CHAPTER 6
The relation between commodity and factor movements has not so far been discussed in a systematic way, particularly in its relation to different types of intra-industry trade. While analysing the trade between intermediate and final goods we have demonstrated that if one is concerned with the explanations of the goods actually traded between countries, factor mobility will have to be taken into considerations. Because, intermediate goods are productive factors in the sense that they cannot directly be used for want satisfaction unless further processing has been done upon them. The sales of intermediate goods by a firm to another firm which uses it result from the disintegration of the production process; in a vertically integrated process, as in pure theory of trade, they would not occur. Vertical disintegration then leads to a distinct inter-firm transactions of goods and factors. Historically, and even today, a significant proportion of international trade has been created through such disintegration of the production process. Intra-industry trade of this type necessarily implies, therefore, an exchange of commodities for factors of production.
The second aspect of factor mobility that we will be concerned with is the two-way movements of the same factor or what is sometimes referred to as 'cross-investment'. Two-way movements of the factors of production may have some relation to intra-industry trade in finished consumption goods. Thirdly, in a world of continuous technological progress or changes in the factor-price ratios, the profit maximizing behaviour of the entrepreneur may find incentive to trade in capital goods within the same industry according to vintages if capital is not a malleable factor. These issues need special attention. However, before we proceed to analyse them, a brief review of the amazing vast literature on trade and factor mobility becomes warranted.

I. General equilibrium approach to trade and factor movements

For a long time, and even today, trade theorists appear to have maintained an extreme position in considering the relation between mobility of goods and factors. In fact, with the notable exception of Ohlin, international economists are less concerned with explanations of the composition of the goods and factors traded across boundaries. This has obvious reasons too. The fundamental assumption on which the 'core' of the standard theory is built is that

131 Ohlin, n. 81.
factors of production are being 'trapped' in locations as a result of which commodities flow between countries. The influence of (i) trade on factor prices and (ii) the influence of factor movements on trade has been conceptualized in a way that international commodity and factor movements can act as substitute for one another. Since the conditions for complete factor price equalization through commodity trade alone are satisfied, international factor mobility is not necessary for the efficiency of world production. These propositions have been rigorously proved by Mundell. 132

The above conditions have been derived within a simplistic $2 \times 2 \times 2$ version of the factor-proportion theory. It is, however, not necessarily true that they also hold within a broader framework of the factor-proportion theory of trade. Given that the overall factor-proportion does not lie within the 'cone of diversification', complete specialization would inevitably occur in which case factor-prices will never be equalized through trade alone. Consider the figure 6.1 below where the dotted curves reflect the technology of producing commodities (1) to (4) and the solid broken curve identifies the production pattern which depends upon the factor endowments of a country. The same 'cook book' containing the knowledge of production is available to all countries which

---

means that the production functions are identical internationally.

Factor prices will be equalized by trade if the factor-endowments of the countries are not too dissimilar. If, for example, \( \alpha \) and \( \beta \) depict the factor-endowment proportions of country A and country B respectively, a completely different pattern of production will emerge with differential wage/rental ratio. Similarly, even if two countries produce some commodity in common as with \( \alpha \) and \( \beta \) factor endowment proportions, there will yet be differences in factor prices.
The country C (whose factor endowment proportion is given by $\theta$) actually adopts different technique in producing commodity (3) because its wage/rental ratio is higher, because its capital/labour ratio is also higher. This shows that differential factor endowments can explain why actual techniques adopted are the same or are different even with the access of the same 'cook book'.

Similarly, an extension of the standard theory into a multifactor framework may give rise to a situation where factor price equalization need not take place. As a result, factors of production would move along with commodities. Again, different factors differ in their relative mobility which require that trade theory must allow for some factors highly mobile, others less so and others immobile. For this, however, no drastic modifications of the Heckscher-Ohlin theory is required, and in fact, this model can easily be adapted to explain some types of trade and factor movements. The reason for our emphasis upon the factor-price equalization theorem is that too often economists consider this theorem as a stumbling-block in accepting the Heckscher-Ohlin theorem of trade. The Heckscher-Ohlin proposition about trade pattern still holds, as indicated in the above diagram, even without factor-price equalization.

