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Economics 410

The Maxwell School
Syracuse University

Exam 1

Spring 2009

VERSION R

Instructions

1. Write your SU ID NUMBER and the exam version letter above on your blue book. Please DO NOT write your name.

2. Do not open the exam until you are told to do so.

3. Please turn off the ringer on your phone right now – before the exam begins.

4. If you are wearing a baseball cap, please remove it or turn it backward.

5. SHOW ALL YOUR WORK. Numerical answers without supporting work will receive little or no credit.

6. You have 80 minutes to work on the exam. There are 75 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.

7. 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.

8. Calculators *may not* be shared.

9. Some handy formulas:

$$PV = \frac{B}{(1+r)^t} \qquad PV = \frac{B}{r}$$

Question 1 (15 points)

Using appropriate livestock grazing practices, it is possible to remove CO_2 from the atmosphere and store the carbon in the soil. However, the amount of carbon stored per acre is uncertain and varies with the weather and other factors.

To keep things simple, suppose that the amount of carbon stored due to grazing depends mainly on the amount of rainfall. Each year there is a 50% chance of normal rainfall, a 25% chance of flooding and a 25% chance of drought. In a normal year, 10 tons of carbon are stored per acre. In a flood year, only 8 tons are stored. In a drought year, there is a 95% chance that no carbon will be stored but there is also a 5% chance there will be a wildfire. If a fire occurs, 160 tons of carbon will be *released* into the atmosphere. You may assume that a fire in one year has no effect on the probability of another fire in subsequent year.

Suppose that each ton of carbon stored creates an external benefit of $1 per year forever in reduced climate damages. In addition, suppose that land is available for grazing at a marginal cost of $500 per acre per year, and that the elasticity of demand for land is -1.5. The interest rate is 5%.

Please compute (a) the expected present value external benefit created by grazing an acre of land. Then determine (b), (c) the efficient subsidy and price of land, and (d) the percentage change in grazing land that would occur under the efficient subsidy.

Question 2 (15 points)

Production of a particular good creates a negative externality. The market willingness to pay for the good is W2P = 300 – 2*Q and the marginal cost of producing it is MC = 50. The external marginal costs are given by MCext = 3*Q.

Please compute: (a), (b) the price and quantity at the market equilibrium, (c), (d) the efficient price and quantity, and (e) the net welfare gain from moving from the market equilibrium to efficiency.

Exam continues on the next page …

Question 3 (15 points)

A pollutant is emitted by 100 firms, each of which is initially generating 50 tons of emissions. Twenty of the firms use an old technology that is difficult to clean up; each of those firms has a marginal abatement cost curve given by the equation $MCA_i = 1*Q_i$ where Q_i is the amount of abatement done by old source *i* and *i* is a subscript running from 1 to 20. The remaining 80 firms use a newer technology that can be cleaned up at a cost given by $MCA_j = (1/5)*Q_j$ where *j* is a subscript running from 1 to 80. The marginal benefit of abatement is known to be given by $MBA = 52 – (1/100) *Qt$, where Qt is total abatement. The government wishes to use a tax to control the externality.

Please calculate: (a) the efficient total amount of abatement, (b) the efficient tax rate on emissions, (c), (d) the amount of abatement done by *individual* firms with the old and new technologies, (e), (f) the abatement cost for a firm of each type, and (g), (h) the tax payment by each type of firm.

Question 4 (15 points)

Three sources each emit 300 tons of a pollutant (900 tons total). The marginal abatement costs for the three sources are given by: $MCA1 = (1/5)*Q1$, $MCA2 = (1/8)*Q2$ and $MCA3=(1/2)*Q3$. The marginal benefit of abatement is given by $MBA = 40 – (1/15)*Qt$, where Qt is total abatement.

Design a tradable permit system that will achieve the efficient amount of abatement while splitting the total compliance cost equally between sources 2 and 3, *leaving source 1 with zero overall cost*. Please calculate: (a) the equilibrium price of a permit, (b), (c) and (d) the number of permits that should be distributed to each source.

Question 5 (15 points)

Suppose that consumption of a particular product creates a positive externality. The good is purchased by 1000 individuals, each of whom has an identical willingness to pay given by $W2Pi=A – B*Qi$, where A and B are parameters and *i* is a subscript indicating individual *i*. Survey data indicate that when P=$45, a typical individual would buy 15 units and when P=$35 the individual would buy 20. The good is produced at a constant marginal cost given by MC=$25 and the external benefit is given by MBext = $4.

Please calculate: (a), (b) the values of A and B, (c), (d) the market equilibrium price and quantity, (e), (f) the efficient price and quantity, and (g) the total cost to the government of using a subsidy to get to efficiency.