

Environmental Economics (AAE / ECON / Env. St. 343)

Practice Exam #1. Solutions taken from past student exams

1. What do open access resources and public goods have in common? Explain how this common characteristic leads to the failure of markets for these goods (i.e., market failure).

Open access resources are rival but non-exclusive. Because property rights are not well-defined (not exclusive), the welfare theorem does not hold and the market fails to allocate resources efficiently. Public goods are non-rival and non-exclusive. Impure public goods are either non-rival or non-exclusive but not both; making open access resources impure public goods.

2. Last year the Rainforest Conservation Society (a Canadian environmental group) purchased the commercial hunting rights to an area of 7,700 square miles in British Columbia. The group's plan is to ban hunting in this area. While this type of bargaining has been recognized for years as a potential solution to environmental issues, why has it not been implemented very often?

It hasn't been implemented because there are high transactions costs involved in organizing a group of people (conservationists into Rainforest Conservation Society) that would be able to bargain efficiently with those that own the commercial hunting rights. Also involved with this is the problem of free riding, because everyone will get the benefit of abundant wildlife, but only the conservationists will pay for it.

The government of Busytown contracts with a private waste management firm to collect and dispose of household garbage. The landfill where Busytown's garbage is dumped is located in Busytown (assume only Busytown garbage is dumped here). A recent scientific study revealed that pollution from the landfill has seeped into an aquifer that provides drinking water for all Busytown's residents, and that the greatest threat is posed by hazardous materials found in products such as motor oil, batteries, and paint. The Busytown government is interested in adopting policies that will limit the disposal of these products. Currently all Busytown residents are charged \$100 per year to have their garbage collected. Residents can dispose of at most two 50-gallon cans of garbage per week.

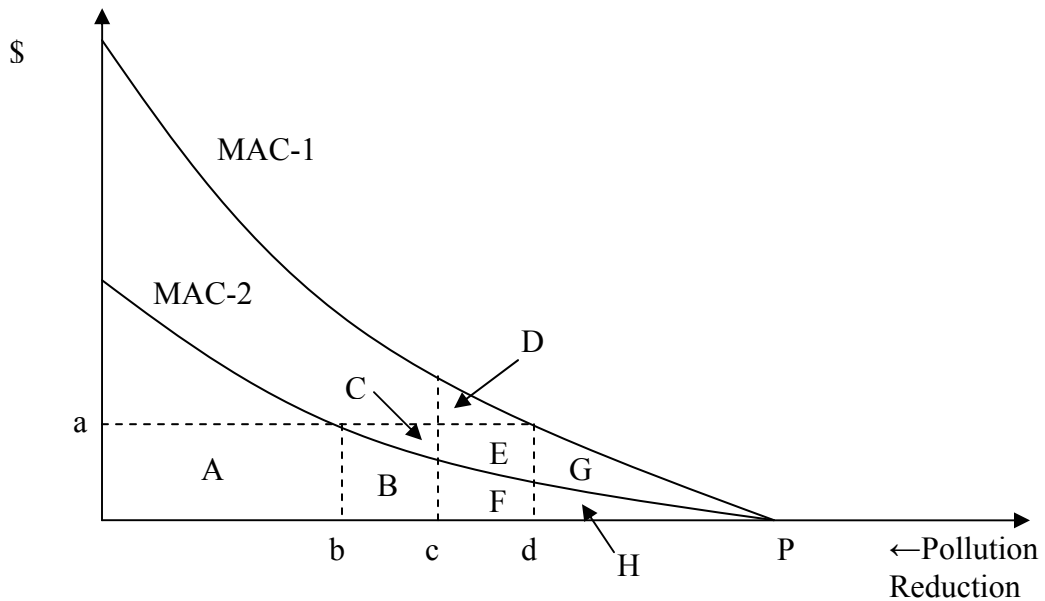
3. Provide a general definition of a public bad. Are the damages caused by the disposal of hazardous materials a public bad? Why or why not?

