Chapter Four

PUBLIC GOODS

There exists an intrinsic connection between the common good on the one hand and the structure and function of public authority on the other. The moral order, which needs public authority in order to promote the common good in human society, requires also that the authority be effective in attaining that end.

—POPE JOHN XXIII

In the aftermath of the terrorist attacks on the United States on September 11, 2001, all Americans agreed that the government had to take steps to prevent future attacks. Although there was (and continues to be) a vigorous debate about just what those steps should be, everyone took for granted that providing defense was a proper function for government. What characteristic of national defense makes it an appropriate government responsibility? Are there other goods and services that partake of this characteristic, and should the government provide them as well? These questions lie at the heart of some of the most important controversies in public policy. In this chapter, we discuss the conditions under which public provision of commodities is appropriate. Special attention is devoted to understanding why markets may fail to provide particular goods at Pareto efficient levels.

▸ PUBLIC GOODS DEFINED

What's the difference between national defense and pizza? The question seems silly, but thinking about it leads to a useful framework for determining whether public or private provision of various commodities makes sense. To begin, one big difference between the two commodities is that two people cannot consume a pizza simultaneously—if I eat a piece, you can't. In contrast, your consumption of the protective services provided by the army does nothing to diminish my consumption of the same services. A second major difference arises because I can easily exclude you from consuming my pizza, but excluding you from the benefits of national defense is all but impossible. (It's hard to imagine a situation in which terrorists are allowed to overrun your home but not mine.)

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National defense is an example of a **pure public good,** defined as follows:[1]

pure public good

A commodity that is nonrival and nonexcludable in consumption.

- Once it is provided, the additional resource cost of another person consuming the good is zero—consumption is *nonrival.* Talep edeni çok olmayan
- To prevent anyone from consuming the good is either very expensive or impossible—consumption is *nonexcludable.* hariç tutulamayan

[1] There is some controversy in the literature with respect to the characteristics of a pure public good. Here we follow the treatment of Cornes and Sandler [1996].

In contrast, a **private good** like pizza is rival and excludable.

Several aspects of our definition of public good are worth noting.

private good

A commodity that is rival and excludable in consumption.

Even Though Everyone Consumes the Same Quantity of the Good, It Need Not Be Valued Equally by All Consider house cleaning in an apartment with many college roommates, which has a public good characteristic to it—everyone benefits from a clean bathroom, and it is hard to exclude anyone from these benefits. Yet some students care about cleanliness much more than others. Similarly, in our defense example, people who are deeply concerned about the intentions of hostile foreigners place a higher value on national defense than people who feel relatively safe, other things being the same. Indeed, people might differ over whether the value of certain public goods is positive or negative. Each person has no choice but to consume the services of a new missile system. For those who believe the system enhances their safety, the value is positive. Others think additional missiles only lead to arms races and decrease national security. Such individuals value an additional missile negatively. They would be willing to pay not to have it around.

Classification as a Public Good Is Not an Absolute; It Depends on Market Conditions and the State of Technology Think about a lighthouse. Once the beacon is lit, one ship can take advantage of it without impinging on another ship's ability to do the same. Moreover, no particular vessel can be excluded from taking advantage of the signal. Under these conditions, the lighthouse is a pure public good. But suppose that a jamming device were invented that made it possible to prevent ships from obtaining the lighthouse signal unless they purchased a special receiver. In this case, the nonexcludability criterion is no longer satisfied, and the lighthouse is no longer a pure public good. A scenic view is a pure public good when there are a small number of people involved. But as the number of sightseers increases, the area may become congested. The same "quantity" of the scenic view is being "consumed" by each person, but its quality decreases with the number of people. Hence, the nonrivalness criterion is no longer satisfied.

In many cases, then, it makes sense to think of "publicness" as a matter of degree. A pure public good satisfies the definition exactly. Consumption of an **impure public good** is to some extent rival or excludable. There are not many examples of pure public goods. However, just as analysis of pure competition yields important insights into the operation of actual markets, so the analysis of pure public goods helps us to understand problems confronting public decision makers.

impure public good

A good that is rival and/or excludable to some extent.

