Chapter 16

ECONOMICS OF THE ENVIRONMENT

Essentials of Economics in Context (Goodwin, et al.), 1st Edition

Chapter Summary

This chapter focuses on environmental sustainability. It considers problems of population, resource depletion, climate change, and possible limits to economic growth, putting our analysis of aggregate demand and economic growth into a new framework emphasizing sustainability. After providing a brief overview of some of the key environmental issues in the first section, the chapter 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 chapter then provides a standard classification of different types of goods based on the properties of rivalness and excludability. For each type of good, government interventions may be warranted for reasons of efficiency and fairness. This chapter also covers standard theories such as the Environmental Kuznets Curve, raising serious challenges to the belief that economic growth and markets, on their own, will solve the social and environmental problems of the coming century. Policies on addressing environmental challenges are discussed next. This is followed by detailed economic analysis of climate change. The final section presents some concluding remarks.

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

1. Recognize ecological sustainability as a major issue for the 21st century.
2. Identify major environmental challenges.
3. Use a supply-and-demand graph to illustrate why the unregulated market equilibrium is inefficient in the presence of externalities.
4. Discuss how a negative externality can be internalized with a Pigovian tax.
5. Discuss how subsidizing products that create positive externalities can lead to more efficient outcomes from a social welfare perspective.
6. Classify goods into different categories based on the properties of rivalness and excludability.
7. Describe why an unregulated outcome for a common property resource will be inefficient, and how policies can be used produce a more efficient outcome.
8. Discuss why private markets don't exist for public goods, and how a government can determine the efficient provision level for a public good.
9. Be familiar with the Environmental Kuznets Curve and its limitations.
10. Understand the concepts of limits to growth and a steady-state economy.
11. Describe several policies directed towards sustainable development.
12. Describe the causes and consequences of global climate change.
13. Summarize the results of economic analyses and policy responses to global climate change.

Key Term Review

climate change
nonrenewable resources
renewable resources
Pigovian tax
internalizing negative externalities
subsidy
private good
excludable good
rival good
public good
common property resource
individual transferable quota (ITQ)
free riders
environmental Kuznets curve (EKC) hypothesis
steady-state economy
weak sustainability
strong sustainability
upstream taxes
revenue-neutral (taxes)
throughput
social cost of carbon
discount rate

Active Review Questions

Fill in the Blank

1. The _____ approach measures the human impacts on the environment in terms of the land area required to supply a society's resources and assimilate its wastes and pollution.

2. Resources that do not regenerate through natural processes, at least on a human time scale, such as oil, coal, and mineral ores are called _____.

3. Emissions of _____lead to global warming and climate change.

4. The _____ agreement allowed each country set their own emissions targets on a voluntary basis and enact national policies to meet these targets.

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

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

7. A public good is defined as one that is _____ and _____.

8. Most of the growth in future global carbon dioxide emissions will come from _____ (developed/developing) countries.

9. The two most prominent market-based policies for addressing climate change are _____ and _____.

10. The _____ curve posits an inverted U-shaped relationship between economic development and environmental damages, suggesting that as nations develop their damage to the environment decreases.

11. Taxes that are used as a means to internalize the negative externalities from pollution are called _____.

12. A discount rate that reflects social rather than market valuation of future costs and benefits, and is usually lower than the market discount rate, is called a _____.

13. An economy with no increase in population, or in the rate of use of raw-materials and energy is termed _____.

True/False

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

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

16. A common property resource is nonexcludable and nonrival.

17. An ocean fishery is an example of a public good.

18. An uncrowded health club is an example of a private good.

19. For a common property resource, inefficiency occurs because each user of the resource fails to account for the impact of his or her actions on other resource users.

20. The Stern Review's main conclusion was that the benefits of strong action on climate change far outweigh the costs of not acting.

21. Environmental damage per capita tends to decline with increasing income for all major pollutants.

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

23. According to leading scientists, global emissions of greenhouse gases will eventually need to be reduced significantly—up to 50 percent lower than current levels by 2050—if we are to avoid the most dangerous effects of climate change.

24. Tradable permit systems allow overall pollution to increase since businesses can purchase permits to pollute.

Short Answer

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

26. Distinguish between the "weak" and "strong" perspectives on sustainability. What are some of the indicators that can be used to measure each of these?

