Chapter 8

The Modern Theory of Factor Endowments : The Heckscher-Ohlin Theory

1. INTRODUCTION

Bertin Ohlin in his famous book *Inter-regional and International Trade* (1933) criticised the classical theory of international trade and formulated the General Equilibrium or Factor Endowment or Factor Proportions Theory of International Trade. It is also known as the *Modern Theory of International Trade* or the *Heckscher-Ohlin* (H.O.) *Theory*. In fact, it was Eli Heckscher, Ohlin's teacher, who first propounded the idea in 1919 that trade results from differences in factor endowments in different countries, and Ohlin carried it forward to build the modern theory of international trade.

2. THE HECKSCHER-OHLIN THEORY

The H.O. theory states that the main determinant of the pattern of production, specialisation and trade among regions is the *relative* availability of factor endowments and factor prices. Regions or countries have different factor endowments and factor prices. "Some countries have much capital, others have much labour. The theory now says that countries that are rich in capital will export capital-intensive goods and countries that have much labour will export labour-intensive goods."[1] To Ohlin, the immediate cause of international trade always is that some commodities can be bought more cheaply from other regions, whereas in the same region their production is possible at high prices. Thus *the main cause of trade between regions is the difference in prices of commodities based on relative factor endowments and factor prices.*

Its Assumptions

Before analysing the theory in detail, we discuss below its assumptions:

1. It is a *two-by-two-by-two model*, *i.e.*, there are two countries (*A* and *B*), two commodities (*X* and *Y*), and two factors of production (capital and labour).
2. There is perfect competition in commodity as well as factor markets.

1. Bo Sodersten, *International Economics*, 1970, p. 64.

3. There is full employment of resources.

4. There are quantitative differences in factor endowments in different regions, but qualitatively they are homogeneous.

5. The production functions of the two commodities have different factor intensities, *i.e.*, labour-intensive and capital-intensive.

6. The production functions are different for different commodities, but are the same for each commodity in both countries. It means that the production function of commodity X is different from commodity Y. But the technique used to produce commodity X in both countries is the same, and the technique used to produce commodity Y in both countries is the same.

7. Factor intensities are non-reversible.

8. There is perfect mobility of factors within each region but internationally they are immobile.

9. There are no transport costs.

10. There is free and unrestricted trade between the two countries.

11. There are constant returns to scale in the production of each commodity in each region.

12. Tastes and preferences of consumers and their demand patterns are identical in both countries.

13. There is no change in technological knowledge.

14. There is incomplete specialisation. Neither country specialises in the production of one commodity.

Its Explanation

Given these assumptions, Heckscher and Ohlin contend that the immediate cause of international trade is the difference in relative commodity prices caused by differences in relative demand and supply of factors (factors prices) as a result of differences in factor endowments between the two countries. Fundamentally, the relative scarcity of factors—the shortage of supply in relation to demand—is essential for trade between two regions. Commodities which use large quantities of scarce factors are imported because their prices are high while those using abundant factors are exported because their prices are low.

The H.O. theorem is explained in terms of two definitions: (1) factor abundance (or scarcity) in terms of the price criterion; and (2) factor abundance (or scarcity) in terms of physical criterion. We discuss these one by one below:

(1) Factor Abundance in Terms of Factor Prices. Heckscher-Ohlin explain richness in factor endowment in terms of factor prices. According to their definition, country A is abundant in capital if $(P_C/P_L)_A < (P_C/P_L)_B$, where P_C and P_L refer to prices of capital and labour, and the subscripts A and B denote the two countries. In other words, if capital is relatively cheap in country A, the country is abundant in capital, and if labour is relatively cheap in country B, the country is abundant in labour. Thus country A will produce and export the capital-intensive good and import the labour-intensive good and country B will produce

and export the labour-intensive good and import the capital-intensive good. This is illustrated in Figure 1.

