

Lecture 13

Trade in Factors

1. A gains-from-trade theorem
2. The Jones-Coelho-Easton two-factor, one-good model.
3. The Heckscher-Ohlin Model: trade in goods and factors as substitutes.
Mundell (1957).

Zero trade costs, specialization

Positive trade costs

4. Possible different results in the three-good specific-factors model.
Neary (1995).

5. Trade in goods and factors as complements
Markusen (1983)

Countries differ in technology
Product market distortions
Increasing returns.

6. Home market effects in models with scale economies and transport costs.

A gains-from-trade theorem

Notation:

X - vector of goods, subscript i

p - vector of goods prices

superscript f - free trade

subscript p - production quantities

V^* - factor endowments

V - vector of factors, subscript j

w - vector of factor prices

superscript a - autarky

subscript c - consumption quantities

Producer (profit) maximization

$$(1) \quad \sum_i p_i^f X_{ip}^f - \sum_i \sum_j w_j^f V_{jip}^f \geq \sum_i p_i^f X_{ip}^a - \sum_i \sum_j w_j^f V_{jip}^a$$

$$(2) \quad \sum_i \sum_j w_j^f V_{jip}^f = \sum_j w_j^f V_{jp}^f$$

$$(3) \quad \sum_i \sum_j w_j^f V_{jip}^a = \sum_j w_j^f V_j^*$$

Balance of Trade

$$(4) \quad \sum_i \left[p_i^f X_{ip}^f - p_i^f X_{ic}^f \right] + \sum_j \left[w_j^f V_j^* - w_j^f V_{jp}^f \right] = 0$$

Autarky market clearing

$$(5) \quad X_{ip}^a = X_{ic}^a$$

Substitute (2), (3) and (5) into (1). Replace three terms with $\sum_i p_i^f X_{ic}^f$ from (4)

$$(6) \quad \sum_i p_i^f X_{ic} \geq \sum_i p_i^f X_{ic}^a$$

Free trade consumption is revealed preferred to autarky consumption

Jones, Coelho and Easton

Simplest case:

One good, X

Two factors of production, L and K

Two countries, h and f.

World Edgeworth Box.

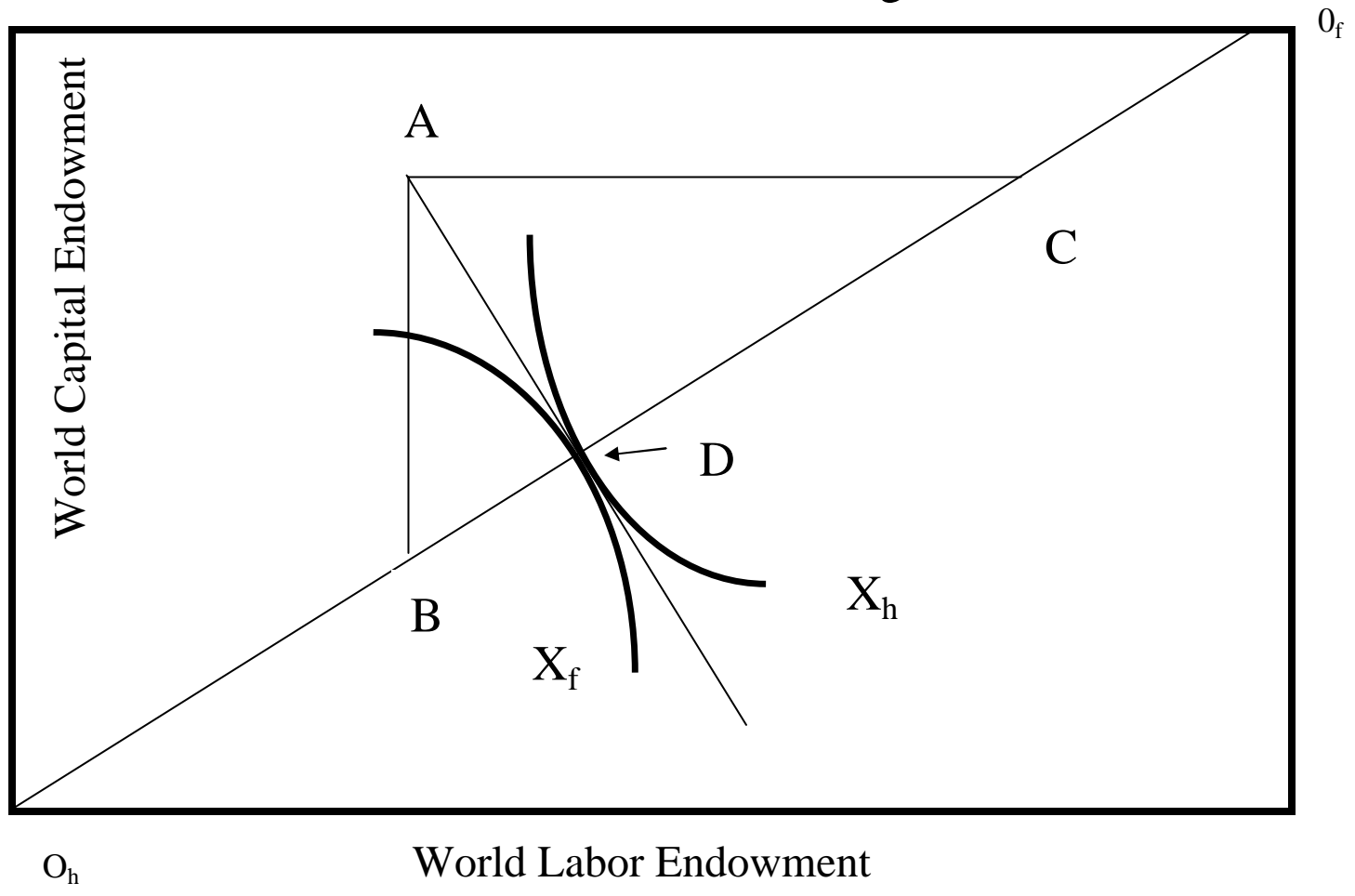
Total dimensions are the total world endowments of labor and capital.

Any point in the box is a division of the world endowment between country h and country f.

Country h is measured from the Southwest corner and country f from the Northeast corner.

E is the endowment point (h is capital abundant and f is labor abundant).
Trade is to a final equilibrium at point A, the consumption point.

