

INTRA-INDUSTRY TRADE

(A Review of Literature)

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CHAPTER I

INTRODUCTION

Intra-Industry Trade (IIT) involves the simultaneous import and export of products belonging to the same "industry", thus representing the exchange of goods within rather than between industries. Most of the trade theories are concerned with analysing the exchange of goods between industries, i.e. inter-industry specialization. Thus trade was generally analysed between commodities, which served entirely different ends and used different inputs. The theories of absolute advantage, comparative advantage and the Heckscher-Ohlin Theorem (HOT) are the most widely used, and they explain the existence of international trade in commodities with entirely different factor uses. Many empirical studies conducted by Balassa, Grubel and Lloyd (referred to as G-L) and others, however, brought out an entirely new concept of trade which seemed to go against all the basic implications of the recognised theories, especially HOT. The studies indicated that a large proportion of international trade appeared between commodities with similar end and input uses. Thus, in the European Market, there was the exchange of cars between countries, e.g. between Volkswagon, Renault and Opel. Yet another example is the case of cigarettes. If trade is assumed to exist only between completely different goods as in the classic case of Portugal's wine exports and its import of cloth from England, then how can one explain such trade in similar goods? Not only inter-industry but also intra-industry trade is thus important in international trade studies. The earliest recognition of IIT in final consumption goods

belonging to the same industry is found in Haberler¹ as follows:

"In trade statistics a single class of goods may frequently be found both among exports and imports of the same commodity. This may occur for several reasons. But the distinction between regular exports and imports does not thereby become meaningless". Some indirect evidences of IIT can also be gathered from empirical researches which were mainly concerned with the empirical verification of the theories of international trade. The works of Leontief can be mentioned in this context. Hufbauer took up the issue as to whether countries that are close to or distant from one another in terms of per capita income levels and economic structures exchange manufactured goods that are similar or dissimilar in terms of factor content. For that, he compared the relative commodity composition of the export and import factors of individual countries with different economic structures as distinguished by gross domestic product per capita. He discerned that export and import sectors tend to become more alike as per capita incomes converge.

The Factor-Proportions theory of trade (HOT) argues that international trade exists because of differences in factor endowments and hence supply capabilities. These differences generate differences in relative costs of production, under autarky, which, in turn, are reflected in selling prices. This theory stresses differences in production characteristics, which are determined by the relative endowments of the different factors of production. These factors are then assumed to be immobile between nations and hence it appears that a capital-rich country would export goods that are capital-intensive

1. Haberler, G.V., The Theory of International trade : with its applications for commercial policy. p. 34, London, 1936.

and the labour-abundant countries would export labour-intensive goods. The major problem in such an analysis is that it ignores the demand aspect in trade. In a practical situation, one must acknowledge the existence of oligopolistic market structures, where product-differentiation and economies of scale are very important. Thus goods which are close, but not perfect, substitutes could still be traded between countries. This aspect is not explained by the HOT, which generally assumes a perfectly competitive market structure and perfectly homogeneous goods, which have the same factor-intensity in every country. But this is a highly unrealistic assumption. In all recent literature monopolistic competition plays a very important role and must be included in international trade studies.

G-L have tried to explain the existence of such simultaneous exports and imports of goods within an industry with the help of product differentiation and economies of scale through lengthening of production runs. They have further shown that an extension of HOT by removing the restrictive assumptions is sufficient to explain some types of Intra-Industry Trade. Thus homogeneous goods differentiated with respect to location, time etc. can be incorporated into the HOT framework. Although product differentiation by style and quality is important, they have also included differences in technology as another factor explaining Intra-Industry trade.² Peter Gray also has given an explanation of Intra-Industry Trade through product differentiation and Export Price Ranges.³

2. Grubel, H.G. and Lloyd, P.J., "Intra-Industry Trade" London, Macmillan, 1975, p.p71 to 102.

3. Gray, Peter, "Two-way International Trade in Manufactures : A Theoretical Underpinning" in Weltwirtschaftliches Archivs, 1973, p-19.

There are a large number of products which are close substitutes and with almost identical input requirements. Thus France produces Galoises cigarettes as well as other brands and England manufactures Players along with other brands. Analogous conditions are found in the car and other industries. If the input proportions are same for producing these substitutable goods in all countries then it would seem that exchange is not profitable as relative prices would be the same among countries. Yet we observe the exchange of such commodities. This is because of the presence of economies of scale with identical production function, or because production functions are not identical across countries because of differences in technology.

Economies of scale are considered as a function of the length of the production runs, and the organisation of production in a plant. Thus, reduced costs occur due to reduced downtime of machines, greater specialisation of machines and labour, and smaller inventories of inputs and outputs. It is possible, hence, to have an industry with products which are differentiated in minor ways relevant to consumer tastes, but which require very few adjustments in the basic production process, and alongside leads to costly machine downtime, inventories, selling costs etc. Thus the exchange of these goods becomes profitable due to exploitation of economies of scale.

Another explanation of intra-industry trade is through technology-gap trade, which ensures that differences in technology can reduce costs of production and make exchange profitable.

Wassily Leontief's empirical verification of the HOT gave an indication that intra-industry trade is a likely phenomenon. With the help of his input-output matrix the amount of capital (stock) and labour (flow) needed per unit of production in all industries involved in international trade could be arrived at. It was found that although U.S.A. is capital abundant, its imports were capital intensive. Once we recognise the existence of intra-industry trade, this does not seem surprising.

Most trade theories deal only with final products. But intermediate goods form the bulk of all trade. Intra-Industry trade between inputs and outputs is an important aspect. Thus a capital-rich country can send its good for foreign processing in a labour-rich country and then import it back.

Linder (1961) also has made a great contribution to the studies in intra-industry trade.⁴ He showed that the income distribution in the trading countries and the elasticity of demand for quality with respect to levels of income are necessary to determine the pattern of trade. Thus high quality goods will be produced by rich countries, but low quality goods would be exported from the poorer countries to satisfy its lower-income populations. This could be another explanation of intra-industry trade.

In view of the above, an attempt has been made in this dissertation to review the literature on IIT, which seems to be increasing in importance in the present day economy.

4. Linder, S.B., "An Essay on Trade and Transformation", New York, John Wiley and Sons, 1961

Chapter II deals with the measures of IIT as put forth by G-L, Balassa, Aquino and Michealay. An attempt has also been made to show that IIT is economically meaningful and not just the result of aggregation which combines distinct goods in the same category which may not be related in consumption and production. Finally, some empirical studies on IIT have been examined, with special reference to the European Economic Community, Latin America, Central American Common Market and The Soviet Union.

In Chapter III various theories and models explaining the causes of IIT, mainly with reference to final goods are reviewed. However, no production consists only of primary factors of production. Intermediate goods always appear in the process and hence must be incorporated in the system. Therefore, in Section 3.5 of Chapter III, Intra-Industry Trade between inputs and outputs has been considered in brief.

In Chapter V the broad conclusions of the study emerge. It also indicates certain implications for developing nations, drawn from Central American Common Market and Latin America Free Trade Association data as put forth by Balassa (1978).

CHAPTER II

MEASUREMENT AND EMPIRICAL RELEVANCE OF INTRA-INDUSTRY TRADE

The first section of this chapter explains the concept of Intra-Industry Trade. The second explain and reviews the various measures of IIT. The third section deals with the Problem of Aggregation with special reference to Australia. The fourth section aims at an empirical presentation of the phenomenon of Intra-Industry Trade, with respect to the EEC countries, Latin America, CACM, and USSR bringing out the essential characteristics of Developed and Under Developed Countries in this aspect.

2.1 The Concept of Intra-Industry Trade

In recent years, some economists have suggested that under a wide range of circumstances, free international trade will result in a situation where each country simultaneously exports and imports, products which are very close substitutes for each other in consumption, production, or both. Because of the similarity of these products, they are commonly accounted for in the same statistical "industry" classification and the resultant pattern of production and trade can be described as "intra-industry specialization" in contrast with "inter-industry specialization" where countries produce and export but do not import the output of some industries while they import but do not produce or export the output of some other industries.⁵ For the purpose of empirical measurement, an industry is defined

5. Grubel, H.G., "Intra-Industry Specialization and the pattern of Trade", in Canadian Journal of Economics and Political Science, Vol. 33, August 1967, p. 374

to include commodities that have high substitution elasticities in production and/or consumption. In practice, limitation of data availability necessitates the use of a 91 industry classification scheme consisting of 3 digit and 4 digit items in the UN Standard International Trade Classification (SITC). This does not, however imply, as will be seen in the next section, that Intra-Industry trade arises only as a result of aggregation, due to the definition of an Industry. Although a further disaggregation and refinement of data would be desirable, a considerable level of Intra-Industry Specialization is still apparent in the European Economic Community (EEC), and the Central American Common Market (CACM) even at a very disaggregated level of commodity classification.

A study by Balassa indicated that Tariff reduction resulted in intra-industry specialization rather than inter-industry trade in the EEC for the period 1950-63.⁶

2.2 The Measures of Intra-Industry Trade

Under the SITC classification of Industries, Grubel and Lloyd, put forth some measures of Intra-Industry Trade⁷. Intra-Industry Trade for industry i (R_i), at any given level of aggregation, was defined as the value of exports of an "industry" exactly matched by the imports of the same industry. That is

$$R_i = (X_i + M_i) - |X_i - M_i| \quad [1]$$

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6. Balassa, B., "Tariff Reduction and Trade in manufactures among the industrial countries", American Economic Review, 1966, pp. 466-473.
7. Lloyd, P.J., "The Empirical Measurement of Intra-Industry Trade", in Economic Record, Dec. 1971, pp. 494-517.

where X_i and M_i are the value of exports and imports in the same industry, valued at the home country's currency. This measure can be used to calculate a country's trade with one, or a subset, or all foreign countries. Thus R_i is the value of total trade ($X_i + M_i$) remaining after subtracting net exports or imports of the industry $|X_i - M_i|$. Inter-Industry Trade is defined as

$$S_i = |X_i - M_i| \quad [2]$$

This measures the net trade in a particular industry.

To facilitate comparisons of these measures for different countries and industries, G-L expressed them as a percentage of each industry's total trade ($X_i + M_i$). The resulting measures of Inter and Intra-Industry Trade are

$$A_i = [|X_i - M_i| / (X_i + M_i)] \cdot 100 \quad [3]$$

$$B_i = [(X_i + M_i) - |X_i - M_i|] / (X_i + M_i) \cdot 100 \quad [4]$$

Both the measures vary between 0 and 100. Since inter-industry trade is always 100 minus the measured level of intra-industry trade, it would suffice to compute only intra-industry trade i.e. B_i .

When exports of an industry are exactly matched by its imports, i.e. where net trade is zero, B_i is 100. When there are exports but no imports or vice versa, the measure is zero. When exports are equal to one half of imports, or vice versa, the measure is 66.6%.⁸ This is shown in an example, later, in this section.

8. Grubel, H.G. and Lloyd, P.J., "Intra-Industry Trade", London, Macmillan, 1975, p. 21

When Intra-Industry trade is to be measured for all individual industries at all levels of aggregation, the analysis must be two-fold— First, at a given level of aggregation, G-L examine the distribution of these measures among individual industries; and second, for a particular set of goods, they examine the measures of intra-industry trade computed at different levels of aggregation.

For the first direction of analysis the most useful statistic is the mean, using as weights the relative size of the sum of exports and imports of each industry in the total value of imports and exports of all the n industries. This mean they call \bar{B}_i .

$$B_i = \frac{[(X_i+M_i) - |X_i - M_i|]}{(X_i+M_i)} \times 100$$

$$\bar{B}_i = \frac{\sum_i B_i (X_i+M_i)}{\sum_i (X_i+M_i)} \times 100$$

$$= \frac{\sum_i (X_i+M_i) - \sum_i |X_i - M_i|}{\sum_i (X_i+M_i)} \times \frac{(X_i+M_i)}{\sum_i (X_i+M_i)} \times 100$$

$$\bar{B}_i = \frac{\sum_i (X_i+M_i) - \sum_i |X_i - M_i|}{\sum_i (X_i+M_i)} \times 100 \quad [5]$$

By using as weights the relative proportion of each individual industry's total trade (Exports + Imports) to the total trade of all the n industries, the distribution of this particular measure of intra-industry trade can be determined.⁹

9. Ibid, pp 21-22.

\bar{B}_i measures the average intra-industry trade as a percentage of export plus import trade. It is also equal to the sum of the intra-industry trade for the industries as a percentage of the total export plus import trade of the n industries.

$$\bar{B}_i = \frac{\sum_i [(X_i + M_i) - |X_i - M_i|]}{\sum_i [X_i + M_i]} \times 100 \quad [6]$$

The mean is a biased measure of intra-industry trade if a country's total commodity trade is imbalanced. With an imbalance between exports and imports, which is most likely, the mean would be less than 100, no matter what the pattern of exports and imports are. This is because the exports and imports will not match each other in every industry. The bias is thus mostly downward in this measure, because the average or the mean includes both the trade imbalance as well as the strength of intra-industry trade.

To remove the above imbalance, an adjustment can be made for the aggregate trade imbalance by expressing intra-industry trade as a proportion of total commodity trade $\sum_i (X_i + M_i)$ minus the trade imbalance. This gives

$$\bar{C}_i = \frac{\left[\sum_i (X_i + M_i) - \sum_i |X_i - M_i| \right]}{\sum_i (X_i + M_i) - \left| \sum_i X_i - \sum_i M_i \right|} \times 100 \quad [7]$$

where n is the total number of industries at a given level of aggregation.¹⁰

10. Ibid, pp 22-23

Multiplying both the denominator and the numerator in (7) by $\sum_i (X_i + M_i)$ we get

$$\begin{aligned} \bar{C}_i &= \frac{\sum_i (X_i + M_i) - \sum_i |X_i - M_i| \times \sum_i (X_i + M_i)}{\sum_i (X_i + M_i) \times \left[\sum_i (X_i + M_i) - \left| \sum_i X_i - \sum_i M_i \right| \right]} \times 100 \quad [8] \\ &= \bar{B}_i \times \frac{\sum_i (X_i + M_i) / \sum_i (X_i + M_i)}{\sum_i (X_i + M_i) - \left| \sum_i X_i - \sum_i M_i \right|} \end{aligned}$$

By dividing the numerator and denominator by $\sum_i (X_i + M_i)$, we get

$$\begin{aligned} \bar{C}_i &= \bar{B}_i \times \frac{\sum_i (X_i + M_i) / \sum_i (X_i + M_i)}{\sum_i (X_i + M_i) / \sum_i (X_i + M_i) - \left| \sum_i X_i - \sum_i M_i \right| / \sum_i (X_i + M_i)} \\ \bar{C}_i &= \bar{B}_i \times 1/1-K, \text{ where } K = \left| \sum_i X_i - \sum_i M_i \right| / \sum_i (X_i + M_i) \end{aligned} \quad [9]$$

Thus K is a country's overall trade imbalance as a proportion of its total trade and the adjusted measure increases as the trade imbalance increases as a proportion of total trade.

When the measures relate to trade with individual countries, the adjustment makes a substantial difference if the bilateral trade imbalances are large relative to the combined total export and import trade. For e.g. if the trade deficit (surplus) is equal to one ninth or one-sixth of the value of export plus import trade, the adjustment increases the measure by one-eighth and one-fifth respectively. For trade with individual or all countries, this adjustment increases the average measures by the same proportion

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at all levels of aggregation.

The ensuing example shows the various adjusted and unadjusted measures of Intra-Industry Trade (i.e. B_i , $\overline{B_i}$ and $\overline{C_i}$) for country j.

Example

Industry	X _{ij}			M _{ij}		
	(1)	(2)	(3)	(1)	(2)	(3)
1. Chemicals	20	20	20	10	20	0
2. Textiles	10	10	10	5	10	0
3. Machinery	40	40	40	20	40	0
	70	70	70	35	70	0

$$I \quad B_i = \frac{(X_i + M_i) - |X_i - M_i|}{(X_i + M_i)} \times 100$$

We consider only the chemical industry, since all the other industries will follow the same procedure.

Case (1)

$$B_i = \frac{30 - 10}{30} \times 100 = \frac{20}{30} \times 100 = 66.6\%$$

Case (2)

$$B_i = \frac{40 - 0}{40} \times 100 = 100\%$$

Case (3)

$$B_i = \frac{40 - 40}{40} \times 100 = 0$$

$$II \quad \overline{B_i} = \frac{\sum_i (X_i + M_i) - \sum_i |X_i - M_i|}{\sum_i (X_i + M_i)} \times 100$$

	Industry	X_{ij}	M_{ij}
1.	Chemicals	20	10
2.	Textiles	10	5
3.	Machinery	40	20
		70	35

$$\overline{B_i} = \frac{105 - 35}{105} = 66.6\%$$

$$III \quad \overline{C_i} = \frac{\sum_i (X_i + M_i) - \sum_i |X_i - M_i|}{\sum_i (X_i + M_i) - \left| \sum_i X_i - \sum_i M_i \right|} \times 100$$

$$= \frac{105 - 35}{105 - (70 - 35)} = \frac{70}{70} \times 100 = 100\%$$

With the removal of the bias in B_i , the measure of Intra-Industry Trade increases to 100% in this example.

Aquino (1978) however showed that the Grubel & Lloyd (G-L) adjustment for trade imbalance does not ensure constant results, and proposed an alternative for consistent measurement. This measure is equivalent to that earlier used by Michaely (1962), which was cited but discarded by Grubel and Lloyd.

