

# The Product Pattern of Intra-Industry Trade: Stability among Countries and over Time

By

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## I. Introduction

A large and growing part of international trade, in particular trade among industrialized countries, consists of the simultaneous exports and imports of the same products, i.e. a country has both exports and imports in the same statistical category. This paper studies the product pattern of intra-industry trade in manufactured products of a sample of developed market economies in different geographic regions. The share of intra-industry trade in a product group (i) is defined by Grubel and Lloyd [1975] as

$$B_i = 1 - |X_i - M_i| / (X_i + M_i) \quad (1)$$

where X is exports, M imports.

Intra-industry trade may be caused by excessive or improper aggregation of products using different factor proportions or raw materials [Lipsey, 1976]. That intra-industry variation in factor proportions is frequent has been shown by Finger [1975] and Rayment [1976]. We would expect such "Heckscher-Ohlin trade in disguise" to take place between countries with widely differing factor endowments, i.e. predominantly between developed and developing countries.

Alternatively, intra-industry trade may be explained by product differentiation in oligopolistic markets with increasing returns to scale [Lancaster, 1980; Krugman, 1979; 1981]. This type of trade in differentiated products can be

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expected to be most frequent among countries on a high level of per capita income and with similar factor endowments.

The intra-industry share in total trade may increase over time, if demand for product differentiation grows with income, or if differences in factor endowments are reduced. Since the demand for differentiated goods from a given firm or country may be expected to be price elastic, such intra-industry trade can be expected to be reduced more than inter-industry trade by trade barriers, including tariffs and transport costs.

If the intra-industry trade among developed countries is of a different kind, and caused by other factors, than that between developed and developing countries, there is no reason to expect that the product patterns of intra-industry trade in these trade flows will be identical. Thus, we would expect to find a high proportion of intra-industry trade among countries on the same (high) income level, with similar relative factor endowments, and with low trade barriers, such as tariffs and transport costs; such trade will take place in product groups which are differentiated on the demand side, where markets are oligopolistic [Brander, 1981], production exhibits increasing returns to scale, and tariffs and transport costs are low. In addition, there may also be intra-industry trade between countries with widely different factor endowments, in product groups with heterogeneous factor requirements (i.e. disguised Heckscher-Ohlin trade).

With regard to the welfare effects of intra-industry trade, the general view seems to be that the gains from intra-industry trade are of a different kind, and presumably less than those from inter-industry trade; on the other hand, the adjustment cost associated with an expansion of trade are believed to be less in the intra-industry case [Balassa, 1967; Grubel, Lloyd, 1975; Krugman, 1981].

This raises important questions regarding the future development of world trade. Will international trade and specialization in the future increasingly be of the intra-industry kind? Will the intra-industry share of trade between developed and developing countries increase and thus become more similar to the exchange between developed countries themselves? Will the current product pattern of intra-industry trade remain, or will there be an increase in intra-industry trade in products where there now is mostly net trade? In which industries is intra-industry trade with developing countries likely to increase?

These issues involve the question of the stability, or the invariance, of the product pattern of intra-industry trade. Another question is if the product patterns in the trade with developed and developing countries are the same or, if not, if they are likely to converge. Our paper addresses the following questions:

(i) Is the product pattern of intra-industry trade

- stable over time, that is, is there much intra-industry trade in the same products in different years?
  - the same in a country's trade with different partners, in particular with developed and developing countries?
  - the same for different countries?
- (ii) Can the variation in the intra-industry share in different trade flows be explained by characteristics of the products and the trading countries?

The data used to analyze these questions cover total trade in manufactured goods for 11 industrialized countries in the period 1970–1980, disaggregated on the 4-digit industry level of the ISIC and allocated on major regions and country groupings. The data were transformed from the SITC to the ISIC by the World Bank Market Penetration Group.

## **II. Average Shares of Intra-Industry Trade in the Trade with Different Country Groups and for Different Products**

Table 1 presents data on the average share of intra-industry trade for each of 11 industrialized countries' trade with the world and with different regional country groups in 1980. The indices for intra-industry trade in individual product groups are calculated on the 4-digit level of the ISIC for all sectors of manufacturing industry (that is, raw materials and services are excluded).

The figures illustrate the fact that intra-industry trade, even at this detailed level, is an important feature in the trade of the industrialized countries. The share of intra-industry trade in total international trade in manufactured products is very high (around 80 percent) for France, Belgium and the United Kingdom; it is rather low for Japan and Australia. The ranking of countries did not change much in the period 1970–1980. There is no clear pattern with respect to country size, since small countries (with respect to population) show both very high (Belgium) and very low (Australia) values, and the largest country (USA) lies in the intermediate range. However, there may be a geographical pattern: For all the European countries in the sample, the average share of intra-industry trade is above 65 percent, while for all the non-European industrial countries the figure is below 60 percent.

