EE451

Chapter 4:

The Heckscher-Ohlin Model

Basic Assumptions

- 2 countries, 2 homogeneous goods, 2 homogeneous factors of production (relatively different for each country)
- Identical technology in both countries ➔ same production functions
- Constant returns to scale for both commodities in both countries
- The two commodities are produced using **different factor intensities**,
  - and the respective commodity factor intensities are the same for all factor price ratios.

Basic Assumptions

- Identical preferences
- Perfect competition
- Perfect factor mobility within each country, but not between countries
- No transportation costs
- No policies restricting the movement of goods between countries
- No policies interfering market mechanisms determining prices and output levels.

Country's Factor Endowment/ Abundance

- Different ***relative*** (not absolute) factor endowments
- Relative factor abundance may be defined in 2 ways:
  - Physical definition: country I would be the *capital-abundant country* relative to country II if

$$(K/L)_I > (K/L)_{II}$$

  - Price definition: country I would be the *capital-abundant country* relative to country II as long as

$$(r/w)_I < (r/w)_{II}$$

The link between the two definitions

- The physical definition focuses on availability (or supply) of factors. So in a country with large population, it is not surprising that the price of labour is relatively low while that of capital is relatively high.
- However, the price also reflects 'demand for factor', which is derived from demand for outputs. Then an ambiguous link between the two definitions may result.

The link between the two definitions

- Fortunately, the H-O model assumes identical technology and preferences in both countries.
- So the two definitions produce the same result for factor abundance.

Commodity Factor Intensity

- A commodity *x* is said to be factor-K-intensive, relative to commodity *y*, whenever

$$(K/L)_x > (K/L)_y$$

  - *Fixed coefficients of production*

Commodity	Inputs per unit of output		K-L ratio
	Labour (L)	Capital (K)	
Cloth	6	2	
Steel	8	4	

Graphical Illustration of Factor Intensity

- *Variable coefficients of production*

The Heckscher-Ohlin Theorem

- The PPF will differ between two countries solely as a result of their differing factor endowments.
- With a given factor-intensity relationship between final products, the country with abundant capital will be able to produce relatively more of the capital-intensive good, while the country with abundant labour will be able to produce relatively more of the labour-intensive good.

The Heckscher-Ohlin Theorem

- The shape and position of the PPF is thus determined by the factor intensities of the two goods and the amount of each factor available.
- Then two different sets of relative prices will emerge in autarky.
- The trade implication is that TOT must lie necessarily between the two internal price ratios so that both will find themselves better off by trading internationally.

The Heckscher-Ohlin Theorem

- Relationship between relative factor prices and relative product prices establish a basis for and pattern of trade.
- H-O theorem: *A country will export the commodity that uses relatively intensively its relatively abundant factor of production, and it will import the good that uses relatively intensively its relatively scarce factor of production.*

Graphical Illustration of the H-O Theorem

Gains from Trade

H-O in practice

- Violations of H-O assumptions can lead to different behaviour in terms of the commodity structure of trade.
- Empirical test

The Factor Price Equalisation Theorem

- *A contribution of the H-O analysis*
- As trade takes place, prices adjust until both countries face the same set of relative prices.
- Price changes signal producers to alter productions ➔ Δ demand for factors (assuming fixed labour supply) ➔ Δ factor prices.
- The adjustment takes place in both countries.
- Then,

The Factor Price Equalisation Theorem

- *In equilibrium, with both countries facing the same relative (and absolute) product prices, with both having the same technology, and with constant returns to scale, relative (and absolute) costs will be equalised. The only way this can happen is if, in fact, factor prices are equalised.*

The Factor Price Equalisation Theorem

- *That is, trade in goods essentially substitutes for movement of factors between countries, leading to an increase in the price of the abundant factor and a fall in the price of the scarce factor among participating countries until relative factor prices are equal.*

The FPE in practice

- Although logically correct, we do not observe the FPE in practice.
- Transportation costs, tariffs, subsidies, or other economic policies, as well as imperfect competition, different quality of factors, and unemployment contribute to different prices between countries.
- Despite these limitations, it provides some helpful insights into the likely impact of trade on relative factor prices.

The FPE in graph

The Stolper-Samuelson Theorem: Income Distribution Effects of Trade

- When a L-abundant country exports L-intensive product, wage will rise ➔ an increase in labour's total nominal income (given full employment taking place both before and after trade)
- However, ability to consume depends on *real* income, which depends not only on changes in income but also on *changes in product prices*.
  - Workers who consume only the cheaper, imported K-intensive good are clearly ***better off***, since their nominal incomes increase and the price of the K-intensive good has fallen.
  - But it's not clear for those workers who consume only the L-intensive export good.

The Stolper-Samuelson Theorem: Income Distribution Effects of Trade

- The ultimate impact of trade on income distribution depends on relative changes in income and the price of the good consumed.
- In equilibrium, $w = MP * P$. So which is rising relatively more depends on the nature of the Δ MP.
  - If labour is more productive, then $\Delta w > \Delta P$, making real income to be rising.