Jones, et. al., two factors, one good



Consider the trade from E to A. Three ways to do this.

1. h exports capital, imports labor (E directly to A)
2. h exports capital (E to C), imports X (C to A).
3. h imports labor (E to B), exports X (B to A).

All three are equivalent in welfare terms. Wage rate and return to capital are the same.

Implications for the trade account.

Merchandise account: balance of trade in X only.

Current account: balance of trade in X and in factor services.

Option 1: No trade in goods, merchandise account balances

Option 2: Deficit in the merchandise account. Government nervous, critics ask "why are we importing this stuff, why can't we make it at home?".

Option 3: Surplus in the merchandise account. Critics ask, "why are we letting in these foreigners who are taking jobs from our own people?".

Complications:

Congestion effects. In fact there is at least one additional factor, land. Importing people creates effects not present with the other two. Immigrants also demand public services, etc.

Factor trade and commodity trade as substitutes

Heckscher-Ohlin Model

1. Factor prices are equalized by trade and there is no reason to add factor trade to commodity trade.
2. Countries are sufficiently different such that they are specialized in trade: then each country has a relatively high price for its scarce factor, the factor used intensively in its import competing industry.

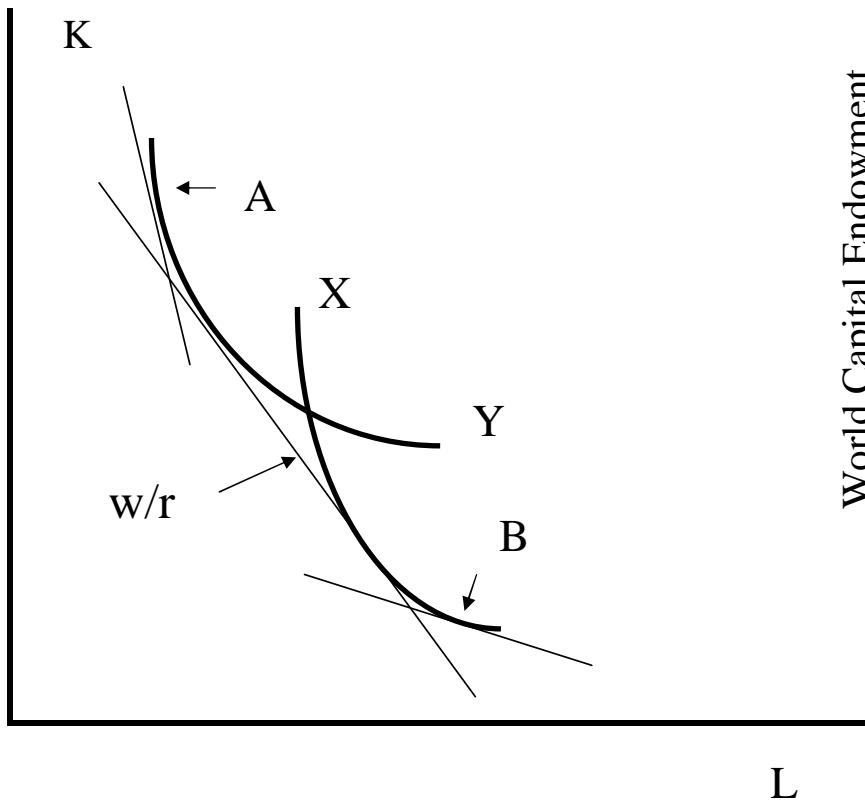
Allowing factors to move implies that relative factor endowment differences will be reduced and in general trade will be reduced.

3. Trade barriers prevent commodity prices from being equalized, and so factor prices are not equalized.

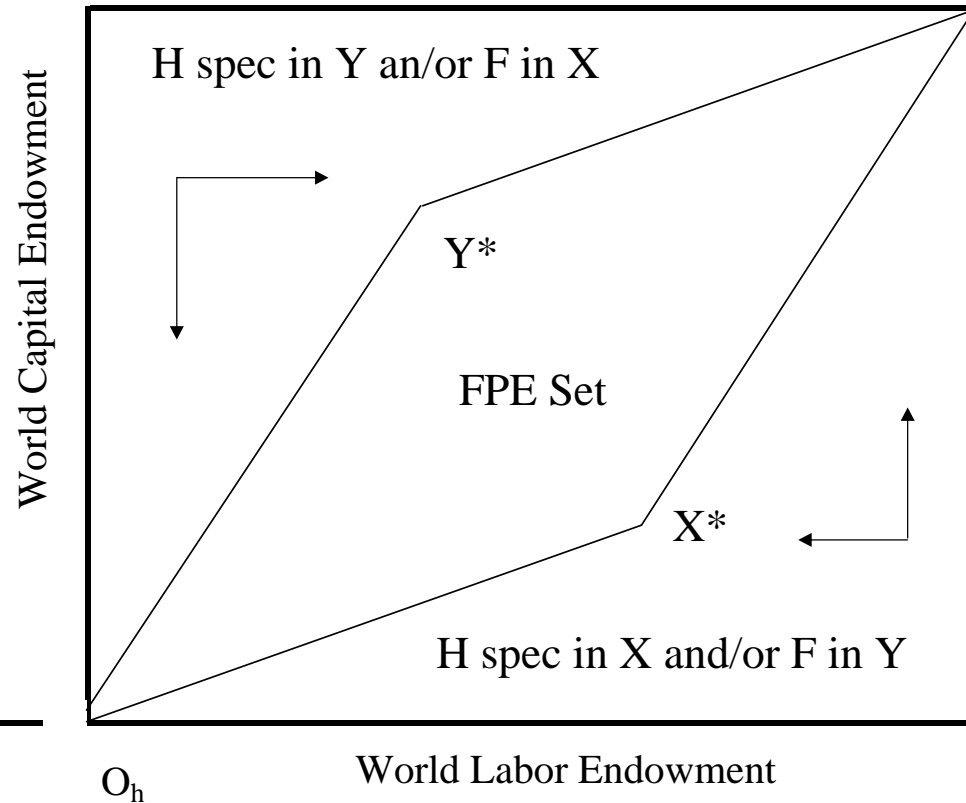
Each country has a relatively high price for its own import good, and thus a relatively high price for its scarce factor (Stolper-Samuelson theorem).