The share of two-way trade differs a great deal in each country's trade with different country groups, in particular with groups on a different level of economic development. There also seems to be a certain geographic pattern. For all countries in the sample except Australia, intra-industry trade is much more important in their trade with the developed (DC) than with the developing (LDC) countries. Within the latter group, there are also differences with regard to the level of two-way trade that in many cases reveal the importance of geographic proximity. For all countries except Australia and Japan, the intra-industry trade share is higher with South Europe than with

any other group of developing countries: In particular France and Italy show a very high figure. For Australia and Japan, on the other hand, intra-industry trade is most frequent with the Asian NIC's. The highest figure for two-way trade with Latin America is shown by the USA<sup>1</sup>.

Trade resistance is likely to reduce intra- more than inter-industry trade. The very low shares of intra-industry trade in total trade and in trade with DC's for Australia and Japan may therefore reflect high barriers to trade, in the form of transport costs (from/to other DC's) as well as tariffs and non-tariff import restrictions.

Table 1 – *Shares of Intra-Industry Trade in Total Trade and in Trade with Certain Groups of Countries in 1980*

Country	Trade with							CPE's
	world	South Europe	Asian NIC's	Latin America	other LDC's	all LDC's	all DC's	
Australia ..	35.8	16.3	26.9	19.4	22.9	29.2	22.7	5.5
Belgium ...	79.7	54.1	29.8	11.4	33.4	40.1	77.6	29.0
Canada ...	58.5	30.6	15.7	25.0	11.0	33.0	56.7	18.1
France ....	80.4	64.4	29.7	16.3	31.4	44.2	79.2	40.0
Germany ..	65.4	42.3	24.4	13.0	28.9	34.6	74.1	31.6
Italy .....	65.4	55.1	36.0	19.8	28.1	44.3	59.8	40.2
Japan .....	28.8	14.8	27.2	10.6	10.1	17.6	33.6	11.8
Netherlands	74.2	43.0	24.8	17.7	35.5	45.5	70.3	22.6
Sweden ...	66.5	29.2	15.1	7.6	8.8	17.4	72.5	30.7
U.K. ....	79.1	50.7	27.4	24.0	38.6	44.2	77.5	30.9
USA .....	60.7	33.8	26.5	29.6	25.8	35.0	66.7	37.9

Definitions: *South Europe*: Greece, Portugal, Spain, Cyprus, Gibraltar, Israel, Malta, Turkey, Yugoslavia. *Asian NIC's*: Hongkong, Macao, Singapore, Taiwan, South Korea. *CPE's*: European centrally planned economies.

Intra-industry trade seems to grow at a higher rate than inter-industry trade, and thus to increase its share of world trade. Table 2 shows that the share of intra-industry trade in total trade increased in the period 1970–1980 for all countries in the sample except for Canada and Japan. The increase was highest in the U.K. possibly as a result of the British entry into the EEC. Two-way trade seems to have increased more in the developed countries trade with the developing countries than in their trade with each other: The intra-industry trade share increased more in the trade with LDC's than with DC's for all countries except for Australia, Sweden and USA. This increase was particularly strong in the trade with Southern Europe.

<sup>1</sup> Because of the aggregation properties of the Grubel-Lloyd index, the value for a region is usually higher than the mean value of the member countries. The pattern in Table 1, therefore, is to some extent dependent on the particular level of disaggregation.

Table 2 – *Change in the Share of Intra-Industry Trade between 1970 and 1980 (percentage units)*

Country	Trade with							
	world	South Europe	Asian NIC's	Latin America	other LDC's	all LDC's	all DC's	CPE's
Australia ..	5.4	-0.7	-8.3	2.8	3.8	0.1	4.2	-10.6
Belgium ...	4.1	15.3	10.7	-1.1	17.1	16.3	5.2	-17.7
Canada ...	-3.4	19.6	7.9	13.0	-8.4	11.6	-5.4	-6.5
France ....	3.6	29.4	9.2	1.5	11.0	19.0	6.4	4.0
Germany ..	6.6	14.5	7.5	4.9	14.1	15.1	7.4	-4.2
Italy .....	6.6	26.8	1.1	9.3	7.5	20.5	0.3	8.7
Japan .....	-7.3	7.3	10.3	2.9	-2.5	1.9	-4.6	-21.5
Netherlands	5.5	7.8	11.3	-9.1	-1.2	7.0	5.7	-18.8
Sweden ...	4.1	9.3	9.0	2.7	-1.2	4.8	5.8	-0.6
U.K. ....	18.3	21.1	-0.8	7.3	12.7	12.8	12.3	-3.4
USA .....	1.4	8.1	2.4	6.3	1.1	4.3	5.8	6.9

The main part of the theory of intra-industry trade deals with trade in consumer products [see e.g. Lancaster, 1980]. Some explanations of intra-industry trade and specialization might be applied to investment goods and semi-fabricated products as well, for instance border trade, or the fact that economies of scale may lead to a concentration of production in a country to a few product lines, while importing others. However, there seems to be no specific theory to explain intra-industry trade in semi-fabricated products. One might therefore expect that intra-industry trade predominantly occurs in consumer products.

