Chapter 12

THE ECONOMICS OF THE ENVIRONMENT

Microeconomics in Context (Goodwin, et al.), 4th Edition

Chapter Summary

This chapter has three sections. The first section presents the standard economic theory of externalities, demonstrating the need for a tax (in the case of a negative externality) or a subsidy (in the case of a positive externality) to correct the market failure. The second section discusses economists' methods to value environmental services and natural capital, as well as cost-benefit analysis. The final section summarizes environmental policies in theory and practice.

After reading and reviewing this chapter, you should be able to:

1. Use a supply-and-demand graph to illustrate why the unregulated market equilibrium is inefficient in the presence of externalities.
2. Discuss how a negative externality can be internalized with a Pigovian tax.
3. Define what is meant by total economic value.
4. List and define the four nonmarket valuation methodologies.
5. Describe how a cost-benefit analysis is conducted, including discounting and valuing human lives.
6. List and define the four main types of environmental policies.
7. Briefly describe a few major environmental laws, and the relationship between environmental protection and the economy.

Key Term Review

Pigovian tax
subsidy
revenue-neutral (taxes)
intrinsic value
nonuse benefits
nonmarket valuation techniques
lower-bound estimate
revealed preference methods
defensive expenditures approach
contingent valuation
cost-benefit analysis
present value
value of a statistical life (VSL)
pollution standards
tradable pollution permits
internalizing negative externalities
upstream taxes
willingness-to-pay (WTP) principle
ecosystem services
total economic value
cost of illness method
replacement cost methods
travel cost models
stated preference methods
contingent ranking
discounting
discount rate
precautionary principle
market-based approaches (to pollution regulation)

Active Review Questions

Fill in the Blank

1. A negative externality can be incorporated into a supply-and-demand graph as a _____ (upward / downward) shift of the _____ (supply / demand) curve.

2. The common policy recommendation in a market with a positive externality is to implement a _____.

3. The _____ states that something has economic value only according to the maximum amount people are willing to pay for it.

4. Nonmarket valuation techniques that base estimates on the cost of substitutes for ecosystem services are known as _____.

5. Using surveys to elicit respondents' willingness to pay for hypothetical scenarios is known as _____.

6. A discount rate is used in cost-benefit analysis to convert a future cost or benefit into its equivalent _____.

7. The main advantage of _____, compared to other environmental policy options, is that enforcement and monitoring costs are relatively low.

8. The first attempt to use tradable pollution permits in the United States was implemented to reduce emissions of _____.

True/False

9. A Pigovian tax is shown in the supply-and-demand model as an upward shift of the demand curve.

10. Instituting a Pigovian tax will increase the equilibrium price and decrease the equilibrium quantity.

11. A tax on coal extracted from a coal mine is an example of an upstream tax.

12. An example of a nonuse benefit would be the welfare gain a person gets who visits a lake but doesn't go swimming or boating.

13. The cost-of-illness method provides an upper-bound estimate to the true willingness to pay to avoid diseases.

14. Economists generally prefer revealed preference methods over other approaches to nonmarket valuation.

15. Contingent valuation has been criticized for producing willingness to pay estimates that tend to be exaggerated.

16. The higher the discount rate, the lower the present value of a future cost or benefit.

17. The main advantage of pollution standards is that they are cost effective.

18. When faced with a pollution tax, a firm will reduce its pollution as long as the marginal cost of pollution reduction is lower than the tax.

Short Answer

19. Explain in your own words why the unregulated market outcome in a market with a negative externality is economically inefficient.

_____
_____
_____
_____
_____

20. What are the four main environmental policy options? List one advantage and one disadvantage of each.

_____
_____
_____
_____
_____

Self Test

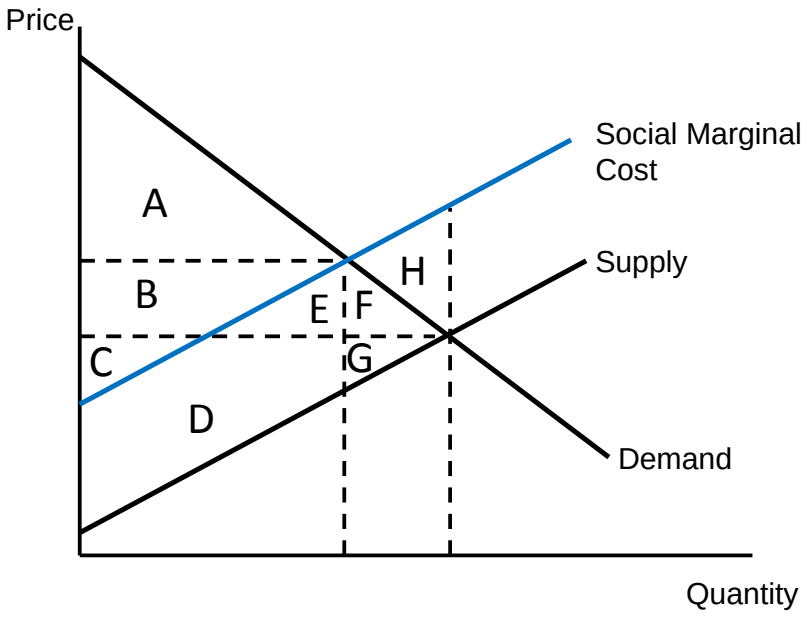
1. How will imposing a Pigovian tax normally affect a market that produces a negative externality?

