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Oli Havrylyshyn and Engin Civan

Intra-Industry Trade and the Stage of Development

A Regression Analysis of Industrial and Developing Countries

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INTRA-INDUSTRY TRADE
Empirical & Methodological Aspects
P.K.M. Tharakan (editor)

INTRA-INDUSTRY TRADE AND THE STAGE OF DEVELOPMENT: A REGRESSION ANALYSIS OF INDUSTRIAL AND DEVELOPING COUNTRIES+

O. HAVRYLYSHYN* and E. CIVAN**

**Professor of Economics, George Washington University, and Consultant to the World Bank*
***Ph.D. Candidate, George Washington University, and on the Staff of the World Bank*

ABSTRACT

The paper analyzes the determinants of a country's intra-industry trade index, in a cross-section of sixty-two countries. By including a large number of developing countries, unlike earlier studies which consider mostly industrial countries, we are able to obtain much stronger econometric results, and contrary to Loertscher and Wolter, a strong confirmation of the hypothesis that intra-industry trade is higher the higher the stage of development. We also find customs unions raise intra-industry trade only if they are trade-creating. Finally there is indirect evidence to support the well-known proposition that intra-industry trade is a function of the degree of product differentiation.

I. INTRODUCTION

It has long been known that trade among industrial countries with similar factor endowments is in large proportion intra-industry trade 5IIT) or two-way trade, rather than trade in clearly distinct "complementary goods" with different factor intensities [1]. While there has been some debate in the literature as to whether the large amount of IIT trade is something other than Heckscher-Ohlin trade, or whether it is a statistical artifact, the broad consensus

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appears to be that, as Corden (1979)[2] suggests: "less weight should be given to factor proportions theory... and it is desireable that there be developed a rigorous general equilibrium model with economies of scale possibly embodying some dynamic elements and allowing for more than two products." The statistical fact of a large amount of IIT has indeed led to some recent theorizing on such trade flows, for example, Lancaster (1980) and Krugman (1980), emphasizing economies of scale and product diversity in monopolistic competition. Also, since the pioneering empirical work of Grubel and Lloyd (1975) several studies have attempted to determine the factors behind IIT, applying econometric analysis to levels of IIT by industry (Pagoulatos and Stern (1975), Caves (1980), Lundberg (1983)), and by country (Loertscher and Wolter (1980), Clair, Gaussens and Phan (1983)).

The large majority of studies have considered only industrial countries. It is the purpose of this paper to extend analysis of IIT to include also developing countries. While such an extension has inherent interest as suggested by Tharakan (1981), it is particularly important in testing the "stage of development hypothesis". Loertscher and Wolter (1980) found that, contrary to expectations the stage of development does not seem to affect the level of IIT. But their sample included only the OECD countries, for which the range of development is of course very small. We show in the present paper that with developing countries included the stage of development is in fact a very important determinant of the level of IIT.

In brief, the present paper analyzes the determinants of IIT across a wide range of countries, and tests explicitly for the effect of the stage of development, product diversity, size, and customs unions. Three principal results are obtained. First, the overall fit of the equations and significance of coefficients is much higher than in most earlier econometric studies of IIT. Second, the stage of development has a strong positive effect on the level of a country's IIT. Third, customs unions appear to raise the level of IIT only if they are trade-creating; with trade diversion the effect is not clear.

The remainder of the paper is organized as follows. In Part II of the paper, the IIT concept is briefly reviewed, the underlying theory is discussed, as are the measurement formulae and data. Part III presents a model of determinants of IIT levels across countries, and Part IV presents the regression results. Some concluding remarks are given in Part V.

II. THEORY AND METHODOLOGY

1. The Meaning of Intra-Industry Trade

In a Heckscher-Ohlin world, trade between two countries is characterized by a greater capital intensity of exports from the country with a higher relative endowment of capital. This is typically expressed in either a "factor-content" version in which the capital intensity of the entire bundle of exports is measured, or in the "commodity version" in which exports of each goods category are correlated to the capital intensity of each category [3]. In such a model, trade flows between two countries are in "complementary" goods with differing factor intensities, and the bulk of empirical testing since the "Leontief Paradox" findings has been addressed to finding such complementarity. In counterpoint to this view (though not irreconcilably so) some researchers found that a very high proportion of the trade of industrial countries appeared to be trade in similar products, or "competitive" trade. That is, for a given statistically-measured category of goods (for example, organic chemicals, SITC 512) most industrial countries had large flows of both exports and imports.

The empirical work of Grubel and Lloyd (1975), though not the first application of the concept of intra-industry trade, is perhaps the most extensive of these and became the focus of discussion about the implications of these results for trade theory. Grubel and Lloyd inferred from the fact of high levels of IIT of industrial countries (50 percent to 60 percent for manufactured goods in 1967) that at best half of trade flows could be explained by the conventional factor-endowments model. The remainder, being two-way trade in similar commodities with presumably similar factor characteristics could not be attributed to differing factor endowments. While some writers expressed doubt that intra-industry trade was in fact trade in commodities with similar factor characteristics (Finger (1975), Lipsey (1976) and Finger and DeRosa (1978) in particular), most trade theorists have agreed that there is some truth to the Grubel and Lloyd contention, and recently several have attempted to develop a theoretical explanation for trade in similar goods : Lancaster (1980), Krugman (1979) and (1980), Brander (1981), Falvey (1981).

The dissenting views consist of saying that intra-industry trade within a 3-digit SITC category (or "overlapping trade" as Finger prefers to label it) can still be Heckscher-Ohlin trade because there is as much if not more variation in factor characteristics within these industry groups as among them. In effect, this suggests high IIT values may only be a statistical artifact resulting from disaggregation inadequate to capture "true" industries with unique capital-labor ratios. While there is certainly truth in this position, it does not apparently explain away all of IIT.

One may counter this criticism both conceptually and empirically. While some IIT would probably disappear if one correctly defined industries in more disaggregated statistics, some two-way trade in different categories may be in goods with the same factor intensity, and in principle therefore also non-Heckscher-Ohlin trade. After all, the fundamental point of factor endowment theory pertains neither to arbitrarily defined categories of statisticians, nor to specific end-use characteristics of products, but rather to the factor characteristics of goods. Thus, one may argue that very disaggregated measures underestimate IIT.