This hypothesis, however, is not supported by our data. We have divided the total number of manufacturing industries on the 4-digit level into three subgroups, namely consumer goods, semi-fabricated products and investment goods, simply by judging which of these three uses accounts for the largest share of the industry's output. Table 3 shows that the share of intra-industry trade is clearly higher for consumer goods than for other products only in the case of Belgium and Canada; for other countries (Australia, Japan, Italy and the Netherlands) intra-industry trade in consumer goods is in fact less frequent than for other products.

The last two columns in Table 3 indicate the group of products – consumer goods (C), semi-fabricated goods (S) or investment goods (I) – for which the share of intra-industry trade is the highest in the reporting countries' trade with LDC's and DC's separately. Intra-industry trade with developing countries is clearly most frequent in semi-fabricated goods: This is true for all countries except for Australia, U.K. and USA. This means that intra-industry trade between developed and developing countries primarily seems to consist of an

exchange of "the same" types of semi-fabricated products, not in an exchange of "the same" consumer and investment goods. With regard to the trade between developed countries, intra-industry trade seems to be more evenly distributed between the three groups of goods.

Table 3 – *Shares of Intra-Industry Trade in Total Trade for Consumer Goods, Semi-Fabricated Goods and Investment Goods in 1980*

Country	All goods	Consumer goods (C)	Semi-fabricated goods (S)	Investment goods (I)	LDC	DC
Australia ..	35.8	18.6	53.9	32.8	I	S
Belgium ...	79.7	84.5	76.4	77.0	S	C
Canada ...	58.5	72.3	43.9	59.0	S	C
France ....	80.4	70.9	86.2	85.8	S	S
Germany ..	65.4	62.0	71.4	60.3	S	S
Italy .....	65.4	51.7	75.5	70.2	S	I
Japan .....	28.8	18.4	38.0	31.5	S	I
Netherlands	74.2	69.0	74.7	85.8	S	I
Sweden ...	66.5	67.3	59.2	79.7	S	I
U.K. ....	79.1	78.6	78.8	80.0	I	I
USA .....	60.7	63.1	63.4	54.0	C	S
Number of products ..	81	36	28	17		

### III. Stability of the Product Pattern over Time

To study the stability over time of the product pattern of intra-industry trade we have computed for each country the vector of  $B_i$ 's, the shares of intra-industry trade in the international trade in each industry on the 4-digit level of the ISIC, for the years 1970 and 1980. A high correlation between the indices  $B_i$  for the two years means that the product pattern of intra-industry trade has been stable during the period, i.e., that those products with much intra-industry trade tend to be the same over time. This has been done not only for each country's trade with the world as a whole but also for its trade with DC's, LDC's, South Europe and Asian NIC's (i.e. by computing the vectors  $B_{ij}$ , where  $j = \text{World, South Europe, NIC's, LDC's, DC's}$ ). The correlations between the 1970 and 1980 product structures of intra-industry trade in each country's trade with these country groups and with the world are given in Table 4.

The first point to notice is that the intertemporal stability of the product pattern of intra-industry trade with the world as a whole has been rather high; the correlation coefficients between the patterns of 1970 and 1980 range between .6 and .8 for total trade. For all countries except Japan, the stability is higher for the pattern in their trade with developed countries than

Table 4 – *Correlation Coefficients between Indices of Intra-Industry Trade for Industries for the Years 1970 and 1980 in Trade with the World and Different Country Groups*

Country	Trade with				
	world	South Europe	Asian NIC's	all LDC's	all DC's
Australia ..	.658	.404	.233	.360	.690
Belgium ...	.760	.375	.193	.391	.721
Canada ...	.783	.465	.344	.554	.717
France ....	.715	.424	.266	.525	.740
Germany ..	.613	.656	.255	.502	.624
Italy .....	.736	.363	.181	.477	.762
Japan .....	.600	.493	.504	.465	.431
Netherlands	.738	.552	.439	.573	.616
Sweden ...	.810	.498	.177	.623	.796
U.K. ....	.744	.594	.593	.674	.728
USA .....	.716	.649	.411	.619	.669

in their trade with the LDC's. For some countries (Australia, Belgium and Italy) the difference is substantial. The product pattern appears to be far less stable in the trade with the Asian NIC's than in other trade flows (except for U.K. and Japan). It seems therefore that not only has the average share of intra-industry trade in the trade between the developed countries and the Asian NIC's increased during the 1970s, as was shown in Table 2, but also has the product pattern of intra-industry trade with these NIC's changed substantially.

