

ECON 3224 International Economics
Problem Set 1 – Part 2 Solutions

Solutions to MCOs (Part 2)

1. d
2. b
3. e
4. a
5. d

Problem 1. In this question we will try to relate the Heckscher-Ohlin model and the Ricardian model. Hence, the equilibrium condition in the market for goods (price = marginal cost) can be written as

$$P_X = MC_X = w \cdot (L_X/X) + r \cdot (K_X/X) = w \cdot a_{LX} + r \cdot a_{KX} \quad (1)$$

and

$$P_Y = MC_Y = w \cdot (L_Y/Y) + r \cdot (K_Y/Y) = w \cdot a_{LY} + r \cdot a_{KY} \quad (2)$$

Suppose that $a_{LX} = 60$, $a_{KX} = 30$, $a_{LY} = 90$ and $a_{KY} = 30$.

- (a) In equations (1) and (2) above, which assumption allows us to use the same wage rate (w) and rental rate (r) in both industries (X and Y)?

ANS: The perfect mobility of workers across the X and Y industry as well as the perfect mobility of capital across industries X and Y is the assumption that makes w and r the same in both industries.

- (b) Suppose that the market prices are $P_X = \$420$ and $P_Y = 600$. What are the equilibrium values for wages and rentals?

Ans: Let us put in the numbers that we know into equations 1 and 2.

Equation 1 becomes $420 = w \cdot 60 + r \cdot 30$ (3)

Equation 2 becomes $600 = w \cdot 90 + r \cdot 30$ (4)

The question asks for us to solve for w and r (2 unknowns) and we have 2 equations (3) & (4). So it is possible!

Invert equation (3) to w : $w = 7 - 0.5r$

Plug this into equation (4): $600 = 90[7 - 0.5r] + 3r \Rightarrow r = \2 per hour.

Now use this value of r in the inverted equation (3) to get w . That is, $w = 7 - 0.5 \cdot 2 = \$6$ per hour.

- (c) Suppose P_Y rises to 610 (no change in anything else). What are the new equilibrium values of w and r ?

Ans: Using the same method as in part (b), we have

Equation (3): $420 = w \cdot 60 + r \cdot 30$

Equation (4): $610 = w \cdot 90 + r \cdot 30$

Solving this system we find that in equilibrium, $w = \$6.34$ per hour and $r = \$1.33$ per hour.

Economic intuition: Note what happened from (b) to (c) – Y became more expensive and so the factor that is used relatively more intensively in the Y sector (labor) got higher returns while the other factor (capital) lost as a result of rise in price of Y.

(d) Suppose that initially, this country was in autarky with $P_Y = \$600$. Then, P_Y went up to \$610. That is, country A began exporting Y and hence, its price went up. Is country A capital-abundant or labor-abundant, relative to the world?

ANS: The country is exporting the relatively labor-intensive good, hence the country is relatively labor-abundant. (Use the a_{LX} , a_{KX} , a_{LY} , a_{KY} numbers to show this).

(e) Suppose that each worker and each machine works 1000 hours a month. So if the per hour wage that you have calculated is say, \$3 then the worker has total income of \$3000 per month. Similarly for capital. After the rise in the price of Y (part c), what are the real incomes of workers in terms of Y and X? That is, what are the physical units of X and Y that workers can buy once P_Y and their on wages have changed?

**Ans: In the post-trade equilibrium, $w = \$6.34$ per hour and $r = \$1.33$ per hour. Thus, total monthly income for workers $W = 1000 * 6.34 = \$6340$, and total monthly income for capitalists $R = 1000 * 1.33 = \$1330$
Real wage = $W/Prices$.**

**Hence Real wage ito X = $6340/P(X) = 6340/420 = 15.09$ units of X
And Real wage ito Y = $6340/P(Y) = 6340/610 = 10.39$ units of Y**

**In the pre-trade equilibrium, we have $W = 6 * 1000 = \$6000$ and $R = 2 * 1000 = \$2000$
Hence Real wage ito X = $6000/P(X) = 6000/420 = 14.28$ units of X
And Real wage ito Y = $6000/P(Y) = 6000/600 = 10$ units of Y**

Thus after trade, real wage ROSE in terms of both goods. Workers are better off.