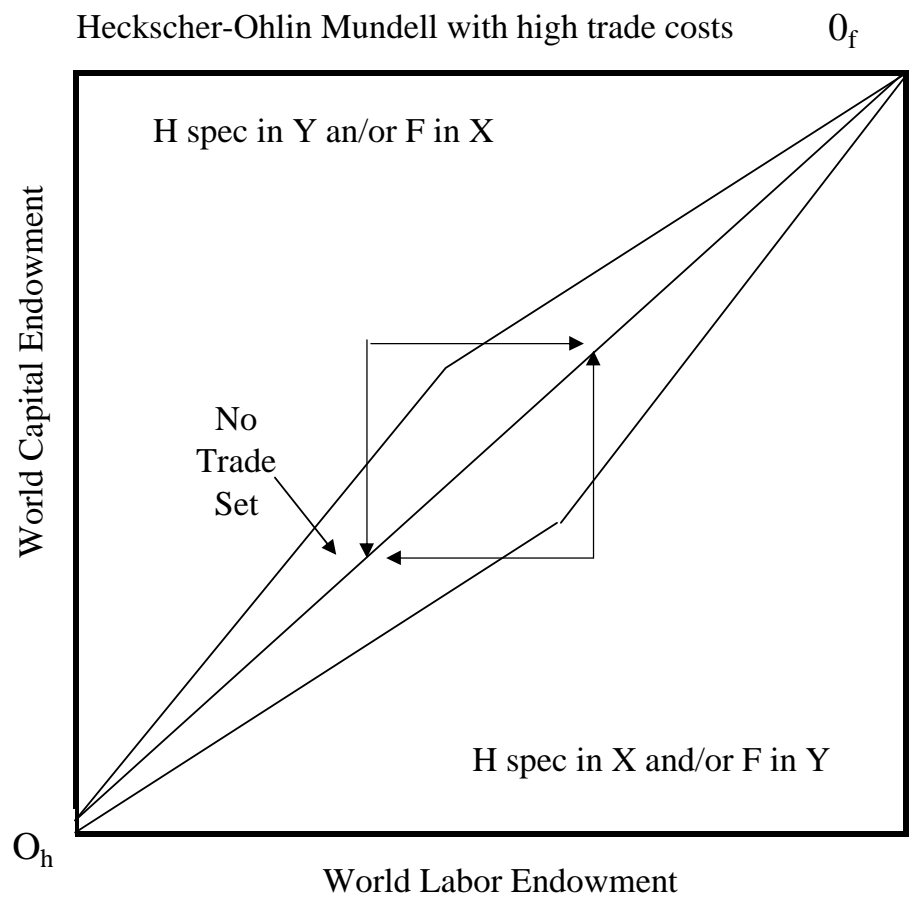
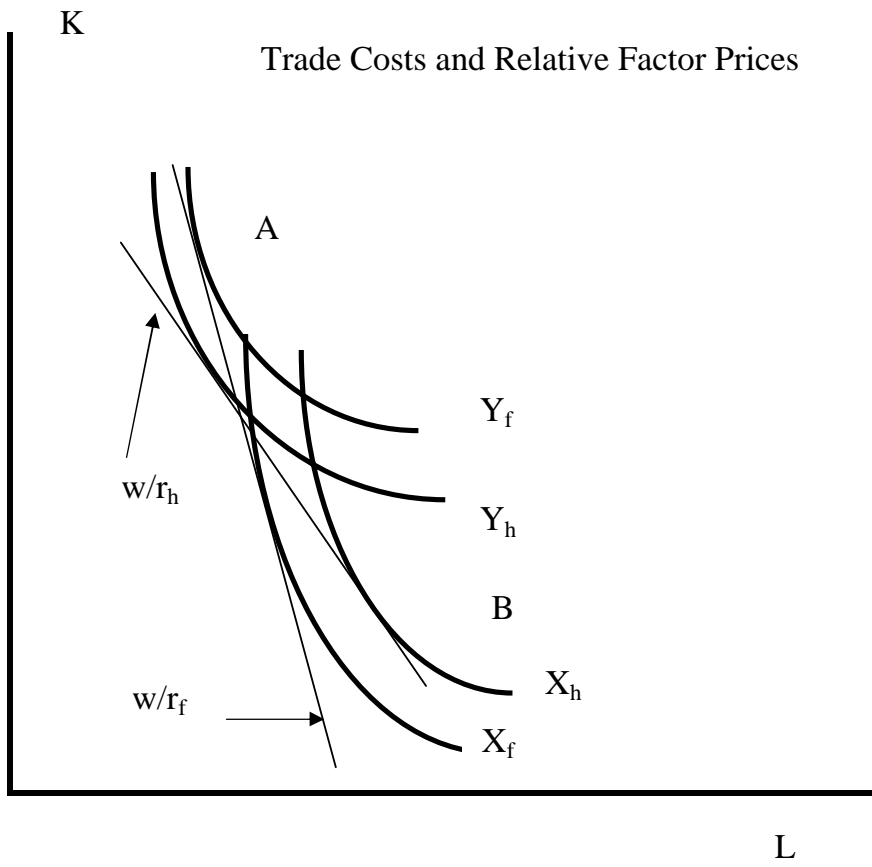
Factor trade tends to equalize relative endowments and thereby reduce or even eliminate trade.