Table 5 – *Coefficients of Variation of the Grubel-Lloyd Index of Intra-Industry Trade across Industries*

Country	Trade with			
	world		LDC's	
	1970	1980	1970	1980
Australia .....	.74	.73	.85	.72
Belgium .....	.35	.33	.90	.71
Canada .....	.51	.52	.94	.75
France .....	.27	.29	.89	.62
Germany .....	.31	.30	1.00	.76
Italy .....	.51	.47	.94	.76
Japan .....	.69	.69	1.12	.91
Netherlands .....	.32	.28	.80	.78
Sweden .....	.48	.40	.94	.89
U.K. ....	.44	.35	.89	.76
USA .....	.48	.45	.76	.67

A high coefficient of variation (i.e. the ratio of variance to mean) of the intra-industry trade share over product groups, indicates that intra-trade is concentrated to a few product groups. Table 5 shows that the variation of the Grubel-Lloyd index is generally lower, i.e. that intra-trade is more evenly spread across industries, for the European countries. For all the reporting countries except Australia, intra-trade with the developing countries appears to be much more concentrated to a few products than is the case for total trade.

There seems to have been a tendency for the coefficient of variation of the Grubel-Lloyd index to decrease in the 1970s, particularly in the trade with the LDC's. This means that the developed countries' intra-industry trade with the developing countries has tended to spread to new product groups where there initially was mostly net trade.

#### **IV. The Product Pattern of Intra-Industry Trade in the Trade with Developed and Developing Countries**

According to the theory of intra-industry trade we would expect not only a higher proportion of intra-industry trade in the trade flows between the developed countries than in trade between developed and developing countries, but also that intra-industry trade between DC's and LDC's would be of a different kind than that between the DC's themselves. Because of the differences in factor endowments between the DC's and the LDC's we should expect that a high proportion of the intra-industry trade between these two country groups reflects international specialization according to comparative advantage, "disguised" as intra-industry trade because of categorical aggregation, i.e. aggregation of products with widely differing factor requirements. Intra-industry trade between DC's and LDC's might be expected to occur in industries where there are substantial differences in factor requirements between products or between stages of processing, and where an international division of the stages of processing is feasible; it seems likely that such products have to be easily transportable, and that production techniques have to be standard and well-known. Intra-industry trade between the developed countries, on the other hand, might involve a greater extent of exchange of differentiated consumer products.

There is therefore no particular reason to expect the reporting countries to have much intra-industry trade with the DC's and with the LDC's in the same products. As shown in Table 3, for most countries the type of goods where there is most intra-industry trade is not the same in their trade with DC's and LDC's. To investigate the degree of similarity of the product patterns of intra-industry trade in the trade with DC's and LDC's, we have computed, for each country and each of the years 1970 and 1980, the vectors  $B_{i(DC)}$  and



$B_{i(LDC)}$ . Table 6 shows the correlation coefficients between the DC and LDC vectors for 1970 and 1980.

Table 6 – *Correlation Coefficients between Indices of Intra-Industry Trade with Developed and Developing Countries*

Country	1970	1980
Australia .....	.220*	.225*
Belgium .....	.065	.228*
Canada .....	-.188*	.003
France .....	-.146	-.022
Germany .....	.285*	.385*
Italy .....	-.159	-.103
Japan .....	.059	.157
Netherlands .....	-.118	.065
Sweden .....	.001	.240*
U.K. ....	.282*	.206*
USA .....	.024	.140

\* Significant at the 5 percent level.

In 1970 the correlations between the reporting countries' product pattern in their trade with developed and developing countries were generally very low: only for Germany and the United Kingdom was there a significant (on the one percent level) positive correlation. This indicates that the intra-industry trade with developed and with developing countries did occur in quite different products. However, in all cases except the United Kingdom, the correlation coefficients between the DC and LDC product patterns did increase from 1970 to 1980. This means that, though they are still rather different, the product patterns of intra-industry trade with developed and developing countries have indeed been converging during the 1970s.

#### V. Similarity among Countries of the Product Pattern of Intra-Industry Trade

Is the product pattern of intra-industry trade the same in the reporting countries? This question could be addressed by pairwise correlating the vectors  $B_i$  in 1980 for the 11 countries. However, as have been seen, the product pattern of two-way trade in general is not the same in trade with LDC's and DC's. Hence, the product pattern of one country could differ from that of another because of different geographical composition of trade. To control this effect, we have studied the similarity of the product patterns of intra-industry trade with DC's and LDC's separately. The matrices of correlation coefficients are given in Table 7. The upper-right half concerns trade with the

DC's, the lower-left half shows trade with the LDC's. As can be seen from the table, there is a rather low degree of similarity of the product patterns of intra-industry trade with other developed countries among the reporting countries (upper-right half of Table 7). The mean correlation amounts only to .178. This means that the reporting countries in general do not tend to have much intra-industry trade in the same product groups. The correlation coefficients for the comparison across countries in Table 7 are much lower than the coefficients in Table 4 concerning comparisons over time.