Introducing the possibility of trade in intermediate products within this broader version of the factor proportion theory, we have argued that the same factor-proportion reasoning may also be applied to explain trade between final and intermediate products. Allowing factor-
proportion dissimilarities between countries, we have tried
to build a bridge between trade theory and location theory.
It has been shown that in presence of such dissimilarities,
relative transferability (in terms of transport costs or
tariffs) between final and intermediate products will
determine the pattern of vertical disintegration. However,
in order to explain trade between final and intermediate
products, it is necessary to introduce economies of scale or
in terms of location theory, certain agglomeration economies
at the final stage of production. This is a step towards an
understanding of Ohlin's path-breaking analysis, the most
concrete and penetrating study available in the entire history
of the discipline, of his vision and imagination of the forces
determining the pattern of trade and factor movements.

Technological differences; Its causes and its
affects on factor movements

As expressed in a recent survey of trade theories
by Haberler, Ohlin's formulations of the trade theory has
failed to recognize the qualitative differences in the factors
of production or in other words, international differences in
the production functions. In such cases, factors of
production will move to the region where the conditions of

133 C. Haberler, "Survey of circumstances affecting the
location of production and international trade as
analysed in the theoretical literature", in E. Ohlin
and others, op. n. 13, pp. 1-24.
production are more favourable. Of course, Ohlin himself conceded recently on his reflections that to disregard the possibility of differences in technology is "a conscious but serious omission." It is necessary, however, to give reasons for such technological inequalities and how the countries are capable of maintaining such differences in a world of continuous change. We may consider the following reasons for technological differences:

(i) The first cause may be the extreme differences in factor-proportion itself as indicated in the diagram G.1.

(ii) The existence of certain qualitative differences in the primary factors which will make production functions different. For example, natural resources like oil in different countries differ in chemical composition (sulphur content), geographical location (proximity to the sea), distance from the surface etc. A country endowed with rich mineral deposits may use quite different technique in relation to another that uses low-grade mines. Similarly, differences in transport conditions, like supply and quality of roads, railways, harbours and other kinds of internal and external transport conditions, can influence the technique of transportation and the volume of production and, thereby, the technique used in production.

134 Ohlin, n. 13, p. 39.
(iii) The absence in some countries of certain factors - present in others - like certain natural resources or technical labour of high quality. The former results from the inequalities in the 'original' distribution of natural resources while the latter is caused by capital investment to improve the quality of labour. Elsewhere we have discussed the factors responsible for labour quality variations.

(iv) Knowledge may not be a 'free good' in which case the assumption of international identical production function may be a highly restrictive one. There are good reasons, as we have explained earlier, why firms that are engaged in the creation of knowledge also like to internalize it, leading to monopolistic conditions in the technology market.

(v) A fifth reason may be that countries at different stages of development also differ in their efficiencies in production. A very early development of manufacturing industry, which may be a sheer historical accident, may give some unique advantage to a country not available to others. The various forms of external and internal economies of scale further augment this irreversible process of growth. These factors contribute greatly to skill formation - an important factor indeed in determining a country's capacity to innovate.
(vi) A sixth type is dependent on social legislation or traditions about the hours of work. Expensive real capital (fixed) will be better utilized in countries where workers accept working longer hours.

If the above factors constitute the major source of variations in technological possibilities among countries, their implications for trade and factor movements need to be considered. It should, however, be noted that the assumption of identical production function has been removed from the orthodox trade theory, and a number of authors, notably Jones and Chipman have explored the relations between trade and factor movements. They have two products, two countries and two factors, labour being immobile in each country and capital perfectly mobile, so that its reward is equalized between countries. There are no transport costs, but they allow technology to be different in the two countries. The latter assumption is necessary because otherwise in the absence of factor reversals, they would simply have the Mundell results.