Michaelry (1962) used an index of dissimilarity in the commodity composition of trade in order to study the relationship between the composition of exports and imports on the one hand and the fluctuations in the commodity terms of trade on the other

$$\bar{E}_i = \sum_i \left| \frac{X_i}{\sum_i X_i} - \frac{M_i}{\sum_i M_i} \right| \quad [10]$$

This index varies between 0 (complete similarity) and 2 (complete dissimilarity). Grubel and Lloyd (G-L) multiplied the above measure by 1/2, so that it varied between 0 and 1.¹² Then the corresponding measure of Intra-Industry Trade would be

$$\bar{F}_i = 1 - \frac{1}{2} \sum_i \left| \frac{X_i}{\sum_i X_i} - \frac{M_i}{\sum_i M_i} \right| \quad [11]$$

Aquino (1978) criticized Grubel & Lloyd (G-L) who stated that the bias due to trade imbalance, arises only in the construction of \bar{B}_i as a mean of the values of B_i . This elementary index (B_i) they considered as unbiased. Aquino however, commends that, infact, \bar{B}_i is a downward biased summary measure only because B_i is a downward biased index of Intra-Industry Trade in each commodity. This is because, one cannot maintain that the overall trade imbalance, has not an imbalancing effect on the single commodities trade flows and then recognize that the imbalancing effect appears at a highest level of industry aggregation. It is true that there is no reason to expect the imbalancing effect to be equi-proportional in each industry but on an average, the imbalancing effect on each industry's trade must be

12. Grubel, H.G. and Lloyd, P.J., 'Intra-Industry Trade', 1975, op.cit. p. 27.

equal to the overall trade imbalance. Aquino assumes this, while deriving his measure.¹³

Correction of trade imbalance at the elementary level, i.e. before calculating B_i (assuming equi-proportional imbalance effect in all industries) requires an estimate of what the values of exports and imports of each commodity would have been if total exports had been equal to total imports. Denoting these theoretical values with the super script e, he obtains

$$X_{ij}^e = X_{ij} \frac{1/2 \sum_i (X_{ij} + M_{ij})}{\sum_i X_{ij}} \quad [12]$$

$$M_{ij}^e = M_{ij} \frac{1/2 \sum_i (X_{ij} + M_{ij})}{\sum_i M_{ij}}$$

It can easily be seen that $\sum_i X_{ij}^e = \sum_i M_{ij}^e = 1/2 \sum_i (X_{ij} + M_{ij})$

Applying the G-L formula for Intra-Industry trade (i.e. B_i) to the values of X_{ij}^e and M_{ij}^e , he obtains a measure of the proportion of intra-industry trade in country j's trade in commodity i, purged of the imbalancing effect of the overall imbalance in j's trade. This new index he calls Q_{ij} . This is a weighted average, with weights given by each commodity's share in j's total trade, and gives a corrected summary measure of the proportion of Intra-Industry Trade in j's total trade.

$$Q_{ij} = \frac{\sum_i (X_{ij} + M_{ij}) - \sum_i |X_{ij}^e - M_{ij}^e|}{\sum_i (X_{ij} + M_{ij})} \times 100 \quad [13]$$

13. Aquino, A., "Intra-Industry Trade and Inter-Industry Specialization", Weltwirtschaftliches Archiv, Vol. 114, 1978, pp 275-295.

This has an advantage over both \bar{B}_i and \bar{C}_i in G-L's analysis. This is because both these measures depend on the value of $\sum_i |X_{ij} - M_{ij}|$ which has the peculiarity that for $X_{ij} \leq M_{ij}$ for all i or $X_{ij} \geq M_{ij}$ for all i , its value is constantly equal to $|\sum X_{ij} - \sum M_{ij}|$, whatever the values of X_{ij} and M_{ij} . This means that when the set of trade flows under investigation is characterised by a substantial overall imbalance, if the bias is not corrected at the single commodity level, the country-summary indexes give an identical measure of the relevance of Intra-Industry Trade for situations which, even at a glance, appear to be substantially different.¹⁴ This aspect is clarified with the help of an e.g.

Example 2

	Case I		Case II	
	X_{ij}	M_{ij}	X_{ij}	M_{ij}
Chemicals	20	10	10	10
Textiles	10	5	40	5
Machinery	40	20	20	20
	70	35	70	35

In case I, there is no inter-industry specialization between chemicals, textiles, and machinery, as the ratio of exports to Imports is the same in all industries. Thus all trade would be Intra-Industry trade. In case II, on

14. Ibid; pp 279-281.

the other hand, the textile industry is a clear advantage to the country and hence only a proportion of total trade is intra-industry trade, because the country would specialize in textiles with respect to chemicals and machinery. This situation is self-evident, even by looking at the example.

If the G-L measures \overline{Bi} & \overline{Ci} are used, we get the surprising result that the same values for Intra-Industry Trade are obtained in both cases I and II.

Case I

$$a) \quad \overline{Bi} = \frac{\sum_i (X_i + M_i) - \sum_i |X_i - M_i|}{\sum_i (X_i + M_i)} \times 100$$

$$= \frac{105 - 35}{105}$$

$$= 66.6\%$$

$$\overline{Ci} = \frac{\sum_i (X_i + M_i) - \sum_i |X_i - M_i|}{\sum_i (X_i + M_i) - \left| \sum_i X_i - \sum_i M_i \right|} \times 100$$

$$= \frac{105 - 35}{105 (70 - 35)}$$

$$= 100$$

Case II

$$a) \quad \overline{Bi} = \frac{105 - 35}{105} = 66.6\%$$

$$b) \bar{C}_i = \frac{105 - 35}{105 - (70-35)} = 100$$

Aquino prescribes Q_{ij} as a more sensible measure for correcting trade imbalance. For this, using the same e.g. X_{ij}^e and M_{ij}^e must be calculated.

Case I

$$X_{ij}^e = X_{ij} \times \frac{1/2 \sum_i^n (X_{ij} + M_{ij})}{\sum_i^n X_{ij}}$$

$$\frac{1/2 \sum_i^n (X_{ij} + M_{ij})}{\sum_i^n X_{ij}} = \frac{1}{2} \times \frac{105}{70} = .75$$

$$M_{ij}^e = M_{ij} \times \frac{1/2 \sum_i^n (X_{ij} + M_{ij})}{\sum_i^n M_{ij}}$$

$$\frac{1/2 \sum_i^n (X_{ij} + M_{ij})}{\sum_i^n M_{ij}} = \frac{1}{2} \times \frac{105}{35} = 1.5$$

<u>X_{ij}^e</u>	<u>M_{ij}^e</u>	<u>$X_{ij}^e - M_{ij}^e$</u>
.75 x 20 = 15	1.5 x 10 = 15	0
.75 x 10 = 7.5	1.5 x 5 = 5	0
.75 x 40 = 30	1.5 x 20 = 20	0

$$Q_{ij} = \frac{105 - 0}{105} \times 100 = 100$$

All trade is Intra-Industry trade.

Case II

Firstly, we can compute the common weights.

$$\frac{1/2 \sum_i (X_{ij} + M_{ij})}{\sum_i X_{ij}} = \frac{1}{2} \times \frac{105}{70} = .75$$

$$\frac{1/2 \sum_i (X_{ij} + M_{ij})}{\sum_i M_{ij}} = \frac{1}{2} \times \frac{105}{35} = 1.5$$

<u>X_{ij}^e</u>	<u>M_{ij}^e</u>	<u> X_{ij}^e - M_{ij}^e </u>
10 x 7.5 = 7.5	10 x 1.5 = 15	7.5
40 x .75 = 30	5 x 1.5 = 7.5	22.5
20 x .75 = 15	20 x 1.5 = 30	15
		<hr style="width: 50%; margin: 0 auto;"/>
		45
		<hr style="width: 50%; margin: 0 auto;"/>

$$Q_{ij} = \frac{105 - 45}{105} \times 100 = 57.1\%$$

In this case Inter-Industry specialization is 42.9% and Intra-Industry specialization is 57.1%. Thus it is seen that any imbalance in trade must be corrected not only at the aggregate level, but also when measuring intra-industry trade in single industries. Although G-L perceived the existence of these peculiarities for \overline{CT} , they thought it did not affect B_i . But, as is shown by the example, $\overline{B_i}$ and $\overline{C_i}$ have the same shortcomings.¹⁵

15. Ibid, p. 28²

Aquino's measure is also equivalent to Michael y 's measure, put forth by G-L as \bar{F}_i .

$$\begin{aligned} Q_{ij} &= \frac{\sum_i (X_{ij} + M_{ij})}{\sum_i |X_{ij}^e - M_{ij}^e|} \bigg/ \frac{\sum_i (X_{ij} + M_{ij})}{\sum_i (X_{ij} + M_{ij})} \\ &= 1 - \frac{\sum_i |X_{ij}^e - M_{ij}^e|}{\sum_i (X_{ij} + M_{ij})} \end{aligned}$$

substituting for X_{ij}^e and M_{ij}^e , we get

$$\begin{aligned} & 1 - \frac{\sum_i \frac{1}{2} \sum_i (X_{ij} + M_{ij}) \left[\frac{X_{ij}}{\sum_i X_{ij}} - \frac{M_{ij}}{\sum_i M_{ij}} \right]}{\sum_i (X_{ij} + M_{ij})} \\ &= 1 - \frac{1}{2} \sum_i \left[\frac{X_{ij}}{\sum_i X_{ij}} - \frac{M_{ij}}{\sum_i M_{ij}} \right] \end{aligned}$$

which is really \bar{F}_i or Micheal y 's measure. This also overcomes the imbalancing effect unlike G-L's measure.

Aquino has made an assessment of the magnitude of the differences between \bar{B}_i , \bar{C}_i and Q_{ij} with reference to trade flows of manufactured goods in 1972. The values of \bar{B}_i , \bar{C}_i and Q_{ij} , the percentage difference between Q_{ij} and \bar{B}_i and Q_{ij} and \bar{C}_i are given.

TABLE 2.1
DIFFERENT MEASURES OF INTRA-INDUSTRY TRADE :
BY COUNTRY, 1972

Country	\bar{B}_i	\bar{C}_i	Qij	$\frac{Q-B}{B} \%$	$\frac{Q-C}{C} \%$
1	2	3	4	5	6
Canada	66.3	87.6	73.5	10	-16
United States	57.4	58.1	57.3	-6	- 1
Australia	40.8	85.3	58.5	43	-31
Japan	30.0	88.5	54.8	82	-38
Belgium	70.1	79.3	70.1	0	-11
Denmark	70.7	84.3	70.3	-0	-16
France	86.5	93.1	87.4	1	- 6
West Germany	62.5	92.4	76.0	21	-17
Ireland	55.2	94.8	64.5	16	-31
Italy	66.6	91.7	72.3	8	-21
Netherlands	78.6	80.6	78.7	0	- 2
United Kingdom	76.0	96.8	81.9	7	-15
Austria	73.4	85.7	75.0	2	-12
Greece	26.5	88.3	35.7	34	-59
Norway	69.2	97.2	72.5	4	-25
Portugal	39.1	56.2	40.9	4	-27
Spain	43.8	56.3	49.1	12	-12

Contd.

1	2	3	4	5	6
Sweden	75.6	77.4	76.3	0	- 1
Switzerland	60.5	61.4	60.9	0	- 0
Yugoslavia	53.3	68.0	55.3	3	-18
Brazil	25.3	80.8	49.8	94	-38
Mexico	36.6	89.1	54.8	49	-38
India	21.7	24.3	22.9	5	- 5
Singapore	53.6	88.7	71.4	33	-19
Korea Republic	37.5	41.9	39.2	4	- 6
Hong Kong	39.5	42.6	39.2	0	- 8

Source : Aquino, A., 'Intra-Industry Trade and Inter-Industry Specialization', Weltwirtschaftliches Archiv, 1978, p. 284, Table 1.

$\overline{B_i}$ in most cases shows a downward biased index of Intra-Industry Trade. This is particularly high in countries with large trade imbalances in manufactured goods trade. e.g. Brazil (94%) and Japan (82%). $\overline{C_i}$ on the other hand is an upward biased measure of Intra-Industry trade for most countries. This is apparent both in Example 1 and Example 2 where $\overline{C_i} = 100$. Values of Q_{ij} ranged from 22.9% in India to 87.4% in France. This table gives an idea of the trend of the bias in $\overline{B_i}$ and $\overline{C_i}$ compared to Q_{ij} .

The second direction of analysis concerns the comparisons of the measure of intra-industry trade (i.e. the B_i 's) at different levels of aggregation in classification. For the i^{th} industry, at a particular level of aggregation, the imports and exports of the industry are defined at a

more disaggregated level of classification (i.e. at a higher digit level under SITC), called X_{ij} & M_{ij} respectively. The higher the digit level of classification of industries, we find that the data is more refined, with a finer commodity break down. For e.g., at a 7 digit level of industry classification, we have the item ski-boots. The 5-digit level would show Footwear with leather uppers, soles of rubber or plastic. The three digit would include shoes, and the 2-digit level, footwear, gaiters and other articles. Thus it is seen that at the lower digit levels, there is greater clustering of commodities, whereas at the higher digit levels, a finer break-up is apparent.¹⁶

The percentage of intra-industry trade for the industry is calculated by using the sums $\sum_j X_{ij}$ and $\sum_j M_{ij}$.

$$B_i = \frac{\sum_j (X_{ij} + M_{ij}) - |\sum_j X_{ij} - \sum_j M_{ij}|}{\sum_j (X_{ij} + M_{ij})} \times 100$$

$$\sum_j (X_{ij} + M_{ij}) - |\sum_j X_{ij} - \sum_j M_{ij}| \gg \sum_j (X_{ij} + M_{ij}) - \sum_j |X_{ij} - M_{ij}|$$

This inequality follows from the generalized triangle inequality where

$|\sum_i a_i| \leq \sum_i |a_i|$. Since the denominator of B_i is not affected by aggregation, it follows that at a lower level of aggregation, with a finer classification of commodities, the measure of intra-industry trade is lower, or at least not greater than measured intra-industry trade at a more aggregated level. Aggregation increases the measured intra-industry trade¹⁷ by a greater amount, the greater the extent to which the terms $(X_{ij} - M_{ij})$ at the less aggregative level are of the opposite sign.

16: Grubel, H.G. and Lloyd, P.J. 'Intra-Industry Trade', 1975, op. cit. pp. 19-20

17. Ibid, pp. 23-24.

Balassa (1966) defined his measure of intra-industry trade as

$$\bar{D}_i = (1/n) \sum_i^n \left(\frac{|X_i - M_i|}{(X_i + M_i)} \right) \quad [14]$$

where X_i and M_i are the exports and imports of the commodity category i , and n is the number of commodity categories considered.¹⁸

Balassa (1966) conducted a study on the pattern of intra-area exports of the European Economic Community (EEC) and the relationship between exports and imports in the various industries of these countries. He found a positive correlation between the structure of intra-area exports of the individual EEC countries. Also, the export patterns became more uniform after the establishment of the community.¹⁹

18. Balassa, B., "Tariff Reductions and Trade in Manufactures among the industrial countries", in American Economic Review, 1966, pp. 471.

19. Ibid.

TABLE 2.2
RANK CORRELATION COEFFICIENTS FOR THE
STRUCTURE OF INTRA-EEC EXPORTS
OF MANUFACTURED GOODS (1958-63)

		Belgium	France	Germany	Italy	Netherland
Belgium	1958	x	.576	.433	.403	.339
	1963	x	.791	.595	.485	.682
France	1958	.576	x	.643	.528	.651
	1963	.719	x	.760	.716	.782
Germany	1958	.433	.643	x	.416	.566
	1963	.595	.760	x	.592	.682
Italy	1958	.403	.528	.416	x	.549
	1963	.485	.716	.592	x	.688
Netherlands	1958	.539	.651	.566	.549	x
	1963	.632	.782	.682	.688	x

Source : American Economic Review, Vol. 56, 1966, p. 470, Table 2.

The rank correlation coefficients calculated over 91 industries ranked by the value of intra-EEC exports are larger in 1963 than 1958 for all pairs of countries, with differences of at least 1/5th of the values in 1958.

Note : The Rank Correlation Coefficient is used mostly when the data available is qualitative and cannot be measured numerically. The variables or observations are ranked in a specific sequence and the relationship between their ranks is reassured. The rank correlation coefficient is computed by the formula

$$r' = 1 - 6 \frac{\sum D^2}{n(n^2-1)}$$

where D = difference between ranks of corresponding pairs of observation, and n = number of observation. The values of r' may assume range from +1 to -1.

The increasingly apparent uniformity of export patterns in the EEC countries show intra-industry specialization rather than inter-industry specialization, which had increased as a result of 5% reduction in tariffs between the countries.

Balassa used the formula $\overline{D_i}$ which is the ratio of the absolute difference between exports and imports in each category and the sum of exports and imports. An unweighted average of these ratios could be calculated for each country. If there was inter-industry specialization, these ratios which he calls "representative ratios" would approach unity as each country would either export or import a commodity. On the other hand, if intra-industry specialization was prominent, then the ratio would tend towards zero because exports and imports would be more or less equal within each category. The relevant ratios were approximately in the range .4 to .6 in 1958 and .3 to .5 in 1963, indicating the relative importance of intra-industry specialization.²⁰

TABLE 2.3

REPRESENTATIVE RATIOS OF TRADE BALANCES
FOR COMMODITY CATEGORIES

	Representative ratios of Trade Balances	
	1958	1963
Belgium	.458	.401
France	.394	.323
Germany	.531	.433
Italy	.582	.521
Netherlands	.495	.431

Source : American Economic Review, Vol. 56, 1966, p. 471, Table 3.

20. Ibid, p. 471

The above are calculated as unweighted averages of the ratio of the absolute difference of exports and imports to the sum of exports and imports for 91 industries using the formula

$$1/n \sum_i \left[\frac{|X_i - M_i|}{(X_i + M_i)} \right]$$

Balassa's measure is similar to the one used by G-L (1975) who used the measure

$$\begin{aligned} B_i &= \frac{(X_i + M_i) - |X_i - M_i|}{(X_i + M_i)} \times 100 \\ &= \left[1 - \frac{|X_i - M_i|}{(X_i + M_i)} \right] \times 100 \end{aligned}$$

Their measure equals one minus the measure used by Balassa. Thus while Balassa's measure (\overline{D}_i) assumes a value of zero in the case of complete intra-industry, and a value of one for complete inter-industry specialization, the G-L measure shows the opposite pattern.

To show this, we again use an example.