Table 7 – *Correlation Coefficients between Indices of Intra-Industry Trade for Industries in Different Countries for the Trade with Developed Countries (upper-right half) and with Developing Countries (lower-left half) in 1980*

	Australia	Belgium	Canada	France	Germany	Italy	Japan	Netherlands	Sweden	U.K.	USA
Australia		.133	.219*	.119	-.126	.059	-.043	.042	-.063	-.152	-.102
Belgium	.107		.204*	.275*	.246*	.032	.111	.198*	.313*	.247*	.278*
Canada	.315*	.199*		.227*	-.133	.088	.230*	.052	.329*	.142	.054
France	-.011	.465*	.063		.164	.253*	.201*	.204*	.429*	.303*	.212*
Germany	.029	.669*	.158	.613*		-.012	.038	.234*	.031	.163	.009
Italy	-.163	.071	-.068	.442*	.178		.109	.109	.417*	.412*	.235*
Japan	-.064	.092	-.050	.304*	.102	.153		.123	.369*	.390*	.273*
Netherlands	.105	.570*	.203*	.467*	.503*	.217*	.145		.323*	.286*	.235*
Sweden	.011	.376*	.384*	.306*	.371*	-.040	.179	.467*		.475*	.431*
U.K.	-.018	.554*	.047	.610*	.694*	.453*	.218*	.480*	.235*		.378*
USA	.203*	.334*	.355*	.171	.408*	.011	.209*	.325*	.276*	.300*	

\* Significant at the 5 percent level.

The product structures of two-way trade with less developed countries (lower-left part) are generally more alike – the mean correlation is .250. In particular, this is the case among the European countries; there are 12 cases with coefficients above .450, all of them intra-European. We have argued that intra-industry trade between developed and less developed countries can be expected to consist mainly of an exchange of goods with different factor requirements in the same statistical product group, e.g. parts and final products. If this is true, we may expect that the countries in the sample, which all have rather similar factor endowments relative to the LDC's, should tend to have intra-industry trade with the LDC's in the same products. This may explain why the product pattern of intra-industry trade with the LDC's, based on product differentiation on the supply side, is more similar than the pattern of intra-industry trade among the DC's themselves, which is probably mainly

based on differentiation on the demand side, i.e. on monopolistic competition with economies of scale in differentiated products.

How can we interpret the fact that the product patterns of two-way trade of different countries in general are dissimilar? Let us assume that the share of intra-industry trade in total trade with the world in a product group  $i$  in any country  $j$  depends on some general factors,  $X$  and  $Y$ , which may be characteristics of the product, the production process or the market structure, and a random factor  $u_{ij}$ , that represents specific circumstances varying from case to case. We have then

$$B_{ij} = a_j + b_j X_{ij} + c_j Y_{ij} + u_{ij} \quad (2)$$

If the coefficients  $a_j$ ,  $b_j$  and  $c_j$  were the same for all countries, if for any product  $i$  the values of  $X$  and  $Y$  were the same for all countries, and finally if the variance of  $u_{ij}$  was small, then we should observe approximately the same value of  $B_{ij}$  in any given sector in all countries, which means that the correlations between the vectors  $B_{ij}$  among countries would be high. The low values of the correlation coefficients in Table 7 mean that one or more of these conditions are not met.

In many econometric studies attempting to explain the share of intra-industry trade by regression across products for individual countries [see e.g. Finger, DeRosa, 1979] the resulting values of  $R^2$  are rather low. This indicates that the influence of specific circumstances is large compared with the explanatory value of the variables entered in the regression, e.g. measures of product differentiation and economies of scale. In other words, the variance of the random term  $u_{ij}$  in (2) can be expected to be high.

The theoretical contributions to the explanation of intra-industry trade have stressed different causes of that phenomenon. Two-way trade can be a consequence of aggregating products with different factor requirements [Finger, 1975], of border trade [Grubel, Lloyd, 1975], of market concentration [Brander, 1981] or of product differentiation in combination with economies of scale [Lancaster, 1980; Krugman, 1979]. However, the relative importance of these factors may not be the same in different types of economies. For instance, border trade may be relatively important among small countries that are adjacent to each other. Intra-industry trade in differentiated products of the Lancaster-Helpman type [Lancaster, 1980; Helpman, 1981] might be less important in a given product group for large countries, where the size of the domestic market makes it possible to achieve economies of scale for a large number of domestic producers. Since the countries in the sample are different with regard to size, distance to trade partners and natural resource and factor endowments, it is quite natural to find substantial differences with respect to the product structure of intra-industry trade. In terms of (2) this means that the coefficients  $a_j$ ,  $b_j$  and  $c_j$  are not the same for all  $j$ .

