CHAPTER 2

SURVEY OF THE LITERATURE

The theoretical and empirical literature relating to each of the two issues will be surveyed below. At the end of each survey, we shall indicate the possible ways of extending the analyses which will be followed in the later chapters.

I. Trade between final and intermediate products

The central body of international trade theory (both Ricardian and the HOS) customarily assumes primary factors and integrated processes of production\(^1\) to derive logical proposition regarding the structure of trade in finished consumption goods. Produced means of production play no role in these models;\(^2\) and even if its presence is sometimes recognized, it is considered to be an unnecessary complication to the inviolable basic foundation of the trade

1 The assumption of integrated processes of production sounds as if division of labour is being abrogated. However, it is tolerable in models based on constant returns to scale.

theory. In his celebrated survey article Bhagwati has criticized this traditional analytical framework to be the 'central limitation' of trade theory. Recent theoretical researches in this sphere have established few important results that question the validity of some well-accepted propositions. The nature of the conclusions of trade models with intermediate products, however, depends crucially upon the exact formulation of the model; and in some cases, it turns out that both Ricardian and the HOS models need to be reinterpreted. Moreover, there occur distinct regions within the zone of possible specialization patterns that allow trade between final and intermediate products.

(a) Intermediate products in neoclassical trade model

The basic difference between the neoclassical trade model and the neo-Ricardian model formulated in a

3 Thus Samuelson writes: "To discuss the role of intermediate goods and durable machinery in factor-price equalization, we can often employ the net production function giving each final good in terms of total primary inputs needed for it alone. We thus sweep all complications into the background and concern ourselves only with the crucial factor-intensities (and generalized Jacobian matrices) of the standard net functions." (Emphasis added). See P.A. Samuelson, "Equalization by trade of the interest rate along with the real wage", in R.R. Baldwin and others, ed., Trade, Growth and the Balance of Payments: Essays in Honor of Gottfried Haberler (Chicago, 1965), ed. 2, p. 52.

Leontief-Sraffa system of production\(^5\) lies in that the former allows factor substitutability within a well-behaved neoclassical production function that relates flows of inputs to the flows of outputs. The latter may, however, be considered as a special case of the former. The task of introducing intermediate products into the neoclassical model can be approached in at least two ways. One may retain both primary factors or one may drop one primary factor but allow substitution possibilities between the primary factor and the intermediate inputs. Then, holding the rate of interest constant, one can examine the implications for the rentals of the primary factors of production of autonomous changes in commodity prices.\(^6\)

(1) **The two primary-factors case**

The earliest systematic attempt to incorporate intermediate products in neoclassical trade model has been made by Vanek\(^7\) who had demonstrated that the traditional theorems of Stolper-Samuelson, Rybczynski, and Heckscher-Ohlin

\(^5\) If one wishes to introduce intermediate products into the Ricardian model of comparative advantage, one can possibly do it along the Leontief-Sraffa lines.

\(^6\) Kemp, n. 2, p. 253.

hold unambiguously without any qualification. The main feature of Vanek's model is his treatment of two commodities—traditionally taken to be consumption goods—as both final outputs and intermediate inputs for each other. He assumed that intermediate goods are used in fixed proportions. In this model, the gross and net factor-intensity rankings are identical. An interesting possibility that emerges from the model is that a country when exposed to international trade may utilize a part or all of the imported goods as an input in the production of the exportable good. Later, Warne, Kemp, and others have extended Vanek's model into one where intermediate products are used in variable proportions. The main conclusions, nevertheless, remain the same. However, in this formulation where intermediate and final products are identical, one cannot really explain the basis for trade between inputs and outputs.

Some economists, as a result, felt dissatisfied with such treatment of intermediate products where one is unable to distinguish between final and intermediate products. This dissatisfaction has led to the development of trade


9 Kemp, n. 2, pp. 253-60.
model with pure intermediate products. Batra and Casas have been able to derive few interesting results regarding the implication of pure intermediate products in a Heckscher-Ohlin framework. The model assumes two final products and a pure intermediate good which is produced solely to serve as an input in the production of the final products. The basic difference between Batra-Casas model and Vanek's model lies in the possibility of a conflict between the net and the gross factor-intensity rankings of the final products in the former model. The factor-intensity rankings of the final products in the net and gross sense are identical if (i) the factor-intensity of the intermediate good lies between the factor intensities of the two final goods, or (ii) 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 commodity. If condition (ii) above is not satisfied there arises the possibility of a conflict between


11 Thus, assuming that intermediates are not traded and that Samuelson's conjecture holds (that is, the factor-intensities of the net function should crucially determine the pattern of trade), the model would then predict a pattern of trade that would, in fact, contradict the basic HOS theorem.

12 Batra and Casas, n. 10, p. 304.
the factor-intensity rankings in the net and gross sense. Even in such a situation if intermediate goods are not traded and the factor-intensity rankings are defined in the gross sense, the basic HOS proposition will, of course, be valid although the pattern of trade will be reversed than would have been when comparisons are made in terms of the net factor-intensities only. But there is no reason to keep intermediate goods non-traded, given the fact that bulk of the international trade consists of the intermediate products. Then all goods are traded, the relevant factor-intensity rankings should be the net rather than the gross to indicate comparative advantage. From this position, it is only a step further to show why trade takes place between inputs and output. The basic pre-condition for such trade is that the net factor-intensities must differ according to successive stages of production.