A Commodity Can Satisfy One Part of the Definition of a Public Good and Not the Other That is, nonexcludability and nonrivalness do not have to go together. Consider the streets of a downtown urban area during rush hour. In most cases, nonexcludability holds, because it is not feasible to set up enough toll booths to monitor traffic. But consumption is certainly rival, as anyone who has ever been caught in a traffic jam can testify. On the other hand, many people can enjoy a huge seashore area without diminishing the pleasure of others. Despite the fact that individuals do not rival each other in consumption, exclusion is quite possible if there are only a few access roads. Again, the characterization of a commodity depends on the state of technology and on legal arrangements. The road congestion example is relevant here. E-ZPasses use radio waves to identify passing cars and automatically charge tolls to drivers' charge accounts. For example, State Route 91 near Los Angeles is a four-lane highway accessible only to drivers who buy the required devices

for their cars. One can imagine someday using such technology to charge cars as they enter congested city streets—the streets would become excludable.

Some Things That Are Not Conventionally Thought of as Commodities Have Public Good Characteristics An important example is honesty. If each citizen is honest in commercial transactions, all of society benefits due to the reduction of the costs of doing business. Such cost reductions are characterized both by nonexcludability and nonrivalness. Similarly, the income distribution is a public good. If income is distributed "fairly," each person gains satisfaction from living in a good society, and no one can be excluded from having that satisfaction. Of course, because of disagreements over notions of fairness, people may differ over how a given income distribution should be valued. Nevertheless, consumption of the income distribution is nonrival and nonexcludable, and therefore it is a public good. Certain types of information are also public goods. In Los Angeles, restaurants are now forced by the local government to display a hygiene rating—either "A" (clean), "B" (dirty), or "C" (disgusting). This information dissemination exhibits public good characteristics—it is nonrival in consumption in the sense that everyone can costlessly learn about the restaurant's hygiene by going to the Internet, newspaper, or simply glancing in the restaurant's window, and it is nonexcludable.

publicly provided private goods

Rival and excludable commodities that are provided by governments.

Private Goods Are Not Necessarily Provided Exclusively by the Private Sector There are many **publicly provided private goods**—rival and excludable commodities that are provided by governments. Medical services and housing are two examples of private goods sometimes provided publicly. Similarly, as we will see later, public goods can be provided privately. (Think of individuals donating money to maintain public spaces, which is how Central Park in New York City manages to have such beautiful flowers.) In short, the label *private* or *public* does not by itself tell us anything about which sector provides the item.

Public Provision of a Good Does Not Necessarily Mean That It Is Also *Produced* by the Public Sector Consider refuse collection. Some communities produce this service themselves—public sector managers purchase garbage trucks, hire workers, and arrange schedules. In other communities, the local government hires a private firm for the job and does not organize production itself. In the United States, about 37 percent of fire protection services are contracted out to private firms. The figure is 23 percent for libraries and 48 percent for public transit [Lopez-de-Silanes, Shleifer, and Vishny, 1997].

▸ EFFICIENT PROVISION OF PUBLIC GOODS

What is the efficient amount of defense or any other public good? To derive the conditions for efficient provision of a public good, we begin by reexamining private goods from a slightly different perspective than that in Chapter 3. Assume again a society populated by two people, Adam and Eve. There are two private goods, apples and fig leaves. In Figure 4.1A, the quantity of fig leaves (f) is measured on the horizontal axis, and the price per fig leaf (P_f) is on the vertical. Adam's demand curve for fig leaves is denoted by D_f^A. The demand curve shows the quantity of fig leaves that Adam would be willing to consume at each price, other things being the same.[2]

[2] Demand curves are explained in the appendix to this book.

