

Economics 101
Spring 2011
Homework #6
Due 5/3/11

Directions: The homework will be collected in a box **before** the lecture. Please place your name, TA name and section number on top of the homework (legibly). Make sure you write your name as it appears on your ID so that you can receive the correct grade. Please remember the section number for the section **you are registered**, because you will need that number when you submit exams and homework. Late homework will not be accepted so make plans ahead of time. **Please show your work.** Good luck!

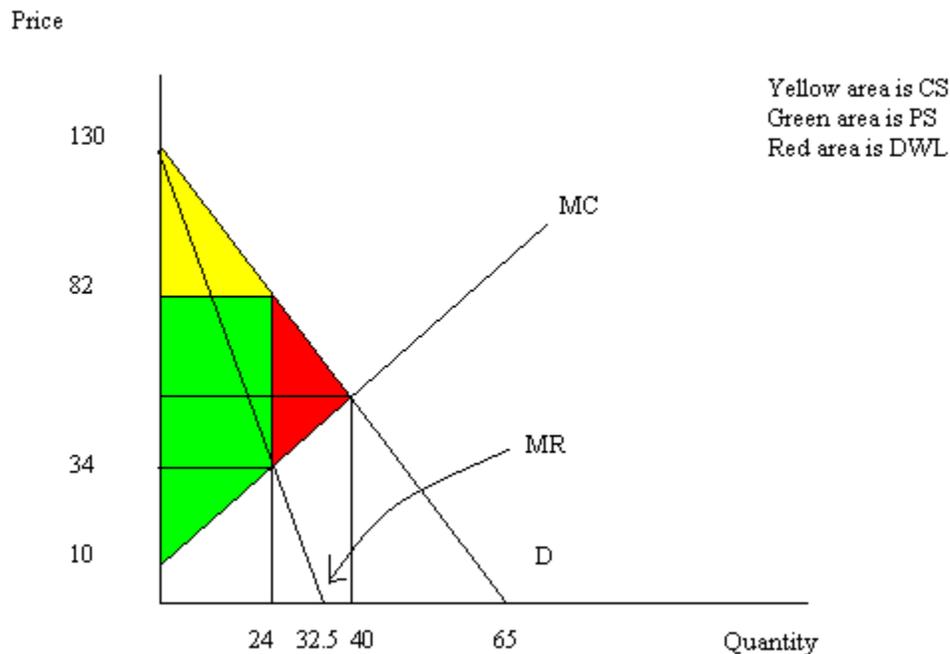
1. Monopoly: Because of a drug patent, the market for a certain new prescription drug is a monopoly. Assume the market demand is given by $P=130-2Q$. The marginal cost is given by $MC=10+Q$.

a. What is the marginal revenue curve of this monopolist?

Take the demand curve and double the slope: $MR=130-4Q$

b. Graph the demand, marginal revenue, and marginal cost curves.

See your class notes or look at the graph below (not drawn to scale).



c. What is the socially optimal level of production?

Set $MC=Demand$:

$$10+Q=130-2Q \rightarrow Q=40$$

d. What is the monopolist's ideal quantity of production if the monopolist only charges one price for the good? What price does he charge?

Set $MC=MR$

$$10+Q=130-4Q \rightarrow Q=24$$

Plugging Q back into the demand curve gives $P=82$

e. What are the consumer and producer surpluses for the monopolist described in part (d)? What is the deadweight loss for this monopolist? Mark these areas on your graph.

$$CS=(1/2)(130-82)(24)= \$576$$

$$PS=(82-34)(24)+(1/2)(34-10)(24)= \$1440$$

Note that 34 is the MR at $Q=24$. See class notes for where to find PS, CS, and DWL on the graph and review the graph provided in part (b).

$$DWL=(1/2)(82-34)(40-24)= \$384$$

f. If the total cost curve is given by $TC=15+10Q+Q^2$, what is the monopolist's ATC? What's the monopolist's profit? In the LR, can the monopolist stay in business? (Note: you do not need to graph TC or ATC to do this question.)

$$ATC=15/Q+10+Q \rightarrow \text{For this monopolist, } ATC=\$34.625/\text{unit of output}$$

Plugging in the monopolist's Q into TC gives us $TC=\$831$

$$TR=P*Q=82*24=\$1968$$

$$\text{Profit}=\$1137$$

The monopolist is earning positive profit, so he will stay in business.

g. T/F: The "double-the-slope" method for finding MR works both when your demand curve is solved for Q and when it is solved for P .