13 Ohlin himself suggested recently that it is "much more realistic to think about costs at different stages of production. In other words, total costs refer to the costs incurred by manufacture at each stage of production. Under equilibrium conditions the total unit cost is equal to 'the value added by manufacture' at a certain stage." (Emphasis in the original) See, R. Ohlin, "Some aspects of the relations between international movements of commodities, factors of production, and technology", in R. Ohlin and others, ed., *The International Allocation of Economic Activity: Proceedings of a Nobel Symposium held at Stockholm* (London, 1977), p. 31.
(ii) The single primary-factor case

Paul Samuelson, James Melvin, and others have developed a model with a single primary factor and two intermediate/final goods, each used as input in the other industry, and with substitution between inputs. Thus, they differ from Varsh by eliminating a primary factor but by allowing the intermediate inputs to be used in variable proportions. Assuming linear homogeneous production function, they have used the total product curves to construct a net production function. It turns out that even if the production functions allow substitution between factors, such substitution will never take place. In equilibrium there will be a single production coefficient used in each industry, and furthermore, the autarky production possibility surface will be linear. This is the well-known non-substitution theorem which states that the relative prices and the choice of technique will be independent of the composition of final demand.


The curve $f_1^*$ in Figure 2.1 is the total product curve for commodity $X_1$; it shows the relation between the levels of output of $X_1$ and the levels of input of $X_{21}$ under the assumption that all labour are devoted to $X_1$. The curve $f_2^*$ is the corresponding curve for commodity $X_2$. The slope of $f_2^*$ at $B$ shows the marginal product of $X_2$ with respect to $X_{12}$ which is equal to the ratio of output prices, $P_1/P_2$. Similarly, at $E$ the slope of $f_1^*$ is the ratio of output prices, and thus an equilibrium can exist only if the slopes of $f_2^*$ at $B$ and $f_1^*$ at $E$ are equal. It is clear that the
maximum output will be achieved where a line is just tangent to both $f_2^*$ and $f_1^*$ (as shown in the diagram). If no trade is allowed, then the set of efficient production point is CD, for points on BC and DE could be produced only if additional quantities of the intermediate could be obtained through international trade. The interesting feature of this model is that the neoclassical basis for trade no longer holds. Thus Samuelson writes: "Ironically, when I push the Heckscher-Ohlin axioms all the way, we come full circle back to a uniform Ricardian world."\(^{17}\) (Emphasis in the original)

The second interesting feature is that if intermediate inputs are traded, then ABCDF becomes the production possibility curve. The non-substitution theorem loses its validity with trade in intermediates. With trade and complete specialization it will be possible to attain the maximum attainable production point like A or F. As anticipated by McKenzie\(^{18}\) and recently demonstrated by Melvin,\(^{19}\) trade in intermediates causes outward shift of

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17 Paul A. Samuelson, n. 3, p. 52.
the world transformation curve resulting in further expansion of the consumption availability set.

(b) Intermediate products in Ricardian trade model

The Ricardian theory of trade is usually postulated in terms of simple labour theory of value, in which prices are proportional to labour inputs. It assumes that rates of profits are zero or that each country's technology is of the "equal organic composition of capital" type. Only in these cases, relative prices are determined independently of the distribution of income. Ricardo himself recognized that the existence of a positive rate of profit could make prices diverge from direct labour costs but thought the difference was insignificant. In a recent article, Mainwaring has investigated the implication of a positive rate of profit for the Ricardian theory of trade. He uses a circulating capital model of Leontief-Sraffa variety in which production takes place in self-contained periods. There are two commodities (1 and 2) which are produced by means of labour and the same two commodities. He then examined the implications for the wage rate and the rate of interest to changes in commodity prices. The price equations of the system are

20 The term 'organic composition of capital' means value capital : labour ratio.

\[ P = (1 + r) (a_{11} P + a_{21}) + w a_1 \]  
\[ 1 = (1 + r) (a_{12} P + a_{22}) + w a_2 \]

where \( a_{ij} \) = input of labour into a unit of \( j \)

\( a_{ij} \) = input of commodity \( i \) into a unit of \( j \)

\( P = P_2/P_1 \), the price ratio, and wage, \( w \) is expressed in terms of good 2.

Competition ensures the equality of \( r \) (the rate of profit), \( w \) and \( P \) throughout the economy. We can solve (1) and (2) to obtain the wage-profit (\( w-r \)) relationship

\[ w = \frac{\det ([I - vA])}{(1-a_{11}v)a_2 + a_1 a_{12}v} \]  

and relative prices as a function of \( r \)

\[ p = \frac{(1-a_{22}v) a_1 + a_{21}a_2v}{(1-a_{11}v)a_2 + a_1 a_{12}v} \]  

where \( v = 1 + r; \ A = \|a_{ij}\| \); and \( I \) is the identity matrix.