The Stolper-Samuelson Theorem: Income Distribution Effects of Trade

- With full employment both before and after trade takes place, the increase in the price of the abundant factor and the fall in the price of the scarce factor because of trade imply that the owners of the *abundant factor* will find their *real incomes rising* and the owners of the *scarce factor* will find their *real incomes falling*.
- So it is not surprising that owners of the relatively abundant resources tend to be 'free traders', while owners of relatively scarce resources tend to favour trade restrictions.

The Stolper-Samuelson Theorem: Income Distribution Effects of Trade

- Since individuals often own several factors of production, the final impact of trade on ***personal*** income distribution is far from clear.
- Note: the SS theorem does not involve any comparison between countries.

The Rybczynski Theorem (Trade & Growth)

- An expansion in the endowment of one factor of production raises the output of the commodity that uses the expanded factor intensively and reduces the output of the other commodity.
  - As labour grows, the output of the L-intensive commodity must expand to absorb the extra supply of labour. Given fixed coefficient of production, the output of the K-intensive commodity must decrease in order to release the necessary amount of K.
  - Then, make further impacts on trade & income distribution.
- To be discussed.

Conclusion: the main propositions of the H-O model

- H-O Theorem
- FPE Theorem
- Stolper-Samuelson Theorem
- Rybczynski Theorem

Theoretical Qualifications of the H-O Model

- Recall basic assumptions:
  - 2 countries, 2 homogeneous goods, 2 homogeneous factors of production (relatively different for each country)
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Demand Reversal

- Difference in demand across countries could result in a reverse pattern of trade.
  - A K-abundant country with strong preference for K-intensive outputs can end up with exporting L-intensive outputs and importing K-intensive outputs.

Graphical Illustration of Demand Reversal

Factor Intensity Reversal

- Product that is L-intensive at low level of wage can turn to be K-intensive at higher levels of wage.
- One of the two countries can end up exporting the good that intensively uses its relatively scarce factor.
- So interferes the FPE.

Graphical Illustration of Factor Intensity Reversal

Transportation Costs

- The participating countries will *not necessarily* share the transportation costs *equally*.
- Ultimately, the incidence of transportation cost will depend upon the elasticities of supply and demand in each country.

$$\left.\begin{matrix} E_d^{IM} < 1 \\ E_s^{IM} < 1 \end{matrix}\right\} \& \left.\begin{matrix} E_d^{EX} > 1 \\ E_s^{EX} > 1 \end{matrix}\right\} \Rightarrow t_{IM} > t_{EX}$$

Transportation Costs

- Due to the existence of transport costs, relative product prices do not equalise between countries.
- So relative factor prices will not equalise ➔ FPE breaks down.
- Sufficiently large TC can also prevent trade from taking place. ➔ non-traded good.

Imperfect Competition

- (I) Monopolist acts as a price setter at home, but becomes a price taker on the world market.
  - Can lead to an increased difference between the domestic price and the world price, not a convergence to a single commodity price.
  - Inhibits product price equalisation and thus FPE.

Imperfect Competition

- (II) Monopolist exercising price discrimination to international trade.

Imperfect Competition

Immobile Factors

- Leads to a specific-factor (SF) model
- Assumption: Three factors in the SR.
  - Labour (L): mobile between X and Y.
  - X-type Capital (K_X): specifically used in X.
  - Y-type Capital (K_Y): specifically used in Y.

Immobile Factors

Empirical Tests on H-O Theorem: the Leontief Paradox

- Using I-O table to identify K/L ratios.

$$Leontief\ \ statistic = \frac{(K/L)_M}{(K/L)_X}$$

- According to H-O theorem,
  - a relatively K-abundant country: a L.s. < 1,
  - a relatively L-abundant country: a L.s. > 1.
- Empirical evidence reveals the reverse, which casts doubts on the widely accepted H-O theorem ➔ Leontief Paradox.

Suggested Explanations for the Leontief Paradox

- Demand reversal (Consumption bias)
- Factor intensity reversal
- US tariff structure & trade distortion
- Different skill levels of labour
- Natural resources eg: copper, iron, lead, zinc, and especially oil ➔ the production of these N.R. requires large quantities of physical capital.

Comments on Leontief Test

- Leontief (1954) utilised data in 1947 – the year of postwar reconstruction of the world economy.
- In general, the new studies have reaffirmed the L.P. for the early years but detected that the paradox may have disappeared by the early 1970s

Empirical Challenges to Traditional Theories

- The world trade data contain several empirical regularities (or stylised facts) that appear to be inconsistent with the traditional theories.
- 3 basic stylised facts of world trade
  - Trade among similar economies: eg: trade in Asia where they have similar factor endowments
  - Intra-industry trade: eg: Japan exports Toyota to US and US exports Chrysler to Japan.
  - Trade liberalisation: SS theorem predicts that trade reduces the real income of one factor. But the fact is that a number of former socialist countries have transformed toward market system taking advantage of trade between countries and enjoying increasing in real income.