False! This is a friendly reminder that if you have a demand curve that looks like " $Q=20-3P$ " you will NOT get the correct marginal revenue curve unless you solve for P first.

2. Natural Monopoly: Suppose a local utility company has a TC function given by $TC=400+4Q$. The demand is given by $P=120-4Q$, and the MC is constant at \$4.

a. What's the equation for the ATC?

$$ATC=TC/Q=400/Q+4$$

b. If the government decides to regulate the industry through MC pricing, what's the minimum subsidy necessary to keep the firm in business?

$$\text{Production where } MC=\text{Demand} \rightarrow 120-4Q=4 \rightarrow Q=29$$

$$TR = 4*29 = \$116$$

$$TC = 400+4(29) = \$516$$

$$\square \text{ Subsidy} = \$400$$

c. Suppose this firm is regulated and told that it must produce at least 15 units of the good and that it should select that price and output given its cost curves that will result in the firm earning zero economic profit. Given this regulatory directive, what price and quantity will be produced?

$$ATC = Demand \rightarrow 400/Q + 4 = 120 - 4Q$$

$$Q = 25$$

$$P = 120 - 4(25) = 20$$

3. Externalities: On Aloha Island, the demand of widgets is given by $P = 30 - Q$ and the supply for widgets is given by $P = Q$. It is estimated that for every widget that's produced, the factory creates enough pollution to cost the local fishing industry \$2.

a. What is the market equilibrium without regulation?

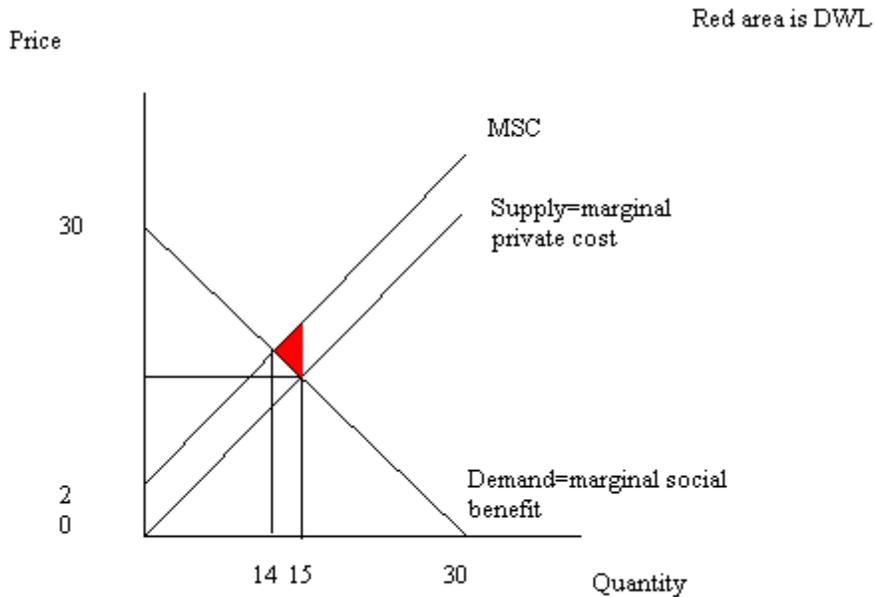
$$Q = P = 15$$

b. What is the equation for the Marginal Social Cost curve? Use this to figure out what the socially optimal amount of widgets is. Is the socially optimal the same amount as you found in part (a)?

