

Heckscher-Ohlin Model; Monopolistic Competition

Study Questions: (not to be handed in)

Heckscher-Ohlin Model

1. What does this model assume about the use and mobility of factor inputs within an economy and how is that different from the Ricardian and Specific Factors models?
2. What is the difference between factor abundance and factor intensity?
3. What determines relative demands for factors in a single industry versus relative demands for factors in the economy as a whole?
4. What is the Rybczynski theorem? What is the Stolper-Samuelson theorem?

Scale Economies

1. Define constant returns to scale (CRS), increasing returns to scale (IRS), IRS internal to the firm, IRS external to the firm.
2. What are some sources of increasing returns to scale internal to the firm, and what are some sources of increasing returns external to the firm (external economies of scale)?
3. Which of these (CRS, IRS internal, IRS external) have we assumed in all our models in class so far (Ricardian, Specific Factors, Heckscher-Ohlin)?
4. How do external scale economies help explain the existence and size of cities?
 - a. Given these reasons, why doesn't everyone live in one enormous city?

Monopolistic Competition (chp 6)

1. Define intra-industry trade. Why is it a puzzling phenomenon when viewed from the perspective of the Ricardian, Specific Factors, or Heckscher-Ohlin models?
2. Why do firms create distinct varieties of similar goods? Given this, what prevents the existence of an infinite number of subtly different distinct varieties?
3. How does the number of varieties and price of each variety relate to the size of the market in which they are being sold?
4. How does international trade affect the number and price of goods?
5. How are the gains from trade in this model different from what we discussed in the Ricardian, Specific Factors, and Heckscher-Ohlin models?

Monopoly Pricing.

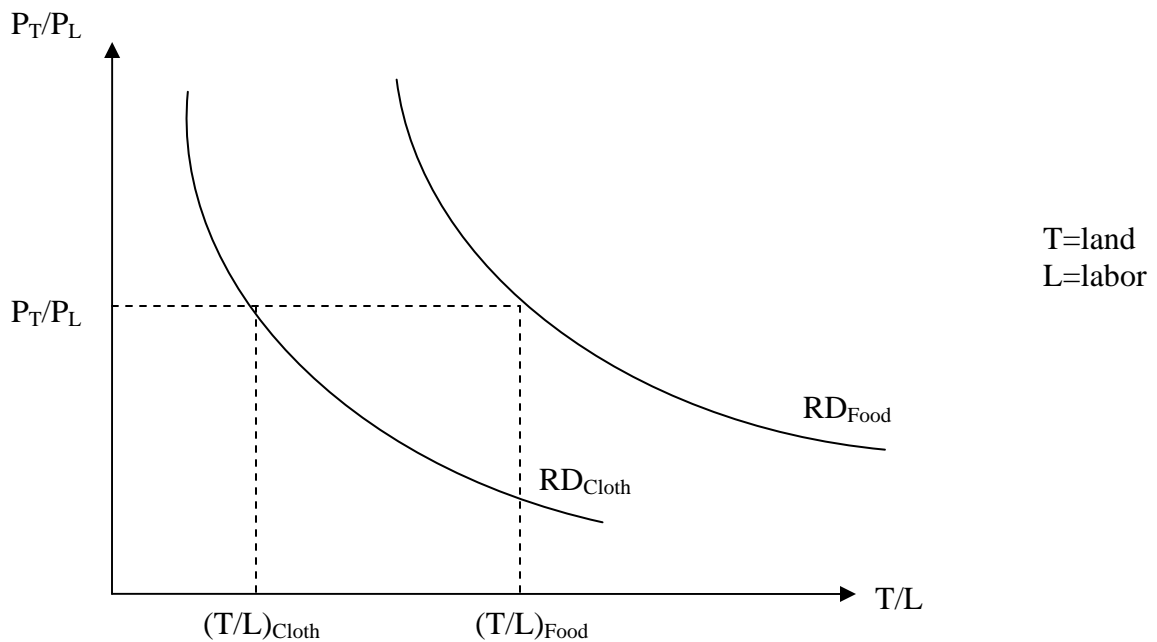
1. Define marginal revenue.
 - a. How is MR different for a competitive firm and a monopolist?
 - b. Why is this important for a monopolist's pricing decision?
2. Explain how a monopolist chooses quantity to maximize profits. The last part of this answer is an equation for optimal price setting.
3. Given the optimal price equation, what are some reasons that optimal prices vary across different markets internationally?
4. Related, explain why pharmaceutical firms charge higher prices in the US market than in Europe or in Canada.
 - a. What policies might correct this?
 - b. Would such a policy obviously be a good thing for consumers?

