

Chapter 5

Factor Endowments and the Heckscher-Ohlin Theory

5.1 Introduction

- Chapter 2 and 3 showed:
 - ✓ The difference in relative commodity prices between two nations is evidence of their comparative advantage and forms the basis for mutually beneficial trade.
- Using the Heckscher-Ohlin theory, Chapter 5 extends our trade model in two directions:
 - (1) We explain the basis of (i.e., what determines) comparative advantage. (i.e., We explain the reason for the difference in relative commodity prices.) → Heckscher-Ohlin Theorem
 - (2) We analyze the effect that international trade has on the earnings of production factors in the two trading nations.
→ Factor-Price Equalization Theorem

5.2 Assumptions of the Theory

- (1) There are two nations (Nation 1, Nation 2), two commodities (commodity X, commodity Y), and two factors of production (labor, capital)
- (2) Both nations use the same technology in production.
 - i.e., if factor prices were the same in both nations, producers in both nations would use exactly the same amount of labor and capital in the production of each commodity.
- (3) Commodity X is labor intensive, and commodity Y is capital intensive in both nations.
 - i.e., $(K/L)_X < (K/L)_Y$

5.2 Assumptions of the Theory

- (4) Both commodities are produced under constant returns to scale in both nations.
 - CRS means that increasing the amount of labor and capital used in production of any commodity will increase output of that commodity in the same proportion.
 - example:
- (5) There is incomplete specialization in production in both nations.
 - i.e., Even with free trade both nations continue to produce both commodities.
 - This implies that neither of the two nations is “very small.”
- (6) Tastes are equal in both nations.
 - i.e., The shape of indifference curves in the two nations are the same.

5.2 Assumptions of the Theory

- (7) There is perfect competition in both commodities and factor markets in both nations.
 - i.e., Commodity prices equal their costs of production, leaving no profit after all costs are taken account.
- (8) There is perfect factor mobility within each nation but no international factor mobility.
 - i.e., Earning for the same type of labor and capital are the same in all industries of the nation, while international differences in factor earnings would persist in the absence of international trade.
- (9) There are no transportation costs, tariffs, or other obstructions to the free flow of international trade.
 - After trade, specialization proceeds until commodity prices are the same in both nations.

5.2 Assumptions of the Theory

- (10) All resources are fully employed in both nations.
- (11) International trade between the two nations is balanced.
 - The total value of each nation's exports equals the total value of the nation's imports.
- (12) Nation 1 is labor abundant and Nation 2 is capital abundant.
 - Definition in terms of physical units: $(TK/TL)_{N1} < (TK/TL)_{N2}$
 - Definition in terms of relative factor prices: $(r/w)_{N1} > (r/w)_{N2}$

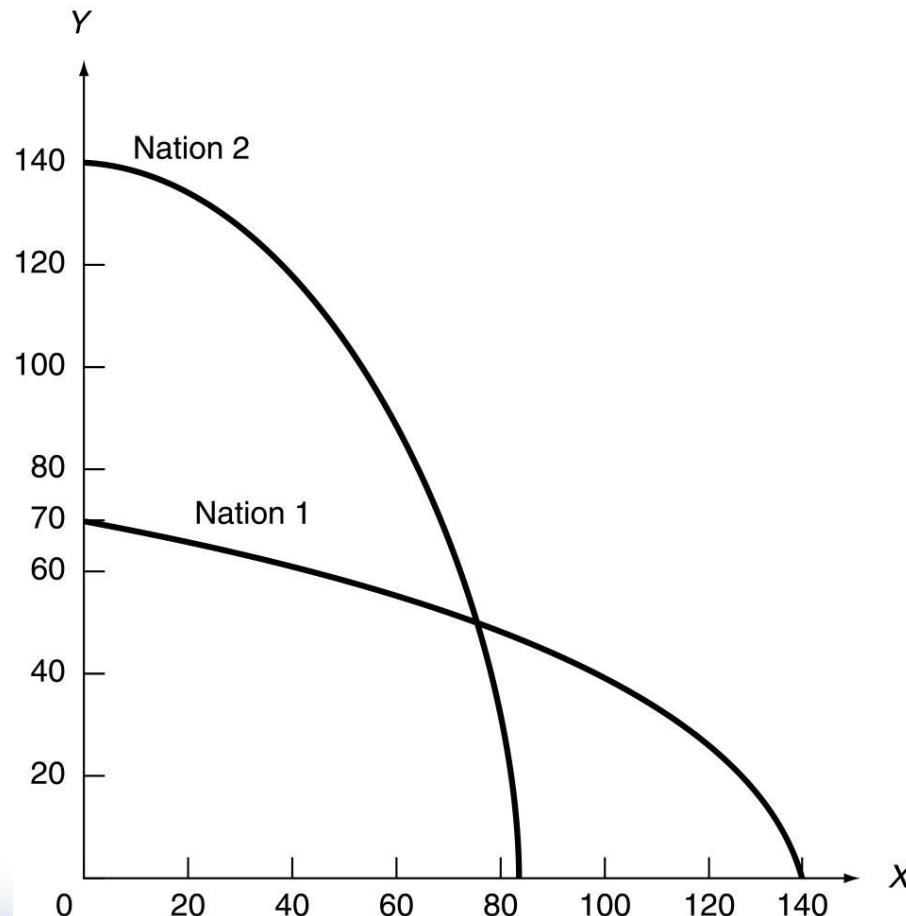
5.3 Factor Intensity, Factor Abundance, and the Shape of the Production Frontier