In fact calculations of IIT using more disaggregated data, while they diminish its value, by no means make it small enough to ignore. Thus Gray (1979) finds that disaggregation does not cause the IIT phenomena to disappear.[4] Finally, one should consider that even as far back as 1967, industrial countries had quite similar factor endowments. It should be no great surprise that a theory explaining trade on the basis of factor endowment differences is not applicable to a large portion of trade among countries that have very small differences in factor endowments.

This is not to say the theory of Heckscher-Ohlin is to be ignored, for the critics of IIT are right to some degree. There is a statistical problem, and probably an overstatement of the extent of such trade. Furthermore, whatever the explanations of IIT its values are what matter, for "IIT" is not a theory but an observation. And when such explanations are considered they consist of elements that have either always been a part of the trade theorists' perception -- scale economies, tastes -- or of elements which may add to factor endowment but do not contradict it -- differentiated products, monopolistic competition.

But even if the factor endowment theory has become less important in explaining trade among similarly endowed industrial countries, it surely remains important in determining the pattern of trade between developing and industrial countries. As to trade among developing countries, their similar factor endowments (and other "similarities" in the Linder sense) should lead one to expect a greater amount of intra-industry trade than in trade with industrial countries. However, the overall level of IIT for developing countries may be lower than for industrial ones because production of highly differentiated goods is not very important in sucb economies, with their relatively new industrial sectors.

2. Computation Formula and Data

The data source used in this analysis is the UN trade data classified by the Standard International Trade Classification (SITC) at the 3- and 4- digit levels of aggregation. In this study we have focused our attention on non-fuel manufactured goods only (SITC 5 to 8, excluding 3 (Fuels) and 68 (Iron & Steel)). The sample consists of forty-four developing countries (DCs) including thirteen Newly Industrialized Countries (NICs), and eighteen Industrial Countries (ICs) as shown in Table 1.

The basic formula used follows that elaborated by Grubel and Lloyd (1975). In a given trade channel, inter-industry trade, or trade in different products is defined as the absolute value of the difference between exports in a product category (X_i) and imports in that category (M_i), that is

(1) Inter-Industry Trade $= |X_i - M_i|$

It then follows that intra-industry trade, or trade in similar products is given by the value of total trade remaining upon subtraction of inter-industry trade :

(2) Intra-Industry Trade $= (X_i + M_i) - |X_i - M_i|$

A more useful measure is the normalized index of intra-industry trade

$$(3) \quad IIT_i = \frac{[(X_i+M_i) - |X_i-M_i|]}{(X_i+M_i)} .100\%$$

which is simplified to :

$$(3a) \quad IIT_i = 1 - [\frac{|X_i-M_i|}{(X_i+M_i)}] .100\%$$

If there is no intra-industry trade, one of X_i or M_i will be zero, hence $|X_i-M_i|/(X_i+M_i)$ will be equal to one and the index IIT_i will take a value of zero percent. If all trade is intra-industry, $X_i = M_i$, hence $|X_i-M_i| = 0$ and the index IIT_i will take a value of 100 percent. The basic data for computations are the 3-digit level of SITC, that is one begins by calculating IIT for each 3-digit commodity category "i". We noted in footnote 4 the effect of using 4-digit SITC data.

For purposes of presenting data at a more aggregated level than 3-digit, (usually 1-digit), some aggregation formula is needed.

As is discussed in Grubel and Lloyd (1975) as well as Aquino (1978), a simple mean of 3-digit IIT_i values will generally overestimate the extent of intra-industry trade because it gives equal weight to all 3-digit categories regardless of their importance in trade. Therefore, we employ the weighted formula as in Grubel and Lloyd. The intra-industry trade index for some aggregation "A", containing 3-digit "i" components from 1 to n, is :

$$(4) \quad AIIT = \frac{\sum_{i=1}^{n} (X_i+Mi) - \sum_{i=1}^{n} |Xi-Mi|}{\sum_{i=1}^{n} (Xi+Mi)} .100\%$$

For each country, formula (3a) was used to compute the IIT value for each 3-digit item, and formula (4) was used to calculate the aggregated values shown in the tables. As Grubel and Lloyd (1975) note, and Aquino (1978) elaborates further, an imbalance of total trade may bias the IIT calculations, hence an adjustment needs to be made. It was found that this adjustment yielded values very close to those using formula (4), hence only the unadjusted ones are reported here for comparability with other studies.

III. A MODEL OF DETERMINANTS OF IIT ACROSS COUNTRIES

1. Hypotheses

With the increase of statistical data collection in all countries and the advent of computerized means of data manipulation, it has become more common to find statistical facts preceding theory. Certainly, in contrast to the conventional Heckscher-Ohlin theory the statistical phenomenon of intra-industry trade came very much ahead of the theoretical attempts to explain trade in similar goods. To some extent this may be a reflection of the view that IIT is but a statistical phenomenon. The majority of trade theorists now accept that some theory other than (though not necessarily incompatible with) factor endowments is needed to explain IIT. Consequently, one now finds several new models of intra-industry trade based on product differentiation and monopolistic competition, scale economies, as well as transport costs and trade restriction.

Also,empirical work on IIT has gone well beyond measuring it and testing methodological hypotheses such as aggregation and categorization, to regression analysis of the determinants of IIT.

In particular, studies by Hesse (1974), Pagoulatos and Sorensen (1975), Finger and DeRosa (1979), Loertscher and Wolter (1980), and Caves (1981) have explored the variance of IIT across industries in relation to industry characteristics. The findings contain contradictions,[5] but at least some confirm the predictions of the new theories : intra-industry trade is higher in industries with greater heterogeneity of products, greater degree of product differentiation and monopolistic competition and greater involvement of multinationsls. The effect of trade restrictions appears to be to lower intra-industry trade, though the empirical results are less consistent in different studies -- Caves (1981) is particularly sceptical of this effect. Surprisingly, scale economies do not come out statistically significant, except in Loertscher and Wolter (1980), where the sign is negative!

With the exception of Loertscher and Wolter (1980), both the theoretical and empirical work on IIT has focused on variations across industries and not across countries, even though it should be evident from the earliest attempts to measure IIT that the differences among countries are substantial. Grubel and Lloyd (1975) found that total IIT of manufactured goods ranged from a low of 17 percent for Australia to a high of 69 percent for the U.K. If developing countries are included, the level of IIT in 1978 varies even more, between nearly zero to nearly 80 percent, as is clear in Table 1.