It can be shown that

\[ \frac{\partial p}{\partial v} < 0 \text{ as } \frac{a_{11} \partial P + a_{21}}{a_1} < \frac{a_{21} \partial P + a_{22}}{a_2} \]  

The condition (5) implies that the relationships between relative commodity prices and the rate of interest depend on the "organic composition of capital" (capital : direct labour ratio) of the two commodities. When these capital : direct labour ratios are the same for both processes, we have what Marx called 'equal organic composition of capital' in which case Ricardian labour theory of value holds unambiguously. Otherwise, relative prices are a (monotonic) increasing or decreasing function in \( r \). For each of these possibilities we can draw a wage-profit frontier as shown in figures 2.2, 2.3 and 2.4.

![Diagram of wage-profit frontiers](image-url)
In a no-trade economy any single activity is not sustainable on its own. But with trade, it is possible to have a single activity supported by intermediate inputs. So the possibility of trade presents two additional techniques, each consisting of a single activity. Now, for any given international price, we can find a wage-profit frontier for each activity. Such a frontier for activity 1, denoted by \((w-r)_1\), is

\[
v = \frac{\int P - v (a_{11}P + a_{21})}{a_1} \]

with a straight line slope \(-\frac{(a_{11} + a_{21})}{a_1}\)

and for activity 2, denoted by \((w-r)_2\), is

\[
v = \frac{\int P - v (a_{12}P + a_{22})}{a_2} \]

with a straight line slope \(-\frac{(a_{12} + a_{22})}{a_2}\)

There will be a family of these straight lines corresponding to different price ratios, and thus having a different slope from every other. If \(s_1\) and \(s_2\) are the slopes for \((w-r)_1\) and \((w-r)_2\) respectively, then it can be shown that
i) \( s_1 > s_2 \Rightarrow \frac{\partial y}{\partial v} > 0 \)

ii) \( s_2 < \frac{\partial y}{\partial v} < s_1 \) for \( \frac{\partial y}{\partial v} > 0 \)

\( s_1 < \frac{\partial y}{\partial v} < s_2 \) for \( \frac{\partial y}{\partial v} < 0 \)

\( s_1 = \frac{\partial y}{\partial v} = s_2 \) for \( \frac{\partial y}{\partial v} = 0 \)

where \( \frac{\partial y}{\partial v} \) stands for the slope of the au~enky wage-profit frontier.

**Case 1: Intermediate are not traded**

Even if both countries share a common technique, pre-trade differences in the distribution of income \( r_a < r_b \) is sufficient to explain trade in figure 2.2 and figure 2.4 above. The country with lower rate of interest will export the capital-intensive good. Enough trade should take place so as to equalise factor-prices in both countries. This conclusion is quite similar to the one derived from neoclassical trade model.

22 Thus, pre-trade differences in income distribution patterns become a new basis for trade in Ricardian model as against the well-known postulate of differences in production functions. Such a possibility of explaining Ricardian trade pattern is also suggested by Steedman and Metcalfe. See Ian Steedman and J.S. Metcalfe, "The non-substitution theorem and international trade theory", *Australian Economic Papers*, vol. 12, December 1975, pp. 257-69.
However, in figure 2.3, international trade will not take place unless both countries adopt different techniques of production. This is the usual representation of the Ricardian theory of trade in the textbooks. But both countries must, however, produce positive amounts of both goods since intermediates are not traded. Thus, specialization does not mean complete specialization as in usual Ricardian model.

**Case II: Intermediates are traded**

Assume that both countries show a common technique but have different rates of interest. Neither intermediate nor final commodities will be traded if both industries have the same factor-intensities as in figure 2.3. We shall, therefore, concern ourselves to figures 2.2 and 2.4 only.
We have drawn in figures 2.5 and 2.6 the wage-profit frontiers for activity 1 and activity 2 with respect to the given international price $P_1$ on the assumption that intermediates are traded. If the 'motive' for trade is the attainment of superior ($w-r$) combination, it is seen that such a combination is attained when each country specialized in the commodity which is relatively cheapest to produce. Trade in intermediate, thus, leads to higher per capita consumption (i.e. real wage level) than otherwise would be, at the prevailing rate of interest. Alternatively, trade in intermediates raises the rate of profit at the prevailing level of real wages. However, as soon as free trade leads to specialization and importing of inputs, local and international price ratios are no longer given by domestic cost ratios in either country. The pattern of equilibrium prices now depends on the strength of international reciprocal demands.

(c) Increasing returns to scale and trade in intermediates

No formal model has yet been developed with economies of scale that incorporates trade in intermediates. The reason is that it severely complicates things and the

direction of causation may be multidimensional. While it is true that in Adam Smith's example of pin factory specialization in terms of productive activities is emphasized, it is nevertheless a fact that the commodity rather than the activity interpretation has pride of emphasis in contemporary trade theory.