## VI. Factors Influencing the Regional and Industry Pattern of Intra-Industry Trade

In order to go deeper into the issues raised by the correlation analysis, we will attempt to explain the share of intra-industry trade in 11 developed economies' trade with 7 regions (South Europe, Asian NIC's, Latin America, other LDC's, EEC, other developed market economies, and centrally planned economies) in 81 manufacturing industries on the 4-digit level of the ISIC, in the years 1970 and 1980, by means of regression analysis<sup>2</sup>. Two types of explanatory variables are used:

(i) Country characteristics:

- geographical distance ( $DIS_{jk}$ ) between trade partners is assumed to reflect "trade resistance" in the form of transport costs: the closer the trade partners  $j$  and  $k$ , the more intra-industry trade among them;
- similarity of economic development and demand should increase intra-industry trade; this is measured by the absolute values of the differences in 1980 GNP per capita ( $DGP_{jk}$ ) between trade partners (Source: World Development Report);
- the Grubel-Lloyd index of intra-industry trade will be affected by trade imbalance [Aquino, 1978]. The more balanced the total trade flows with a given trade partner, the more intra-industry trade one can expect at the product level. A measure of such imbalance is provided by BAL, the ratio of total exports to total imports of manufactured products with a given trade partner, or its inverse when that ratio happens to be less than unity; one therefore expects a negative relation between the share of intra-industry trade and BAL;

(ii) Industry characteristics:

- an index of industrial concentration (CON), measured by the share of employment in plants with more than 500 employees, as a proxy of economies of scale and monopolistic competition;
- the Hufbauer [1970] index of product differentiation (DIF), measured by the ratio of the variance of export unit values to different countries to the average export unit value;
- the unit value of exports (UVA); a high value of UVA may give more two-way trade if it reflects a low relative transport cost, and thus low trade resistance.

Intra-industry trade probably occurs in product groups of different kinds, i.e. with different characteristics, in developed countries trade among each

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<sup>2</sup> The method, i.e. analyzing bilateral trade flows by introducing product and country variables simultaneously, is similar to that used by Loertscher, Wolter [1980]. The main differences are that our data cover a broader sample of trade flows, i.e. not only among DC's, but also between DC's and LDC's, and that intra-industry trade is measured according to an industry (ISIC), not a product, classification.

other than in their trade with developing countries. This means that we should expect the regression coefficients for the product variables to be different for these two types of trade flows. To allow for this we have introduced a slope dummy variable for each of the product variables.

The data for the product variables DIF, CON and UVA refer to Sweden, in 1977/78; therefore, we have to assume that these data are representative for the other 10 countries of our sample. A time trend in the development of the intra-trade index is allowed for by the introduction of a dummy variable DYT that takes the value 0 in 1970, 1 in 1980. Since all the independent variables except BAL actually are pure cross-section data, referring to one single year, the effects of changes in these variables will be reflected by the time dummy, in addition to the effects of other developments, not included in the regression.

Three alternative functional forms have been estimated: a linear (additive), a double logarithmic (multiplicative), and a logit form, where the dependent variable is  $\log(B/(1-B))$  and the independent variables are in a linear form. The latter is used to overcome the drawback with the original Grubel-Lloyd index  $B$ , which is constrained to the interval 0 to 1.

## VII. Regression Results

Table 8 shows the estimated regression coefficients for the determinants of intra-industry trade for the linear, the double log and the logit specifications. For all three, the explanatory variables referring to characteristics of the trading countries, i.e. DIS, DGP and BAL, all have the expected signs and are highly significant. The longer the distance, the greater the difference in average income, and the more unbalanced trade in manufactured products, the less the intra-industry share of trade is likely to be<sup>3</sup>. The positive and significant coefficient of the time dummy indicates an average increase of about 5 percentage points in 1970–1980.

It is clear that the country characteristics are more important for explaining intra-industry trade than the product characteristics. When the product variables (DIF, CON and UVA) alone are used as independent variables, the  $R^2$  is reduced drastically (to 0.01). The significance of the product variables are also generally lower. This confirms the conclusion from Table 7 that the product patterns of two-way trade are in general rather dissimilar. There are several possible explanations for the low  $R^2$ . Important variables may be omitted, or variables used in the regression may not correspond very well to theoretical concepts. In terms of (2), the values of the product characteristics ( $X_{ij}$ ,  $Y_{ij}$ ) may not be constant for product  $i$  across countries, or the coefficients

<sup>3</sup> For the income difference and distance variables, our results confirm the findings of the analysis of intra-OECD trade by Loertscher, Wolter [1980].