135 N. Jones, "The role of technology in the theory of international trade", in Vernon, ed., n. 26, pp. 323-34.


137 Mundell, n. 132.
Assuming different labour-output coefficients between the two trading countries with perfect mobility of capital, Chipman 133 has demonstrated that the world production possibility frontier must contain a flat segment corresponding to the efficient world output combinations. Thus, international terms of trade will be determinate and unaffected by changes in demand. Within this region, the wage rate in each country and the common rental of capital will be determined independently of demand; adjustment to changes in demand takes place via capital movement between countries rather than through changes in the terms of trade.

Jones 139 has explored the important question of which country will have comparative advantage in which good. When capital is perfectly mobile, one can no longer apply the simple R-O-S factor endowment approach arguing that the country that is relatively well endowed with capital must export the capital intensive good. For it may export its capital instead, to the point where it ceases to be relatively well endowed with capital. In such a situation, international differences in production functions along with factor endowment differentials interact together in determining the pattern of trade and factor movements. If country A is more efficient in product X compared with country B, and if either the two countries are equally efficient in the case of product Y, or if country B is more efficient in producing

133 Chipman, n. 136.
139 Jones, n. 135.
that product, one would expect that A would export X and B would export Y (unless demand effects are offsetting). But Jones has brought out another consideration. Suppose that country A is more efficient to the same extent in both products compared with country B. Capital will then tend to flow to country A to exploit this efficient environment, so that capital-labour ratio finally will be higher in A than B. Thus, the more efficient country A will export the capital-intensive product and import the labour-intensive one even if country A was originally labour abundant.

II. The ' Peripheral' literature on trade and factor movement

Parallel to the 'core' theory of trade, there have developed in the recent past two quite separate strands of research in the field of the positive theory of international trade and investment. In contrast to the general equilibrium approach, they take an empirically oriented approach and depend heavily on made-to-measure varieties of oligopoly theory.

The first one is concerned with the explanations of trade flows through the introduction of more realism into the orthodox doctrines. These theories are mainly based on ambitious empirical testing of the plausible hypotheses about the causes of trade. The main criticism against

140 See Mufbauer, n. 50.
these theories is that they do not make any distinction in their studies regarding commodity and factor movements. The data used for the purpose of testing any proposition about trade pattern are grossly insufficient as well as inadequate for the following reasons:

(i) Trade statistics usually give details of the gross outputs of goods exported. But where exports contain a high import content, their total value may tell us little about the use made of indigenous endowments. The gross exports from an industry may appear to be highly capital intensive while the ‘value-added’ component is, in fact, highly labour-intensive. Thus one gets an intuitive explanation of Leontief’s paradox. Intra-industry factor movements may be considered as an important factor causing this paradox.

(ii) Trade statistics either ignore completely or classify separately, intermediary goods, such as technology, management and organization which are exported in their own right. Since these factors often appear in export production, they should be given a commodity classification.

(iii) As a result of vertical disintegration when trade takes place between inputs and outputs within the same enterprise, the recorded prices may bear little resemblance to ‘arms-length’ prices, and so to the value of the factor inputs used.
The second strand of research centred on explaining the growth and composition of foreign direct investment. Most theories of direct foreign investment that developed till early sixties tried to explain it in terms of orthodox trade or location theory; but for various reasons, neither approaches proved very helpful. Later, while Caves, Johnson, and McManus provided explanations of direct foreign investment in terms of product differentiation, knowledge and underutilisation of entrepreneurial and management capacities respectively, a more behavioural perspective was taken by Vernon and Hymer, who choose to emphasize


145 Vernon, n. 79.

on the role played by defensive oligopolistic strategy. However, with the notable exception of Vernon, no attempt was made to integrate the two forms of international involvement - trade and investment - into a single theory.