The effect of increasing returns to scale on trade depends on the way in which increasing returns are reflected in changes in the organization of industrial activities. In a general equilibrium framework, increasing returns to scale means an expansion of the size of the industry through diversion of resources from other industries. International trade then leads to inter-industry specialization as is usually depicted. Although this is an important form of division of labour, there also exist other plausible forms which are often ignored. Allyn Young has long ago insisted that the Smithian notion of the division of labour essentially implies splitting up of occupations and development of specialized crafts. He, therefore, says:

With the extension of the division of labour among industries the representative firm, like the industry of which it is a part, loses its identity. Its internal economies dissolve into internal and external economies of the more highly specialized undertakings which are its
successors, and are supplemented by new economies. 24

In such a case where increasing returns cause disintegration of the production process, our usual habit of attaching it to the size of the 'industry' will be quite misleading. However, much attention has been paid in the theoretical literature to economies of scale which are associated with the size of the plant or firm. Even in empirical studies attempts have been made to observe whether there exist any positive relationships to indicate economies of scale between plant size and labour productivity. But firm size may not be the true index if economies of scale are achieved through disintegration of the production process. Fritz Machlup 25 suggests that one can distinguish division of labour in the following ways:

(i) \textit{Intra-plant division of labour}

It refers to organization of production within the same establishment. This means intra-plant division of labour is always intra-national. Since division of labour is limited

\begin{enumerate}
\item \textit{Intra-plant division of labour}
\end{enumerate}

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by the size of the market, international trade will always provide the scope to exploit such advantages.

(ii) Inter-firm division of labour

It refers to the case where division of labour takes place between different establishments i.e. division of labour in the production of particular product or product line where some intermediate products or materials, fuel, energy etc. are acquired from different plants managed by different firms.

It hardly needs saying that 'inter-firm' division of labour may take place internationally while intra-plant or intra-firm is always intranational. Intra-firm division of labour may, however, take place internationally (for example, the multinational enterprises) if the firm decides to locate its productive activities in different locations.

Recognizing the importance of such division of labour to international trade theory, Raymond Vernon wrote:

Few branches of economic theory can wholly disregard the fact that modern industrial processes usually involve a drawn out sequence of commodity transformations, rather than a single act of transformation. Sometimes these sequences - including the conversion of raw materials into intermediate products and components followed by incorporation in some final product - are undertaken from beginning to end within a single firm. The economies of these intra-firm transfers may be important, but they can often be
disregarded by the theorist when the transfer occurs inside a single national market. Where international trade is concerned, however, intrasfirm transfers become disconcertingly prominent. About one-quarter of US exports of manufactured goods, for instance, has consisted of transfers of goods between affiliates; and the proportion has been especially high in technically advanced products. 26

Summing-up

It is quite evident from our survey that trade between final and intermediate products has recently been extensively discussed in the literature and traditional models of trade (Heckscher-Ohlin and Ricardian) find no difficulty in explaining it.

But given the importance of natural resources in trade, the single primary-factor model (neo-classical as well as Leontief-Griffa type) seems to be highly unrealistic. On the other hand, the two-factor neo-classical model needs to be extended to incorporate technological differences between countries. We can, then, say something more about trade between inputs and outputs.

Our major departure from the conventional explanation will be in the direction of introducing economies of scale and factor-proportion dissimilarities. Since intra-industry trade between inputs and outputs results from vertical disintegration of the production process, we shall examine how economies of scale may itself be a force causing such disintegration or, in other words, the conditions for inter-firm division of labour.

Vertical disintegration also results from the existence of factor proportion dissimilarity. In that case, transfer costs play an important role in determining location of economic activities. However, if economies of scale are very strong at the final stage of production, intra-industry trade might eventually take place.

(II) **Intra-industry trade in final products**

The international exchange in finished consumption goods belonging to the same industry is conventionally referred to as intra-industry trade. Its earliest recognition is to be found in Heberler as follows:

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In trade statistics a single class of goods may frequently be found both among the imports and among the exports of the same commodity. This may occur for several reasons....But the distinction between regular exports and imports does not thereby become meaningless. (23)

Ironically, recent empirical researches have quite convincingly established that such a distinction is, in fact, meaningless insofar as much of the international trade may be characterized as intra-industry trade. The discovery of this phenomenon has often led to a presumption that the existence of intra-industry trade invalidates the traditional theory of international trade. Such a presumption, as is obvious, necessarily raises a theoretically interesting question whether within the traditional theorem conditions do exist such that intra-industry trade may not violate the internal logic of the model. In case it does violate, one


30 Since the material input requirements are same for products within an industry "it is analytically difficult to explain the marked increase in this intra-industry trade by use of the traditional Heckscher-Ohlin model of comparative advantage", see Grubel and Lloyd, n. 27, pp. 9-10.
must then provide alternative explanations for its existence. A brief survey of the literature that directly or indirectly concerned with this type of intra-industry trade is given below.