   a) Price and quantity will both increase
   b) Price will increase and quantity will decrease
   c) Price and quantity will both decrease
   d) Price will decrease and quantity will increase
   e) We can't determine the impacts in advance

2. Which one of the following statements is false?

   a) A Pigovian tax will reduce the negative externality damage in a market.
   b) The equilibrium outcome in an unregulated market with a negative externality will not be economically efficient.
   c) The damage from a negative externality can be incorporated into a supply-and-demand graph as an upward shift of the supply curve.
   d) Setting a Pigovian tax at the "correct" level reduces the negative externality damage in a market to zero.
   e) A Pigovian tax does not ensure that that those suffering the negative externality damage are directly compensated.

For Questions 3-4 refer to the following graph.



3. In the graph above, what area(s) represent the negative externality damage in an unregulated market (i.e., with no Pigovian taxes)?

   a) D+E
   b) D+E+F+G
   c) H
   d) F+G+H
   e) D+E+F+G+H

4. In the graph above, what area(s) represent the tax revenue if a Pigovian tax is implemented which fully internalizes a negative externality?

    a) B+E+F
    b) C+D+G
    c) C+D
    d) D+E
    e) B+E+F+H

5. How can the social benefits from a positive externality be represented in a supply-and-demand graph?

    a) As an upward shift of the supply curve
    b) As an upward shift of the demand curve
    c) As a downward shift of the supply curve
    d) As a downward shift of the demand curve
    e) None of the above

6. What is an upstream tax?

    a) A tax placed on consumer goods
    b) A tax on pollution dumped into rivers
    c) A tax placed on raw materials
    d) A tax placed primarily on high income households
    e) A tax placed primarily on low income households

7. About how much are environmental taxes in the United States, expressed as a percentage of total tax revenue?

    a) 3%
    b) 7%
    c) 12%
    d) 18%
    e) 25%

8. Total economic value excludes which one of the following components?

    a) Profits
    b) Nonuse benefits
    c) Ecosystem services
    d) Recreation benefits
    e) Intrinsic value

9. Which one of the following is not a nonmarket valuation technique?

    a) Revenue-neutral methods
    b) The cost of illness method
    c) Replacement cost methods
    d) Revealed preference methods
    e) Stated preference methods

10. Suppose a household purchases a water purification system to avoid exposure to contaminated drinking water. Estimating the value of safe drinking water by measuring the cost of the purification system is an example of what valuation method?

    a) The replacement cost method
    b) The travel cost method
    c) Contingent valuation
    d) The defensive expenditures approach
    e) Contingent ranking

11. Using a survey to elicit people's willingness to pay for a hypothetical scenario is known as …

    a) contingent ranking.
    b) contingent valuation.
    c) replacement cost methods.
    d) revealed preference methods.
    e) the defensive expenditures approach.

12. Which of the following methods would be most likely to produce an accurate estimate of the recreation benefits of a National Park?

    a) Replacement cost methods
    b) Defensive expenditures approach
    c) Travel cost models
    d) Contingent valuation
    e) Cost of illness method

13. What is considered to be the main advantage of contingent valuation?

    a) Responses can be validated by comparison to market behavior
    b) Results are unbiased
    c) Surveys can be done at low cost
    d) Values can be obtained for any type of benefit
    e) Results are easily replicated

14. The present value of a benefit of $50 that occurs 10 years from now, at a discount rate of 3%, is obtained by which of the following formulas?

a) $\$50 * (1.03)^{10}$
b) $\$50 / (0.97)^{10}$
c) $\$50 / (1.03)^{10}$
d) $\$50 – (0.97)^{10}$
e) $\$50 – (1.03)^{10}$

15. Which one of the following statements is false?

a) The higher the discount rate, the lower the present value of a future benefit.
b) The further a benefit occurs in the future, the lower the present value.
c) The precautionary principle states that policies should err on the side of caution when there is a risk of a catastrophic outcome.
d) The value of a statistical life can be used in cost-benefit analysis to determine the benefits of policies that reduce environmentally-related deaths.
e) The accepted approach among economists for choosing a discount rate is to set it equal to the rate of return on U.S. corporate stocks.

