48f.). Another reason to doubt the economic significance of the perceived levelling-out of IIT lies in the non-linear nature of the GL index, which, given random trade changes, is inherently more likely to fall, the higher its initial level (see Brülhart and Elliott, 1996).
17. This finding is in line with the result of a study of sectoral employment patterns by Brülhart (1996). It was found that specialisation pressures among EU countries in the 1980s were greater in traditional, factor-cost sensitive industries than in modern, scale-sensitive and high-tech sectors. The determinants of industrial specialisation emphasised by recent models of the "new" theories of trade and economic geography might therefore not be the principal driving forces of ongoing adjustment in the EU.
18. One solution might be to use absolute change in sectoral employment ($|\Delta Empl.|$) as an alternative proxy for adjustment costs, presuming that frictional unemployment is related to the magnitude of change in the number of jobs provided by a certain industry. The optimum, however, would be to obtain data on intra- and inter-sectoral employment flows, as well as information on intra- and inter-sectoral wage dispersion.
19. This analysis draws on Hine *et al.* (1994). A similar exercise was conducted by Larre (1995). Note that data constraints do not allow us to overcome the problem of inaccurate specification of the dependent variable, representing adjustment costs.
20. This finding is supported by the results of a more rigorously categorised analysis of locational shifts in EU industry by Brülhart (1996).

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