The MSC curve is given by $MSC = Q + 2$ → Set the MSC equal to the marginal social benefit (in this case the MSB is the market demand curve) to find the socially optimal amount of the good. $30 - Q = Q + 2$ → $Q = 14$ is the socially optimal amount of the good. In this case the market produces too much of the good since there is a negative externality that the market fails to take into account.

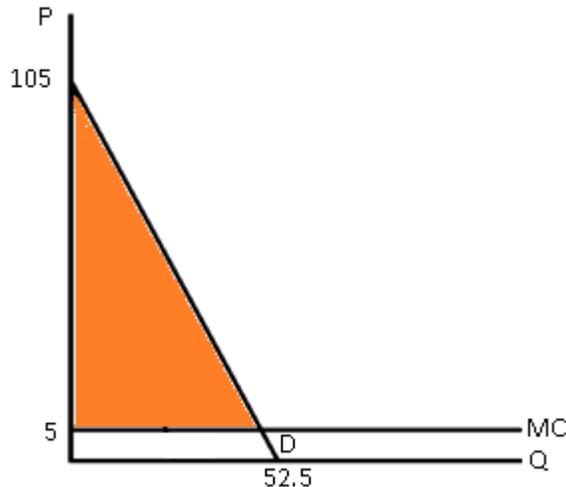
c. The government could achieve the outcome in (b) by charging a "pollution tax" on each widget produced equal to \$2. What would be the deadweight loss if the government did not do this? (Hint: draw a graph with the unregulated market supply curve, the MSC, and the demand curve. Use your notes to identify the DWL on this graph.)

For the graph: See class notes or consult the figure below.



The marginal social cost at $Q_{\text{market}} = \$17$
 $DWL = \frac{1}{2} * 1 * (17 - 15) = \1

4. First Degree Price Discrimination: Suppose the market demand for psychics is given by the equation: $P = 105 - 2Q$. Currently, there are many psychics in the market, and because there is so little cost to being a psychic, the market is perfectly competitive. The marginal cost of being a psychic is \$5.
- a. Graph the demand and marginal cost for the psychic market.



- b. Calculate the equilibrium quantity of psychic consultations in this market.
- Answer: equilibrium in perfect competition is $P = MC$
 $105 - 2Q = 5, Q^{PC} = 50$
- c. What are the producer, consumer, and total surpluses? Label them on your graph.

Answer: Shaded on the graph in part (a) is Consumer surplus
 $CS = (1/2)(105-5)*(50) = \2500
 $PS = \$0$
 $TS = 2500 + 0 = \$2500$

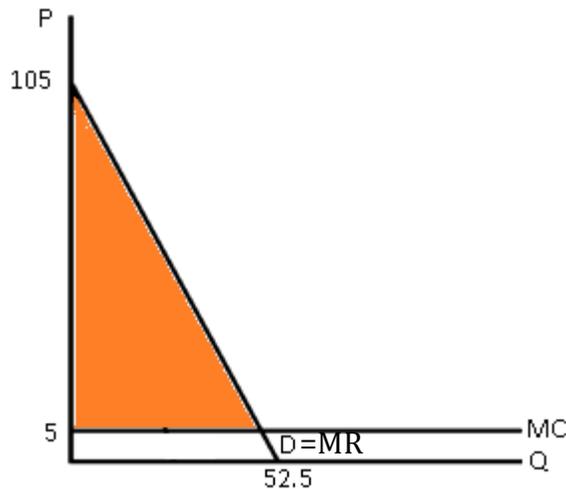
Scientists have come out with a new test to determine with 100% accuracy whether or not someone is a psychic. After testing all of the psychics that practiced in the United States, they found that there was only one who was actually what she claimed to be. Now, the lone psychic Miss Cleo, is a monopolist psychic. Miss Cleo's marginal cost for providing her services is a constant \$5. Now that she is a monopolist, Miss Cleo decides to take advantage of her gift and to practice first-degree price discrimination.

- d. What is the equation for marginal revenue?

Answer: Marginal revenue is the same as the demand curve for first-degree price discrimination. So, $MR = 105 - 2P$

- e. On a separate graph from parts (a) and (b), graph the demand, marginal revenue, and marginal cost for Miss Cleo.

