B.E. International Program

Faculty of Economics, Thammasat University

EE 465/463 Project Evaluation

Semester 2/2014

Homework Assignment 1 – Suggested Answers

There are four questions in total; each is worth 10 points. Use diagrams to illustrate your answers when needed.

1. Three mutually exclusive projects are being considered for building a dam: Project A, a dam used for irrigation purposes only, has estimated benefits of $12 million and costs of $8 million; Project B, an irrigation dam with some recreational facilities, has estimated benefits of $14 million and costs of $10 million; Project C, an irrigation dam with a hydroelectric power station, has estimated benefits of $20 million and costs of $18 million. In addition, a road could be built for a cost of $2 million that would increase the benefits of project A, project B, and Project C by $3 million, $7 million, and $5 million, respectively. Even in the absence of any of the other projects, the road has estimated benefits of $3 million.
    a. (8 points) Calculate the ***benefit-cost ratio*** and ***net benefits*** for each possible alternative to the status quo. Note that there are seven possible alternatives to the status quo: A, B, and C, both with and without the road, and the road alone.
    b. (8 points) If only one of the seven alternatives can be selected, which should be selected according to the CBA decision rule?

Answer:

a. The seven possible alternatives to the status quo have the following costs (millions), benefits (millions), benefit/cost ratios, and net benefits (millions):

Alternative	B	C	B/C	NB
Project A without road	12	8	1.50	4.0
Project A with road	15	10	1.50	5.0
Project B without road	14	10	1.40	4.0
Project B with road	21	12	1.75	9.0
Project C without road	20	18	1.11	2.0
Project C with road	25	20	1.25	5.0
Road alone	3	2	1.50	1.0

b. Project B with road should be selected.

2. Suppose that the inverse demand and supply functions of liquor consumption (say, vodka) in a market are given by:

$$P = 100 - 2Q_d \qquad \text{and} \qquad P = 0.5Q_s - 10$$

where Q_d is the quantity demanded of vodka, Q_s is the quantity supplied of vodka and P is the price per bottle of vodka.

a. (2 points) Find the equilibrium price and quantity of vodka in this market.
Ans. $Q^* = 44$, $P^* = \$12$

b. (4 points) Research has shown that drinking vodka can decrease people's driving ability, and this imposes an extra cost to the society. Suppose the external cost (or negative externality) of vodka consumption is $2 per unit. Draw a diagram to illustrate the deadweight loss to society if the market is left to its own device.
(see attached file)

c. (4 points) Suppose a per-unit tax of $1.5 is charged from vodka buyers. As a result, the inverse demand shifts downward. Illustrate the changes in net social benefits. Discuss the impact of this tax policy.
Ans. The deadweight loss will be reduced but not totally – see attached file.

[Note: For parts (b) and (c), you need to label the diagrams clearly. No need to calculate.]

3. Consider a low-wage labor market. Workers in this market are not presently covered by the minimum wage, but the government is considering implementing such legislation. If implemented, this law would require employers in the market to pay workers a 300 baht daily wage. Suppose all workers in the market are equally productive, the current market clearing wage rate is 200 per day, and that at this market clearing wage there are 1,000 employed workers. Further suppose that under the minimum wage legislation, only 800 workers would be employed and 400 workers would be unemployed. Finally, assume that the market demand and supply schedules are linear and that the market reservation wage, the lowest wage at which any worker in the market would be willing to work, is 50 baht per day. Compute the monetary value of the impact of the minimum-wage policy on employers, workers, and society as a whole.

Answer:

- (4 points) The impact on employers (demanders) is the loss in consumer surplus (the trapezoid area under the demand curve and between the two wages):
  - ⇨ Employers' total loss = ½*[(1000+800)/2]*฿100 = $90,000
- (4 points) The impact on workers (suppliers) can be decomposed into two groups:
  - The 800 workers who remain employed and gain $100 higher wage:
  - ⇨ Total gain to 800 workers = 800 * ฿100 = ฿80,000
  - The 200 workers who become unemployed. Assume these workers are assumed to be equally distributed along the market supply curve between the market reservation wage of ฿50 and the market equilibrium wage of ฿200.
  - ⇨ Total loss to 200 workers = 200*[½*(฿200+฿50] = ฿25,000.

Finally, 400 workers are induced by the higher wage to enter the market. However, since jobs are not available for these persons, they do not work either before or after the minimum wage is introduced. Hence, they neither gain nor lose surplus.

➔ (2 points) Therefore, the total impact of the minimum wage on society as a whole equals: ฿80,000 – ฿90,000 – ฿25,000 = -฿35,000.

4. Suppose the government is considering an increase in the toll on a certain stretch of expressway from 40 baht to 50 baht. At present, 25,000 cars per day use that expressway stretch; after the toll increase is imposed, it is projected that only 20,000 cars per day will use the expressway stretch.

    a. (5 points) Assuming that the marginal cost of expressway use is constant (i.e., the supply schedule is horizontal) and equal to 40 baht per car, calculate the change in consumer surplus and the net cost to society attributable to the increase in the toll. (Hint: The toll increase will cause the supply schedule, not the demand schedule, to shift.)

    Answer:

    - Change (loss) in consumer surplus = (1/2)*(50-40)*[1/2*(20,000+25,000)] = 225,000
    - The increased toll paid by the remaining drivers is (50-40)(20,000) = 200,000. This collected toll can be viewed as a transfer from the drivers to the government.

    Hence, the net social cost of the project is the deadweight loss = (1/2)(50-40)(25,000-20,000) = 25,000 baht.

    b. (5 points) Because of the reduced use of the expressway, demand in the secondary market for gasoline increases by 20,000 liters per day (since drivers avoid the expressway by using local roads which have longer distance). As we realize, there is a stiff tax on gasoline, one that existed prior to the new toll. Assuming that the marginal cost of producing gasoline is 30 baht per liter, that these marginal costs are constant (i.e., the supply schedule is horizontal), that no externalities result from the consumption of gasoline, and that the gasoline tax adds 5 baht to the supply price, are there any additional costs or benefits due to this shift? If so, how large are they?

    Answer: Yes, there are additional costs due to the increase in the toll – that is, the increase in the government's tax revenue from increased gasoline sales: 5*20,000 = 100,000 baht.