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# Intra-Industry Specialization in a Multi-Country and Multi-Industry Framework

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The paper tests alternative hypotheses as to the factors determining the extent of intra-industry trade, defined as the share of this trade in total trade, in a multi-country and multi-industry framework. The empirical results show that the extent of intra-industry trade in a particular industry between any two countries depends on the characteristics of the industry and the countries concerned.

The explanatory power of the regressions for the entire group of countries exporting manufactured goods, as well as for trade among the developed countries, is relatively high and practically all the hypotheses concerning the impact of industry and country characteristics on intra-industry trade are supported by the empirical results. Lower coefficients of determination have been obtained for trade between developed and developing countries and for trade among developing countries, but the estimates generally support the hypotheses put forward in the paper in these cases also.

# INTRA-INDUSTRY SPECIALIZATION IN A MULTI-COUNTRY AND MULTI-INDUSTRY FRAMEWORK

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# INTRA-INDUSTRY SPECIALIZATION

# IN A MULTI-COUNTRY AND MULTI-INDUSTRY FRAMEWORK

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## Introduction

Since the time the senior author first introduced the concept of intra-industry -- as compared to inter-industry -- trade (Balassa, 1966a), a vast literature has developed on the subject. Early efforts concentrated on the measurement of the extent of intra-industry specialization. 1/ Subsequently, several contributions were made to the theory of intra-industry trade. Also, empirical investigations were undertaken to examine the determinants of intra-industry specialization. 2/

This paper sets out to test alternative hypotheses as to the factors determining the extent of intra-industry trade, defined as the share of this trade in total trade, in a multi-country and multi-industry framework. The investigation is limited to trade in manufactured goods where product differentiation predominates while trade in primary commodities occurs largely in standardized products. Seasonal and border trade apart, intra-industry specialization is not expected to occur in standardized commodities. 3/

The determinants of intra-industry specialization are analyzed in the trade of every country with every other country in each industry category,

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1/ The expressions 'intra-industry specialization' and 'intra-industry' trade will be used interchangeably in the paper.

2/ For references, see below.

3/ However, Brander (1981) considers the case of intra-industry trade in standardized commodities under conditions of Cournot-type duopoly.

with reference to country and industry characteristics. The former pertain to pairs of countries; they represent common country characteristics (average per capita income, income inequality, average country size, size inequality, average trade orientation, distance, common borders) and specific country characteristics (participation in economic integration schemes and common language). The latter pertain to individual industries; they include product differentiation, marketing costs, variability of profit rates, scale economies, industrial concentration, foreign investment, foreign affiliates, offshore assembly, average tariffs, and tariff dispersion.

The senior author earlier used the same country characteristics in an investigation of intra-industry specialization in a multicountry framework (Balassa, 1984a) and the same country and industry characteristics in an investigation of the intra-industry specialization of the United States with the rest of the world (Balassa, 1984b). The present investigation represents an extension of the former by including industry characteristics in addition to country characteristics in the analysis, and an extension of the latter by examining the extent of intra-industry specialization of every country with every other country. Apart from an attempt by Loertscher and Wolter (1980), referred to below, no other author has made estimates that combined the intercountry and the interindustry determinants of intra-industry trade in a multilateral framework.

The study covers 38 countries whose manufactured exports exceeded $300 million, and accounted for at least 18 percent of their total merchandise exports, in 1979. Apart from trade among all the countries concerned, estimates have been made for trade among developed countries, among developing countries, as well as between developed and developing countries. Eighteen

countries with per capita incomes of $2254 or higher in 1973 1/ have been included in the developed, and twenty countries with per capita incomes of $2031 or lower in 1973 2/ in the developing, country group. 3/

The investigation includes altogether 152 industry categories in the manufacturing sector as defined by the United States Standard Industrial Classification (SIC), with the exclusion of natural resource products whose manufacture is importantly affected by the availability of natural resources in a particular country. 4/ The classification scheme has been established by merging 4-digit SIC categories in cases when the economic characteristics of

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1/ In order of their per capita GNP, the countries in question are Switzerland, United States, Sweden, Denmark, Germany, Australia, Canada, Norway, France, Belgium, Netherlands, Japan, Finland, Austria, United Kingdom, Israel, Italy, and Ireland.

2/ In order of their per capita incomes, they are Spain, Singapore, Greece, Argentina, Hong Kong, Portugal, Yugoslavia, Mexico, Brazil, Taiwan, Malaysia, Tunisia, Korea, Morocco, Turkey, Egypt, Thailand, Philippines, India, and Pakistan.

3/ Among empirical studies of the intercountry determinants of intra-industry trade, Havrylyshyn and Civan (1983) included countries, such as Algeria, the Central African Republic, Nigeria, and Sudan, in whose exports manufactured goods accounted for less than one percent of the total. In turn, Bergstrand (1983), Clair, Gaussens, and Phan (1984), and Loertscher and Wolter (1980) limited the investigation to trade among the developed countries. All other empirical studies of intra-industry trade, referred to on p. 4, examined the interindustry determinants of this trade.

4/ The investigation excludes foods and beverages (SIC 20), tobacco (SIC 21), non-ferrous metals (SIC 333), as well as several 4-digit categories covering textile waste, preserved wood, saw mill products, prefabricated wood, veneer and plywood, wood pulp, dyeing and tanning extracts, fertilizers, adhesives and gelatin, carbon black, petroleum refining and products, asbestos and asphalt products, cement and concrete, lime, gypsum products, cut stone products, and lapidary work. It also excludes ordnance (SIC 19), for which comparable trade data are not available.

particular products have been judged to be very similar. 1/ The use of an economically meaningful classification scheme is of importance, so as to identify 'genuine' as compared to spurious intra-industry trade, which latter is an artifact of the classification scheme employed. The individual industry categories have further been matched against the 3- and 4-digit categories of the United Nations Standard International Trade Classification (SITC). 2/

Section I of the paper describes the methodology utilized. Sections II and III, respectively, review the intercountry and the interindustry determinants of intra-industry specialization. Section IV provides the empirical results obtained for bilateral trade among all the countries covered, among developed countries, among developing countries, as well as between developed and developing countries. Finally, Section V compares the results obtained for the various groups of countries.

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1/ The principal criteria have been high substitution elasticities in production and in consumption.

