Economics 101 — Fall 2018

International Trade

Problem Set 2

October 30, 2018

Due: **Fri, November 9, *before* 4:50pm**
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1 Heckscher-Ohlin Trade Theory and Wages

The relationship between the wage-rental rate ratio w/r and the relative price of cloth in terms of food P_C/P_F is

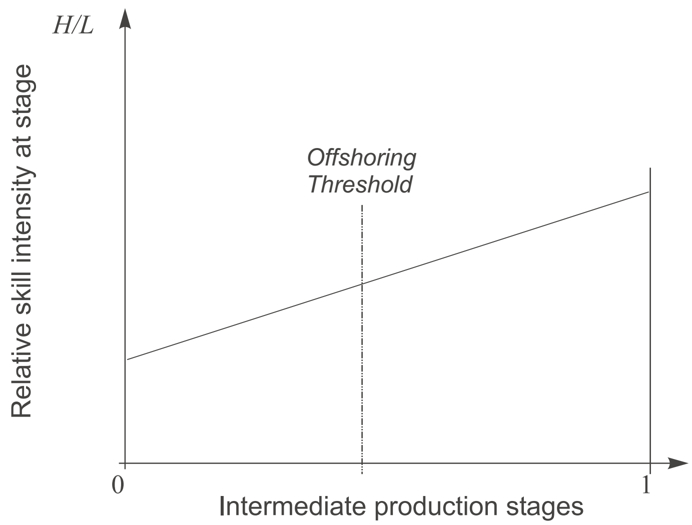
$$P_C/P_F = \sqrt{w/r}$$

in the Home economy. The optimal land-labor ratio choice is given by $T_F/L_F = 5 \cdot w/r$ in food production and by $T_C/L_C = \frac{1}{2} \cdot w/r$ in cloth production.

- *Factor price equalization.* Home opens up to free trade and experiences a doubling of the relative price of cloth. Use a goods-price-to-input-choice diagram to show how a doubling of the relative price of cloth affects wages and the choice of land-labor ratios in both industries.
- *Resource allocation.* How can it happen that both industries change land-labor ratios in the same direction, although total land and labor resources are given? [*Hint*: Describe the factor flows within the Home economy.]
- *Relative sector size.* Use an Edgeworth box to show the effect of a doubling in the relative price of cloth. [You may reuse the Edgeworth box from the preceding question for the initial state of the economy.]

2 Offshoring Intermediate Production Stages

There are two regions, North (no asterisk) and South (asterisk), and many intermediate production stages. The production stages are ordered by their skill intensity, H/L, as depicted along the horizontal axis in the graph below.



Offshoring tasks to the South is preferable below the threshold. Production in the North is preferable above the threshold.

- Depict the range of production stages offshored to the South, and depict the range of production stages located in the North under the shown threshold.
- Depict the average relative employment of H^S/L^S in the South and the average relative employment of H^N/L^N in the North.

Now suppose offshoring costs increase and fewer production stages are offshored to the South.

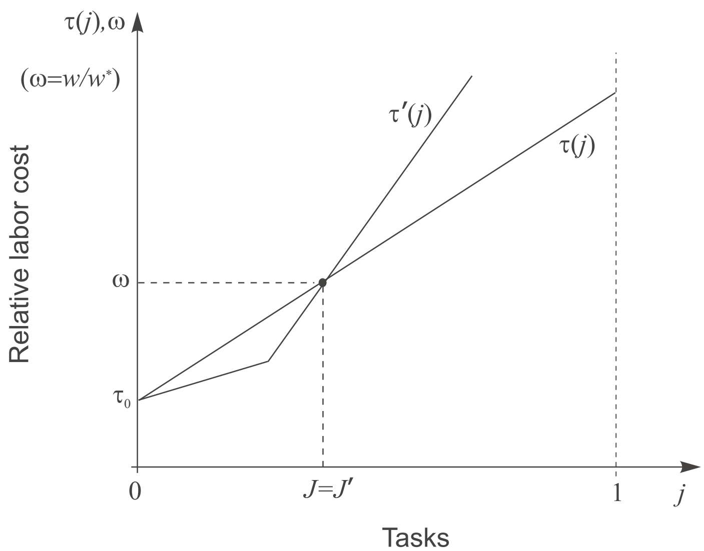
- Depict the position of the new threshold.
- Depict the average relative employment of $(H^S/L^S)'$ in the South and the average relative employment of $(H^N/L^N)'$ in the North under the new threshold.
- Does income inequality fall or increase in the South? Does income inequality fall or increase in the North?

3 Trade in Tasks

There are two economies, Onshore (no asterisk) and Offshore (asterisk). Each economy has two industries, X and Y, and two factors of production: land T (earning a land rent r) and labor L (earning a wage w). Some labor tasks can be offshored. The T-factor (land) cannot be offshored. There is free trade in final goods as in the Heckscher–Ohlin model.