Answer:



- f. Calculate the equilibrium quantity of psychic consultations in this market.

Answer: In perfect price discrimination, the equilibrium quantity is to sell up until $P = MC$, so the equilibrium quantity is unchanged at $Q = 50$.

- g. What are the producer, consumer, and total surpluses? Label them on your graph.

Answer: Shaded on the graph in part (a) is producer surplus
 $CS = \$0$
 $PS = (1/2)(105-5)*(50) = \2500
 $TS = 2500 + 0 = \$2500$

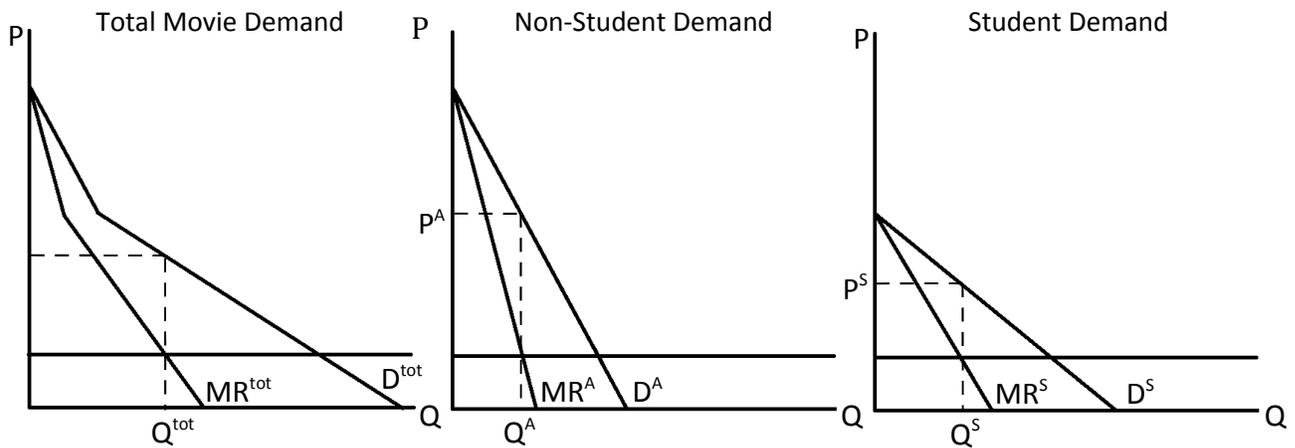
- h. What is the deadweight loss from Miss Cleo acting as a perfect price discriminating monopolist? Give a conceptual explanation of why this is the case (i.e. using notions of efficiency).

Answer: there is no deadweight loss in the case of first-degree price discrimination. First-degree price discrimination is allocatively efficient/socially optimal. By definition, something is allocatively efficient if the price at which the last unit is sold is exactly equal to the cost of producing that unit. This is the case in both perfect competition and in first-degree price discrimination.

5. Third Degree Price Discrimination: Starplex Cinema is trying to decide whether or not to use third degree price discrimination. They think that the demand for movie tickets by college students is much more elastic than it is for their other patrons. Starplex does some economic studies and finds that the demand for college students is given by $P = 12 - Q_s$. Starplex also finds that demand for movie tickets by non-college patrons is $P = 20 - 2Q_A$. Suppose that Starplex has a constant marginal cost of \$3.

- a. Graph the market for movie tickets on three graphs. One for the total movie ticket demand, one for non-student demand, and one for student demand.

Answer:



- b. Calculate the aggregate demand curve.

Answer: Solving both demand curves for quantity and adding them together gives part of the aggregate demand curve:

$$Q = (12 - P) + (10 - 1/2P) = 22 - 1.5P$$

Which is the aggregate demand curve only for the prices and quantities at which both sets of consumers are purchasing goods.

Aggregate demand:

$$P = 20 - 2Q \text{ for } P > 12$$

$$P = (44/3) - (2/3)Q \text{ for } P < 12$$

- c. Calculate the aggregate marginal revenue curve.

