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Economics 437

The Maxwell School
Syracuse University

Exam 2

Spring 2015

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)

The marginal benefits of abating a pollutant are given by MBA=1800–1*Q. Two sources of the pollutant were recently regulated. Just before regulation, each source was emitting 1000 tons (2000 tons total). At the time of regulation, the sources were believed to have abatement costs given by: MCA1=1*Q1 and MCA2=4*Q2. Using this information, the regulator set up a tradable permit system and gave each source exactly the number of permits it would need for its abatement to be efficient. After the system was in place, however, the MCA curves for both sources were discovered to be wrong. The true curves are MCA1=2*Q1 and MCA2=2*Q2.

Please calculate: (a) the efficient total quantity of abatement and the MCA if the original MCA curves had been correct; (b) the number of permits the regulator gave each firm; (c) the efficient total quantity of abatement given the true MCAs; (d) the deadweight loss, if any, under the permit system; (e) the equilibrium price of a permit under the actual MCAs; and (f) the value of any permit sales from one firm to the other.

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 = 2000 – 5*Qa. The marginal costs of abating it were believed at the time of regulation to be given by the equation MCAe = 3*Qa. Prior to regulation, 800 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 = 360 + 3*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 number of waivers sold, if any; and (g) the deadweight loss, if any.

Question 3 (10 points)

A government is considering selling forested land to a mining company. However, using the land for mining would irreversibly destroy scenic and recreational benefits now provided by the forest. No admission fee is charged for use of the forest and 98,000 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	$20	12,500	10,000
B	$40	25,000	16,000
C	$60	87,500	42,000
D	$80	62,500	20,000
E	$100	62,500	10,000
F	$120	70,000	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 50,000 people who do not visit the site but who value its existence and are each willing to pay $50 to keep it protected.

The government is evaluating the project over two periods: 0 (the present) and 1 (the future). The mining company is willing to pay $13 million for the land in either period. The government is not certain about the value of the forest in period 1. It believes that the value to the visitors will be the same as period 0 but is uncertain about the value to the non-visitors. It believes there is a 60% chance it will be the same as in period 0 and a 40% change it will be 5 times higher (250,000 people willing to pay $50 each). *The government uses an interest rate of **25%** between the two periods.*

Please compute: (a) the number of people who would visit the forest in period 0 if a $20 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 forest in period 0 including the people who don't visit, (e) the expected net present value of keeping the land as a forest in period 0, and (f) indicate whether or not the city should sell the land to the mining company.

Question 4 (10 points)

Benzene is a carcinogenic air pollutant that is emitted by gas stations, vehicles, refineries and chemical plants. It is also a component of cigarette smoke. Exposure to an average of 1 microgram (μg) of benzene per cubic meter (m3) of air increases a person's annual risk of cancer by 62.5 x 10^{-9} (62.5 in a billion) and you may assume the dose-response relationship is linear. Suppose the US can be divided into three regions based on benzene concentrations as shown in the table below:

Region	**Benzene Concentration**	**Population**
L	1.5 μg/m3	20 million
M	2.1 μg/m3	280 million
H	5.1 μg/m3	20 million

Three policies are available: policy L would cost $400 million and would reduce the concentration of benzene in region L to 0.5 μg/m3; policy M would cost $1.8 billion ($1800 million) and would reduce the concentration in region M to 0.7 μg/m3; policy H would cost $200 million and would reduce the concentration in H to 1.7 μg/m3. In each case, the cost would be paid in year 0 and the impact on benzene would begin in year 1 and would be permanent. The public is willing to pay $8 million per fatality avoided (the VSL is $8 million). *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 benzene without any change in policy; (b) the expected number of fatalities prevented by each policy per year; and (c) the NPV of each policy. If the government can carry any or all of the policies, (d) which should it adopt? Finally, (e) how many expected cases of cancer would be prevented?

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	$WTP_0 = 1000 - 0.5*Q_0$	300
1	$WTP_1 = 1200 - 0.5*Q_1$	300
2	$WTP_2 = 1400 - 0.5*Q_2$	300

Initially, there are 4450 units of the resource available. *The interest rate between the generations is **50%**.*

Please calculate: (a) the equilibrium royalty, 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 $390. Please calculate: (b) the new equilibrium royalty, 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 = 1500 – 2*Q. Initially, 300 units of the resource are known to be available and they can be extracted at MEC = $200; call these the original deposits. It is also possible to find more of the resource via exploration in either of two new areas: A and B. Roughly speaking, the resource is hard to find in area A but cheap to extract; in area B it is easier to find but much more expensive to extract. Key details about the areas are shown in the table below, where “probability” is the chance that anything is found per well; “quantity” is the average quantity when something is found; “MCexp” is the cost of an exploratory well; and “MEC” is the MEC for the area.

Area	Probability	Quantity	MC exp	MEC
A	20%	10	$580	$110
B	40%	10	$320	$500

Once extracted, resources from A and B are perfect substitutes for the original resource.

Please determine: (a) in which area, if any, exploration will take place; (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.