Hubbard, R. G., & O'Brien, A. P. (2019). Microeconomics (7th ed.). Pearson. ISBN 978-0-13-4737508.

5 Externalities, Environmental Policy, and Public Goods

Why Does ExxonMobil Want to Pay a Carbon Tax?

Why would the head of an oil company advocate taxing the company's own product? In 2017, ExxonMobil's chief executive officer (CEO), Darren Woods, did just that. He confirmed the company's support for a carbon tax, under which the federal government would tax energy consumption on the basis of the carbon content of the energy. For example, oil refiners like ExxonMobil would pay a tax on the carbon content of the oil they were refining into products such as gasoline and home heating oil, and electric utilities like Pacific, Gas, & Electric (PG&E) would pay a tax on the carbon content of the coal and natural gas they burn to generate electricity. The burning of fossil fuels like oil and coal generates carbon dioxide, CO_2, a "greenhouse gas" that most scientists believe contributes to global warming.

Public opinion polls show that a majority of people believe that the government should regulate greenhouse gases. Most economists agree that government policy should attempt to reduce these gases, but they disagree with the public about which government policies would be best. The public tends to support government rules that require firms to use particular methods to reduce pollution—for example, by requiring that automobile companies produce cars with better fuel efficiency. Many economists believe that using these *command-and-control policies* is a less economically efficient way to reduce pollution than is using *market-based policies* that rely on economic incentives rather than on administrative rules.

A carbon tax is an example of a market-based policy that provides households and firms with an economic incentive to reduce their use of those fuels by raising their price. Government policies to reduce pollution, including the carbon tax, have been controversial, however. Some businesses oppose the carbon tax because they believe it will raise their costs of production. Other businesses view the carbon tax favorably, particularly in comparison with command-and-control policies that they see as more costly and less effective. In addition, command-and-control policies can be complex and difficult for government regulators to administer, so oil firms, electric utilities, and other firms subject to the policies face uncertainty about how they will be able to operate in the future. A carbon tax would provide these firms with greater certainty. According to an article in the *Wall Street Journal*, a spokesman for ExxonMobil argued, "A straightforward carbon tax . . . is far preferable to the patchwork of current and potential regulations on the state, federal and international levels."

KingWu/iStock/Getty Images

As we will see in this chapter, economic analysis plays an important role in the debate over environmental policies.

Sources: Amy Harder and Bradley Olsen, "Exxon Touts Carbon Tax to Oil Industry," *Wall Street Journal*, June 30, 2016; Suzanne McCarron, "Letter: Exxon Favors a Carbon Tax," *New York Times*, December 30, 2016; and Paola Sapienza and Luigi Zingales, "Economic Experts vs. Average Americans," *American Economic Review, Papers and Proceedings*, Vol. 103, No. 3, May 2013, pp. 636–642.

Chapter Outline & Learning Objectives

Economics in Your Life & Career

Giving Advice on the "Best" Level of Pollution

Policymakers debate alternative approaches for achieving the goal of reducing carbon dioxide emissions. Suppose you have taken a job in Washington, DC, as a policy aide to a U.S. senator. The senator asks you, "If carbon dioxide emissions hurt the environment, shouldn't the federal government take action to eliminate them completely?" How do you respond? As you read this chapter, try to answer this question. You can check your answer against the one we provide on **page 173** at the end of this chapter.

Pollution is a part of economic life. Consumers create air pollution by burning gasoline to power their cars and natural gas to heat their homes. Firms create air pollution when they produce electricity, pesticides, or plastics, among other products. Utilities such as electric power plants produce sulfur dioxide when they burn coal to generate electricity. Sulfur dioxide contributes to acid rain, which can damage trees, crops, and buildings. The burning of fossil fuels generates carbon dioxide and other greenhouse gases that can increase global warming.

Externality A benefit or cost that affects someone who is not directly involved in the production or consumption of a good or service.

Pollution is just one example of an **externality**, which is a benefit or cost that affects someone who is not directly involved in the production or consumption of a good or service. In the case of air pollution, there is a *negative externality* because, for example, people with asthma may bear a cost even though they were not involved in the buying or selling of the electricity that caused the pollution. In the case of medical research, there is a *positive externality* because people who are not directly involved in producing it or paying for it can benefit.