(a) **Empirical findings**

The quantitative significance of intra-industry trade has been brought into limelight by a series of empirical studies. For instance, one strand of empirical researches has since the early sixties been concerned with evaluating the effect of tariff reductions on the pattern of resource allocation. Assuming that the pattern of resource reallocation will be dictated by the comparative advantage, it was expected that a movement towards freer trade would lead to greater national specialization. By closely examining the pattern of trade for the Benelux countries by Verdoorn, 31 and for the EEC countries by Balassa, 32 it was found that trade liberalization did not


lead to increased specialization. On the contrary, they
found that intra-industry specialization has been the most
important form of trade expansion.

Similarly, Hufbauer and Chiles\(^{33}\) find no signifi-
cient increase in specialization (defined in terms of net
trade flows) in trade in manufactures among the developed
countries since 1937. Interestingly enough, their measure of
specialization does not change significantly with dis-
aggregation from 6 industry categories to 112. Their
explanation for the absence of increased specialization is
that "GATT negotiations very much favor intra-industry over
inter-industry specialization."\(^{34}\)

On the other hand, Robert Baldwin\(^{35}\) has considered
the net trade and employment effect of a significant tariff
reduction in a much more detailed industry breakdown (over
350 industries) for the US economy. The aggregate trade and
employment effects in the U.S. of a 50 per cent multilateral
tariff reduction are found to be quite negligible. While a

33 C.C. Hufbauer and J.C. Chiles, "Specialization by
industrial countries: extent and consequences", in H. Giersch, ed., The International Division of
Labour: Problems and Perspectives (Tubingen, 1974).

34 Hufbauer and Chiles, ibid., p. 76.

35 R.T. Baldwin, "Trade and employment effects in the
U.S. of multilateral tariff reductions", The American
50 per cent duty reduction leads to changes in exports and imports that each exceed $1.5 billion, the net trade change is a negligible $\$4$ million for all industries. The employment effect is also small, -15,000 man-years for all industries. The main conclusion that emerges from the study is that the US can participate in a substantial tariff cutting negotiation without causing significant adverse trade and employment effects in the country. Such a possibility can happen, if and only if, the relative factor contents of the export and import sectors are not too dissimilar. Willmore and Morawetz have shown that tariff reductions have led to intra-industry specialization even in some developing countries.

No attempt has, however, been made in these studies to measure the level of intra-industry trade. Balassa, for example, considered the trend in the average of the ratios $|x_1 - M_1|/(x_1 + M_1)$ for all commodity classes, where $x_1$ and $M_1$ stand for the values of export and import.


38 Balassa, n. 32.
respectively for the ith commodity class. This ratio will have values plus 1 or minus 1 depending upon whether the commodity is a pure exportable or a pure importable. We usually expect that this ratio will take either of these two extreme values. However, because of the presence of intra-industry trade the modulus value of this ratio will always be between 0 and 1. When it is zero, then, there is perfect intra-industry specialization i.e. exports are exactly matched by imports. Again, a declining trend in this ratio over time will indicate a tendency towards intra-industry specialization. While such a prediction is perfectly consistent, it does not give us a measure of intra-industry trade at any point in time. Grubel and Lloyd, therefore, suggest a measure in which intra-industry trade is defined as a residual - that portion (or proportion) left after deducting inter-industry trade from the total trade. 39

39 The measure suggested by them is the following:

\[ B_i = \frac{\sum (X_{i} + M_{i}) - |X_{i} - M_{i}|}{100} \]

where \( B_i \) = relative intra-industry trade index for the ith industry

\( X_i = \) exports of the ith industry

\( M_i = \) imports to the ith industry

\(|X_i - M_i| = \) inter-industry trade

See Grubel and Lloyd, n. 27, pp. 40-45.
Using this measure to calculate the volume of intra-industry trade for the OECD countries for the year 1967 and assuming a 3-digit SITC as a representative of an industry, they found that no industry has an average level of intra-industry trade below 30 per cent. Generally, minerals and raw materials have lower percentages than manufactures. According to the ranking of the countries, UK has the highest average of 69 per cent while Japan and Australia rank lowest with 21 per cent and 17 per cent respectively. Also, they have observed an increasing trend in intra-industry trade in OECD countries for the period of 1959-67. During this period two significant developments took place. First, the EEC and EFTA countries lowered internal tariffs towards zero at a rapid pace. Second, the Kennedy Round of tariff reductions lowered tariffs among all industrial countries of the world. In view of these developments, the trend in intra-industry trade in the OECD countries has again confirmed Balassa's earlier result for the EEC.

In the meantime, there has been a growing interest in measuring the volume of intra-industry trade for individual countries as well as for individual industries. For instance,

40 Ibid., p. 36.
41 The explanation given is that manufactures provide greater scope for product differentiation.
42 Grubel and Lloyd, n. 27, pp. 40-45.
Pegulatos-Sorensen, and Finger have shown high levels of intra-industry trade for the US economy at a 3-digit classification level while Grubel and Lloyd found its existence even at a highly disaggregated 7-digit classification level for the Australian economy. The individual industry studies are done by Ohlsson for metal products, Adler for steel industry, Grubel and Lloyd for steel, petroleum, and refrigerator industries, and Gregory and


48 Grubel and Lloyd, n. 27, pp. 82-67.
Tearle\textsuperscript{49} for refrigerator industry. These industry studies based on a fairly disaggregated level of classification re-affirmed that intra-industry trade is economically meaningful and not just the result of statistical aggregation.