Specialization and Relative Factor



Heckscher-Ohlin with zero trade costs O_f





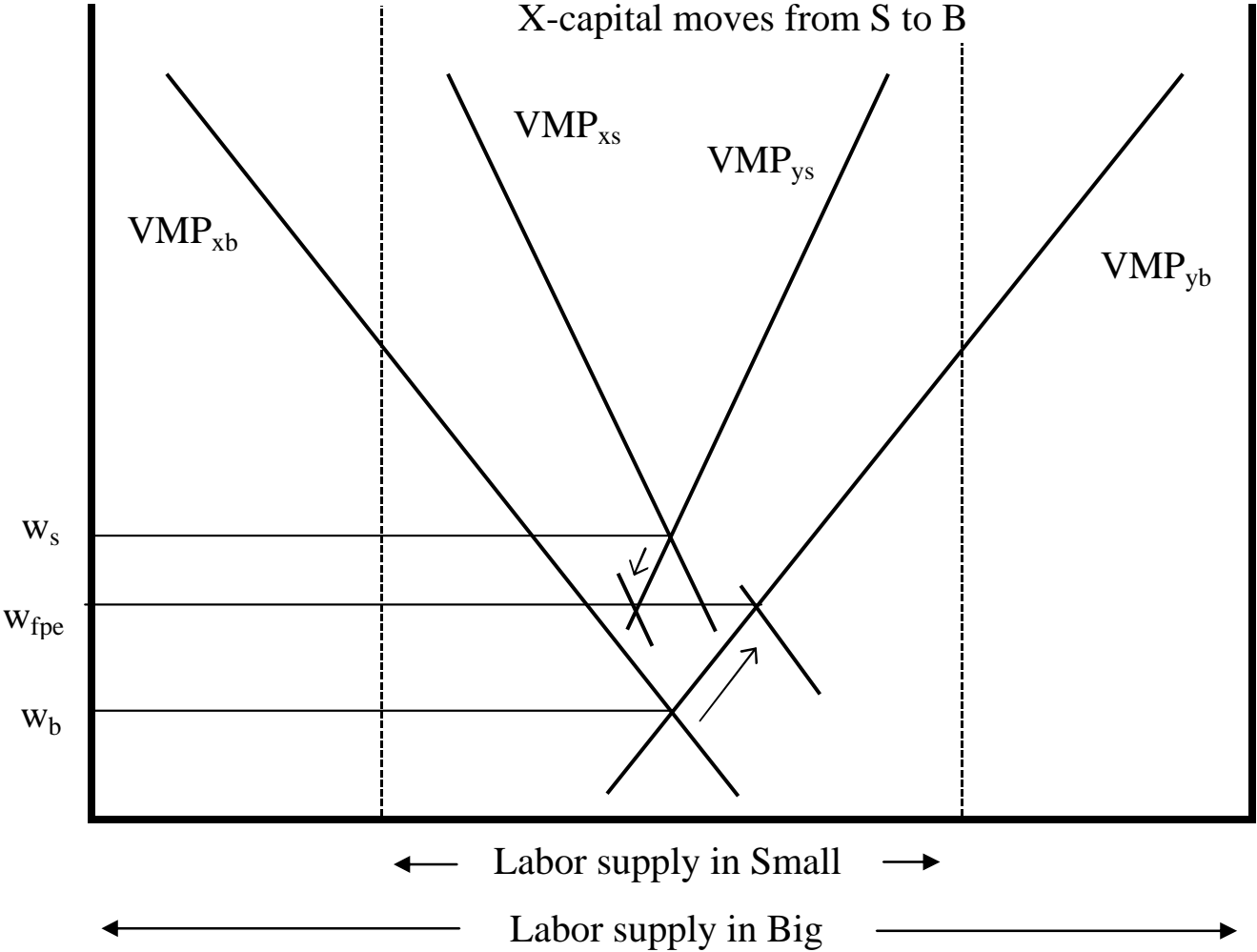
Factor Trade and Commodity Trade as Complements

1. Specific-factors model. Suppose that the two countries have identical stocks of the two specific factors, but one has more labor.

Assume that the production functions in the two sectors are identical, except for which specific factor they use. Then there will be no trade initially.

But the prices of the two specific factors will be higher in the country with more labor. If we let one move, it will make the specific factor endowment unequal across countries and create a basis for trade.

Example of Compelementarity: Specific-Factors Model
 Countries have identical K_x and K_y stocks, different L_s .



2. Differences in technology: add Ricardo to Heckscher-Ohlin.

Suppose that country h has a superior technology in Y, the capital intensive sector.

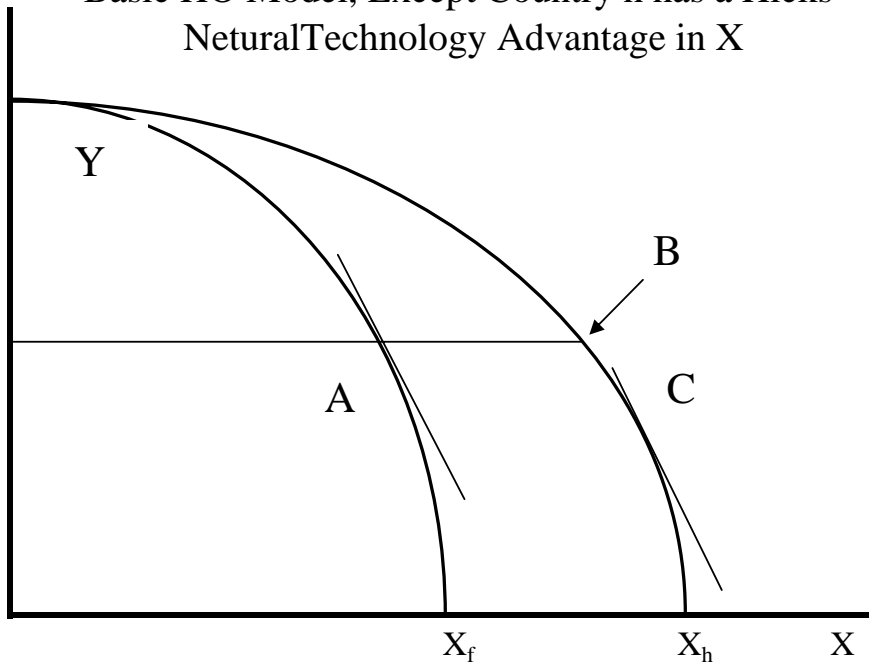
But suppose that countries have equal relative endowments of both labor and capital.

Country h will produce relatively more Y in free-trade (in goods) equilibrium. But this will bid up the price of capital in country h.