The neo-Ricardo-Heckscher-Ohlin approach, which emphasizes upon the need to introduce many factors and technological inequalities, provides us a rich analytical framework within which various types of commodity and factor movements, including the multinational corporations, can be explained. This theory can explain why 'knowledge' is created mostly by the rich countries as it can also explain why Vernon's 'product-cycle' starts from the advanced economy. Monopolistic elements may be introduced within this modal to cause technological inequalities provided such inequalities can be maintained by internalisation of the technology. It also explains the ownership advantage of a foreign firm over the domestic one - the only argument for why a foreign firm also owns the ownership of production in the host economy.

III. Intra-industry capital movements

Stephen Hymer first discovered that developed countries are often involved in simultaneous imports and exports of capital even within the same industry. He has

---

147 Hymer, ibid.
called it as 'cross-investment'. According to the standard theory, the immediate cause of profit-oriented capital movements is the interest rate differentials. Under perfect competition and with homogeneous capital, a country can never have high as well as low rate of interest such that cross-investment can be explained in terms of the standard theory. Hymer provides an explanation in terms of the oligopolistic interdependence i.e. if a firm in country A invests in, say, country B, a competitive firm in country B will follow the same strategy of investment in country A. Hence, intra-industry capital movements would take place. Later, Grubel' has put forward an alternative explanation in terms of a portfolio balance model developed originally by Markowitz' and Tobin. This model considers the behaviour of asset holders in an uncertain situation. It has been shown that under uncertainty the profit-maximizing risk-averse firms will always prefer a diversified asset holding over an undiversified one. Asset diversification either increases the expected rate of returns with equal risks or decreases the riskiness of the portfolio investments at the same expected


149 H. Markowitz, Portfolio Analysis (New York, 1959).

rate of return. Hence with the opening up of economic rela-
tions between two countries, private wealth holders will
involve in mutual exchange of bonds.

It would, however, be an interesting exercise if
we try to link up intra-industry capital movements with
intra-industry trade. We have shown in chapter four that
the Heckscher-Ohlin model can easily be extended to explain
some types of intra-industry trade in differentiated goods
if factor-intensities differ as between product varieties.
Can we conclude from this that restrictions upon intra-
industry trade may lead to intra-industry capital movements?
This may not occur with homogeneous capital. However, if
product differentiation is looked upon as the result of
product specific factor-endowments, intra-industry movements
of capital can be explained. The assumption of product
specific factor endowment implies that they are immobile
between products but are mobile between countries assuming
that both countries produce the same set of differentiated
products. We shall make use of a general equilibrium model
with specific factors developed recently by Jones.

(a) Trade and capital movements with specific factors

Specific factor model of trade has long been fami-
liar to the trade theorists, and it has recently become popular
after many years of neglect. This powerful approach, dubbed
as Viner-Ricardo model by Samuelson, 151 demonstrates that complete commodity price equalization does not imply complete factor price equalization. Thus, there is still a vital role for factor mobility to play in increasing the global efficiency of production.

In the spirit of Heckscher-Ohlin model, let us assume that there are two countries, A and B, capable of producing two differentiated products, $X_1$ and $X_2$. Labour is homogeneous and perfectly mobile between the two products but does not move across national boundaries. The stocks of capital $V_1$ and $V_2$ are potentially mobile across national boundaries but specific to the two respective products. The model can be extended to a commodity-specific factors case as in Samuelson. 152

Following Jones 153 we shall denote $a_{ij}$ as the amount of the $i$th input used per unit of $j$th product. The basic competitive equilibrium relations can be set out as follows:

151 P.A. Samuelson, "Ohlin was right", The Scandinavian Journal of Economics, vol. 73, no. 4, December 1971, pp. 365-34.

152 Samuelson, ibid.

\[ a_{11} x_1 = v_1 \quad (1.1) \]
\[ a_{22} x_2 = v_2 \quad (1.2) \]
\[ a_{11} x_1 + a_{22} x_2 = v_N \quad (1.3) \]

These equations represent the full employment conditions. Similarly, we have another set of equations representing the competitive profit relationship:

\[ a_{11}^R_1 + a_{22}^R_1 R_N = p_1 \quad (1.4) \]
\[ a_{22}^R_2 + a_{22}^R_2 R_N = p_2 \quad (1.5) \]

where \( R_1 \) is the 'rental' return for the use of one unit of factor \( i \), and \( p_j \) is the price of commodity \( j \). Equations \((1.1)\) to \((1.5)\) could be taken to represent all the equilibrium relationships for a competitive economy with fixed factor endowments facing fixed commodity prices only if techniques of production are invariant. Thus, the full employment condition is required along with the commodity prices to determine the factor returns.