Refer to the data of the earlier e.g. I

$$\begin{aligned} \overline{D}_i &= \sum_i \left[\frac{|X_i - M_i|}{(X_i + M_i)} \right] \\ &= \left[\frac{|X_1 - M_1|}{(X_1 + M_1)} + \frac{|X_2 - M_2|}{(X_2 + M_2)} + \frac{|X_3 - M_3|}{(X_3 + M_3)} + \dots \right] \\ &= \frac{10 + 5 + 20}{105} = \frac{35}{105} = .33 \end{aligned}$$

If $\bar{D}_i \rightarrow 1$, it implies Inter-Industry Specialization and if $\bar{D}_i \rightarrow 0$, Intra-Industry Specialization is more prominent. For the same example, as indicated earlier, the G-L measure showed a value of .66.

G-L criticized Balassa's measure because, firstly because it gave equal weightage to all industries irrespective of their share in total industry exports and imports. Secondly there was no correction for the aggregate trade imbalance. Their own measure of intra-industry trade is weighted, whereas Balassa's measure is unweighted.

2.3 The Problem of Aggregation and Intra-Industry Trade

In this section, we analyse the magnitude of intra-industry specialization, based on the above measures, as a function of different levels of aggregation from 7-digit to 1-digit — SITC classifications, and consider whether intra-industry trade is a real phenomenon, or is an accident of statistical aggregation. This study was conducted by G-L and is based on Australian trade data for the year 1968-69.²¹ The disadvantage in considering Australia, is that it is only semi-industrialized, with its manufacturing highly protected by tariffs unlike the EEC and other highly industrialized nations. Consequently, its intra-industry trade is only 17% of its total commodity trade whereas the average of 10 major industrial countries examined is 50%. However, in the case of some of Australia's industries, the magnitude of intra-industry trade is high and hence indicates that the phenomenon of Two-way-Trade is not peculiar only to trade among highly industrialized nations, but also exists in semi-industrialized countries, which

21. Economic Record, 1971, op. cit. pp 499-500.

are more specialized in agricultural and mining products, and which have high levels of protection for their manufacturing industries. This data supplements the evidence of intra-industry trade in the EEC presented by Balassa (1966).

TABLE 2.4

AUSTRALIAN INTRA-INDUSTRY TRADE WITH MAJOR TRADING
PARTNERS AT DIFFERENT LEVELS OF AGGREGATION, 1968-69

	Country	Digit Levels of Aggregation				
		7	5	3	2	1
1.	U.S.A.	3.2 (2.3)	10.0 (7.0)	14.6 (10.3)	25.0 (17.5)	39.7 (27.8)
2.	U.K.	1.3 (1.0)	4.2 (3.1)	7.7 (5.7)	12.5 (9.3)	31.5 (23.5)
3.	Japan	0.2 (0.2)	2.2 (1.5)	4.8 (3.3)	10.6 (7.2)	18.0 (12.2)
4.	EEC	1.0 (1.0)	3.2 (3.2)	4.9 (4.9)	6.3 (6.3)	15.3 (15.3)
5.	Canada	0.8 (0.4)	7.2 (4.1)	17.6 (10.0)	27.5 (15.7)	38.6 (22.0)
6.	New Zealand	4.4 (2.8)	19.5 (12.3)	30.5 (19.3)	47.5 (30.1)	79.8 (50.5)
7.	Hong Kong	1.4 (1.1)	6.5 (5.0)	13.3 (10.3)	17.3 (13.4)	50.5 (39.1)
8.	India	0.2 (0.2)	1.8 (1.8)	5.5 (5.5)	9.5 (9.5)	49.5 (49.5)
9.	South Africa	0.7 (0.4)	7.3 (4.5)	16.3 (10.0)	30.3 (18.1)	65.4 (40.3)
10.	South East Asia	1.5 (1.0)	4.4 (3.0)	8.7 (5.9)	9.8 (6.6)	17.4 (11.7)
11.	Rest of the World	3.1 (3.0)	10.6 (10.3)	18.9 (18.3)	27.0 (26.1)	52.0 (50.3)
12.	All Countries	6.2 (6.1)	14.9 (14.6)	20.2 (19.7)	25.9 (25.3)	42.9 (42.0)

Source : Economic Record, Volume 47, 1971, p. 501, Table 1.

The above table gives the average of Australia's intra-industry trade, (adjusted and unadjusted) for bilateral imbalances, for all industries broken down by trading partners. It is seen that even at the 7-digit level of classification, with a finer commodity break up and a low level of aggregation thereof, intra-industry trade represents an average of 6.2% of total trade (with all countries). One cannot really say whether this percentage is relevant, considering that there is no ready Standard of Comparison. However, this readily signifies that the SITC classification is not sufficiently sensitive even at the 7-digit level of classification, to discriminate among the various forms of differentiation which give rise to the simultaneous import and export of an 'industry's' output.

It can be seen from the table that the measured intra-industry trade increases, in all cases, reaching 20% at the most widely used 3-digit level of classification and 43% at the 1-digit level, in the case of total trade (with all countries). However it is quite possible for a low level of intra-industry commodity trade among several 'industries', reflecting that the country exports but does not import the products of some of these industries while it imports and does not export the others, to become a high level of intra-industry trade when these industries are aggregated.

G-L examined the above data, and calculated the averages of the 3-digit measures within each of the 2-digit items and the averages of the 5-digit measures within each of the 3-digit items. The simple correlation coefficients between the 2-digit measures and the corresponding 3-digit averages and between the 3-digit measures and the corresponding 5-digit averages were 0.905 and 0.705 respectively.* This showed that over the 2,3 and 5 digit levels of aggregation,

* Note : The simple correlation coefficient determines a precise quantitative measurement of the degree of correlation between two variables X & Y and is denoted by $r_{XY} = \frac{\sum X_i Y_i}{\sqrt{\sum X_i^2} \sqrt{\sum Y_i^2}}$

the patterns of intra-industry trade were essentially preserved even when the data were aggregated from 5-digit to 3-digit and 2-digit items. This result implied that industries retain their relative strength of intra-industry trade through these levels of aggregation and studies of differences among industries would be insensitive to the level of aggregation.²²

It is also noteworthy that there are significant differences in the levels of intra-industry trade among Australia's trading partners at all levels of aggregation. It is significant that the level of intra-industry trade is highest for trade with New Zealand and South Africa which are countries with resource endowments and levels of development similar to those of Australia. The adjusted averages are generally higher than the unadjusted figures and more so for bilateral trade than total trade. However, the general conclusions about differences in the measures at different levels of aggregation and among countries are the same for the adjusted and unadjusted measures.

G-L calculated the percentage of intra-industry trade at the 3-digit level for nine countries of the Organization for Economic Cooperation and Development (OECD) - (Belgium-Luxembourg, Netherlands, West Germany, France, Italy, Canada, U.S., Japan and Australia).²³ The unweighted mean of intra-industry trade

22. Economic Record, 1971, op. cit., p. 500

23. Grubel, H.G. and Lloyd, P.J., Intra-Industry Trade, 1975, op. cit., p. 53

across the sample countries, in all industries was 50%. While Verdoorn & Balassa considered mainly the increase in trade within industries., since the formation of the EEC, the average intra-industry trade as a per cent of total commodity trade was not measured by them. This could be done by summing up the total intra-industry trade of each country according to the measures mentioned in the earlier section (B_i , $\overline{B_i}$, & $\overline{C_i}$) and dividing by the total trade of these countries.

$$\text{i.e. } \overline{B_i} = \frac{\sum_j \sum_i [(X_{ij} + M_{ij}) - |X_{ij} - M_{ij}|]}{\sum_j \sum_i (X_{ij} + M_{ij})} \quad [15]$$

where $j = 1 \dots 10$, are the individual countries and i are the industries.

There are a few cases of intra-industry Trade for which the simultaneous exports and imports require very little theorizing once the precise nature of the goods in the Sub-classes are known. For e.g. trade in zoo animals and pet dogs and cats (S.I.T.C Group 941) is essentially due to a country's comparative advantage or some purely historical factors. Similarly for SITC Group 212 (fur skins etc.).

However certain products like iron and steel, largely, at the 5-digit level of classification allow the inclusion of several similar products differentiated in minor ways. The basic reason for intra-industry trade in this case is that Australia is an efficient producer of some, not all, of the finely differentiated goods in the industry. The comparative advantage that Australia enjoys can be explained by economies of scale, plant capacity and product mix which determine the cost of production through the length of production runs. This will be elaborated in the next chapter.

Another cause of intra-industry trade in goods like petroleum and its products is explained by the economics of joint production. The petroleum products industry illustrated a case where joint production, with a limited range of products from a plant once installed, which is not matched by complementarity in demand for these products, leads to significant intra-industry trade in functionally homogeneous products.

Certain other forms of trade for e.g. in 'stone gravel and sand' (SITC 273) is different. This is more due to high transportation costs than economies of scale in production. In this case intra-industry trade was 76% for 10 OECD countries. This is called "Border Trade" and can be explained by the Heckscher-Ohlin Theorem, in most cases.

All the above data, imply that the simultaneous export and import of goods in the same industry are quantitatively important and merit further study.

In the case of some industries the phenomenon is due to simple statistical procedures which makes its explanation with the traditional Heckscher-Ohlin plausible. However, even in these cases trade data on net exports or imports do not correspond to the concept of trade derived from pure theory and empirical work may require disaggregation which is not available in published statistics. Most of the intra-industry trade persists below the SITC 3-digit level. The significant presence of intra-industry trade in Australia which is only semi-industrialized, as well as in the OECD countries, has several implications for commercial policy in developing and developed countries.

We can see that the Question of Aggregation is basic to the theory of Intra-Industry Trade. In fact, it is the factor which helps to decide whether the phenomenon of Intra-Industry trade is real, or just a statistical inefficiency as a result of lack of data. Thus Intra-Industry Trade could very well be the result of aggregation within a single trade category of goods, which are quite different in terms of input-mix or end-use.

Peter Gray refers to this as "Categorical Aggregation".²⁴ In fact there are certain economists like Finger (1975) who argued that all observed Intra-Industry trade can be explained by categorical aggregation. Any Trade data showing simultaneous exports and imports, must indicate the existence of categorical aggregation because of short-comings in the body of data, intra-industry trade, or some mixture of the two. The crux of the matter lies in the degree to which compiled trade data include goods with different production function within a single trade category. Only if categorical aggregation can be shown to be substantially less than the reported amount of trade overlap, can intra-industry trade be said to exist.

Peter Gray used Balassa's index of Intra-Industry Trade, to find out if categorical aggregation becomes less important as the degree of disaggregation (i.e. at higher digit levels) increases. This is presented in terms of a one-digit index comprising one good (1) and a two digit index comprising two goods (A & B).²⁵

24. Gray, H.P., "Intra-Industry Trade : The effects of Different Levels of Data Aggregation", in On the Economics of Intra-Industry Trade, Symposium 1978, ed. by Herbert Giersch, Tubingen, 1979, p. 88

25. Ibid, p. 94

$$(1) \quad B_1 = \frac{|X_1 - M_1|}{X_1 + M_1} = \frac{|X_A + X_B - M_A - M_B|}{X_A + X_B + M_A + M_B} \quad [17]$$

$$(2) \quad B_2 = \frac{1}{2} \left[\frac{|X_A - M_A|}{X_A + M_A} + \frac{|X_B - M_B|}{X_B + M_B} \right]$$

Assuming sub-categories A & B exhaust category 1, then categorical aggregation will exist when $(X_A - M_A)$ and $(X_B - M_B)$ have opposite signs. Then the lower value of B_1 will exaggerate the amount of true Intra-Industry Trade.

TABLE 2.5

SIMPLE AVERAGES OF BALASSA INDEXES OF WEST GERMAN TRADE

IN SITC 0 THROUGH 4 AND 5 THROUGH 8, 1973

SITC 0 - 4

	Belgium	France	EEC	OECD	Belgium	France	EEC	OECD
1 digit	0.26	0.54	0.37	0.34	0.20	0.18	0.20	0.20
2 digit	0.43	0.55	0.42	0.48	0.32	0.33	0.31	0.27
3 digit	0.51	0.56	0.53	0.52	0.43	0.39	0.33	0.35
4 digit	0.76	0.66	0.65	NA	0.52	0.45	0.34	NA

Source : Gray, H.P. "IIT - The effects of different levels of Data Aggregation" page 96, Table 1, in On the Economics of IIT., Symposium 1978, ed. by Herbert Giersch, Tubingen, 1979

The value of Balassa's index tends to increase as the number of digits increase, because categorical aggregation is eliminated, by the refinement of data.

The major problem, is that most of the literature on IIT, uses the 3-digit level of classification which is believed to be the closest to the definition of an industry, because it corresponds to products with similar factor intensity. But, infact it is this practice of calling a statistical class of goods an 'industry' which gives rise to the aggregation problem. However, once this problem is acknowledged, we can still show that IIT is an important phenomenon.

2.4 Empirical Evidence of Intra-Industry Trade

The best empirical evidence of intra-industry trade was found in the European Economic Community (EEC), in the 1950's and 1960's.

Following Balassa, the ratio R , of the absolute difference between exports and imports of all steel products divided by the sum of exports plus imports, was calculated, for the member countries of the ECSC (The European Coal & Steel Community) who together established a Customs Union in coal and steel products, in 1952. This gives an insight into the kind of specialization that took place in Europe's steel industries. Any increase in R indicates an increase in inter-industry trade and declines in R imply increase in intra-industry trade.²⁶

26. Adler, M., "Specialization in the European Coal and Steel Community", in Journal of Common Market Studies, 1970, pp 177-179.

TABLE 2.6

INTRA-INDUSTRY TRADE RATIOS

Year	Germany	France	Italy	Netherlands	Belgium - Luxemburg
1952	0.5050	0.7025	0.9927	0.9695	0.9331
1954	0.4047	0.5139	0.9644	0.7458	0.8329
1956	0.3931	0.2677	0.6595	0.7640	0.8084
1958	0.2899	0.1099	0.6758	0.5716	0.7945
1960	0.0192	0.1604	0.7833	0.5417	0.7917
1962	0.0869	0.1440	0.9303	0.5510	0.7426
1964	0.0009	0.1791	0.5968	0.4604	0.6465
1966	0.0005	0.2075	0.4641	0.3504	0.5917

Source : Journal of Common Market Studies, Vol. 8, 1970, 'Specialization in the ECSC' by Micheal Adler, p. 178, Table 1.

$$R = \frac{|X_j - M_j|}{(X_j + M_j)} \quad \text{where } X_j \text{ and } M_j \text{ are}$$

total exports and imports of steel products for country j , denoting n different products by subscripts i , $i = 1, 2, \dots, n$, $X_j = \sum_{i=1}^n X_{ij}$ and $M_j = \sum_{i=1}^n M_{ij}$, when inter-industry trade increases, $R \rightarrow 1$, since by definition, either X_j or $M_j \rightarrow 0$. When intra-industry trade increases, R declines. Writing

for each country j

$$R = \frac{\left| \sum X_{ij} - \sum M_{ij} \right|}{\sum X_{ij} + \sum M_{ij}}$$

$$= \frac{\left| X_{1j} - M_{1j} + X_{2j} - M_{2j} + \dots + X_{nj} - M_{nj} \right|}{X_{1j} + M_{1j} + X_{2j} + M_{2j} + \dots + X_{nj} + M_{nj}}$$

when intra-industry trade increases, any single, or set of, X_{ij} and M_{ij} can approach 0, but not all together. In fact some other set of product X_{ij} or M_{ij} will increase. R must thus be less than one. As intra-industry trade increases further, exports and imports will tend to equality and R will decrease. When intra-industry specialization is complete, $R \rightarrow 0$.

The table reveals that intra and not inter-industry specialization was more prominent in all the countries.

In a study conducted by Grubel, trade statistics covering intra-EEC trade of three digit manufacturing industries for the years 1955, 1958 and 1963 were used. In 1955 trade in the EEC was restricted by tariff and foreign exchange regulations. In 1963, tariff rates on intra-community trade was lowered drastically. Over these years, trade between the EEC countries expanded rapidly; the sum of intra-community exports in the sample rose from \$ 3.5 billion in 1955 to \$ 9.3 billion in 1963, representing an increase of 166%. If inter-industry trade were to increase, then one would expect countries to expand output and exports of industries in which they have a comparative advantage and increase imports and reduce production for commodities with a comparative disadvantage. This can be found through the extent of export concentration. For e.g., if Germany has a

comparative advantage in the production of automobiles, its exports to the other EEC countries should become an increasingly larger share of total intra-community exports of automobiles. At the same time the share of the other countries should fall. Statistically, such export concentration reveals itself in the relative shares which each country holds in intra-community exports of industrial industries. The increase of some and the decrease of other shares raises the variance of distribution of shares computed for each country, as specialization takes place. If the variance decreases or remains unchanged, then national concentration in individual industries does not take place, and trade expansion is in the form of national specialization in commodities within the industrial categories.²⁷

TABLE 2.7

VARIANCE OF SHARES OF TOTAL EXPORT TRADE
OF EEC COUNTRIES WITH EACH OTHER

	1955	1958	1963
Belgium-Luxembourg	0.0439	0.0427	0.0336
France	0.0212	0.0176	0.0175
Germany	0.0616	0.0557	0.0347
Netherlands	0.0194	0.0158	0.0095
Italy	0.0163	0.0154	0.0182
All Countries	0.0427	0.0401	0.0256

Source : Grubel, H.G. "Intra-Industry Specialization", Canadian Journal of Economics & Political Science, Vol.33, 1967, p. 377, Table I.

27. Canadian Journal of Economics and Political Science, op. cit., pp 376-377

It can be seen from the table, that all the variances decreased with the exception of Italy. Thus this strongly suggests that the expansion of trade during the period occurred in commodities belonging to the same three-digit industries.

To explore the extent to which trade liberalization lead to intra-industry specialization, the increase in trade (Exports + Imports) of 2 groups of commodities was compared. The first loosely called "manufactures" (includes SITC 1, 6, 7, 8 and 9). The second group is called 'raw materials' or 'resource based' (SITC 0, 2, 3, 4 and 5) which also include some manufactured intermediate products like chemicals, lubricants etc. In Group 1, product differentiation by style, quality etc. can be easily achieved. In the second group, product differentiation is much more difficult to achieve. Between 1959 and 1963, total intra-EEC trade increased by 95.1%, but trade in manufactures alone increased by 116.4%, or 91.4% more than did trade in Raw Materials.