Some indirect evidences of intra-industry trade can also be gathered from empirical research which were mainly concerned with the empirical verification of the theories of international trade. Haubauer,\textsuperscript{50} for instance, has taken up the issue whether countries that are close to or distant from one another in terms of per capita income levels and economic structure exchange manufactured goods that are similar or dissimilar in terms of factor content. For that purpose, he compared the relative commodity composition of the export and the import vectors of individual countries with different economic structures as distinguished by GDP per capita. He observed that export and import vectors tend to become more alike as per capita income converged.

Gruber and Vernon,\textsuperscript{51} on the other hand, have shown that the export patterns of the main manufacturing countries

\textsuperscript{49} R.C. Gregory and D. Tearle, "Product differentiation and international trade flows: an application of the 'hedonic' regression technique", \textit{Australian Economic Papers}, vol. 12, no. 20, June 1973, pp. 78-90.

\textsuperscript{50} G.C. Haubauer, "The impact of national characteristics and technology on the commodity composition of trade in manufactured goods", in R. Vernon, ed., n. 26, pp. 199 ff.

\textsuperscript{51} W.F. Gruber and R. Vernon, "The technology factor in a world trade matrix", in Vernon, ed., n. 26, pp. 237-42.
in twenty-four relatively large industrial categories are similar. Kravis\textsuperscript{52} later confirmed that such similarity of export patterns also persists when the industrial classification is extended to hundreds of categories. What is the significance of this similarity? One possibility is that all advanced manufacturing countries tend to produce highly similar baskets of commodities and export them to relatively less advanced countries. But Kravis has pointed out that "such an explanation cannot, however, be more than part of the story, since the intra-trade among industrial countries is quite important."\textsuperscript{53} In view of the similarities of the industrial composition of exports (in terms of factor content) of similar countries as shown by Hufbauer, these results also provide some support to the existence of intra-industry trade.

In spite of the fact that substantial amount of trade falls into the same industry categories, it is not possible to draw straightaway a conclusion that such trade necessarily represents intra-industry trade. The reason is that there may be discrepancy between the concept of

\textsuperscript{52} I.B. Kravis, "Comment", in Vernon, ed., n. 26, pp. 286-96.

\textsuperscript{53} Kravis, ibid., p. 292.
industry as assumed in the theory and the industry as
defined for the statistical estimation of intra-industry
trade. One must, therefore, show not only that intra-
industry trade exists at a given level of aggregation but
also that factor-intensities are also same for all
commodities at that level of aggregation.

(b) Theoretical approaches

The only serious attempt to construct theoretical
models of intra-industry trade has been made by Grubel
and Lloyd54 (G-L study hereinafter). Although they tried
to explain some types of intra-industry trade in physically
homogeneous products in terms of locational, time or other
special factors, their major emphasis falls upon product
differentiation.55 They seem to believe that product
differentiation is a necessary precondition for intra-
industry trade to arise. In their attempt to explain trade
in differentiated products, they have rejected the HOS

54 Grubel and Lloyd, n. 27, pp. 71-128.

55 To quote them: "This term (intra-industry trade) 
describes aptly the international trade in different-
tiated products because commonly used statistical
trade classification schemes result in much of this
trade showing up as the simultaneous export and
import of products belonging to the same 'industry',
thus representing the exchange of goods and services
within, rather than between, industries". (Emphasis
added) See Grubel and Lloyd, n. 27, p. 1.
model of trade. Drawing especially upon the work by Balassa they argued that economies of scale coupled with differences in income distribution profiles and in consumer's taste and the differences in the rate of technological adoption for new products and processes can only provide plausible explanations of intra-industry trade in differentiated products. Our dissatisfaction with the G-L study arises out of the following reasons:

(1) The HOS model by itself does not constitute the 'core' of the traditional theory of trade. The Ricardian technological hypothesis and the economies of scale are also traditionally given causes of international trade. In the latter cases, what definition of industry one should adopt to distinguish intra-industry trade from inter-industry trade? For instance, even if two industries have identical factor-intensities (which implies that they constitute only one industry according to the HOS concept of industry), the existence of productivity differentials or economies of scale is sufficient to explain trade. Whether one calls it intra-industry or inter-industry trade, it would simply remind us that other determinants of trade are more important than the neo-classical basis for trade.

The meaning of intra-industry trade would conspicuously depend upon how industries are defined for analytical purposes. In the C-L study, we find two different definitions of industry as a theoretical counterpart of their analysis of intra-industry trade. They are (1) homogeneous industries with respect to tastes\(^57\) (that is, when products are closely substitutable in consumption such that consumers are indifferent between, say, product A and product B); and (2) homogeneous industries with respect to inputs.\(^58\)

Definition (1) is neither a necessary nor a sufficient condition to represent the HOS industry since we cannot logically infer anything about factor-intensities of products from our knowledge of consumers being indifferent or not between product varieties. On the other hand, definition (2) is indeed the HOS definition of industry provided the factors used are also homogeneous. If qualitatively different factors, say iron ore of different chemical composition, are used in the same production process, final output corresponding to each quality factor must represent a separate industry according to the strict HOS concept of industry. It is altogether a different question whether meaningful empirical proposition can be drawn from such a multi-factor view of the HOS theory of trade, but

\(^57\) Grubel and Lloyd, n. 27, p. 72.
\(^58\) Ibid., p. 88.
in any case, intra-industry trade in terms of these two definitions need not violate the internal logic of the theory of comparative advantage.

