Factor Endowments

- Factor-endowment theory
  - Heckscher-Ohlin theory
  - Immediate basis for trade: difference between pre-trade relative product prices of trading nations
    - Prices depend on the production possibilities curves and tastes and preferences (demand conditions) in the trading countries
    - Production possibilities curves depend on technology and resource endowments
Factor Endowments

- Factor-endowment theory
  - Ultimate determinants of comparative advantage
    - Technology
    - Resource endowments
    - Demand
  - Assumption: technology and demand are approximately the same between countries
Factor Endowments

• Factor-endowment theory
  • Resource-endowment ratio
    • Determines comparative advantage
  • Export the product that uses a large amount of its relatively abundant resource
  • Import the product which in production uses the relatively scarce resource
FIGURE 5-1 Factor Intensities for Commodities X and Y in Nations 1 and 2.
FIGURE 5-2 The Shape of the Production Frontiers of Nation 1 and Nation 2.
FIGURE 5-3 General Equilibrium Framework of the Heckscher-Ohlin Theory.
FIGURE 5-4 The Heckscher-Ohlin Model.
FIGURE 5-5 Relative Factor-Price Equalization.
Factor Endowments

- Effect of resource endowments on comparative advantage

Differences in relative resource endowments ➔ Differences in relative resource prices ➔ Differences in relative product prices ➔ Pattern of comparative advantage
TABLE 3.2 Capital stock per worker of selected countries, 1997*

<table>
<thead>
<tr>
<th>Industrial Country</th>
<th>1997</th>
<th>Developing Country</th>
<th>1997</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>$77,429</td>
<td>South Korea</td>
<td>$26,635</td>
</tr>
<tr>
<td>Germany</td>
<td>61,673</td>
<td>Chile</td>
<td>17,699</td>
</tr>
<tr>
<td>Canada</td>
<td>61,274</td>
<td>Mexico</td>
<td>14,030</td>
</tr>
<tr>
<td>France</td>
<td>59,602</td>
<td>Turkey</td>
<td>10,780</td>
</tr>
<tr>
<td>United States</td>
<td>50,233</td>
<td>Thailand</td>
<td>8,106</td>
</tr>
<tr>
<td>Italy</td>
<td>48,943</td>
<td>Philippines</td>
<td>6,095</td>
</tr>
<tr>
<td>Spain</td>
<td>38,897</td>
<td>India</td>
<td>3,094</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>30,226</td>
<td>Kenya</td>
<td>1,412</td>
</tr>
</tbody>
</table>

*In 1990 international dollar prices
A country exports the good whose production is intensive in its relatively abundant factor. It imports the good whose production is intensive in its relatively scarce factor.
Factor Endowments

• Factor-endowment theory, U.S.-China trade

  • United States
    • Relatively abundant: human capital (skills), scientific talent, and engineering talent are relatively abundant
    • Relatively scarce: unskilled labor is relatively scarce

  • China
    • Relatively rich: unskilled labor
    • Relatively scarce: scientific and engineering talent
Factor Endowments

• Factor-endowment theory, U.S.-China trade
  • United States exports to China
    • Goods embodying relatively large amounts of skilled labor and technology
      • Aircraft, software, pharmaceuticals, and high-tech components of electrical machinery and equipment
  • China exports to the United States
    • Goods for which a relatively large amount of unskilled labor is used
      • Apparel, footwear, toys, and the final assembly of electronic machinery and equipment
Factor Endowments

• **Factor-Price Equalization**
  
  • Redirect demand away from the scarce resource
    
    • Toward the abundant resource in each nation
  
  • Trade leads to factor-price equalization
  
  • The cheap resource becomes relatively more expensive
  
  • The expensive resource becomes relatively less expensive
  
  • Until price equalization occurs
By forcing product prices into equality, international trade also tends to force factor prices into equality across countries.

**FIGURE 3.2 The factor-price equalization theory (a)**

(a) Trade Alters the Mix of Factors (resources) Used in Production

By forcing product prices into equality, international trade also tends to force factor prices into equality across countries.
By forcing product prices into equality, international trade also tends to force factor prices into equality across countries.
Factor Endowments

• Factor-Price Equalization

• Real world – no full factor-price equalization
  • Uneven ownership of human capital
    • Education, training, skill, and the like
  • Not all countries use the same technology
    • New and better technology replaces older technologies
      – faster in developed countries
  • Transportation costs and trade barriers
    • Reduce the volume of trade
Factor Endowments

- **Stolper-Samuelson Theorem**
  - Extension of the theory of factor-price equalization
  - An increase in the price of a product
    - Increases the income earned by resources that are used intensively in its production
  - A decrease in the price of a product
    - Reduces the income of the resources that it uses intensively
  - Some people will suffer losses from free trade
Factor Endowments