5.3C. The Shape of the Production Frontier

- Since Nation 2 is the K-abundant nation and commodity Y is the K-intensive commodity, Nation 2 can produce relatively more of commodity Y than Nation 1.
- On the other hand, Nation 1 is the L-abundant nation and commodity X is the L-intensive commodity, Nation 1 can produce relatively more of commodity X than Nation 2.

5.3 Factor Intensity, Factor Abundance, and the Shape of the Production Frontier

Figure 5.2. The Shape of the Production Frontiers of Nation 1 and Nation 2



5.3 Factor Intensity, Factor Abundance, and the Shape of the Production Frontier

Case Study 5-1 Relative Resource Endowments of Various Countries and Regions

Country/Region	Capital	Skilled Labor	Unskilled Labor	All Resources
United States	20.8%	19.4%	2.6%	5.6%
European Union	20.7	13.3	5.3	6.9
Japan	10.5	8.2	1.6	2.9
Canada	2.0	1.7	0.4	0.6
Rest of OECD	5.0	2.6	2	2.2
Mexico	2.3	1.2	1.4	1.4
Rest of Latin America	6.4	3.7	5.3	5.1
China	8.3	21.7	30.4	28.4
India	3.0	7.1	15.3	13.7
Hong Kong, South Korea, Taiwan, Singapore	2.8	3.7	0.9	1.4
Rest of Asia	3.4	5.3	9.5	8.7
Eastern Europe (including Russia)	6.2	3.8	8.4	7.6
OPEC	6.2	4.4	7.1	6.7
Rest of the world	2.5	4	10	8.9
Total	100.0%	100.0%	100.0%	100.0%

5.3 Factor Intensity, Factor Abundance, and the Shape of the Production Frontier

Case Study 5-2 Capital-Labor Ratios of Selected Countries

Developed Country	1997	Developing Country	1997
Japan	77,429	Korea	26,635
Germany	61,673	Chile	17,699
Canada	61,274	Mexico	14,030
France	59,602	Turkey	10,780
United States	50,233	Thailand	8,106
Italy	48,943	Philippines	6,095
Spain	38,879	India	3,094
United Kingdom	30,226	Kenya	1,412

5.4 Factor Endowments and the Heckscher-Ohlin Theory

Two major features of the H-O Theory

- The sources of comparative advantage: H-O Theorem
- The effects of free trade on factor prices: Factor-Price Equalization Theorem

5.4A. The Heckscher-Ohlin Theorem

“A nation will export the commodity whose production requires the intensive use of the nation’s relatively abundant and cheap factor and import the commodity whose production requires the intensive use of the nation’s relatively scarce and expensive factor.”

i.e., “A nation has a comparative advantage in a commodity which is intensive in the nation’s abundant factor.”