TABLE 2.8

INCREASE IN TRADE OF COMMON MARKET
COUNTRIES, 1956-63 (PERCENTAGES)

Trade with	All commodities	Raw & Intermediate material	Manufactures	$\frac{[(3) - (2)]}{2 \times 1000}$
Other EEC countries	95.1	60.7	116.4	91.7
U.S.A.	51.4	42.6	57.2	34.3
Rest of the world excluding EEC & U.S.A.	36.7	35.1	38.3	9.1

Source : Same source as Table 2.7, p. 379, Table III.

The above indicates that intra EEC trade grew at a considerably faster rate than trade with U.S.A. and the rest of the world. Also, the increase of trade in manufactures over that in raw materials for the U.S. and the rest of the world was only about one third and one tenth respectively of that found for the EEC countries. Thus, even with due allowance being made for higher income elasticity of demand for manufactures over raw materials, as for example in the EEC-U.S.A. trade, there remains a substantial increase in the intra-EEC trade in manufactures over raw materials which can be attributed to intra-industry specialization accompanying trade liberalization.²⁸

Balassa (1979) made calculations for measuring intra-industry specialization in manufactured goods for the countries of the Latin American Free Trade Association (LAFTA) and the Central American Common Market (CACM) - 6 countries of the former and 3 of the latter, utilizing the 91 industry break-down that he earlier employed for the EEC. They are Argentina, Brazil, Chile, Colombia, Mexico and Venezuela in LAFTA and Costa Rica, Honduras and Nicaragua in CACM, using 1975 data in most cases, except Chile and Mexico where 1974 data was used.²⁹

Table 2.9 shows that with very few exceptions, the extent of intra-industry specialization in the 6 LAFTA countries is greater with their LAFTA partners than with other LDC's or Developed countries. The exceptions are Mexican trade with developed countries, using unweighted measure, and Venezuela's trade with non-LAFTA developing countries, using unweighted and adjusted weighted measures.

28. Ibid, pp 378-379

29. Balassa, B., "Intra-Industry Trade and Integration of Developing Countries in the World Economy", in "On the Economics of Intra-Industry Trade, Symposium 1978, pp 249-255.

TABLE 2.9

MEASURES FOR INTRA-INDUSTRY TRADE IN MANUFACTURED GOODS, 1975

	Argentina				Brazil				Chile			
	World	DC	LAFTA	LDC-LAFTA	World	DC	LAFTA	LDC-LAFTA	World	DC	LAFTA	LDC-LAFTA
Unweighted Average	.652	.871	.706	.889	.693	.793	.711	.741	.913	.975	.847	.973
Weighted Average (Unadjusted)	.653	.871	.599	.916	.745	.864	.655	.796	.861	.935	.809	.976
Weighted Average (Adjusted)	.675	.874	.573	.908	.689	.828	.597	.796	.865	.935	.813	.973
		<u>Colombia</u>				<u>Mexico</u>				<u>Venezuela</u>		
Unweighted Average	.730	.885	.655	.799	.599	.688	.734	.774	.939	.973	.921	.844
Weighted Average (Unadjusted)	.783	.934	.492	.799	.657	.754	.537	.638	.970	.989	.893	.828
Weighted Average (Adjusted)	.781	.932	.472	.782	.610	.689	.550	.646	.975	.989	.834	.832
		<u>Costa Rica</u>				<u>Honduras</u>				<u>Nicaragua</u>		
	World	DC	CACM	LDC-CACM	World	DC	CACM	LDC-CACAM	World	DC	CACM	LDC-CACM
Unweighted Average	.764	.969	.587	.705	.888	.972	.762	.932	.802	.980	.737	.943
Weighted Average (Unadjusted)	.664	.989	.390	.420	.861	.987	.647	.927	.752	.987	.595	.916
Weighted Average (Adjusted)	.622	.988	.400	.406	.840	.987	.653	.900	.728	.987	.560	.910

Source ; Balassa, B., Intra-Industry Trade and the Integration of Developing Countries in the World Economy in On the Economics of Intra-Industry Trade, Symposium 1978, op. cit. p. 250, Table 1.

The measures used were (1) $1/n \sum |x_i - m_i| / (x_i + m_i)$, (2) $\sum |x_i - m_i| / \sum (x_i + m_i)$, and (3) $\sum |x_i^e - m_i^e| / \sum (x_i^e + m_i^e)$ where $x_i^e = 1/2 \sum (x_i + m_i) / \sum x_i$ and $m_i^e = m_i / 2 \sum (x_i + m_i) / \sum m_i$.

It is noteworthy, that with any of the measures, the extent of intra-industry trade with developed countries is greatest in Mexico, Brazil and Argentina which are more industrialized and smallest with Colombia, Chile and Venezuela which are less industrialized.

It is also seen that intra-LAFTA trade is considerably greater in Argentina, Brazil and Mexico than in Chile and Venezuela largely due to the complementarity agreements for intra-LAFTA trade in 1964.

In the CACM, inter-industry specialization is predominant in trade with the developed countries. This again can be attributed to the lower level of industrial sophistication than the LAFTA countries. At the same time, the three CACM countries show a relatively high degree of intra industry specialization in trade with their CACM partners. Also the level of intra-industry trade was higher in CACM than in LAFTA because trade liberalization was higher in CACM.

It was also seen that the extent of intra-industry specialization was far greater in the European Common Market than in either CACM or LAFTA. This is mainly due to the disparities in the level of industrial development and the more far-reaching economic integration of the EEC.

After looking into the aspects of intra-industry trade in the developed EEC countries, and the developing LAFTA and CACM countries, it appears that intra-industry specialization assumes particular importance among countries at similar levels of development, where differences in relative factor prices are small. Also it points to the fact that the full benefits of intra-industry

specialization can be obtained through the elimination of tariffs and other barriers to intra-area trade. However in developing countries, where the manufacturing industry is highly protected, trade liberalization has encountered difficulties, mainly because differing levels of efficiency among firms have created fears that competition will cause the demise of a few.²⁹

As regards the commodity composition of intra-industry trade, it seems that intra-area trade in LAFTA and CACM, were characterised mainly by product differentiation in consumer goods, non-electrical goods, electrical machinery and intermediate goods.

Peter Gray suggested that "The gains from international trade in differentiated goods are to be found in the wider range of choice offered to consumers in the different nations, in the possibilities of an exchange of scale economies among nations, and perhaps the most important- in the exposure to foreign competition of Domestic industries". However "It is not immediately apparent that involvement in two-way trade with other countries is a worthwhile goal for a developing country".³⁰

However, Balassa (1979) after his study on LAFTA and CACM, indicated the opposite conclusion i.e. "It is countries at the lowest levels of development that have the most gain from intra-industry trade with a regional union. This is because in this case industrialization will occur in the framework of a larger market, permitting increased specialization and greater competition, so

29. Balassa, B., On the Economics of Intra-Industry Trade, Symposium 1978, pp 254-55.

30. Gray, H. Peter, "Two way International Trade in Manufactures : A Theoretical Underpinning" Weltwirtschaftliches Archiv, 1973, p.27

that one may avoid the establishment of high-cost industries serving exclusively national markets." 31

Since trade liberalization is more difficult in developing countries at higher levels of industrialization, that have established national industries, under protection, The LAFTA resorted to tariff reductions only on a preferential and selective bases which tends to be trade-diverting. In contrast, the CACM eliminated practically all tariffs, being industrialized and hence having larger inter-area trade.

Economic integration also has an advantage in horizontal specialization, which is apparent in the CACM, where reduction in the variety of goods produced by individual plants cause economies of scale.

Integration may also contribute to vertical specialization that involves the production of parts, components and accessories for assembly in different countries. This is of considerable importance for the U.S., Canada and Western Europe which are the developed world. However few of the possibilities of vertical specialization have been utilized in developing countries. This is because of the high tariffs maintained on products of industries subject to vertical specialization and the uncertainty in regard to economic policies in general. This points to the desirability of economic integration in developing countries at low levels of industrialization, so that the benefits from vertical specialization will not be foregone. Even countries at higher levels of development that have industrialized in the framework of high

31. Balassa, B., "Intra Industry Trade & Integration of Developing Countries in the world economy in On the Economics of Intra-Industry Trade, op. cit. pp 258 - 59.

protection, would derive gains through horizontal and vertical specialization.

Possibilities of vertical and horizontal specialisation exist also between developed and developing countries.

Once we recognize differences in consumption patterns within countries, because of inter-personal differences in income and taste, horizontal specialization will occur among countries at different levels of development, with product varieties corresponding to factor endowments. The developing countries will generally export lower-quality varieties requiring skilled labour and import higher-quality product varieties from developed countries. This is found in a variety of consumer goods like clothes, bicycles, transistor, radios etc. This does not generally involve multinational firms, and is mostly in the form of contractual relationships between large foreign buyers e.g. department houses, and national producers in developing countries. With improvement of quality, in the course of industrialization, the relative importance of these relationships is on the decline.³²

Baranson (1969) and Helleiner (1973) gave emphasis to vertical specialization in the framework of multinational firms. The 1960's saw the development of specialized labour intensive techniques or processes within vertically integrated international manufacturing industries. However Balassa refuted the above argument and showed that infact the share of intra-firm trade in U.S.A's imports of manufactured goods from developing countries declined from 16% in 1966 to 11% in 1970, hence emphasizing the declining importance of multinational firms in vertical specialization between U.S.A.

32. Ibid.

and the developing countries which indicates that national firms in these countries are increasingly able to provide products that conform to firms in the U.S.

Soviet-Comecon trade and Intra-Industry specialization was analysed by Joseph Pelzman (1978). He used G-L's formula and the 3-digit F.T.N. (Foreign Trade Commodity Nomenclature) foreign trade data listed according to final use.

Table 2.10 shows, that Intra-Industry specialization for USSR was less than 40% with the world and even smaller with COMECON's members. Thus it is much smaller than what G-L and Balassa found for Australia and the EEC. The reason could be that Intra-Industry trade may be obscured within some sectors as these figures are averages over all sectors. Further, he found that Intra-Industry specialization was really significant only in the machinery, equipment, and chemical sectors. This again was more prevalent in USSR's trade with the more industrialized members of the COMECON. Thus it appears that Intra-Industry^{trade}, though possible, is limited in the USSR-COMECON trade. This is in fact consistent with the Soviet-COMECON cooperation. In the early stages (1940's and 1950's), the East European Countries were dependent on USSR for heavy raw materials and a market for their new heavy industry output. In the 1960's, as the above arrangement proved to be a loss for USSR, it initiated a move to restrict the exchange of raw materials for East European Machinery unless they were willing to supply USSR with semi-manufactures

TABLE 2.10

INTRA-INDUSTRY TRADE AS A PERCENTAGE OF TOTAL TRADE TURNOVER 1958-1973

Year	USSR intra-industry trade with															
	World		COMECON		Bulgaria		Czech.		Germany		Hungary		Poland		Rumania	
	A ^c	NA ^b	A	NA	A	NA	A	NA	A	NA	A	NA	A	NA	A	NA
1958	41	38	26	23	5	5	8	8	5	4	11	8	17	16	13	13
1959	40	38	24	21	8	7	10	10	4	3	18	13	17	15	7	6
1960	40	35	26	23	15	14	11	10	6	4	15	11	17	16	9	8
1961	37	34	29	26	17	16	10	10	9	6	11	9	15	14	12	10
1962	35	33	26	24	7	16	11	10	7	5	10	9	14	13	14	13
1963	40	37	25	24	14	13	11	10	6	5	12	11	17	17	12	10
1964	39	34	25	25	13	12	15	14	6	5	11	9	18	18	13	12
1965	39	34	24	24	12	11	10	9	5	4	8	8	19	18	16	13
1966	36	33	27	26	15	14	11	11	7	5	15	14	13	12	15	14
1967	33	31	27	26	19	17	9	9	10	8	17	17	14	14	14	12
1968	34	32	26	26	20	19	12	12	10	9	15	15	21	19	21	18
1969	34	32	26	25	19	16	13	13	13	12	11	11	21	19	20	17
1970	37	35	27	27	18	17	10	10	13	13	13	13	24	23	17	15
1971	38	36	30	28	17	16	12	11	16	14	12	12	26	23	21	19
1972	37	34	31	27	17	17	13	12	15	12	14	14	26	22	21	19
1973	34	32	29	27	16	16	13	13	15	14	14	13	25	22	20	18

c - adjusted. b - not adjusted

consumer goods and food stuffs. This move resulted in the growth of Intra Industry trade in the machinery, equipment, chemical sectors.³³

The USSR-COMECON Intra-Industry trade, although less than the other western countries trade, still seems to follow the same pattern and is more pronounced between similar countries.

33. - Pelzman, Joseph, "Soviet-COMECON Trade", in Weltwirtschaftliches Archiv, 1978, pp 301-302.

CHAPTER III

SOME MODELS OF INTRA-INDUSTRY TRADE

The theory of intra-industry trade analyses the nature and determination of the simultaneous exports and imports of products between nations. Intra-Industry trade deals with trade in goods which are close substitutes in production and consumption, or both. Importance is given to an analysis of trade in differentiated products, which the traditional Heckscher-Ohlin theory is unable to explain. In the last chapter, we have seen that it is intra-industry specialization which is more prominent than inter-industry trade in the EEC. This chapter is an attempt to study the various models and causes of intra-industry trade following the theoretical and empirical evidence put forth by Balassa, Grubel, Vernon etc. as indicated in Chapter II.

The first section deals with the explanation of the simultaneous trade in products which are perfect substitutes, except for differences in respect to location and timing in manufacture. The second explains the existence of intra-industry trade through product differentiation and economies of scale. The third section deals with the explanation of the phenomenon of intra-industry trade based on dynamic changes in technology and production functions, changes in the product itself, and changes in tariffs and transport costs. Section 4 discusses the emergence of Intra-Industry Trade with the help of

export price ranges. The last section concerns the incorporation of intermediate goods in to the theory of Intra-Industry trade.

3.1 Homogeneous Goods

A certain proportion of intra-industry trade entering trade statistics consists of products which are both from the producers' and consumers' points of view, perfectly homogeneous. The two goods serve the same purpose and a consumer is indifferent between them. They, therefore sell for the same price at a particular location and time. Trade in these products is due to a number of causes.

(a) Differentiation by Location

First, there is trade in bulky materials like sand, bricks and cement, for which transportation costs are a large fraction of the total cost of products, at the point of consumption, and for which the location of manufacturing plants is dictated by the availability of natural resources. The Heckscher-Ohlin theorem, has a high level of abstraction and generally assumes away the existence of transportation costs. Thus with zero transport costs and concentration of production at a single point, the simultaneous exports and imports of the same commodity will not take place.³⁴

34. Grubel, H.G. and Lloyd, P.J., "Intra-Industry trade", London, Macmillan, 1975, p. 73

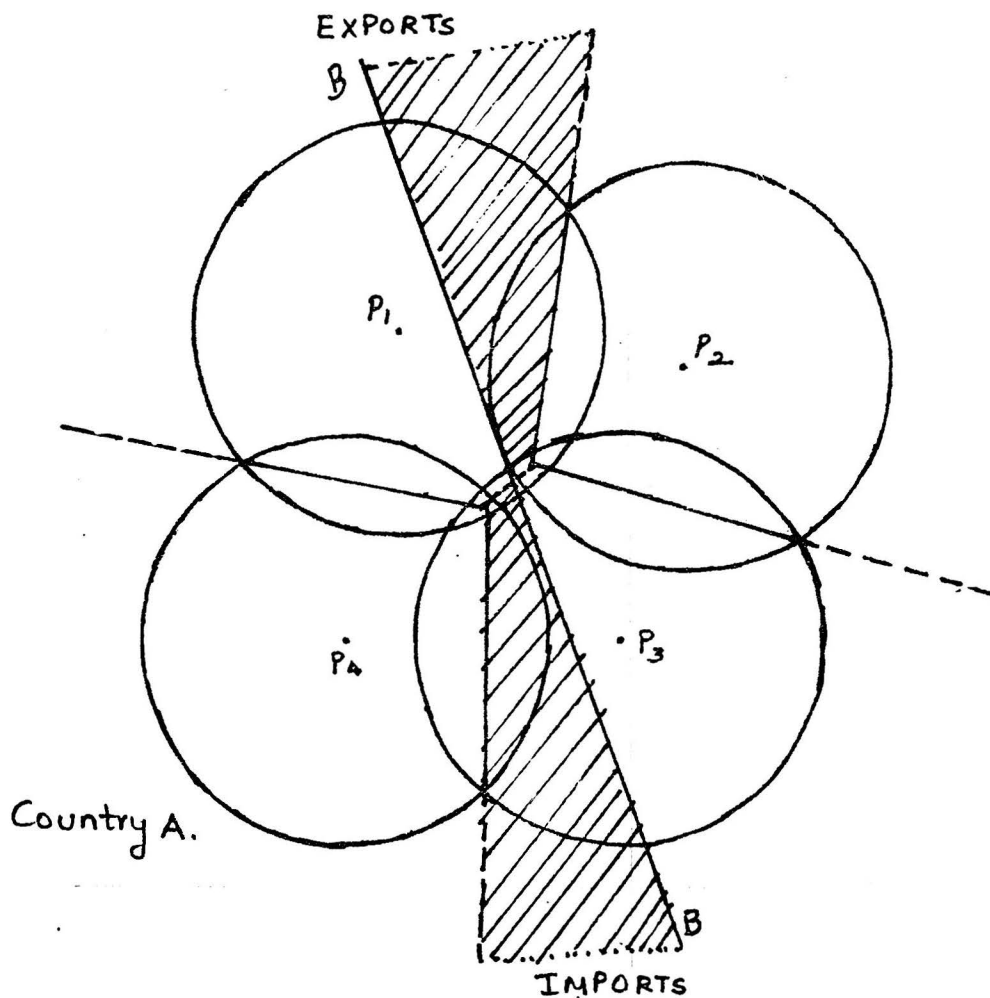
The geographic dimensions of any market area are determined as we know, by the costs of transportation. Production always takes place in the vicinity of the source of raw materials. This again is important in determining the extent of the marketing area.