Let X be the labour-intensive commodity taken on the horizontal axis and Y be the capital-intensive commodity taken on the vertical axis. XX is the isoquant of commodity X and YY that of commodity Y. They are the same for both the countries A and B. The relative factor prices in country A for both the commodities are given by the factor price line AA_1. Assuming that each isoquant represents one unit of the respective commodity, then 1 unit of Y will be produced with OC amount of capital and OD amount of labour at point E where the isocost line AA_1 is tangent to the isoquant YY. By the same reasoning, we find that the cost of producing one unit of commodity X in country A is OM amount of capital and ON amount of labour. Since capital is abundant and cheap in country A, it will specialise in the production of the capital-intensive commodity Y. This is clear from Fig. 1 where in order to produce 1 unit of Y it uses more amount of capital OC with OD of labour at point E on the isoquant YY. While at point L on the isoquant XX, it uses less amount of capital OM with more of labour ON in order to produce 1 unit of X. Hence country A will produce and export the relatively capital abundant and cheap commodity Y to the other country B.

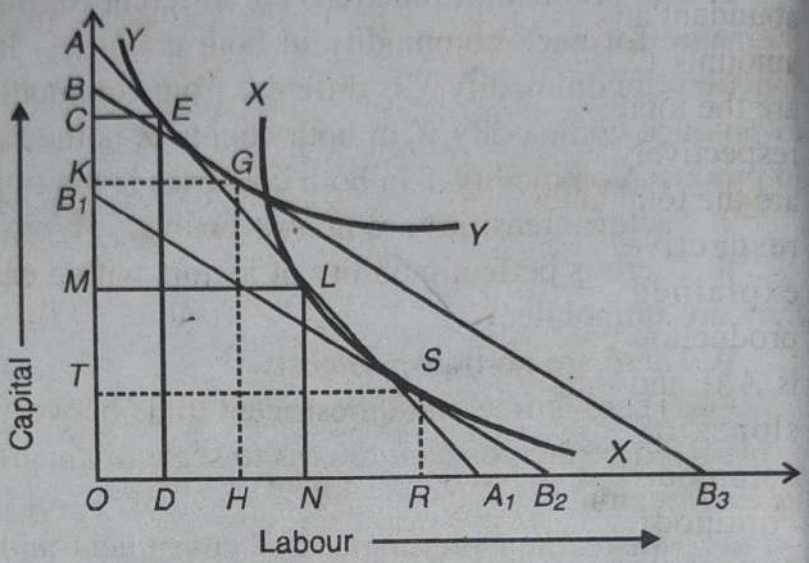

FIG. 1

In order to find the cost of producing one unit of each commodity in country B where labour is relatively cheap and abundant, draw a flatter factor price line BB_3 tangent to the isoquant YY at point G. A similar factor price line B_1B_2 is drawn parallel to BB_3 which is tangent to the isoquant XX at point S. Now it requires OK amount of capital and OH amount of labour to produce one unit of commodity Y in country B, and OT amount of capital and OR amount of labour to produce one unit of commodity X in this country. Since labour is cheap and abundant in country B, it will specialise in the production of labour-intensive commodity X. So it will produce commodity X at point S on the isoquant XX, which requires more amount of labour OR with less amount of capital OT than commodity Y which requires less amount of labour OH with more amount of capital OK at point G on the isoquant YY. Hence country B will export commodity X to country A in exchange for commodity Y.

This establishes the H.O. theorem that the capital abundant country will export the relatively cheap capital-intensive commodity, and the labour abundant

country will export the relatively cheap labour-intensive commodity.