No new theory is needed to analyze the variations of IIT levels among countries, as it should be clear that the determinants of differences in IIT among countries are but an aggregation of the industry characteristics considered in the theory. In general the greater the degree to which a country's production, tends to "contain" the relevant industry characteristics, the greater the value of total IIT. However, aggregation may in some instances bring in counter-vailing effects. Let us consider the macro analogue of the three principal hypotheses from the present theory of intra-industry trade : scale economies; product differentiation and/or monopolistic competition; and tariff preferences or integration schemes.

Loertscher and Wolter (1980) posited the effect of scale as follows. The larger an economy, the greater the opportunities for scale effects, hence the higher should be IIT. But critics of the IIT concept are certainly correct in pointing out that the measure of IIT is subject to an overestimate due in part to cross-border trade. Size variables in a regression analysis may easily act as proxies for the cross-border trade as smaller countries (Belgium, Netherlands) tend to do much more trading in general than larger ones (Germany, U.S.). It is the essence of the intra-industry

TABLE 1 : INTRA-INDUSTRY TRADE INDICES BY COUNTRY, 1978 (percent)

Non-NIC Developing Countries				Newly Industr. Countries		Industrial Countries	
Algeria	1.5	Kenya	13.9	Argentina	42.3	Australia	25.3
Cameroon	6.1	Malawi	6.6	Brazil	37.8	Austria	74.1
Central African Rep.	0.7	Malaysia	32.4	Greece	21.1	Belgium-Luxemb.	79.2
Chile	10.1	Morocco	10.9	Hong Kong	40.8	Canada	66.9
Colombia	20.0	Nigeria	0.2	India	37.4	Denmark	67.0
Costa Rica	32.4	Pakistan	14.8	Israel	61.9	Finland	45.4
Dominican Rep.	6.9	Peru	10.3	Korean Republ.	34.9	France	80.3
Egypt	6.8	Philippines	15.0	Mexico	31.9	Germany	62.7
El Salvador	33.0	Senegal	18.7	Portugal	32.8	Ireland	61.3
Ghana	4.3	Sri Lanka	4.8	Singapore	66.9	Italy	59.0
Guatemala	32.7	Sudan	0.8	Spain	52.1	Japan	26.0
Guyana	19.6	Thailand	17.3	Taiwan	34.7	Netherlands	74.2
Haiti	46.3	Trinidad	14.3	Yugoslavia	50.7	New Zealand	25.9
Ivory Coast	13.4	Tunisia	17.3			Norway	44.4
Jamaica	14.4	Turkey	7.9			Sweden	68.3
Jordan	14.9					Switzerland	59.5
						U.K.	8.10
						U.S.A.	59.4

trade phenomenon that international trade is fundamentally but an extension of internal trade, somewhat along the lines of the Linder (1961) hypothesis. This suggests country size may have a negative effect on IIT, balancing the positive effect of industry scale economies and product differentiation. Consequently, it is not clear what sign one should expect for the size variables in regression analysis.

With product differentiation (or the related effect of monopolistic competition) one might expect that the more sophisticated and advanced an economy the greater the opportunities for differentiation hence the greater the IIT. This can be seen as two separate (though related) hypotheses in practical terms.

Higher income per capita, or the "stage of development", results in a more diversified pattern of demand and is a pre-condition for the product heterogeneity in monopolistic competition that underlies IIT theory. Hence, the stage of development hypothesis is, simply, that the more developed the economy the greater the level of IIT.

In addition, one may observe the diversity phenomenon more directly on the supply side. The more "advanced" and "sophisticated" the industrial sector of an economy, the more it is able to produce a wide range of diverse (and probably heterogeneous) products. Thus, for some measure of industrial advancement (discussed below), the greater this is the higher will be IIT.

Finally, consider the effect of tariffs, or more specifically customs union arrangements. At the micro-level, the lower the tariff level the more IIT. Pagoulatos and Sorensen (1975) find support for this, though Caves (1981) is sceptical. It should be remembered here, that the "birth" of the IIT concept came when Verdoorn and others first observed that creation of customs unions of the Benelux led to increased trade in both directions.

More recently Falvey (1981) has shown theoretically that we should expect countries which have less restrictive barriers to do more two-way trade with each other and even to import more from those with high tariffs. Hence, for the sample in this paper, industrial countries should have higher IIT because of their lower trade barriers, and developing countries with high barriers should have lower IIT. However, some developing countries may belong to preferential trade groupings, in which case the effect is unclear. High tariffs outside the group may lower IIT levels via trade diversion while internal preferences may raise it. The net effect will depend on whether trade creation or trade diversion dominates. Our hypothesis is that successful integration schemes with high trade creation will tend to raise

IIT while schemes with a lot of trade diversion may have little net effect on IIT, or even lower it.

2. Specification of Model and Data

On the basis of the literature's theoretical and empirical findings, the following cross-section specification of intra-industry trade is posited :

$$IIT_j = f\,[SIZE_j\ (\underset{?}{POP} \text{ or } \underset{?}{GDP}),\ \underset{+}{PCI_j},\ IADV_j\ (\underset{+}{MAN} \text{ or } \underset{-}{XCONC}),\ \underset{+}{EEC},\ \underset{+}{LAFTA},\ \underset{+}{CACAR}]$$

where IIT = intra-industry trade for country j in total manufactured goods, SIZE = size of country measured by population or gross domestic product, PCI = stage of development as measured by per capita income, IADV = a measure of the industrial advancement or sophistication of the economy, proxied either by the share of industry in GNP (MAN) or (by inverse relation) the degree of product concentration of exports (XCONC), and the last three variables are dummy variables representing membership in major integration schemes: the EEC, LAFTA, and the Central American plus the Caribbean Common Market (CACAR). The expected signs of the coefficients are as shown.

As noted earlier, the expected effect of size is ambiguous. It is proxied either by population (POP) or Gross Domestic Product (GDP) in US$, with 1978 data taken from the World Bank Development Report (1981). The effect of the stage of development is measured by per capita income (PCI) in US$ for 1978, taken from the same source. It is expected that a country will do more intra-industry trade the higher its per capita income.

However, while the stage of development as measured by per capita income should certainly reflect the demand side of product diversification and heterogeneity that underlies IIT at the micro-level, it may not fully capture the side of supply as discussed above. For countries with a rich resource endowment, per capita income may overestimate the extent of development of the industrial base. This is certainly the case for the major oil exporters, though the sample here contains only a handful of cases for which this is relevant -- Nigeria, Trinidad and Tobago, and possibly Mexico and Norway. But, this effect may also be evident for non-oil resource exporters, of which there are several both among the developing and industrial countries, e.g. Ivory Coast, Jamaica, Morocco, Finland, Norway, New Zealand, Australia. The effect may also go in the opposite direction, as for example with India whose "industrial economy within a rural economy" is much older and more sophisticated than per capita income alone would suggest.

