CHAPTER

11

Public Goods and Common Resources

An old song lyric maintains that "the best things in life are free." A moment's thought reveals a long list of goods that the songwriter could have had in mind. Nature provides some of them, such as rivers, mountains, beaches, lakes, and oceans. The government provides others, such as playgrounds, parks, and parades. In each case, people do not pay a fee when they choose to enjoy the benefit of the good.

Goods without prices provide a special challenge for economic analysis. Most goods in our economy are allocated in markets, in which buyers pay for what they receive and sellers are paid for what they provide. For these goods, prices are the signals that guide the decisions of buyers and sellers, and these decisions lead to an efficient allocation of resources. When goods are available free of charge, however, the market forces that normally allocate resources in our economy are absent.

In this chapter, we examine the problems that arise for the allocation of resources when there are goods without market prices. Our analysis will shed light on one of the *Ten Principles of Economics* in Chapter 1: Governments can sometimes improve market outcomes. When a good does not have a price attached to it, private markets cannot ensure that the good is produced and consumed in the proper amounts. In such cases, government policy can potentially remedy the market failure and increase economic well-being.

11-1 The Different Kinds of Goods

How well do markets work in providing the goods that people want? The answer to this question depends on the good being considered. As we discussed in Chapter 7, a market can provide the efficient number of ice-cream cones: The price of ice-cream cones adjusts to balance supply and demand, and this equilibrium maximizes the sum of producer and consumer surplus. Yet as we discussed in Chapter 10, the market cannot be counted on to prevent aluminum manufacturers from polluting the air we breathe: Buyers and sellers in a market typically do not take into account the external effects of their decisions. Thus, markets work well when the good is ice cream, but they work badly when the good is clean air.

In thinking about the various goods in the economy, it is useful to group them according to two characteristics:

excludability
the property of a good whereby a person can be prevented from using it

rivalry in consumption
the property of a good whereby one person's use diminishes other people's use

- Is the good **excludable**? That is, can people be prevented from using the good?
- Is the good **rival in consumption**? That is, does one person's use of the good reduce another person's ability to use it?

Using these two characteristics, Figure 1 divides goods into four categories:

private goods
goods that are both excludable and rival in consumption

1. **Private goods** are both excludable and rival in consumption. Consider an ice-cream cone, for example. An ice-cream cone is excludable because it is possible to prevent someone from eating one—you just don't give it to her. An ice-cream cone is rival in consumption because if one person eats an ice-cream cone, another person cannot eat the same cone. Most goods in the economy are private goods like ice-cream cones: You don't get one unless you pay for it, and once you have it, you are the only person who benefits. When we analyzed supply and demand in Chapters 4–6 and the efficiency of markets in Chapters 7–9, we implicitly assumed that goods were both excludable and rival in consumption.

public goods
goods that are neither excludable nor rival in consumption

2. **Public goods** are neither excludable nor rival in consumption. That is, people cannot be prevented from using a public good, and one person's use of a public good does not reduce another person's ability to use it. For example, a tornado siren in a small town is a public good. Once the siren sounds, it is impossible to prevent any single person from hearing it (so it is not excludable). Moreover, when one person gets the benefit of the warning, she does not reduce the benefit to anyone else (so it is not rival in consumption).

common resources
goods that are rival in consumption but not excludable

3. **Common resources** are rival in consumption but not excludable. For example, fish in the ocean are rival in consumption: When one person catches fish, there are fewer fish for the next person to catch. Yet these fish are not an excludable good because, given the vast size of an ocean, it is difficult to stop fishermen from taking fish out of it.

Excludable? \ Rival in consumption?	Yes	No
Yes	Private Goods • Ice-cream cones • Clothing • Congested toll roads	Club Goods • Fire protection • Cable TV • Uncongested toll roads
No	Common Resources • Fish in the ocean • The environment • Congested nontoll roads	Public Goods • Tornado siren • National defense • Uncongested nontoll roads

FIGURE 1

Four Types of Goods
Goods can be grouped into four categories according to two characteristics: (1) A good is *excludable* if people can be prevented from using it. (2) A good is *rival in consumption* if one person's use of the good diminishes other people's use of it. This diagram gives examples of goods in each category.

4. **Club goods** are excludable but not rival in consumption. For instance, consider fire protection in a small town. It is easy to exclude someone from using this good: The fire department can just let her house burn down. Yet fire protection is not rival in consumption: Once a town has paid for the fire department, the additional cost of protecting one more house is small. (We discuss club goods again in Chapter 15, where we see that they are one type of a *natural monopoly*.)

club goods
goods that are excludable but not rival in consumption

Although Figure 1 offers a clean separation of goods into four categories, the boundaries between the categories are sometimes fuzzy. Whether goods are excludable or rival in consumption is often a matter of degree. Fish in an ocean may not be excludable because monitoring fishing is so difficult, but a large enough coast guard could make fish at least partly excludable. Similarly, although fish are generally rival in consumption, this would be less true if the population of fishermen were small relative to the population of fish. (Think of North American fishing waters before the arrival of European settlers.) For purposes of our analysis, however, it will be helpful to group goods into these four categories.