By allowing changes in factor-endowments and commodity prices in this type of a \( 3 \times 2 \) model, Jones has shown that changes in endowments will always alter the returns to the mobile factor in a direction opposite to the returns to both specific factors. An increase in the mobile factor,
labour, will lower its own returns while it raises the returns to both the specific factors. Alternatively, an increase in any specific factor will lower the returns to both the specific factors and will raise the returns to labour. Thus, $R_1$ and $R_2$ will move in the same direction; but $R_1$ will undergo a greater relative change than $R_2$ if the share of the mobile factor used in the first product exceeds its share in the second product. However, changes in the commodity prices will lead to changes in the returns to the factors in the opposite direction. The reason is a simple one. An increase in the relative price of, say, product $X_1$ will draw the mobile factor labour from the production of $X_2$ to increase the production of $X_1$. As a result, the specific factor $V_1$ will be used more intensively while $V_2$ will be used less intensively. Therefore, $R_1$ will rise and $R_2$ will fall.

The question that comes up is how to define the factor-intensities of products in this type of a model where there are specific factors. There is still a possibility of defining a product according to factor-intensity if the distributive share of the mobile factor exceeds in one product in comparison to the other.

Now, allow Heckscher-Ohlin pattern of trade without factor mobility. Factor price equalization would, of course, not occur. As a result of specialization, the returns to the specific factors will move in opposite directions.
one type of product-specific capital perfectly mobile does cause equalization, if both countries remain incompletely specialized. If both \( V_1 \) and \( V_2 \) were internationally mobile, one country could be expected to specialize completely and contain none of the stock of the other type of capital.

Consider an exogenous movement of factor \( V_1 \) from country \( A \) to \( B \). This would lead to a rise in the return to factor \( V_2 \) in country \( A \) and a fall in its return in country \( B \). Consequently, there will be a reverse flow of capital to country \( A \) - the case for two-way capital movements. Similarly, a restriction upon trade in differentiated products would lead to intra-industry trade in the capital goods. Thus one has an explanation of why direct investment tends to be cross-hailed between countries.

(b) The case of trade in second-hand machinery

The theory of international trade is basically a theory of long-run equilibrium. The long run is assumed to be a duration of time during which everything can be changed. Thus, the assumption in most trade theories that capital is malleable can be justified in terms of such long run equilibrium. If, however, one is interested in explaining the short-run phenomenon of trade, say, in capital goods, the malleability assumption becomes highly restrictive.

'Malleability means capital goods already in existence are 'versatile' i.e. they can be recast - costlessly.
to be transformed into capital goods of different specifications. For example, as labour becomes expensive with the opening up of trade in the labour-abundant country, the existing machinery there can be reshaped into less labour-intensive forms. Similarly, the fruits of technological progress that have taken place since the old machinery was built can be incorporated into them - again costlessly. The implausibility of this theorization is glaring.

Technological progress would always lead to reduction of input costs to produce the same level of output. It may be towards the direction of reducing either labour inputs or capital inputs costs depending upon the relative factor prices. then such technological progress is taking place and new machines are built, the old machinery may become obsolete. This gives rise to the possibility of trade in used machines. In a seminal paper A.K. Sen first attempted to provide a theory of trade in second-hand machinery. The theory goes like this: Once a machine is installed its value no longer depends on what was paid for it but on what it will earn in the way of rent in the future. The rent it can earn depends on the difference between the

unit variable costs of operating the machines and the price of the final outputs from it. In a competitive market the price of the output equals the total unit costs of making it with the most efficient new machine that is available on the capital goods market. So, the rent per unit of output from the installed machine is equal to the difference between total unit costs on new machines and the unit variable costs on the installed machines. This rent must cover depreciation on the installed machines as well as giving the owner some net return. The value of the machine to him can be imputed from the net return if we know the rate of interest or profit. The theory is that the owner will go on using his machine so long as its operating value is greater than zero, or if it has some value as scrap, so long as its operating value is greater than scrap value. However, if someone offers the owner a price for the machine greater than its value in use, he would be wise to part with it.