(f) After the rise in the price of Y (part c), what are the real incomes of capitalists in terms of Y and X? That is, what are the physical units of X and Y that capitalists can buy once P_Y and their on wages have changed? Remember to multiply the hourly rental rates that you have calculated by the number of hours worked by machines per month (1000).

**Ans: Post-trade real income of capitalists = $R/prices$
Real rental ito X = $1330/420 = 3.16$ units of X
Real rental ito Y = $1330/610 = 2.18$ units of Y**

**Pre-trade real income of capitalists:
Real rental ito X = $2000/420 = 4.76$ units of X
Real rental ito Y = $2000/600 = 3.3$ units of Y**

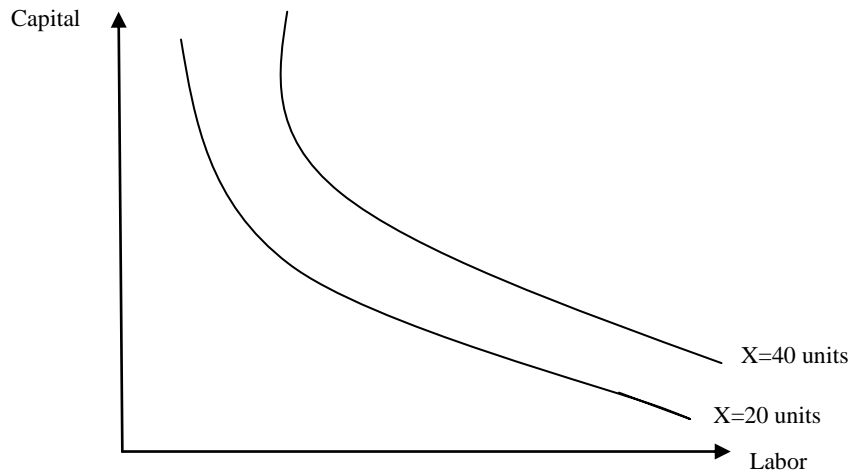
Thus after trade opens, real rental FELL in terms of both goods. Capitalists are worse off.

(g) Which theorem of international trade can answer both parts (f) and (g) without even knowing the numbers.

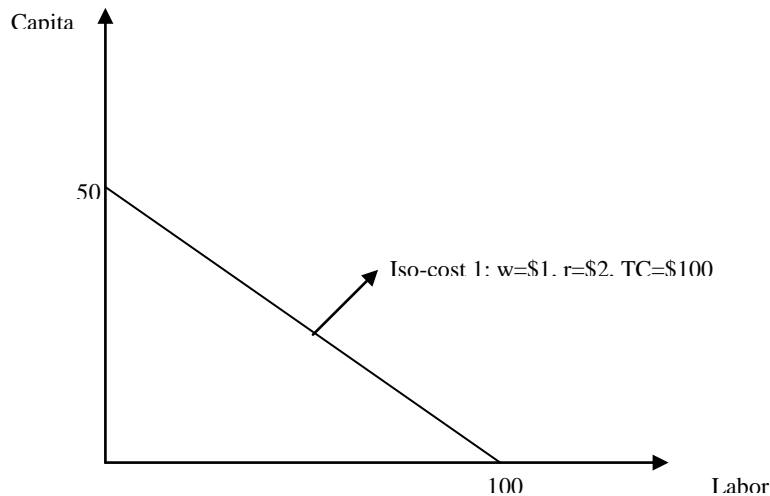
Ans: The Stolper-Samuelson theorem tells that under all the assumptions of the Heckscher-Ohlin model of international trade, when the price of the labor-intensive good rises (in our case, this is good Y) relative to the price of the capital-intensive good then real wages rise in terms of both goods and real rentals fall in terms of both goods.