In this chapter, we examine goods that are not excludable: public goods and common resources. Because people cannot be prevented from using these goods, they are available to everyone free of charge. The study of public goods and common resources is closely related to the study of externalities. For both of these types of goods, externalities arise because something of value has no price attached to it. If one person were to provide a public good, such as a tornado siren, other people would be better off. They would receive a benefit without paying for it—a positive externality. Similarly, when one person uses a common resource such as the fish in the ocean, other people are worse off because there are fewer fish to catch. They suffer a loss but are not compensated for it—a negative externality. Because of these external effects, private decisions about consumption and production can lead to an inefficient allocation of resources, and government intervention can potentially raise economic well-being.

Quick Quiz *Define* public goods *and* common resources *and give an example of each.*

11-2 Public Goods

To understand how public goods differ from other goods and why they present problems for society, let's consider an example: a fireworks display. This good is not excludable because it is impossible to prevent someone from seeing fireworks, and it is not rival in consumption because one person's enjoyment of fireworks does not reduce anyone else's enjoyment of them.

11-2a The Free-Rider Problem

The citizens of Smalltown, U.S.A., like seeing fireworks on the Fourth of July. Each of the town's 500 residents places a $10 value on the experience for a total benefit of $5,000. The cost of putting on a fireworks display is $1,000. Because the $5,000 benefit exceeds the $1,000 cost, it is efficient for Smalltown to have a fireworks display on the Fourth of July.

Would the private market produce the efficient outcome? Probably not. Imagine that Ellen, a Smalltown entrepreneur, decided to put on a fireworks display. Ellen would surely have trouble selling tickets to the event because her potential customers would quickly figure out that they could see the fireworks even without a ticket. Because fireworks are not excludable, people have an incentive to be free riders. A **free rider** is a person who receives the benefit of a good but does not pay for it. Because people would have an incentive to be free riders rather than ticket buyers, the market would fail to provide the efficient outcome.

free rider
a person who receives the benefit of a good but avoids paying for it

One way to view this market failure is that it arises because of an externality. If Ellen puts on the fireworks display, she confers an external benefit on those who see the display without paying for it. When deciding whether to put on the display, however, Ellen does not take the external benefits into account. Even though the fireworks display is socially desirable, it is not profitable. As a result, Ellen makes the privately rational but socially inefficient decision not to put on the display.

Although the private market fails to supply the fireworks display demanded by Smalltown residents, the solution to Smalltown's problem is obvious: The local government can sponsor a Fourth of July celebration. The town council can raise everyone's taxes by $2 and use the revenue to hire Ellen to produce the fireworks. Everyone in Smalltown is better off by $8—the $10 at which residents value the fireworks minus the $2 tax bill. Ellen can help Smalltown reach the efficient outcome as a public employee even though she could not do so as a private entrepreneur.

The story of Smalltown is simplified but realistic. In fact, many local governments in the United States pay for fireworks on the Fourth of July. Moreover, the story shows a general lesson about public goods: Because public goods are not excludable, the free-rider problem prevents the private market from supplying them. The government, however, can potentially remedy the problem. If the government decides that the total benefits of a public good exceed its costs, it can provide the public good, pay for it with tax revenue, and make everyone better off.

11-2b Some Important Public Goods

There are many examples of public goods. Here we consider three of the most important.

"I like the concept if we can do it with no new taxes."

National Defense The defense of a country from foreign aggressors is a classic example of a public good. Once the country is defended, it is impossible to prevent any single person from enjoying the benefit of this defense. Moreover, when one person enjoys the benefit of national defense, she does not reduce the benefit to anyone else. Thus, national defense is neither excludable nor rival in consumption.

National defense is also one of the most expensive public goods. In 2011, the U.S. federal government spent a total of $717 billion on national defense, more than $2,298 per person. People disagree about whether this amount is too small or too large, but almost no one doubts that some government spending for national defense is necessary. Even economists who advocate small government agree that the national defense is a public good the government should provide.

Basic Research Knowledge is created through research. In evaluating the appropriate public policy toward knowledge creation, it is important to distinguish general knowledge from specific technological knowledge. Specific technological knowledge, such as the invention of a longer-lasting battery, a smaller microchip, or a better digital music player, can be patented. The patent gives the inventor the exclusive right to the knowledge she has created for a period of time. Anyone else who wants to use the patented information must pay the inventor for the right to do so. In other words, the patent makes the knowledge created by the inventor excludable.

By contrast, general knowledge is a public good. For example, a mathematician cannot patent a theorem. Once a theorem is proven, the knowledge is not excludable: The theorem enters society's general pool of knowledge that anyone can use without charge. The theorem is also not rival in consumption: One person's use of the theorem does not prevent any other person from using the theorem.

Profit-seeking firms spend a lot on research trying to develop new products that they can patent and sell, but they do not spend much on basic research. Their incentive, instead, is to free ride on the general knowledge created by others. As a result, in the absence of any public policy, society would devote too few resources to creating new knowledge.

