Problem Set 5

Exercise 1:

Explain the difference between transaction costs and opportunity costs.

Solution 1):

Transaction Cost:

Transaction costs are the cost in excess of the actual amount paid to the supplier, including the costs of locating a seller, negotiating a price and putting the product to use.

Opportunity Cost:

Opportunity costs are the potential benefits an individual has forgone when making a choice over alternatives.

Exercise 2:

If you are a PhD supervisor, how are you going to design a solution to make your PhD student work hard? (Hint: Consider it as a principle-agent problem)

Solution 2):

One possible way is to link the PhD student's salary/bonus with the outputs of journal publications, conference papers, etc.

Exercise 3:

Consider an industry that has eight firms with the following market share percentages: 20%, 20%, 16%, 16%, 9%, 8%, 6%, and 5%.

a) Calculate the four-firm concentration ratio for this industry.

Solution 3a):

Four-Firm Concentration Ratio:

$$CR_4 = \frac{S_1 + S_2 + S_3 + S_4}{S_T}$$

, where $S_1, S_2, S_3, and\ S_4$ are the sales of the largest 4 firms and S_T are the total sales in the market

$$CR_4 = w_1 + w_2 + w_3 + w_4$$

, where $w_1, w_2, w_3, and\ w_4$ are the market shares of the largest 4 firms

Identify market shares of largest firms and apply formula:

$CR_4 = w_1 + w_2 + w_3 + w_4$

$CR_4 = 0.2 + 0.2 + 0.16 + 0.16$

$CR_4 = 0.72$

➔ The 4 largest firms account for 72% of total industry output

b) Calculate the Herfindahl-Hirschman index for this industry.

Solution 3b):

Herfindahl-Hirschman Index (HHI):

$$\text{HHI} = 10{,}000 * \sum_{i}^{n} w_i^2$$

, where w_i is the market share of firm i.

- ➔ *Multiply by 10,000 to eliminate the need of decimals*
- ➔ *By squaring the market shares before adding them up, the index weights firms with high market shares more heavily*

Identify market shares of largest firms and apply formula:

$$\text{HHI} = 10{,}000 * \left[\left(\frac{20}{100}\right)^2 + \left(\frac{20}{100}\right)^2 + \left(\frac{16}{100}\right)^2 + \left(\frac{16}{100}\right)^2 + \left(\frac{9}{100}\right)^2 + \left(\frac{8}{100}\right)^2 + \left(\frac{6}{100}\right)^2 + \left(\frac{5}{100}\right)^2\right]$$

$$\text{HHI} = 10{,}000 * [0.04 + 0.04 + 0.0256 + 0.0256 + 0.0081 + 0.0064 + 0.0036 + 0.0025]$$

$$\text{HHI} = 10{,}000 * 0.1518$$

$$\text{HHI} = 1{,}518$$

c) Discuss the Pros and Cons for each of the two measures for market structure.

Solution 3a):

Four-Firm Concentration Ratio:

Pros: Does not need the information of all firms

Cons: Might not capture the overall picture of the industry

Herfindahl-Hirschman Index (HHI):

Pros: Covers all firms and the weights for larger firms are higher to capture the market structure better

Cons: It might not be easy to get the information of all firms in the industry

Exercise 4:

Let a firm's total cost function be: $TC(Q) = 800 + 8Q + 8Q^2$

The firm's marginal cost is given by: $MC(Q) = 8 + 16Q$

a) Derive an expression for the firm's average cost function.

Solution 4a):

Average Cost Function:

$$AC(Q) = \frac{TC(Q)}{Q}$$

$$AC(Q) = \frac{800 + 8Q + 8Q^2}{Q}$$

$$AC(Q) = \frac{1}{Q}800 + 8 + 8Q$$

b) Find the range of production characterized by economies of scale.

Solution 4b):

Economies of Scale:

➔ Economies of scale is the phenomenon where the cost per unit of production decreases as the scale (output) of production increases.

➔ Therefore, economies of scale exist if the marginal cost is lower than the average cost, i.e., $MC(Q) < AC(Q)$. That is, if $MC(Q) < AC(Q)$, then the average cost of the firm are decreasing.

Set marginal cost equal to average cost and solve for Q:

$$MC(Q) = AC(Q)$$

$$8 + 16Q = \frac{1}{Q}800 + 8 + 8Q$$

$$16Q = \frac{1}{Q}800 + 8Q$$

$$16Q^2 = 800 + 8Q^2$$

$$16Q^2 - 8Q^2 = 800$$

$$8Q^2 = 800$$

$$Q^2 = 100$$

$$Q = 10$$

➔ Thus, for $0 < Q < 10$ the condition of $MC(Q) < AC(Q)$ holds and there exists economies of scale.

c) Do you think the economies of scale constitute a serious barrier to entry into the industry? Explain your reasoning.

Solution 4c):

This will depend on the demand of the industry.

If the demand is much larger (relative to 10), the economies of scale do not constitute a serious barrier to entry.

Otherwise, there will be an entry barrier due to the economies of scale.

Exercise 5:

Use the externality concept you learned from class to explain why everyone gets the Covid-19 vaccine for free.

Solution 5):

The Covid-19 vaccine is considered a positive externality. That is, its widespread adoption not only benefits individuals (by reducing their risk of infection) but also benefits society as a whole by lowering the overall transmission of the virus.

With a positive externality, the market equilibrium quantity would be less than the social optimum.

Therefore, to internalize the externality, the government will need to provide a subsidy to increase vaccination.