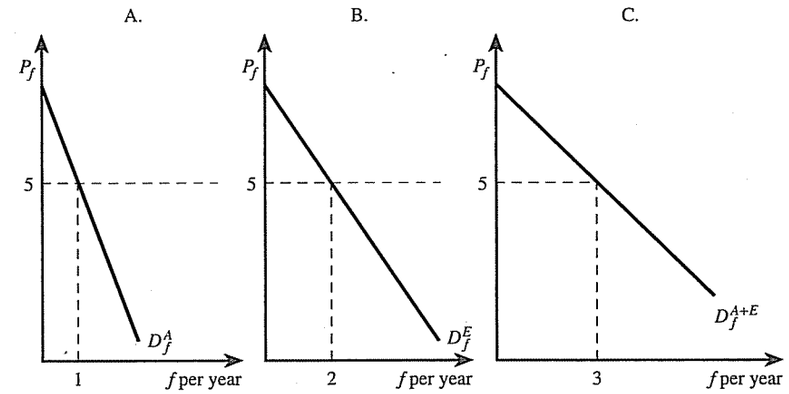

Figure 4.1
Horizontal summation of demand curves
The market demand curve for a private good like fig leaves is derived by adding together the number of fig leaves each person demands at every price. For example, at a price of $5, Adam demands one fig leaf and Eve demands two fig leaves, so the total quantity demanded is three fig leaves.

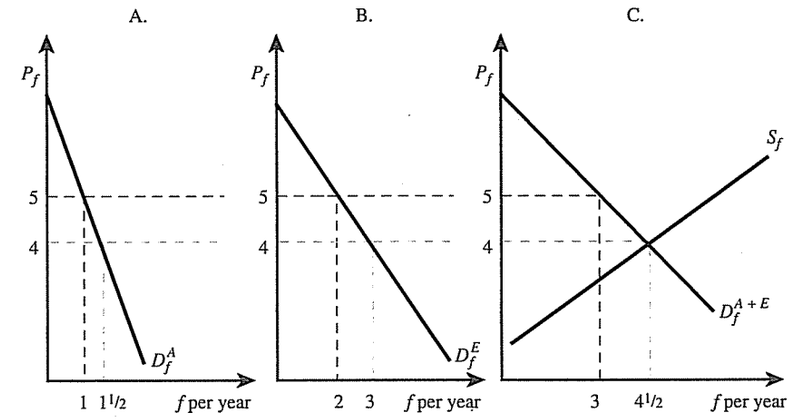

Figure 4.2
Efficient provision of a private good
The market is in equilibrium when supply and demand are equal.

Similarly, D_f^E in Figure 4.1B is Eve's demand curve for fig leaves. At the same time, each person's demand curve shows how much he or she would be willing to pay for a particular quantity. (See the appendix at the end of the book.)

Suppose we want to derive the market demand curve for fig leaves. To do so, we simply add together the number of fig leaves each person demands at every price. In Figure 4.1A, at a price of $5, Adam demands one fig leaf, the horizontal distance between D_f^A and the vertical axis. Figure 4.1B indicates that at the same price, Eve demands two fig leaves. The total quantity demanded at a price of $5 is therefore three leaves. The market demand curve for fig leaves is labeled D_f^{A+E} in Figure 4.1C. As we have just shown, the point at which price is $5 and quantity is 3 lies on the market demand curve. Similarly, finding the market demand at any given price involves summing the horizontal distance between each of the private demand curves and the vertical axis at that price. This process is called **horizontal summation.**

horizontal summation

The process of creating a market demand curve by summing the quantities demanded by each individual at every price.

Figure 4.2 reproduces the information from Figure 4.1. Figure 4.2C then superimposes the market supply curve, labeled S_f, on the market demand curve D_f^{A+E}.

Equilibrium in the market is found where supply and demand are equal. This occurs at a price of \$4 in Figure 4.2C. At this price, Adam consumes 1 1/2 fig leaves and Eve consumes 3. Note that there is no reason to expect Adam and Eve to consume the same amounts. Due to different tastes, incomes, and other characteristics, they demand different quantities of fig leaves. This is possible because fig leaves are private goods.