Problem 2. Short answers

- a. Iso-quants are downward sloping due to the substitutability of capital and labor in the production function. They are convex because as we employ lesser and lesser of one factor we will need more and more of the other factor to maintain output levels. That is, diminishing returns to a factor.
- b. Production function $X=0.5 \cdot K^2L$. Iso-quants from the same production function can NEVER intersect each other.

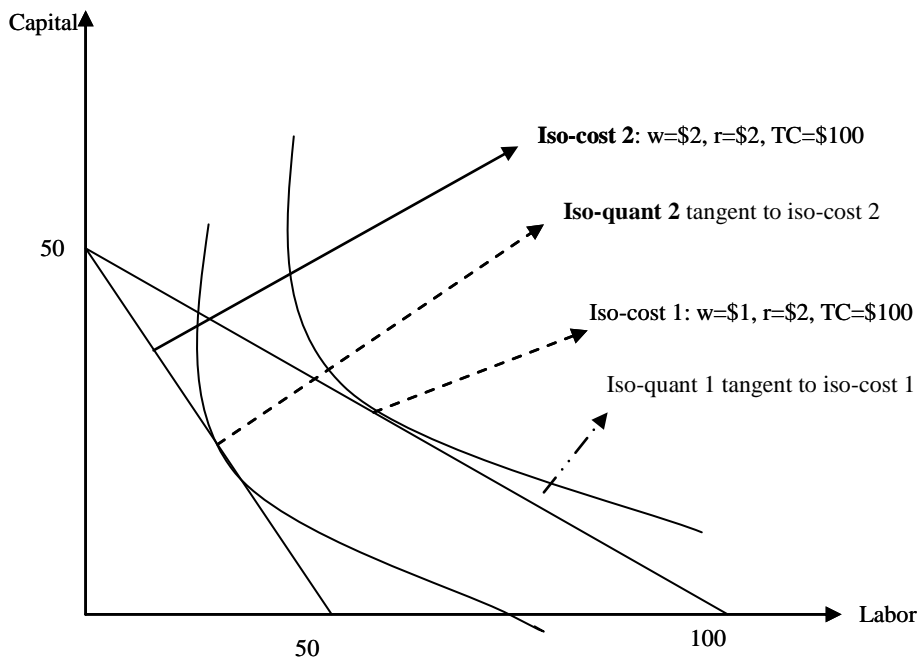


- c. See diagram below:



- d. The profit maximizing firm (in this case) knows the total cost of his project. Thus, in order to maximize profits it needs to produce the maximum possible output => choose the highest affordable iso-quant. Such an isoquant will be tangent to the iso-cost line associated with \$ 100. Once output is chosen, we can figure out the amount of labor and capital that the firm will employ from the two axes.
- e. When wage rises to \$2, the iso-cost line will become steeper. Its y-intercept remains unchanged at 50 units. But its x-intercept falls to 50 units of labor. As the digram below shows, the new equilibrium is on a new (lower) iso-quant. That is,

- i. Output falls in the new equilibrium
- ii. The number of workers used in the new equilibrium falls
- iii. The amount of capital used in the new equilibrium rises
- iv. The optimal capital-labor ratio rises (slope of ray through the origin)



Problem 3. Consider the country Ubetcha. Ubetcha produces two goods- autos and hats – using capital and labor. Autos are relatively capital intensive relative to hats. The country has long enjoyed its isolation from the world but is now considering free trade. Ubetcha economists notice that the relative price of autos is lower in the world markets than it is in Ubetcha. All Heckscher-Ohlin assumptions hold. (1 point each)

- a. Is there a basis for trade between Ubetcha and the world?

Answer: Yes, a difference in relative prices means that there is profit to be made from trading.

- b. From the information above, can you infer if Ubetcha is relatively capital-abundant or labor-abundant, relative to the world? If so, which one?

