

Economics 500: Microeconomic Theory  
State University of New York at Binghamton  
Department of Economics  
Fall, 2004

Problem Set #10

1. Suppose there are 100 identical firms in a perfectly competitive industry. Each firm has a short-run total cost curve of the form

$$\text{SRTC} = (1/300)q^3 + 0.2q^2 + 4q + 10$$

- a. Calculate the firm's short-run supply curve with  $q$  as a function of market price ( $P$ ).
  - b. On the assumption that there are no interaction effects among costs of the firms in the industry, calculate the short-run industry supply curve.
  - c. Suppose market demand is given by  $Q = -200P + 8,000$ . What will be the short-run equilibrium price-quantity combination?
2. Suppose there are 1,000 identical firms producing diamonds and the total cost curve for each firm is given by

$$\text{SRTC} = q^2 + wq$$

where  $q$  is the firm's output level and  $w$  is the wage rate of diamond cutters.

- a. If  $w = 10$ , what will be the firm's short run supply curve? What is the industry's supply curve? How many diamonds will be produced at a price of 20 each? How many more diamonds would be produced at a price of 21?
- b. Suppose the wages of diamond cutters depends on the total quantity of diamonds produced and the form of this relationship is given by
$$W = 0.002Q$$
where  $Q$  represents total industry output, which is 1,000 times the output of the typical firm.

In this situation, show that the firm's marginal cost (and short run supply) curve depends on  $Q$ . What is the industry supply curve? How much will be produced at a price of 20? How much will be produced at a price of 21? What do you conclude about the shape of the short-run supply curve?

3. A perfectly competitive market has 1,000 firms. In the very short run, each of the firms has a fixed supply of 100 units. The market demand is given by

$$Q = 160,000 - 10,000P$$

- a. Calculate the equilibrium price in the very short run.
- b. Calculate what the equilibrium price would be if one of the sellers decided to sell nothing or if one seller decided to sell 200 units.
- c. At the original equilibrium point, calculate the elasticity of the industry demand curve and the elasticity of the demand curve ( $e_{D,P} = \partial Q / \partial P * P/Q$ ) facing any one seller.

Now suppose that in the short run, each firm has a supply curve that shows the quantity the firm will supply ( $q_i$ ) as a function of market price. The specific form of this supply curve is given by

$$q_i = -200 + 50P$$

Using this short run supply response, answer questions (a) through (d) above.

4. Suppose the demand for Frisbees is given by

$$Q = 100 - 2P$$

and the supply by

$$Q = 20 + 6P$$

- a. What will be the equilibrium price and quantities for Frisbees?
- b. How would your answers to part (a) change if the supply curve were instead

$$Q = 70 + P$$

What do you conclude by comparing these two cases?

5. Suppose that the demand for broccoli is given by

$$Q = 1,000 - 5P$$

Where  $Q$  is quantity per year measured in hundreds of bushels and  $P$  is price in dollars per hundred bushels. The long-run supply curve for broccoli is given by

$$Q = 4P - 80$$

- a. Show that the equilibrium quantity here is  $Q = 400$ . At this output, what is the equilibrium price? How much in total is spent on broccoli? What is consumer surplus at this equilibrium? What is producer surplus at this equilibrium?
- b. How much in total consumer and producer surplus would be lost if  $Q = 300$  instead of  $Q = 400$ ?
- c. Show how the allocation between suppliers and demanders of the loss of total consumer and producer surplus described in part (b) depends on the price at which broccoli is sold. How would the loss be shared if  $P = 140$ ? How about if  $P = 95$ ?
- d. What would be the total loss of consumer and producer surplus if  $Q = 450$  rather than  $Q = 400$ ? Show that the size of this total loss also is independent of the price at which the broccoli is sold.
- e. Suppose the demand for broccoli shifted outward to

$$Q = 1,270 - 5P$$

What would be the new equilibrium price and quantity in this market?

- f. What would be the new levels of consumer and producer surplus in this market?
- g. Suppose the government had prevented the price of broccoli from rising from its equilibrium of before. Describe how the consumer and producer surplus measures would be reallocated or lost entirely.