5.4 Factor Endowments and the Heckscher-Ohlin Theory

5.4C. Illustration of the H-O Theorem

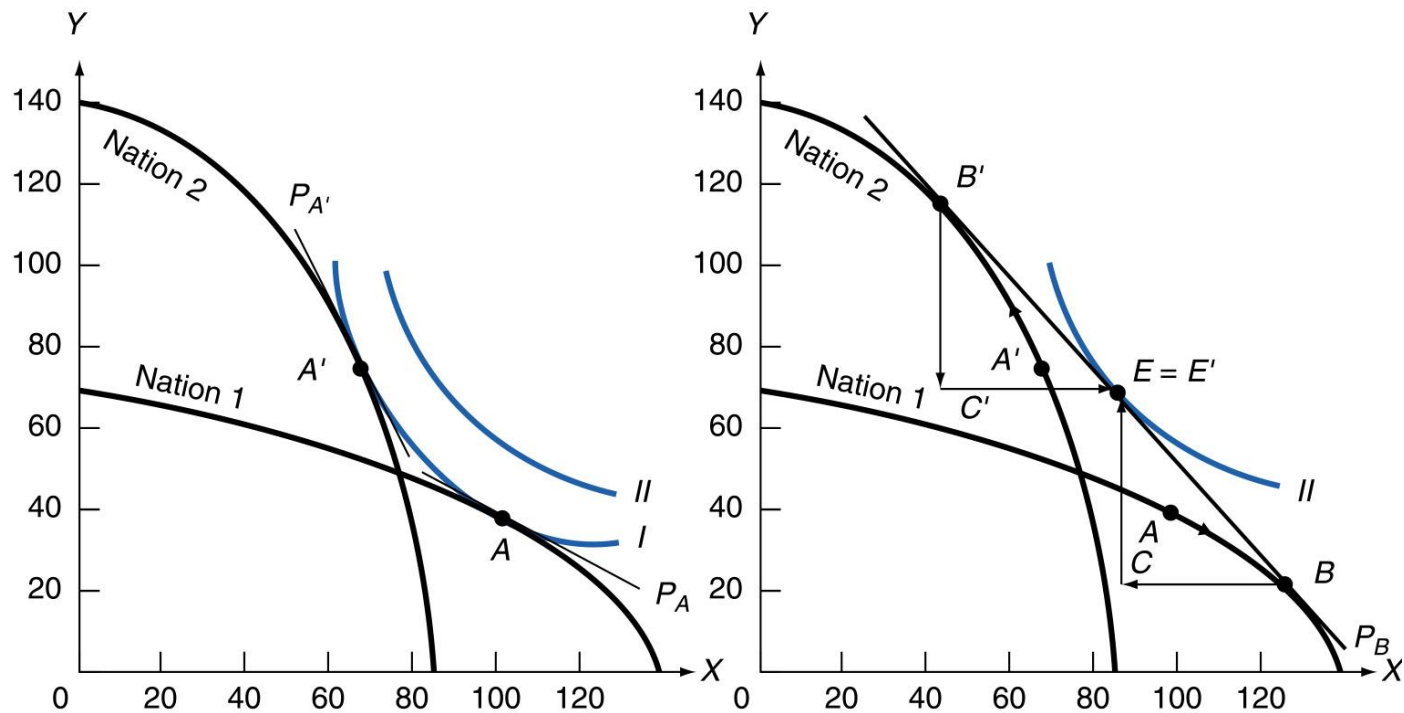


Figure 5.4. The H-O Model

5.4 Factor Endowments and the Heckscher-Ohlin Theory

Table 5.3. The Revealed Comparative Advantage of Various Countries and Regions

Country/Region	Capital	Skilled	Unskilled
United States	0.11	0.06	-0.3%
European Union	0.03	0.01	-0.06
Japan	0.07	0.15	-0.5
Canada	0.19	-0.25	-0.03
Rest of OECD	0.00	-0.01	0.01
Mexico	-0.05	0.02	0.01
Rest of Latin America	-0.16	-0.23	0.47
China	-0.24	-0.25	0.44
India	-0.04	-0.64	0.37
Hong Kong, South Korea, Taiwan, Singapore	-0.11	-0.03	0.14
Rest of Asia	-0.33	-0.05	0.4
Eastern Europe (including Russia)	-0.08	-0.31	0.36
OPEC	-0.09	-0.29	0.45
Rest of the world	-0.17	-0.18	0.4%

5.5 Factor-Price Equalization and Income Distribution

5.5A. The Factor-Price Equalization Theorem (Heckscher-Ohlin-Samulson Theorem)

“International trade will bring about equalization in the relative and absolute returns to homogeneous factors across nations.”