2/ Among other empirical studies of intra-industry trade, Havrylyshyn and Civan (1983) and Pagoulatos and Sorensen (1975) used 102 3-digit SITC categories; Loertscher and Wolter selected 59 such categories because of a lack of sufficient reliable export data for others (1980, p. 285n); Caves chose 84 3-digit SITC categories which could be matched with 4-digit SIC categories (1981, p. 206); Toh utilized 112 4-digit SIC categories for which comparable trade data could be "derived from aggregating comparable and not too many SITC numbers in order to keep the extent of statistical aggregation bias to the minimum" (1982, p. 288); Lundberg (1982) made calcaulations for the 77 manufacturing sectors of the International Standard Industrial Classification; Bergstrand (1983) used 3 digit categories within SITC class 7, and Clair, Gaussens, and Phan (1984) utilized 5-digit categories in SITC classes 5 and 7. None of these authors attempted to replace the statistical categories by more appropriate industry categories or to exclude natural-resource products. In turn, several of them introduced variables to evaluate the implications for the index of intra-industry trade of the heterogeneity of the statistical categories that is not necessary if an economically meaningful system of classification is used.

I

The index of intra-industry trade, $IIT_{jki}$, has been defined as in (1), where $X^e_{jki}$ and $M^e_{jki}$ stand for the adjusted exports and imports of industry i in trade between countries j and k. The formula makes adjustment for imbalance in total trade between countries j and k, when $X_{jk}$ and $M_{jk}$ represent the total exports and imports of country j in trade with country k. 1/ The index takes values from 0 to 1 as the extent of intra-industry trade increases.

$$(1)\quad IIT_{jki} = 1 - \frac{|X^e_{jki} - M^e_{jki}|}{X^e_{jki} + M^e_{jki}} = 1 - \frac{\left|\frac{X_{jki}}{X_{jk}} - \frac{M_{jki}}{M_{jk}}\right|}{\frac{X_{jki}}{X_{jk}} + \frac{M_{jki}}{M_{jk}}}$$

where $X^e_{jki} = X_{jki}\,\frac{X_{jk} + M_{jk}}{2X_{jk}}$ and $M^e_{jki} = M_{jki}\,\frac{X_{jk} + M_{jk}}{2M_{jk}}$

In the regression equations explaining intercountry and interindustry differences in the extent of intra-industry trade, $IIT_{jki}$ has been used as the dependent variable. In turn, the explanatory variables include the country characteristics and the industry characteristics described in Sections II and III, respectively.

Various considerations are relevant to the choice of the functional form utilized in the estimation. To begin with, a linear or loglinear

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1/ While Aquino (1978) made adjustment for the imbalance in trade in manufactured goods, the present study follows Balassa (1979) in adjusting for the imbalance in total trade, so as to allow for inter-industry specialization between primary and manufactured goods that is of particular importance in trade between developed and developing countries.

equation may give estimated values that lie outside the 0 to 1 range. While a logistic function does not have this shortcoming, its logit transformation 1/ cannot handle values of 0 and 1. At the same time, although values of 1 (representing complete intra-industry specialization) do not occur in the sample, values of 0 (representing complete inter-industry specialization) are of importance.

In trade among all the countries concerned, there are potentially 106,856 observations. 2/ $IIT_{jki}$ is, however, not defined in 41 percent of the cases, because $X_{jki} = M_{jki} = 0$ ; i.e. no trade takes place in a particular industry category between two particular countries. Among the remaining 62,770 observations, 51 percent are equal to 0, because either $X_{jki}$ or $M_{jki}$ is zero; i.e. there is complete inter-industry specialization.

Given the importance of the zero observations, the choice has been made for the nonlinear least squares estimation of the logistic function that can handle such observations. We have thus estimated (2), where $Z_{jki}$ is the vector of the explanatory variables, $\beta$ is the vector of the regression coefficients, and $\varepsilon_{jki}$ is a random disturbance term. Estimation has

$$(2)\quad IIT_{jki} = \frac{1}{1+\exp -\beta' Z_{jki}} + \varepsilon_{jki}$$

been done by decomposing $\beta' Z_{jki}$ as shown in (3), where C refers to country characteristics and I to industry characteristics.

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1/ $\ln (IIT_{jki}/1-IIT_{jki}) = b'Z_{jki} + u_{jki}$

2/ There are 38 countries trading with 37 countries in 152 commodity categories, but we eliminate one-half of the observations since $IIT_{jki} = IIT_{kji}$.

$$(3) \quad \beta' Z_{jki} = \quad + \beta^{C'} X_{jk}^{C} + \beta^{I'} X_i$$

It is apparent that while none of the individual terms in (3) includes both the country and the industry dimensions of the variation of the dependent variable $IIT_{jki}$, they are both incorporated in the entire function. This means that the effects of country characteristics on the index of intra-industry specialization are assumed to be invariant across industries and the effects of industry characteristics on the index of intra-industry specialization are assumed to be invariant across country pairs.[1/]

## II [2/]

In examining trade in differentiated products, Linder advanced the proposition that "the more similar the demand structures of two countries, the more intensive, potentially, is the trade between these two countries" (1961, p. 94). He further argued that while "a whole array of forces influences the demand structure of a country...the level of average income is the most important single factor and that it has, in fact, a dominating influence on the structure of demand [so that] similarity of average income levels could be

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1/ In order to estimate industry-specific effects of country characteristics and country-specific effects of industry characteristics on the extent of intra-industry trade, one would ideally estimate (3) with industry-specific coefficients $b_i^C$ and country-specific coefficients $b_{jk}^I$, instead of the coefficients $b^C$ and $b^I$. However, this would involve the estimation of several thousands of coefficients. Such an estimation would be excessively costly and might be infeasible in practice, even if the sample size is in principle sufficiently large.

2/ This section is based on Balassa, 1984a.

used as an index of similarity of demand structures" (Ibid.). The converse of this proposition is that "per capita incomes differences are a potential obstacle to trade.... When per capita income differences reach a certain magnitude, trade can only take place in certain qualitatively homogeneous products" (Ibid., p. 98).

In utilizing a model where intra-industry trade occurs in differentiated manufactured goods produced under economies of scale, Helpman subsequently provided proof of the proposition that, in the case when the home country has a lower (or equal) capital-labor ratio than the foreign country and factor prices are equalized, "if we reallocate the world's labor and capital stock in a way which increases the foreign country's capital-labor ratio and reduces the home country's capital-labor ratio without disturbing commodity prices and factor rewards, then the share of intra-industry trade...will decline" (1981, p. 325). Now, "since the higher the capital-labor ratio the higher is income per capita (in a cross country comparison), this raises the hypothesis that a country's share of bilateral intra-industry trade is negatively correlated with the absolute difference in bilateral incomes per capita" (Ibid., p. 337).