To capture this supply-side effect of the level of industrial development as distinct from the demand effect, two alternative proxies were used : the share of manufacturing in GDP (MAN) and a Herfindahl index of concentration of manufactured goods exports (XCONC) both in 1978. For the latter exports rather than production are used because consistent production data are not easily obtained for many countries and also because ability to export a diversified range of goods may better capture "advancement" particularly in developing countries which practice import substitution protection policies. One expects IIT to be higher the more advanced the industrial development of a country. Thus with the proxy MAN, the coefficient should be positive. The same hypothesis tested with the XCONC variable implies a negative coefficient, since a greater degree of product diversity existing in a more advanced industrial economy is shown by a lower concentration index. Though product diversity is not necessarily the same as product differentiation it is assumed (for now) that diversity is a pre-condition for heterogeneity or at least that economies which have reached the level of advancement in which differentiated demand and supply exist must have also attained a large degree of diversity in production. The first proxy (MAN) is taken from the cited World Bank source, and the second is computed using U.S. trade data.[6]

Consistent and representative measures of average protection levels are not readily available and could not be included. However, it is possible to test the hypothesis relating to integration schemes by use of dummy variables to observe whether the level of IIT is increased by the existence of integration or common market schemes. Four major such schemes are analyzed : the European Economic Community (EEC), the Latin American Free Trade Association (LAFTA), the Central American Common Market and the Caribbean Common Market. The last two were lumped together in one dummy variable (CACAR) to avoid excessive use of dummies for the two schemes. The variable INTEG is a dummy for all the integration schemes, used here to test the hypothesis as to whether the effect of integration is universal. Other schemes were not considered, as only these are generally thought to have been at all effective in changing trade volumes. A positive sign is expected for the coefficients.

IV. REGRESSION RESULTS

In comparison to earlier empirical studies on intra-industry trade determinants, the most striking result of the regressions shown in Table 2 is the very high proportion of the variation explained. The best regressions (no. 1-2) yield adjusted R^2 values of .7704 to .7806 (unadjusted R^2 of .7855 to .7960), which is extremely high for cross-section data, and indeed is frequently considered a high degree of explanation even in time-series analysis. In comparison (see Table 3) Loertscher and Wolter (1980) obtained an R^2 value of .147 in cross-country analysis, while in cross-industry analysis Pagoulatos and Stern (1978) showed values of about .36 to .40, Finger and DeRosa (1979) about .015 to .186, and Caves (1980) about .27 to .29. Though normally it is not important in econometric results to ensure high R^2 values -- in particular with cross-section data -- the unusually high degree of fit found here merits emphasis. The reason for such a fit is probably because the sample includes countries from the highest to the lowest levels of development. We should add that the hypothesis tested here (stage of development) is perhaps an "easier" one to verify than the industry level tests of a theory which is still only partly formed.

The most important individual variables in the regression are per capita income (PCI) and the export concentration index (XCONC), both significant at well below 1 percent, and with the expected sign. The variable MAN was positive but not significant; the results are not shown in Table 2, but are discussed later in the text. The strong correlation between IIT and per capita income is also quite evident in the scatter diagram of Figure 1. Overall the best regression with all sixty-two countries included is number 1 in Table 2, which retains only variables with 5 percent or better significance levels. It includes PCI and XCONC plus a dummy variable for the EEC, and a dummy distinguishing the newly industrialized countries, DNIC. This latter was added to the earlier list when it was found that in a regression with just the other three variables (regression 10), though the fit was quite good and significant, residuals for the newly industrialized countries (NICs) were positive, that is the equation predicted higher values than actual ones for industrial countries.[7]

A simple outlier analysis yielded up four countries for which there are good independent reasons to expect very high or very low IIT values. Singapore's high IIT of 66.9 percent may be attributable to its continuing role as an entrepot port, with a great deal of re-exports.[8] Israel's political relations with its geographic neighbors no doubt reduce trade with them; inasmuch as many of them are considerably less developed (certainly in the degree of industrialization), one might reasonably guess that trade would very likely be complementary or Heckscher-Ohlin trade, and would make Israel's IIT levels lower. Algeria and Nigeria have extremely low IIT values, perhaps because the oil boom effects have depressed manufactured goods development in the "Dutch disease" sense. Rather than resort to yet more dummies than already used for the integration scheme variables, it was felt best to consider these four cases sui generis and exclude them altogether. This is done in regression 2, which gives a clear improvement in the fit of the regression, but not enough to make a substantial difference in comparison to the first regression including the outliers. Therefore in all other regressions, the four outlier countries are left in the observation sample, even though excluding them, in all the specifications shown in Table 2, raises the R^2 somewhat.

A number of other outliers remain unexplained. From Figure 1, as well as from Table 7, Haiti seems to have a level of IIT (46.3) well above its "norm", while Greece (21.1), New Zealand (25.9), Australia (25.3) and Japan (26.0) are far lower than might be expected. Only in the case of New Zealand does this become explained in the regression, by the inclusion of either XCONC or MAN; New Zealand is a perfect case of a very rich agricultural resource based economy. Australia might be too, were it not for its long standing policies of high protection for domestic manufacturing. Haiti may be explained by off-shore assembly (baseballs are sewn from pieces produced in the U.S., and shipped back). Greece and Japan are less obvious. In the latter case the low IIT is consistent both with the current popular view that Japan imports too little and is in fact quite protectionist, and the more conventional interpretation that Japan's dearth of natural resources necessarily results in a large surplus of manufactured exports.

We turn now to discuss each of the major variables, considering first size effects, integration schemes, and leave to the last the two most interesting (and most difficult) ones, stage of development and product diversity/differentiation.