The government tries to provide the public good of general knowledge in various ways. Government agencies, such as the National Institutes of Health and the National Science Foundation, subsidize basic research in medicine, mathematics, physics, chemistry, biology, and even economics. Some people justify government funding of the space program on the grounds that it adds to society's pool of knowledge. Determining the appropriate level of government support for these endeavors is difficult because the benefits are hard to measure. Moreover, the members of Congress who appropriate funds for research usually have little expertise in science and, therefore, are not in the best position to judge what lines of research will produce the largest benefits. So, while basic research is surely a public good, we should not be surprised if the public sector fails to pay for the right amount and the right kinds.

Fighting Poverty Many government programs are aimed at helping the poor. The welfare system (officially called TANF, Temporary Assistance for Needy Families) provides a small income for some poor families. Food stamps (officially called SNAP, Supplemental Nutrition Assistance Program) subsidize the purchase of food for those with low incomes. And various government housing programs make shelter more affordable. These antipoverty programs are financed by taxes paid by families that are financially more successful.

Economists disagree among themselves about what role the government should play in fighting poverty. We discuss this debate more fully in Chapter 20, but here we note one important argument: Advocates of antipoverty programs claim that fighting poverty is a public good. Even if everyone prefers living in a society without poverty, fighting poverty is not a "good" that private actions will adequately provide.

To see why, suppose someone tried to organize a group of wealthy individuals to try to eliminate poverty. They would be providing a public good. This good would not be rival in consumption: One person's enjoyment of living in a society without poverty would not reduce anyone else's enjoyment of it. The good would not be excludable: Once poverty is eliminated, no one can be prevented from taking pleasure in this fact. As a result, there would be a tendency for people to free ride on the generosity of others, enjoying the benefits of poverty elimination without contributing to the cause.

Because of the free-rider problem, eliminating poverty through private charity will probably not work. Yet government action can solve this problem. Taxing the wealthy to raise the living standards of the poor can potentially make everyone better off. The poor are better off because they now enjoy a higher standard of living, and those paying the taxes are better off because they enjoy living in a society with less poverty.

case study

Are Lighthouses Public Goods?

Some goods can switch between being public goods and being private goods depending on the circumstances. For example, a fireworks display is a public good if performed in a town with many residents. Yet if performed at a private amusement park, such as Walt Disney World, a fireworks display is more like a private good because visitors to the park pay for admission.

Another example is a lighthouse. Economists have long used lighthouses as an example of a public good. Lighthouses mark specific locations along the coast so that passing ships can avoid treacherous waters. The benefit that the lighthouse provides to the ship captain is neither excludable nor rival in consumption, so each captain has an incentive to free ride by using the lighthouse to navigate without paying for the service. Because of this free-rider problem, private markets usually fail to provide the lighthouses that ship captains need. As a result, most lighthouses today are operated by the government.

In some cases, however, lighthouses have been closer to private goods. On the coast of England in the 19th century, for example, some lighthouses were privately owned and operated. Instead of trying to charge ship captains for the service, however, the owner of the lighthouse charged the owner of the nearby port. If the port owner did not pay, the lighthouse owner turned off the light, and ships avoided that port.

In deciding whether something is a public good, one must determine who the beneficiaries are and whether these beneficiaries can be excluded from using the good. A free-rider problem arises when the number of beneficiaries is large and exclusion of any one of them is impossible. If a lighthouse benefits many ship captains, it is a public good. Yet if it primarily benefits a single port owner, it is more like a private good. ◢

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What kind of good is this?

11-2c The Difficult Job of Cost–Benefit Analysis

So far we have seen that the government provides public goods because the private market on its own will not produce an efficient quantity. Yet deciding that the government must play a role is only the first step. The government must then determine what kinds of public goods to provide and in what quantities.

Suppose that the government is considering a public project, such as building a new highway. To judge whether to build the highway, it must compare the total benefits of all those who would use it to the costs of building and maintaining it. To make this decision, the government might hire a team of economists and engineers to conduct a study, called a **cost–benefit analysis**, to estimate the total costs and benefits of the project to society as a whole.

cost–benefit analysis
a study that compares the costs and benefits to society of providing a public good

Cost–benefit analysts have a tough job. Because the highway will be available to everyone free of charge, there is no price with which to judge the value of the highway. Simply asking people how much they would value the highway is not reliable: Quantifying benefits is difficult using the results from a questionnaire, and respondents have little incentive to tell the truth. Those who would use the highway have an incentive to exaggerate the benefit they receive to get the highway built. Those who would be harmed by the highway have an incentive to exaggerate the costs to them to prevent the highway from being built.

The efficient provision of public goods is, therefore, intrinsically more difficult than the efficient provision of private goods. When buyers of a private good enter

a market, they reveal the value they place on it through the prices they are willing to pay. At the same time, sellers reveal their costs with the prices they are willing to accept. The equilibrium is an efficient allocation of resources because it reflects all this information. By contrast, cost–benefit analysts do not have any price signals to observe when evaluating whether the government should provide a public good and how much to provide. Their findings on the costs and benefits of public projects are rough approximations at best.

case study

How Much Is a Life Worth?