Besides, there is a second category of goods like fresh vegetables and milk, which are perishables. The location of productive facilities for these goods is determined by the availability of suitable land and the proximity of consumers. Thus, for both these categories of commodities, the marketing area is determined by the resource availability, the transport costs and the distribution of consumers.

We shall now go on to see how intra-industry takes place, when transport costs exist. This was explained by Grubel and Lloyd (1975).³⁵ In Figure 3.1, the 4 points P_1, P_2, P_3, P_4 are four production centres in a given geographic area; in the absence of a border. We assume costs of production and the costs of transport are the same for all the points, the latter cost from each production point being proportional to the distance the commodity is transported. If we draw intersecting circles of equal diameter around the points, each production point will supply consumers in the area bounded by the dotted straight lines drawn between intersections of the four circles. These dotted lines represent a loci of points equi-distant between centres of two overlapping circles. Every consumer purchases from the closest production point.

35. Ibid, pp 74-75

FIGURE 3-1

BORDER - TRADE

SOURCE: GRUBEL, H.G. and LLOYD, P.J; "INTRA - INDUSTRY
TRADE, p. 74, FIGURE 5.1

We now introduce 2 countries A and B in this geographic area and separate them by drawing a national border, like BB in the Figure. Further we assume that there are no restrictions in trade and no extra costs to shippers. Then country A to the left of the border, will export a commodity X as shown by the shaded area, labelled exports. This is because each production point will supply consumers closest to it; and the dotted line denotes the area which the production point P_1 , in this case can supply. But since the national boundary is denoted by BB, country A will export the excess as shown by the dotted lines. Analogously, the same country will also import commodity X. The consumers around production point P_4 in country A can be supplied by it only as far as the dotted line. But since the national boundary is beyond this line, imports of the same commodity are also necessary.

Country B will also show a similar intra-industry trade pattern, by the same reasoning. This was called border trade by Grubel & Lloyd (1975). and in essence refers to trade in products which are functionally homogeneous but differentiated by location.

The extent of border trade depends on the resource availability for producing a commodity, the geographic distribution of consumers and the extent of trade regulations at the border. These are generally in the form of direct payments to tariff authorities. Moreover the uncertainty about

future commercial policies in the foreign country, and about the price of foreign exchange are costs peculiar to trade accross borders. Both these border costs (transport and uncertainties) modify the shape of the effective marketing areas, and border trade is a decreasing function of the height of these barriers.

Further border trade may be related to the size of the bordering countries. The geometry of size suggests that a small country has a larger frontier in proportion to her area than a large country of the same shape. Areas of similar figures necessarily stand to one another in the proportion of the squares of their several linear dimensions. For e.g., a circle whose area is one quarter of the area of another circle, will have a circumference which is only one half that of the larger circle. A second property of small area is that the average distance from the border is less. For e.g. if one circle is four times as large as another, the average distance from the circumference (border) of the smaller circle is only one half that of the larger area. There is thus a larger quantum of border trade between small neighbouring countries.

To sum up the nature of border trade, we can say that when a national border is drawn arbitrarily through a geographic area, in which competitive equilibrium has resulted in an efficient distribution of several industrial plants of an industry, such that the given population is supplied at a minimum cost; it is found that as long as trade can move across the border

without restrictions, simultaneous exports and imports of the same commodity is possible.

(b) Differentiation by Time

There are certain types of goods for which the timing of consumption is an important element. The best examples of these are seasonal agricultural products and electricity.

Intra-Industry trade in these goods is basically due to the fact that the domestic prices of these goods vary because of differences in demand and supply conditions. Thus producing a certain fruit may not be profitable in winter under temperate climates which must then be imported from more suitable climates. The same countries may, however export the fruit in summer. These involve differences in supply conditions. In the case of electricity on the other hand, although cost of production is unchanged through the day, demand condition vary, and are more pronounced at certain predictable periods of the day. As a result efficient shadow prices of electricity are different at different hours of the day. Differences in these shadow prices between two countries at a given moment which are not reflected in prices charged to domestic consumers give rise to intra-industry trade in electricity.³⁶

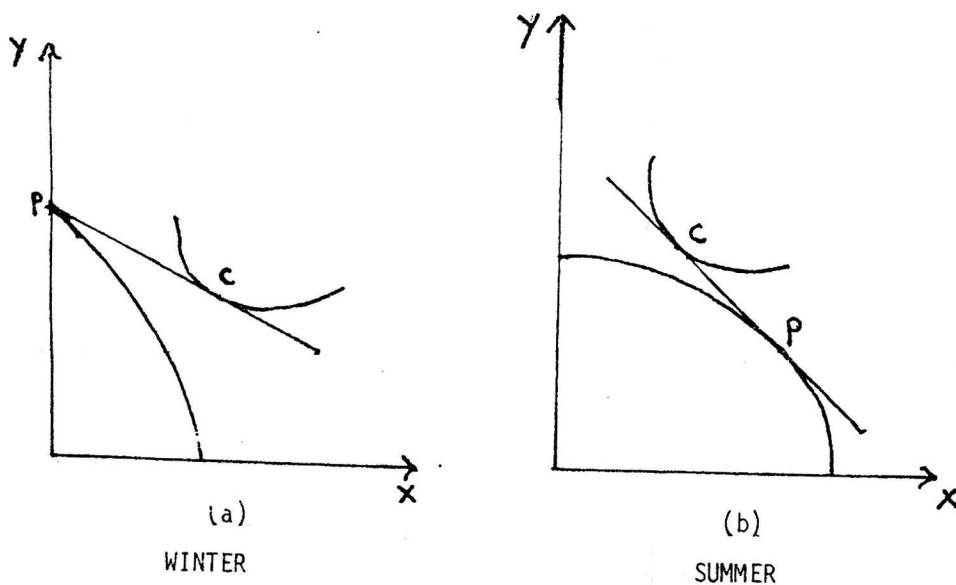
Consider a country A, which produces 2 commodities, X and Y, the former is a perishable agricultural product and the latter a manufactured product.

36. Grubel, H.G. and Lloyd, P.J., "Intra-Industry Trade", London. Macmillan, 1975, pp 77-78.

Since good X depends on seasonal conditions, the production possibility frontier (for X and Y) would be a different shape in each season. In summer, X can be produced with ease, as the climatic condition suits its production, but in winter, assuming it cannot be produced at all, the trade-off between X and Y would be rather unfavourable, since the opportunity cost of producing more of X would be much higher. These conditions would change the shape of the production - possibility curve accordingly. It is further, assumed that the total resources available for the production of X and Y are unchanged over summer and winter; and the prices of all other commodities are fixed.

Figure 3.2.

PERIODIC GOODS.



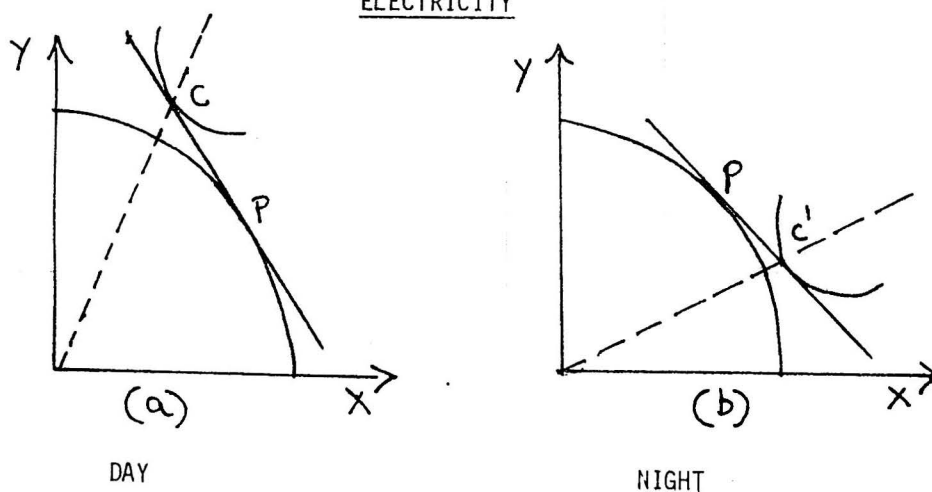
Source: Grubel, H.G. and Lloyd, P.J. 'Intra-Industry Trade', Pg.78, Figure 5.2.

Consider Figure 3.2(a). In winter, at the given world prices of X and Y, X is not produced at all, as indicated by Point P, and all domestic consumption of this good, denoted by point C on the community indifference curve, is to be imported, and Y is exported. In summer, on the other hand, as shown in Figure 3.2(b), the production of X is more than feasible and hence the opportunity cost of producing X falls. The trade-off is more favourable. At the given world price ratio, the country will produce at point P. But now it can export commodity X, though it has to import some Y. Consequently, the trade statistics of country A will show simultaneous exports and imports of both X and Y.

The case of electricity denotes the demand side of the picture. We consider conditions during the day and night. The production-possibility frontier for product X (electricity) and product Y alone, and the relative prices are unchanged.

FIGURE 3.3

ELECTRICITY



SOURCE: Grubel, H.G. and Lloyd, P.J. 'Intra-Industry Trade' p.79, Figure 5.3.

Since electricity is used to a much larger extent during the evening and night times, the public demands X (electricity) and Y in different proportions in the evening compared to the day. This is depicted in Figures 3.3(a) and (b) by the indifference curves in 3.3 (a) and (b) and the points C and C^1 . C^1 in 3(b) indicates a larger demand for electricity during evening hours. Consequently, electricity can be imported during the night and exported during the day time. This then, is another example of intra-industry trade which occurs as a result of differentiation with respect to time.

Grubel and Lloyd confer that periodic trade, shown in Figures (3.2) and (3.3) refers to trade in agricultural products, electricity and the like, which is based on periodic fluctuation in a country's production conditions or demand conditions. The traditional Heckscher-Ohlin model, as we know does not by itself, refer to any form of periodic trade or trade arising from existence of transport and storage costs. But if the assumptions of zero transport costs is dropped and if we account for the existence of periodic influences, then Grubel & Lloyd have shown in Figures 3.2 and 3.3 that the Heckscher-Ohlin Theorem can also be extended to explain such types of intra-industry trade.

Periodic Intra-Industry trade, they claimed, tended to be a decreasing function of a country's geographical size and diversity of climate.

(c) Another explanation of intra-industry trade in functionally homogeneous goods, which are differentiated by virtue of location and time, is where the trade pattern is cyclical in contrast to the previous case, where the pattern was periodic. In this case intra-industry trade is due to the lumpiness of some investments and the inequality in the phase and amplitude of business cycles in different countries which is referred to as trade in cycle goods by Grubel and Lloyd.³⁷ However a detailed discussion on this was not conducted by them as they believed that the magnitude of such trade is not a very significant proportion of total intra-industry trade.

(d) Another group of functionally homogeneous commodities which gives rise to intra-industry trade involves commodities which are imported and exported in completely unchanged form and the trader's value added consists of providing storage facilities and services of a retailer. This is called Entrepot trade. Re-Export trade involves products subject to "blending, packaging, bottling, cleaning, sorting, husking and shelling which leaves them essentially unchanged."³⁸ Countries like Hong Kong and Singapore engage in substantial entrepot and re-export trade.

The goods processes in such trade are not transformed sufficiently to warrant statistical reclarification between importation and exportation. Thus intra-industry trade is observed. This again is a very small fraction of total intra-industry trade.

37. Grubel & Lloyd, 'Intra Industry Trade', London, Macmillan, 1975, p. 81

38. Grubel, H.G., "The theory of Intra-Industry Trade" in Studies in International Economics ed. by I.A.McDougall and R.H. Snape, 1970, p. 37

(e) Government produced distortions of prices can result in the simultaneous export and import of identical products by entrepreneurs aiming at maximizing profits.

There are certain Government actions which intentionally involve simultaneous import and export of goods to promote certain social objectives. For example exports from certain backward regions may be subsidised to help an infant industry whereas other regions which are more advanced may import the same commodity from abroad.

Certain Government actions may on the other hand promote simultaneous exports and imports of homogeneous commodities unintentionally. It may however be rather difficult to document such cases. The amount of intra-industry trade caused by Government regulation is again very minimal.

Grubel & Lloyd have shown that most of the intra-industry trade in such perfectly homogeneous commodities can easily be fitted into the analytical framework of the Hecksher-Ohlin model by its proper extension, to include consideration of transportation costs, time, and Government activities.

3.2 Differentiated Products

Much of the trade statistics involve commodities with similar end uses but which differ with respect to quality, size, style, brand, design etc. This is the essence of product differentiation in the theory of monopolistic

competition and can provide a good explanation of Intra-Industry Trade. Grubel & Lloyd and Peter Gray have emphasized this cause. Grubel & Lloyd introduce this concept into International trade, under a partial equilibrium analysis. This section emphasizes the effect of Economies of Scale.

In general, Grubel and Lloyd consider three groups of differentiated products.³⁹

- (1) Commodities with similar input requirements, but low substitutability in use, e.g. Petroleum products like Tar and Gasoline and Iron products like bars and sheets.
- (2) Commodities with high degree of substitution in use, but with entirely different input use e.g. Wood and Steel Furniture.
- (3) Commodities with very high substitutability in use and also using similar inputs. Examples of this type are found in cars and cigarettes of different brands e.g. Renault and Volkswagen and Players and Galoise cigarettes.

Group 2 can be easily explained through comparative advantage; because the input requirements in the different types of furniture for e.g. (wood and steel) are so very different. Thus simultaneous exports and imports in the same commodity group can easily be explained by the Heckscher-Ohlin Theorem. The relative costs of the primary inputs, wood and steel provide the basis for the comparative advantage patterns.

39. Grubel and Lloyd, 1975, op cit, pp 86-87

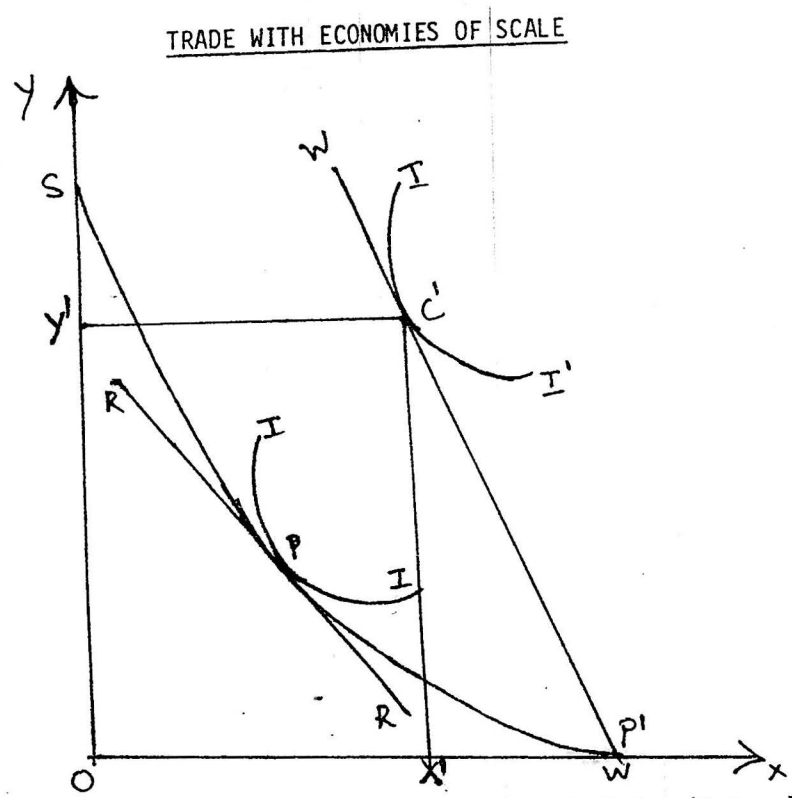
Certain commodities like petroleum products (tar, gasoline and oils) in Group 1, are characteristically technical peculiarities and can be produced only in fixed proportions in most cases. Intra-Industry trade, here, can be explained by joint product technology combined with international differences in demand, analytically speaking. Empirically, however this trade is limited in many industries because processes changing the properties of certain joint products are available.

(1) Product Differentiation & Economies of Scale

Studies on Economies of Scale in literature, have generally assumed that plant size is very important, to enjoy all the reductions in average cost of production that optimum plant size can yield. Recently, however, it has become apparent that lowering of costs of products is a function of increasing the length of the production runs of each product in a plant of given size. Low costs of production or increased production thus depends on the organization of production in a plant of given size. Thus it is possible for two countries to produce the same range of commodities in an industry, but with differences in the length of production runs. Grubel & Lloyd have emphasized this aspect of economies of scale.⁴⁰ The important factors in this decrease in unit costs are the reduced downtime of machines, reduction in inventories of raw materials and finished products and greater work-force skill due to accumulating experience and greater specialization. Grubel & Lloyd consider commodities which are imperfect but close substitutes in consumption, and are produced in the same plant, and have identical input requirements.

40. Ibid, pp 6-9

Figure 3.4



Source : Grubel, H.G. and Lloyd, P.J., 'Intra-Industry Trade', pg. 90, Figure 6.2

Increasing Returns to Scale, or Scale economies have been used to explain Intra-Industry Trade. Thus commodities like cigarettes of different brands, with almost identical input-use are still exchanged internationally because of product-differentiation and the existence of such economies of scale.⁴¹

In Figure 3.4 the Production-Possibility frontier is SW which is concave from above, because of increasing returns to scale. X and Y are two differentiated products. RR is the relative price ratio and P is the point of production in an autarky equilibrium situation. II^1 is the community indifference curve. RR indicates the domestic price ratio P_x/P_y for a country A. Assuming that in the rest of the world there are products X^1 and Y^1 which are very close substitutes of X and Y, in the sense that consumers are indifferent between X and X^1 and Y and Y^1 when offered at identical prices. Production functions are identical for the commodities, but due to differences in tastes and production, price ratios are $(P_x/P_y) \neq (P_x^1/P_y^1)$. Thus, with no barriers to trade, X is relatively cheaper than X^1 and Y is more expensive than Y^1 , at the above price ratios. Country A will tend to produce more of X and less of Y until complete specialization is reached as at point P^1 in Figure 3.4. Thus with reduction in transport costs and removal of trade barriers, economies of scale can allow profitable

41. Studies in International Economics, Ed. by McDougall and Snape, op.cit. pp 38-39.

trade between differentiated products, having similar input requirements. Oligopolistic market structures and the existence of product differentiation can thus explain the existence of intra-industry specialization. The best example of this is seen in the export and import of cars between France and Germany. These are extremely close substitutes but satisfy different tastes and hence demand conditions would influence trade in such commodities. Several such examples can be found in foods, soaps, cameras, clothing etc.

