[Academic Script]
[Factor Price Equalization Theory]

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Unit No. & Title:	Unit - 2 Factor Endowment and Heckscher-Ohlin Theory
Lecture No. & Title:	2: Factor Price Equalization Theory

Factor Price Equalization Theory

Introduction:

The concept of factor price equalization was given by Paul Samuelson. This theory is also known as Heckscher-Ohlin-Samuelson (H-O-S) theory. The factor price equalization theorem is derived from the Heckscher-Ohlin theorem. Heckscher-Ohlin theory uses general equilibrium approach to analyze the comparative cost advantage. According to H-O theory trade arises due to difference in factor prices. Difference in commodity prices is the result of difference in factor endowments. So basically difference in factor endowments is the root cause of comparative cost differences this in turn results in international trade.

In the absence of transport costs or other restrictions to international trade, the most immediate effect of international trade is that it would equalize relative commodity prices in both nations. It means that international trade reduces the pre-trade differences of commodity prices. Difference in commodity prices will reduce as the volume of international trade increases. Therefore, we can say that greater the volume of trade, lower the difference in commodity prices. The relative commodity prices would become equal when the relative factor prices are equalized. It means that when the prices of the output goods are equalized between countries as they move to free trade, then the prices of the factors (capital and labor) will also be equalized between countries.

H-O-S Theorem:

International trade will equalize the relative and absolute prices of factors of production across nations.

According to this definition we can say that, international trade will equalize price of labor i.e. wage rate across nations and price of capital i.e. rate of interest across nations. Here we assume that labor and capital are homogeneous. International trade in commodity will bring about equalization in returns to factors of production.

Example:

Two nations: A and B and

Two commodities: X and Y.

(1) Nation A is capital abundant nation and nation B is labor abundant nation. Commodity X is capital-intensive and commodity Y is labor-intensive. Therefore, nation A can produce more of X and nation B can produce more of Y.

(2) It means that price of commodity X is lower in nation A than in nation B because the relative price of capital, or interest rate(r/w), is lower in nation A in the absence of trade. Similarly, price of commodity Y is lower in nation B than in nation A because the relative price of labor, or wage rate (w/r), is lower in nation B in the absence of trade.

(3) After having trade with nation B, nation A will specialization in commodity X. Nation A increases the production of X and therefore demand for capital will increase which in turn raises the rate of interest. The relative demand for labor declines, causing the wage rate to fall.

(4) After having trade with nation A, nation B will specialization in commodity Y. Nation B increases the production of Y and therefore demand for labor will increase which in turn raises the wage rate. The relative demand for capital declines, causing the interest rate to fall.

(5) In autarky situation,

Nation A: r is lower

w is higher

Nation B: r is higher

w is lower.

(6) International trade causes interest rate to rise in nation A (low interest rate nation) in which r was lower in autarky situation. Similarly, international trade will increase the wage rate in nation B (low wage nation) in which w was lower in absence of international trade. Thus, we can say that international trade reduces the pre-trade difference in wage rate and rate of interest between two nations.

(7) The international trade will keep increasing until relative commodity prices are completely equalized; it means that relative factor prices have also become equal in the two nations.

Assumptions:

(1) There are only two countries, two goods and two factors of production. This model is known as **2x2x2 model.**

(2) There is a **perfect competition in goods market** which means that price is determined by the industry and producers and consumers cannot affect the market price.

(3) There is **perfect competition in factor market** which means that neither labor nor capital has the power to affect prices or factor rewards.

(4) There is **full employment** in both nations.

(5) There is **constant return to scale (CRS).** It exhibits that doubling the inputs (labor and capital), output will increase by twofold. We can say that production function is homogenous of degree one. If we double the amount of labor and keep capital constant, output will increase less than the increase in the amount of labor. It shows the diminishing returns to labor. Similarly, there is diminishing returns to capital also.

(6) We can know the abundance of goods. One cannot change the abundance of the goods.