A competitive market usually does a good job of producing the economically efficient quantity of a good or service, but not when there is an externality in the market. When there is a negative externality, the market may produce a quantity of the good that is greater than the efficient amount. When there is a positive externality, the market may produce a quantity that is less than the efficient amount. Government interventions in the economy—such as the price floors on agricultural products or price ceilings on rents we discussed in Chapter 4, Section 4.3—can reduce economic efficiency. But, when there are externalities, government intervention may actually *increase* economic efficiency and enhance the well-being of society. The way in which government intervenes is important, however. Economists can help policymakers ensure that government programs are as efficient as possible.

In this chapter, we explore how best to deal with the problems resulting from pollution and other externalities. We also look at *public goods*, such as national defense, which may not be produced at all unless the government produces them.

5.1 Externalities and Economic Efficiency

LEARNING OBJECTIVE: Identify examples of positive and negative externalities and use graphs to show how externalities affect economic efficiency.

When you consume a Big Mac, only you benefit, but when you consume a college education, other people also benefit. College-educated people are less likely to commit crimes, and by being better-informed voters, they are more likely to contribute to better government policies. So, although you capture most of the benefits of your college education, you do not capture all of them.

When you buy a Big Mac, the price you pay covers all of the cost McDonald's incurs in producing the Big Mac. When you buy electricity from a utility that burns coal and generates carbon dioxide, though, the price you pay covers some of the costs the utility incurs but does not cover the cost of the damage carbon dioxide does to the environment.

So, there is a *positive externality* in the production of college educations because people who do not pay for them will nonetheless benefit from them. There is a *negative externality* in the generation of electricity. For example, if fish and wildlife have disappeared from a lake because of acid rain generated by a utility, people who live near the lake incur a cost—even though they may not purchase electricity from that utility.

The Effect of Externalities

Externalities interfere with the *economic efficiency* of a market equilibrium. A competitive market achieves economic efficiency by maximizing the sum of consumer surplus and producer surplus (see Chapter 4, Section 4.2). *But that result holds only if there are no*

The graph shows that although the tax shifts down the demand curve for gasoline, the price consumers pay increases by less than the amount of the tax. To see this, note that the price consumers pay rises from P_{Market} to P, which is smaller than the per gallon tax, which equals the vertical distance between $P_{Efficient}$ and P.

Source: Ian W. H. Parry and Kenneth A. Small, "Does Britain or the United States Have the Right Gasoline Tax?" *American Economic Review*, Vol. 95, No. 4, September 2005, pp. 1276–1289.

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Your Turn: For more practice, do related problems 3.10, 3.11, and 3.12 on page 178 at the end of this chapter.

Pigovian taxes and subsidies
Government taxes and subsidies intended to bring about an efficient level of output in the presence of externalities.

Because Pigou was the first economist to propose using government taxes and subsidies to deal with externalities, they are sometimes called **Pigovian taxes and subsidies**. Note that a Pigovian tax eliminates deadweight loss and improves economic efficiency, unlike most other taxes, which are intended simply to raise revenue and can reduce consumer surplus and producer surplus and create a deadweight loss (see Chapter 4, Section 4.4). In fact, one reason that economists support Pigovian taxes as a way to deal with negative externalities is that the government can use the revenues raised by Pigovian taxes to lower other taxes that reduce economic efficiency. For instance, the Canadian province of British Columbia has enacted a Pigovian tax on carbon dioxide emissions and uses the revenue raised to reduce personal income taxes.

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Command-and-Control versus Market-Based Approaches

Command-and-control approach
A policy that involves the government imposing quantitative limits on the amount of pollution firms are allowed to emit or requiring firms to install specific pollution control devices.

Although the federal government has sometimes used taxes and subsidies to deal with externalities, it has more frequently used a *command-and-control approach* to deal with pollution. A **command-and-control approach** involves the government imposing quantitative limits on the amount of pollution firms are allowed to emit or requiring firms to install specific pollution control devices. For example, in the 1980s, the federal government required auto manufacturers such as Ford and General Motors to install catalytic converters to reduce auto emissions on all new automobiles.

Congress could have used a command-and-control approach to achieve its goal of reducing sulfur dioxide emissions by 8.5 million tons per year by 2010. However, this approach would not have been an economically efficient solution to the problem because utilities can have very different costs of reducing sulfur dioxide emissions. Some utilities that already used low-sulfur coal could reduce emissions further only at a high cost. Other utilities, particularly those in the Midwest, were able to reduce emissions at a lower cost.

