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Economics 437

The Maxwell School
Syracuse University

Exam 2

Spring 2014

VERSION P

Instructions

1. Write your **SU ID NUMBER** on your blue book and DO NOT write your name.
2. Write the **EXAM VERSION** from the box above on your blue book.
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 120 minutes to work on the exam. There are 60 points possible (6 questions with 10 points each); 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. YOU MAY NOT USE YOUR PHONE OR TABLET. *Any use of phones, tablets or other wireless devices during the exam will be presumed to be collaboration and therefore cheating.*
9. 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.
10. Calculators *may not* be shared.
11. Some handy formulas:

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

Question 1 (10 points)

Three sources emit a pollutant and have the characteristics shown in the table below. In addition, the marginal benefit of abatement is given by MBA = 320 – 1*QaT, where QaT is total abatement.

Source	**Initial Emissions**	**MCA**
1	200	MCA1 = (1/4)*Qa1
2	100	MCA2 = (1/2)*Qa2
3	100	MCA3 = 1*Qa3

Design a tradable permit system that will achieve the efficient amount of abatement while shifting the total compliance cost so that each source pays a share of total abatement costs equal to its share of initial emissions (i.e., source 1 pays 50% and so on). 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 2 (10 points)

Suppose a pollutant was recently regulated using a hybrid policy. The marginal benefits of abating the pollutant were known to be given by the equation MBA = 1000 – 2*Qa. The marginal costs of abating it were believed at the time of regulation to be given by the equation MCAe = 400 + 2*Qa. Prior to regulation, 400 tons were being emitted. The regulator set up the hybrid policy with the following features: the initial quantity of permits distributed was equal to the efficient amount of pollution, and the price of waivers (additional permits) was set to the efficient MCA (that is, the tax rate that would be efficient). After the system was in place, however, the MCA curve was discovered to be wrong: the true curve is MCAa = 200 + 2*Qa.

Please calculate: (a) the efficient total quantity of abatement and the MCA if the original MCA curve had been correct; (b) the number of permits the regulator initially issued; (c) the efficient total quantity of abatement given the true MCA; (d) the actual quantity of abatement under the hybrid policy given the true MCA; (e) the equilibrium price of a permit given the true MCA; and (f) the deadweight loss, if any.

Question 3 (10 points)

A government is considering selling land to a power company to build a hydroelectric dam. However, building the dam would irreversibly destroy a scenic river now heavily used for whitewater rafting and other recreational activities. No admission fee is charged for use of the river and 114,000 people currently visit from six geographic zones labeled A through F. Information about the zones and visitors is given in the table below.

Zone	Travel Cost	Population	Visitors
A	$50	16,000	12,000
B	$100	25,000	15,000
C	$150	66,667	30,000
D	$200	150,000	45,000
E	$250	80,000	12,000
F	$300	40,000	0

The public's willingness to pay for visits (including people from all zones) is known to be given by an equation of the form: WTP = A - B*Q, where Q is the number of visitors and A and B are constants. The government also knows there are 200,000 people who do not visit the site but who value its existence and are each willing to pay $25 to keep it protected.

The government is evaluating the project over two periods: 0 (the present) and 1 (the future). The power company is willing to pay $24 million for the land in period 0 or $16 million for it in period 1. The government is not certain about the value of the river in period 1. It believes there is a 30% chance it will be the same as period 0 and a 70% chance it will be 3 times the period 0 value. The government uses an interest rate of 100% between the two periods.

Please compute: (a) the number of people who would visit the river in period 0 if a $50 admission fee were charged, (b) the values of A and B, (c) the amount of consumer surplus received by visitors in period 0, (d) the total benefit produced by the river in period 0 including the people who don't visit, (e) the expected net present value of keeping the land as a river in period 0, and (f) indicate whether or not the city should sell the land to the power company.

Question 4 (10 points)

Suppose a government wants to regulate a new air pollutant believed to be carcinogenic. Laboratory animals exposed to 600 micrograms (μg) of the pollutant per cubic meter (m3) of air have a 0.1% increased risk of premature death due to lung cancer in each year they are exposed. The government is concerned about two areas where the pollutant is present. Region A has a population of 1 million and its air has 21 μg/m3 of the pollutant. Region B has a population of 5 million and its air is somewhat cleaner: it has 12 μg/m3 of the pollutant.

The government is considering two policies to deal with the problem. Policy 1 would cost $400 million in year 0 and would permanently reduce pollution in A to match conditions in B: to 12 μg/m3. It would have no effect on B. Policy 2 would cost $1.5 billion ($1500 million) in year 0 and would permanently reduce pollution in A to 15 μg/m3 and in B to 9 μg/m3. The dose-response function for the pollutant is believed to be linear. The public is willing to pay $8 million per fatality avoided (the VSL is $8 million). Each policy's effects begin in period 1 and the government uses an interest rate of 10% when doing present value calculations.

Please calculate: (a) the expected number of cases of cancer per year due to the pollutant without any change in policy; (b),(c) the expected number of fatalities prevented by each policy per year; and (d),(e) the NPV of each policy. Finally, (f) if the government can only carry out one of the policies, which should it adopt?

Question 5 (10 points)

Consider the allocation of an exhaustible resource across three generations. The following information is available about demand and MEC in the three periods (today is generation 0):

Period	Demand	MEC
0	$WTP_0 = 1000 – 2Q_0$	400
1	$WTP_1 = 1500 – 2Q_1$	300
2	$WTP_2 = 2000 – 2Q_2$	300

Initially, there are 1330 units of the resource available. The interest rate between generations is 100%.

Please calculate: (a) the equilibrium royalty, extraction cost, price and quantity that would occur in each period, and summarize your results in a table. Then suppose that a backstop is available at a marginal cost of $500. Please calculate: (b) the new equilibrium royalty, extraction cost, price and quantity in each period, summarizing your results in a second table. Finally, calculate (c) the total amount of the resource produced via the backstop and (d) indicate the period(s) when the backstop will be used.

Question 6 (10 points)

Suppose that the demand for an exhaustible resource is given by WTP = 340 – (1/2)*Q. Initially, 400 units of the resource are known to be available and they can be extracted at MEC = $10; call these "conventional" deposits. It is also possible to find more of the resource by exploring more difficult geologic terrain (e.g., extracting natural gas via hydraulic fracturing); call these "unconventional" deposits. Drilling an exploratory well in an unconventional deposit costs $150. In 75% of exploratory wells nothing is found. In the remaining 25%, an average of 20 units are found. The unconventional nature of these deposits makes the resource more difficult to extract than conventional deposits and the MEC = $30. Once extracted, conventional and unconventional resources are perfect substitutes.

Please calculate: (a) minimum price that will induce exploration; (b) the equilibrium values of the royalty, price and total quantity consumed (taking exploration into account); (c) the amount of the resource that will be found via exploration; and (d) the expected number of wells that will be drilled.