A public bad is something which causes the public damage in a non-rival, non-excludable way. The damages caused by the hazardous materials are public bads because they are non-excludable since everyone uses the same aquifer for drinking water; and non-rival because the pollutants taint the entire water supply in a way such that the aquifer remains polluted no matter how much water is consumed.

4. Under the current waste management policy, are Busytown residents likely to limit the quantity of hazardous materials in their garbage? Why or why not?

The residents are unlikely to limit the quantity of hazardous materials in their garbage because the only incentive to reduce waste is to limit the total volume to 100 gallons per week. Because there is no specific incentive not to dispose of hazardous materials, citizens are likely to discard them in the garbage because it is the least costly thing to do.

5. The following graph shows the marginal abatement costs for two pollution sources. The curves are labeled MAC-1 and MAC-2. On the graph, lowercase letters indicate quantities measured on the vertical or horizontal axis (e.g., b corresponds to a number of pollution units; a corresponds to some dollar value). Uppercase letters indicates quantities measured as areas (e.g., A is the area of the rectangle with height a and width b). Prior to being regulated, each source emitted P units of pollution, for a total of $2 \times P$ units. A government agency charged with regulating pollution decided that the total pollution from these sources should be reduced from $2 \times P$ units to P units. At first, the agency used a uniform command-and-control standard to regulate the sources. Later, the agency switched to using a green tax.



Precisely identify the following from the graph (you do not need to include an explanation):

The optimal green tax $t^* =$ a

Firm 2's pollution level under CAC = c

Firm 2's pollution level under the green tax = b

Firm 1's pollution level under the green tax = d

The total cost of reducing pollution under the green tax = G+2H+B+F

The cost savings to society achieved by using the tax instead of CAC = D+E+F-B

The following information applies to question # 6. Consider two firms who initially release 5 units of pollution each, for a total of 10 units. The marginal costs for these firms to reduce their pollution are given below. For firm 1, for example, it costs \$3 to eliminate the 5th unit of pollution it releases, it costs the firm \$6 to eliminate the 4th unit of pollution it releases, and so on. Suppose that the government's goal is to reduce the total amount of pollution from 10 units to 6 units.

| ----- Firm 1 ----- | | ----- Firm 2 ----- | |
|--------------------|-------------------------|--------------------|-------------------------|
| Pollution unit | Marginal Abatement Cost | Pollution Unit | Marginal Abatement Cost |
| 5 | \$3 | 5 | \$1 |
| 4 | \$6 | 4 | \$3 |
| 3 | \$9 | 3 | \$5 |
| 2 | \$12 | 2 | \$7 |
| 1 | \$15 | 1 | \$9 |

6. Suppose the government initially uses a command-and-control (CAC) program where neither firm can exceed 3 units of pollution. How much would each firm be willing to pay the government to adopt a tradable pollution permit program (TPP) instead of CAC?

Firm 2 would be willing to pay the profit they make on selling their 3rd tradable permit to firm 1 ($P_{TPP} - \$5$). Firm 1 would be willing to pay $\$6 - P_{TPP}$; in other words, the amount they save from buying a 4th tradable permit versus cleaning up the 4th unit. The price of the permit (P_{TPP}) would be somewhere between \$5 and \$6.

7. In recent years the internet has been used by individuals to download music for free. However, the recording industry has begun suing people who download music for free, with the ultimate goal being to eliminate free downloads of music from the internet. As an economist, you've been asked to make an argument that the recording industry's lawsuits are good for society. What is your argument?

Before the internet the property right for music was essentially exclusive, because people had to pay money to buy a CD. The advent of free downloads from the internet has made the property right non-exclusive and insecure, so it is no longer well-defined. Therefore the purpose of the industry lawsuits is to enforce their property rights and ensure that they are well-defined. If property rights are not well-defined, then a primary assumption of the welfare theorem is violated and we can no longer be assured of an efficient allocation of music throughout society.