Imagine that you have been elected to serve as a member of your local town council. The town engineer comes to you with a proposal: The town can spend $10,000 to build and operate a traffic light at a town intersection that now has only a stop sign. The benefit of the traffic light is increased safety. The engineer estimates, based on data from similar intersections, that the traffic light would reduce the risk of a fatal traffic accident over the lifetime of the traffic light from 1.6 to 1.1 percent. Should you spend the money for the new light?

To answer this question, you turn to cost–benefit analysis. But you quickly run into an obstacle: The costs and benefits must be measured in the same units if you are to compare them meaningfully. The cost is measured in dollars, but the benefit—the possibility of saving a person's life—is not directly monetary. To make your decision, you have to put a dollar value on a human life.

At first, you may be tempted to conclude that a human life is priceless. After all, there is probably no amount of money that you could be paid to voluntarily give up your life or that of a loved one. This suggests that a human life has an infinite dollar value.

For the purposes of cost–benefit analysis, however, this answer leads to nonsensical results. If we truly placed an infinite value on human life, we should place traffic lights on every street corner, and we should all drive large cars loaded with all the latest safety features. Yet traffic lights are not at every corner, and people sometimes choose to pay less for smaller cars without safety options such as side-impact air bags or antilock brakes. In both our public and private decisions, we are at times willing to risk our lives to save some money.

Once we have accepted the idea that a person's life has an implicit dollar value, how can we determine what that value is? One approach, sometimes used by courts to award damages in wrongful-death suits, is to look at the total amount of money a person would have earned if she had lived. Economists are often critical of this approach because it ignores other opportunity costs of losing one's life. It thus has the bizarre implication that the life of a retired or disabled person has no value.

A better way to value human life is to look at the risks that people are voluntarily willing to take and how much they must be paid for taking them. Mortality risk varies across jobs, for example. Construction workers in high-rise buildings face greater risk of death on the job than office workers do. By comparing wages in risky and less risky occupations, controlling for education, experience, and other determinants of wages, economists can get some sense about what value people put on their own lives. Studies using this approach conclude that the value of a human life is about $10 million.

We can now return to our original example and respond to the town engineer. The traffic light reduces the risk of fatality by 0.5 percentage points. Thus, the expected benefit from installing the traffic light is 0.005 × $10 million, or $50,000. This estimate of the benefit well exceeds the cost of $10,000, so you should approve the project. ◢

Quick Quiz *What is the* free-rider problem*? Why does the free-rider problem induce the government to provide public goods? • How should the government decide whether to provide a public good?*

11-3 Common Resources

Common resources, like public goods, are not excludable: They are available free of charge to anyone who wants to use them. Common resources are, however, rival in consumption: One person's use of the common resource reduces other people's ability to use it. Thus, common resources give rise to a new problem. Once the good is provided, policymakers need to be concerned about how much it is used. This problem is best understood from the classic parable called the **Tragedy of the Commons**.

Tragedy of the Commons
a parable that illustrates why common resources are used more than is desirable from the standpoint of society as a whole

11-3a The Tragedy of the Commons

Consider life in a small medieval town. Of the many economic activities that take place in the town, one of the most important is raising sheep. Many of the town's families own flocks of sheep and support themselves by selling the sheep's wool, which is used to make clothing.

As our story begins, the sheep spend much of their time grazing on the land surrounding the town, called the Town Common. No family owns the land. Instead, the town residents own the land collectively, and all the residents are allowed to graze their sheep on it. Collective ownership works well because land is plentiful. As long as everyone can get all the good grazing land they want, the Town Common is not rival in consumption, and allowing residents' sheep to graze for free causes no problems. Everyone in the town is happy.

As the years pass, the population of the town grows, and so does the number of sheep grazing on the Town Common. With a growing number of sheep and a fixed amount of land, the land starts to lose its ability to replenish itself. Eventually, the land is grazed so heavily that it becomes barren. With no grass left on the Town Common, raising sheep is impossible, and the town's once prosperous wool industry disappears. Many families lose their source of livelihood.

What causes the tragedy? Why do the shepherds allow the sheep population to grow so large that it destroys the Town Common? The reason is that social and private incentives differ. Avoiding the destruction of the grazing land depends on the collective action of the shepherds. If the shepherds acted together, they could reduce the sheep population to a size that the Town Common can support. Yet no single family has an incentive to reduce the size of its own flock because each flock represents only a small part of the problem.

In essence, the Tragedy of the Commons arises because of an externality. When one family's flock grazes on the common land, it reduces the quality of the land available for other families. Because people neglect this negative externality when deciding how many sheep to own, the result is an excessive number of sheep.

If the tragedy had been foreseen, the town could have solved the problem in various ways. It could have regulated the number of sheep in each family's flock, internalized the externality by taxing sheep, or auctioned off a limited number of sheep-grazing permits. That is, the medieval town could have dealt with the problem of overgrazing in the way that modern society deals with the problem of pollution.