Answer:

$$P = 20 - 4Q \text{ for } P > 12$$

$$P = (44/3) - (4/3)Q \text{ for } P < 12$$

- d. What total quantity of movie tickets will be sold by Starplex?

Answer: the total quantity will be where aggregate marginal revenue is equal to the marginal cost curve. From the graph, we can tell that the quantity Starplex produces will fall on the lower portion of the demand curve. [Hint: your answer should be carried out to two places past the decimal: you might find a calculator handy for this calculation.]

$$(44/3) - (4/3)Q = 3$$

$$(35/3) = (4/3)Q$$

$$Q = 35/4 = 8.75$$

- e. What price would Starplex charge if it were a single price monopolist and not a price discriminating monopolist? [Hint: this price is not a whole number, you might want to use your calculator here.]

Answer: Starplex would charge the price where aggregate marginal revenue is equal to marginal cost.

$$P = (44/3) - (2/3)(35/4) = \$8.33 \text{ per unit}$$

- f. Suppose that Starplex decides to implement third degree price discrimination. How many tickets will be purchased by college students? What price should Starplex charge college students? [Hint: carry your answer out to two places past the decimal.]

Answer: Starplex would sell where the marginal revenue of college student tickets is equal to marginal cost from the aggregate market.

$$12 - 2Q^S = 3$$

$$Q^S = 4.5 \text{ units should be sold to college students}$$

$$P^S = 12 - 4.5 = \$7.50 \text{ per movie ticket for college students}$$

- g. Suppose that Starplex decides to implement third degree price discrimination. How many tickets will be purchased by non-students? What price should Starplex charge non-students?

Answer: Starplex would sell where the marginal revenue of non-student tickets is equal to the marginal cost from the aggregate market.

[Hint: carry your answer out to two places past the decimal.]

$$20 - 4Q^S = 3$$

$$Q^S = 4.25 \text{ units should be sold to non-students}$$

$$P^S = 20 - 4.25 * 2 = \$11.50 \text{ per movie ticket for non-students}$$

6. Game Theory: Suppose that there are two musicians: Ricky Rock Star and Harry Hip Hop. Working by himself Ricky can capture the rock audience and earn a profit of \$5 million. Working by himself Harry Hip Hop can capture the rap audience and earn a profit of \$5 million. If the two musicians decide to collaborate they can also capture a third audience of listeners who like rap-rock fusion. Capturing this audience is worth a total of \$3 million in profit that the two musicians would need to split evenly.

Both musicians have two possible options: (1) he can collaborate with the other musician and share all three markets or (2) he can go it alone and try to win over the other markets separately.

If a musician chooses not to collaborate, then he can release a CD much more quickly than if he worked with another artist. Therefore, if one musician chooses to collaborate and the other does not, then the artist going it alone will be able to release a CD and earn all of their own market and the fusion audience. If both decide to work alone, then the fusion audience becomes disillusioned with the music industry and refuses to buy any records.

- a. Construct a payoff matrix from the above information. The following matrix is provided for your convenience.

		Ricky Rock Star	
		Alone	Collaborate
Harry Hip Hop	Alone		
	Collaborate		

Answer:

Ricky Rock Star

		Alone	Collaborate
		Alone	5,5
Harry Hip Hop	Collaborate	0,8	6,5,6,5

- b. Is there a strictly dominant strategy for Ricky Rock Star?
Answer: yes, "alone" is the strictly dominant strategy.
- c. Is there a strictly dominant strategy for the Harry Hip Hop?
Answer: yes, "alone" is the strictly dominant strategy.
- d. What will be the outcome of the game?
Answer: the outcome will be (Alone, Alone).
- e. Is this outcome socially optimal (i.e. can no one be made better-off without making someone else worse-off)? If so, why? If not, which outcome is socially optimal?
Answer: No. The socially optimal outcome would be for both musicians to collaborate since this is where their joint profits are maximized: $6.5 + 6.5 = \$13$ million in profit which is better than the sum of any other cell in the payoff matrix.