Helpman also provided proof of the proposition that, in two countries that have the same capital-labor ratio, "a redistribution of resources which preserves each country's initial capital-labor ratio increases the volume of trade if it reduces the inequality in country size, and it reduces the volume of trade if it increases the inequality in country size. The volume of trade is largest when both countries are of equal size" (Ibid. p. 327). On the assumptions made, the entire increase in trade takes the form of intra-industry trade. Correspondingly, one may hypothesize that the extent of

intra-industry trade between any two countries will be negatively correlated with differences in their size.

The two propositions were combined by Dixit and Norman who showed that "if the two countries are of similar size, and have no clear comparative advantage across industries, then we will see the predominant pattern of trade as one of intra-industry trade" (1980, p. 288). Comparative advantage is defined in terms of differences in factor endowments, for which per capita income differences may again be used as a proxy.

Linder further suggested that "the higher the per capita income, the higher will be the degree of quality characterizing the demand structure as a whole" (1961, p. 99), when higher product quality is embodied in more complex, elaborated, refined or luxurious" (Ibid.) products. As these products tend to be differentiated, the extent of intra-industry trade between any two countries is expected to be greater, the higher is their (average) per capita income.

Finally, Lancaster showed that, owing to economies of scale, the equilibrium number of differentiated manufactured products will be the greater, the larger is the size of the market [1/] (1980, p. 158). Correspondingly, it may be hypothesized that the extent of intra-industry trade between any two countries will be positively correlated with their (average) size.

We have considered various hypotheses linking the level of per capita incomes and country size, as well as intercountry differences thereof, to the

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1/ As Lancaster notes, this result will not obtain if economies of scale are derived from a homogeneous production function of constant degree.

extent of intra-industry trade. According to these hypotheses, the extent of intra-industry trade is expected to be positively correlated with the average per capita income and the average size of the two countries and negatively correlated with intercountry differences in per capita incomes and in country size.

While the hypotheses have originally been formulated in a two-country model, in the present case they will be tested in a multi-country model. At the same time, it should be recognized that empirical testing has not permitted introducing some of the restrictive assumptions made by the authors in developing their hypotheses.

In testing the stated hypotheses, per capita income has been represented by GNP per head and country size by GNP. 1/ But, rather than taking absolute values of intercountry differences in per capita incomes and size, use has been made of a relative inequality measure that takes values between 0 and 1. This measure is superior to utilizing the absolute values of the differences, which latter are affected by the magnitudes of the particular country characteristics in the different countries. The relative inequality measure is shown in (4),

$$(4) \quad INEQ = 1 + [(w) \ln (w) + (1-w) \ln (1-w)]/\ln 2$$

1/ While the domestic consumption of manufactured goods would have been a more appropriate measure of the size of domestic market for these products, the necessary data are not available for some countries and are subject to considerable error in regard to others. At the same time, from available information it appears that the consumption of manufactured goods and the gross national product are highly correlated.

where w refers to the ratio of a particular country characteristic in country j to the sum of this characteristic in country j and partner country k.

The next question concerns the introduction of transportation costs. In models of intra-industry trade, such as that of Krugman (1980), transportation costs will reduce the volume of such trade. However, the literature does not provide us with a presumption that intra-industry trade will thereby be affected relatively more (or less) than inter-industry trade. Such a presumption may be established if information flows are introduced.

There is no need to provide information on the characteristics of standardized (non-differentiated) products, such as copper metal, steel ingots, and caustic soda, which have uniform specifications across the world and hence their trade is determined largely by relative costs, giving rise to inter-industry specialization. However, there is need for information on the characteristics of differentiated products, such as machinery, transport equipment, and consumer goods, which are subject to intra-industry trade.

It can be assumed that the availability of information decreases, and its cost increases, with distance. Correspondingly, it may be hypothesized that the extent of intra-industry trade between any two countries will be negatively correlated with the distance between them. Distance has been measured in terms of miles between the centers of geographical gravity for each pair of countries.

The existence of common borders will also contribute to information flows. Furthermore, as Grubel and Lloyd suggested, in countries sharing a common border, intra-industry trade may occur "in products which are functionally homogeneous but differentiated by location" (1976, p. 5). Thus,

it may be hypothesized that the extent of intra-industry trade will be greater between countries that share a common border than between countries which do not have common borders. At the same time, the separate introduction of distance and border variables permits testing the hypothesis that common borders have economic significance for intra-industry trade beyond that of distance. In the econometric investigation, the existence of common borders has been represented by a dummy variable, which takes the value of 1 when the two countries share a common border and is 0 otherwise.

In a model incorporating specific capital and constant returns to scale, Falvey found that the volume of intra-industry trade will vary inversely with the level of tariffs and of trade restrictions in general (1981, p. 505). But, again, the question is if tariffs will affect intra-industry trade relatively more than inter-industry trade. The senior author suggested that such would be the case in the event of trade liberalization in general and economic integration in particular. This is because adjustments to reductions in trade barriers would occur largely through rationalizing operations and changing the product composition of individual industries, with national product differentiation contributing to intra-industry trade (Balassa, 1977).

The same author showed that trade liberalization (1977) and economic integration in the European (1966a, 1975) and the Latin American (1979) area were in fact accompanied by increases in the extent of intra-industry trade among the countries in question. In the present investigation, the hypotheses will be tested that the extent of intra-industry trade between any two countries is negatively correlated with the average level of their trade

restrictions and positively correlated with participation in integration schemes.

Estimates of tariff levels are not available for a number of countries and the tariff equivalent of quantitative import restrictions is not known with any confidence for others. Correspondingly, an indicator of trade orientation has been used to represent the extent of trade restrictions. Trade orientation has been defined in terms of deviations of actual from hypothetical values of per capita exports. Hypothetical values have been derived from a regression equation that, in addition to the per capita income and population variables utilized in early work by Chenery (1960), includes variables representing the availability of mineral resources and propinquity to markets. 1/

Mineral resource availability has been represented by the ratio of mineral exports $(X^m)$ to the gross national product while propinquity has been defined as the weighted average of the inverse of distance between country j and partner country $k(D_{jk})$, the weights being the gross national product of the partner countries $(Y_k)$ : $\sum_k (Y_k/D_{jk})/\sum_k Y_k$ . The results are reported in

1/ Although the paper deals with trade in manufactured goods, the extent of trade orientation in regard to all products in the appropriate variable. This is because protection is a relative concept and trade barriers on primary product affect trade in manufactured goods as well.

