Factor Endowment and Trade

Heckscher-Ohlin-Samuelson (HOS) model

Heckscher-Ohlin theory

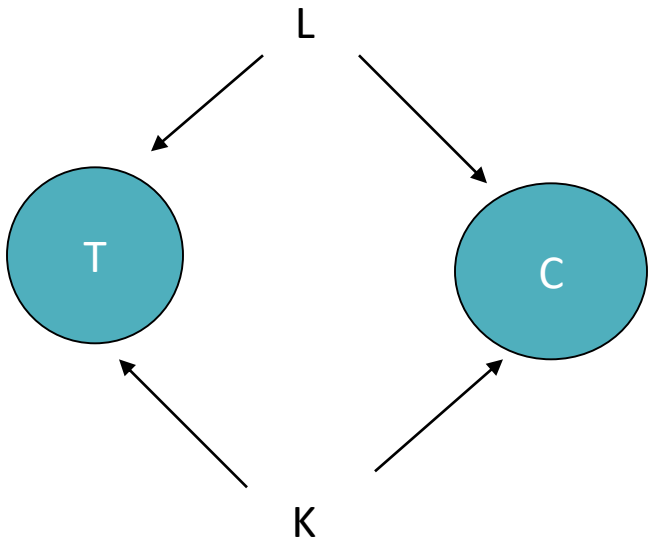
- Formulated by Eli Heckscher (1949) and Bertil Ohlin (1933). Later enriched by Paul Samuelson.

- **HO theorem** states that a relatively labour abundant country will export relatively labour intensive good and import relatively capital intensive good from a capital abundant country.

- A country is said to be *abundant in labour* relative to another country if it is endowed with more labour and less capital than the other. The other country is thus *capital abundant*.

Structure of HOS model

- 2x2x2 structure: two countries (Home country and Foreign country) produce two goods (computers and cotton textiles), using two factors of production, labour (*L*) and physical capital (*K*).



Assumptions

i. Both computers and textiles use the same type of labour and physical capital;
ii. L and K can move freely and without any cost from one sector to another within each country;
iii. Factors cannot move from one country to the other;
iv. All markets are perfectly competitive;
v. Full employment of L and K;
vi. Production technology for each good follows constant returns to scale with diminishing returns to the variable factor;
vii. Each good is produced by the same technology in both the countries;
viii. Production technologies for these goods differ from each other in each country;

Contd.

x. Identical and homothetic taste– rule out demand side;

xi. Computer is *capital-intensive* relative to textiles:

$$k_C > k_T \quad \forall \quad W/r \tag{1}$$

xii. Assume that the Foreign country is relatively capital abundant (or labour scarce) and the Home country is relatively labour abundant (or capital scarce).

$$k < k^* \tag{2a}$$

or equivalently, $l > l^*$ (2b)

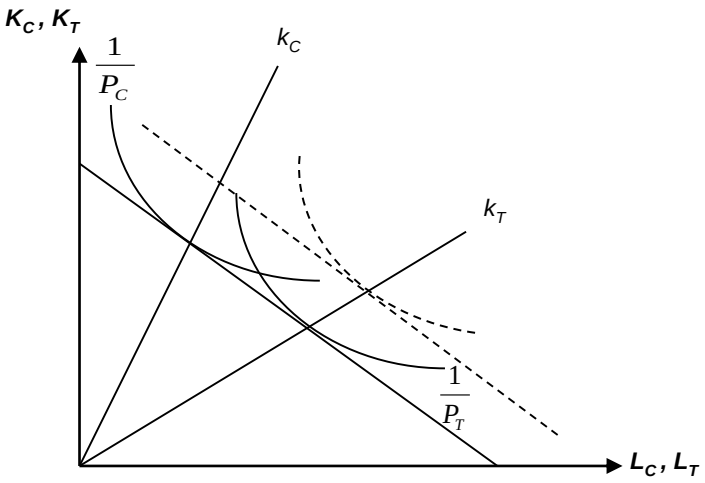


Figure 1: CRS Production Function and Least-Cost Choice of Techniques

The model

Zero profit conditions

$$P_C = a_{LC}W + a_{KC}r \quad (3)$$

$$P_T = a_{LT}W + a_{KT}r \quad (4)$$

Input requirement

$$a_{ij} = a_{ij}(W / r) \quad , \; i = L, K; \; j = C,T \quad (5)$$

$$a_{Lj} \equiv \frac{L_j}{X_j} \qquad a_{Kj} \equiv \frac{K_j}{X_j}$$

Full employment conditions

$$L = a_{LC}X_C + a_{LT}X_T \quad (6)$$

$$K = a_{KC}X_C + a_{KT}X_T \quad (7)$$

The demand side (relevant under autarky)