$b_j$  and  $c_j$  might vary; this means that intra-industry trade is explained differently in different countries. One should be cautious, therefore, in empirical studies when trying to explain the product pattern of two-way trade in different countries with the same set of independent variables.

Table 8 – Regression Coefficients for the Determinants of the Share of Intra-Industry Trade

	Linear		Double log		Logit	
Constant . . . . .	56.6 (63.9)		6.5 (25.3)		3.3 (10.6)	
Country characteristics						
DIS . . . . .	-.0016 (-27.2)		-.57 (-24.7)		-.71 (-23.5)	
DGP . . . . .	-.0014 (-14.5)		-.04 (-2.7)		-.004 (-.2)	
BAL . . . . .	-1.7 (-7.2)		-2.8 (-5.3)		-4.1 (-6.5)	
Time trend						
DYT . . . . .	4.8 (8.9)		6 (13.4)		7 (13.4)	
Industry characteristics						
	Trade with:					
	DC's	LDC's	DC's	LDC's	DC's	LDC's
DIF . . . . .	-.000 (.0)	.00007 (2.2)	.14 (5.9)	.20 (2.2)	.20 (7.0)	.22 (.6)
CON . . . . .	.198 (11.4)	-.062 (-12.9)	.3 (2.6)	-.01 (-1.8)	.05 (4.1)	-.00 (-3.6)
UVA . . . . .	.0056 (5.8)	-.0007 (-5.5)	.20 (7.2)	-.08 (-9.1)	.26 (7.6)	-.10 (-9.5)
R <sup>2</sup> . . . . .	.20		.18		.21	

*Note:* t-value in parentheses. – t-values for LDC coefficients refer to the difference between DC and LDC coefficients.

In the trade among the developed countries, the share of intra-industry trade appears to be higher, the more concentrated the industry and the higher the unit value; this is in line with our hypotheses, if the variables CON and UVA can be assumed to indicate monopolistic competition in combination with increasing returns to scale and low relative transport costs. The indicator of product differentiation DIF also shows the expected positive sign except in the linear equation, where it is not significant.

The hypothesis that intra-trade among developed countries on the one hand and between developed and developing countries on the other is of a different nature and does not take place in the same types of products is confirmed by the fact that the coefficients for CON and UVA both are significantly lower in trade with LDC's than with DC's. On the other hand, the results contradict the hypothesis for the variable DIF, since the coefficient is higher in trade with LDC's. It is, of course, possible that the Hufbauer measure reflects not only product differentiation but also intra-group heterogeneity of other kinds, possibly also differences in factor and raw materials requirements, in which case it would of course lead to intra-industry trade between countries with different resource endowments.

### VIII. Summary and Conclusions

Intra-industry trade is an increasingly important phenomenon in international trade. Measured on the 4-digit level of the ISIC, the share of intra-industry trade of the total foreign trade in manufactures varied between 35 percent and 80 percent for a sample of 11 industrial countries. The European countries in the sample all have a higher share of intra-industry trade in their total foreign trade than the non-European countries. Intra-industry trade is much more important among developed countries than between developed and developing countries. The analysis shows that the intra-industry share of total trade between two countries tends to be higher, the less are the difference in average income and the geographic distance between the trading partners. Furthermore, two-way trade between developed and developing countries does not occur in the same product groups as intra-industry trade among developed countries. The former can be expected to occur predominantly in products differentiated on the supply side by factor requirements, while the latter probably consists mainly of products differentiated on the demand side by product attributes. There is, however, a tendency for the product patterns in DC and LDC trade to become more alike over time.

Contrary to what might be expected from theoretical analysis, intra-industry trade is not restricted to consumer goods, but is important for investment goods and semi-fabricated goods too. In fact, two-way trade between developed and developing countries seems to occur mostly in semi-fabricated goods. This means that a theory of intra-industry trade in investment goods and in semi-fabricated goods is required.

The share of intra-industry trade in the total international trade of the developed countries in the sample has been increasing during the 1970s. The highest rate of increase is shown by the intra-industry trade with the less developed countries, in particular Southern Europe. The product pattern of two-way trade in the reporting countries have been fairly stable during the

period; however, this does not hold for all country groups, especially the Asian NIC's. In general, there seems to be a tendency for two-way trade to increase most in those product groups where there was initially mostly inter-industry trade and specialization.

With regard to trade between developed and developing countries, the average share of intra-industry trade has increased rapidly, thus approaching the level in the trade among the developed countries. In addition, the product pattern of intra-industry trade has become somewhat more similar to the pattern in the trade among developed countries. These facts may be interpreted as the effects of a high rate of economic growth and industrialization in some developing countries, notably the NIC's, which means that these countries have been approaching the developed countries in terms of factor proportions and income per capita. From our hypothesis concerning the different causes of intra-industry trade among developed countries on the one hand and between developed and developing countries on the other hand, it follows that this will lead to a convergence of the product patterns.