Ans: Yes, the HO model allows us to infer information about Ubetcha’s factor endowments. Ubetcha is a relatively expensive producer of auto’s (relative to the world). So Ubetcha must be a cheaper producer of Hats, which are labor-intensive. In the HO model, a country produces a good cheaper when that good is relatively intensive in the use of its abundant factor. That is, Ubetcha is relatively L-abundant.

- c. What is the pattern of trade going to be if Ubetcha opens up to trade?

Ans: Ubetcha will export Hats and import Autos from the world.

- d. Suppose Ubetcha engages in free trade with the world. What happens to the ratio of K/L used by Ubetcha’s producers in the production of autos?

Ans: When a L-abundant country opens up to trade, there is excess demand for L (to produce the labor-intensive export good). This means that rental rates of K fall and hence, all producers (in hats and auto's) will move to hire the cheaper factor. That is, K/L ratio will rise in the auto sector.

- d. Suppose Ubetcha engages in free trade with the world. How will the marginal product of capital change in the hat industry?

Ans: From the answer above we know that the hat industry will employ more K (since it is cheaper) after trade opens up. This means that the MP of K in the hat industry will fall. As you employ more machines, you value workers more, machines less.

- e. Suppose the union of capitalists in Ubetcha (which represents the interests of capital owners in the country) hears about the free trade proposal. Would this organization support the proposal or oppose it?

Ans: Ubetcha is a L-abundant country. The Stolper-Samuelson theorem tells us that when a L-abundant country opens up to trade, the real wages of L rise in terms of both goods, while the real incomes of capitalists fall. That is, the returns to the abundant factor rise, while returns to the scarce factor fall. This means that the union of capitalists will OPPOSE free trade.

Problem 5: Chapter 4, Problem 1

1. This exercise uses the Heckscher-Ohlin model to predict the direction of trade. Consider the production of hand-made rugs and assembly line robots in Canada and India.

- a. Which country would you expect to be relatively labor-abundant, and which capital-abundant? Why?

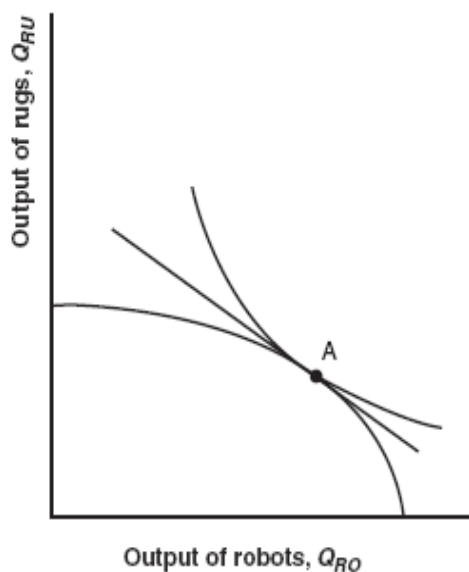
Answer Given Canada's relatively small population (~30 million compared with more than 1 billion in India) and level of development, it is a safe assumption that $L_{CAN} / K_{CAN} < L_{IND} / K_{IND}$. That is, there is more capital per worker in Canada, making it capital-abundant compared with India. Similarly, India would be labor-abundant.

- b. Which industry would you expect to be relatively labor-intensive, and which is capital-intensive? Why?

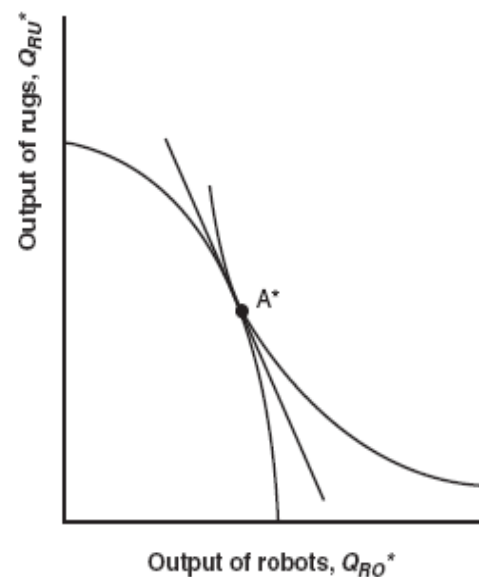
Answer: Given the amount of capital required to produce robots and the amount of labor required to produce rugs, one would expect that $L_{ROBOT} / K_{ROBOT} < L_{RUG} / K_{RUG}$, making robots capital intensive and rugs labor intensive.