equation (5), with t-values shown in parenthesis; all the regression coefficients are significant at the 1 percent level, using a one-tail test. 1/

$$(5) \quad \log \frac{X_j}{P_j} = \underset{(0.38)}{-\,0.1864} + \underset{(15.02)}{0.9212} \log (Y_j/P_j) - \underset{(6.83)}{0.3541} \log P_j$$

$$+ \underset{(2.91)}{0.0251}\, X_j^m/Y_j + \underset{(2.06)}{0.0598} \sum \frac{Y_k/D_{jk}}{\sum_k Y} \; ; \; \bar{R}^2 = 0.9404$$

While the lack of data on tariffs and non-tariff barriers does not permit one to directly test the results of the equation for the individual countries, the pattern of the estimates indicates its practical usefulness. Thus, deviations from the regression line are larger for developing countries than for developed countries, reflecting the fact that variations in trade policies are greater in the former group than in the latter. Also, upward deviations are the largest in cases, such as Korea, Hong Kong, Singapore, and Taiwan, where outward-oriented policies have been applied while downward deviations predominate in countries, such as Argentina, Egypt, India, and Mexico, characterized by inward-orientation. 2/

For any pair of countries, the sum of their trade orientation index has been introduced in the estimating equations to test the hypothesis that the extent of intra-industry trade is positively correlated with trade orientation. In turn, dummy variables have been included to represent

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1/ While population appears on both sides of the equation, as in Chenery's original formulation, and mineral exports are part of total exports, this should not affect the appropriateness of using deviations from hypothetical values as an indicator of trade orientation.

2/ On the classification of countries, cf. Balassa, 1982.

participation in the European Common Market (EEC), the European Free Trade Association (EFTA), and the Latin American Free Trade Area (LAFTA). 1/

Familiarity with each other's products may also contribute to intra-industry trade between particular countries. As common language breeds familiarity, it can be hypothesized that the existence of a common language will increase the extent of intra-industry trade between any two countries. This hypothesis will be tested in regard to English, French, Spanish, German, Portuguese, and Scandinavian languages.

III 2/

As far as industry characteristics are concerned, Linder (1961) and Dreze (1960) were the first to emphasize the importance of product differentiation in international trade. In the theoretical models of Krugman (1979, 1980), Lancaster (1980) and Helpman (1981), product differentiation is taken to be a precondition of intra-industry specialization.

Hufbauer (1970) used the coefficient of variation of export unit values as a measure of product differentiation on the assumption that an inverse relationship exists between the degree of product standardization and the dispersion of prices within each category. While Gray and Martin (1980) criticized this procedure on the grounds that unit values do not appropriately represent prices, at the 7-digit level of the SITC classification utilized by

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1/ For example, the EEC dummy is equal to 1 when both countries are members, and to 0 in all other cases.

2/ This section is based on Balassa, 1984b, where the author acknowledged the receipt of data provided by Professor Caves. -- With the exception of the tariff variables all data derive from U.S. statistics; their use in regard to other countries is predicated on the assumption that the interindustry pattern of the individual variables is invariant among countries. This alternative has been chosen as comparable data for other countries are not available.

Hufbauer differences in unit values can be assumed to largely reflect differences in product characteristics. At any rate, for lack of price observations in the necessary detail, the hedonic price indices suggested by Gray and Martin are not practicable. Consequently, following Caves (1981) and Toh (1982), in the present study use has been made of the Hufbauer measure of product differentiation.

Caves utilized Hufbauer's measure of product differentiation along with other indicators arranged on a scale, reflecting the assumption that 'complexity' would favor international trade and 'information' would discourage it. In descending order, following Hufbauer's proxy for product differentiation, the variables are research and development as a percentage of sales; selling costs as a percentage of total costs; marketing, planning, and support costs as a percentage of total costs; and advertising expenditures as a percentage of sales.

Caves also included foreign direct investment under this heading on the grounds that it indicates the opportunities created by product differentiation to serve foreign markets by local production rather than by exports. But this variable has dimensions other than product differentiation and will be considered separately below. In turn, one may regard the standard deviation of profit rates on equity capital, used by Caves to indicate the heterogeneity of individual commodity categories, as a measure of product differentiation.

Theorists of intra-industry trade hold that economies of scale are a sine qua non of intra-industry specialization; in the absence of scale economies, all product varieties could be produced domestically and no intra-industry trade would take place. Various measures were employed as proxies

for economies of scale in empirical investigations of intra-industry trade. Hufbauer regressed value added per man on firm size, measured in terms of employment; Loertscher and Wolter (1980) used average value added per establishment; Caves (1981) divided minimum plant size by a measure of the cost disadvantages of small firms; and Lundberg (1982) utilized the share of labor force in firms having more than 500 workers for this purpose.

All these measures relate costs to plant size. This is not the relevant consideration, however, regarding economies of scale in industries producing differentiated products, which are characterized by horizontal and vertical specialization. 1/ The former involves lessening product variety in individual plants while the latter entails producing parts, components, and accessories of a particular product in different plants. Now, vertical and horizontal specialization may involve reducing -- rather than increasing -- plant size.

Correspondingly, the above measures of economies of scale will reflect the relative importance of product standardization and are hence expected to be negatively correlated with the extent of intra-industry trade. 2/ In the present investigation, use has been made of Caves' measure. This involves dividing the ratio of the average size of the largest plants in U.S. industry, accounting for approximately one-half of industry shipments, to total industry shipment, by the ratio of value added per worker in the smaller

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1/ These concepts were first introduced in Balassa, 1967.

2/ Caves also expects a negative sign for this variable on the grounds that extensive scale economies would confine production to a few locations. This notion again pertains to standardized rather than to differentiated products.

plants, again accounting for one-half of industry shipments, to value added per worker in the larger plants.

In turn, Toh suggested defining the length of the production run, associated with reductions in product variety, as the ratio of expenditures on new machinery to the capitalized value of the difference between the average wage and the unskilled wage. However, this measure indicates the relative physical capital intensity of the production process rather than the length of the production run. At any rate, the use of this variable has not given statistically significant results in the present investigation and it has been excluded from the estimating equations reported in the tables.

Product standardization is further related to the extent of industrial concentration; ceteris paribus, the possibilities for concentration can be expected to decline with the differentiation of the product. 1/ It may thus be hypothesized that intra-industry trade will be negatively associated with industrial concentration. This hypothesis has been tested by utilizing the internationally adjusted concentration ratio introduced by Toh that is derived by dividing the traditional concentration ratio (the share of the largest four firms in the industry's output) by the share of imports in the industry's output. 2/

The senior author suggested nearly two decades ago that, as the size of the foreign market increases, exports will give place to foreign direct

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1/ As Eastman and Stykolt note, a different conclusion would be reached if product differentiation raised entry barriers (1967, Ch. 1). For further discussion, see Caves, Porter, Spence, and Scott (1980, p. 44).