Congress decided to use a market-based approach to reducing sulfur dioxide emissions by setting up a *cap-and-trade system* of tradable emission allowances. The federal government gave allowances to utilities equal to the total target amount of sulfur dioxide emissions. The utilities were then free to buy and sell the allowances on the Chicago Mercantile Exchange. Utilities that could reduce emissions at low cost did so and sold their allowances to utilities that could only reduce emissions at high cost.

Using tradable emission allowances to reduce acid rain was a success in that it made it possible for utilities to meet Congress's emissions goal at a much lower cost than expected. Just before Congress enacted the allowances program in 1990, the Edison Electric Institute estimated that the cost to utilities of complying with the program would be $7.4 billion by 2010. By 1994, the federal government's General Accounting Office estimated that the cost would be less than $2 billion. In practice, the cost was almost 90 percent less than the initial estimate, or only about $870 *million*.

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The End of the Sulfur Dioxide Cap-and-Trade System

The dollar value of the total benefits of reducing sulfur dioxide emissions turned out to be at least 25 times as large as the costs. Despite its successes, however, the sulfur dioxide cap-and-trade system had effectively ended by 2013. Over the years, research showed that sulfur dioxide emissions had caused more illnesses than had been initially thought. In response to these findings, President George W. Bush proposed legislation lowering the cap on sulfur dioxide emissions, but Congress did not pass the legislation. Court rulings kept the Environmental Protection Agency (EPA) from using regulations to set up a new trading system for sulfur dioxide allowances with a lower cap. As a result, the EPA reverted to the previous system of setting limits on sulfur dioxide emissions at the state or individual power plant level.

Because nationwide trading of emission allowances was no longer possible, the allowances lost their value. Many economists continue to believe that using market-based policies, such as the sulfur dioxide cap-and-trade system, is an efficient way to deal with the externalities of pollution. But in the end, any policy requires substantial political support to be enacted and maintained. MyLab Economics Concept Check

Are Tradable Emission Allowances Licenses to Pollute?

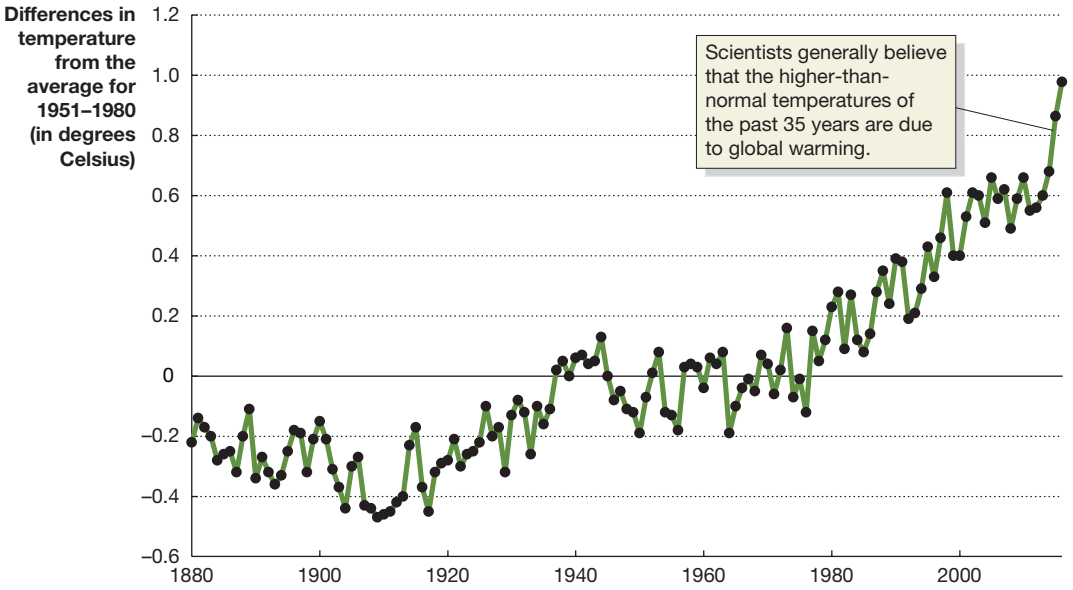
Tradable emission allowances face a political problem. While many environmentalists support these allowances, other environmentalists have criticized the allowances for being "licenses to pollute." These environmentalists argue that just as the government does not issue licenses to rob banks or drive drunk, it should not issue licenses to pollute. But, this criticism ignores one of the central lessons of economics: Because resources are scarce, trade-offs exist. Resources that are spent on reducing one type of pollution are not available to reduce other types of pollution or for any other use. Because reducing acid rain using tradable emission allowances cost utilities $870 million per year, rather than $7.4 billion, as originally estimated, society saved more than $6.5 billion per year. MyLab Economics Concept Check

Apply the Concept

MyLab Economics Video

Should the United States Enact a Carbon Tax to Fight Global Warming?