• Magnification effect of Stolper-Samuelson theorem
  • The change in the price of a resource
  • Is greater than the change in the price of the good
  • That uses the resource relatively intensively in its production process
Factor Endowments

• Policy implications of Stolper-Samuelson theorem

• Even though free trade may provide overall gains for a country
  • There are winners and losers

• Owners of relatively abundant resources
  • Favor free trade

• Owners of relatively scarce factors
  • Favor trade restrictions
Effect of Output Prices on Factor Prices

• **Stolper-Samuelson Theorem**
  • Link between changes in output prices and changes in factor prices.
  • Most general form: an increase in the relative price of a good increases the real return to the factor used intensively in that good’s production and decreases the real return to the other factor.
    • Factor prices change proportionally more than output prices (*magnification effect*).

See Figure 4.1
Figure 4.1: How Does Trade Affect the Demand for Inputs in a Labor-Abundant Country?

(a) Labor Market

(b) Capital Market
Effect of Output Prices on Factor Prices

• In Figure 4.1, as production of the labor-intensive good increases, opening trade generates a net increase in demand for labor.
  • Net effect on demand for capital is negative, because production of the capital-intensive good falls.
  • With fixed factor endowments, the reward paid to the abundant factor rises and that paid to the scarce factor falls.
    • The wage-rental ratio under restricted trade exceeds the ratio under autarky.
Effect of Output Prices on Factor Prices

- When assumptions of Heckscher-Ohlin model are added, the Stolper-Samuelson theorem means that opening trade *raises* the real reward to the abundant factor and *lowers* the real reward to the scarce factor.

- Trade boosts production of the good of comparative advantage, increasing that good’s opportunity cost and relative price.
  
  - See Table 4.1 for trade’s effects on production, output prices, and factor prices.
How Do Factor Prices Vary Across Countries?

- The Factor Price Equalization Theorem
  - According to Stolper-Samuelson theorem, moving from autarky to unrestricted trade raises the real reward of the abundant factor.
    - Similarly, such a move lowers the real reward of the scarce factor.
  - Same adjustment takes place in the second country, but with the roles of the two factors reversed.
    - Trade raises the real reward of a factor in a country where that factor is abundant and lowers its price in the country where it is scarce.
How Do Factor Prices Vary Across Countries?

• Thus, even when factors are immobile between the two countries, unrestricted trade in goods tends to equalize the price of each factor across countries.
  
  • With free trade in goods and no international factor mobility, \( w^A = w^B \) and \( r^A = r^B \).
    
    • This is idea behind Factor Price Equalization Theorem.
    
    • Table 4.2 (page 111) summarizes the theorem’s implications, assuming country A is labor-abundant and good X is labor intensive.
How Do Factor Prices Vary Across Countries?

• Figure 4.2 illustrates how a firm’s cost-minimizing production techniques change.
  • To increase production of the labor-intensive good (X), firms in both industries must increase their capital-labor ratios.
    • The rise in wage-rental ratio from \((w/r)_0\) to \((w/r)_1\) brings about this adjustment.
      • Firms choose to use less labor and more capital as labor becomes more expensive relative to capital.
**Figure 4.2**: Changes in Factor Cause Firms to Change Their Capital-Labor Ratios

Slope = \(-\frac{w}{r}\) 

\((K/L)_{x0}\) \quad \text{(a) X Industry} 

\((K/L)_{y0}\) 

\text{(b) Y Industry}
How Do Factor Prices Vary Across Countries?

• The factor price changes predicted by the factor price equalization theorem provide the firm an incentive to undertake the necessary changes in production techniques.

• Profit-maximizing firms will choose to use more of the scarce factor as it becomes relatively cheaper and less of the abundant factor as it becomes relatively more expensive.

• This “economizing” on use of the abundant factor allows the country to specialize in producing the comparative advantage good.
An Alternate View of Factor Price Equalization

- Trade in outputs serves as a “substitute” for trade in factors of production.
  - For example, when a labor-abundant country exports a unit of a labor-intensive good, it indirectly exports labor to a labor-scarce country.
  - Unrestricted trade in either output or input markets can serve as a substitute for trade in the other markets.
Factor Endowments

• International trade - substitute for migration?