Neither of the size variables as seen in regressions 3 and 4 appears to be significant, which is consistent either with the hypothesis stated above -- offsetting positive and negative effects -- or with a hypothesis that size has no effect on intra-industry trade. This result differs from findings of Loertscher and Wolter (1980), where GDP has a positive and significant coefficient, as summarized in Table 3. It is however consistent with the results of other studies, which as Tharakan (1981) notes, generally fail to find scale economies a significant explanatory variable. Nevertheless, some explanation may be needed for the different results of Loertscher and Wolter. Their interpretation

TABLE 2 : REGRESSION RESULTS FOR ANALYSIS OF INTRA-INDUSTRY TRADE BY COUNTRY, 1978

Regression I	No.	Constant	POP	GDP	PCI	XCONC	EEC
Most Significant							
All	1	+19.13[a]	---	---	+.0038[a]	-23.47[a]	+26.81[a]
		(3.44)			(7.40)	(2.79)	(5.37)
Excluding 4 Outliers	2	+20.27[a]	---	---	+.0036[a]	-23.86[a]	+27.03[a]
		(6.16)			(7.35)	(2.92)	(5.69)
Size Effects	3	+19.13[a]	---	+.147	+.0038[a]	-23.43[a]	+26.83[a]
		(5.49)		(0.03)	(6.49)	(2.74)	(5.29)
	4	+19.33[a]	-4.59	---	+.0038[a]	-23.72[a]	+26.84[a]
		(5.45)	(0.25)		(7.32)	(2.78)	(5.33)
Integration Effects	5	+17.27[a]	---	---	+.0046[a]	-28.68[a]	---
		(4.56)			(8.96)	(3.19)	
	6	+16.32[a]	---	---	+.004[a]	-18.50[a]	+27.53[a]
		(4.33)			(7.67)	(2.12)	(5.56)
Stage of Development Only	7	+16.87[a]	---	---	+.005[a]	---	---
		(5.98)			(8.49)		
	8	+46.17[a]	---	---	---	-62.68[a]	---
		(12.16)				(4.72)	
	9	+27.01[a]	---	---	+.0046[a]	-37.88[a]	---
		(7.31)			(7.65)	(3.80)	
Excluding DNIC Dummy	10 All	+27.06[a]	---	---	+.0034[a]	-36.84[a]	+23.17[a]
		(8.27)			(5.96)	(4.17)	(4.15)
Excluding 4 Outliers	11	+25.76[a]	---	---	+.0033[a]	-33.23[a]	24.83[a]
		(8.71)			(6.40)	(4.09)	(4.92)

a. Significant at 1 percent ; b. Significant at 5 percent ; c. Significant at 10 percent.

TABLE 2 (cont.)

Regression I	LAFTA	CACAR	DNIC	INTEG	Adjusted R^2	F
Most Significant						
All	---	---	+16.67[a]	---	.7704	52.18[a]
			(4.21)			
Excluding 4 Outliers	---	---	+12.35[a]	---	.7806	51.71[a]
			(3.05)			
Size Effects	---	---	+16.68[a]	---	.7663	41.01[a]
			(4.15)			
	---	---	+16.87[a]	---	.7666	41.07[a]
			(4.15)			
Integration Effects	---	---	+15.02[a]	+14.70[a]	.7347	43.23[a]
			(3.56)	(4.15)		
	-13.64	+13.36[c]	+18.61[a]	---	.7761	36.24[a]
	(1.49)	(1.85)	(4.56)			
Stage of Development Only	---	---	---	---	.5384	72.15[a]
	---	---	---	---	.2613	22.57[a]
	---	---	---	---	.6228	51.37[a]
Excluding DNIC Dummy	---	---	---	---	.7043	49.43[a]
Excluding 4 Outliers	---	---	---	---	.7469	57.07[a]

a. Significant at 1 percent ; b. Significant at 5 percent ; c. Significant at 10 percent.

TABLE 3 : STYLIZED SUMMARY: SELECTED ECONOMETRIC STUDIES OF INTRA-INDUSTRY TRADE

Studies	Development Stage	Income Difference	Econ. Size	Indus. Scale	Product Differ.	MNE	Tariff Level	Customs Union	Max. R^2
Industry Cross-Section	(+)	(-)	(+)	(+)	(+)	(+)	(-)	(+)	
Pagoulatos & Sorensen (US total)	---	YES	---	---	NO	YES	YES	---	.40
Finger & DeRosa (US, bilateral)	---	---	---	NO	NO	---	---	---	.19
Caves (OECD 13 bilateral)	---	---	---	NO	YES	YES	NO	---	.27 (also logit)
Savelin and Lundberg (Sweden, total)	---	---	---	YES	YES	---	---	---	.34
Cross-Country									
Loertscher & Wolter (OECD 13, bilateral & cross industry)	NO	YES	YES	NO	YES	---	NO	YES	.147
Havrylyshyn & Civan (62 countries, total)	YES	---	YES	---	YES(?)	---	---	YES	.78

N.B. The specifications as well as the econometric procedures are not strictly speaking comparable; this should be taken as an indicative, stylized, summary. The dependent variable is alternatively defined as IIT by industry, total trade of a country, or bilateral trade flows. Expected signs are shown for each type of independent variable. Results are represented as significant tests supporting the expectation (YES), or as insignificant results or opposite signs. Overall fit is indicated by the maximum R^2 in any equation.

was that greater size permits greater opportunities for scale economies and product differentiation. Here, the variable XCONC may capture the product differentiation effect more directly, and consequently the positive effect of size is not working through the size variable. Conversely, in Loertscher and Wolter the negative effect of size (border trade) is perhaps directly[9] captured in their border-trade variable. In the results reported here there is no variable for border-trade effects and the size variables though insignificant do have a negative sign.

Regressions 4, 5, and 6 present results for several variables reflecting integration schemes: the EEC, LAFTA, [10] CACAR, and INTEG for all the countries in these four groups. No other integration schemes in developing countries were analyzed because of the consensus that other trade groupings were on the whole ineffectual, and some such as Asean were until very recently almost completely inactive in practice, while the ones noted at least "succeeded" in making some difference to trade volumes and patterns.[11] As regression 6 makes clear integration appears to have a positive and significant effect. However, in the regression using variables for separate schemes (4 and 5), only the EEC dummy is significant, suggesting that the statistical fit of the INTEG variable is largely attributable to the effect of the EEC. The internal preferences in this trading bloc have apparently led to a strong increase in the level of intra-industry trade of its members. This should not be a surprising result, rather a comforting confirmation of earlier studies. Loertscher and Wolter (1980) also find a significant positive effect for customs unions (see Table 3), which of course for OECD countries means almost exactly the same as the EEC dummy variable used here. Even much earlier Verdoorn (1960) emphasized the increase of intra-industry trade for the Benelux, and Balassa (1966) and Grubel (1967)showed the same for the EEC. Of course it is possible that the EEC dummy is capturing an additional effect: proximity of European economies to each other and the consequent border trade. But in a regression not reported, a dummy for all industrial countries was used, which would capture some of this proximity effect; the EEC dummy remained as significant and the new dummy was positive and significant at about 10 percent, and given the earlier findings of the positive effect of customs unions varying IIT levels, it seems reasonable to interpret the result as support for the hypothesis that a successful customs union, the EEC, results in an increased amount of intra-industry trade.