In the past 35 years, the global temperature has increased about 0.75 degree Fahrenheit (or 0.40 degree Celsius) compared with the average for the period between 1951 and 1980. The following graph shows changes in temperature in the years since 1880.



Source: NASA, Goddard Institute for Space Studies, data.giss.nasa.gov/gistemp.

Over the centuries, global temperatures have gone through many long periods of warming and cooling. Nevertheless, most scientists are convinced that the recent warming trend is not part of the natural fluctuations in temperature but is primarily a result of the burning of fossil fuels, such as coal, natural gas, and petroleum. Burning these fuels releases carbon dioxide, which accumulates in the atmosphere as a "greenhouse gas." Greenhouse gases cause some of the heat released from the earth to be reflected back, increasing temperatures. Worldwide annual carbon dioxide emissions increased from about 198 million metric tons of carbon in 1850 to 3,855 million metric tons in 1930 and to 35,700 million metric tons in 2015.

If greenhouse gases continue to accumulate in the atmosphere, according to some estimates, global temperatures could increase by 3 degrees Fahrenheit or more during the next 100 years. Such an increase in temperature could lead to significant changes in climate, which might result in more hurricanes and other violent weather conditions, disrupt farming in many parts of the world, and lead to increases in sea levels, which could result in flooding in coastal areas.

Although most economists and policymakers agree that emitting carbon dioxide results in a significant negative externality, there is extensive debate over which policies should be adopted for three key reasons. First, there are disagreements about how rapidly global warming is likely to occur and what the economic cost will be. Second, carbon dioxide emissions are a worldwide problem; sharp reductions in carbon dioxide emissions only in the United States and Europe, for instance, would not be enough to stop global warming. But coordinating policy across countries has proven difficult. Third, policymakers and economists debate the relative effectiveness of different policies.

In 2015, representatives from 195 nations meeting in Paris agreed to voluntary efforts to restrict emissions of greenhouse gases. The same year, the Obama administration introduced the Clean Power Plan, which would have required states to reduce power plant emissions to 32 percent below 2005 levels by 2030. In 2017, though, the Trump administration decided to withdraw from the Paris agreement and cancel the Clean Power Plan regulations. Some members of the Trump administration argued that the Clean Power Plan's goals would be difficult to meet without disrupting the country's power supply.

Many economists favor a carbon tax as a market-based policy to reduce carbon dioxide emissions. In 2017, economists working at the U.S. Department of the Treasury's Office of Tax Analysis estimated that the marginal social cost of carbon dioxide emissions was about $49 per metric ton. A carbon tax would be intended to replace other regulations on the emissions of carbon dioxide, relying instead on market forces responding to an increase in the price of products that result in carbon dioxide emissions. For example, a $49 per ton carbon tax would raise the price of gasoline by about $0.44 per gallon. This price increase would lead some consumers to switch from cars and trucks with poor fuel mileage to vehicles, including electric cars and trucks, with higher fuel mileage. The federal government's Corporate Average Fuel Economy (CAFE) standards, which require car companies to achieve an average of 54.5 miles per gallon by 2025, would no longer be necessary.

Treasury Department economists estimate that a carbon tax that was set at $49 per ton and increased to $70 per ton over 10 years would raise tax revenue of about $2.2 trillion over that period. Because lower-income households spend a larger fraction of their incomes on gasoline, heating oil, and other energy products than do higher-income households, they would bear a proportionally larger share of the tax. Most proposals for a carbon tax, including one made in 2017 by former Republican secretaries of state George Schultz and James Baker, include a way of refunding to lower-income households some part of their higher tax payments, possibly by increasing and expanding eligibility for the earned income tax credit, which we discussed briefly in an *Apply the Concept* in Chapter 4, pages 119–120.

Some policymakers opposed implementing a carbon tax because they preferred the command-and-control approach of directly regulating emissions. Other opponents worried that a tax generating trillions of dollars of revenue might disrupt the economy

in unanticipated ways, even if most of the revenue was refunded back to households. As of late 2017, it seemed doubtful that Congress would pass a carbon tax. The debate over policies to deal with global warming is likely to continue for many years.