$D_j = D_j(p_j, y) \qquad , j = C, T$

$y = p_C X_C + X_T$

Walras' Law: $p_C E_C + E_T = 0$

$D_j = X_j , \quad j = C, T$

$a_{ij} = a_{ij}(W^* / r^*) \quad , \quad i = L, K; j = C, T$

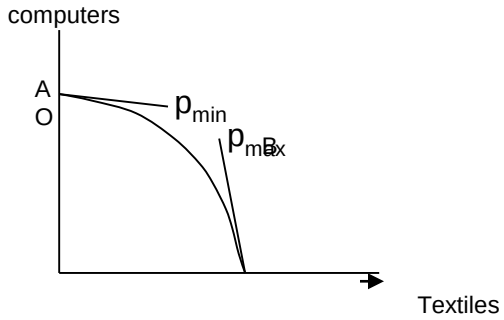


Figure 2: PPC in the HOS Model

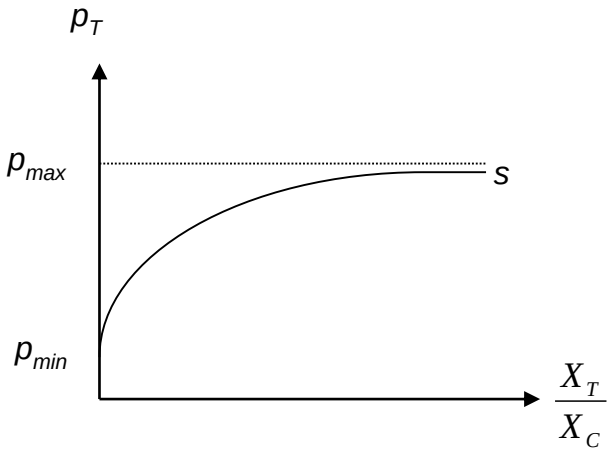


Figure 3: Relative Supply Curve for Textiles in Home Country

Endowment shock and output changes

Proposition 1. Rybczynski theorem or the output magnification effect

If there is a more than proportionate exogenous growth in capital compared to the growth in labour force, then the production of the capital intensive good will increase more than the growth in capital, whereas increase in the production of the labour-intensive good, *if at all*, will be less than proportionate to the growth in labour force.

$$\hat{X}_C > \hat{K} > \hat{L} > \hat{X}_T$$

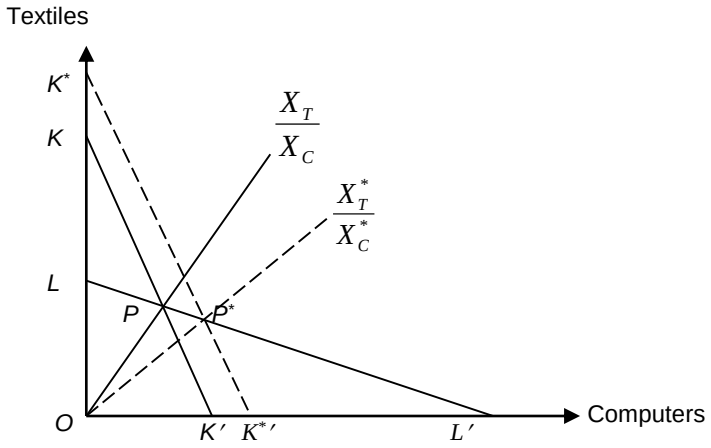


Figure 4: Endowment Difference and Relative Production

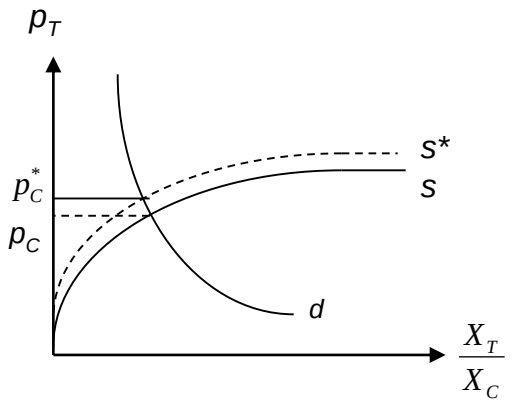


Figure 5: Supply Bias and Pattern of Trade

Proposition 2. Stolper-Samuelson theorem or the price magnification effect

If the price of the capital intensive commodity rises more than proportionate to the price of the labour intensive commodity in a country, then the real return to capital will unambiguously rise whereas the real wage will unambiguously fall.

