

Self Test

Public Goods and Global Warming

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Click on True or False to test your knowledge of the chapter.

1. **True False** The free rider problem of public goods occurs when some individuals sneak on the bus to avoid paying.
2. **True False** In the private market, market forces work to support CO₂ abatement.
3. **True False** Because pollution causes damage to health and property, we may want to abate or reduce pollution. The marginal costs of abatement are the damages that occur from pollution and the marginal benefits of abatement are the costs of abatement equipment or the reduced output required for abatement.
4. **True False** Optimal abatement is where the demand for abatement, or the marginal benefit of abatement, is equal to the marginal cost of abatement.
5. **True False** Suppose we have a pure public good consumed by two groups of people. If $MB_1 = 300 - 2A$ and $MB_2 = 150 - A$, then the total or social MB curve is $MB = 450 - 3A$.
6. **True False** Carbon dioxide mixed with water vapor and other greenhouse gases like methane and nitrous oxide trap heat at the earth's surface and decrease the amount that radiates back into space. A molecule of methane has over 300 times and a molecule of nitrous oxide has over 20 times, the heat trapping capacity of a molecule of carbon dioxide.
7. **True False**. It is estimated that CO₂ contributes between 60-70% of global warming.
8. **True False** Accounting for uncertainties, the expected MB is equal to $\sum (MB_i)$ over the interval of $i = 1$ to n . Where MB_i is the marginal benefits under circumstance i , and n is the total number of possible circumstances.
9. **True False**. The no regrets policy of abatement implies that if we do nothing to abate global warming in the present, we will not regret it in the future.
10. **True False** High real interest rates, riskiness of expected returns, greater uncertainty for long-term investments, and more innovative projects are the only obstacles to financing energy conservation.
11. **True False**. Game theory can be used when taking the approach to abatement of minimaxing regrets.
12. **True False** The U.S. has the greatest amount of CO₂ emissions per capita.

13. **True False** Countries that possess more wealth contribute the majority of CO₂ emissions.

14. **True False.** CO₂ emissions and global warming are problems recognized on a global level.

15. **True False** Perfect information is available regarding emissions and abatement costs. Such information allows governments to compute optimal levels of pollution and abatement.

16. **True False** Three neighboring firms are located in a highly polluted region (we assume that the responsibility for the pollution cannot be attributed to anyone of them specifically). The three small firms will benefit from pollution abatement; however, their benefits are not equal, for:

$$\text{firm 1: } MB_1 = 70 - A;$$

$$\text{firm 2: } MB_2 = 20 - (1/4)A;$$

$$\text{firm 3: } MB_3 = 60 - (1/2)A.$$

The abatement cost is the same for all of them = \$50 to abate each unit of pollution. So total abatement cost is $TC = 50A$. If each firm does not know the abatement plans of the other firms, the amount of total abatement will be 40 units.

17. **True False** Take the three firm example from the above question. Assume that abatement is a public good so all firms benefit from each other's abatement.

$$\text{firm 1: } MB_1 = 70 - A;$$

$$\text{firm 2 : } MB_2 = 20 - (1/4)A;$$

$$\text{firm 3: } MB_3 = 60 - (1/2)A.$$

The social marginal benefits or sum of the MB will be $\Sigma MB = 150 - (7/4)A$

18. **True False** For the example in the above two questions, we showed that the marginal social benefits are:

$$\Sigma MB = 150 - (7/4)A \text{ for } 0 \leq A \leq 70;$$

$$\Sigma MB = 80 - (3/4)A \text{ for } 70 \leq A \leq 80;$$

$$\Sigma MB = 60 - (1/2)A \text{ for } A \geq 80.$$

Marginal costs are \$50. Then the socially optimal level of abatement is 57.14, and the social losses from private market are 1,207.

19. **True False** For the example in the above three questions, we had three firms with:

$$\text{firm 1: } MB_1 = 70 - A;$$

$$\text{firm 2: } MB_2 = 20 - (1/4)A;$$

$$\text{firm 3: } MB_3 = 60 - (1/2)A.$$

The abatement cost is the same for all of them = \$50 to abate each unit of pollution. So total abatement cost is $TC = 50A$.

Separately we found:

Firm 1 will abate 20 units

$$MC = MB_1$$

$$50 = 70 - A$$

$$A = 20$$

Firm 2 will abate 0 units

$$MC = MB_2$$

$$50 = 20 - (1/4)A$$

$$A = -120.$$

Firm 3 will abate 20 units

$$MC = MB_3$$

$$50 = 60 - (1/2)A$$

$$A = 20.$$

Now if firms 1-3 know each others benefit functions and want to free ride for the maximum amount, you expect 1 to produce 20, and 2 and 3 to produce nothing.