Sources: Coral Davenport, "Trump Lays Plans to Reverse Obama's Climate Change Legacy," *New York Times*, March 21, 2017; Coral Davenport, "Nations Approve Landmark Climate Accord in Paris," *New York Time*, December 12, 2015; Jessica Shankleman and Joe Ryan, "Trump Likely to Withdraw from Paris Climate Pact, Ebell Says," bloomberg.com, January 17, 2017; John Horowitz, Julie-Anne Cronin, Hannah Hawkins, Laura Konda, and Alex Yuskavage, "Methodology for Analyzing a Carbon Tax," Office of Tax Analysis, Working Paper No. 115, January 2017; and George P. Shultz and James A. Baker III, "A Conservative Answer to Climate Change," *Wall Street Journal*, February 7, 2017.

Your Turn: Test your understanding by doing related problems 3.15 and 3.16 on page 179 at the end of this chapter.

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5.4 Four Categories of Goods

LEARNING OBJECTIVE: Categorize goods on the basis of whether they are rival or excludable and use graphs to illustrate the efficient quantities of public goods and common resources.

We can explore further the question of when the market is likely to succeed in supplying the efficient quantity of a good by understanding that goods differ on the basis of whether their consumption is *rival* and *excludable*:

- **Rivalry** occurs when one person's consumption of a unit of a good means no one else can consume it. If you consume a Big Mac, for example, no one else can consume it.
- **Excludability** means that anyone who does not pay for a good cannot consume it. If you don't pay for a Big Mac, McDonald's can exclude you from consuming it. The consumption of a Big Mac is therefore rival and excludable.

Rivalry The situation that occurs when one person's consumption of a unit of a good means no one else can consume it.

Excludability The situation in which anyone who does not pay for a good cannot consume it.

The consumption of some goods, however, can be either *nonrival* or *nonexcludable*:

- *Nonrival* means that one person's consumption does not interfere with another person's consumption.
- *Nonexcludable* means that it is impossible to exclude others from consuming the good, whether they have paid for it or not.

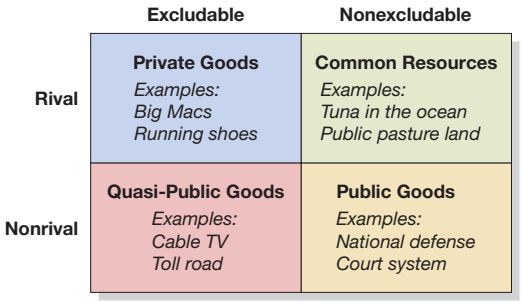
Figure 5.7 shows four possible categories into which goods can fall:

1. A **private good** is both rival and excludable. Food, clothing, haircuts, and many other goods and services fall into this category. One person's consuming a unit of these goods keeps other people from consuming that unit, and no one can consume these goods without buying them. Although we didn't state it explicitly, when we analyzed the demand and supply for goods and services in earlier chapters, we assumed that the goods and services were all private goods.

Private good A good that is both rival and excludable.

2. A **public good** is both nonrival and nonexcludable. Public goods are often, although not always, supplied by a government rather than by private firms. The

Public good A good that is both nonrival and nonexcludable.



MyLab Economics Animation

Figure 5.7

Four Categories of Goods

Goods and services can be divided into four categories on the basis of whether people can be excluded from consuming them and whether they are rival in consumption. A good or service is rival in consumption if one person consuming a unit of the good means that another person cannot consume that unit.

Continued from page 147

Economics in Your Life & Career

Giving Advice on the "Best" Level of Pollution

At the beginning of this chapter, we asked you to think about what advice you would give as a policy aide to a U.S. senator on the "best" level of carbon emissions. Conceptually, this is a straightforward question to answer: The efficient level of carbon emissions is the level for which the marginal benefit of reducing carbon emissions exactly equals the marginal cost of reducing carbon emissions. In practice, however, this question is very difficult to answer. For example, scientists disagree about how much carbon emissions are contributing to climate change and what the damage from climate change will be. In addition, the cost of reducing carbon emissions depends on the method of reduction used. As a result, neither the marginal benefit curve nor the marginal cost curve for reducing carbon emissions is known with certainty. This uncertainty makes it difficult for policymakers to determine the economically efficient level of carbon emissions and is the source of much of the current debate. In any case, economists agree that the total cost of *completely* eliminating carbon emissions is much greater than the total benefit. So, at least you can provide the senator you work for with that conclusion!

