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Economics 437

The Maxwell School
Syracuse University

# Exam 1

Spring 2016

**VERSION P**

*Instructions*

1. Write your **SUID NUMBER** on your bluebook and DO NOT write your name.
2. Write the **EXAM VERSION** from the box above on your bluebook.
3. Do not open the exam until you are told to do so.
4. Please turn off the ringer on your phone right now – before the exam begins.
5. If you are wearing a baseball cap, please remove it or turn it backward.
6. **SHOW ALL YOUR WORK**. Numerical answers without supporting work will receive little or no credit and may be presumed to be copied from another exam.
7. You have 80 minutes to work on the exam. There are 80 points possible; please budget your time accordingly. Also note that many of the questions have (a), (b), etc., inserted into the text to help you avoid overlooking part of the answer.
8. Collaboration of any kind on the exam is not allowed. *Use of phones or other wireless devices at any time during the exam will be presumed to be collaboration – so don't do it.* Cheating of any kind will result in an F on the exam and referral of the case to the Dean's office for further sanctions.
9. Calculators *may not* be shared.
10. Some handy formulas:

Present Value: $PV = \frac{B}{(1+r)^t}$ $PV = \frac{B}{r}$

Areas: $\text{Triangle} = \frac{bh}{2}$ $\text{Trapezoid} = \left(\frac{b_1 + b_2}{2}\right)h$

**Question 1 (15 points)**

A city is struggling with traffic. Currently, traffic costs drivers $1 million per year in frustration and wasted time. Two policies, B and R, have been proposed to address it. Policy B would create special express bus lanes on major roads. Policy R would construct a light rail system (essentially an above-ground subway). The policies differ in how much they cost, how likely they are to work, and how much traffic would be reduced if they did. You've been given the following information and asked to determine which policy, if any, the city should adopt:

B: Costs $1 million in year 0 (no other payments); begins operating in year 5; has an 80% chance of working; and would reduce traffic costs *to* $800,000 per year (starting in 5) if it works.

R: Requires three payments of $1 million each in years 0, 5 and 10 (no payments in any other years); begins operating in year 11; has a 50% chance of working; and would reduce traffic costs *to* $300,000 per year (starting in 11) if it works.

For both policies: there is no change in traffic until operation begins (year 5 or year 11), and if the policy doesn't work, people continue to drive and traffic costs remain $1 million per year.

Using an interest rate of 5%, please determine: (a) the expected NPV of option B; (b) the expected NPV of option R; and (c) indicate which one (or neither) the city should choose.

**Question 2 (20 points)**

Consider a good purchased by two types of buyers, H and L (think of them as high and low income). There 5 type-H buyers and 10 type-L buyers. The WTP equations for an individual *i* of each type are shown below. The WTA curve for suppliers as a group (that is, the market supply) is also given. In addition, it is known that production of the good creates a negative externality according to the MCext curve shown below.

| | |
|---|---|
| Type-H individual: | WTPhi = 500 – (1/4)*Qhi |
| Type-L individual: | WTPli = 300 – (1/8)*Qli |
| Market WTA: | WTA = Qt/100 |
| Externality: | MCext = 140 |

The government would like to control the externality with a tax policy. Please determine: (a) the market equilibrium price and quantity in the absence of the policy; (b) the efficient tax rate; (c) the new equilibrium with the tax imposed; (d) the change in CS for an individual buyer of type H; (e) the total revenue raised by the tax; and (f) the overall gain in social surplus from the policy.

Exam continues on the next page…

**Question 3 (15 points)**

Some kinds of electronics contain heavy metals and other toxins that can leach out of landfills to contaminate water supplies. This question examines a stylized version of that problem. Suppose that a particular electronic product E purchased in year 0 is usually discarded in year 4. There is a 50% chance it will be recycled, in which case it causes no externalities. However, if it isn't recycled, it ends up in a landfill and has a 40% chance of causing $1.16 of contamination every year forever starting in year 4. The supply of E is known to be perfectly elastic at MCe = $40. Initially, there is no tax on E, the market is in equilibrium, and 10,000 units of E are being sold. The elasticity of demand for E is equal to -2.

The government would like to impose an appropriate tax to address the problem. Please determine: (a) the efficient tax on E; (b) the efficient quantity of output; and (c) the amount of tax revenue that would be raised each year. You may assume the government uses an interest rate of 5% in PV calculations.

**Question 4 (15 points)**

Production of a good creates a negative externality. The market willingness to pay for the good is WTP = 100 – (1/2)*Q and the market willingness to accept is WTA = 10 + (1/18)*Q. The external cost associated with the good is given by MCext = (5/18)*Q. The government would like to reach efficiency by imposing a quota on production of the good.

Please determine: (a) the market equilibrium price and quantity; and (b) the efficient quantity. Then suppose that a quota is imposed limiting output to the efficient quantity. Please determine: (c) the buyer price that will occur in the market when the quota is imposed; (d) the change in CS; (e) the change in PS; (f) the change in the externality; and (g) the overall change in social surplus.

**Question 5 (15 points)**

A particular good causes a $5 external cost when it is discarded. The supply of the good is known to be perfectly elastic at MC = $20, there are 100 units being sold, and no policy is now in place to address the externality. The demand elasticity is known to be -3. A government is considering two approaches to the problem: taxing the good (policy T) or setting up a recycling program (policy R). The tax policy would impose the efficient tax on sales of the good. In contrast, the recycling policy would have no impact on the market itself. Instead, the government would spend $4 per unit to collect and recycle every unit that was produced. To keep things simple, please assume that the government can impose one policy or the other but not both.

Please determine: (a) the gain in social surplus from imposing the tax policy; (b) the gain in social surplus from carrying out the recycling policy; and (c) indicate which policy, if any, is a better option and briefly explain why.