Questions to be handed in.

Q1-6. Suppose that Home is endowed with 600 hours of labor and 300 acres of land. Foreign is endowed with 300 hours of labor and 300 acres of land. At current factor prices in Home, one yard of cloth is produced using 20 hours of labor and 5 acres of land, and one ton of food is produced using only 5 hours of labor and 10 acres of land. Both countries have the same production technology.

In autarky

1. Draw the relative demand curves showing how Home will choose input techniques for food and clothing depending on price of land / price of labor. (just show where they are in relation to each other, and use the information above).

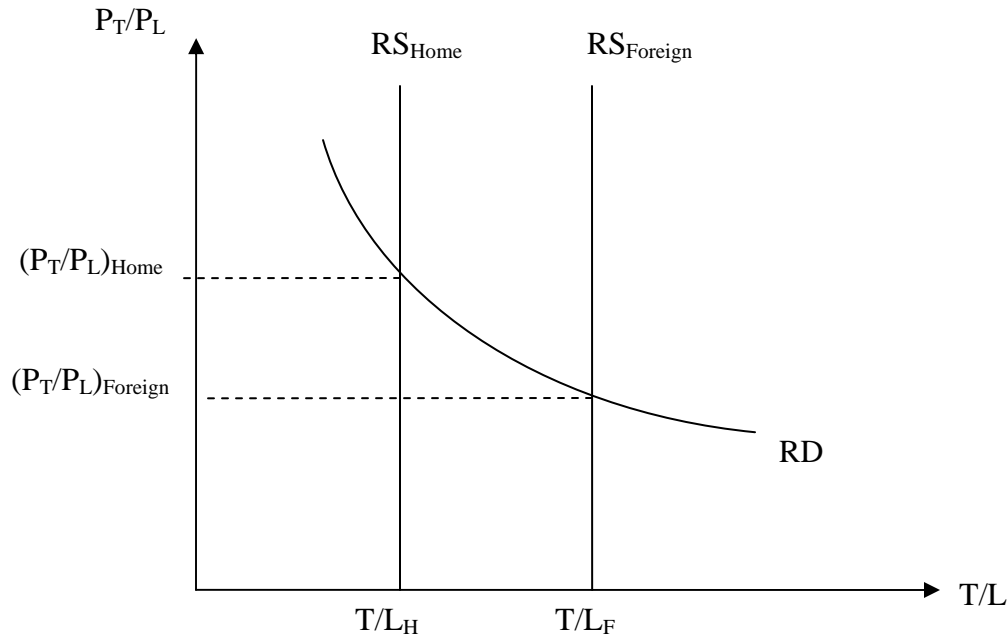


The RD curve for both sectors slopes downward.

From the information given on factor input requirement, cloth production is labor intensive and food production is land intensive. This implies that at each relative price of land/labor (P_T/P_L), the quantity demanded of land relative to labor is lower in the clothing sector than in the food sector. As a result the RD curve for food is to the right of the RD curve for cloth.

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2. Assume Home and Foreign initially produce the exact same mix of goods. Draw the relative supply and relative demand for land/labor in the two places. Compare the price of land/ price of labor in Home versus Foreign.



The aggregate RD curve for Home and Foreign is a weighted average of the RD curves for each sector. Since both countries produce the exact same mix of goods and they have the same technology, then aggregate RD curve is going to be identical in the two countries.