(2) Factor Abundance in Physical Terms. Another way to explain the H.O. theorem is in physical terms of factor abundance. According to this criterion, *a country is relatively capital abundant if it is endowed with a higher proportion of capital and labour than the other country.* If country *A* is relatively capital-abundant and country *B* is relatively labour-abundant , then measured in physical amounts $C_A/L_A > C_B/L_B$, where C_A and L_A are the total amounts of capital and labour respectively in country *A*, and C_B and L_B are the total amounts of capital and labour respectively in country *B*. This is explained in Figure 2, where the production possibility curve of country *A* is AA_1 and that of country *B* is BB_1. The slopes of these two curves show that commodity *Y* is capital intensive and commodity *X* is labour intensive. If countries *A* and *B* produce both commodities in the same proportion, they will produce along the ray *OR*. When both produce at their respective points, country *A* will produce at point *E* where the factor-price line *ST* touches the production productivity curve AA_1. It will produce more of commodity *Y* (that is *OS*) which is cheaper in it and less *(OT)* of commodity *X* which is dearer in it. Country *B* will produce at point *F* where the factor-price line *KR* touches the production possibility curve BB_1. It will produce more *(OR)* of commodity *X* which is cheaper in it and less *(OK)* of commodity *Y* which is dearer in it. This is proved by the slope of the factor-price line *ST* of country *A* which is steeper than the factor-price line *KR* of country *B* which is flatter:

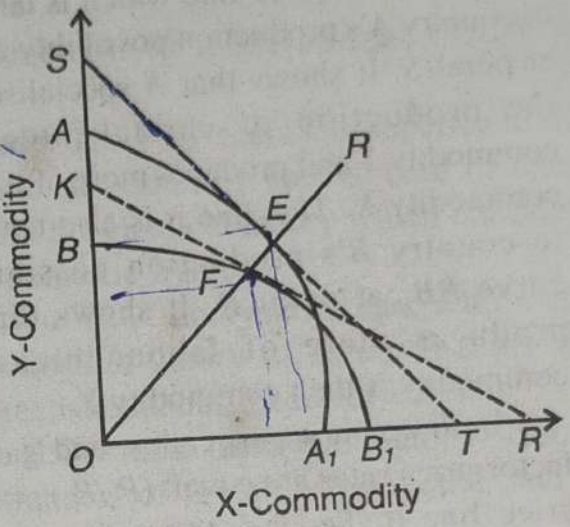

FIG. 2

$$\text{Slope of } KR > \text{Slope of } ST$$

or

$$\left(\frac{P_x}{P_y}\right)_A > \left(\frac{P_x}{P_y}\right)_B$$

The difference between both factor-price lines *TR* on *X*-axis indicates that *OR* of commodity *X* is produced more in country *B* relatively to *OT* quantity of *X* in country *A*. Similarly, the difference between both factor price lines *KS* on *Y*-axis shows that *OS* of commodity *Y* is produced more in country *A* relatively to *OK* quantity of *Y* in country *B*. Thus the capital-abundant country *A* has a bias in favour of capital-intensive commodity *Y* from the production side, and the labour abundant country *B* has a bias in favour of producing the labour-intensive commodity *X*.

But the above analysis of physical terms does not show that the capita

abundant country will export the capital-intensive commodity *Y* and the labour-abundant country will export the labour-intensive commodity *X*.

The H.O. theorem in terms of physical criterion will be *valid only if tastes (demand or consumption preferences) for each commodity in the two countries are identical*. This is shown in Fig. 8.3 where *tt* is the factor-price line which is tangent to country *A*'s production possibility curve at point *S*. It shows that *A* specialises in the production of capital-intensive commodity *Y* and produces more of it than commodity *X*. This line *tt* is also tangent to country *B*'s production possibility curve BB_1 at point *R*. It shows that *B* produces more of labour-intensive commodity *X* than commodity *Y*.