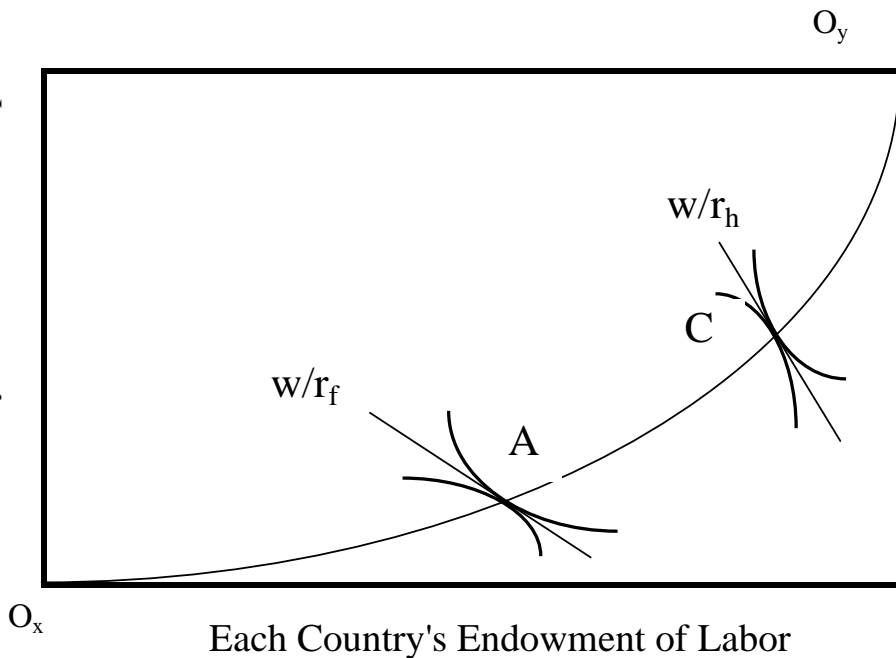
Then capital should flow to country h until all X is produced in country h.

If Silicon Valley has a higher productivity in computer hardware and software, then engineers will move there. They may move from where they are scarce to where they are abundant.

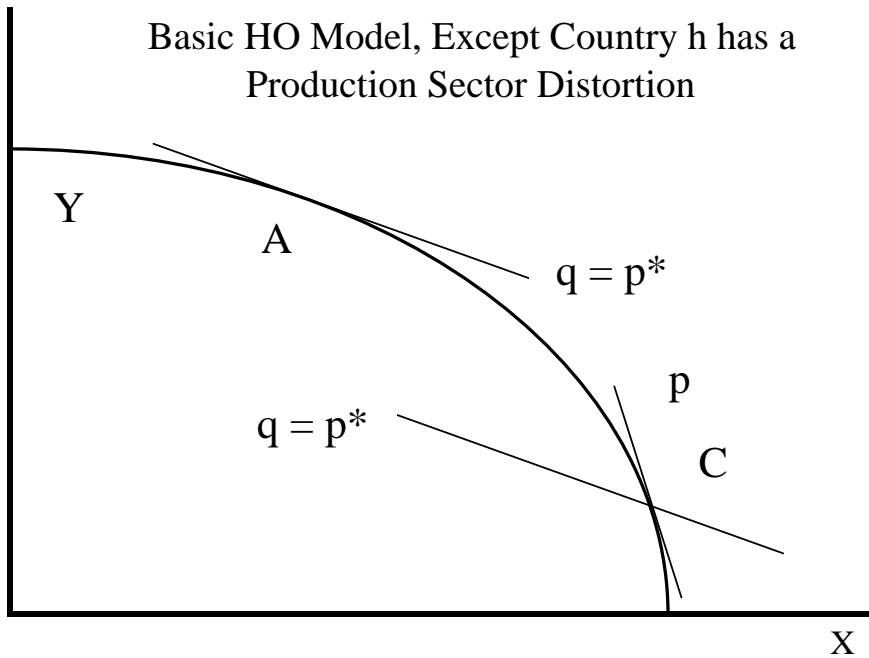
Basic HO Model, Except Country h has a Hicks-Neutral Technology Advantage in X



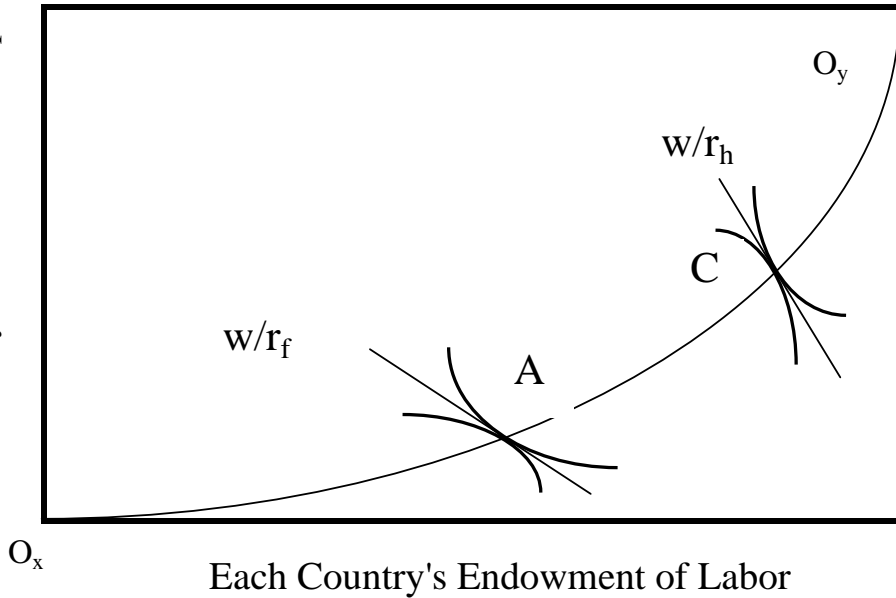
Each Country's Endowment of Capital



Basic HO Model, Except Country h has a Production Sector Distortion



Each Country's Endowment of Capital



3. Production taxes or imperfect competition

Suppose that we have two identical economies. Country f is undistorted. Country h has a production tax on Y, a production subsidy on X, or imperfect competition in the Y sector.

Then the producer price ratio (p_x / p_y) will be higher in country h. Country h will export X and country f will export Y.

By the Stolper-Samuelson theorem, the price of the factor used intensively in X will be higher in country h, and vice versa for the factor used intensively in country f.

If one factor is allowed to move, it will move toward the country which is exporting the good using that factor intensively, and so increase the volume of trade.

