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Economics 437

The Maxwell School
Syracuse University

Exam 1

Fall 2012

VERSION M

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.
7. 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.
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: $PV = \frac{B}{(1+r)^t}$ $\qquad PV = \frac{B}{r}$

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

Question 1 (15 points)

A city is evaluating whether it should upgrade its system for managing stormwater. Currently, stormwater drains into the city's water treatment system. During large storms the system becomes overloaded and raw sewage overflows into a nearby lake. The chance of an overflow in each year is 10% and the damage when it happens is $20 million. The city is considering two proposals. Proposal 1 would expand the water treatment plant. Construction would cost $25 million (paid in year 0) and the expansion would cost $500,000 a year to operate (paid from year 1 on). The new plant would eliminate the overflows. Proposal 2 would leave the water treatment plant alone but would use landscaping and special sidewalks and pavement to reduce the amount of stormwater entering the water treatment system. It would cost $16 million to construct (paid in year 0) and $200,000 a year to maintain (paid from year 1 on). It would not prevent the overflows completely but would make them less likely and less damaging: the chance of an overflow would drop to 5% and the damage would drop to $10 million. For both proposals, you may assume the project would begin operating in year 1 and would last forever.

Please compute (a) the expected present value cost with neither plan in place, and then (b), (c) the expected present value cost of each plan. Then (d) explain briefly which what plan is best. You may assume the city uses an interest rate of 5% in present value calculations.

Question 2 (15 points)

Production of a good creates a positive externality. The market willingness to pay for the good is WTP = 4800 – 2*Q and the marginal cost of producing it is MC = 2*Q. The external marginal benefits are given by MBext = 1*Q.

Please compute: (a), (b) the price and quantity at the market equilibrium, (c), (d) the efficient price and quantity, (e) the efficient subsidy per unit; (f) the total cost of the subsidy to the government; and (g) the net welfare gain from moving from the market equilibrium to efficiency.

Question 3 (15 points)

A pollutant is emitted by three firms: A, B and C. Firm A emits 40 tons and has an MCA given by MCAa = 2*Qa; firm B emits 60 tons and has an MCA given by MCAb = 4*Qb; firm C is identical to B: it emits 60 tons and has MCAc = 4*Qc. The government wants to reduce emissions by 50% and initially imposed a command and control regulation requiring each plant to cut its emissions in half. However, it is now considering switching to an emissions tax instead.

Please calculate: (a) the total cost of abatement under the command and control policy; (b) the emissions tax rate that would achieve the same reduction as the command and control policy; (c) the total cost of abatement under the tax policy; (d) each firm's overall compliance cost under the tax policy; and (e) the efficiency gain or loss from switching to the tax policy.

Exam continues on the next page …

Question 4 (15 points)

Three sources each emit 200 tons of a pollutant (600 tons total). Their marginal abatement costs are given by: MCA1 = 2*Q1, MCA2 = 4*Q2 and MCA3=8*Q3. The marginal benefit of abatement is given by MBA = 440 – 2*Qt, where Qt is total abatement.

Design a tradable permit system that will achieve the efficient amount of abatement while shifting the total compliance cost so that sources 2 and 3 each pay 50% of the cost and source 1 has a net payment of zero. Please determine: (a) the equilibrium price of a permit, and (b), (c) and (d) the number of permits that should be distributed to each source.

Question 5 (15 points)

Suppose a government is concerned about two goods, C and D. Good C is clean and has no external costs or benefits. Demand for C is given by WTPc = 300 – (1/100)*Qc and its marginal cost is MCc = 100. Good D is dirty and has external costs. Demand for D is given by WTPd = 1000 – (1/10)*Qd, its marginal cost is MCd = (1/30)*Qd, and its external costs are MCextd = 40.

Good C is currently subject to a $20 tax per unit and good D is not taxed. The government would like to impose an efficient tax on D and reduce the tax on C to $10. However, it will only do so if its overall tax revenue does not decrease (that is, the revenue from D is at least enough to make up for the lost revenue on C). Shifting taxes from clean to polluting goods is sometimes described as “green tax reform”.

Please calculate: (a) the efficient quantity of D; (b) the efficient tax rate on D; (c) amount of revenue raised by the new tax on D; (d) the amount of revenue raised on C after the tax on C has changed. (e) Does the tax on D make up for the change in revenue on C? (f) What is the overall efficiency gain in the D market? (g) What is the change in DWL in the C market? (h) What is the overall gain or loss from the swap?