In the case of land, however, there is a simpler solution. The town can divide the land among town families. Each family can enclose its parcel of land with a fence and then protect it from excessive grazing. In this way, the land becomes a private good rather than a common resource. This outcome in fact occurred during the enclosure movement in England in the 17th century.

The Tragedy of the Commons is a story with a general lesson: When one person uses a common resource, she diminishes other people's enjoyment of it. Because of this negative externality, common resources tend to be used excessively. The

IN THE NEWS

The Case for Toll Roads

Many economists think drivers should be charged more for using roads. Here is why.

Why You'll Love Paying for Roads That Used to Be Free

By Eric A. Morris

To end the scourge of traffic congestion, Julius Caesar banned most carts from the streets of Rome during daylight hours. It didn't work—traffic jams just shifted to dusk. Two thousand years later, we have put a man on the moon and developed garments infinitely more practical than the toga, but we seem little nearer to solving the congestion problem.

If you live in a city, particularly a large one, you probably need little convincing that traffic congestion is frustrating and wasteful. According to the Texas Transportation Institute, the average American urban traveler lost 38 hours, nearly one full work week, to congestion in 2005. And congestion is getting worse, not better; urban travelers in 1982 were delayed only 14 hours that year.

Americans want action, but unfortunately there aren't too many great ideas about what that action might be. As Anthony Downs's excellent book *Still Stuck in Traffic: Coping With Peak-Hour Traffic Congestion* chronicles, most of the proposed solutions are too difficult to implement, won't work, or both.

Fortunately, there is one remedy which is both doable and largely guaranteed to succeed. In the space of a year or two we could have you zipping along the 405 or the LIE at the height of rush hour at a comfortable 55 miles per hour.

There's just one small problem with this silver bullet for congestion: many people seem to prefer the werewolf. Despite its merits, this policy, which is known as "congestion pricing," "value pricing," or "variable tolling," is not an easy political sell.

For decades, economists and other transportation thinkers have advocated imposing tolls that vary with congestion levels on roadways. Simply put, the more congestion, the higher the toll, until the congestion goes away.

To many people, this sounds like a scheme by mustache-twirling bureaucrats and their academic apologists to fleece drivers out of their hard-earned cash. Why should drivers have to pay to use roads their tax dollars have already paid for? Won't the remaining free roads be swamped as drivers are forced off the tolled roads? Won't the working-class and poor be the victims here, as the tolled routes turn into "Lexus lanes"?

And besides, adopting this policy would mean listening to economists, and who wants to do that?

There's a real problem with this logic, which is that, on its own terms, it makes perfect sense (except for the listening to economists part). Opponents of tolls are certainly not stupid, and their arguments deserve serious consideration. But in the end, their concerns are largely overblown, and the benefits of tolling swamp the potential costs.

Unfortunately, it can be hard to convey this because the theory behind tolling is somewhat complex and counterintuitive. This is too bad, because variable tolling is an excellent public policy. Here's why: the basic economic theory is that when you give out something valuable—in this case, road

government can solve the problem by using regulation or taxes to reduce consumption of the common resource. Alternatively, the government can sometimes turn the common resource into a private good.

This lesson has been known for thousands of years. The ancient Greek philosopher Aristotle pointed out the problem with common resources: "What is common to many is taken least care of, for all men have greater regard for what is their own than for what they possess in common with others."

11-3b Some Important Common Resources

There are many examples of common resources. In almost all cases, the same problem arises as in the Tragedy of the Commons: Private decision makers use the common resource too much. Governments often regulate behavior or impose fees to mitigate the problem of overuse.

space—for less than its true value, shortages result.

Ultimately, there's no free lunch; instead of paying with money, you pay with the effort and time needed to acquire the good. Think of Soviet shoppers spending their lives in endless queues to purchase artificially low-priced but exceedingly scarce goods. Then think of Americans who can fulfill nearly any consumerist fantasy quickly but at a monetary cost. Free but congested roads have left us shivering on the streets of Moscow.

To consider it another way, delay is an externality imposed by drivers on their peers. By driving onto a busy road and contributing to congestion, drivers slow the speeds of others—but they never have to pay for it, at least not directly. In the end, of course, everybody pays, because as we impose congestion on others, others impose it on us. This degenerates into a game that nobody can win.

Markets work best when externalities are internalized: i.e., you pay for the hassle you inflict on others…. Using tolls to help internalize the congestion externality would somewhat reduce the number of trips made on the most congested roads at the peak usage periods; some trips would be moved to less congested times and routes, and others would be foregone entirely. This way we would cut down on the congestion costs we impose on each other.

Granted, tolls cannot fully cope with accidents and other incidents, which are major causes of delay. But pricing can largely eliminate chronic, recurring congestion. No matter how high the demand for a road, there is a level of toll that will keep it flowing freely.

To make tolling truly effective, the price must be right. Too high a price drives away too many cars and the road does not function at its capacity. Too low a price and congestion isn't licked.