- c. Given your answers to (a) and (b), draw production possibilities frontiers for each country. Assuming that consumer preferences are the same in both countries, add indifference curves and relative price lines (without trade) to your PPF graphs. What do the slopes of the price lines tell you about the direction of trade?

Answer: See the following figures.



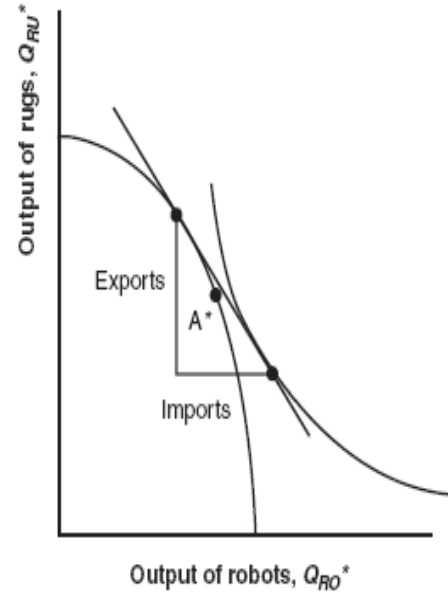
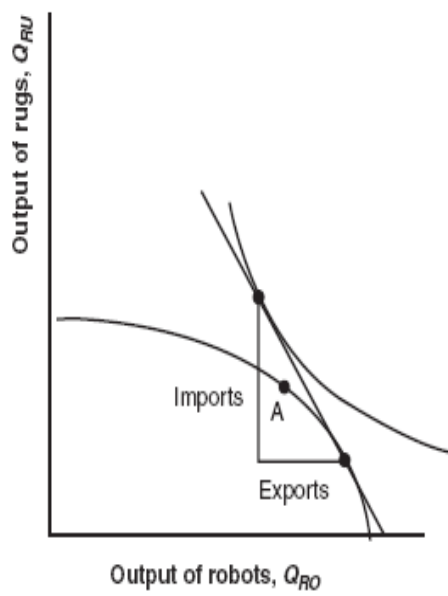
(a) Canada



(b) India

- d. Allowing for trade between countries, redraw the graphs and include a “trade triangle” for each country. Identify and label the vertical and horizontal sides of the triangles as either imports or exports.

Answer: See the following figures.



Problem 4: Chapter 4, Question 6

6. Suppose when Russia opens to trade, it imports automobiles, a capital-intensive good.
- a. According to the Heckscher-Ohlin theorem, is Russia capital abundant or labor abundant? Briefly explain.

Answer: Russia is labor abundant because it imports the capital-intensive good.

- b. What is the impact of opening trade on the real wage in Russia?

Answer: Russia will specialize in the labor-intensive product, which will lead to an increase the relative demand for labor in the labor-intensive industry. This causes an increase in the relative wage. The higher relative wage cuts the number of workers hired per unit of capital in the labor-intensive industry, thereby reducing the labor/capital ratio. By the law of diminishing returns, the decrease in the labor/capital ratio leads to a rise in the marginal produce of labor in both industries. Thus, the real wage will increase in Russia following trade.

- c. What is the impact of opening trade on the real rental on capital?

Answer: The real rental on capital will decrease because the world relative price of automobiles is lower than Russia's no-trade relative price. More specifically, with a lower labor/capital ratio in both industries, the marginal product of capital decreases so that the real rental on capital falls.

- d. Which group (capital owner or labor) would support policies to limit free trade? Briefly explain.

Answer: The capital owners will support policies to limit free trade because they suffer a loss due to the decrease in the relative price of automobiles when Russia engages in trade.