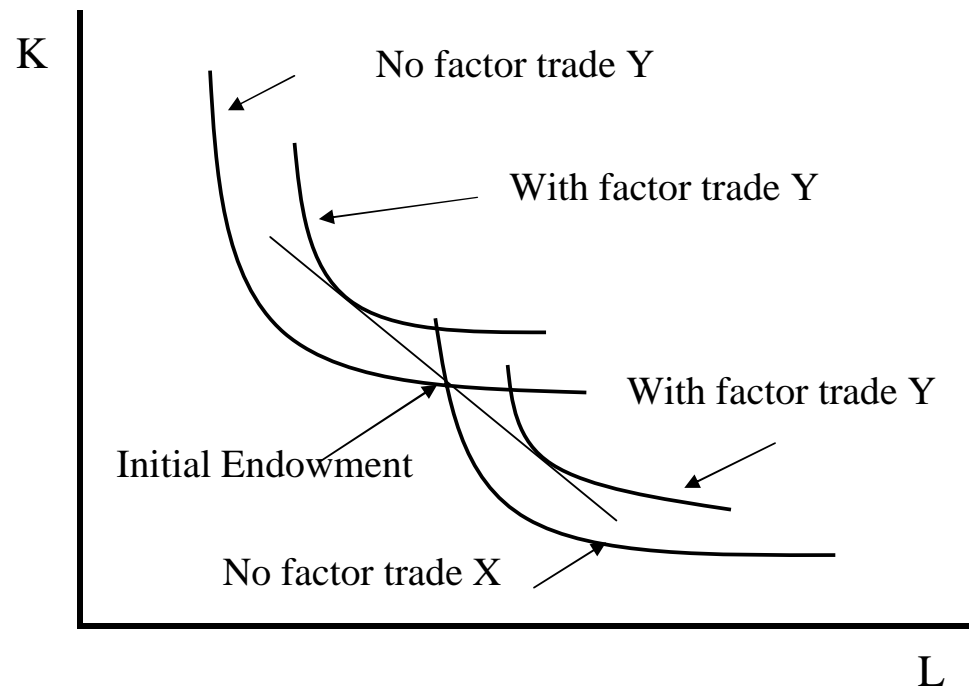
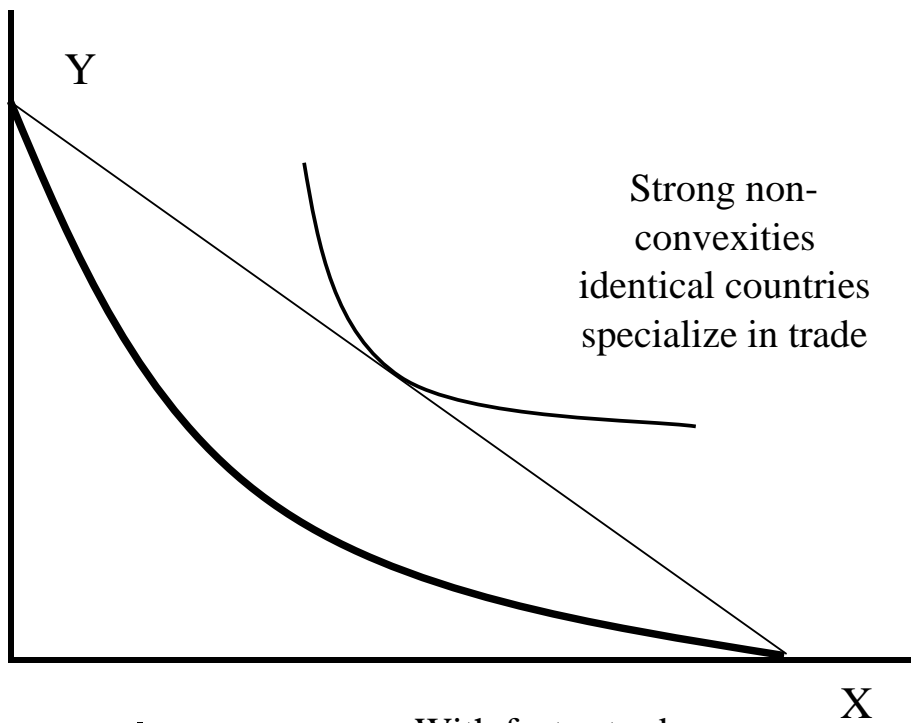
4. Increasing returns to scale

Suppose that two identical non-convex economies specialize. The economy that specializes in the capital-intensive good will have a relatively high price for capital and vice versa for the country specializing in the labor-intensive good.

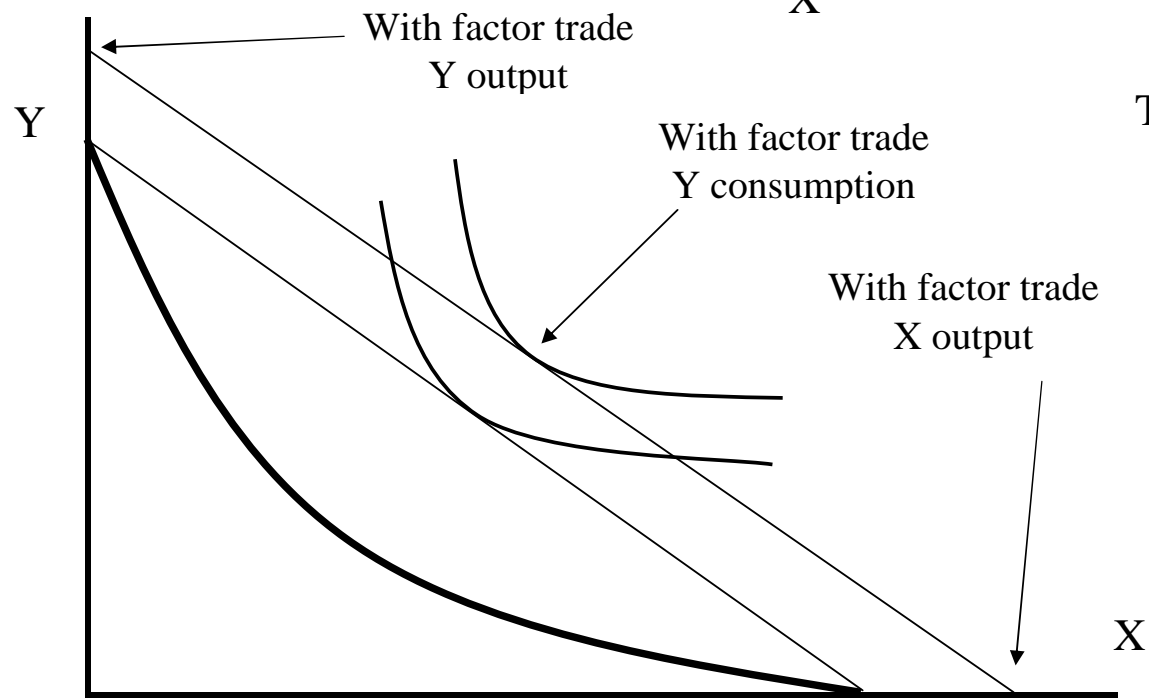
Then capital will flow to the country specializing in the capital intensive good, expanding that sector further. Factor trade can make the initially-identical country different in relative endowments.