(7) There is **free trade** between two nations. There are no restrictions like tariffs, quota etc.

(8) The **factors of production** are completely **mobile within the nation**. But they cannot move from one nation to another. Therefore, **international mobility does not exist.** We can say that one labor can move from Mumbai to Ahmedabad but he or she cannot move from Mumbai to New York.

(9) The production function of two goods is different but they are same in both nations. It means that production function of good X is same in both nations and production function of good Y is same in both nations. But production functions of X and Y are different in both nations.

(10) Factors affecting demand like tastes, preferences and income are constant.

(11) The stock of the factors of production in both nations is constant. They are homogeneous.

The assumptions are same which we made in H-O theorem.

Relative Factor Price Equalization:

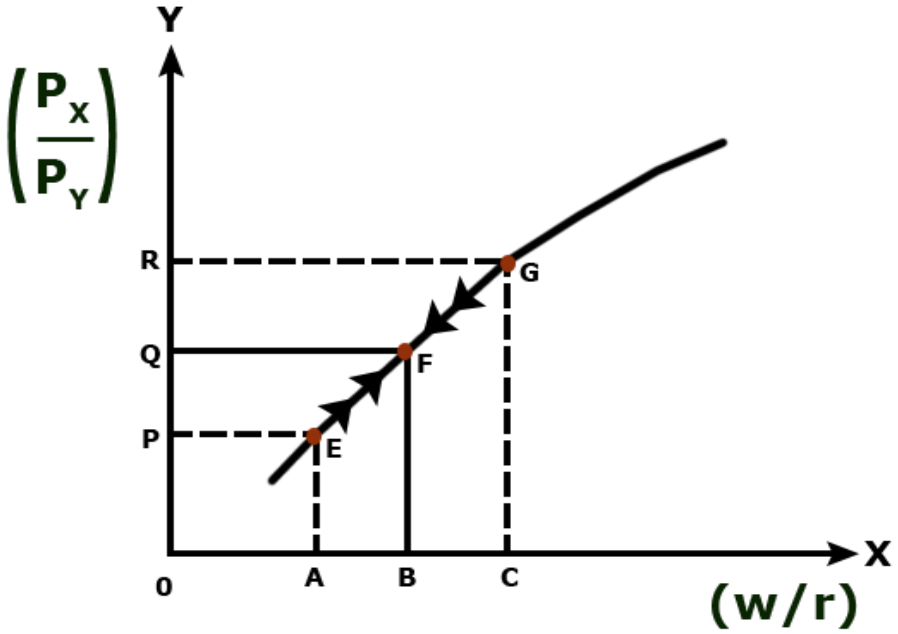
Consider Figure-1:

Relative price of factor (w/r) is measured on X-axis and relative commodity price (P_X/P_Y) is measured on Y-axis. We assume the condition of perfect competition; each w/r ratio is associated with a specific P_X/P_Y ratio.

(1) In autarky situation, nation B is at point E, with OA amount of relative factor price and OP amount of relative commodity price.

(2) Similarly, in autarky situation, nation A is at point G, with OC amount of relative factor price and OR amount of relative commodity price.

Figure-1: Relative Factor Price Equalization



(3) It means that w/r is lower in nation B than in nation A in absence of trade, OP is lower than OR. Therefore, we can say that nation A has comparative advantage in production of X.

(4) After having trade with nation B, nation A specializes in production of X because nation A is capital abundant nation and commodity X is capital-intensive. It means that specialization will increase the production of X and reduce the production of Y in nation A. Therefore, demand for capital rises relative to demand for labor and w/r falls in nation A. This causes P_X/P_Y to fall in nation A.

(5) After having trade with nation A, nation B specializes in production of Y because nation B is labor abundant nation and commodity Y is labor-intensive. It means that specialization will increase the production of Y and reduce the production of X in nation B. Therefore, demand for labor rises relative to demand for capital and w/r rises in nation B. This causes P_X/P_Y to rise in nation B.