2/ The explanation given by Toh for the negative sign he obtains is couched in terms of oligopolistic interdependence without reference to differences between industries producing standardized and differentiated products.

investment by oligopolistic firms that wish to exploit the possibilities inherent in the differential characteristics of their products (Balassa, 1966b). Correspondingly, it may be hypothesized that the extent of intra-industry trade will be negatively correlated with the extent of foreign direct investment. 1/ Following Caves, the latter has been measured as the sum of dividends received from foreign affiliates and foreign tax credits, divided by total business receipts of the industry.

In turn, according to Caves, intra-industry trade will increase with the extent of trade (exports plus imports) with majority-owned foreign affiliates, expressed as a proportion of the industry's total exports. However, the opposite result will obtain if this 'input effect' is dominated by a 'replacement effect,' involving the shift of the production of differentiated commodities to foreign affiliates.

In their investigation of intra-industry trade, Pagoulatos and Sorensen (1975) included the average height of tariff and of non-tariff barriers, as well as their dispersion, among the explanatory variables on the assumption that both the height and the variability of protection limit the extent of intra-industry trade. However, as Caves noted, theoretical considerations do not lead to a definite hypothesis in regard to the effects of inter-industry differences in protection levels on the extent of intra-industry trade.

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1/ As suggested by Professor Masahiro Kawai of the Johns Hopkins University, in a more general model foreign direct investment may be considered to be another endogeneous variable. The same conclusion may apply to industrial concentration.

In view of the difficulties involved in estimating the tariff equivalent of non-tariff barriers, in the present investigation only tariff variables have been used. Following Caves, they have been derived as the average trade-weighted index of tariff rates for thirteen major industrial countries and the standard deviation of these tariff rates.

Finally, offshore assembly provisions may lead to increased intra-industry specialization by encouraging the international division of the production process, involving vertical specialization. Correspondingly, a positive correlation is hypothesized between offshore assembly and the extent of intra-industry trade. In the present investigation, the offshore assembly variable has been derived as the share of imports exempted from duties under offshore assembly provisions to total U.S. imports.

IV

The estimates reported here pertain to trade in manufactured goods in 1971 1/ among all the countries of the sample (Table 1), among developed countries (Table 2), among developing countries (Table 3), and between developed and developing countries (Table 4). The results shown in the first column of each table include all the described variables that are statistically significant in at least one of the calculations at a level of 10 percent or higher. In turn, the second column of each table reports the estimates obtained by excluding all variables that are not statistically significant at the 10 percent level in the particular calculation.

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1/ While the calculations refer to 1971, data for manufactured exports in the year 1979 have been used as a benchmark for the choice of the countries for the present investigation, so as to include countries that have shown a potential to export manufactured goods.

Table 1

Estimation of Intra-Industry Trade
in a Multi-Country and Multi-Industry Framework:
Trade Among Developed and Developing Countries Combined
(regression coefficients, with t-values in parenthesis)

| | (1) | | (2) | |
|---|---|---|---|---|
| Constant | 1.516 | (17.01) | 1.513 | (17.02) |
| ln AY/P | 0.691 | (27.10) | 0.694 | (27.65) |
| INEQY/P | -1.038 | (20.89) | -1.038 | (20.92) |
| ln AY | 0.348 | (36.42) | 0.347 | (36.54) |
| INEQY | -0.862 | (27.02) | -0.863 | (27.07) |
| ATO | 0.453 | (32.83) | 0.453 | (32.83) |
| ln D | -0.372 | (49.15) | -0.372 | (49.27) |
| BORDER | 0.302 | (11.94) | 0.311 | (12.71) |
| EEC | 0.163 | (5.00) | 0.159 | (4.91) |
| EFTA | 0.308 | (12.67) | 0.321 | (14.52) |
| LAFTA | 0.601 | (4.92) | 0.594 | (4.37) |
| ENGLISH | 0.085 | (2.97) | 0.085 | (2.97) |
| FRENCH | 0.193 | (2.67) | 0.191 | (2.65) |
| SPANISH | 0.066 | (0.34) | - | |
| GERMAN | 0.268 | (5.11) | 0.254 | (4.95) |
| PORT. | 0.633 | (2.07) | 0.635 | (2.08) |
| SCAND. | 0.053 | (1.25) | - | |
| PD | 0.254 | (12.03) | 0.254 | (12.04) |
| MKT | 3.628 | (12.08) | 3.626 | (12.09) |
| SDPR | 0.371 | (2.56) | 0.370 | (2.55) |
| ECSC | -2.248 | (8.01) | -2.248 | (8.00) |
| IACR | -2.085 | (14.71) | -2.085 | (14.68) |
| FDI | -0.395 | (2.67) | -0.395 | (2.67) |
| AFFL | -0.121 | (2.69) | -0.120 | (2.67) |
| OAP | 0.406 | (10.20) | 0.405 | (10.20) |
| TSD | -2.753 | (6.00) | -2.754 | (6.00) |
| $R^2$ | 0.4430 | | 0.4430 | |
| N | 62770 | | 62770 | |

The results reported in Table 1 support the hypotheses put forward in Section II of the paper as far as common country characteristics are concerned. As expected, the extent of intra-industry trade is positively correlated with average per capita incomes (AY/P), average country size (AY), trade orientation (TO), and the existence of a common border (BORDER), and it is negatively correlated with income inequality (INEQY/P), inequality in country size (INEQY), and distance (D). All the variables are highly significant statistically.

Among specific country characteristics, the EEC, EFTA, and LAFTA dummy variables have the expected positive sign and are highly significant statistically. In turn, the regression coefficients of the language dummy variables have a positive sign, but their level of statistical significance varies. The English, French, and German language variables are significant at the 1 percent level, the Portuguese language variable at the 5 percent level, while the Spanish and Scandinavian language variables are not significant at even the 10 percent level.

Among industry characteristics, the Hufbauer measure of product differentiation (PD) has the expected positive sign and it is highly significant statistically. This is also the case for the marketing variable (MKT), leading to the conclusion that marketing expenditures increase with the degree of product differentiation. The other product differentatiation variables are not significant at the 10 percent level in any of the regressions and have been excluded from the equations reported in all the tables.

The standard variation of profit rates (SDPR) is also positively related to the extent of intra-industry trade and it is statistically

significant at approximately the 2 percent level. This is the expected result, irrespective of whether one follows Caves in regarding the variability of profit rates as an indication of product heterogeneity or the variable is taken to represent product differentiation as suggested in Section III.