It is more surprising at first sight that the Latin American schemes do not appear to have had a significant impact on the level of IIT. This appears contrary to the conclusions of Willmore (1972) and (1979) for the CACM, and Balassa (1979) for LAFTA, both of whom found IIT to have increased within the groups as a result of preferences and complementation agreements. The results here can, however, be easily reconciled with the Willmore and Balassa studies. First, neither Balassa nor Willmore controlled for the effects of other determinants of IIT in the manner done here or in Loertscher and Wolter (1980). In particular, they had no direct correction for the simple fact that the members of these groups were geographic neighbors. Hence it may be that the higher intra-trade within the group compared to intra-trade outside, should be attributed at least in part to proximity.[12]

Second, and more importantly, their analysis extends only to the early and middle seventies. Even the three years to 1978 may have already made a difference as these trading arrangements were beginning to deteriorate.[13] Consequently, it is not unlikely that the effects of the trade agteements in raising IIT were strongly diluted by 1978. For the CACM, data in Willmort's (1979) paper suggests a peaking of IIT among these countries in about 1972-73.[14] The effect of Central American domestic and international military disruptions from the mid-seventies no doubt resulted in a further deterioration of the CACM effects.

But the third and most important reason for the apparent contradiction is the (also well known) likelihood that trade diversion was considerable in the Latin American cases but not in the EEC. That is, the EEC was an economically successful integration scheme, while the others, though active, were economically much less successful -- at best. Such a difference should give precisely the results it does in the regression analysis here given that the dependent variable is measured as global intra-industry trade, not bilateral IIT as in Willmore and Balassa. If integration results in mostly trade creation and little trade diversion (the EEC case), the bilateral IIT index with member countries would rise without causing IIT with countries outside to decline very much, hence the global IIT is likely to increase. In contrast, if integration results in considerable trade diversion (the Latin American experience), the bilateral IIT index with member countries rises, but that with outside ones declines, and the global IIT may be unaffected. The significant regression results found here for the EEC and insignificant ones for the Latin American integration schemes certainly support the view that the former was a successful case with little trade diversion while the latter were unsuccessful ones with a lot of trade diversion.

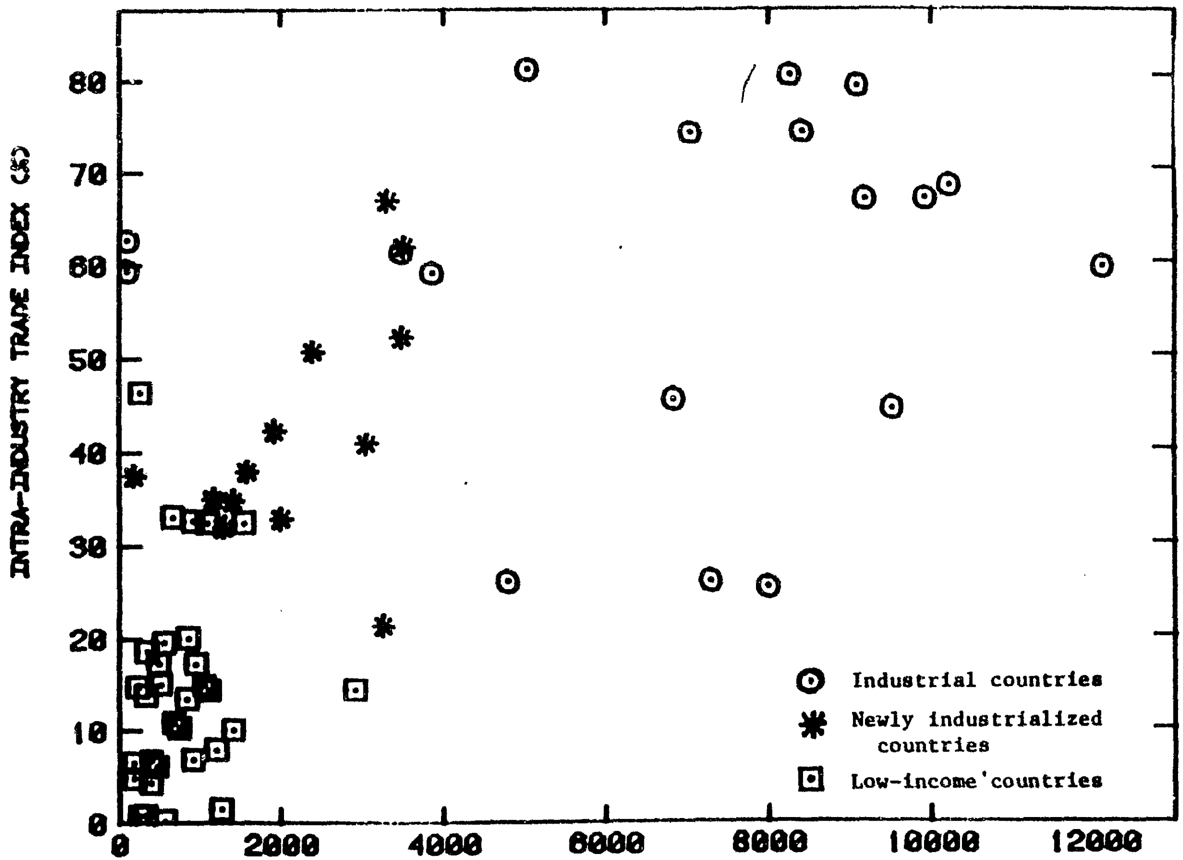
Overall, it is evident that the most significant factors explaining cross-country differences in the level of intra-industry trade are the indicators of the stage development: per capita income and the product diversity of exports. This certainly is consistent with the conventional view in the cross-industry theorizing and empirical testing as to the positive effect of heterogeneity and product differentiation. Just how important these factors are in the explanation of IIT levels is clear in regresions 7, 8 and 9 which include only these two variables separately and jointly, as well as in Figure 1 for the case of per capita income. The overall fit is nearly as good as in the "best" regressions (1 and 2), and the coefficients are highly significant.