20. True False For the example in the above four questions, we had three firms with:

$$\text{firm 1: } MB_1 = 70 - A;$$

$$\text{firm 2: } MB_2 = 20 - (1/4)A;$$

$$\text{firm 3: } MB_3 = 60 - (1/2)A.$$

Now change the total cost of abatement to $5 + (1/2)A^2$. Benefits are as above:

$$\sum MB = 150 - (7/4)A \text{ for } 0 \leq A \leq 70;$$

$$\sum MB = 80 - (3/4)A \text{ for } 70 \leq A \leq 80;$$

$$\sum MB = 60 - (1/2)A \text{ for } A \geq 80.$$

Now the socially optimal amount of abatement will be 54.54.

21. True False Let social benefits be as above

$$\sum MB = 150 - (7/4)A \text{ for } 0 \leq A \leq 70;$$

$$\sum MB = 80 - (3/4)A \text{ for } 70 \leq A \leq 80;$$

$$\sum MB = 60 - (1/2)A \text{ for } A \geq 80.$$

If the total cost of abatement is now 20A, then the optimal social amount of abatement will be 74.

22. **True False** Integrated Resource Planning (IRP) looks at all environmental and social costs and benefits with equal emphasis on demand and supply side alternatives.

23. **True False** The total demand for public goods is the same as the total demand for private goods.

24. **True False** Coal, oil, and gas emit E_c , E_o , E_g tons of carbon/billion BTU. If a carbon tax T_c were passed on coal, the carbon equivalent tax on oil and on gas should be $T_o = (E_o/E_c)*T_c$, and $T_g = (E_g/E_c)*T_c$.

25. **True False** In the above example, let coal, oil, and gas have prices P_c , P_o , P_g and income be Y . Assume the price and income elasticity are β_1 , β_2 , β_3 and γ_1 , γ_2 , γ_3 with α_1 , α_2 , α_3 shift parameters for each product. If the tax is passed on the consumer and income growth averages i a year, the total carbon emissions after three years should be $= E_c*\alpha_1(P_c+T_c)^{\beta_1}[Y(1+i)^3]^{\gamma_1} + E_o*\alpha_2(P_o+T_o)^{\beta_2}[Y(1+i)^3]^{\gamma_2} + E_g*\alpha_3(P_g+T_g)^{\beta_3}[Y(1+i)^3]^{\gamma_3}$

26. **True False** The 'International Agreement in Montreal' or 'Montreal Protocol' was an unsuccessful first attempt to diminish global warming.

27. **True False** If the exchange rate for dollars increases, the foreign currency appreciates and the US dollar depreciates.

28. **True False** The exchange rate in the foreign currency market will affect imports and exports. For example, if the Chinese Yuan appreciates in the foreign currency market, the quantity exported to foreign countries will increase.

29. **True False** If an economic recession occurs in China, the dollar will appreciate and the Yuan will depreciate.

30. **True False** If you increase U.S. productivity and lower U.S. inflation, the value of the U.S. dollar will appreciate.

31. **True False** Increasing foreign country's interest rate will decrease the value of the dollar.

32. **True False** With reduced interest rates and higher electricity prices the high cost of fluorescent lamps would be relatively expensive even with their energy efficiency compared to the low cost incandescent lamps.

33. **True False** An increase in purchases of European cars by Americans will cause the Euro to rise in value.

34. **True False** Economists believe that the private market will provide too many pure public goods.

35. True False If the marginal benefit of abatement is $240 - 2.5 A$ and if marginal cost of abatement is uncertain but you believe that MC is 60 with probability of 0.4 and 20 with probability of 0.6, the expected optimal level of abatement is 204.

36. True False You use lights for about 50 hours per month and pay your light bill at the end of the month. Suppose you can choose between two lighting systems. The first fixture lasts 1 month and has operating cost of \$0.02 per hour and costs \$1.25. The second lasts 2 months and uses less energy with operating costs of 0.01 per hour and costs \$3.00. At a monthly interest rate of 10%, the energy conserving technology is the most economical?

37. True False. Three neighboring firms are located in a highly polluted region (we assume that the responsibility for the pollution cannot be attributed to anyone of them specifically). The three small firms will benefit from pollution abatement; however, their benefits are not equal, for:

$$\text{firm 1 : } MB_1 = 50 - A;$$

$$\text{firm 2 : } MB_2 = 25 - (1/5)A;$$

$$\text{firm 3 : } MB_3 = 40 - (1/4)A.$$

The abatement cost is the same for all of them = \$30 to abate each unit of pollution. So total abatement cost is $TC = 30A$. If each firm does not know the abatement plans of the other firms, the amount of total abatement will be 60 units.