The RS curves are vertical lines, since factors are supplied inelastically.

$$\text{Home: } \frac{T^H}{L^H} = \frac{300}{600} = 1/2$$

$$\text{Foreign: } \frac{T^F}{L^F} = \frac{300}{300} = 1$$

Since $\frac{T^F}{L^F} > \frac{T^H}{L^H}$, Foreign is land abundant country and its relative supply curve RS lies to the right of the RS for Home.

As a result, the equilibrium relative price of land P_T/P_L is higher in Home than in Foreign.

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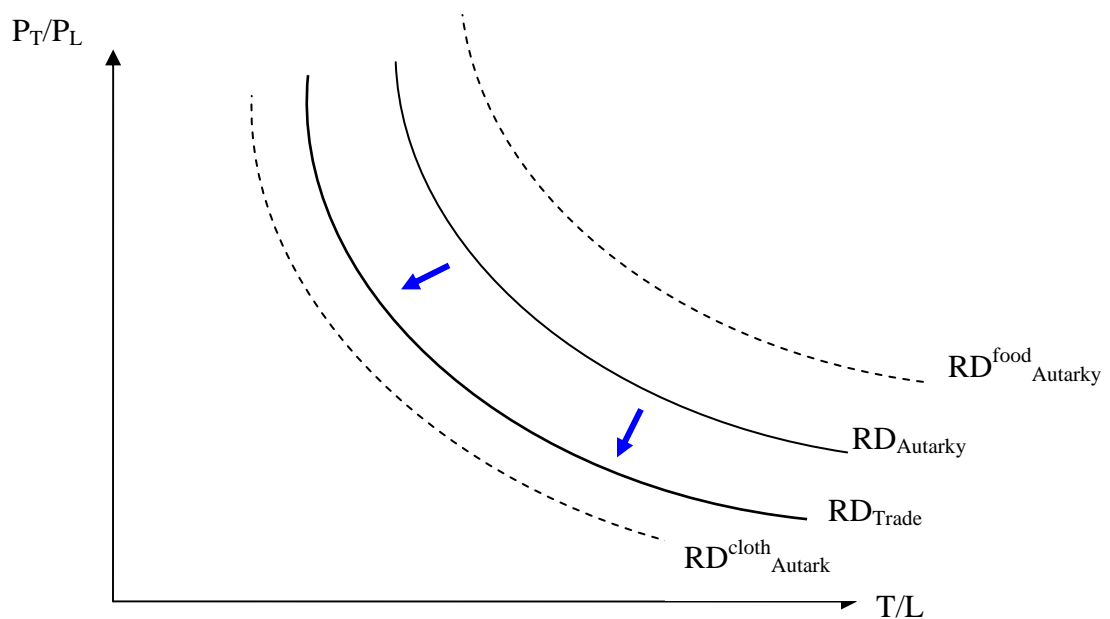
3. In autarky, will Foreign use the same mix of land/labor to produce cloth as in Home, or will it use more or less?

Both Home and Foreign have access to the same production technology.

But given that the relative price for land/labor in Foreign is lower than in Home, Foreign will prefer to use more land and less labor to produce cloth.

Free Trade

4. Draw the economy-wide relative demand for land/labor in Home under autarky and under free trade. How has that changed?



Home is the labor abundant country, so under free trade Home will export cloth.

As Home specializes in cloth, it demands less land relative to labor. This implies a decrease in the aggregate relative demand for land, which is equivalent to a shift to the left towards the RD curve for cloth (see Q1).

5. As a result of the move from autarky to free trade, what happens to the price of land / price of labor in each country?

Under free trade, Home is specializing in cloth (based on factor abundance). As a result the relative price of cloth/food rises in Home. Given that cloth production is relatively labor intensive, the price of land / labor will decrease in Home (i.e. P_T/P_L will decrease). This can be noticed from the graph in Q4, if one draws the vertical RS curve.

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Under free trade, Foreign specializes in food according to its relative factor abundance. This drives down the price of cloth/food, which in turn increases the relative price of land/labor.

Note that as a result of free trade the factor prices in the two countries converge.