The economies of scale (ECSC) and the industrial concentration (IACR) variables are negatively correlated with the extent of intra-industry trade and are highly significant statistically. Again, the results correspond to expectations as the variables are considered to be indicators of product standardization.

The foreign direct investment (FDI) and foreign affiliates (AFFL) variables have a negative sign and are significant at the 1 percent level. The result for foreign direct investment corresponds to expectations; in turn, the negative coefficient for the foreign affiliates variable points to the conclusion that the 'replacement effect' exceeds in importance the 'input effect.'

The tariff dispersion variable (TSD) is highly significant statistically and it has a negative sign, thus conforming to the hypothesis put forward by Pagoulatos and Sorensen. However, possibly reflecting the considerations adduced earlier, the average tariff variable is not statistically significant in any of the equations; correspondingly, it has been omitted from the reported results. Finally, the offshore assembly variable (OAP) has the expected positive sign and it is highly significant statistically.

The results for the developed country group confirm the conclusions obtained for the entire group of countries as regards common country

Table 2

Estimation of Intra-Industry Trade
in a Multi-Country and Multi-Industry Framework:
Trade Among Developed Countries
(regression coefficients, with t-values in parenthesis)

| | (1) | | (2) | |
|---|---|---|---|---|
| Constant | 1.906 | (8.15) | 1.951 | (8.57) |
| ln AY/P | 0.434 | (5.95) | 0.418 | (5.98) |
| INEQY/P | 0.209 | (0.74) | - | |
| ln AY | 0.359 | (17.10) | 0.360 | (17.49) |
| INEQY | -0.827 | (14.61) | -0.828 | (14.63) |
| ATO | 0.365 | (5.29) | 0.357 | (5.24) |
| ln D | -0.357 | (26.06) | -0.358 | (26.33) |
| BORDER | 0.273 | (7.78) | 0.271 | (7.75) |
| EEC | 0.148 | (3.54) | 0.149 | (3.58) |
| EFTA | 0.294 | (9.07) | 0.296 | (9.15) |
| ENGLISH | -0.084 | (1.83) | -0.082 | (1.78) |
| FRENCH | 0.390 | (3.57) | 0.383 | (3.51) |
| GERMAN | 0.309 | (4.74) | 0.313 | (4.81) |
| SCAND. | 0.102 | (1.89) | 0.099 | (1.86) |
| PD | 0.338 | (11.01) | 0.338 | (11.00) |
| MKT | 2.672 | (6.06) | 2.780 | (6.87) |
| SDPR | 0.122 | (0.59) | - | |
| ECSC | -3.104 | (7.63) | -2.998 | (7.82) |
| IACR | -1.444 | (8.44) | -1.452 | (8.54) |
| FDI | -0.046 | (0.22) | - | |
| AFFL | 0.018 | (0.29) | - | |
| OAP | 0.173 | (3.02) | 0.177 | (3.14) |
| TSD | -3.900 | (5.81) | -3.916 | (6.11) |
| $R^2$ | 0.5680 | | 0.5680 | |
| N | 21250 | | 21250 | |

characteristics, the only exception being the income inequality variable. 1/ This exception may be explained by the fact that, with income differences being relatively small among developed countries, their demand structure is more similar. Correspondingly, one may not expect large variations to occur in the extent of intra-industry trade as a function of income differences.

The stated hypotheses are also confirmed in regard to participation in integration arrangements and the responsiveness of intra-industry trade to having French and German as common languages among the developed countries. However, the English language variable has the incorrect sign, possibly reflecting the effect of longstanding separation among the countries concerned. Finally, the level of statistical significance approached 5 percent for the Scandinavian language in the developed country group.

Except for the standard deviation of profit rates, all product differentiation and product standardization variables continue to be highly significant in the developed country group. Also, the offshore procurement and tariff dispersion variables are significant at the 1 percent level while the foreign direct investment and foreign affiliate variables lose their statistical significance.

The coefficient of determination is 0.44 in regard to intra-industry trade among all countries exporting manufactured goods and 0.57 for trade among the developed countries. The differences in the explanatory power of

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1/ The estimated results are shown in Table 2, omitting the dummy variables for LAFTA, Spanish and Portuguese languages, which are not relevant for trade among developed countries.

the regressions are likely to find their origin in the greater homogeneity of the economic structure of the developed country group. 1/

Estimates made for developed countries by Loertscher and Wolter have a much lower coefficient of determination (0.07). There may be two possible explanations for this result. For one thing, Loertscher and Wolter estimated a logit equation that involves excluding zero observations; for another thing, while these authors adjusted the explanatory variables for heteroscedascity, they failed to make this adjustment for the dependent variable. 2/

The results obtained for intra-industry trade among developing countries, reported in Table 3, 3/ also confirm the stated hypotheses as far as average income levels, income inequality, trade orientation, distance, and border trade are concerned. All the coefficients are highly significant statistically, except for the income inequality variable that is significant only at the 5 percent level. The explanation for this result is similar to that adduced in regard to trade among developed countries.

The hypotheses are not confirmed, however, in regard to the average size and size inequality variables; in fact, the signs are the opposite to those expected. In this connection, it should be noted that only about one-

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1/ The proportion of observations for which intra-industry trade is equal to 0 is 22 percent in trade among developed countries, while it is 51 percent in trade among all countries. In the former case, the potential number of observations is 23256, but there are 2006 cases where no trade takes place.

2/ At the same time, as shown in Balassa, 1984a, the values of the regression coefficients and their levels of statistical significance, are affected to a considerable extent by the use of the incorrect weighting procedure. Correspondingly, little purpose would be served by comparing the results of this study with those of Loertscher and Wolter.

3/ The EEC, EFTA, German and Scandinavian language variables are irrelevant in this context and have been excluded from the estimation.

Table 3

Estimation of Intra-Industry Trade
in a Multi-Country and Multi-Industry Framework:
Trade Among Developing Countries
(regression coefficients, with t-values in parenthesis)

| | (1) | | (2) | |
|---|---|---|---|---|
| Constant | -2.000 | (3.35) | -1.950 | (3.37) |
| ln AY/P | 0.788 | (7.97) | 0.808 | (8.29) |
| INEQY/P | -0.362 | (1.95) | -0.341 | (1.84) |
| ln AY | -0.425 | (4.21) | -0.408 | (4.16) |
| INEQY | 0.973 | (3.02) | 0.934 | (2.95) |
| ATO | 0.256 | (7.90) | 0.259 | (8.09) |
| ln D | -0.392 | (10.54) | -0.390 | (10.54) |
| BORDER | 0.606 | (4.12) | 0.603 | (4.13) |
| LAFTA | 1.346 | (7.69) | 1.322 | (7.60) |
| ENGLISH | 0.600 | (8.10) | 0.606 | (8.16) |
| FRENCH | -0.499 | (0.58) | - | |
| SPANISH | 1.207 | (4.63) | 1.167 | (4.52) |
| PORT. | 0.986 | (3.73) | 0.965 | (3.61) |
| PD | 0.243 | (2.85) | 0.252 | (3.08) |
| MKT | 3.373 | (3.11) | 3.361 | (3.38) |
| SDPR | 0.340 | (0.69) | - | |
| ECSC | -1.515 | (1.36) | - | |
| IACR | -0.914 | (1.70) | -0.849 | (1.60) |
| TSD | 0.637 | (0.35) | - | |
| $R^2$ | 0.2249 | | 0.2245 | |
| N | 6697 | | 6697 | |

fourth of trade in manufactured goods among these countries is intra-industry trade and a few aberrant results may have influenced the outcome.