Grubel and Lloyd distinguish between two types of product differentiation—style and quality. The former is based on product appearance and marginal performance characteristics exaggerated by advertisements, while quality differentiation is based on measurable performance characteristics - e.g. differences in size, weight, durability, finish etc.

Decreasing production costs are the result of Economies of Scale. The extent to which domestic brands are replaced by foreign brands, and domestic brands penetrate the foreign markets, is greater in industries where, ceteris paribus, there are increasing returns, than in industries where there are constant or increasing costs, because once a brand's output gains at the expense of a close substitute, the cost advantage of the expanding brand over its substitute becomes larger and larger, raising the possibility that the latter ceases production. Under an oligopolistic market structure, with several types of differentiation, trading patterns could produce extremely close substitutes. The firms which could produce the competing good, with the largest production runs and lowest costs, increased production, whereas those which could not withstand the foreign competition withdrew.

Style Differentiation

An example is in terms of heavy and light furnitures say X and Y. Tastes are such that country B prefers Y and A prefers X; and hence consume accordingly. In Figure 3.4, WW represents the price ratio for X and Y in B which is steeper although production functions are similar. If A is the smaller country and B represents the rest of the world, then WW is the valid price ratio. A would then specialise in X, to maximise welfare. Thus, international trade in products differentiated by style is possible and depends on demand condition and tastes. Thus a country would import commodities appealing to minority tastes and export styles popular with its own population.

Thus, if the production of a given product style is subject to economies of scale, a country would specialize in the production of those styles for which domestic demand is greatest, and because of some overlapping in tastes in the two countries, trade takes place.

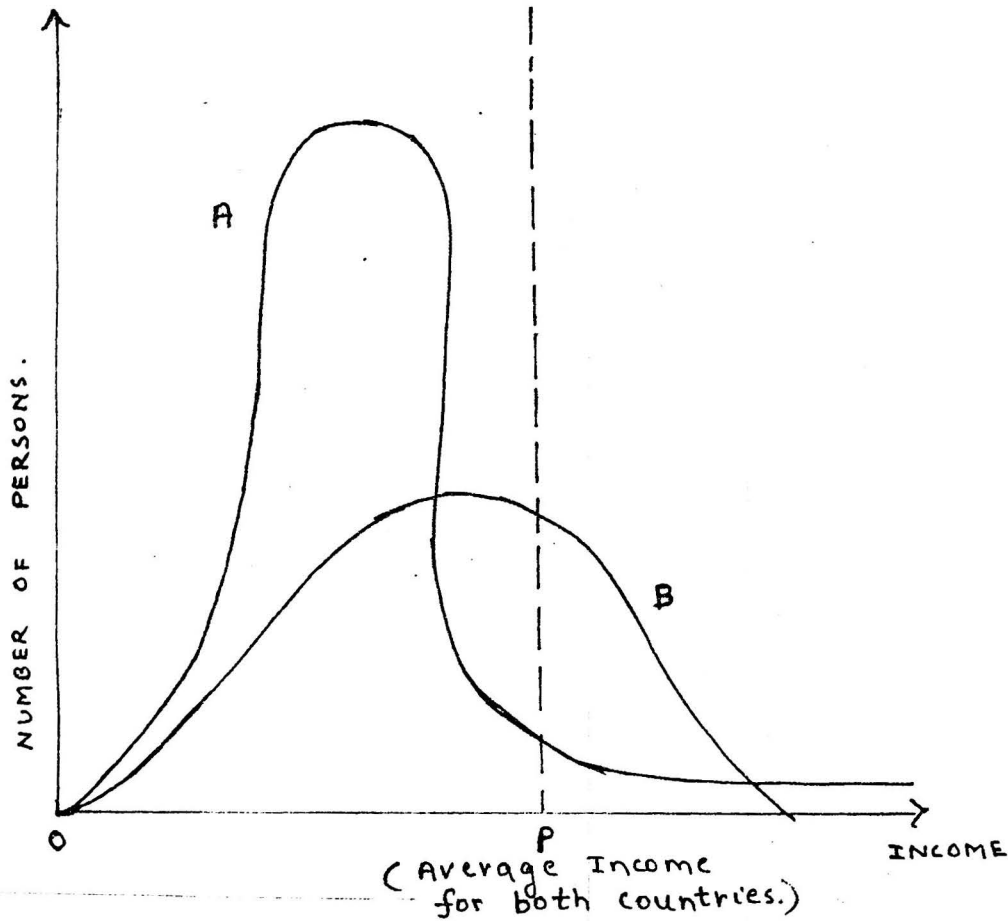
A study by Drè'ze (1960-61) showed that mutual exchange of style differentiated products is a function of the similarity in countries' cultural back grounds and exposure to advertising etc. Also, such trade is greater between countries with equal income levels.

Quality Differentiation

As the name suggests, differentiation here, involves differentiation in quality. Consider two goods X and Y where the latter is of a higher quality. Consumers in country A choose between X and Y on the basis of their incomes. Thus for example persons with incomes above \$ 5000 per year consume Y, those below \$ 5000 consume X. The income distribution of the two countries overlap although skewed differently. In Figure 3.5, X and Y are identical in appearance but differ in price and quality, where quality is an index of measurable performance characteristics like smoothness of ride, acceleration etc. in automobiles. Persons with above average incomes (denoted by P) will then consume Y and vice-versa for X. Since A has the largest number of people below average income, A would specialize in the lesser quality product X, exporting to meet the demands of country B's below average income population. Thus all persons in the income distribution below OP are supplied by A, and all those above OP, by B. Because of scale economies, once again there is complete specialization. This explanation stemmed from the more general explanation of trade relationships based on quality of product and income of population developed by Linder (1961) and explains the pattern of intra-industry trade in quality differentiated products with almost identical input - use, and being subject to increasing returns to scale, is determined by the relationship between countries' income - distributions and the elasticity of demand for quality with respect to levels of income.⁴¹

41. Linder, S.B., "An Essay on Trade and Transformation", New York, John Wiley and Sons, 1961.

INCOME AND PRODUCT QUALITY.



SOURCE: GRUBEL, H.G., "THE THEORY OF INTRA-INDUSTRY SPECIALIZATION" IN STUDIES IN INTERNATIONAL ECONOMICS ed by I.A. McDOUGALL and R.H. SNAPE, P. 40, FIGURE 1.

3.3 Dynamic theories of Intra-Industry Trade

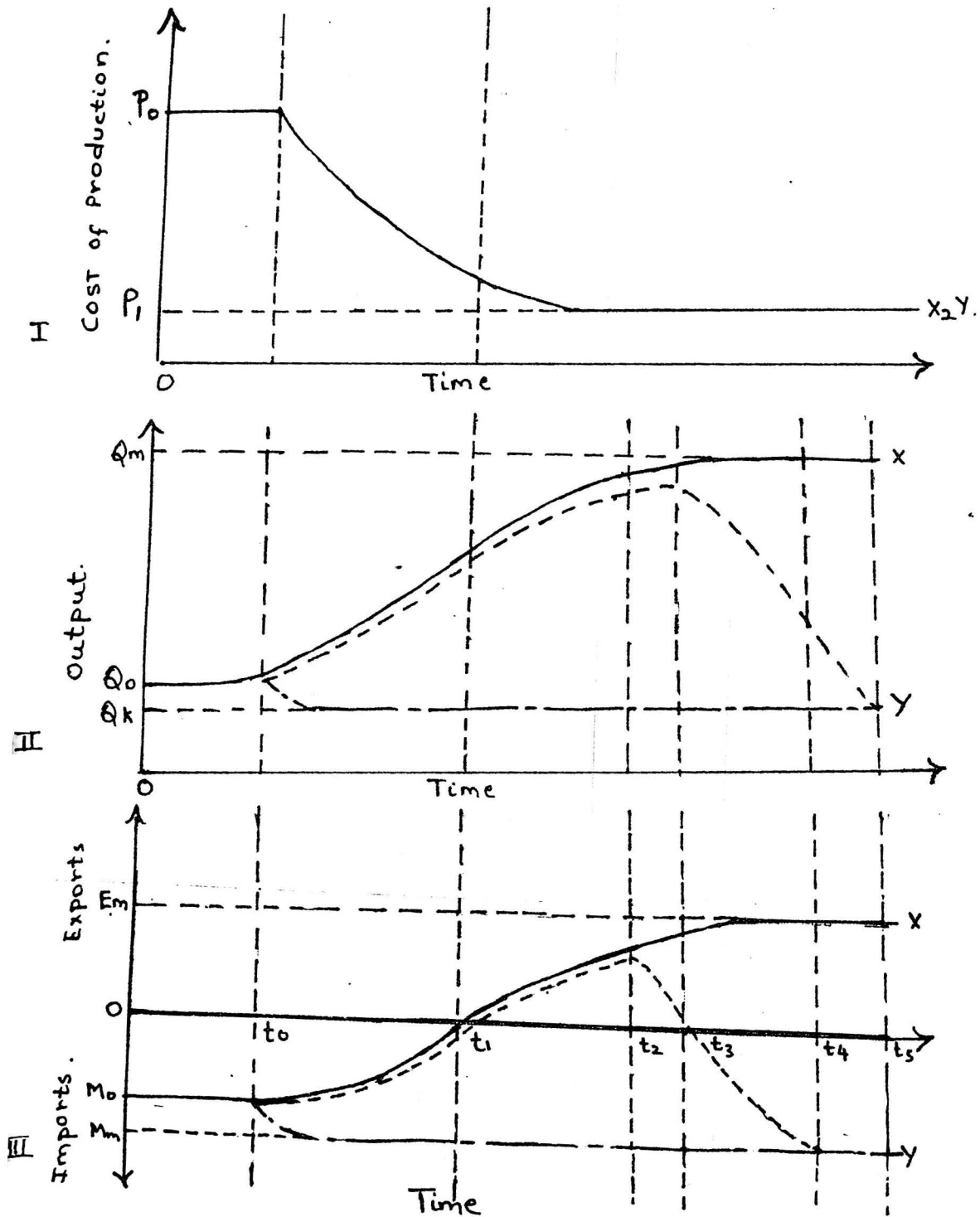
This is concerned with analysing the direction of trade through time, as underlying conditions change. These changes could be in terms of technology, innovations in the product itself, and changes in tariffs and transportation costs.

(1) Technology-Gap Trade & Product Cycle Trade

This is mostly based on the writings of Posner (1961), Hufbauer (1966) and Vernon (1966). New products are developed through time, because of the innovative spirit of entrepreneurs. But this does not occur simultaneously in all countries. This results in a kind of monopoly situation for the innovating country, and is an important cause for international trade. Thus, continuous technical progress can result in continuous trade.⁴³ Grubel & Lloyd have used this aspect of trade to explain intra-Industry specialization. The basic idea was initially developed by Schumpeter. Entrepreneurs who innovate new products, or improve technology and lower costs of production, can earn extraordinary profits. In fact they will invest, only upon certainty of high return. This depends on the protection that the innovators enjoy from their competitors' imitation. To ensure benefits to consumers along with the producers, patent and copyright laws exist, which provide protection to innovators for five to seven years while assuring unrestricted distribution of the benefits of the innovation thereafter. Such protection ensures the monopoly

43. Posner, M.V., "International Trade and Technical Change" in Oxford Economic Papers, 1961, pp 323-4.

TECHNOLOGY - GAP AND PRODUCT-CYCLE TRADE.



SOURCE : GRUBEL, H.G. and LLOYD, P.J., "INTRA-INDUSTRY TRADE", p. 107, FIGURE 7.1.

situation of an innovating producer (in production technology or product design), and enables the innovating country to have a kind of comparative advantage in domestic production and export, which ceases on removal of protection and availability of innovations to imitating rivals. All innovative activity which results in improvement in production methods cause technology-gap trade. Innovations in styling or performance of products manufactured with basically unchanged technology give rise to product - cycle trade. Such trade was given predominance by Raymond Vernon.⁴⁴ In this case, product differentiation, advertisements and imperfect competition play a very important role. The term cycle refers to the time-path of development right from the location of the innovation, its maturing, standardization and finally cessation of production in the innovating country.

The upper panel in Figure 3.6 shows the cost of producing two goods X and Y in a country A as a function of time. P_0 is the past production cost of an unchanged product for which a cheaper production technique has been developed at time t_0 . As the new production process passes through its infancy, learning by doing, minor changes in the technique of production i.e. dynamic scale economies, lower average costs until just before time t_2 , the long run least cost of production, P_1 is reached. Product X is a normal trade product. After the innovation, the rate of change in output and (consumption) follows the normal S - curve pattern found in all successful new products.

44. Vernon. R., "International Investment and International Trade in the Product Cycle" in Quarterly Journal of Economics, 1966, pp 190-207

In panel II, output rises slowly at first, after to rapidly accelerates, reaches an inflexion and then settles down again at OQ_m at t_4 . At this point output equals replacement demand. Panel III shows the exports and imports. After to imports of X fall, and reach zero at t_1 . After that, exports grow following the S - curve found in production, levelling off to demand for replacement or normal growth. Product X is the normal good because at the settled - down price of P_1 , the innovating country retains its' comparative cost advantage, there are no imports of foreign production. We assume that the new production technique is patented and becomes freely available to the rest of the world at time t_2 .⁴⁵

Product Y, we assume is the technology-gap good. Initially, during patent protection, upto t_2 , output and trade in good Y is parallel to X. Foreign and domestic demand are growing in the normal way and are met entirely from domestic production. At t_2 , foreign production starts, because at P_1 , comparative advantage lies with other countries. Exports fall absolutely at that time and domestic production increases at a slower rate and reaches an absolute maximum at t_3 . At this point, exports cease and imports grow until they reach a maximum of OM_m at t_5 . At t_5 , output is assumed to be less than what existed prior to the innovation at t_0 . The essential feature of Y is the development of exports during the time of patent protection between t_0 and t_2 and the subsequent decrease in output and exports. Higher production and exports of Y are solely due to the temporary protection afforded the

45. Grubel and Lloyd, 1975, op. cit, pp 105-106.

innovator in production technology and not because A has a natural comparative advantage in the production of Y, as it does in the case of X. Thus the length of patent protection does not influence the production and exports of X. The exports of Y are termed Technology-gap trade and arise solely due to a temporary comparative advantage afforded due to patent protection. Basically the same analysis applies to product cycle trade. Only now technology is unchanged but there may be perfection of a good, or growing consumers acceptance after an advertising campaign. Assuming good Y is one of many close substitutes making up a given industry's spectrum of products differentiated by style and quality, country A imports a certain proportion of the differentiated goods, including Y, none of which are exported before to. After the innovation, imports of Y are reduced and at t_1 exports develop. Between t_1 and t_3 , A's statistics will show intra-industry trade consisting of exports of Y and continued imports of Y- substitutes.⁴⁶

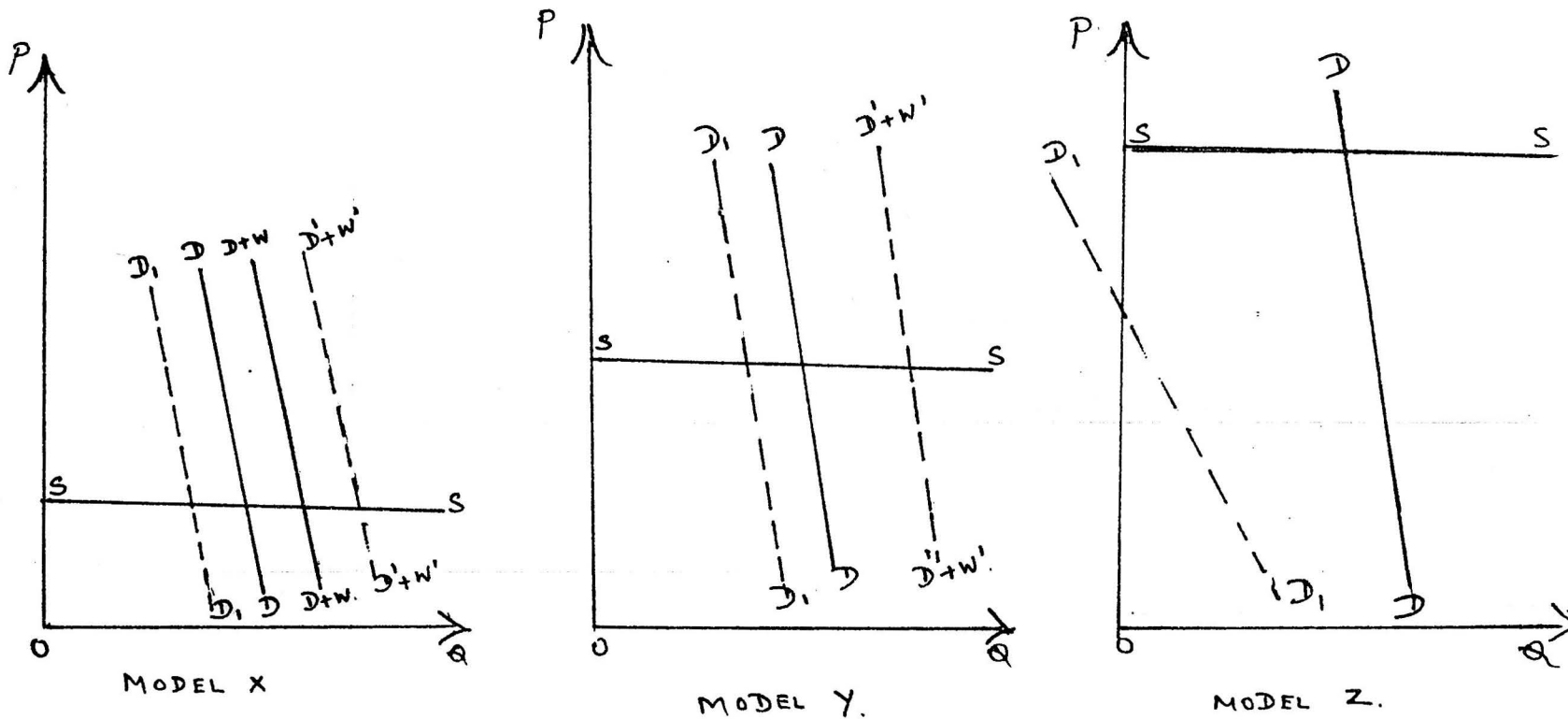
(2) Changes in tariffs and transportation costs

In this section we leave the nature of the product and its costs of production unchanged, but lower distribution costs by reducing tariffs and transportation costs.