6. As a result of the move from autarky to free trade, what happens to the choice of input technique used to produce cloth and food in Foreign?

Since the relative price of land/labor increases, Foreign will use less land and more labor in producing both goods.

Scale Economies

Motion Computers produces memory chips and competes in a monopolistically competitive industry. To make memory chips it must incur fixed research and development costs of $F = \$10$ million and marginal costs per chip of $c = \$5$. The demand facing Motion Computers is given by

$$Q = S \left[\frac{1}{N} - b(P - \bar{P}) \right]$$

where $S = 100$ million chips is total industry sales, N is the number of firms making computers, $b = 0.1$ measures the sensitivity of sales to prices, P is the firms' price and \bar{P} is the average industry price.

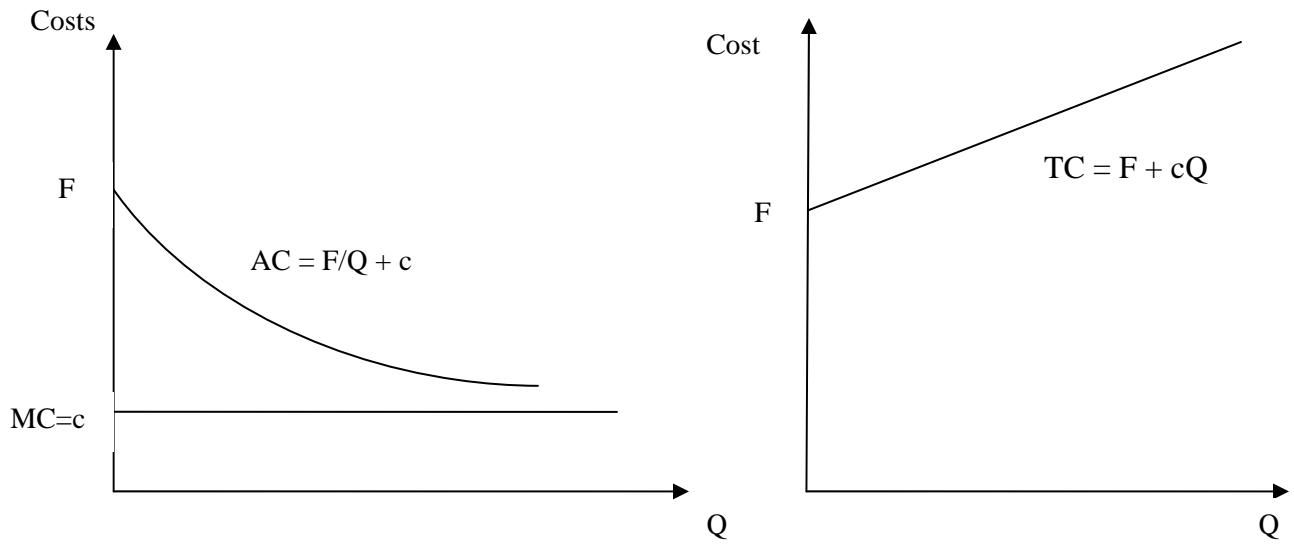
7. Show graphically how the total costs, average costs and marginal costs for Motion Computers depend on the level of its sales.

Marginal cost: $MC = c$

*Total cost: $TC = \text{fixed cost} + \text{marginal cost} * \text{quantity} = F + cQ$*

Average cost: $AC = TC/Q = F/Q + c$

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8. How many computers does Motion have to sell to break even (make zero profits) if a. price is a 10% markup over marginal cost.

$$10\% \text{ markup over } MC = (1+0.1)c = \$5.50$$

To break even:

$$\text{Profits} = PQ - cQ - F = 0$$

$$(P-c)Q = F$$

$$Q = F/(P-c) = 10\text{million}/(5.5-5)$$

so they need to sell 20million computers to break even.

b. price is a 50% markup over marginal cost.