Among specific country characteristics, the LAFTA, English, Spanish, and Portuguese language variables are significant at the 1 percent level in the developing country group. However, the French language variable is not significantly different from zero and has the wrong sign.

The foreign direct investment, foreign affiliate, and offshore procurement variables are not relevant for trade among developing countries and have thus been excluded from the estimates. Among the remaining industry variables, product differentiation and marketing costs are statistically significant at the 1 percent level, the industrial concentration variable at the 10 percent level, while the economies of scale variable approaches this level. In turn, the coefficients of the standard deviation of profit rates and the tariff dispersion are not significantly different from zero.

The coefficient of determination is 0.22 in regard to intra-industry trade among the developing countries; it is 0.25 in regard to trade between the developed and the developing countries, for which the results are reported in Table 4. In both cases, the heterogeneity of the sample and the relatively large proportion of the zero observations appear to have reduced the explanatory power of the regression equations. 1/ As far as the trade of the

1/ Of the potential number of 28800 observations, no trade occurs among developing countries in 22183 cases; the corresponding results are 54720 and 19897 in trade between developed and developing countries. Among the remaining observations, the index of intra-industry specialization takes the value of 0 in 75 percent of the cases in trade among developing countries and 64 percent of the cases in trade between developed and developing countries.

Table 4

Estimation of Intra-Industry Trade
in a Multi-Country and Multi-Industry Framework:
Trade between Developed and Developing Countries
(regression coefficients, with t-values in parenthesis)

| | (1) | | (2) | |
|---|---|---|---|---|
| Constant | 1.723 | (12.13) | 1.734 | (12.94) |
| ln AY/P | 0.704 | (13.67) | 0.704 | (13.67) |
| INEQY/P | -0.727 | (11.43) | -0.726 | (11.47) |
| ln AY | 0.432 | (25.26) | 0.432 | (25.26) |
| INEQY | -1.145 | (18.50) | -1.142 | (18.69) |
| ATO | 0.532 | (26.60) | 0.532 | (26.61) |
| ln D | -0.394 | (29.40) | -0.395 | (29.70) |
| BORDER | 0.547 | (10.48) | 0.547 | (10.50) |
| EFTA | 0.358 | (6.35) | 0.358 | (6.35) |
| ENGLISH | 0.084 | (1.84) | 0.084 | (1.84) |
| FRENCH | 0.033 | (0.24) | - | |
| PD | 0.002 | (0.06) | - | |
| MKT | 8.647 | (15.81) | 8.643 | (15.83) |
| SDPR | 0.556 | (2.08) | 0.557 | (2.09) |
| ECSC | 0.170 | (0.40) | - | |
| IACR | -8.686 | (15.92) | -8.710 | (16.07) |
| FDI | -1.601 | (5.48) | -1.587 | (5.47) |
| AFFL | -0.468 | (5.64) | -0.463 | (5.68) |
| OAP | 1.043 | (14.90) | 1.037 | (15.18) |
| TSD | -1.474 | (2.01) | -1.515 | (2.12) |
| $R^2$ | 0.2484 | | 0.2484 | |
| N | 34823 | | 34823 | |

developing countries is concerned, the prevalence of quantitative import restrictions may also reduce the extent of the correlation.

Nevertheless, all the variables representing common country characteristics are highly significant in intra-industry trade between developed and developing countries. This conclusion also applies to the EFTA variable while the English language variable is significant at the 10 percent level. The French language variable is, however, not significant statistically.

Among industry characteristics, the marketing cost, industrial concentration, foreign direct investment, foreign affiliates, and offshore procurement variables are all highly significant statistically. In turn, the level of statistical significance is 5 percent for the standard deviation of profit rates and for the tariff dispersion variable. The Hufbauer measure of product differentiation and the economies of scale variables are not statistically significant, however.

Conclusions

This paper has tested various hypotheses in regard to the determinants of intra-industry specialization in manufactured goods, including common and specific country characteristics as well as industry characteristics. The study covers altogether 38 countries exporting manufactured goods; calculations have been made for bilateral trade flows among all the 38 countries, among 18 developed countries, among 20 developing countries, as well as between the 18 developed and the 20 developing countries.

The hypotheses put forward in the theoretical literature in regard to common country characteristics are generally confirmed by the empirical

results. Thus, the extent of intra-industry trade is positively correlated with average income levels, average country size, trade orientation, and the existence of common borders and it is negatively correlated with income inequality, inequality in country size, and distance. 1/ All the variables are highly significant statistically in the four calculations, except for the income inequality variable in trade among developed countries and among developing countries; in both cases income differences are smaller than in the entire country sample.

It is further shown that the extent of intra-industry trade and participation in the European Common Market, the European Free Trade Association, and in the Latin American Free Trade Association are positively correlated, with all the coefficients being highly significant statistically in the relevant equations. Also, the language variables have the expected positive sign whenever they are statistically significant, which is the case in most instances.

In turn, the extent of intra-industry trade is expected to be positively correlated with product differentiation, represented by the Hufbauer measure of product differentiation, marketing costs, and the variability of profit rates, and negatively correlated with product standardization, represented by economies of scale and industrial concentration. All the regression coefficients have the expected sign and are generally significant statistically, the exceptions being the standard deviation of profit rates in the case of trade among developed and among

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1/ This conclusion does not apply to the size variables as far as trade among developing countries is concerned, however.

developing countries; the economies of scale variable in the case of trade among developing countries and between developed and developing countries; and the product differentiation variable in trade between developed and developing countries.

The variables associated with foreign investment (foreign direct investment and foreign affiliates) have a negative sign and are statistically significant, except for trade among developed countries. In turn, the offshore procurement variable has the expected positive sign and it is highly statistically significant in all three cases. 1/ And, while the average tariff variable does not reach minimum levels of significance in any of the cases considered, the tariff dispersion variable is statistically significant except for trade among developing countries.