A related proposition can also be derived in the external-economies model where countries are non-specialized, but one country is bigger.

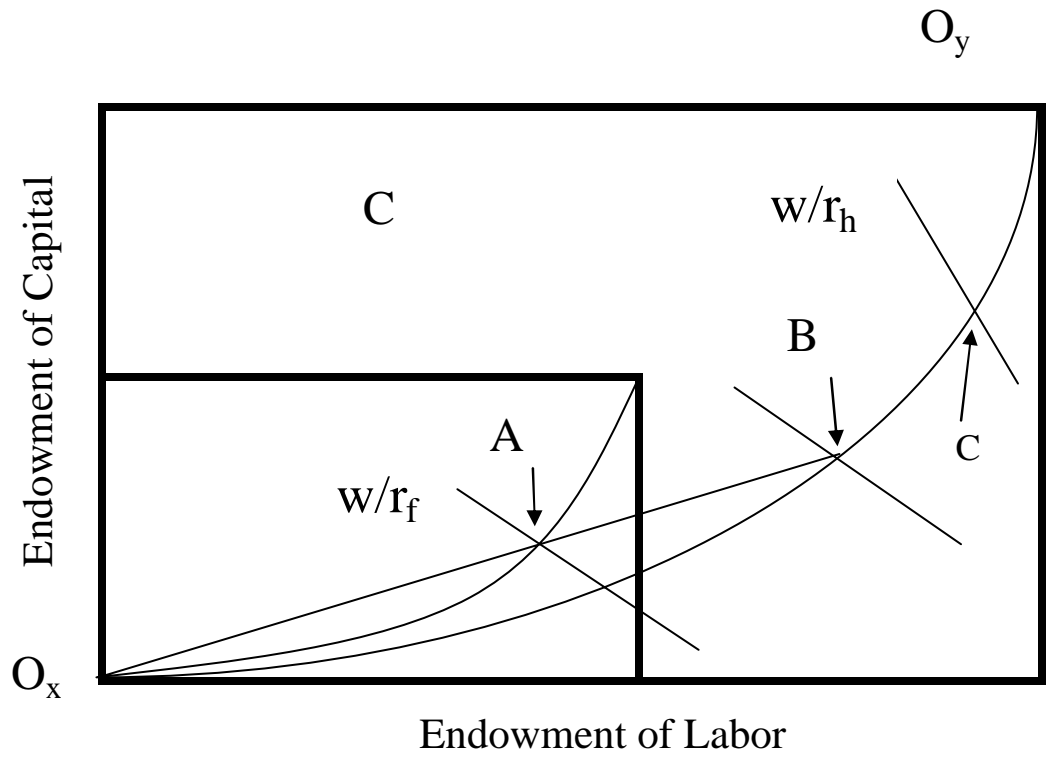
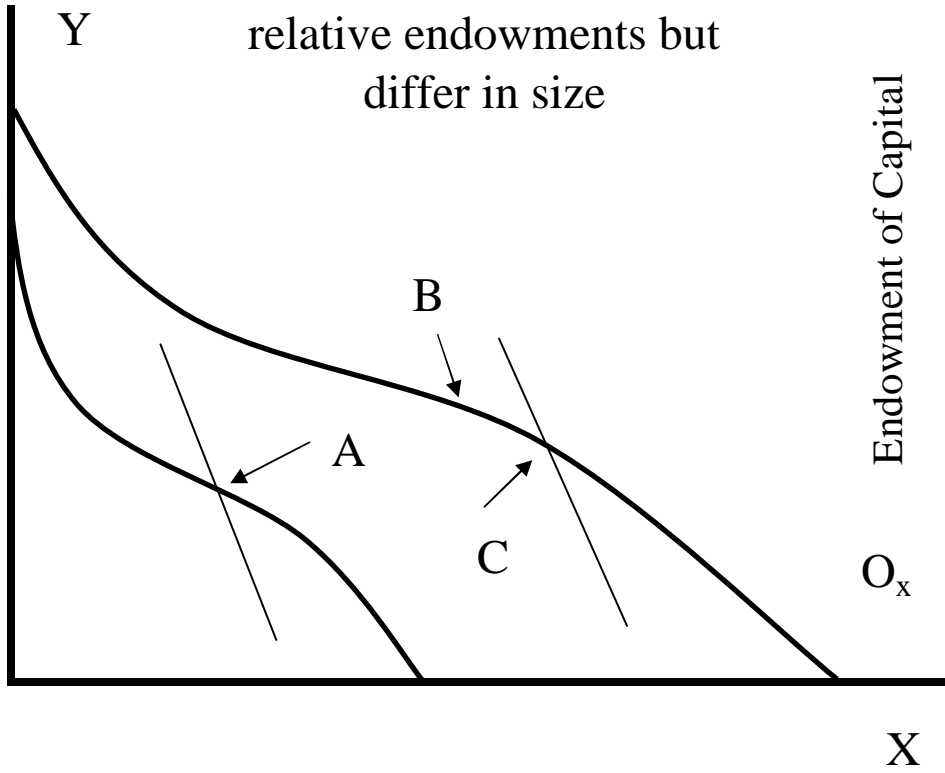
The important point of all these examples is that allowing trade in factors may make countries more different rather than more similar as in the HO model



Two-Good, Two-Factor Model with Strong Scale Economies



External economies of scale,
countries have identical
relative endowments but
differ in size



Other Cases Involving Scale Economies

1. Krugman, 1981 single-factor monopolistic-competition model with transport costs. Large country has lower price index, so the real wage is higher in the large country. Labor migration would lead to a divergence in country size.
2. Class notes: oligopoly with free entry and trade costs. Larger country has higher output per firm, lower price, and a higher real wage. Labor migration would lead to a divergence in country size.
3. These results seem to extend to multi-factor models. Markusen-Venables 2001, two-factor monopolistic-competition model with trade costs.

If countries have equal relative endowments, larger country is relatively specialized in IRS goods (X), and has a higher price for these goods. It then follows that the larger country has a relatively high price for the factor used intensively in the X sector, its export sector.

