

Econ 201 Section 5 - Problem Set 2

Due 2/7 by Start of Class - Graded for ACCURACY

Problem 1

Consider a firm with the production function $f(K, L) = L^{1/3}K^{1/3}$

- (a) Solve the cost minimization problem for this firm, for any given value of output y (Step 1 of Indirect Method of profit maximization).
- (b) Using your result from part a), find the profit maximizing value of output (Step 2 of Indirect Method of profit maximization). Find the optimal amount of profit.
- (c) Now, set up and solve the profit maximization problem for this firm using the Direct Method of profit maximization.
- (d) Do the results from the Indirect and Direct methods agree with one another? Explain why we would expect this is the case.

Problem 2

Continue to work with your results from the first question.

- (a) Demonstrate that the unconditional input demands are homogeneous of degree 0. Explain the intuition for this result.
- (b) Demonstrate that the unconditional input demands will decrease in the prices of their own factors. Explain the intuition for this result.
- (c) Demonstrate that optimal profit is homogeneous of degree 1. Explain the intuition for this result.
- (d) Find the derivative of optimal profit with respect to each input price. Explain the intuition for this result.
- (e) (Bonus - 3 pts on this assignment) Find a way to decompose the derivative of the unconditional input demands into a substitution and scale effect. Is there any way of knowing which is larger?

Problem 3

Consider a firm operating in perfect competition with a total cost of $TC(y) = y^3 + 20$ in the short run.

- (a) Express the profit function for this firm.
- (b) What will be the short-run profit maximizing amount of output for this firm if it faces a price of 12?
- (c) Suppose we move into the long run. In the long run, the firm only pays the \$20 in total cost if it produces any amount of output. (If it produces 0 output, its total cost will now be 0.) Does this change the firm's decision on how much to produce?
- (d) Is there a minimum price at which the firm chooses to produce in the short run? In the long run?
- (e) Find expressions for the short-run and long-run supply curves for this firm. Graph them (no need to be very exact - just capture the general shape).

Problem 4

Consider a representative consumer with a utility function over two goods (x, y) given by $U(x, y) = x^{1/3}y^{2/3}$ and let M denote her income. On the supply side of good y , the cost function of a representative firm is given by $C(y) = \frac{1}{2}y^2$. Let p_x and p_y be the corresponding prices of the two goods.

- (a) Find the consumer's demand for good y . In other words, find $y^D(p_y)$ while holding p_x and M constant.
- (b) By solving the profit maximization problem, find the firm's supply curve, $y^S(p_y)$.
- (c) Calculate the partial equilibrium price p_y^* and quantity y^* in the market for good y where you only have one representative consumer and one firm (the firm acts as it would under perfect competition).
- (d) The government is not happy with the equilibrium price and decides to set a price ceiling p_y^C (i) Should p_y^C be set above or below p_y^* ? Justify your answer. (ii) Draw the graph of the market for good y with the price ceiling. You do not have to be precise but capture the main features of the demand and supply curves and the price ceiling. (iii) Find the quantity that will be traded in the market and the profit level of the firm. (iv) Find also the utility level of the consumer with the price ceiling.
- (e) By comparing the profit levels before and after the intervention, show whether the profits have increased or decreased.

Problem 5

The handmade snuffbox industry is composed of 100 identical firms, each having short-run total costs given by $STC = 0.5q^2 + 10q + 5$ where q is the output of snuffboxes per day.

- (a) What is the short-run supply curve for each snuffbox maker? What is the short-run supply curve for the market as a whole?
- (b) Suppose the demand for total snuffbox production is given by $Q = 1100 - 50P$. What will be the equilibrium in this marketplace? What will each firm's total short-run profits be?
- (c) Graph the market equilibrium and compute total short-run producer surplus in this case.
- (d) Show that the total producer surplus you calculated in part (c) is equal to total industry profits plus industry short-run fixed costs.

Problem 6

Suppose the government imposed a \$3 tax on snuffbox makers in the industry described in Problem 6.

- (a) How would this tax change the market equilibrium? Please calculate the new supply function, demand function, equilibrium price, and equilibrium quantity. Show the change in a graph.
- (b) How would the burden of this tax be shared between snuffbox buyers and sellers?
- (c) Calculate the total loss of producer surplus as a result of the taxation of snuffboxes. Show that this loss equals to the change in total short-run profits in the snuffbox industry. Why don't fixed costs enter into this computation of the change in short-run producer surplus?