(ii) Product differentiation cannot be an independent cause of trade. The basic precondition for any trade is the differences in the relative commodity prices and, therefore, any theory of intra-industry trade must be capable of explaining why such differences exist. For example, relative differences in factor-intensities even within a group of differentiated products is sufficient to cause trade between product varieties.

It should, however, be remembered that product differentiation violates at least two basic assumptions of the neo-classical trade theory, vis. (i) identical taste pattern, and (ii) constant returns to scale. There is no reason to differentiate products if consumers are identical in all respects. Then products are differentiated, it would lead to a situation of monopolistic competition in which case increasing returns to scale would inevitably occur. To quote Chamberlin:

It is true that equilibrium under this type of theory [monopolistic and "imperfect" competition] is usually (though not necessarily) reached within the diminishing cost phase of the (production) cost curve for the individual firm; but then we bear in mind that the cost curve for the firm has the same U-shape, whether under pure or monopolistic competition,
it appears at once that "increasing returns" in the vicinity of equilibrium for the firm are the result of monopolistic competition and no part of the definition of it. 59

Thus, international trade between product varieties may occur as a result of increasing returns to scale. But to be able to explain the pattern of trade in differentiated products, we require a theory of consumer choice behaviour in the presence of differentiated products. Grubel and Lloyd could not give us a theory of trade in differentiated products in the sense that the HOS theory provides us with an explanation of trade in undifferentiated products.

(iii) Another important limitation of their approach to intra-industry trade is their failure to make a distinction between what they call vertical and horizontal specialization. Instead of considering the two issues, that is, trade between inputs and outputs and trade between final products within an industry as analytically quite different problems, they tend to lump them together under a broad concept of intra-industry trade where the former arises mainly "because in many countries, and at most available aggregation levels, the parts and assembled"

products are classed in the same statistical category". 60

(Emphasis added)

(iv) It is claimed that intra-industry trade concept "provides a useful focus for the synthesis and integration of a set of otherwise unrelated international trade models" 61 that emerged since early sixties. This claim appears to be highly superfluous since the underlying determinants of trade in these models are quite different, making it absolutely impossible to bring them all into any particular theory. Depending upon the factors stressed in these models, it is possible to group them into the following three categories: (i) Preference similarity theory, (ii) technology-gap theory, and (iii) product-cycle theory. It is, however, difficult to find in these models as precise a definition of industry as it is in the HOS theory of trade. As a result, pattern of trade is explained usually on product, rather than on industry basis, and depending upon how one defines an industry, both intra- as well as inter-industry trade can possibly be explained.

(1) Preference similarity theory

In his survey of the theory of international trade

60 Grubel and Lloyd, n. 27, p. 115.
61 Ibid., p. 1.
Bhagwati has placed Linder's theory as a parallel and an alternative to the HOS model purporting to explain the pattern of trade. Linder's central thesis is that the greater the similarity of demand patterns between a pair of countries, the more intensive would be the trade in manufactures. The similarity of demand patterns implies similarity of income per capita with additional variables like income distribution and taste patterns. Linder, instead of giving us a theory with a precise proposition about the pattern of trade, has in fact, given a theory concerning the volume of trade. Bhagwati has given several plausible interpretation of Linder's theory. But the most penetrating interpretation has been given by Caves.

Caves argued that much of the underpinnings of Linder's proposition fell into the realm of product differentiation which yields special predictions about

62 Bhagwati, n. 4, p. 36.
64 Bhagwati, n. 4, p. 37.
65 Ibid.
the trade patterns for at least two reasons. First, product innovation or differentiation implies both the opportunity and need for the producer to incur selling costs, costs which consist at least in part in investments subject to uncertain returns. This provides the basis for Linder's argument about the need for manufacturers to serve a domestic market (the home market hypothesis) before entering the export market. The entrepreneurs acquire considerable information about his domestic market at no cost through low cost local information sources. Securing similar information about foreign markets entails either greater costs, wider uncertainty or both, creating a presumption that local market will be occupied first. Second, product differentiation readily suggests the possibility that any broad type of household demand can be satisfied by a variety of different goods or types of goods, and that the effective numbers of this set can be ranked from the most to the least desirable and costly. Economies of scale and differences in income distribution or taste patterns would then provide a basis for Linder type trade. Linder himself found that a country like Sweden tends to specialize in the production and export of such quality goods as are demanded by country's income classes with the largest number. And the country's imports consist of the products demanded by income groups with smaller number. The economies of long production runs may
result in specialization by product variant rather than by industry. Although economies of long production runs explain why countries are led to concentrate on limited range of products, even when they are capable of producing the full range, the determination of the particular variant each country will specialize in must depend upon systematic factors. The relation between product characteristics and consumer's preference pattern becomes important to explain the pattern of specialization.