Consider an industry where product differentiation by style and quality has led to the marketing of three different models (X, Y & Z) with similar

46. Ibid, pp. 109-112.

CHANGES IN TARIFFS AND TRANSPORTATION COSTS.



SOURCE: GRUBEL, H.G. "THE THEORY OF INTRA-INDUSTRY TRADE", in STUDIES IN INTERNATIONAL ECONOMICS ed. by I.A. McDOUGALL and R.H. SNAPE, 1970, p.45, FIGURE 2.

input requirements in two countries A and B. Production costs differ for each model. The demand and cost conditions for the three models in country A are shown in Figure 3.7. The horizontal lines represent constant cost supply curves. The curves labelled DD represent domestic demand and D+W represent domestic plus rest of the world (i.e. B) demand at the initial equilibrium.

Now consider a mutual reduction in tariffs on lowering of transportation costs. In country A, the demand curves for the domestic models X, Y and Z shift left to D'D' as the price of foreign competitive substitutes is lowered. At the same time A's models X and Y are in increased demand in country B and the new total demand curve is shifted to D' + W'. All demand for model Z ceases. The diagrams imply that the foreign competitive substitute models, at their new, lower price are relatively poor substitutes for country A's models X and Y, but very good substitutes for model Z. Conversely, the magnitude of the shifts in the world demand for country A's models X and Y implies that they are good substitutes for existing foreign products. Thus if commodities are good substitutes, then lowering of tariffs could induce trade between countries of goods classified in the same industry, using similar inputs. This, then can increase the volume of intra-industry trade between countries. Foreign substitutes for Z, on the other hand are priced so advantageously in B, that all domestic demand for it ceases in A - hence the larger leftward shift in model Z in the diagram. A would rather import all of its' requirements of Z in the form of foreign substitutes from B.⁴⁷

47. Studies in international Economics, op. cit. pp. 44-46.

A summary of the theoretical approaches of Grubel & Lloyd

One must acknowledge that the first serious attempt to explain the occurrence of Intra-Industry Trade was made by Grubel and Lloyd. They explained some types of Intra-Industry Trade in physically homogeneous goods, in terms of location, time and other special factors, by incorporating them into the usual Heckscher-Ohlin framework. Their major emphasis was however on product differentiation and oligopolistic market behaviour which they believed to be a major pre-condition **for Intra-Industry** trade. This could not be explained by the HOT. **They argued** that economies of scale coupled with differences in Income Distribution profiles and consumer tastes, and the differences in the rate of technological adoption for new products and processes could provide plausible explanations for Intra-Industry Trade in differentiated products.

The major drawback in this analysis is that product differentiation cannot be an independent cause of trade. The basic reason for any trade is differences in relative prices, and any theory must explain why these differences exist. Product differentiation necessitates differences in taste pattern and the absence of constant returns to scale. When goods are differentiated, it is a case of **monopolistic** competition in which case Increasing Returns to Scale would **inevitably** occur and could cause international trade between product varieties. **To explain** such trade, a theory of consumer choice and behaviour is also essential which is **not** really available in the Grubel and Lloyd analysis.⁴⁸

48. Barua, A., "Specialization within industries as a factor in the trade of developing countries", unpublished M.D. Thesis from J.N.U., 1979.

Yet another limitation of the analysis is the stress on final products. Intermediate goods are most important to any economic analysis. They do make a mention of horizontal intra-industry specialization (i.e. in final products) and vertical intra-industry specialization which involves trade between inputs and outputs. They however tend to lump the two together under a broad concept of Intra-Industry Trade and have not dealt in detail with such trade in intermediary goods, which to my mind is the bulk of all trade.⁴⁹

3.4 Export Price Range and Intra-Industry Trade

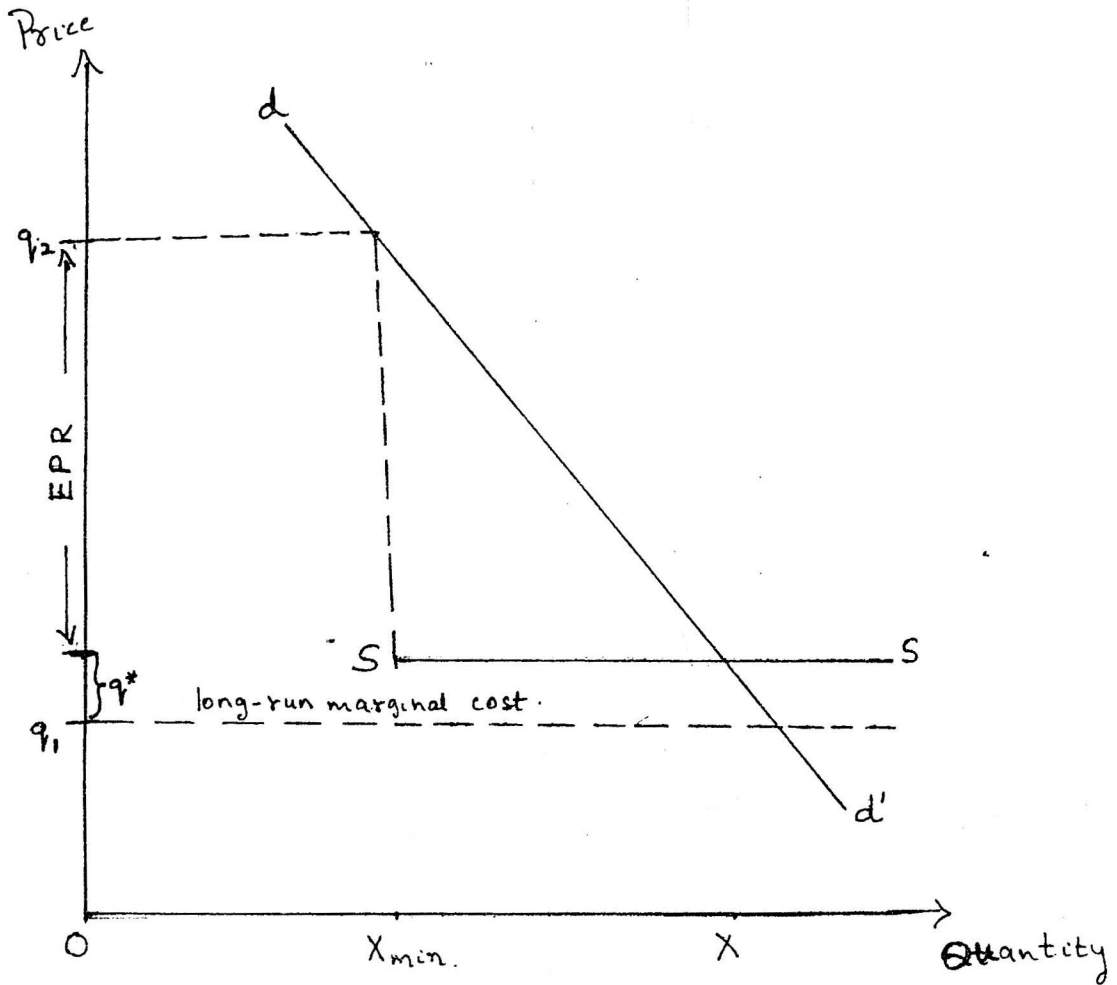
Another explanation of Intra-Industry trade was given by H.P. Gray. He refers to it as Two-way Trade. The stress again is on differentiated products. He analyses the existence of Two-way Trade in terms of 'Export Price Ranges' for competing products in two countries.⁵⁰

Consider two countries A and B where competitive differentiated products are both produced and consumed. There may exist some effective demand for A's differentiated product in B, defined in terms of B's currency, given the Income Distribution, tastes and prices of differentiated products in B. d^B represents the demand curve for A's product, net of selling costs, given the optimum or existing sales effort in B, and is exclusive of excise taxes, but inclusive of any applicable duty. The decision to enter B's market will require A's producer to surmount barriers to entry and to establish a marketing organisation. Because of uncertainty of a differentiated good market, a

49. Ibid

50. Gray, H.P. "Two-way International Trade : A Theoretical Underpinning", in Weltwirtschaftliches Archiv., 1973, pp. 22-38.

FIGURE 3.8.

THE EXPORT DEMAND FOR A DIFFERENTIATED GOOD.

$EPR = \text{Export Price Range}$

SOURCE: WELTWIRTSCHAFTLICHES ARCHIVS, 1973,
P. 23; FIGURE 1.

potential quasi-rent (q^*) and some minimum volume of sales would be expected by A. The minimum volume of sale, X_{\min} will vary with the product and the type of marketing organisation established. For sales less than X_{\min} , the supply is zero, and at prices greater than q_2 , demand is irrelevant. Unless a positive Demand exists at a price which covers long run marginal costs of production (q_1), exports will be zero.

SS, the potential supply schedule is perfectly elastic at $(q_1 + q^*)$, where q_1 is the landed price of the product duty paid at B's frontier, and q^* is the quasi rent. This in turn implies a constant returns to scale assumption in A. The average revenue of a producer in A depends on the money cost of production in A. The export selling price is determined by A's domestic costs and the domestic selling prices. The price computed in B's currency would depend on the exchange rate between the two countries. There is a positive export price range in B for A's differentiated product if $q_2 > (q_1 + q^*)$. A's producer will be willing to export if the above inequality holds over time. In the Figure, B imports the quantity OX per period. If $q_2 < (q_1 + q^*)$, then there will be no exports from A to B because of inadequate profit opportunities.⁵¹

For the existence of two-way trade, reciprocal positive "Export price ranges" for the competing products in the two countries is necessary [i.e. $q_2 > (q_1 + q^*)$ in both countries].

51. Ibid, pp. 23-24.

The more differentiated the goods, the steeper the slope of the demand curves for both countries, and thus higher each q_2 . The higher the pairs of q_2 's, the greater the variation in the two q_1 's that can be accommodated simultaneously with reciprocal EPR's, and the greater the volume of IIT.

With similar per capita incomes, the q_2 's in any two trading countries are likely to be very close and this enhances the possibility of two-way trade. This equality in per capita incomes would imply almost similar factor prices and with similar production functions, the two q_1 's will also be very close. This is in keeping with Linder's postulation that similar PCIs and demand patterns increase the volume of trade, more so with IIT.

Further, with smaller tariff rates and transportation costs, the two q_1 's will be closer and the existence of reciprocal EPR's is enhanced. Hence mutual reduction in tariffs can increase the volume of IIT.

q_2 depends on the magnitude of X_{\min} for any demand curve. X_{\min} will obviously vary for different goods depending on the sales - distribution organizations. The simpler the sales operations, the smaller the X_{\min} and the greater the possibility of IIT.

Gray further comments that IIT in intermediate goods can also take place with reciprocal EPR's and is likely to require the same condition of equal incomes, tastes, factor prices, and significant differentiation among competing products.

Robert Davies puts forward certain points which are not very satisfactory in Gray's analysis.⁵² Since the goods produced in A and B are not identical their exchange can increase the welfare of some consumer in both the countries. This is reasonable provided there is some explanation of why consumer choice is limited in the absence of trade. This could be explained by Increasing Returns to Scale (Limitation of consumer choice) because providing larger consumer choice incurs unincreased costs. But Gray's analysis assumes constant Returns to Scale, and hence no restrictions on the number of varieties to be produced. Limited consumer choice, then can only be due to lack of response by producers to market demand, in the absence of trade. If producers responded, and made use of profit opportunities, then B would try to produce A's goods and two-way-trade would be unnecessary. Thus two-way-trade appears to be the result of producers not taking advantage of profitable markets, which is really not a very good basis for trade. Gray has defended himself on this point by saying that he all along has implied Increasing Returns to Scale over some part of the supply curve and in fact barriers to entry in a new product line is the major cause of Two-way Trade. Domestic producers can never really completely imitate a foreign import. The existence of a foreign supplier in a relatively narrow range of the market will not encourage entry into the segment because of doubts concerning the rate of return on Investment. Two-way Trade takes place because foreigners find it profitable to export their differentiated good to a foreign market, where its price-quality-design mix appeals --- "Countries indulge in Two-Way Trade in order to allow consumers access to varieties of

52. Davies, R., "Two-way International Trade, A Comment", in weltwirtschaftliches Archiv., 1977, pp. 179-181.

goods not domestically produced".⁵³

Although Gray's supplies a new idea in his export price range concept, he is not very clear on the aspect of increasing Returns to Scale.

Thus the basic factors affecting the growth of Intra-Industry Trade appear to be reductions in Transfer Costs, International divergences in technical change, and product differentiation. Transfer costs include natural and artificial barriers to trade like transport and communication, tariffs, Government policies like taxes, subsidies and quotas, and various risks and uncertainties involved in international transactions. As long as factor-cost differences outweigh transfer-costs, any reduction in the latter would increase the volume of trade. They act as barriers to entry for new firms and hence inhibit intra-industry trade in differentiated goods. Any reduction in these costs therefore broaden the firm's decision making horizon and increase the volume of intra-industry trade.

3.5 Intra-Industry Specialization and Intermediate Goods

Most trade theories are concerned with primary factors of production and integrated production processes. Intermediate goods have been generally given less than due importance. In fact one can see that this is a major drawback in the G-L analyses of IIT. G-L do however indicate the possibility of

53. Gray, H.P., "Two-way International Trade : A Reply" in Weltwirtschaftliches Archiv., 1977, pp. 182-184.

vertical intra-industry specialization, which involves trade between final products and intermediate products in an industry in contrast to horizontal intra-industry specialization in different final products. They cite the example of the Australian refrigerator industry which exports compressors and other refrigerator parts and imports complete refrigerators. Foreign processing, international assembly and finishing give rise to IIT because they involve imports and exports of goods which often are reported in the same statistical category. Several examples can be cited, as in the case of German cameras assembled in Singapore from German parts, and the assembling of electronic goods in Mexico, Taiwan, Korea etc. from parts which are imported from USA and Japan. These types of labour intensive assembly or finishing processes give rise to IIT because in most countries the parts and assembled products are classed in the same statistical category. Such foreign processing activities were given prominence by Helleiner.⁵⁴ In fact this involves the exploitation of comparative advantage in the various phases of the production process.

Differences in Labour Quality, skills etc. do exist and are important to determine the pattern of trade, especially IIT. It is generally believed that the developing nations, although labour abundant, have only limited skilled labour. This is because, this requires a lot of investment in education, training etc. which is not easily acquired. Skilled labour is almost like another factor of production. In the production of several goods, the skill intensity may vary according to the stages of production. For instance

54. Helleiner, G.K., 'Transnational Corporation and Trade Structure : The Role of Intra-Firm Trade', in On the Economics of Intra-Industry Trade, symposium 1978, Tubingen, 1979, pp. 159-181.

technological innovations in most industries are skilled labour-intensive because it involves R and D activities. But the processing activities are relatively unskilled jobs. If technology being a produced input, is internationally mobile, then under free trade, low skill labour-intensive phases of production will be located in countries which are unskilled labour-intensive, while advanced countries will specialize in technological knowledge. This is a very relevant cause of IIT.⁵⁵

The HGT does not include intermediate goods and is mainly concerned with primary factors of production and final goods. Economists like Vanek, Batra and Casas, Samuelson etc. have attempted to incorporate intermediate goods into trade models.

The earliest attempt was made by Vanek⁵⁶ (1963). He considered two commodities, traditionally taken as consumption goods, to be both final and intermediate goods for each other. The intermediate goods are assumed to be used in fixed proportions. The interesting result was that a country could import almost all the inputs used in producing its exportable good. Later, other economists like Kemp extended Vanek's model to intermediate goods used in variable proportions but even so, the essence of the above conclusions remained unchanged.

55. Barua, A. "Specialization within Industries as a factor in the trade of developing countries", 1979, op. cit.

56. Vanek, J., "Valuable Factor Proportion and inter-industry flows in the theory of International Trade", in Quarterly Journal of Economics, 1963, pp. 129-142.

Thus a trade model with pure intermediate goods was developed by Batra and Casas (1973), in a H-O. framework.⁵⁷ This model has two final products and one intermediate product, used solely as an input in the production of the final products. Vanek's model assumes identical gross and net factor intensity rankings of the final products. The gross transformation curve is the usual Production Possibility Curve (PPC) or locus of all feasible combinations of the two final goods, if no intermediate good is produced.

In Figure 4.1, if all the 3 goods X_1 , X_2 , and X_3 which is the intermediary good are produced with only primary factors, then the PPC is ABC. This is the gross transformation curve. If now intermediate goods are introduced in the production of X_2 , than maximum net output will be less than OB. It is now OT_1 and utilizes DT_1 of the intermediate good X_3 , with D lying on the Gross PPC. If now net output of X_2 is actually at OF which is chosen arbitrarily then the amount of X_3 needed is FG. Since G is not on the PPC, the unemployed primary factor can be used in X_1 , in an amount GH. We can plot Q, by drawing HQ parallel to GF, which shows that with full employment of the primary factors and a net output of X_2 equal to OF, the maximum net output of X_1 is FQ (=GH). By repeating this for all possible net outputs of X_2 , we get AT_1 which is the net transformation curve.

57. Batra, R.N. and Casas, F.R., "Intermediate Products and the pure theory of international trade : A Neo-Heckscher-Ohlin framework", American Economic Review, 1973, pp. 297-311.