Conclusion

We saw in Chapter 4 that government interventions in the economy, such as imposing price ceilings and price floors, can reduce economic efficiency. But in this chapter, we have seen that the government plays an important role in the economy when the absence of well-defined and enforceable property rights keeps the market from operating efficiently. For instance, because no one has a property right to clean air, in the absence of government intervention, firms will produce too great a quantity of products that generate air pollution. We have also seen that public goods are nonrival and nonexcludable, so the government often supplies them.

Visit MyLab Economics for a news article and analysis related to the concepts in this chapter.

a. Explain why the marginal social cost curve has a different slope than the marginal private cost curve.
b. What tax per item cleaned will achieve economic efficiency in the smaller city? In the larger city? Explain why the efficient tax is different in the two cities.

3.14 **(Related to the Chapter Opener on page 146)** In a letter to the *New York Times*, Suzanne McCarron, an executive at ExxonMobil, argued that a carbon tax would "allow market forces to drive solutions."
a. According to McCarron, what problem would a carbon tax solve?
b. How would a carbon tax allow market forces to "drive solutions"?

Source: Suzanne McCarron, "Letter: Exxon Favors a Carbon Tax," *New York Times*, December 30, 2016.

3.15 **(Related to the Apply the Concept on page 163)** An economist for the Brookings Institution argued that "a price on carbon would minimize the cost of steering economic activity away from the greenhouse gas emissions that threaten the climate."
a. In what sense does a carbon tax put a price on carbon?
b. How would a carbon tax steer economic activity away from greenhouse gas emissions?
c. Why might a carbon tax be less costly to the economy than a command-and-control approach to reducing greenhouse gases? Why might a command-and-control approach to pollution control still be more politically popular than a carbon tax? Include in your answer a brief discussion of the difference between the normative analysis and positive analysis of this policy issue.

Source: Fred Dews, "10 Things You Should Know about the Carbon Tax," brookings.edu, May 4, 2016.

3.16 **(Related to the Apply the Concept on page 163)** An economics student made the following comment about a proposed carbon tax:

> I read that a tax on carbon would have a greater negative effect on low-income consumers than high-income consumers, but I disagree. Business executives spend a lot of money and time traveling—both by car and plane. Many rich people have homes that are considerably larger than the average family's home. Heating and air conditioning bills are certainly greater for larger homes than smaller homes. The cost of a carbon tax would surely be greater for those with the highest incomes.

Explain whether you agree that a carbon tax would impose a greater burden on high-income consumers than low-income consumers.

5.4 Four Categories of Goods, pages 165–172

LEARNING OBJECTIVE: Categorize goods on the basis of whether they are rival or excludable and use graphs to illustrate the efficient quantities of public goods and common resources.

MyLab Economics Visit **www.pearson.com/mylab/economics** to complete these exercises online and get instant feedback.

Summary

There are four categories of goods: private goods, public goods, quasi-public goods, and common resources. **Private goods** are both rival and excludable. **Rivalry** means that when one person consumes a unit of a good, no one else can consume that unit. **Excludability** means that anyone who does not pay for a good cannot consume it. **Public goods** are both nonrival and nonexcludable. Private firms are usually not willing to supply public goods because of free riding. **Free riding** involves benefiting from a good without paying for it. *Quasi-public goods* are excludable but not rival. **Common resources** are rival but not excludable. The **tragedy of the commons** refers to the tendency for a common resource to be overused. The tragedy of the commons results from a lack of clearly defined and enforced property rights. We find the market demand curve for a private good by adding the quantity of the good demanded by each consumer at each price. We find the demand curve for a public good by adding vertically the price each consumer would be willing to pay for each quantity of the good. The optimal quantity of a public good occurs where the demand curve intersects the curve representing the marginal cost of supplying the good.

Review Questions

4.1 Define *rivalry* and *excludability* and use these terms to discuss the four categories of goods.
4.2 What is free riding? How is free riding related to the need for public goods?
4.3 What is the tragedy of the commons? How can it be avoided?

Problems and Applications

4.4 The merry-go-round in Ross Park, a public park in Binghamton, New York, was first installed in 1920 and has been periodically refurbished by the city in the years since. There is no entry fee to visit the park or to ride the merry-go-round. Is the merry-go-round a public good? Briefly explain.

Source: Greater Binghamton, "Carousels," www.visitbinghamton.org/ebrochures/carousels.pdf.

4.5 In writing about the increased popularity of national parks in the United States, such as Yosemite, Yellowstone, and the Grand Canyon, environmental economist Margaret Walls wrote:

> When one person's visit to a park doesn't appreciably diminish the experience for others,