$$\hat{r} > \hat{P}_C > \hat{P}_T > \hat{W}$$

Proposition 3. Factor Price Equalization Theorem

- Free commodity trade between countries will equalize the factor prices across these countries.
- That means, without any international migration of labour and capital movement, workers will earn the same wage and capital will earn the same return everywhere.

free commodity trade acts as a substitute for factor trade.

Factor prices at the post trade equilibrium

Implications:

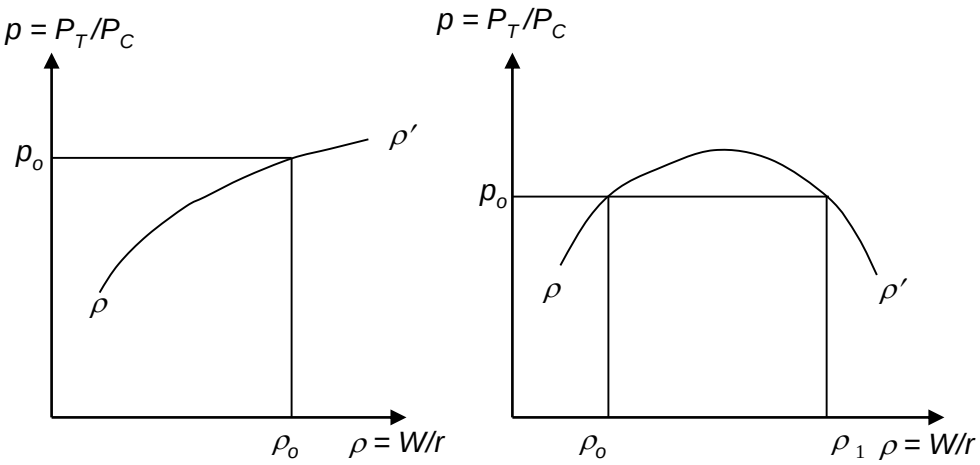
1. Local demand and supply conditions affect commodity and factor prices only indirectly, if at all.
2. Factor endowment conditions matter only indirectly

Local demand or factor endowment conditions are relevant in determining factor prices via affecting world prices, which depends on the country's ability to influence the TOT.

- Hence factor prices in the local market are *solely* determined by the commodity prices.

- Sources of disruption

i. $n < m$
ii. immobility of factors across sectors within an economy
iii. one-to-one correspondence or factor prices being *uniquely* determined by the commodity prices, on the other hand, depends on no factor intensity reversals



a: One-to-One Correspondence

b: Non-Unique Relationship

Figure 7: Correspondence between Commodity and Factor Prices

FPE theorem

- Free commodity trade between countries will equalize the factor prices across countries.
- Even without any international migration of labour and capital movement, workers will earn the same wage and capital will earn the same return everywhere.
- As if the supplies of the scarce factors rise in both countries

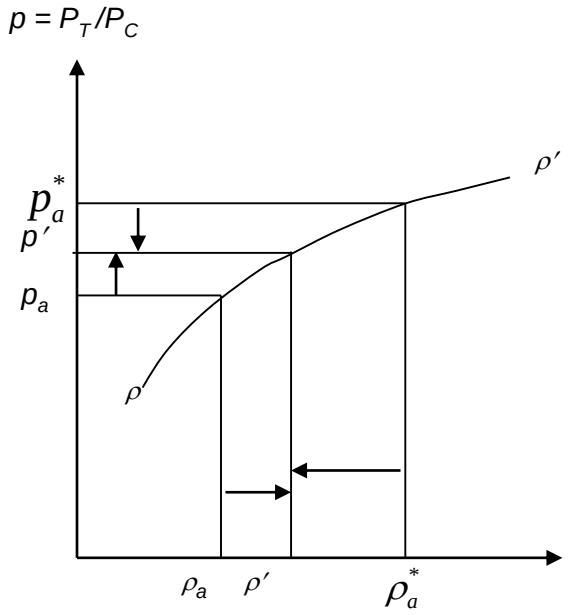


Figure 8: FPE Theorem

Invalidation of the FPE theorem

- If countries completely specialize after trade, like in the Ricardian model;

- If technologies exhibit factor intensity reversals.