- i.e., After trade,

$(w/r)_{N1} = (w/r)_{N2}$: Relative price equalization

$w_{N1} = w_{N2}, r_{N1} = r_{N2}$: Absolute price equalization

<Intuitive Proof>

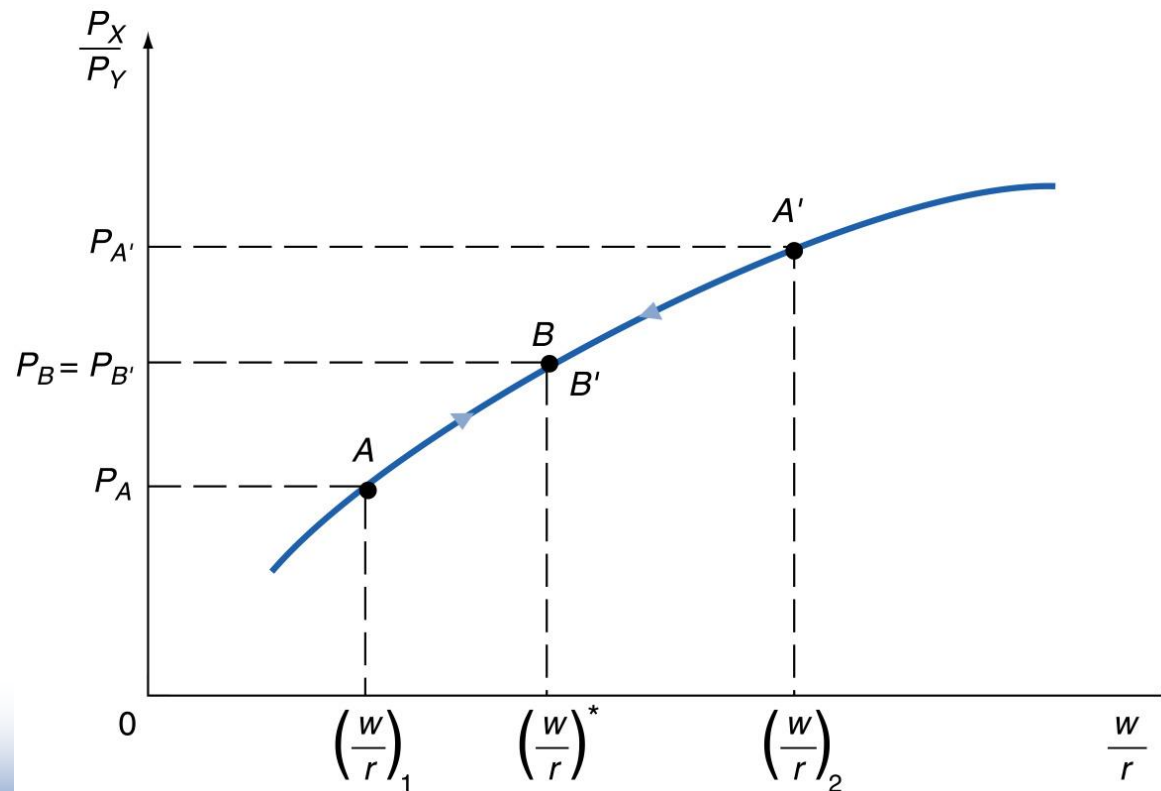
- ✓ Before trade: $(r/w)_{N1} > (r/w)_{N2}$
- ✓ After trade: Nation 1 specializes in the production of commodity X (the L-intensive commodity), the relative demand for labor rises, causing wages (w) to rise, while the relative demand for capital falls, causing the interest rate (r) to fall. Nation 2 *****.

5.5 Factor-Price Equalization and Income Distribution

5.5B. Relative and Absolute Factor-Price Equalization

(1) Proof of the Relative Factor-Price Equalization

Figure 5.5. Relative Factor-Price Equalization



5.5 Factor-Price Equalization and Income Distribution

5.5C. Effect of Trade on the Distribution of Income (8.4C. Stolper-Samuelson Theorem, p.251.)

