

Problem Set 1: Microeconomic Tools of Analysis for IO

1. Demand in a given market is given by $Q_d = 104 - 4P$, while supply in the same market is described by $Q_s = -16 + 8P$.
 - a. What is the equilibrium price and quantity?
 - b. Carefully construct a demand and supply diagram illustrating your results from part (a). Be sure to label the axes and to include the vertical intercept.
 - c. Calculate the price elasticity of demand *at equilibrium*.
2. Empirical studies of the demand for water find that the price elasticity of demand for water in all regions of the United States ranges from 0.4 to 0.7.
 - a. Why is the demand for water price-inelastic?
 - b. In those regions where outdoor use of water makes up a relatively large portion of total use, the price elasticity is relatively high. Why?
 - c. The demand for water in the summer months is greater than in the winter months. What does this imply, on average, for price elasticity of demand?
3. A government agency has estimated that the income elasticity of demand for automobiles is between 2.5 and 3.9.
 - a. What does this mean?
 - b. If incomes rise by 10%, what happens to the purchase of automobiles?
 - c. Based on this empirical estimate, what happens to the percentage of a family budget devoted to automobiles as a family's income rises?
4. Suppose that demand and competitive supply for prescription antidepressants such as Prozac, Paxil, and Zoloft is, in inverse form, given by the following, where Q is number of monthly prescriptions, and P is the price per monthly prescription:

$$\text{Demand: } P = 4,000 - 0.00980Q$$

$$\text{Supply: } P = 20 + 0.00015Q$$

- a. Calculate the equilibrium price and monthly quantity of antidepressant prescriptions.
 - b. Calculate the price elasticity of demand and price elasticity of supply for prescription antidepressants at equilibrium.
 - c. Calculate producer and consumer surplus at equilibrium.
5. Assume that the price of nachos at a baseball stadium is increased from \$2.00 to \$3.00, and as a result the number of servings of nachos sold per game declines from 5,000 to 4,000. Calculate the price elasticity of demand two ways: point and arc (or midpoint). As a result of

the price increase, what happens to total expenditures on nachos, and how is this result related to price elasticity of demand?

6. Consider the following three stylized short-run cost functions, and assume that all variable production inputs are purchased competitively (at a constant price).

$$C_1(q) = 75 + 2q$$

$$C_2(q) = 50 + 14q + 6q^2$$

$$C_3(q) = 60 + 18q - 2q^2 + 0.10q^3$$

- Does $C_1(q)$ incorporate the notion of diminishing marginal returns? If so, at what level of output, q , do diminishing marginal returns set in?
 - Does $C_2(q)$ incorporate the notion of diminishing marginal returns? If so, at what level of output, q , do diminishing marginal returns set in?
 - Does $C_3(q)$ incorporate the notion of diminishing marginal returns? If so, at what level of output, q , do diminishing marginal returns set in?
 - For cost function $C_3(q)$, find the level of output at which AVC reaches its minimum level.
7. Assume that cost function $C_2(q)$ in question #7 is the relevant cost function for a profit-maximizing firm (where q denotes thousands of units). Assume further that the firm can sell as many units as it wants for a price of \$374. Thus, the firm's relevant revenue function is $R(q) = 374q$ (where q again denotes thousands of units). What level of output, q , will maximize profit for this firm? How does your answer change if fixed costs double from \$50 to \$100?
8. For what values of q does the following long-run cost function exhibit economies of scale:

$$C(q) = 200q - 8q^2 + .2q^3$$

9. A recent econometric study estimated that the average cost per patient-day of a for-profit nursing home is

$$C(x) = A - 0.16x + 0.00137x^2$$

where x is the nursing home's number of patient days per year (in thousands) and A is a parameter that indexes for regional cost differences.

- Based on this cost function, how big must a nursing home be in order to minimize cost per patient day?
- Do you think that the number of patient days is a good measure of a nursing home's output?

10. Economists sometimes employ a concept called the degree of scope economies, S_{SCOPE} , which is defined as:

$$S_{SCOPE} = \frac{C(q_1) + C(q_2) - C(q_1, q_2)}{C(q_1, q_2)}$$

If $S_{SCOPE} > 0$, there are economies of scope (joint production is cheaper than separate production), and If $S_{SCOPE} < 0$, there are diseconomies of scope (joint production is more expensive than separate production).