The one-to-one correspondence may break down and thus FPE *may* not hold.

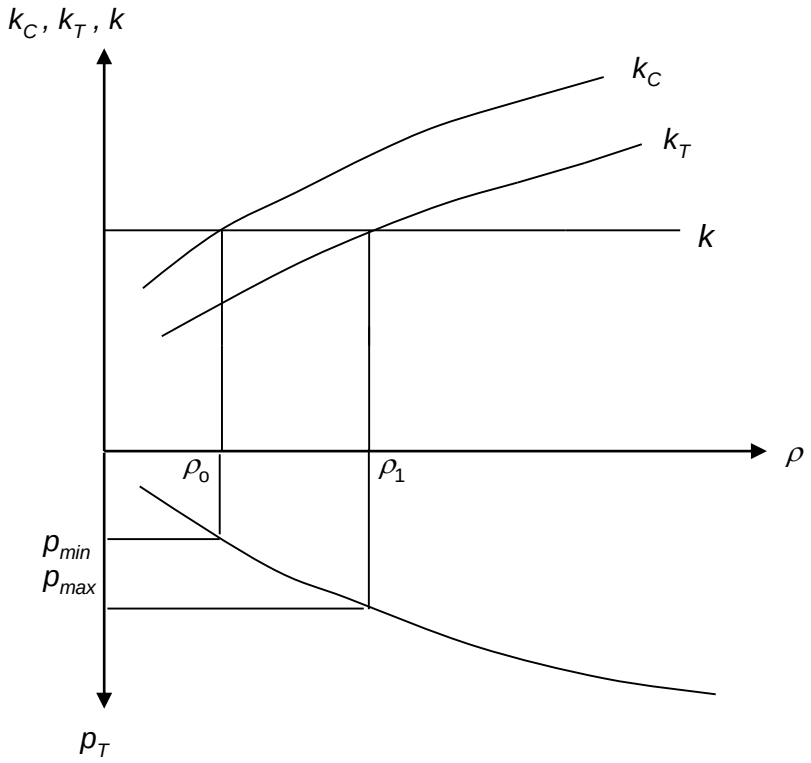


Figure 9: Factor Endowment and Equilibrium Factor Prices

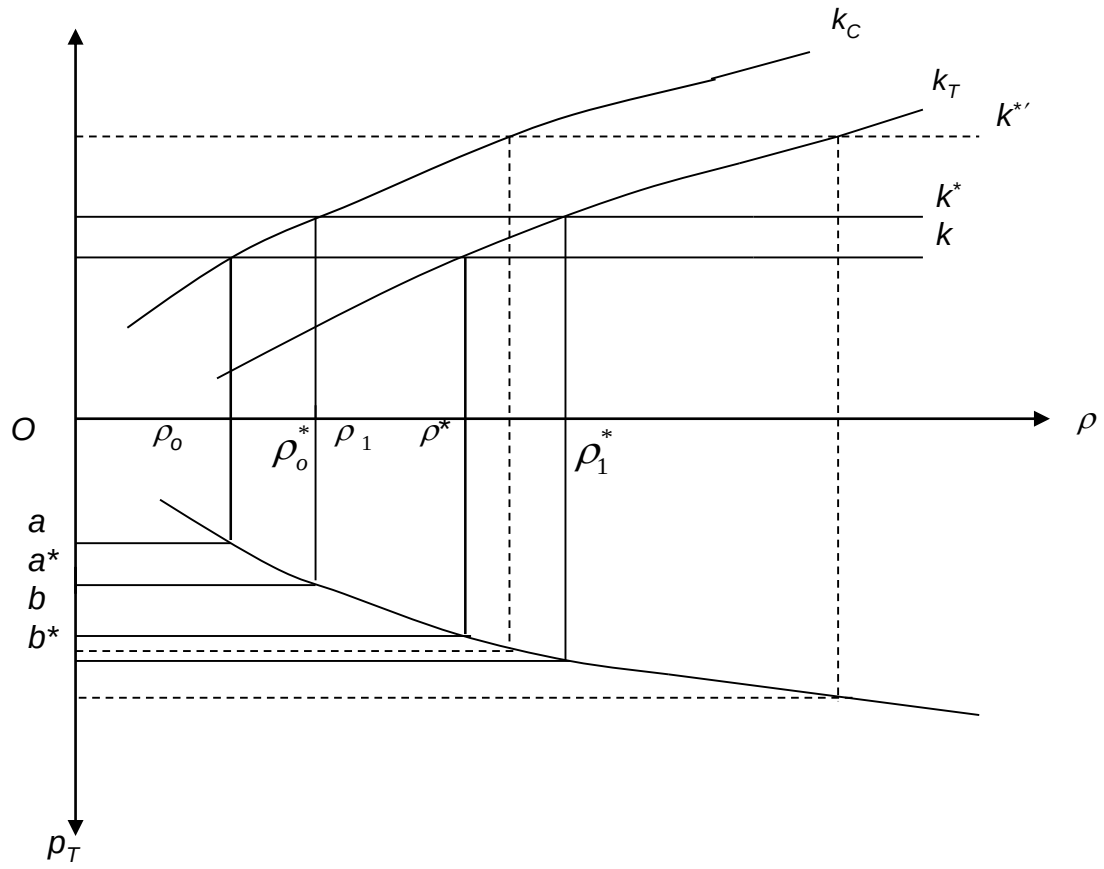


Figure 10: Factor Endowment, Incomplete Specialization and FPE

- As long as factor endowments of countries are not too different in the sense that the range of equilibrium factor prices in the two countries overlap, FPE may hold. Both countries would then be incompletely specialized.

- If endowments are too different to allow for any overlap in their equilibrium factor price range (and hence range of incomplete specialization), the FPE will *never* hold. *At least one country will then be completely specialized*.

FPE under factor intensity reversal

- *Factor intensity reversal per se does not invalidate FPE theorem*. Whether factor endowments are too different to allow incomplete specialization by both countries after trade opens up is what matters the most.