27. Identify three environmental issues that are closely related to economic growth.

28. What are some of the problems predicted to occur with rising levels of greenhouse gas emissions?

29. What is the Environmental Kuznets Curve (EKC) hypothesis? And what is the evidence for this hypothesis?

30. Identify at least three policies for sustainable development.

Self Test

1. Which of the following resources are currently being depleted or at risk of depletion?

    a. Fisheries
    b. Forests
    c. Clean water for drinking and agriculture
    d. Minerals and fossil fuels
    e. All of the above.

2. Which of the following are *not* among the adverse effects of greenhouse gas emissions?

    a. Rising temperatures.
    b. Rising sea-levels.
    c. Ecological disruptions such as species extinction.
    d. Increased frequency of severe weather events such as hurricanes, floods, and droughts.
    e. Depletion of mineral resources.

3. Which of the following countries is the world's top emitter of carbon dioxide?

    a. India
    b. United States
    c. Russia
    d. Saudi Arabia
    e. China

4. Which of the following statements about the level of air pollution is FALSE?

    a. Air pollution has mostly increased in both developing countries and developed countries in recent years.
    b. Air pollution in most major cities in developing countries exceed the World Health Organization's recommended levels.
    c. The most common air pollutants in the U.S. have declined by 73% since the 1970s.
    d. Efforts to reduce pollution levels have generally been found to be cost-effective.
    e. None of the above.

5. What does it mean to say that a good is "nonrival"?

    a. It doesn't face any competition
    b. It has a non-zero price
    c. Owners can exclude others from consuming it or enjoying its benefits
    d. It can be consumed by more than one person at a time
    e. It suffers from congestion

6. 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.

7. 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

8. 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

9. 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. $\$50 - (1.03)^{10}$

10. Which one of the following statements is false?

    a. Climate change will increase economic activity, primarily because it will increase agricultural production.
    b. Burning fossil fuels generates emissions of carbon dioxide.
    c. Greenhouse gases can remain in the atmosphere for decades, or even longer.
    d. Global average temperatures have already increased by about one degree Celsius.
    e. Climate change can be considered to be the result of a market failure.

11. Which one of the following statements is false?

    a. The tragedy of the commons is a likely outcome when a common property resource is unregulated.
    b. The unregulated outcome with a common property resource is inefficient.
    c. Each user of a common property resource creates a positive externality for other resource users.
    d. Private markets are not suited for the allocation of public goods.
    e. Individual transferable quotas can increase social welfare in the allocation of a common property resource.

12. Which one of the following statement is false?

    a. An advantage of a carbon tax over a cap-and-trade policy is that the tax provides certainty about the price of emissions.
    b. The European Union has implemented a tradable permit system for carbon emissions.
    c. The United States has indicated that it intends to withdraw from the Paris Climate Agreement.
    d. Investment in renewable energy is nearly 20% of total global energy investment.
    e. Each country is free to set their own emissions targets under the Paris Climate Agreement.

13. Which of the following statements describes the "strong" version of sustainability?

    a. Two trees are planted to replace each tree cut in the production of timber.
    b. Trees are cut for the production of timber, and the value of timber produced is estimated to be higher than the value of tree lost.
    c. Trees are cut for producing timber, and the value of timber produced is estimated to be lower than the value of tree lost.
    d. Both (a) and (b)
    e. None of the above.

14. If nothing is done now to stem the effects of climate change, what group will face the most dangerous impacts from climate change?

    a. Current generations
    b. Future generations living several decades from now or later
    c. Developed countries
    d. Developing countries
    e. (b) and (d)

15. How can macroeconomic policy deal with environmental considerations?

    a. Seek to modify both the level and composition of consumption spending.
    b. Promote forms of investment that do not increase the "throughput" of natural resources and the creation of wastes.
    c. Direct government spending towards promoting environmental sustainability.
    d. Promote investments that are more future-oriented than those concerned with short-term considerations.
    e. All of the above.

16. The Environmental Kuznets Curve (EKC) hypothesis posits that:

    a. Environmental damage per capita increases in the early stages of economic development, reaches a maximum, and then diminishes as a nation attains higher levels of income.
    b. Environmental damage per capita falls in the early stages of economic development, reaches a minimum, and then rises as a nation attains higher levels of income.
    c. Environmental damage per capita steadily rises during all stages of economic development.
    d. Environmental damage per capita steadily falls during all stages of economic development.
    e. There is no clear relationship between environmental damage per capita and economic development, as it depends on the country, the pollutant, and other contingencies.

