

## Homework #10

**Problem 1:** More on Externality

Consider the market for education. The marginal social cost of education (MSC) and the marginal private benefit of education (MPB) are given by the following equations where  $Q$  is the number of units of education provided per year.

$$MSC = 10 + Q$$

$$MPB = 100 - Q$$

You are also told that each unit of education provides an external benefit to society of \$10 per unit. This external benefit is currently not being internalized in the market.

- a) Given the MSC and MPB curves, what is the current number of education units being produced by the market?
- b) Is the current level of market production for education the socially optimal amount of education? Explain your answer.
- c) What is the value of consumer surplus (CS), the value of producer surplus (PS), and the value of the external benefits of the current level of production. Sum together (CS + PS + external benefits). Draw a diagram illustrating each of these concepts in the market for education.
- d) Given the market level of production, what is the deadweight loss in this market?
- e) Suppose that the external benefit is internalized in this market when the government provides a subsidy of \$10 per educational unit to consumers. What will be the socially optimal amount of education to provide given this subsidy?
- f) Given the subsidy in (e), calculate the value of consumer surplus with the subsidy (CS'), producer surplus with the subsidy (PS'). With the subsidy there are no longer any external benefits that the market fails to account for. Sum together CS' + PS': does this total equal the sum of (CS + PS + external benefits) + DWL from parts (c) and (d)?

**Problem 2:** Public Goods

Consider an economy with two consumers, Ben and Joe. There is public good in this economy in a form of tornado sirens. Ben's demand for tornado sirens is given by  $P = 10 - Q$ , and Joe's demand for tornado sirens is  $P = 8 - 2Q$ . Marginal cost for providing tornado sirens in the markets is constant,  $MC = 9$ .

- a) Which two properties must be satisfied for sirens to be public goods?
- b) Are tornado sirens are non-rival? Explain your answer.
- c) Are tornado sirens are non-exclusive?. Explain your answer.
- d) Is there a potential for free-rider problem?.

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- e) Derive market demand curve for sirens. Draw three graphs on the top of each other– first graph for Ben’s demand, second graph for Joe’s demand, and the third graph for market demand.
- f) How many sirens will be provided in the market?
- g) What will be the price for these sirens?
- h) Is the result from previous question realistic? Discuss how government funds public goods.

**Problem 3:** Expected Utility

$U(W) = W^{1/2}$ ,  $W_a = 100$  with probability 1;  $W_b = 50$  with  $p_1 = 0.5$  and  $W_b = 150$  with  $p_2 = 0.5$ . The expected utility for the possible two wealth situations are as follows:

$E(U(W_a)) = U(W_a)$  (for certain wealth),  $E(U(W_b)) = p_1 * U(W_1) + p_2 * U(W_2)$ (for random wealth)

- a) Compute the expected utility of certain wealth and for gamble
- b) Draw the graph for expected utility
- c) Find the the certainty equivalent wealth associated with  $E[W_b] = 100$ .
- d) Draw CE on the graph