For equalization of commodity prices and relative factor prices across

countries, the larger country must be relatively well endowed with the factor used intensively in the X sector (call it capital). But it is the bigger country so that its price index is lower than the small country's index. Thus if relative factor prices are the same in both countries, then the real prices of both factors (nominal prices divided by the price index) are higher in the large country.

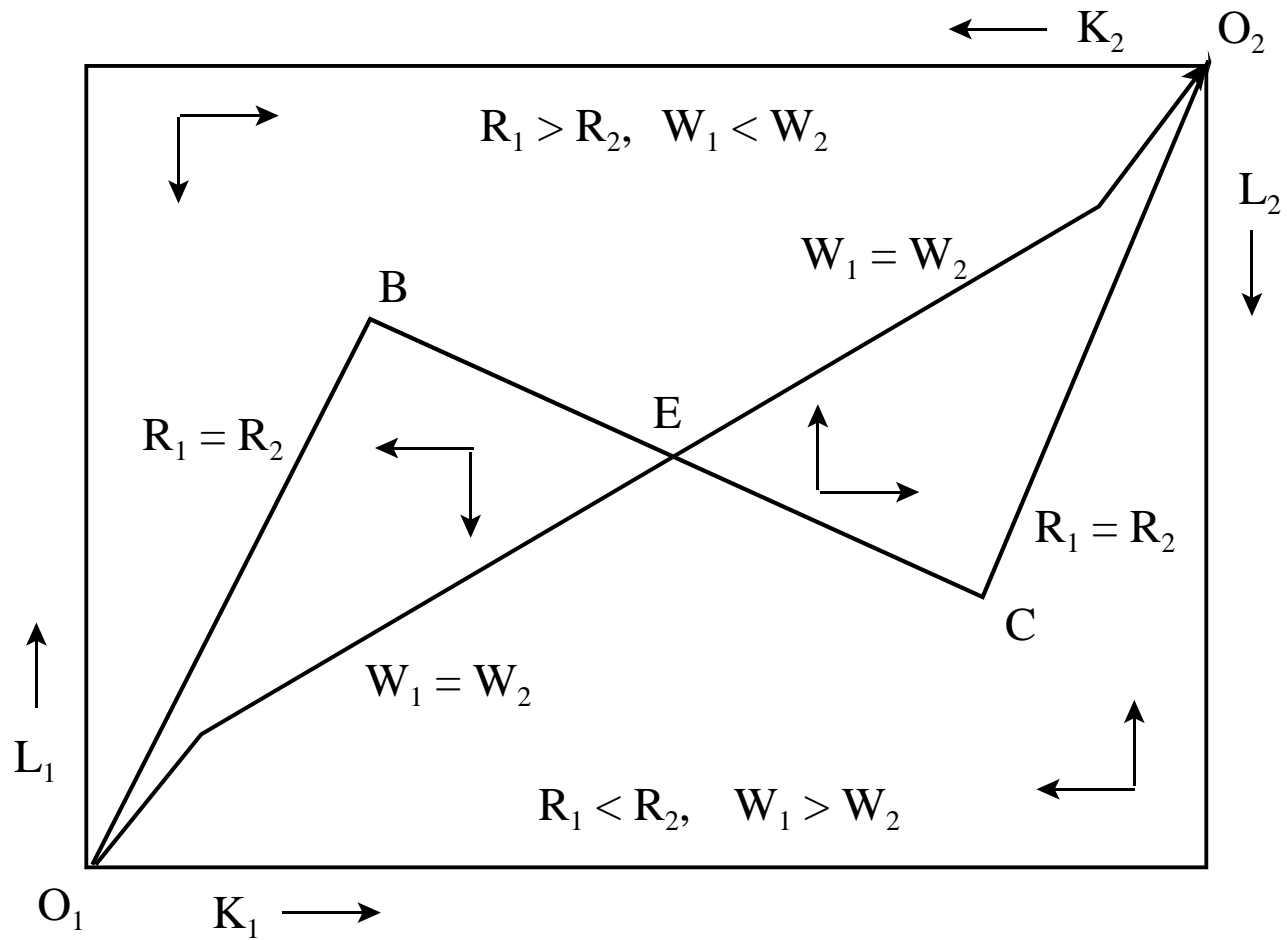
$$e_i = \left[N_i p_i^{1-\sigma} + N_j (p_j t)^{1-\sigma} \right]^{\frac{1}{1-\sigma}} \quad (15)$$

If $w_i = w_j$, $r_i = r_j$ and country i is bigger.

$$w_i / e_i > w_j / e_j \quad r_i / e_i > r_j / e_j$$

Here is the diagram from Markusen and Venables (2001)

The arrows indicate the direction that factors would move in if they were mobile. Note the regions where the real price of both factors is higher in country 1 (or 2).



Markusen & Venables JIE 2000, Figure 8: Factor mobility and agglomeration

Factor Trade, Multiple Equilibria, Agglomeration - Summary Points

1. In the traditional Heckscher-Ohlin-Mundell framework, trade in goods and factors are substitutes. Factor prices may be unequal between countries for either of two reasons: (1) endowments are very different (outside the FPE set), (2) there are costs to trading goods.
2. In either case just mentioned, each country must have a relatively high price for the factor used intensively in its import industry. Allowing factors to move reduces the difference in the relative endowments of the two countries.
3. Exceptions to this simple logic can be produced even in constant returns, competitive models, which was illustrated by the specific-factors example.
4. Other bases for trade typically reverse these findings (if countries have identical relative endowments initially). These include differences in technology, product market distortions, and scale economies. Each country has a high price for the factor used intensively in its export sector. Factor trade would make countries more different.

5. In range of model, trade costs create "home market effects". The larger of two countries will have an advantage in the increasing returns sector, leading to a higher real price for labor in single-factors models. This creates an agglomeration tendency if factors could move.
6. The same results can be extended to multi-factor models. The factor used intensively in the increasing-returns sector has a higher return in the large country. Trade in factors then leads to agglomeration of the sector and to a divergence in country size.
7. Such an effect occurs in the Cournot model with free entry: the larger country has more firms, lower markups, more output per firm, and hence higher price for the factor used intensively in the IRS sector, and possibly for both factors.
8. A similar effect occurs with differentiated goods produced with constant markups and firm scale. The price index is lower in the larger country, leading to higher real factor prices.