Two specific issues deserve close attention in the interpretation of these results. First, why do we obtain results on the stage of development hypothesis so strongly opposed to those of Loertscher and Wolter? Second, in view of the qualification made above that product diversity is not necessarily the same as product differentiation, to what extent should one consider our very strong statistical results for XODNC as support for the product differentiation hypothesis which is almost universal in the theory of intra-industry trade?

The explanation for the different results on stage of development and the PCI variable in particular is two-fold. First, the sample of Loertscher and Wolter covers a range of countries (OECD) with a small dispersion in per capita income, while the sample of this analysis is much wider. In other words, it is not surprising that the "stage of development" makes little difference within a group of countries that are all at about the same stage of development. Furthermore, the measure they used was in fact an <u>average</u> of the per capita income of two countries (corresponding to each bilateral trade flow) and not the absolute level of per capita income of each country as in our analysis. This was perhaps a misspecification as the average of per capita income of two countries is a measure more of development <u>differences</u> than of a country's absolute stage of development.

They do in fact test for the hypothesis that larger differences in stage of development lead to higher IIT, which brings us to the second explanation. Both the variable they call "stage of development" (average of per capita incomes) and the variable they call "differences in development" (absolute difference in per capita income) <u>may</u> in their sample be capturing the same effect: differences in development. But the second measure is probably much better. It would not be surprising then that the stage of development hypothesis is unsupported. However, it is perhaps more correct to interpret their results as confirming that the greater the difference in levels of development between two countries the less IIT among them, but <u>not</u> as a rejection of the hypothesis that a higher stage of development enlarges "the scope for the realization and expansion of trade in highly differentiated products".[15]

Figure 1 : Intra-Industry Trade and Per Capita Income by Country, 1978



The proxy variables for the degree of industrial advancement (MAN & XCONC) give results that may be interpreted conservatively or aduaciously. Before we discuss this, it may be useful to note the effect of replacing XCONC with MAN in equation 2 of Table 2 :

$$\begin{array}{llllll} IIT = 5.7 & + .004\ PCI & + .385\ MAN & + 25.75\ EEC & + 16.78\ DNIC \\ (1.11) & (7.00) & (1.31) & (4.67) & (3.39) \end{array}$$

$$\text{Adj. } R^2 = .7466$$
$$F = 45.94$$

Clearly MAN is of the right sign but of very low significance. Otherwise it has very little effect on the results, as can be seen in comparison with equation 7 in Table 2. The R^2 is slightly lower, but very little so, and all the other coefficients are practically unchanged. Only the constant loses importance. For the other equations in Table 2, using MAN instead of XCONC has a similar effect, with one exception, equation 10 excluding the NIC dummy. In that case we obtain a coefficient for MAN significant at 1 percent, and an R^2 of .727.

These results suggest the following : MAN (percent of GDP in manufacturing) does not capture the heuristic notion of industrial advancement and sophistication (which we have so far used here as representing product differentiation) because it rises fairly quickly from a 10-12 percent minimum to levels of 25-20 percent for recently industrialized countries, but then flattens quickly even though a country continues to mature industrially. The differences in industrial maturity between the NICs and older industrial economies may, we believe, be assumed as a given : they do <u>not</u> show up in the differences in the MAN measure.

In contrast, the XCONC measure may capture these "maturity" differences. When the NICs first industrialized their ability to compete globally was limited to simple labour-intensive comparative advantage, and even for the resource poor economies, exports were fairly conventrated. As they matured, they attained competitiveness in a much wider range of products, a fact captured in the increased diversity of exports.

We have here given a literal explanation and interpretation of the results. This is the more interesting interpretation because it emphasizes the intensive nature of industrial maturation in comparison to simpler extensive aspects of industrial maturation as measured traditionally by the share of value-added in manufacturing. It is also more interesting because it can be related to IIT theories, and in particular lend support to the product differentiation hypothesis, which as Table 3 shows, and Tharakan (1981) emphasizes, fails in "econometric results to satisfactorily explain" IIT.

But this is also the riskier interpretation as there are some doubts about the appropriateness of the XCONC measure. As already noted, it measures product diversity defined across fairly broad product categories (3-digit SITC), which is not necessarily the same as product differentiation or heterogeneity within each of these product categories. While there may be reason to suppose that large differentiation necessarily requires also large diversity, the converse is not true. Diversity may come first, before differentiation.

Why then the strong results? If we take the most critical position against our own analysis, it may be said that this is a statistical necessity, that is XCONC and IIT measure somewhat the same thing. All economies usually have a wide range of imports (Japan?); but the range of exports is lower the less developed the economy. As IIT is a weighted average index of trade balance at product level, it may then follow that the more diversified the range of exports, the higher is this "balance" and of course IIT.

Suggestive of this interpretation is the simple correlation of IIT and XCONC, which is quite high at -.523. (See Appendix Table 1). But against this strict interpretation, it can be said that the correlation between IIT and other independent variables is even higher.

In the event, the inferences drawn are of course problematic and one may prefer a more conservative interpretation, namely that XCONC (or MAN) do not so much measure the product differentiation hypothesis, as they measure (in addition to PCI) the stage of development. Indeed, the presentation of Table 2 and Table 3 is in this more conservative spirit. We certainly conclude in favour of the stage of development hypothesis, contrary to Loertscher and Wolter. As to the hypothesis on product differentiation, we conclude that our empirical results are consistent with, and suggestive of the hypothesis, but this conclusion must be a qualified one.

V. CONCLUSIONS AND POLICY IMPLICATIONS

Intra-industry trade is a phenomenon of developing countries as well as the most highly industrialized countries. The extent of such trade is decidedly higher for the industrial countries, where it generally accounts for 60 to 80 percent of all trade, compared to levels of 40 to 50 percent for the newly industrialized countries, and much lower levels of 10 to 20 percent in other developing countries. In fact, the relationship of intra-industry trade and level of development is very strong. The higher the per capita income, and the greater the diversity of its manufactured goods exports the greater is the amount of a country's intra-industry trade. In a regression analysis based on a conventional model of intra-industry trade, these two development characteristics alone explain over 60 percent of the variation of the intra-industry trade index across countries. By adding the effect of integration in the EEC and a variable for the more advanced level of development of newly industrialized countries, one finds that nearly 80 percent of the variation is explained. That is, the analysis finds very strong support for the hypothesis that intra-industry trade varies directly with the stage of development, contrary to the results of Loertscher and Wolter (1980). As their study looked only at industrial countries, it is perhaps not surprising they did not find support for the hypothesis. By adding developing countries to the analysis, the present study obtains very different results.