The best solution is to vary the tolls in real time based on an analysis of current traffic conditions. Pilot toll projects on roads (like the I-394 in Minnesota and the I-15 in Southern California) use sensors embedded in the pavement to monitor the number and speeds of vehicles on the facility.

A simple computer program then determines the number of cars that should be allowed in. The computer then calculates the level of toll that will attract that number of cars—and no more. Prices are then updated every few minutes on electronic message signs. Hi-tech transponders and antenna arrays make waiting at toll booths a thing of the past.

The bottom line is that speeds are kept high (over 45 m.p.h.) so that throughput is higher than when vehicles are allowed to crowd all at once onto roadways at rush hour, slowing traffic to a crawl.

To maximize efficiency, economists would like to price all travel, starting with the freeways. But given that elected officials have no burning desire to lose their jobs, a more realistic option, for now, is to toll just some freeway lanes that are either new capacity or underused carpool lanes. The other lanes would be left free—and congested. Drivers will then have a choice: wait or pay. Granted, neither is ideal. But right now drivers have no choice at all.

What's the bottom line here? The state of Washington recently opened congestion-priced lanes on its State Route 167. The peak toll in the first month of operation (reached on the evening of Wednesday, May 21) was $5.75. I know, I know, you would never pay such an exorbitant amount when America has taught you that free roads are your birthright. But that money bought Washington drivers a 27-minute time savings. Is a half hour of your time worth $6?

I think I already know the answer, and it is "it depends." Most people's value of time varies widely depending on their activities on any given day. Late for picking the kids up from daycare? Paying $6 to save a half hour is an incredible bargain. Have to clean the house? The longer your trip home takes, the better. Tolling will introduce a new level of flexibility and freedom into your life, giving you the power to tailor your travel costs to fit your schedule.

Source: Freakonomics blog, January 6, 2009.

Clean Air and Water As we discussed in Chapter 10, markets do not adequately protect the environment. Pollution is a negative externality that can be remedied with regulations or with corrective taxes on polluting activities. One can view this market failure as an example of a common-resource problem. Clean air and clean water are common resources like open grazing land, and excessive pollution is like excessive grazing. Environmental degradation is a modern Tragedy of the Commons.

Congested Roads Roads can be either public goods or common resources. If a road is not congested, then one person's use does not affect anyone else's use. In this case, use is not rival in consumption, and the road is a public good. Yet if a road is congested, then use of that road yields a negative externality. When one person drives on the road, it becomes more crowded, and other people must drive more slowly. In this case, the road is a common resource.

One way for the government to address the problem of road congestion is to charge drivers a toll. A toll is, in essence, a corrective tax on the externality of congestion. Sometimes, as in the case of local roads, tolls are not a practical solution because the cost of collecting them is too high. But several major cities, including London and Stockholm, have found increasing tolls to be a very effective way to reduce congestion.

Sometimes congestion is a problem only at certain times of day. If a bridge is heavily traveled only during rush hour, for instance, the congestion externality is largest during this time. The efficient way to deal with these externalities is to charge higher tolls during rush hour. This toll would provide an incentive for drivers to alter their schedules, reducing traffic when congestion is greatest.

Another policy that responds to the problem of road congestion, discussed in a case study in Chapter 10, is the tax on gasoline. Gasoline is a complementary good to driving: An increase in the price of gasoline tends to reduce the quantity of driving demanded. Therefore, a gasoline tax reduces road congestion. A gasoline tax, however, is an imperfect solution, because it affects other decisions besides the amount of driving on congested roads. For example, the gasoline tax discourages driving on uncongested roads, even though there is no congestion externality for these roads.

Fish, Whales, and Other Wildlife Many species of animals are common resources. Fish and whales, for instance, have commercial value, and anyone can go to the ocean and catch whatever is available. Each person has little incentive to maintain the species for the next year. Just as excessive grazing can destroy the Town Common, excessive fishing and whaling can destroy commercially valuable marine populations.

Oceans remain one of the least regulated common resources. Two problems prevent an easy solution. First, many countries have access to the oceans, so any solution would require international cooperation among countries that hold different values. Second, because the oceans are so vast, enforcing any agreement is difficult. As a result, fishing rights have been a frequent source of international tension among normally friendly countries.

Within the United States, various laws aim to manage the use of fish and other wildlife. For example, the government charges for fishing and hunting licenses, and it restricts the lengths of the fishing and hunting seasons. Fishermen are often required to throw back small fish, and hunters can kill only a limited number of animals. All these laws reduce the use of a common resource and help maintain animal populations.

case study

Why the Cow Is Not Extinct

Throughout history, many species of animals have been threatened with extinction. When Europeans first arrived in North America, more than 60 million buffalo roamed the continent. Yet hunting the buffalo was so popular during the 19th century that by 1900 the animal's population had fallen to about 400 before the government stepped in to protect the species. In some African countries today, the elephant faces a similar challenge, as poachers kill the animals for the ivory in their tusks.