17. The evidence for the Environmental Kuznets Curve (EKC) suggests that:

    a. The EKC relationship does seem to hold for all pollutants.
    b. The EKC relationship does not seem to hold for any pollutants.
    c. The EKC relationship does seem to hold for some pollutants, such as per capita sulfur dioxide emissions and other air pollutants, but not for CO_2 emissions.
    d. The EKC relationship does seem to hold for the environmental impacts of CO_2 emissions, but not for per capita sulfur dioxide emissions and other air pollutants.
    e. The EKC relationship does seem to hold for some countries, but not others.

18. Which of the following statements about the 2015 Paris Climate Agreement is FALSE?

    a. Each country is allowed set their own targets and participation is voluntary.
    b. There are no enforceable penalties for failing to meet targets.
    c. Most countries are on track to achieve the treaty's objective of limiting global warming to no more than 2°C above preindustrial levels.
    d. An overall evaluation of the treaty shows that it has resulted in a reduction in the expected increase in temperature levels.
    e. None of the above.

19. Which of the following is *not* a policy to promote environmental sustainability?

    a. Green taxes.
    b. Grants, subsidies and tax breaks to support recycling, renewable energy, and efficient transportation systems.
    c. Tax cuts to stimulate consumption spending.
    d. Elimination of subsidies for environmental degrading activities.
    e. Cap-and-trade system.

20. Which of the following was the conclusion of the 2006 British government report written by former World Bank chief economist Nicholas Stern?

    a. The costs of climate change in the twenty-first century are estimated as equivalent to 5–20 percent of global GDP, while the most severe effects of climate change could be avoided at a cost of around only 1 percent of global GDP.
    b. The costs of climate change in the twenty-first century are estimated as equivalent to 1 percent of global GDP, while the most severe effects of climate change could only be avoided at a cost of around 5 - 20 percent of global GDP.
    c. It now appears that the benefits of current actions to minimize climate change significantly exceed the costs.
    d. (a) and (c)
    e. None of the above.

Answers to Active Review Questions

1. ecological footprint
2. nonrenewable resources
3. greenhouse gases including CO_2
4. 2015 Paris Climate (Agreement)
5. upward, supply
6. subsidy
7. nonexcludable; nonrival
8. developing
9. carbon taxes; a system of tradable permits
10. Environmental Kuznets (Curve)
11. green taxes
12. social discount rate
13. steady-state economy
14. False.
15. True
16. False
17. False
18. False
19. True
20. True

21. False – a declining trend is noted for some pollutants above about $5,000 in per capita income, but other pollutants continue to increase as incomes rise.
22. True
23. False – scientific research indicates that the reduction in greenhouse gases needs to be 70 percent or more by 2050 to avoid major destructive impacts.
24. False. Tradable permit systems allow individual business to purchase permits for pollution, but set an overall limit on the total amount of pollution emitted.
25. 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.
26. The "weak sustainability" perspective asserts that the depreciation of natural capital is justified as long as there is an adequate increase in any other types of capital, while the "strong sustainability" perspective argues that the depreciation of natural capital is only justified if there is an adequate increase in some form of natural capital. Indicators such as GPI and Green GDP can be used for "weak sustainability" and satellite accounts such as forested area, waste generation, and greenhouse gas emissions can be used for "strong sustainability".
27. Global population, depletion of renewable and non-renewable resources, and pollution and wastes
28. The problems include: Rising temperatures, rising sea-levels and coastal flooding, decrease in water supplies, declines in crop yields, increase in food insecurity, ecological disruptions such as species extinction, spread of malaria and other tropical diseases, and increased frequency of severe weather events such as hurricanes, floods, and droughts.
29. The Environmental Kuznets Curve (EKC) hypothesis says that environmental damage per capita increases in the early stages of economic development, reaches a maximum, and then diminishes as a nation attains higher levels of income. The EKC relationship does seem to hold for some pollutants, such as per capita sulfur dioxide emissions and other air pollutants, but not for the environmental impacts of municipal waste, energy use, and CO_2 emissions.
30. Green taxes and tradable pollution permits; Grants, subsidies and tax breaks to support recycling, renewable energy, and efficient transportation systems; Elimination of subsidies for environmental degrading activities.

Answers to Self-Test Questions

1. E
2. E
3. E
4. A
5. D
6. D
7. B
8. C
9. C
10. A
11. C
12. D
13. A
14. E
15. E
16. A
17. C
18. C
19. C
20. D