The transfer of old machines to a low-wage economy may be explained in terms of the following reasons:

(a) Assuming no technological progress or no change in the factor-prices, the cost of an old machine will rise if either (1) the unit variable cost on old machines rises due to increased maintenance costs, maintenance being a
labour-intensive process, or (ii) a fall in the absolute productivity of the machinery with the age.

(b) If there is obsolescence in the advanced country due either to (i) technological progress or (ii) to a rise in wages, old machines might be discarded and sold at lower prices. Because of a lower level of wages in the underdeveloped countries these machines might not be obsolete there.

(c) Even in the absence of obsolescence, there can still be valid reasons for such transfer. Assuming that both old and new machines are used in the advanced economy. There must, therefore, be an equilibrium price between the old and the new machines such that the rate of profit per unit of investment are equal for all types of machines. The relative prices of old and new machines that would be equilibrating from the point of view of profits in country A, the advanced country, would not offer the same rates of profits in country B, and this provides a case for trade in second-hand machinery. The relative price differences between newer and older machinery correspond to a rate of profit that is lower than the one ruling in the less-advanced economy. Therefore, in the absence of transport costs an investor in country B, the less-advanced one, will always find it more profitable to buy an older machine rather than anything of newer vintages.
(c) The case of intra-industry trade in a vintage capital model

The above arguments for trade in second-hand machinery can be rigorously developed in a vintage capital model. Trade theory should be extended to a vintage capital model if one is concerned with the causes and effects of trade in actual machines. For such a theory, a more reasonable assumption is what is sometimes called 'putty-clay', that is, no ex-post factor substitutability is allowed once machines are built. Such a vintage capital model of trade offers a possibility of trade in machines even where there are international immobility of labour or investment.

Assume that a machine of type $k$ gives rise to an output flow of $f(k)$ using a labour input flow $e^{-\lambda v}$, where $v$ is the date of construction of the machine. The output flow is independent of the country in which the machine is used and we assume that there are no transport costs.

Now if the wage rate in country $A$ at time $t$ is $W_A(t) > 0$, a producer using the machine in country $A$ gets a stream of net earning, 'quasi-rent', given by

$$\rho_A(t,v) = f(k) - W_A e^{-\lambda v}$$

Assuming the existence of a competitive equilibrium, the price of a machine, even the profit rate
\( r_A(t) \geq 0, \) satisfies

\[
\frac{\partial P(t,v)}{\partial t} = \gamma_A(t)P(t,v) - \rho_A(t,v) \quad 1.2
\]

the well-known equilibrium condition which equates the capital costs of holding the machines with the sum of the quasi-rent and the capital gain.

The machine being used in country A must not in country B be able to give returns exceeding its costs, so

\[
\frac{\partial P(t,v)}{\partial t} \leq \gamma_B(t)P(t,v) - \rho_B(t,v) \quad 1.3
\]

Hence, all machines are located so as to satisfy

\[
\frac{\partial P(t,v)}{\partial t} = \min \{ \gamma_A(t)P(t,v) - \rho_A(t,v) \} \quad 1.4
\]

At time \( t \), country A is assumed to be capital abundant relative to country B which implies that \( WA(t) > WB(t) \) and \( r_A(t) < r_B(t) \). Since factor-endowment proportions change over time in accordance with the rate of population growth and capital accumulation, it requires a full-fledged dynamic model to trace out the changes in the pattern of optimal distribution of the machines among the countries. However, we want to investigate whether there is
any basis for trade in machines, given static factor endowment differentials which reflect an assumption of international immobility of labour or investment. If machines of different vintages exist and if condition (1.4) above holds, free trade in machines and the output good is inevitable.