(6) The process will continue until point F, at which relative commodity price (OQ) and relative factor price (OB) in both nations become equal.

(7) It shows that nation A moves from G to F and nation B moves from E to F. At point F, relative commodity price and relative factor price both are same in both nations. Relative commodity price is equal in both nations only if relative factor price is equal in both nations. Therefore, we can say that equality in relative factor prices in both nations equalizes the relative commodity price in both nations.

General Equilibrium Approach of Relative Factor Price Equalization Theorem:

We use the Edgeworth box diagram to understand the general equilibrium approach of factor price equalization theorem.

Consider Figure-2:

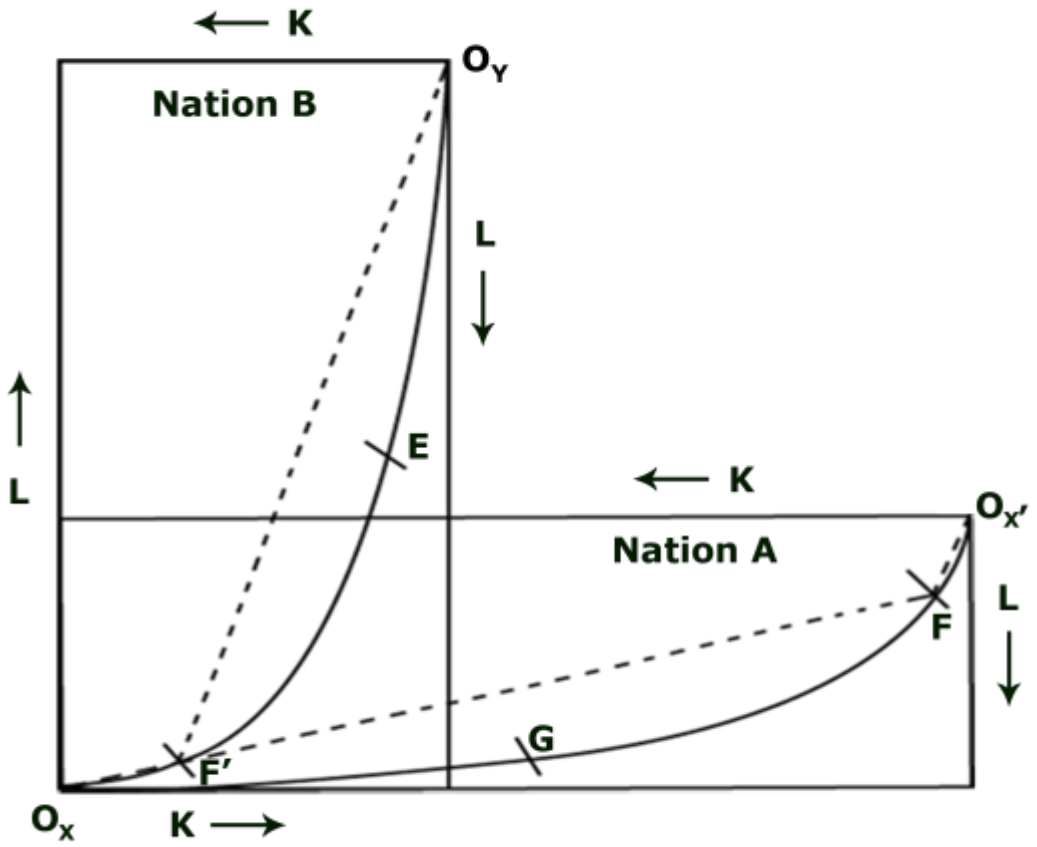
In our example nation A is capital abundant and nation B is labor abundant. Commodity X is capital intensive and commodity Y is labor intensive.

(1) Nation A uses higher amount of capital and smaller amount of labor in the production of both commodities than that of nation B, the productivity of labor is higher and productivity of capital is lower. Therefore, we can say that w is higher than r in nation A than in nation B.