• Immigrants
  • Help the economy grow
    • Increasing the size of the labor force
    • Take low skilled jobs few native-born Americans are available to work
    • Take jobs that contribute to the United States being a leader in technological innovation
Factor Endowments

- **International trade**
  - Substitute for the movement of resources from one country to another
    - International movements in resources are not essential
    - International trade in products can achieve the same result
  - Complement labor migration, short and near-long terms
    - Expanding trade – some unemployed workers
      - Forced to seek employment abroad
Factor Endowments

• Specific-factors theory
  • Income distribution effects of trade
    • In the short term
    • When resources are immobile among industries
  • Resources specific to import-competing industries
    • Lose as a result of trade
  • Resources specific to export industries
    • Gain as a result of trade
Specific factor theory

- Looks at the income distribution effects of trade in the short run, when some factor inputs are not mobile among sectors
- Indicates that workers may be better or worse off, depending on preferences
- Predicts that owners of factors used in export industries gain from trade, while owners of factors used in import-competing industries will lose from trade
Labor Market ($W = VMP$)

The diagram illustrates the labor market equilibrium where the wage ($W$) is equal to the Value of Marginal Product ($VMP$). The graph shows the relationship between the wage and the quantity of labor. The equilibrium point ($E$) occurs where the supply of labor equals the demand for labor, represented by the intersection of the $VMP$ curve with the horizontal wage line ($W_T$). The points $L_1$, $L_E$, and $L_2$ represent different levels of labor supply, with $L_1$ and $L_2$ showing points below and above the equilibrium, respectively.
Returns to the owner of each factor
Relative prices and the specific factor model

US computer and steel industries

Wage/$

Labor used in computers

Labor used in steel

Total labor force (30 workers)

14

18

16

12
Other extensions of the theory(1)

• Is inter trade a substitute for migration?
• Specific factor model: Trade and distribution of income in the short-run
• Skill as a source of comparative advantage
Other extensions of the theory (2)

- Overlapping demands (p. 100)
- Intra-industry trade (p. 101)
- Product cycles (p. 103)
- Dynamic comparative advantage - industrial policy (p. 108-109)
- Transportation cost (p. 112)
Economies of scale as basis for trade

Economies of scale

![Graph showing economies of scale with points A, B, and C, and the minimum efficient scale marked.](image-url)
Technology-Based Theories of Trade

• The Product Cycle
  • Technological innovation and new-product development tend to occur in major industrialized economies.
    • Reflects highly educated and skilled workforce, and the relatively high level of R&D expenditures.
  • Primary implication of this theory is that as each product moves through its life cycle, the geographic location of its production will change.
Technology-Based Theories of Trade

• Stages in the Product Cycle:

1. Actual production needs to be located close to consumers so they can provide feedback on its refinement.
   • Only the domestic firm owns the technology, so production occurs only in the firm's home country.

2. Eventually, the firm perfects the product and production accelerates, first for the domestic market and then for export.

3. As production technology becomes standardized, the innovating firm may find it profitable to license its technology to firms abroad.
   • Production may relocate to other countries with lower costs of production.
Technology-Based Theories of Trade

• **Stages in the Product Cycle:**

4. Next, imports rather than domestic production begin to serve the domestic market of the innovating country.
   • The technology has diffused completely.

5. Finally, the product completes its cycle. Although domestic consumption of the good may continue, imports satisfy that consumption.
Overlapping Demands as a Basis for Trade

• Linder suggested that similarities in demand between two countries can form a basis for trade, especially for manufactured goods.

• States that firms typically do not produce goods solely for export – most produce goods for which domestic demand exists.

• Linder argues that for many manufactured goods, the quality of the good that consumers in a specific country demand depends primarily on their income.

• Consumer with higher incomes tend to demand goods of higher quality.
The Product Cycle Model.

Quantity

Stage I  Stage II  Stage III  Stage IV  Stage V

Consumption
Production
Exports
Imports

Time

0  A  B  C  D

The Product Cycle Model.

The Overlapping-Demand Hypothesis

Product Quality

\[ Q^A_{\text{max}} \]

\[ Q^A_{\text{min}} \]

0

\[ I^A_{\text{min}} \]

\[ I^A_{\text{max}} \]

Income

(a) Income Overlap Determines Quality Overlap
The Overlapping-Demand Hypothesis

(b) Quality Overlap Determines Trade

Product Quality

\( Q^B_{\text{max}} \)
\( Q^A_{\text{max}} \)
\( Q^B_{\text{min}} \)
\( Q^A_{\text{min}} \)

Trade

Income overlap

Income

\( I^A_{\text{min}} \)
\( I^B_{\text{min}} \)
\( I^A_{\text{max}} \)
\( I^B_{\text{max}} \)
Free trade under increasing costs

No transportation costs
Transportation costs

Free trade under increasing costs

Transportation costs of $2000 per auto

Diagram showing the effects of transportation costs on the auto market between the United States and Canada.