Consider the case where each of the countries A and B uses machines of type k. Let,

\[ h(t,v) = r_A(t)P(t,v) - r_B(t,v) - \gamma_P(t,v) + \gamma_P(t,v) \]

\[ = [r_A(t) - r_B(t)]P(t,v) + [w_A(t) - w_B(t)]e^{-\gamma v} \]

At time t, there is a \( v \) such that \( h(t,v) \geq 0 \) and a \( v \) such that \( h(t,v) \leq 0 \), by (1.4). By continuity in \( v \), there is a \( v_0 \) such that \( h(t,v_0) = 0 \), which implies that \( P(t,v_0) > 0 \) and \( r_A(t) < r_B(t) \).

\[ P(t,v) = \frac{\int \frac{w_A(t) - w_B(t)}{[r_A(t) - r_B(t)]} e^{-\gamma v} dv}{[r_A(t) - r_B(t)]} \]

Since \( P(t,v) \) is clearly non-decreasing in \( v \), and \( e^{-\gamma v} \) is strictly decreasing in \( v \), therefore, \( h(t,v) \) is strictly decreasing in \( v \). Hence for \( v < v_0 \), \( h(t,v) > 0 \) and, by (1.4), country A may not use machines of type k built before \( v_0 \). Similarly, country B may not use machines of type k built after \( v_0 \).

The same argument applies to all pairs of countries, so that if we arrange countries using tradable machines in
decreasing order of wage rate i.e.,

\[ W_A(t) > W_B(t) > W_C(t) \]

they are arranged then in increasing order of profit rates, and each country uses vintages of machines of any given type which are newer than those used in countries with lower wage rates, but older than those used in countries with higher wage rate. Given continuously changing factor prices or technological progress over time, possibilities of trade in used machine is an intuitively plausible result. And this provides us an explanation of intra-industry trade in capital goods within the same industry as well. The following diagrammatic representation of this possibility is taken from Jones. 155

---

155. Jones, n. 129.
Initially, the advanced country's wage/rental ratio is tangent to the unit isoquant (1) at A. As a result of innovation in country A, a new set of techniques has developed as described by the unit isoquant (2). These new techniques represent an improvement at the advanced country's factor-prices. So the advanced country shifts from point A to point C in (2). A less advanced country because of lower wage/rental ratio uses a technique B on isoquant (1). The new set of techniques represented by isoquant (2) has no cost-saving appeal to the less-advanced country at that wage/rental ratio.

As real wages are rising in both countries, the advanced country's innovative activity has developed another set of new techniques as depicted by isoquant (3). As the wage rate also rises in the less-advanced economy and becomes steeper than line, the technology represented by (2) becomes attractive to the less advanced country. Thus, it creates a demand for second-hand technology from the less advanced countries.

In the above analysis it has been assumed that technological progress has taken place only in the advanced countries and that such progress has always been in the direction of labour-saving. Production of new knowledge or technology requires intensive use of skilled labour which
may be lacking in the less advanced economy. In a world of high information costs and various barriers to entry, the entrepreneur's profit-maximising behaviour may be determined mostly by the local conditions of production. Since labour is becoming increasingly scarce in the high income advanced countries due to higher preference for leisure value, there is a reason why the entrepreneur should go in for labour-saving technological progress.

Technological progress also brings with it certain qualitative changes in the products. The three isocurves in figure 6.2 may be considered as representing three different product varieties serving essentially the same consumer needs. As labour becomes increasingly scarce in the advanced economy, the consumer may prefer less-labour-using varieties of old products - drip-dry shirt rather than non-drip-dry shirts. Thus factor-proportion operates both from supply as well as demand side to bring about technological progress that also contributes to product differentiation. The existence of such linkages between technology and product characteristics, then gives rise to the possibility of trade not only in capital goods but also in differentiated products.