The equilibrium in Figure 4.2C has a significant property: The allocation of fig leaves is Pareto efficient. In consumer theory, a utility-maximizing individual sets the marginal rate of substitution of fig leaves for apples (MRS_{fa}) equal to the price of fig leaves (P_f) divided by the price of apples (P_a): $MRS_{fa} = P_f/P_a$.[3] Because only relative prices matter for rational choice, the price of apples can be arbitrarily set at any value. For convenience, set P_a = \$1. Thus, the condition for utility maximization reduces to $MRS_{fa} = P_f$. The price of fig leaves thus measures the rate at which an individual is willing to substitute fig leaves for apples. Now, Adam's demand curve for fig leaves (D_f^A) shows the maximum price per fig leaf that he would pay at each level of fig leaf consumption. Therefore, the demand curve also shows the MRS_{fa} at each level of fig leaf consumption. Similarly, D_f^E can be interpreted as Eve's MRS_{fa} schedule. In the same way, the supply curve S_f in Figure 4.2C shows how the marginal rate of transformation of fig leaves for apples (MRT_{fa}) varies with fig leaf production.[4]

At the equilibrium in Figure 4.2C, Adam and Eve both set MRS_{fa} equal to four, and the producer also sets MRT_{fa} equal to four. Hence, at equilibrium

$$MRS_{fa}^{\text{Adam}} = MRS_{fa}^{\text{Eve}} = MRT_{fa} \tag{4.1}$$

Equation (4.1) is the necessary condition for Pareto efficiency derived in Chapter 3. As long as the market is competitive and functions properly, the First Welfare Theorem guarantees that this condition holds.

Deriving the Efficiency Condition

Having now reinterpreted the condition for efficient provision of a private good, we turn to the case of a public good. Let's develop the efficiency condition intuitively before turning to a formal derivation. Suppose Adam and Eve both enjoy displays of fireworks. Eve's enjoyment of fireworks does not diminish Adam's and vice versa, and it is impossible for one person to exclude the other from watching the display. Hence, a fireworks display is a public good. The size of the fireworks display can be varied, and both Adam and Eve prefer bigger to smaller shows, other things being the same. Suppose that the display currently consists of 19 rockets and can be expanded at a cost of \$5 per rocket, that Adam would be willing to pay \$6 to expand the display by another rocket, and that Eve would be willing to pay \$4. Is it efficient to increase the size of the display by one rocket? As usual, we must compare the marginal benefit to the marginal cost. To compute the marginal benefit, note that because consumption of the display is nonrival, the 20th rocket can be consumed by

[3] See the appendix to this book for a proof.

[4] To demonstrate this, note that under competition, firms produce up to the point where price equals marginal cost. Hence, the supply curve S_f shows the marginal cost of each level of fig leaf production. As noted in Chapter 3 under "Welfare Economics," $MRT_{fa} = MC_f/MC_a$. Because P_a = \$1 and price equals marginal cost, then MC_a = \$1 and $MRT_{fa} = MC_f$. We can therefore identify the marginal rate of transformation with marginal cost, and hence with the supply curve.

both Adam and Eve. Hence, the marginal benefit of the 20th rocket is the *sum* of what they are willing to pay, which is \$10. Because the marginal cost is only \$5, it pays to acquire the 20th rocket. More generally, if the sum of individuals' willingness to pay for an additional unit of a public good exceeds its marginal cost, efficiency requires that the unit be purchased; otherwise, it should not. Hence, *efficiency requires that provision of a public good be expanded until the point at which the sum of each person's marginal valuation on the last unit just equals the marginal cost.*

To derive this result graphically, consider panel A of Figure 4.3 in which Adam's consumption of rockets (r) is measured on the horizontal axis, and the price per rocket (P_r) is on the vertical axis. Adam's demand curve for rockets is D_r^A. Similarly, Eve's demand curve for rockets is D_r^E in Figure 4.3B. How do we derive the group willingness to pay for rockets? To find the group demand curve for fig leaves—a private good—we horizontally summed the individual demand curves. That procedure allowed Adam and Eve to consume different quantities of fig leaves at the same price. For a private good, this is fine. However, the services produced by the rockets—a public good—*must* be consumed in *equal* amounts. If Adam consumes a 20-rocket fireworks display, Eve must also consume a 20-rocket fireworks display. It makes no sense to try to sum the quantities of a public good that the individuals would consume at a given price.