Yet not all animals with commercial value face this threat. The cow, for example, is a valuable source of food, but no one worries that the cow will soon be extinct. Indeed, the great demand for beef seems to ensure that the species will continue to thrive.

Why does the commercial value of ivory threaten the elephant, while the commercial value of beef protects the cow? The reason is that elephants are a common resource, whereas cows are a private good. Elephants roam freely without any owners. Each poacher has a strong incentive to kill as many elephants as she can find. Because poachers are numerous, each poacher has only a slight incentive to preserve the elephant population. By contrast, cattle live on ranches that are privately owned. Each rancher makes a great effort to maintain the cattle population on her ranch because she reaps the benefit.

Governments have tried to solve the elephant's problem in two ways. Some countries, such as Kenya, Tanzania, and Uganda, have made it illegal to kill elephants and sell their ivory. Yet these laws have been hard to enforce, and the battle between the authorities and the poachers has become increasingly violent. Meanwhile, elephant populations have continued to dwindle. By contrast, other countries, such as Botswana, Malawi, Namibia, and Zimbabwe, have made elephants a private good by allowing people to kill elephants, but only those on their own property. Landowners now have an incentive to preserve the species on their own land, and as a result, elephant populations have started to rise. With private ownership and the profit motive now on its side, the African elephant might someday be as safe from extinction as the cow.

Quick Quiz *Why do governments try to limit the use of common resources?*

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"Will the market protect me?"

11-4 Conclusion: The Importance of Property Rights

In this and the previous chapter, we have seen there are some "goods" that the market does not provide adequately. Markets do not ensure that the air we breathe is clean or that our country is defended from foreign aggressors. Instead, societies rely on the government to protect the environment and to provide for the national defense.

The problems we considered in these chapters arise in many different markets, but they share a common theme. In all cases, the market fails to allocate resources efficiently because *property rights* are not well established. That is, some item of value does not have an owner with the legal authority to control it. For example, although no one doubts that the "good" of clean air or national defense is valuable, no one has the right to attach a price to it and profit from its use. A factory pollutes too much because no one charges the factory for the pollution it emits. The market does not provide for national defense because no one can charge those who are defended for the benefit they receive.

When the absence of property rights causes a market failure, the government can potentially solve the problem. Sometimes, as in the sale of pollution permits, the solution is for the government to help define property rights and thereby unleash market forces. Other times, as in restricted hunting seasons, the solution is for the government to regulate private behavior. Still other times, as in the provision of national defense, the solution is for the government to use tax revenue to supply a good that the market fails to supply. In all cases, if the policy is well planned and well run, it can make the allocation of resources more efficient and thus raise economic well-being.

Summary

- Goods differ in whether they are excludable and whether they are rival in consumption. A good is excludable if it is possible to prevent someone from using it. A good is rival in consumption if one person's use of the good reduces others' ability to use the same unit of the good. Markets work best for private goods, which are both excludable and rival in consumption. Markets do not work as well for other types of goods.
- Public goods are neither rival in consumption nor excludable. Examples of public goods include fireworks displays, national defense, and the creation of fundamental knowledge. Because people are not charged for their use of the public good, they have an incentive to free ride, making private provision of the good untenable. Therefore, governments provide public goods, basing their decision about the quantity of each good on cost–benefit analysis.
- Common resources are rival in consumption but not excludable. Examples include common grazing land, clean air, and congested roads. Because people are not charged for their use of common resources, they tend to use them excessively. Therefore, governments use various methods to limit the use of common resources.

Key Concepts

excludability, *p. 216*
rivalry in consumption, *p. 216*
private goods, *p. 216*
public goods, *p. 216*
common resources, *p. 216*
club goods, *p. 217*
free rider, *p. 218*
cost–benefit analysis, *p. 221*
Tragedy of the Commons, *p. 223*

Questions for Review

1. Explain what is meant by a good being "excludable." Explain what is meant by a good being "rival in consumption." Is a slice of pizza excludable? Is it rival in consumption?
2. Define and give an example of a public good. Can the private market provide this good on its own? Explain.
3. What is cost–benefit analysis of public goods? Why is it important? Why is it hard?
4. Define and give an example of a common resource. Without government intervention, will people use this good too much or too little? Why?

Quick Check Multiple Choice

1. Which categories of goods are excludable?
   a. private goods and club goods
   b. private goods and common resources
   c. public goods and club goods
   d. public goods and common resources
2. Which categories of goods are rival in consumption?
   a. private goods and club goods
   b. private goods and common resources
   c. public goods and club goods
   d. public goods and common resources
3. Which of the following is an example of a public good?
   a. residential housing
   b. national defense
   c. restaurant meals
   d. fish in the ocean
4. Which of the following is an example of a common resource?
   a. residential housing
   b. national defense
   c. restaurant meals
   d. fish in the ocean
5. Public goods are
   a. efficiently provided by market forces.
   b. underprovided in the absence of government.
   c. overused in the absence of government.
   d. a type of natural monopoly.
6. Common resources are
   a. efficiently provided by market forces.
   b. underprovided in the absence of government.
   c. overused in the absence of government.
   d. a type of natural monopoly.