The only other characteristic of a country that appears to be a significant determinant of intra-industry trade levels is membership in a successful trade integration scheme - only the EEC appears to fit this description. Integration schemes which result in a lot of trade diversion, such as those of Latin America, do not on balance raise intra-industry trade. This is because the increased two-way trade within the group is offset by decreases caused by trade diversion.

Size of a country, whether measured by population or GNP, does not seem to have any influence on the level of a country's intra-industry trade. This does not however mean that scale economies are unimportant in determining the level of intra-industry trade in an industry. A cross-country analysis of total intra-industry trade cannot be used to infer the effects of scale at the micro-level. The reason size is less important in the aggregate is that there it captures not only the scale economy effect, but also a negative effect. While a large economy may permit greater opportunities for scale economies to occur in individual industries, a larger size also means less border trade. Since the first effect tends to increase intra-industry while the second tends to lower it, the two may counter each other. The regression analysis presented here seems to suggest this does happen, which means it is consistent with both the scale economy hypothesis and the view of sceptics who say at least part of intra-industry trade is merely cross-hauling, border trade.

The newly industrialized countries are in a middle stage of development but also distinguish themselves from other developing countries by their record of rapid growth of exports in the past. For them intra-industry trade levels are in fact higher than predicted by the model presented here. That is, their intra-industry trade is even greater than their stage of development and industrial diversity alone would lead one to expect. Apparently, the process of integration of these economies into world trade over the past fifteen to twenty years has taken the form of a strong surge in two-way trade of similar goods.

The strong links observed between intra-industry trade and the stage of development, as well as the very high level of such trade for the newly industrialized countries has important implications for the future evolution of trade patterns and policy. Developing countries will continue to evolve up the ladder of comparative advantage and this will lead inevitably to a continuation of the international division of labor. Adjustment to this inevitable process is therefore essential, and recent attempts to slow down this process by protection of industrial countries'"old industries" is likely to be futile.

But in the same process, it may be that adjustment will be made easier the more the nature of trade becomes intra-industry as opposed to inter-industry. First, this means that in the vast variety of heterogeneous demand for products, old industrial economies will always be able to continue having comparative advantage in many different products.

Second, as the developing countries diversify their exports through increased intra-industry trade, opportunities will develop for exports to these countries by "old" industrial economies in "old" industries. An example of this is already available : textiles (yarns, cloth) from industrial countries are being increasingly exported to NICs. Of course, this does not happen automatically as IIT rises: only those who have the flexibility to find these niches and to search out the new technologies necessary, will be able to reach such competitiveness.

Finally, as developing countries diversify into a wider range of products, the political economy of protection against their imports may change in a favourable way. With less concentrated penetration there is less strength in the arguments that adjustment is more difficult because imports are concentrated by sector, type of labor, and region. Of course, there is the danger that the other "affected" industries will demand the same shelter as have the old ones. This is less likely, however, the more it becomes the case that the industries which compete against imports from developing countries are the same ones which export to developing countries. This is not going to occur overnight, and only at first for the more advanced developing countries, but this is decidedly the direction of evolution for international trade patterns.

Appendix Table 1 : Correlation Matrix of Independent Variables

	GDP	PCI	MAN	XCONC	EEC	LAFTA	CACAR	DNIC	IIT
GDP	1.00								
PCI	.525	1.00							
MAN	.258	.412	1.00						
XCONC	-.311	-.325	.422	1.00					
EEC	.170	.462	.328	-.174	1.00				
LAFTA	-.112	-.131	.175	-.020	-.101	1.00			
CACAR	-.311	-.200	-.176	.281	-.137	-.093	1.00		
DNIC	-.100	-.143	.470	-.299	-.198	.187	-.184	1.00	
IIT	.371	.739	.606	-.523	.605	-.061	-.168	.191	1.00

FOOTNOTES

1 Summarized in Giersch (1979), with the most important earlier study being that of Grubel and Lloyd (1975). Also see Tharakan (1981) for an updated survey of the literature.

2 Corden (1979), p. 10.

3 The most recent and thorough theoretical presentation is in Deardorff (1982).

4 In another paper by the authors (1983) it is found that IIT declines but by no means disappears with disaggregation. With 3-digit SITC data the 1978 average for thirteen NICs is 42.0 percent, and with 4-digit data it is 35.6 percent. Generally, values using 4-digit data are above three-quarters of those using 3-digit data. Even critics of the IIT concept agree one "cannot explain away trade overlap... as the result of failure to systematically classify products". (Finger and DeRosa, 1979, p.223). They emphasize rather that no new theory may be needed to explain the phenomenon.

5 Finger and DeRosa (1979) found scale to have a negative coefficient contrary to the expected positive value found in other studies. However, their regression gives relatively low statistical significance for this.

6 Processed food items and petroleum products are excluded, as the IIT measure used for the dependent variable excludes these.

7 The authors have in another study -- Havrylyshyn and Civan (1983) -- analyzed more closely the intra-industry trade of the NICs. It was found first that their IIT in total trade was higher than predicted by the regression estimated here, but second that IIT among the NICs was in fact lower, contrary to the expectation that IIT is highest among similar countries. The first finding is taken as strong evidence of the NICs having attained by 1978 a very high level on the rungs of the comparative advantage ladder.The second may be attributed to the still high trade barriers of the NICs; this redirects NIC exports to industrial countries in a degree even greater than comparative advantage alone might dictate. On average, only 6 percent of NIC exports go to other NICs.

8 In the case of Hong Kong, trade data are for domestic exports and therefore the re-export problem is largely eliminated.

9 We discuss below the results for MAN and XCONC.

10 The short-term LAFTA is used here to represent both Lafta and the Andean Pact which are strongly overlapping in membership.

11 Nothing need be said on the EEC; on the others see for example Vaitsos (1978). Note that saying the groupings chosen here were effective in promoting trade does not mean they were economically successful in generating benefits through trade. Indeed, the same consensus of experts tends to agree that the Latin American cases failed because their benefits were not large enough to overcome the political disagreements such accords naturally generate. Balassa (1979) takes some exception to this.

12 This is not to say their technique was wrong; it was different, as they were asking slightly different questions. We should note that in our analysis we do not directly control for geographic proximity as do Loertscher and Wolter, but this is not necessary here, as our IIT variable is for all trade, not bilateral flows.

13 As described in Vaitsos (1978).

14 See Table 1, p. 191 in Willmore for tires, and Table 4, p.192 for cement.

15 Loertscher and Wolter (1980) p. 282.

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