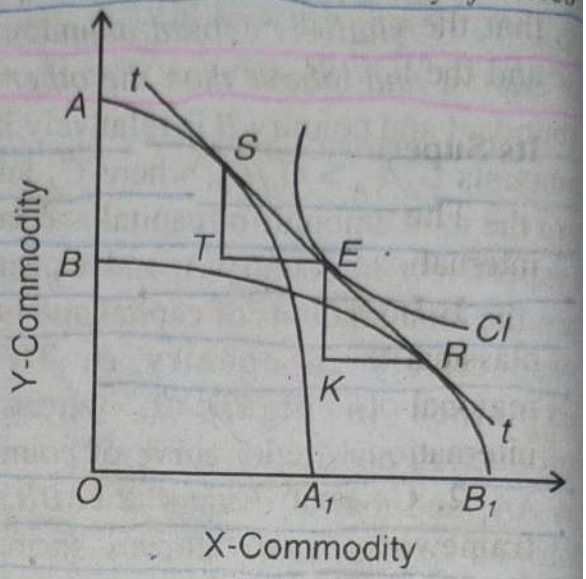

FIG. 3

Both countries specialise and gain from trade for two reasons: *First*, their factor-price rates are equal: $(P_x/P_y)_A = (P_x/P_y)_B$, as shown by the common factor-price line *tt*. *Second*, tastes for the two commodities are identical in both countries, as shown by the community indifference curve *CI*. This curve touches the line *tt* at point *E*. The trade pattern between the two countries is shown by the triangles *STE* and *EKR*. Country *A* exports *TS* quantity of *Y* and imports *TE* quantity of *X*. Country *B* exports *KR* quantity of *X* and imports *KE* quantity of *Y*.

If tastes differ in the two countries and the capital-abundant country *A* consumes more of the capital-intensive commodity *Y* and the labour-abundant country consumes more of the labour-intensive commodity *X*, the H.O. theorem in terms of physical criterion will be *invalid*. This is illustrated in Fig. 4 where the demand in country *A* is represented by the community indifference curve *CIa* and in country *B* by *CIb*. The curve *CIa* is tangent to the production possibility curve AA_1 of country *A* at point *a* which shows that demand in country *A* is mainly concentrated in capital-intensive commodity *Y*. Similarly, the point *b* of tangency between the *CIb* curve and the BB_1 curve shows that demand in country *B* is mainly concentrated in labour-intensive commodity *X*. Before trade commodity *Y* is relatively more expensive in country *A* than in country *B*. This is shown by the relatively flatter price line *PaPa* in country *A* as against the relatively steeper line *PbPb* in country *B*:

$(P_x/P_y)_A < (P_x/P_y)_B$.

When trade begins between the two

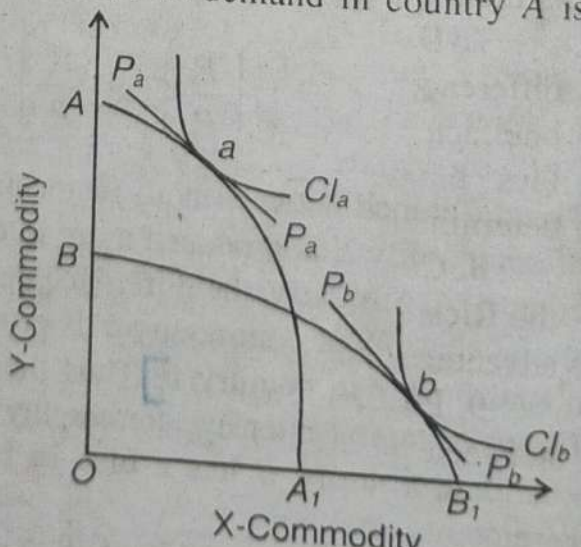

FIG. 4

countries, the capital abundant country *A* will export the *relatively cheap* labour-intensive commodity *X*, and the labour-abundant country *B* will export the relatively cheap capital-intensive commodity *Y*. Thus it leads to the conclusion that the capital-intensive country will export the labour-intensive commodity, and the labour-intensive country the capital-intensive commodity.[1]

Its Superiority over the Classical Theory

The H.O. theorem is an improvement over the classical theory of international trade in many aspects.