16. What is the main advantage of a pollution standard?

a) It can specify a definite result.
b) It is a cost-effective policy.
c) It encourages innovation.
d) The cost is known in advance.
e) Monitoring costs are minimized.

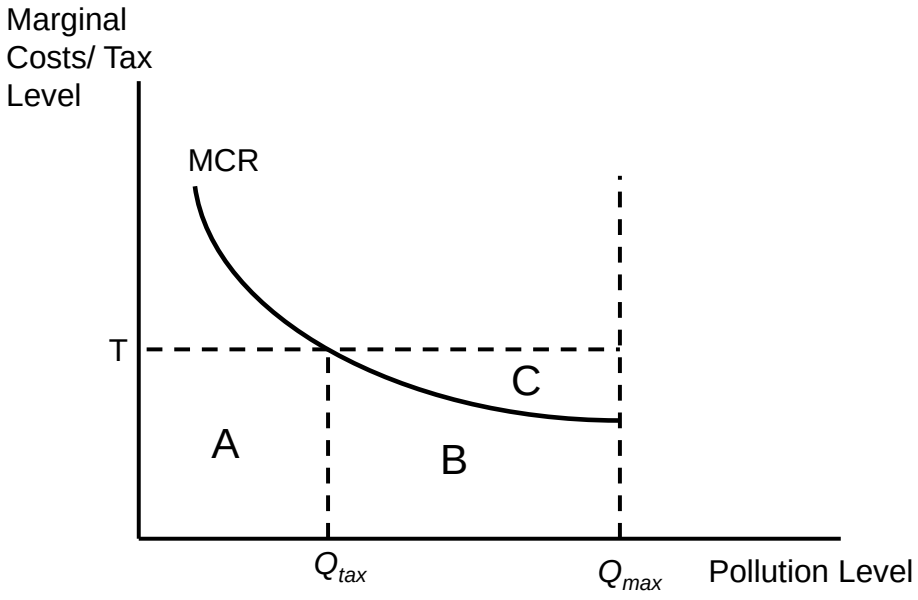
17. What is considered to be the main advantage of a technology-based regulation?

a) It is a market-based approach to regulation.
b) It encourages innovation.
c) It is a cost-effective policy.
d) Technology is always improving.
e) Monitoring costs are minimized.

18. Which one of the following statements is false?

a) The economic benefits of environmental laws in the U.S. are unknown because no federal regulations must be analyzed using cost-benefit analysis.
b) The benefits of the U.S. Clean Air Act significantly exceed the costs.
c) The European Union has implemented a tradable permit system for carbon emissions.
d) The United States has implemented a tradable permit system for sulfur dioxide emissions.
e) Environmental protection can be compatible with economic growth.

For Questions 19 and 20, refer to the following graph.



19. In the graph above showing the marginal cost of pollution reduction for a firm, what area(s) represent the tax revenue the firm pays if a tax is set at T?

    a) A
    b) B
    c) C
    d) A+B
    e) B+C

20. In the graph above, showing the marginal cost of pollution reduction for a firm, what area(s) represent the expenditures the firm makes to reduce its pollution level if a tax is set at T?

    a) A
    b) B
    c) C
    d) A+B
    e) B+C

Answers to Active Review Questions

1. upward; supply
2. subsidy
3. willingness-to-pay principle
4. replacement cost methods
5. contingent valuation
6. present value
7. technology-based regulations
8. sulfur dioxide
9. False
10. True
11. True
12. False
13. False
14. True
15. True
16. True
17. False
18. True
19. At the unregulated market equilibrium, the social marginal cost (including the externality) exceeds the marginal benefits (the demand curve). Thus the market equilibrium results in over-production of the good or service causing the externality. The efficient level of production occurs where the social marginal costs just equal the marginal benefits.
20. See the table below:

Policy Option	**Advantages**	**Disadvantages**
Pollution standards	Can specify a definite result	Not cost-effective; little incentive for further reduction
Technology-based regulation	Relatively low enforcement and monitoring costs; cost savings due to standardization	Not cost-effective; little incentive for further reduction
Pigovian (or pollution) taxes	Cost effective; incentive for further reduction; price of pollution is known	Resulting pollution levels difficult to predict
Tradable pollution permits	Cost effective; incentive for further reduction; resulting pollution level specified in advance	Price of permits difficult to predict

Answers to Self Test Questions

1. b
2. d
3. e
4. d
5. b
6. c
7. a
8. e
9. a
10. d
11. b
12. c
13. d
14. c
15. e
16. a
17. e
18. a
19. a
20. b