The estimates presented in this paper combine the intercountry and the interindustrty determinants of the extent of intra-industry trade. The explanatory power of the regression equation for intra-industry trade among all the countries under consideration is fairly high, notwithstanding the relatively small number of estimated parameters compared to the number of observations. At the same time, the coefficient of determination is the highest for trade among the developed countries that have a relatively more homogeneous economic structure and for which intra-industry trade represents an important proportion of total trade. In turn, the heterogeneity of the sample and the relatively large proportion of zero observations appears to have reduced the explanatory power of the regressions for intra-industry trade among developing, as well as between developed and developing, countries.

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1/ It will be recalled that the last-mentioned three variables are not relevant for trade among developing countries.

## References

Aquino, Antonio (1978), "Intra-Industry Trade and Inter-Industry Specialization as Concurrent Sources of International Trade in Manufactures," Weltwirtschaftliches Archiv, 114(2), 175-96.

Balassa, Bela (1966a), "Tariff Reductions and Trade in Manufactures Among Industrial Countries," American Economic Review, 56(3), 466-73.

Balassa, Bela (1966b), "American Direct Investments in the Common Market," Banca Nazionale del Lavoro Quarterly Review, June, 121-46.

_____ (1967), Trade Liberalization among Industrial Countries: Objectives and Alternatives, New York, McGraw Hill for the Council on Foreign Relations, Chapter 5.

_____ (1975), European Economic Integration, Amsterdam, North-Holland, Chapter 2.

_____ (1977), "Effects of Commercial Policy on International Trade, the Location of Production, and Factor Movements" in Bertil Ohlin, Per-Ove Hesselborn and Per Magnus Wijkman, eds. The International Allocation of Economic Activity, London, Macmillan, 1977, pp. 230-58.

_____ (1979), "Intra-Industry Trade and the Integration of Developing Countries in the World Economy," in Herbert Giersch, ed., On the Economics of Intra-Industry Trade, Tubingen, J.C.B. Mohr (Paul Siebeck), 245-70.

_____ (1982), "Structural Adjustment Policies in Developing Countries," World Development, January 1982, pp. 23-38.

_____ (1984a), "Intra-Industry Trade among Exporters of Manufactured Goods," paper presented at the Symposium on Intra-Industry Trade in Brussels in June 1984; to be published in the Proceedings of the Conference. World Bank Development Research Center Discussion Paper No. 87.

_____ (1984b), "The Determinants of Intra-Industry Specialization in United States Trade," Washington, D.C., World Bank, Development Research Department, Discussion Paper No. 86, Washington, D.C. June 1984.

Bergstrand, J.H. (1983), "Measurement and Determinants of Intra-Industry International Trade," in P. K. M. Tharakan, ed., Intra-Industry Trade, Amsterdam, North Holland, 201-41.

Brander, James A. (1981), "Intra-Industry Trade in Identical Commodities," Journal of International Economics, 11(1), February, 1-14.

Caves, Richard E. (1981), "Intra-Industry Trade and Market Structure in the Industrial Countries," Oxford Economic Papers, 33(2), July, 203-23.

_____ Michael E. Porter, and A. Michael Spence, with John T. Scott (1980), Competition in the Open Economy: A Model Applied to Canada, Cambridge, Mass., Harvard University Press.

Chenery, Hollis B. (1960), "Patterns of Industrial Growth," American Economic Review, 50(4), September, 624-54.

Clair, Claude, Olivier Gaussens, and Duc-Loi Phan (1984) "Le commerce international intra-branche et ses déterminants d'apres le schéma de concurrence monopolistique: une vérification empirique," Revue Economique, 35 (2), March, 347-78.

Dreze, Jacques (1960), "Quelques réflexions sereines sur l'adaptation de l'industrie belge au Marché Commun," Comptes rendus des Travaux de la Société Royale d'Economie Politique de Belgique, No. 275, December.

Dixit, Avinash K. and Victor Norman (1980), Theory of International Trade, Digswell Place, Welwyn, James Nisbet & Co. and Cambridge University Press.

Eastman, H. C. and S. Stykolt (1967), The Tariff and Competition in Canada, Toronto, Macmillan.

Falvey, Rodney F. (1981), "Commercial Policy and Intra-Industry Trade, Journal of International Economics, 11(4), November, 495-512.

Gray, H. Peter and John P. Martin (1980), "The Meaning and Measurement of Product Differentiation in International Trade," Weltwirtschaftliches Archiv, 116(2), 322-29.

Grubel, Herbert G. and P. J. Lloyd (1975), Intra-Industry Trade, London, Macmillan.

Havrylyshyn, Oli and E.. Civan (1983), "Intra-Industry Trade and the Stage of Development: A Regression Analysis of Industrial and Developing Countries," in P.K.M. Tharakan ed., Intra-Industry Trade, Amsterdam, North Holland, 111-140.

Helpman, Elhanan (1981), "International Trade in the Presence of Product Differentiation, Economies of Scale and Monopolistic Competition: A Chamberlin-Heckscher-Ohlin Approach," Journal of International Economics, 11(3), August, 305-40.

Hufbauer, G. C (1970), "The Impact of National Characteristics and Technology on the Commodity Composition of Trade in Manufactured Goods," in Raymond Vernon, ed., The Technology Factor in International Trade, New York, National Bureau of Economic Research, 145-231.

Krugman, Paul R. (1979), "Scale Economies, Product Differentiation, and the Pattern of Trade," American Economic Review, 70(5), December, 950-59.

Lancaster, Kelvin (1980), "Intra-Industry Trade under Perfect Monopolistic Competition," Journal of International Economics, 10(2), May, 151-75.

Linder, Burenstam Staffan (1961), An Essay on Trade and Transportation, New York, John Wiley.

Loertscher, Rudolf and Frank Wolter (1980), "Determinants of Intra-Industry Trade: Among Countries and Across Industries," Weltwirtschaftliches Archiv, 116(2), 280-92.

Lundberg, Lars (1982), "Intra-Industry Trade: The Case of Sweden," Weltwirtschaftliches Archiv, 118(2), 303-16.

Pagoulatos, Emilio and Robert Sorensen (1975), "Two-Way International Trade: An Econometric Analysis," Weltwirtschaftliches Archiv, 111(3), 454-65.

Toh, Kiertisak (1982), "A Cross-Section Analysis of Intra-Industry Trade in U.S. Manufacturing Industries," Weltwirtschaftliches Archiv, 118 (2), 282-301.