

Problem Set #7
PAI 897
Professor David Popp
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Solutions Available Monday, December 11

1. The City of Gallifrey is debating whether to build a new convention center. Currently, the city has no facilities for hosting large conventions. Proponents argue that the convention center will provide several benefits, which are described below. Because of your expertise in cost-benefit analysis, a group of concerned citizens has asked you to review this list and comment on whether the benefits are legitimate.

- The convention center will host several events per year that will be attended by out-of-town businesses. As Gallifrey currently has no facilities appropriate for hosting such events, these events would otherwise take place in other cities.
- In addition, local businesses will be able to use the convention center for events. The city will charge rent for these events, generating additional revenue for the city.
- Catering services required for these events will create new jobs for local businesses.

For each of the benefits above, please state whether or not they are legitimate benefits that should be included in a cost-benefit analysis. For those that you do not think are legitimate benefits, please explain to the city why they should not be counted as benefits.

2. The National Park Service is considering removing two dams in Olympic National Park. These dams provide nearly 40% of the electricity used by the Daishowa pulp and paper mill in Port Angeles, Washington. The mill gets the rest of its power from the Bonneville Power Administration (BPA), a local utility that operates as a monopoly. If the dams are torn down, all of the mill's electricity will have to be purchased from the BPA. To evaluate the economic cost of the power lost if these dams are torn down, is the commercial rate for electricity charged by the BPA a good measure of the shadow price of electricity? Why or why not?

- 3.** To upgrade the services it provides constituents, the government is considering a large purchase of desktop computers. The purchase will increase demand for computers, resulting in higher prices. Government analysts wish to consider how the purchase will affect the computer market so that they can use the proper opportunity cost of the government purchase in their cost-benefit analysis.

To begin, you are given the following information:

- The current computer market is perfectly competitive.
 - All computers are purchased from domestic suppliers.
 - Consumers currently purchase 200,000 computers at a price of \$800.
 - The government plans to purchase 40,000 computers. If they do, the price of computers will increase to \$900.
 - At a price of \$119, consumers will only purchase 170,000 computers.
- a) Use a supply and demand diagram to illustrate the initial equilibrium, before the proposed government purchase. Add a second demand curve to the diagram representing the combined demand of both consumers and the government. Use the information from above to indicate the quantities purchased by consumers at both the initial price of \$800 and the new price of \$900, as well as the combined total purchased by the government and consumers at a price of \$900.
- b) Reproduce your diagram from part (a). On it, please label the changes in consumer surplus and producer surplus that occur as a result of higher computer prices. Is the net change to consumer and producer surplus positive or negative – that is, which change in surplus is larger?
- c) At a price of \$900, the government will spend \$36 million on computers. Based on your answer to part (b), should this expenditure be adjusted up or down to account for changes to consumer and producer surplus? Please calculate the value of this adjustment, using your graph as a guide to the numbers needed.

- 4.** Consider two projects. The first has a large setup costs, but provides larger benefits afterwards. The second involves no set up, but provides only minimal net benefits each year. The net benefits of each project in each year are listed below:

Project	Year 0	Year 1	Year 2	Year 3
A	-\$500	\$250	\$250	\$250
B	\$50	\$50	\$50	\$50

You may assume that all values are presented as real dollars.

- a) Suppose that the real discount rate is 3%. Which project is preferable? Why?
- b) Suppose that the real discount rate is 8%? Which project is preferable? Why?
- c) Explain intuitively why the results differ in parts (a) and (b).

- 5.** Suppose that demand in South Africa for a treatment for HIV infection is given by the following demand curve:

$$P = 50 - 0.0025Q$$

where Q represents one bottle of the medicine.

- a) Currently, a single company holds a patent for this HIV treatment. As such, they are able to set a high price for a bottle of medicine. The current price in South Africa is \$25. How much medicine will be sold at this price? Illustrate on a graph. What is the total willingness to pay for these treatments?
 - b) Suppose that Doctors Without Borders begins a campaign to supply these medicines as the marginal cost of production. The marginal cost of production is just \$1 per bottle. How many bottles would be sold if the price were just \$1? Illustrate on a graph. What is the total willingness to pay for these treatments?
 - c) Based on your answers to (a) and (b), what would be the benefit to South African citizens of providing the drug at marginal cost, rather than at the monopoly price?
- 6.** Mufasaville, a small village in Africa, is considering whether to invest in a rural electrification project. The project requires the purchase of a solar photovoltaic array to generate electricity and investment in transmission lines to provide power to individual households. Construction of the array and transmission lines will cost \$1,500,000.

The village is home to 750 families. This includes 500 middle-income families who currently own electric appliances that they power using generators and 250 low-income families who cannot afford electric appliances, and are thus not expected to benefit from the electrification project. By purchasing electricity from the project, rather than powering their own generators, each middle-income family is expected to save \$200 per year. These benefits are expected to last forever.

For the calculations below, please assume a discount rate of 5%.

- a) Using the information provided above, calculate the net present value of the rural electrification project. You may assume a discount rate of 5%. Is the project worth doing? Why or why not?
- b) Suppose that the project will be financed by charging each middle-income family that owns an electric appliance an “appliance tax” of \$150. This tax will be collected every year, continuing forever. Calculate the net present value of the project to a typical middle-income family. Is the project worth doing under this financing scheme? Why or why not?
- c) Suppose the project will be paid for by charging each family in the village a tax of \$100. This tax will be collected every year, continuing forever. Please calculate the net present value of the project to a typical low-income family and a typical middle-income family. Does your evaluation of the project change? Why or why not?