1. International Trade a Special Case. The H.O. theory is superior to the classical theory in that it regards international trade as a special case of inter-regional or inter local trade as distinct from the classical theory which considers international trade totally different from domestic trade.

2. General Equilibrium Theory. The H.O. analysis is cast within the framework of the realistic general equilibrium theory of value. It frees the classical theory from the defunct and unrealistic labour theory of value.

3. Two Factors of Production: The H.O. model takes two factors—labour and capital—as against the one factor (labour) of the classical model, and is thus superior to the latter.

4. Differences in Factor Supplies. The H.O. theory is superior to the Ricardian theory in that it regards differences in factor supplies as basic for determining the pattern of international trade while the Ricardian theory takes no notice of it.

5. Relative Prices of Factors. The H.O. model is realistic because it is based on the relative prices of *factors* which, in turn, influence the relative prices of goods, while the Ricardian theory considers the relative prices of *goods* only.

6. Relative Productivities of Factors. The H.O. theory considers differences in relative productivities of labour and capital as the basis of international trade, while the classical theory takes the productivity of labour alone. Hence the former is more realistic than the latter.

7. Differences in Factor Endowments. The H.O. model is based on differences in factor endowments in different countries as against the quality of one factor labour in the classical theory. Thus the former is superior because it lays emphasis not only on the quality but also on the quantity of factors in determining international values.

8. Causes of Differences in Comparative Costs. According to Samuelson, the Ricardian theory could not explain the causes of differences in comparative advantage. The merit of H.O. theory lies in explaining the same satisfactorily.

9. Positive Theory. The classical theory demonstrates the *gains* from trade between the two countries. This is related to the *welfare* theory. On the other

hand, the H.O. model is scientific and concentrates on the *basis* of trade. It, thus, partakes of the *positive* theory.

10. Location Theory. According to Haberler[2], the H.O. theory is a location theory which highlights the importance of the space factor in international trade while the classical theory regards the different countries as spaceless markets. Thus the former theory is superior to the latter.

11. Production Functions of Two Countries. The H.O. theorem is explicitly based on the assumption of production functions of the two countries. On the other hand, the classical theory is based on differences in the production of the trading countries.

12. Complete Specialisation. The H.O. model is more realistic than the classical theory in that the former leads to complete specialisation in the production of one commodity by one country and of the other commodity by the second country when they enter into trade with each other. By contrast, the trade between two countries may or may not lead to complete specialisation in the classical theory.

13. Future of Trade. According to Lancaster, the H.O. theory is superior to the classical theory because it refers to the future of trade. In the classical theory, differences in comparative costs between two countries are due to differences in the efficiency of labour. If, in future, labour becomes equally efficient in both the countries, there will be no trade between them. But in the H.O. theory trade will not cease even if labour becomes equally efficient in the two countries because the basis of trade is differences in factor endowments and prices.

Conclusion. It is clear from the above discussion that the H.O. theorem is superior to the classical theory. The H.O. theory absorbs Ricardo's theory of Comparative Costs and Mill's Concept of Reciprocal Demand. But it does not invalidate the Theory of Comparative Costs. Rather, it supplements it because it also accepts comparative advantage as the cause of international trade. At the same time, it improves upon it when it links the pattern of trade with the economic structure of trading countries. In this way, it analyses the effects of a change in trade on the domestic economic structures and on the domestic income distribution.

Its Criticisms

Ohlin's theory has been criticised on the following grounds:

1. Two-by-two-by-two Model. Ohlin has been criticised for presenting two-by-two-by-two model based on oversimplified assumptions. But, as Ohlin himself points out, it can be extended to many regions, many commodities and many factors. He demonstrated it in the mathematical appendix to his book.

2. Static Theory. Like the classical theory, the Ohlin model is static in nature. "It only gives some characteristics of an economy at a given point in time. For instance, it can give information about how to rank goods at any given moments,

2. G. Haberler, *A S*

but it cannot give any indication about how the economy would develop if production conditions were to change."