- While the factor-price equalization theorem explains the effects of international trade on the difference in factor prices “between nations”, Stolper-Samuelson theorem analyses the effect of trade on relative factor prices and income “within each nation”.

5.5 Factor-Price Equalization and Income Distribution

5.5E. Empirical Relevance

- Has international trade equalized the returns to homogeneous factors in different nations in the real world?
- Answer is No.
- Why? Nations do not use exactly the same technology, and transportation costs and trade barriers prevent the equalization of relative commodity prices in different nations. And many industries operate under conditions of imperfect competition and non-constant returns to scale.
- Then what is the legitimacy of the factor price equalization theorem?
- Answer: international trade reduces, rather than completely eliminate, the international difference in the returns to homogeneous factors.

5.5 Factor-Price Equalization and Income Distribution

- Table 5.5. Real Hourly Wage in Manufacturing in the Leading Industrial Countries as a Percentage of the U.S. Wage

Country	1959	1970	1983	1990	2000
Japan	11	24	51	86	96
Italy	23	42	62	79	85
France	27	41	62	102	91
United Kingdom	29	35	53	85	84
Germany	29	56	84	142	140
Canada	42	57	75	84	90
Unweighted average	27	43	65	97	98
United States	100	100	100	100	100

5.6 Empirical Tests of the H-O Model

5.6A. The Leontief Paradox

(1) Empirical test by Wassily Leontief (1951)

- Data: U.S. data for the year 1946.
 - Hypothesis: Since the U.S. was the most K-abundant nation in the world, it was expected that the U.S. exported K-intensive commodities and imported L-intensive commodities.
 - Test method: Calculated the amount of labor and capital in a 'representative bundle' of \$1 million worth of U.S. exports and import substitutes for the year 1947.
 - Result: U.S. import substitutes were more K-intensive than U.S. exports.
- This is called the Leontief paradox.

5.6 Empirical Tests of the H-O Model

- Table 5.6. Capital and Labor Requirements per Million Dollars of U.S. exports and import substitutes

	Exports	Imports Substitutes	Imports Exports
<i>Leotief</i>			
(1947 input requirements, 1947 trade):			
Capital	\$2,550,780	\$3,091,339	
Labor (worker-years)	182	170	
Capital/worker-year	\$14,010	\$18,180	1.30
<i>Leotief</i>			
(1947 input requirements, 1951 trade):			
Capital	\$2,256,800	\$2,303,400	
Labor (worker-years)	174	168	
Capital/worker-year	\$12,977	\$13,726	1.06
Capital/worker-year, excluding natural resources			0.88
<i>Baldwin</i>			
(1958 input requirements, 1962 trade):			
Capital	\$1,876,000	\$2,132,000	
Labor (worker-years)	131	119	
Capital/worker-year	\$14,200	\$18,000	1.27
Capital/worker-year, excluding natural resources			1.04
Capital/worker-year, excluding natural resources and human capital			0.92

5.6 Empirical Tests of the H-O Model

5.6B. Explanations of the Leontief Paradox

- The year 1947 was too close to WW II to be representative.
- A two-factor model (K and L) is too simple and abstracts from other factors such as natural resources.
- U.S. tariff policy distorts the trade.
- Capital includes not only physical capital but also human capital, but Leontief ignored the latter.

It is possible that a commodity (X) is L-intensive in Nation 1 (the Low-wage nation), as at the same time, it is K-intensive in Nation 2 (the high-wage nation): factor-intensity reversal

5.6C. Factor Intensity Reversal (Skip)

5.6 Empirical Tests of the H-O Model

5.6D. Implications of the conflicting empirical results

- The H-O model is useful in explaining international trade in raw materials, agricultural products which is large component of trade between developing and developing countries.
- There should be other basis for trade. → Chapter 6.

Factor Intensity Reversal

- Factor-intensity reversal refers to the situation where a given commodity is the L -intensive commodity in the L -abundant nation and the K -intensive commodity in the K -abundant nation.
- For example, factor-intensity reversal is present if commodity X is the L -intensive commodity in Nation 1 (the low-wage nation), and, at the same time, it is the K -intensive commodity in Nation 2 (the high-wage nation).