Suppose the onshore economy is more productive than the offshore economy by a factor of $A/A^* > 1$. When contracted offshore, a task j costs $\tau(j)$. The tasks are ordered by their offshoring costs $\tau(j)$ from $j = 0$ to $j = 1$ so that $\tau(j)$ increases with j. In the initial equilibrium, J tasks are being offshored.

- How does the wage w relate to $w^*\tau(j)$ for all j below J?
- How does the wage w relate to $w^*\tau(J)$ for task J?
- After offshoring, what are the producers' profits in industries X and Y?



Now suppose the offshoring cost schedule changes to $\tau'(j)$ as depicted in the figure above. The cutoff task remains unchanged at $J' = J$.

- What are the profits of producers in industries X and Y now?
- After the change in offshoring costs, how do r, r^*, and w^* change if there is free trade in final goods?
- After the change in offshoring costs, how does w change if there is free trade in final goods? Why?

4 Intraindustry Trade

Consider car makers that operate under monopolistic competition in symmetric equilibrium. Each monopolistic car maker produces with a total cost function

$$\text{TC} = F + c \cdot Q_C,$$

where $F = 500,000$ and $c = 100$.

- What are the average and marginal cost functions of a car maker?

Each of n car makers faces residual demand of

$$Q_C^d = S \cdot [1/n - b \cdot (P_C - \bar{P}_C)],$$

where $S = 50,000$, $b = 1/1,000$ and $\bar{P}_C$ is average equilibrium price.

- What are marginal revenues? [*Hint*: You may use the formula in the textbook. Otherwise, reformulate demand so that $P_M = P_M(Q^d_M)$ and derive total revenue; differentiate total revenue with respect to quantity.]
- Graph the average-cost-variety (CC) and the price-variety (PP) schedules for this industry in a diagram that shows price, average cost and the number of firms (varieties).
- Find the number of firms (varieties) in this industry in the absence of trade. What is price in a symmetric autarky equilibrium?
- Cars can be traded across countries at not cost. Using the average-cost-variety (CC) and the price-variety (PP) schedules above, show how equilibrium price and the equilibrium number of firms change after trade.
- How could you measure the gains from trade? Explain briefly.

5 Diverse Firms and Trade

Consider three car makers that can potentially operate under monopolistic competition in equilibrium. There are two completely identical countries. To start operations, a car maker i needs to pay a fixed cost of $F = 1,250$ and can produce at a constant marginal cost of c_i. To enter the foreign market, a car exporter needs to pay an additional fixed cost of $F_X = 312.5$. To ship an export, a car maker incurs an additional transport cost of $\tau = 1$ (100 percent) on top of marginal production cost so that marginal costs for an export good are $(1 + \tau) \cdot c_i$.

In each country, the three car makers have constant marginal cost of production $c_1 = 50, c_2 = 150, c_3 = 300$ (and $c^*_1 = 50, c^*_2 = 150, c^*_3 = 300$).

Every car maker i faces residual demand of

$$Q^d_i = S \cdot [1/n - b \cdot (P_i - \bar{P})]$$

under monopolistic competition, where $S = 5,000$, $b = 1/100$ and $\bar{P}$ is average equilibrium price.

Recall from class that, for this residual demand, optimal quantity and profits are

$$Q_i = \frac{Sb}{2}\left(\bar{P} + \frac{1}{b \cdot n} - c_i\right) \quad \text{and} \quad \Pi_i = \frac{Sb}{4}\left(\bar{P} + \frac{1}{b \cdot n} - c_i\right)^2.$$

The domestic marginal-cost ceiling at which the last (highest-cost) entrepreneur n just enters and the marginal-cost ceiling for exports at which the last (highest-cost) domestic firm n_X just exports are

$$c_n = \bar{P} + \frac{1}{b \cdot n} - 2\sqrt{\frac{F}{Sb}} \quad \text{and} \quad c^X_{n_X} = \bar{P}^* + \frac{1}{b \cdot n^*} - 2\sqrt{\frac{F_X}{S^* b}}.$$

- Use profits Π_i and fixed entry costs F to derive the domestic marginal-cost ceiling c_n.
- Use the equilibrium price-variety relationship for the average firm $\bar{P} = 1/(b \cdot n) + \bar{c}$ to restate the marginal-cost ceilings in terms of the average markup $1/(b \cdot n)$ and market-average marginal cost $\bar{c}$.

- Consider autarky (fixed export costs are prohibitively high at $F_X = 350,000$.) Use the marginal-cost ceiling to show that two firms will enter the domestic market, but not three.
- Consider free trade (fixed export cost of $F_X = 312.5$) and suppose that wages remain unchanged. Use the marginal-cost ceiling for exports to show that exactly one domestic firm will export and that the two foreign incumbent firms remain in operation. Also show that two exporters and two foreign incumbents cannot be an equilibrium outcome, and that one home exporter and three foreign firms cannot be an equilibrium outcome.
- Continue to consider free trade and unchanged wages. How does free trade affect the average markup $1/(b \cdot n)$ and market-average marginal cost $\bar{c}$? How does market average price $\bar{P}$ change?