3. Factors not Homogeneous. The theory assumes the existence of the homogeneous factors in the two countries which can be measured for calculating factor endowment ratios. But, in reality, no two factors are homogenous qualitatively between countries, and even one factor is of various types. For instance, labour both skilled and unskilled, is of various types. Similarly, capital goods take many forms and also perform the tasks of labour when they are labour saving.

4. Production Techniques not Homogeneous. Again, the Ohlin model assumes homogeneous production techniques for each commodity in the two countries. But production techniques are different for the same commodity in the two countries. For instance, textiles may be produced with handlooms which require more labour and less capital or with highly sophisticated powerlooms requiring a small number of workers. In such a situation, trade may not follow the Ohlin pattern.

5. Tastes and Demand Patterns not Identical. The H.O. theory is based on the assumption of identical tastes and demand patterns of consumption in both countries. This assumption implies that the tastes and demand patterns of consumers are the same for different income groups. This is unrealistic. Moreover, with inventions taking place in consumers' goods, changes in tastes and demand patterns of consumers also occur even among developed countries. Commodities which consumers demand in the United States are different from what consumers demand in Germany. Consequently, tastes are not identical in trading countries.

6. No Constant Returns. The assumption that there are constant returns to scale is also not realistic because a country having rich factor endowments often obtains the advantages of economies of scale through lesser production and exports. Thus there are increasing returns to scale rather than constant.

7. Transport Costs influence Trade. This theory does not consider transport costs in trade between two countries. Ths is an unrealistic assumption. Alongwith transport costs, loading and unloading of goods and other port charges affect the prices of produced commodities in the two countries. When transport costs are included, they lead to price differentials for the same commodity in the two countries which affect their trade relations.

8. Unrealistic Assumptions of Full Employment and Perfect Competition. The H.O. theory is based on the unrealistic assumptions of full employment and perfect competition because there is neither full employment nor perfect competition in any country of the world. Rather, countries do not have free trade but impose trade restrictions on a large scale.

9. Leontief Paradox has Falsified the Theory. Ohlin assumes that relative factor prices reflect exactly relative factor endowments. It implies that in the determination of factor prices, supply is more important than demand. If, however, the demand factors are given more importance in determining factor prices, a

capital-rich country will export a labour-intensive commodity because the high demand for capital will raise the price of capital relative of labour. Prof. Leontief's[3] empirical study of the Ohlin theorem, known as the Leontief Paradox, has led to paradoxical results that the United States exports labour-intensive goods and imports capital-intensive goods, even though it is a capital-rich country.

10. Partial Equilibrium Analysis. Prof. Haberler criticises Ohlin for his failure to develop a comprehensive general equilibrium concept. He regards Ohlin's theory as, by and large, a partial equilibrium analysis.[4]

11. Factor Prices do not determine Commodity Prices. Wijanholds has criticised Ohlin for his view that commodity prices are determined by the factor prices which in turn, determine costs. He holds that the prices of commodities are determined by their utility to the consumers, and that the prices of raw materials and labour are ultimately dependent on the prices of the final commodities. He maintains that the right approach is to start with commodity prices rather than factor prices.[5]

12. Vague and Conditional Theory. Ohlin's theory has been characterised as "somewhat vague and conditional.' As pointed out by Haberler, "With many factors of production, some of which are qualitatively incommensurable as between different countries, and with dissimilar production functions in different countries, no sweeping a *priori* generalisation concerning the composition of trade are possible."

Conclusion. Despite these criticisms, the Ohlin theory of international trade is definitely an improvement over the classical theory as it attempts to explain the basis of international trade in the general equilibrium setting. According to Lancaster, the H.O. model "occupies the very centre of international trade theory for reasons unconnected with its realism, and indeed strengthened by the very properties which have been subject to so much criticism."[6]