(2) The K-L ratio used in commodity X is higher in nation A than in nation B. Similarly, K-L ratio used in commodity Y is smaller in nation B than in nation A.

(3) With a lower w and higher r in nation B, w/r is lower in nation B than in nation A. Similarly, with a higher r and lower w in nation A, w/r is higher in nation A than in nation B. This has been understood by the slope of the line at point G and E. The line passing through G is flatter than the line passing through E.

Figure-2: General Equilibrium Approach of Relative Factor Price Equalization Theorem



(4) Nation A is capital abundant nation and commodity X is capital intensive. Therefore, nation A will specialize in commodity X. Similarly, nation B is labor abundant nation and commodity Y is labor-intensive commodity. Therefore, nation B will specialize in production of commodity Y.

(5) Specialization in production continues until nation A reaches at point F and nation B reaches at point $F^{/}$. At these two points, K-L ratio is the same in each commodity in both nations. It has been depicted by the slope of the dashed blue line from O_X through points $F^{/}$ and F for commodity X and slope of the parallel dashed blue lines from O_Y and $O_{X'}$ to points F and $F^{/}$.

(6) As nation A moves from G to F, K-L ratio falls in production of both commodities. The productivity of labor and therefore w falls and r raises in nation A (high wage-low rate of interest rate nation) due to decrease in K-L ratio.

(7) As nation B moves from E to $F^{/}$, K-L ratio rises in production of both commodities. The productivity of labor and therefore w rises and r falls in nation B (low wage nation-high rate of interest nation) due to increase in K-L ratio.

(8) Specialization in production of continues until K-L ratio and w/r have become equal in two nations. This happens when nation A produces at F and nation B produces at $F^{/}$.

Absolute Factor Price Equalization:

To understand the concept of absolute factor price equalization, we need to understand the Euler's theorem.

According to Euler's theorem, if each factor is rewarded equal to its marginal product, the total product should be exhausted. It means that there is neither surplus nor deficit. Here we assume the constant returns to scale in production. In other words, **total production will be just exhausted if all factors are paid rewards equal to their marginal products.** This problem is also known as Product Exhaustion Problem (PES).

In mathematical form, Euler's theorem can be written as:

$TP_Y = (MPL \times L) + (MPK \times K)$…… (1)

Where, TP_Y = total production of Y

MPL = marginal product of labor

L = amount of labor

MPK = marginal product of capital

K = amount of capital

This equation shows that the total output of Y is the summation of marginal product of labor (MPL) times amount of labor used in production of X and marginal product of capital (MPK) times amount of capital used in production of Y.

Dividing equation (1) by L,

$TP_Y/L = (MPK \times K)/L + MPL$ …… (2)

Therefore,

$TP_Y/K = MPL\ [(MPK/MPL) \times (K/L) + 1]$ …….... (3)

Now, after having trade with each other nation A produces at point F and nation B produces at point F/, w/r is same in both nations and MPK/MPL is also same in both nations. At F and F/, K-L ratio in the production of commodity Y is also same in both nations. TP_Y/K is the average product of capital in the production of commodity Y. the average product is same in both nations because of the assumption of CRS and same production function. If equation (3) is true, MPL in both nations must be equal. It means that MPL (= w) is same in production of commodity Y in both nations. Similarly, we can prove for commodity X. Therefore we can say that, real wages (w/r) in production of commodity X are equal to real wages (w/r) in production of commodity Y in both nations.

Summary:

The factor price equalization theorem is derived from the Heckscher-Ohlin theorem. Heckscher-Ohlin theory uses general equilibrium approach to analyze the comparative cost advantage. According to H-O theory trade arises due to difference in factor prices. Difference in commodity prices is the result of difference in factor endowments. According to this definition of H-O-S theorem, international trade will equalize price of labor i.e. wage rate across nations and price of capital i.e. rate of interest across nations.