Identical net and gross factor - intensity rankings are possible only if 1) The factors - intensity of the intermediate goods lies between the factor-intensities of the two final products or 2) The commodity whose Capital-Labour ratio lies between the Capital-Labour ratios of the intermediate product and the other final product, is at least as intensive in the use of the intermediate product as the other final product. If (2) is not satisfactory, there is possibility of a conflict between the factor - intensity rankings in the net and the gross sense. This was overlooked by Vanek. Even in such a situation, if intermediate goods are not traded and the factor-intensity rankings are defined in gross terms, the basic H.O.T. is unviolated, although the pattern of trade would be reversed compared to net factor intensity terms only. But intermediate goods are a major portion of international trade, and the relevant factor-intensity should be net rather than gross to indicate differences in comparative advantage. The basic pre-condition for trade between Inputs and Outputs, relevant to our study, is that net factor intensities should differ according to successive stages of production.⁵⁸

Samuelson and Melvin extended the model to a single primary factor and two intermediate goods/final goods each used as an input in the other industry. Once we recognize trade in intermediate goods, then the world PPC would obviously shift outward, resulting in further expansion of the consumption availability set.

58. Barua, A., "Specialization within Industries as a factor in the trade of Developing Countries", 1979, op. cit.

3.5.1 Increasing return to scale and intermediate goods

In a general equilibrium framework, Increasing returns to Scale is generally associated with the expansion of the size of an industry, through diversion of resources from other industries. This is an important form of Division of Labour by the splitting up of activities and development of specialized crafts. International Trade, then, leads to inter-industry specialization as is usually depicted. The usual trend is to connect the size of an industry with increasing Returns which causes disintegration of the production process. But firm size, need not be a true index if Economies of Scale are achieved through disintegration of the production process. In fact there are many empirical studies to observe if there are any positive relationships to indicate economies of scale between plant size and labour productivity. It was found that the relationship need not hold. One can distinguish between several types of Divisions of Labour.⁵⁹

(1) Intra-Plant Division of Labour

This refers to the organization of production within the same establishment. This is always at an intranational level and since Division of Labour is limited by market size, International trade will always expand the scope to exploit all the advantages of Division of Labour.

59. Ibid

(2) Inter-firm Division of Labour

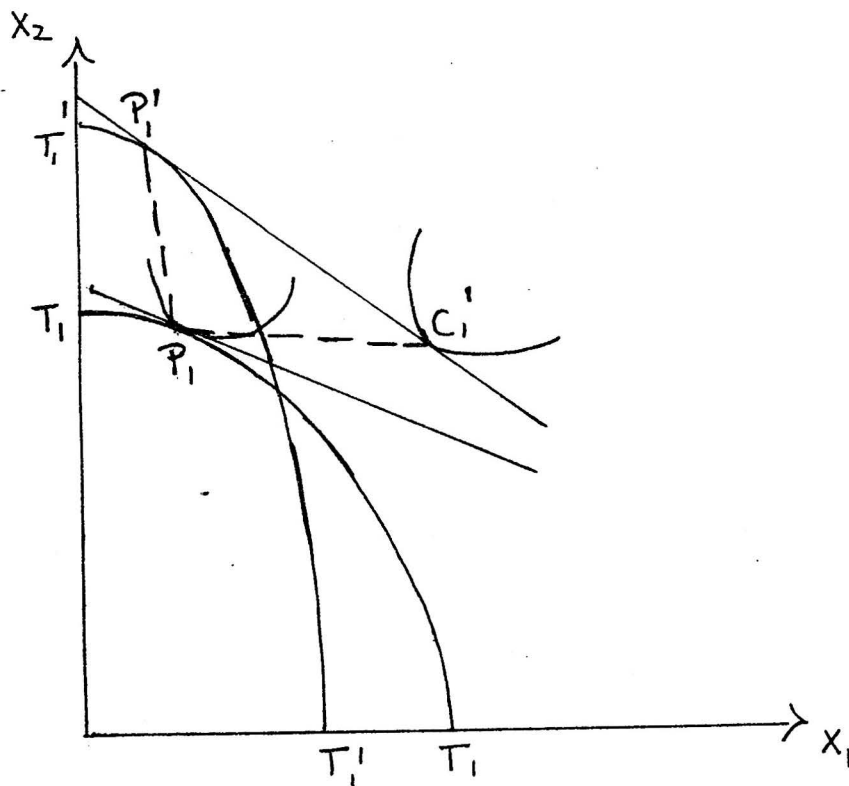
This refers to a situation where Division of Labour takes place between different establishments. This is division of labour in the production of a particular product line where some intermediate products or materials, fuel, energy etc. are acquired from different plants managed by different firms. Inter-firm division of labour also may be international if the firm decides to locate its production activities in different locations or regions. Most Industrial Processes involve a series of commodity transformations rather than a single act of transformation. Sometimes these sequences - including the conversion of raw materials into intermediate goods followed by their incorporation in some final products, are done in a single firm. This is not so important theoretically, but at an international level, these transfers become very prominent. - In fact, Intra-Industry Trade between Inputs and Outputs occurs mainly because of such vertical disintegration of the production process. Thus we must see how such integration occurs. The conditions for inter-firm Division of Labour are important. This could be as a result of Economies of Scale or due to the existence of factor proportions dissimilarities, where transfer costs are important in determining the location of economic activities.

3.5.2 Intra-Industry Trade between Inputs and Outputs

Most of the work in this section is based on the unpublished thesis work of Dr. Barua A. In the previous sections, we have discussed the nature of intermediate goods. The bulk of international trade consists of intermediate products. These appear in trade because of vertical disintegration of the production process.

Consider a situation where final and intermediate goods are equally tradable. Each industry produces an homogenous product with two factors, Labour and Capital. With a smooth neo-classical production function, and factor-price flexibility, the optimal factor intensity of any production process is determined by relative factor prices and the state of knowledge and it is invariant to scale of production. Factor-intensity is generally concerned with final products, and intermediate stages of production are generally ignored. It is generally assumed that labour-intensive final products also use labour-intensive intermediate products. This is not necessary, and in principle, both labour-intensive and capital-intensive final products may be produced with either labour or capital-intensive intermediate products. A real detailed disaggregation of the production process into a large number of small tasks, involves an examination of the factor proportions in each activity separately. This can easily be done by using pure trade theory. Thus if the production of an intermediate good is relatively more labour-intensive than the final product, the capital-abundant country will import the raw materials and inputs and export the finished product.

Figure 4.2



Source : Unpublished Ph.D. thesis, "Specialization within industries as a factor in the Trade of Developing Countries", 1979, by Barua A. pg. 52, Figure 3.1.

In Figure 4.2, there are two goods X_1 and X_2 and two intermediate products M_1 and M_2 , specific to the two final goods respectively. Both the goods are produced with two factors labour and capital. Direct requirements of Capital and Labour for X_1 and X_2 are same but different for M_1 and M_2 . In an open economy, where final and intermediate goods are traded, a profit-maximizing enterprise would no longer be constrained by domestic supply conditions, and would buy where inputs are cheapest. If M_1 is relatively more capital-intensive than M_2 and a country A is more capital-abundant than a country B, then production of M_1 would be cheaper in A. A would thus specialize in the production of M_1 which it would export, and M_2 would be imported. Since M_1 and M_2 are productive factors used in the production of X_1 and X_2 , A will produce more of finished good X_2 and less of X_1 than previously, according to Rybizynski's theorem. B will be just the opposite. In the post trade situation, it is possible that A will have to import X_1 to fulfil domestic demand for X_1 . In the figure, T_1T_1 is the Autarky Production possibility Curve and P_1 is the production and consumption equilibrium in A. Since A exports M_1 and Imports M_2 , the post trade production possibility curve would become $T_1^1T_1^1$. At the same commodity prices, the new equilibrium point of production will be at P_1^1 , which shows an absolute increase in the production of X_2 and an absolute decrease in the production of X_1 . As a result X_2 will be in excessive supply and X_1 in excessive demand in A. The new consumption equilibrium will be above P_1 which implies that country A will now import X_1 and export X_2 . There are obviously gains from trade, as the country moves to a higher indifference curve.

After seeing how differences in factor endowments affect intra-industry trade, we shall see how economies of scale affect such trade. Economies of Scale imply reduction in production costs as a result of an increase in the scale of output. Intra-Industry trade is the result of vertical disintegration of industries. There are several sources of economies of scale like Technical Economies which arise due to indivisibility of superior techniques, marketing economies, managerial economies, scale economies of R and D etc. Economies of Scale may be a strong force leading to integration or disintegration of the production processes. If scale economies arise due to association of various production phases, then there is an incentive to integrate. Vertical disintegration occurs if the optimum level of production for various phases in the process are so different that it creates serious input-output balancing problems within the firm. This leads to "Inter-Firm" division of labour, and when this occurs internationally then it inevitably leads to trade between inputs and output.

Another very important aspect is the location of the various stages of production and the relative transferability of final and intermediate products. This is the transferability of the product of unit value in comparison with the transferability of the inputs per unit value of the product. The transferability of a product varies as it passes through successive stages of transformation. If for example the inputs are more transferable than the final good as the latter increases in bulk, then for minimum transfer costs, the finishing activity must be close to the market. Webers

theory of location is important for deciding such aspects wherein production is divided into stages and the location of each stage is conditioned by localized factors and transfer advantage, nearness to markets, sources etc.

Intra-Industry Trade arises if there are economies of scale in the finishing stage in which case the region with a large market might import materials and intermediate goods and export surpluses in final products.

Thus we can see that although not much work has been done, in this aspect of intermediate goods and Intra-Industry Trade, it is an excellent field for further research. No production process consists of only primary factors and a single activity. Intermediate goods appear in all commodities and hence deserve a lot of attention. Again a lot of Intra-Industry trade is bound to be found between inputs and output in an industry as has been shown in this chapter.

CHAPTER IV

CONCLUSION

This dissertation is a survey of literature on Intra-Industry Trade and has addressed itself to a study of the nature and causes of the same. Almost all trade theories have stressed the importance of trade between industries, with completely different input and end use. In the late sixties, however, it was found that quite a bulk of trade was in commodities belonging to the same industry classification. The standard example cited was trade in cars between France and Germany. Several other empirical tests conducted by Balassa, Peter Gray, Grubel and Lloyd, Verdoorn etc. showed similar results. However there are also several economists like Finger, Lipsey etc. who suggested that the very existence of such specialization was purely due to lacunae in statistical data. Thus, the problems of aggregation came up as an important aspect in deciding whether the phenomenon was real or just a result of exaggeration of data and type of classification. Grubel and Lloyd (G-L) and Peter Gray showed that it was a significant proportion of total trade even at a disaggregated 7-digit level of data. Of course there are still many who argue that it is not significant enough, but then this is a subjective decision and is open for discussion.

Balassa showed that his measure could also be applied to the developing nations, with similar results. Everywhere, Intra-Industry trade between similar nations was maximum and it was more so with the removal of tariffs and other trade barriers.

Grubel and Lloyd have considered the effect of Economies of Scale and Product Differentiation as possible explanations of IIT. They have shown that very few types of Intra-Industry trade, like products, differentiated with respect to time, location etc. can be included in the Heckscher-Ohlin framework. Then, by dropping the assumptions of constant Returns to scale and perfectly homogeneous commodities, in the HOT, they have shown economies of scale in the form of length of runs in an oligopolistic market structure with product differentiation to be an important determinant of Intra-Industry specialization for goods with similar input requirements. Peter Gray has also emphasized the product differentiation aspect, and explained simultaneous exports and imports of goods in the same industry via what he terms 'Export Price Ranges'. Linder's (1961) hypothesis has been used in quality differentiation to show that higher quality goods in the same industry satisfy consumers in the higher income brackets, and exports and imports from a country are likely to be the same to satisfy all its income groups.

Yet another explanation was in terms of changes in technology and the product cycle itself, between nations. These ideas were taken from the works of Posner and Vernon. Intra-Industry Trade can be explained here by the innovations and production methods in a pioneering country, which has a monopoly advantage, in so far as the industry is protected from foreign limitation. But once the patent protection is removed, the production and exports of the other good will increase and imports reduce, until the point of complete cessation of imports. It is during this time, that trade

statistics will show exports and imports of goods in the same industry. Changes in technology imply initial differences in production functions. Product cycle trade assumes that goods are no longer homogeneous after an innovation. Otherwise the implications for Intra-Industry Trade are analogous to technology-gap trade. Reduction in tariffs and other barriers, also help to increase the scope of Intra-Industry specialization.

It seems that the introduction of intermediate goods into the neo-classical framework, allows for trade between inputs and outputs. Generally, most of the work done by the theorists of Intra-Industry trade has been in final products. The assumption that goods are produced merely with the help of primary factors is far fetched and unrealistic. Several inputs also appear in any production process, and it is possible that these are imported by a country which exports the final good. Thus the functioning of MNC's and other foreign processing activities involve such vertical integration of the production process and are indicative of the pattern of trade and specialization. There is a lot of scope for research in this field, but unfortunately there is not much literature available.

Loertcher and Wolter⁶⁰ contended that Intra-Industry trade among countries is intense -

- (1) if the average of their level of development is high. This is because more developed countries have a higher capacity to innovate, and this is a precondition for product differentiation. Besides these countries

60.- Loertcher R. and Wolter F., "Determinants of Intra-Industry Trade : Among Countries and Across Countries", in Weltwirtschaftliches Archiv, Vol. 116, 1980, pp 282-284

are characterised by a highly differentiated demand which allows for exploitation of economies of scale in the production of a wide variety of goods. Also, there are developed information and communications linkages between them. This can be measured by taking the average of the PCI's of the countries.

- (2) Intra-Industry trade between countries is intense if the difference in their levels of development is relatively small. This implies similar preference structures, and factor price ratios, production of only slightly differentiated goods and hence more intense Intra-Industry trade is likely. Condition (1) can show a high average when both countries are at high levels of development. But a high average is also the resulting mean of a low and very high level of development. But in the latter case, the absolute difference in PCI's between countries can indicate development stage differentials.
- (3) Intra-Industry trade is intense if the average of their market sizes is large. This is because many differentiated products can be produced under economies of scale. At the same time, demand for these differentiated goods is large and thus there is a great potential for IIT. Average gross domestic products of the countries can indicate average market size.
- (4) IIT is intense if the difference in the market sizes is small. Obviously there is greater scope for IIT when both markets are close. This corrects determinant (3) in the same way as (2) corrects (1). The absolute difference of gross domestic products between countries can be used as an indicator.

- (5) With low barriers to trade, tariff as well as non-tariff, like communications, information etc., there is greater scope for such trade within industries.

Thus it appears that autonomous catching up processes, simultaneous growth of domestic markets and lowering of transaction costs among countries are accompanied by an increase in intra-industry trade.

The empirical evidence of Intra-Industry trade in the CACM and LAFTA regions indicate implications for other developing countries.⁶¹ At first glance, it may appear that Intra-Industry trade is not a worthwhile goal for developing countries. But in fact, it is these countries which have more of monopolistic and oligopolistic situations. The opening of markets to other developing countries provides an incentive to improve production methods. Further, because of horizontal specialization, i.e. gains in production efficiency through reductions in product variety, in industrial firms manufacturing consumer goods, intermediate products, etc. there will be further improvement in welfare. These gains are obtained through the lengthening of production runs, which permit the use of special purpose machinery, and lowers the costs of operation. These gains will appear particularly important in developing countries, where, in general, short production runs dominate. Thus such economies of scale advantages are more important in the developing nations.

61. Balassa B., "On the Economics of Intra-Industry Trade" Symposium 1978, op cit pp 249-65.

Further, the elimination of tariffs enable the reaping of the full benefits of intra-industry specialization, but this is more difficult in the developing countries because their industries function behind a high level of protection, because differing levels of efficiency among firms have created fears that competition could destroy some firms. Thus it appears that countries at lower levels of development have a lot to gain from intra-industry specialization in the framework of a regional union, because industrialization will occur in a much larger, international market, permitting increased specialization, and greater competition, so that smaller production runs, and high cost industries serving only the national market are avoided.

The problem in most of the LDC's is that due to heavy protection through high tariffs, there is generally inefficiency in the industries. Thus it appears that economic integration in the CACM has led to horizontal specialization and welfare gains. This has led to longer production runs, greater efficiency and the achievement of economies of scale through a reduction in the variety of good produced. Apart from this, integration could also result in vertical integration, which involves the production of inputs, components etc. for assembly in different countries. This brings gains through exploitation of economies of scale in the manufacture of individual inputs at various levels of fabrication. Such specialization in automobile parts is prominent in Western Europe, U.S.A. and Canada. It also has possibilities in the LDC's but has not really taken place because

there is generally a high tariff on the products of industries subject to vertical specialization because of the uncertainties in economic policies, exchange rates etc. which generally exist in the developing countries.

Thus economic integration in developing countries at low levels of integration is desirable, so that potential benefits from vertical and horizontal specialization are not foregone. Of course, even the more industrialized developing countries would benefit from lengthening production runs and exploitation of economies of scale, if tariff reductions took place.

There is also a possibility for intra-industry trade between the developed and developing countries. Horizontal specialization can take place through the exchange of consumer goods, with developing countries specializing in product varieties utilizing unskilled labour. This is also possible in regard with intermediate goods. All along, empirical evidence shows larger scope for IIT between countries of similar PCI and taste patterns. But at the same time one must also acknowledge that inter-personal differences in incomes and tastes are also conducive to trade. Focussing on "quality" among product attributes, it is possible that developing countries will export low-quality varieties requiring chiefly unskilled labour to developed countries, and import higher-quality product varieties from them. Examples of these are found in a variety of consumer goods like clothes, shoes, bicycles etc.

Vertical specialization is generally in the form of the LDC's specializing in unskilled - labour intensive operations, involving the production of certain components, parts or assembly. Efficiency objectives would also be served if developing countries engaged in vertical specialization. This may be in the form of imports of capital - intensive and technology - intensive parts, components etc., for combining them with labour-intensive inputs produced domestically. International vertical specialization brings gains to developed and developing countries by allowing specialization to take place according to the relative labour-intensity of the production process.

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