In general, the larger the market the wider the range of products for which the country will be able to obtain the economies of long runs and the more likely it is to be able to export a variety of goods catering to specialized needs. A country with a small home market would specialize in standardized products; this has been pointed out by Drezé.67

Drezé observes that Belgium concentrates its production and exports on standardized products not only by broad classes such as semi-finished iron and steel, flat glass, and photographic film, but within categories which vary

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in standardization. Thus Belgium produces white china, but not coloured or decorated (i.e., standardized qualities rather than the qualities subject to taste), and within automobile components, such products as standardized batteries, tyres, windows, upholstery fabrics, wiring harnesses, and radiators, rather than engines, bodies and their components, which vary among producers, models and countries. 68

On the other hand, H.P. Gray 69 had developed a preference similarity model to explain two-way trade (i.e., intra-industry trade) in differentiated products on the assumption of the existence of what he calls a "positive export price range" (EPR). He suggests that a firm will export its product if a price-exists which yields the firm an economic rent over time. When such a condition occurs, a positive export price range (EPR) is said to exist. In order for producer in each country to export and import each other's products simultaneously, it is necessary that EPRs exist for the competing differentiated products in each of two countries. While Gray's conclusion relating to


the pattern of trade in differentiated products sounds convincing, his presentation hardly constitutes a theory since he fails to explain the existence of EPAs.

(ii) The technology-gap theory

This theory is originally developed by Kravis, and later popularized by Posner, Hufbauer, and Gruber, Mehta and Vernon. Kravis argued that trade tends to be confined to goods which are not available at home and the reasons cited for such unavailability are lack of natural resources (relative to demand) or technical change and product differentiation which confer temporary monopoly of production on the innovating country (until the trading partners have learnt to imitate).


74 Donald Findlay, Trade and Specialization (London, 1970), edn. 2, pp. 76-86.
Now consider a situation in which different countries do innovate different products within the same industry. As a result of specific skills and technology associated with such products, Kravis-type hypothesis inevitably leads to intra-industry trade. Recently Kravis himself suggested such an interpretation that "it is possible to outline a hypothesis to explain this intra-trade that can be viewed in one sense as an extension of the availability argument I offered some years ago; that is, trade consists to a significant degree of products, or still more importantly of product variants that are not available in the recipient country." Posner has extended this idea to explain flourishing trade among similar countries: "In so far as the process of growth implies continuous technical progress, the effect of economic growth is to develop a sense of trade sui generis." The role of Research and Development has been emphasized by Gruber, Mehta and Vernon that R & D expenditure lead to new products and thus confer temporary availability advantage of the Kravis-type which leads to comparative advantage.

75 Eufbauer provides some examples of innovation of different products by different countries in the synthetic materials industry. See Eufbauer, n. 72, pp. 94-104.

76 Kravis, n. 52, p. 292.

77 Posner, n. 71, p. 324.

78 Gruber, Mehta and Vernon, n. 73.
Though the Kravis-type hypothesis looks quite attractive, it appears to be a simple extension of the Ricardian postulate that trade is caused by international differences in technology. But such a dynamic theory of trade based upon continuous technical change requires a theory of innovation itself so as to enable us to explain the dynamic pattern of trade. It may also be interesting to attempt to relate the innovation theory itself to the factor-proportions approach. Posner points out rightly that they are logically independent since two countries with exactly the same factor endowment might generally innovate in different particular lines. The demand factor, as Schmookler suggested, may be important. However, it is also true that the capacity to undertake research and development is itself dependent on a relatively large endowment of capital and skilled labour. Vernon's product-cycle model is a contribution in this direction.

(iii) The Product-cycle model

Raymond" Vernon has developed a product cycle model of trade which differs from the technology gap

model in that it assumes that new products are introduced only in the advanced countries. The abundant supply of skilled labour, Vernon argues, gives an advantage to the relatively advanced countries to generate new knowledge through research and development. In the initial phase of the product the technology is assumed to be highly skill-intensive which also gives an advantage to the advanced countries to produce and to export. As the product becomes standardized, the input-mix changes in such a way that relatively greater role is now played by capital and ordinary labour. In a world of perfect capital mobility, the less-advanced countries eventually develop comparative advantage in such products. Assuming that the new and the old goods are substitutable in consumption, the pattern of trade between old and the new goods may be interpreted as intra-industry trade.

Summing-up

The theoretical explanations of intra-industry trade are not satisfactory for variety of reasons as indicated above. We shall try to examine the determinants

of intra-industry trade under alternative definitions of industry. The traditional theory of trade is highly deficient in explaining trade in differentiated products. Similarly, technical changes lead to differentiation of products and creation of new goods. It requires, therefore, an integration of the theory of trade and the theory of innovation in a way such that we can explain the causes of trade in new goods or between new and old goods.