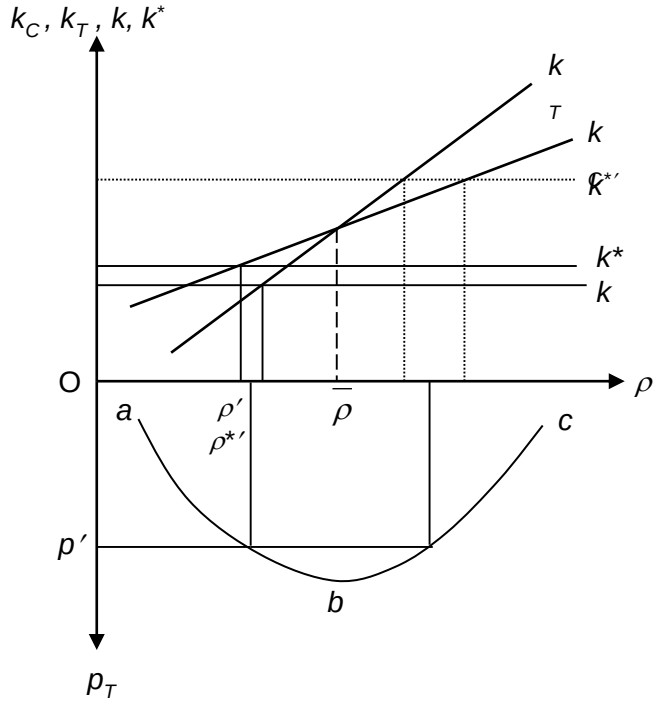


Figure 11: Factor Intensity Reversal and FPE Theorem

- Even with FIR the one-to-one correspondence still holds for all relevant *equilibrium* factor prices leading to FPE.

- But if endowment difference is high the one-to-one correspondence holds for *each* country but breaks down *across* countries, and thereby invalidating the FPE theorem.

- In Figure 11 both the countries may still be incomplete specialized but NOT for the *same* set of equilibrium factor prices. Hence FPE does not hold.

- Therefore incomplete specialization and factor prices being solely and uniquely determined by commodity prices *within* each country is not a sufficient condition for FPE after commodity trade.

- This brings out the importance of the factor intensity reversal.