Show that the following cost function exhibits economies of scope for $q_1 = q_2 = 10$ by comparing the costs of individual production and joint production, and by calculating the degree of scope economies, S_{SCOPE} :

$$C(q_1, q_2) = 200 + 20q_1 + 4q_1^2 + 30q_2 + 3q_2^2 - 4q_1q_2 + 0.05q_1^2q_2^2$$

Does this cost function continue to exhibit economies of scope for $q_1 = q_2 = 11$?

11. Consider the following cost functions for two goods, where the third function is a joint production cost function:

$$C(x) = 2 + x^{0.5}$$

$$C(y) = 2 + y^2$$

$$C(x, y) = 3 + x^{0.5} + y^2$$

- Show that there are significant scale economies in the production of x , but not in y . Based on this information alone, what would you predict about the extent of concentration in the markets for these two products?
 - Show that there are scope economies to joint production. Why might this fact change your conclusion about the extent of concentration in the market for good y ?
12. Suppose the president of some firm tells you that, at its profit-maximizing level of output, the price of his firm's product is triple its marginal cost. What price elasticity of demand for the product is implied by this statement?
13. Suppose that demand and supply in a certain unregulated competitive market may be accurately estimated by the following equations:

$$Q_d = 24 - 4P$$

$$Q_s = 8P$$

where Q is measured in millions of units per day, and P is measured in dollars per unit.

- Calculate the competitive market equilibrium price and quantity. Illustrate your answer on a carefully constructed demand and supply diagram. Include a calculation of consumer surplus and producer surplus.

- b. Suppose that public outcry over excessive prices results in the government imposing a price ceiling of $P = \$1.00$ in this market. Illustrate this on your diagram. Calculate the shortage that will result, the transfer of surplus from producers to consumers, and the dead weight loss.
14. It has been suggested in an article published by the Federal Reserve Bank of Philadelphia that bank managers “be encouraged to own stock in the companies they manage. In this way, they would directly benefit from the decisions they make that increase the market value of the bank.”
- a. What problem does this suggestion aim to resolve?
- b. What do you think are some pros and cons of the suggested policy?
15. Assume that an industry is perfectly competitive, and that industry demand and supply are characterized by the following demand and supply functions:

$$Q_d = 180 - 2P \qquad Q_s = 10P$$

Furthermore, assume that the total cost function for a *representative firm* in this industry is given by the following total cost function:

$$TC = 81 + q^2$$

- a. In equilibrium, how many total units will be produced by this industry?
- b. How many units will the representative firm produce? Taking this quantity as the average per firm, how many firms will populate the industry?
- c. Given the profit-maximizing solution in part (b), in the short run is the representative firm earning a profit, incurring a loss, or breaking even? Given this profit situation, over the long run, what would you expect to happen in this industry?
- d. Suppose now that the industry supply curve shifts as a result of the change you predict in part (c), such that the new industry supply curve is:

$$Q'_s = 8P$$

- Calculate the new market price (industry demand does not change), the average firm output, the number of firms in the industry, n (where $n = Q/q$), and the profit outcome for the representative firm.
- e. Calculate consumer surplus, producer surplus and total surplus generated given the supply function in part (d).
- f. Finally, suppose that this industry becomes monopolized. Calculate the monopoly price and output, as well as the deadweight loss generated by monopolization.

16. What is the deadweight loss due to a profit-maximizing, single-price monopolist under the following conditions: The demand curve is linear and downward sloping and the marginal cost curve is linear and upward sloping. The optimal price for the monopolist is \$10. The intersection of the marginal revenue and marginal cost curves occurs where output is 100 units and marginal revenue is \$5. The socially efficient level of production is 110 units.
17. If demand in a monopolized market is described by $P = 30 - Q$, and $MC = 1Q$, what is the single-price monopolist's optimal price and quantity? Calculate the deadweight loss.
18. Suppose that the market shares for prescription antidepressants are as follows:

Brand	Market Shares
Prozac	40%
Paxil	25%
Zoloft	25%
Others	10%

- a. Calculate the approximate Herfindahl-Hirschman Index (HHI) for the U.S. prescription antidepressant market based upon these market share numbers.
- b. Calculate the approximate Herfindahl-Hirschman Index (HHI) for the U.S. prescription antidepressant market under the assumption that the makers of Prozac and Zoloft merge.
- c. Be prepared to argue the following:
- “The proposed merger of the makers of Prozac and Zoloft is dangerously anti-competitive, and poses a serious threat to consumer welfare in the market for prescription antidepressants.”
 - “The proposed merger of the makers of Prozac and Zoloft will not significantly alter the competitive conditions in the market for prescription antidepressants, and poses no real threat to consumer welfare.”