Problems and Applications

1. Think about the goods and services provided by your local government.
   a. Using the classification in Figure 1, explain which category each of the following goods falls into:
      - police protection
      - snow plowing
      - education
      - rural roads
      - city streets
   b. Why do you think the government provides items that are not public goods?
2. Both public goods and common resources involve externalities.
   a. Are the externalities associated with public goods generally positive or negative? Use examples in your answer. Is the free-market quantity of public goods generally greater or less than the efficient quantity?
   b. Are the externalities associated with common resources generally positive or negative? Use examples in your answer. Is the free-market use of common resources generally greater or less than the efficient use?

3. Charlie loves watching *Downton Abbey* on his local public TV station, but he never sends any money to support the station during its fund-raising drives.
   a. What name do economists have for people like Charlie?
   b. How can the government solve the problem caused by people like Charlie?
   c. Can you think of ways the private market can solve this problem? How does the existence of cable TV alter the situation?
4. Wireless, high-speed Internet is provided for free in the airport of the city of Communityville.
   a. At first, only a few people use the service. What type of a good is this and why?
   b. Eventually, as more people find out about the service and start using it, the speed of the connection begins to fall. Now what type of a good is the wireless Internet service?
   c. What problem might result and why? What is one possible way to correct this problem?
5. Four roommates are planning to spend the weekend in their dorm room watching old movies, and they are debating how many to watch. Here is their willingness to pay for each film:

	Judd	Joel	Gus	Tim
First film	$7	$5	$3	$2
Second film	6	4	2	1
Third film	5	3	1	0
Fourth film	4	2	0	0
Fifth film	3	1	0	0

   a. Within the dorm room, is the showing of a movie a public good? Why or why not?
   b. If it costs $8 to rent a movie, how many movies should the roommates rent to maximize total surplus?
   c. If they choose the optimal number from part (b) and then split the cost of renting the movies equally, how much surplus does each person obtain from watching the movies?
   d. Is there any way to split the cost to ensure that everyone benefits? What practical problems does this solution raise?
   e. Suppose they agree in advance to choose the efficient number and to split the cost of the movies equally. When Judd is asked his willingness to pay, will he have an incentive to tell the truth? If so, why? If not, what will he be tempted to say?
   f. What does this example teach you about the optimal provision of public goods?
6. Some economists argue that private firms will not undertake the efficient amount of basic scientific research.
   a. Explain why this might be so. In your answer, classify basic research in one of the categories shown in Figure 1.
   b. What sort of policy has the United States adopted in response to this problem?
   c. It is often argued that this policy increases the technological capability of American producers relative to that of foreign firms. Is this argument consistent with your classification of basic research in part (a)? (*Hint*: Can excludability apply to some potential beneficiaries of a public good and not others?)
7. There is often litter along highways but rarely in people's yards. Provide an economic explanation for this fact.
8. The nation of Wiknam has five million residents whose only activities are producing and consuming fish. They produce fish in two ways. Each person who works on a fish farm raises 2 fish per day. Each person who goes fishing in one of the nation's many lakes catches X fish per day. X depends on N, the number of residents (in millions) fishing in the lakes. In particular, if N million people fish in the lakes, each catches $X = 6 - N$ fish. Each resident is attracted to the job that pays more fish, so in equilibrium the two jobs must offer equal pay.
   a. Why do you suppose that X, the productivity of each fisherman, falls as N, the number of fishermen, rises? What economic term would you use to describe the fish in the town lakes? Would the same description apply to the fish from the farms? Explain.
   b. The town's Freedom Party thinks every individual should have the right to choose between fishing in the lake and farming without government interference. Under its policy, how many of the residents would fish in the lakes and how many would work on fish farms? How many fish are produced?
   c. The town's Efficiency Party thinks Wiknam should produce as many fish as it can. To achieve this goal, how many of the residents should fish in the lakes and how many should work on the farms? (*Hint*: Create a table that shows the number of fish produced—on farms, from the lake, and in total—for each N from 0 to 5.)
   d. The Efficiency Party proposes achieving its goal by taxing each person fishing in the lake by an amount equal to T fish per day. It will then distribute the proceeds equally among all Wiknam residents. (Fish are assumed to be divisible, so these rebates need not be whole numbers.) Calculate the value of T that would yield the outcome you derived in part (c).

e. Compared with the Freedom Party's hands-off policy, who benefits and who loses from the imposition of the Efficiency Party's fishing tax?

9. Many transportation systems, such as the Washington, D.C., Metro (subway), charge higher fares during rush hours than during the rest of the day. Why might they do this?

10. High-income people are willing to pay more than lower-income people to avoid the risk of death. For example, they are more likely to pay for safety features on cars. Do you think cost–benefit analysts should take this fact into account when evaluating public projects? Consider, for instance, a rich town and a poor town, both of which are considering the installation of a traffic light. Should the rich town use a higher dollar value for a human life in making this decision? Why or why not?