$$50\% \text{ markup} = (1+0.5)*5 = \$7.50$$

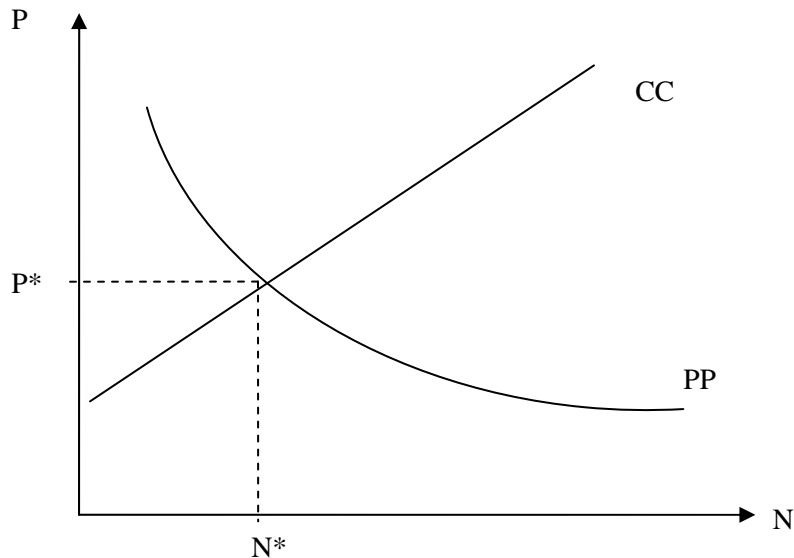
To break even they need to sell $Q = F/(P-c) = 10\text{million}/(7.5-5) = 4\text{million}$.

Suppose there are N total firms like Motion computers in the United States, facing the same cost structure and same demand curves. If the US is in autarky ($Q=10$),

9. Show in a graph how product prices and average costs for each firm depends on the total number of firms in the US laptop industry (dollars on the vertical axis, number of firms on the horizontal axis). Label the price curve PP and the average cost curve CC.

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If all N firms are identical in terms of demand and cost structure, then $P = \bar{P}$, and so the demand becomes $Q = S/N$.



a. explain why each curve slopes this particular way.

The CC curve slopes upward because as the number of firms N increases, the demand faced by each firm decreases. This means that each firm can sell less than before, making the average fixed cost higher (i.e. F/Q increases). As a result AC increases, and therefore the slope of the CC curve is thus positive.

The PP curve is downward sloping. The reason is that as new firms enter (i.e. N increases), there is more competition on the market and so each firm must charge lower markups over marginal cost in order to sell.

b. Discuss the economic significance of the intersection point of PP and CC , and the significance of points to the left and to the right of the intersection point.

All the points on the horizontal axis between the origin and N^* correspond to a region where $P > AC$. In such a case firms earn positive profits and so keep entering. As new firms enter the market, the price decreases and at the same time as the average cost increases. When $P = AC$, firms just break even and so no other firm wants to enter the market. This is the point that determines the equilibrium price and number of firms in the market.

All the points to the right of N^* correspond to a region where $P < AC$. This means that profits are negative and so firms do not want to stay in the market any more (i.e. firms exit).

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10. Solve for the number of firms operating in the US laptop market and the optimal price and quantity of memory chips Motion will sell.

The expression for the average cost is:

$$AC = F/Q + c$$

Substituting in the AC formula the demand Q faced by each firm we obtain:

$$AC = F/(S/N) + c = N*(F/S) + c = N*(10/100) + 5 = N/10 + 5$$

The price of computers is given by:

$$P = c + Q/S$$

Since in our case $Q = S/N$, the expression for the price of computers becomes:

$$P = c + 1/bN = 5 + 10/N$$

Set $P = AC$ and you get

$$N/10 = 10/N \quad \text{or} \quad N^2 = 100 \quad \Rightarrow \quad N = 10$$

Plugging back into the price expression you get

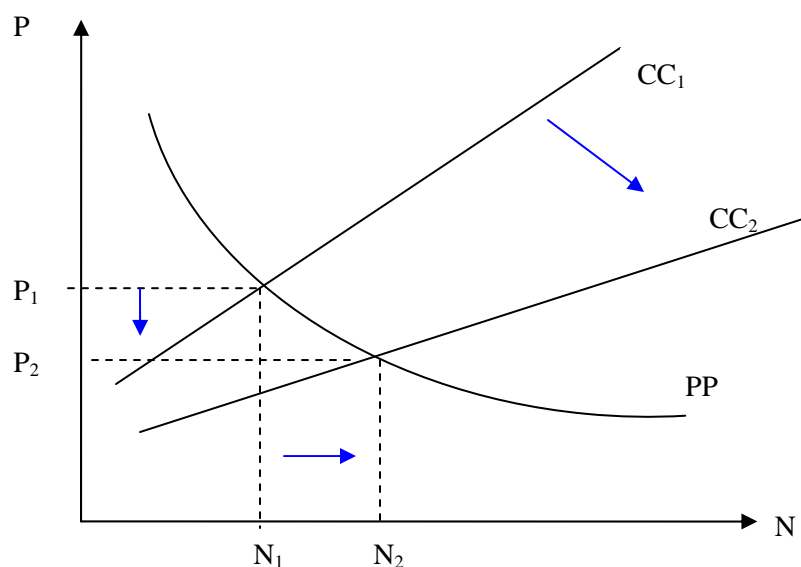
$$P = 5 + 1 = 6$$

Then the quantities sold become $Q = S/N = 100/10 = 10$ million units.

Check zero profit:

10 million units at \$1 markup per unit = fixed costs.

Now the US opens up to free trade. Both US and foreign chip makers face the same demand and cost structure and can compete equally in all markets. Total worldwide industry sales of memory chips $S = 225$ million.

11. Redraw the autarky PP and CC curves and show graphically how they change as a result of the move to free trade.

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As a result of the move to free trade, the market size S increase since firms can sell the computers both domestically and abroad. As firms can sell more units, the average cost decreases, leading to a shift to the right in the CC curve (from CC_1 to CC_2).

At the same time, as a result of the market increase, the number of firms N rises from N_1 to N_2 . This increases the market competition, forcing firms to reduce their mark-up. Therefore price drops from P_1 to P_2 .

12. Solve for the number of firms operating in the world market, and prices and quantities sold for each firm.

Similarly to Q10:

$$AC = N * (\text{fixed cost/sales}) + c = N * (10/225) + 5 = N/22.5 + 5$$

$$P = c + 1/bN = 5 + 10/N$$

$$\text{Set } P=AC \Rightarrow N/22.5 = 10/N \quad \text{or } N^2 = 225 \Rightarrow N = 15$$

Plugging back into the price expression we get

$$P = 5 + 1/1.5 = 5.66$$

Then the quantities sold become $Q = 225\text{million} / 15 = 15\text{million units}$.

a. If the US has half of the world's firms, does trade lead to a rise or a fall in the number of firms producing in the US market?

If the US has half of the world's firms, it means that the number of firms in the US is 15/2. So trade leads to a fall in the number of firms producing in the US market.

b. At the new price, can Motion break even? If so, how?

The profit condition for Motion becomes:

$$PQ - cQ - F = (P - c)Q - F = (0.66) * 15\text{million} - 10\text{million} = 0.$$

Note that the mark-up for Motion drops from \$1 per unit to \$0.66 per unit. But at the same time the quantity of computers sold increases from 10million units to 15million units. The increase in quantity is a result of selling computers to foreign markets.

13. Explain why trade may be beneficial. How is this different from the gains from trade in the Ricardian or Heckscher-Ohlin models?

By allowing countries to trade, the consumers can buy more varieties (remember that as a result of opening up for trade the number of firms selling goods increased to $N_2=15$). Such gains from trade arise as a result of increased market competition (which lowers firms' markups), and of increased economies of scale (which is possible because

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each firm can spread fixed costs over more units of sales). These mechanisms are different from Ricardian or Heckscher-Ohlin models, where the gains from trade came from comparative advantage (sourcing goods from the lowest marginal cost suppliers).