

Solutions Available Wednesday, December 8

1. The state of Wisconsin is considering building a new highway connecting its largest city, Milwaukee, to its suburbs. As the highway only covers a short distance, planners anticipate that most drivers on the highway will be local residents using it to commute to and from the city of Milwaukee. Proponents argue that the highway 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 provide your advice. For each of the benefits listed below, please complete the following:
- State whether or not they are legitimate benefits that should be included in a cost-benefit analysis.
 - For those that are legitimate, please state briefly how the benefits could be quantified.
 - For those that you do not think are legitimate benefits, please explain why they should not be counted as benefits.
- a) The highway will reduce traffic congestion in a busy area, reducing the average commute time into the city by 10 minutes.
- b) Because there will be less traffic, more shoppers will come into the city of Milwaukee to shop. Proponents project that this will lead to an additional \$10 million in revenue for downtown shops.
- c) Drivers will be charged a \$3 toll to use the highway. This will generate new revenue for the community.
2. A recent Department of Transportation study shows that purchasing automated safety equipment packages (e.g. automated braking, blind spot detection) reduces the risk of death in a car accident by 1 in 1,500. That is, for every 1,500 people that purchase automated safety equipment when they buy a new car, 1 less person will die in a car accident.

You have been asked to use this information to estimate the value of a life for a cost-benefit analysis on new safety regulations. After careful study, you have determined that the demand curve for automated safety equipment is:

$$P = 8,000 - 0.5Q$$

where Q represents the number of car buyers who purchase an automated safety equipment package.

- a) Automated safety equipment currently costs \$2,000. At this price, how many car buyers will purchase automated safety equipment? Illustrate on a graph.
- b) What is the total willingness to pay for the number of automated safety packages purchased that you found in part (a)?
- c) Based on the results from the Department of Transportation study, how many lives will be saved if this number of safety packages are purchased? Using this information and the total willingness to pay found in part (b), calculate the value of a life saved to a typical car buyer.

3. The government is considering purchasing several commercially built drones for use in weather observation. Because of the large size of the purchase, this will increase demand for drones, resulting in higher prices. Government analysts wish to consider how the purchase will affect the drone 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 drone market is perfectly competitive.
- All drones are produced by domestic suppliers.
- Consumers currently purchase 10,000 drones at a price of \$85.
- The government plans to purchase 5,000 drones. If they do, the price of drones will increase to \$119.
- At a price of \$119, consumers will only purchase 7,200 drones.

- 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 \$85 and the new price of \$119, as well as the combined total purchased by the government and consumers at a price of \$119.
- 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 drone 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 \$119, the government will spend \$595,000 on drones. 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. Bill rides the subway at a cost of 75 cents per trip, but currently would switch if the price were any higher. His only alternative is a bus that takes five minutes longer, but costs only 50 cents. He makes 10 trips per year.

The city is considering renovations of the subway system that would reduce the trip by 10 minutes. Fares would rise by 40 cents per trip to cover the costs of the renovation.

The fare increase and benefits of reduced travel time are both projected to be in effect forever. Alternative investments made by the city currently earn a 7% nominal rate of return. Inflation is 2%.

- a) Use the information on Bill's travel decisions to calculate the value he places on a minute of his time.
- b) Based on this information, what is the present value of the project's benefits and costs to Bill?
- c) The city's population consists of 55,000 middle-class people, all of whom are identical to Bill, and 5,000 poor people. The poor people are either unemployed or work close to home, so they do not use any form of public transportation. What are the total benefits and costs of the project for the city as a whole? What is the net present value of the project? Is the project worth doing?
- d) Suppose that, instead of raising fares, the city decided to pay for the renovations by increasing taxes to cover the cost. This leads to a tax increase of \$3.67 per person. All families, whether or not they ride the subway, must pay the higher taxes. How, if at all, does this change your answer to part (c)?