If the tendencies of the 1970s should continue into the 1980s the exchange of goods between developed and developing countries will increasingly be of the intra-industry kind, and the product structure of this two-way trade will tend to become more similar to the pattern among the developed countries. Such a scenario would become more likely if the future world economic development could be expected to imply

- a high rate of growth of GDP in the developing countries, higher than in the developed economies, such that the income differences between DC's and LDC's would fall (the variable DGP would be reduced, which according to our model would increase intra-industry trade),
- a transformation of the economic structure of the LDC's away from primary production and towards manufacturing industry; this might lead to a more balanced exchange of manufactured products between DC's and LDC's (the variable BAL would fall),
- a reduction of transport cost; this would reduce the economic importance of the geographic distance between DC's and LDC's,
- a liberalization of trade policy both in DC's and LDC's, since a reduction of barriers to trade (tariffs, non-tariff barriers or transport costs) can be expected to increase intra-trade more than net trade.

If an expansion of the trade between developed and developing countries to an increasing extent will consist of intra-industry trade, the preconditions for trade policy might well be different from the case where trade would mainly lead to inter-industry trade and specialization. Insofar as the adjustment problems in general may be expected to be less when trade and specialization is of the intra-industry kind, demand for protection in the developed countries should be less in this case.



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Zusammenfassung: Die Güterstruktur des intraindustriellen Handels: Stabilität zwischen den Ländern und im Zeitablauf. – Gemäß der vierstelligen ISIC schwankt der Anteil des intraindustriellen Handels am gesamten Außenhandel mit Industriegütern für eine Gruppe von elf Industrieländern zwischen 35 und 80 Prozent. Der intraindustrielle Handel spielt zwischen den Industrieländern und hier insbesondere in Europa eine bedeutend größere Rolle als im Verhältnis zwischen Industrie- und Entwicklungsländern. Sein Anteil scheint im Handel zwischen zwei Ländern um so größer zu sein, je geringer der Unterschied

im Durchschnittseinkommen und je kleiner die geographische Distanz zwischen den Handelspartnern ist. Außerdem findet der intraindustrielle Handel zwischen Industrie- und Entwicklungsländern nicht in denselben Produktgruppen statt wie in denjenigen zwischen entwickelten Ländern. Es besteht allerdings eine Tendenz, daß sich die Güterstruktur im Handel der Industrie- und Entwicklungsländer im Laufe der Zeit angleicht. Im Gegensatz zu theoretisch fundierten Erwartungen ist der intraindustrielle Handel nicht auf Konsumgüter beschränkt, sondern auch für Investitionsgüter und Halbfabrikate wichtig.

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Résumé: Le commerce intra-industriel par produit: La stabilité de la structure parmi des pays et sur temps. - Mesuré sur le niveau 4 chiffres d'ISIC, la portion du commerce intra-industriel en commerce extérieur total dans le secteur manufacturier varie entre 35 et 80 pour cent pour un échantillon de onze pays industriels. Le commerce intra-industriel est beaucoup plus important parmi les pays développés, particulièrement en Europe, qu'entre les pays développés et développants. La portion du commerce intra-industriel en commerce total de deux pays tend à monter si la différence en revenu moyen et la distance géographique entre les deux partenaires commerciaux tend à baisser. De plus, deux-voies commerce entre les pays développés et développants ne se passe dans les mêmes groupes de biens que celui entre les pays développés. En contraste de ce qu'on peut attendre de l'analyse théorique le commerce intra-industriel n'est pas limité aux biens de consommation, mais il est aussi important pour les biens d'investissement et les biens demi-fabriqués.

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Resumen: El perfil del comercio intrasectorial a nivel de productos: estabilidad entre países y en el tiempo. - La participación del comercio intrasectorial, medida al nivel de 4 dígitos de la CIIU, en el total del comercio internacional de manufacturas varía entre un 35 y un 80 por ciento en una muestra de 11 países industriales. El comercio intrasectorial tiene mayor importancia para el comercio entre países desarrollados, particularmente entre los de Europa, que para el comercio entre países desarrollados y países en desarrollo. La participación del comercio intrasectorial en el total del comercio entre dos países tiende a ser más alta, cuanto menor sea la diferencia entre el ingreso medio y la distancia geográfica entre los dos. Además, el comercio entre países desarrollados y en desarrollo no abarca las mismas ramas que el comercio intrasectorial entre países desarrollados. Contrariamente a lo comúnmente esperado, el comercio intrasectorial se da no sólo en bienes de consumo sino también en bienes de capital y en productos semielaborados.