Instead, to find the group willingness to pay for rockets, we add the *prices* that each would be willing to pay for a given quantity. The demand curve in Figure 4.3A tells us that Adam is willing to pay \$6 for the 20th rocket. Eve is willing to pay \$4 for the 20th rocket. Their group willingness to pay for the 20th rocket is therefore \$10. Thus, if we define D_r^{A+E} in Figure 4.3C to be the group willingness to pay schedule, the vertical distance between D_r^{A+E} and the point $r = 20$ must be 10.[5] Other points on D_r^{A+E} are determined by repeating this procedure for each output level. For a public good, then, the group willingness to pay is found by **vertical summation** of the individual demand curves.

vertical summation

The process of creating an aggregate demand curve for a public good by adding the prices each individual is willing to pay for a given quantity of the good.

Note the symmetry between private and public goods. With a private good, everyone has the same *MRS,* but people can consume different quantities. Therefore, demands are summed horizontally over the differing quantities. For public goods, everyone consumes the same quantity, but people can have different *MRS*s. Vertical summation is required to find the group willingness to pay. Put another way, for standard private goods, everyone sees the same price and then people decide what quantity they want. For public goods, everyone sees the same quantity and people decide what price they are willing to pay.

The efficient quantity of rockets is found where Adam's and Eve's willingness to pay for an additional unit just equals the marginal cost of producing a unit. In Figure 4.4C, the marginal cost schedule, S_r, is superimposed on the group willingness to pay curve D_r^{A+E}.[6] The intersection occurs at output 45, where the marginal cost is \$6.

Once again, prices can be interpreted in terms of marginal rates of substitution. Reasoning as before, Adam's marginal willingness to pay for rockets is his marginal rate of substitution (MRS_{ra}^{Adam}), and Eve's marginal willingness to pay for rockets is

[5] D_r^{A+E} is not a conventional demand schedule because it does not show the quantity that would be demanded at each price. However, this notation highlights the similarities to the private good case.

[6] This analysis does not consider explicitly the production possibilities frontier that lies behind this supply curve. See Samuelson [1955].

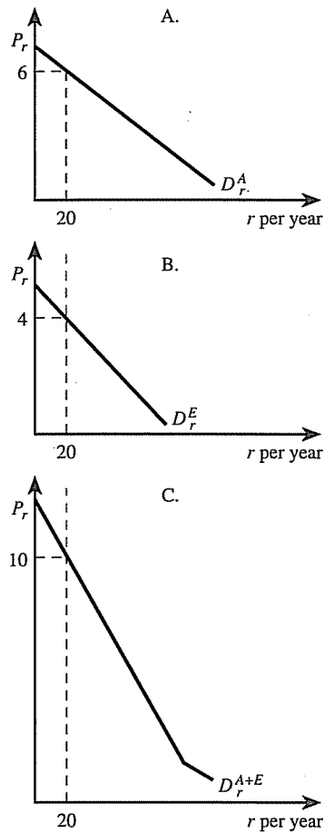

Figure 4.3
Vertical summation of demand curves
The total demand curve for a public good like rockets is derived by adding the prices that each person is willing to pay for a given quantity. For example, Adam is willing to pay $6 for the 20th rocket and Eve is willing to pay $4 for the 20th rocket, so the total willingness to pay for the 20th rocket is $10.

her marginal rate of substitution (MRS_{ra}^{Eve}). Therefore, the sum of the prices they are willing to pay equals $MRS_{ra}^{\text{Adam}} + MRS_{ra}^{\text{Eve}}$. From the production standpoint, price still represents the marginal rate of transformation, MRT_{ra}. Hence, the equilibrium in Figure 4.4C is characterized by the condition

$$MRS_{ra}^{\text{Adam}} + MRS_{ra}^{\text{Eve}} = MRT_{ra} \tag{4.2}$$

Contrast this with the conditions for efficiently providing a private good described in Equation (4.1). For a private good, efficiency requires that each individual have the same marginal rate of substitution, and that this equal the marginal rate of transformation. For a pure public good, the sum of the marginal rates of substitution must equal the marginal rate of transformation.[7] Because everybody must

[7] This analysis assumes the taxes required to finance the public good can be raised without distorting economic decisions in the private sector. When this is not the case, the efficiency condition changes. See Atkinson and Stern [1974].

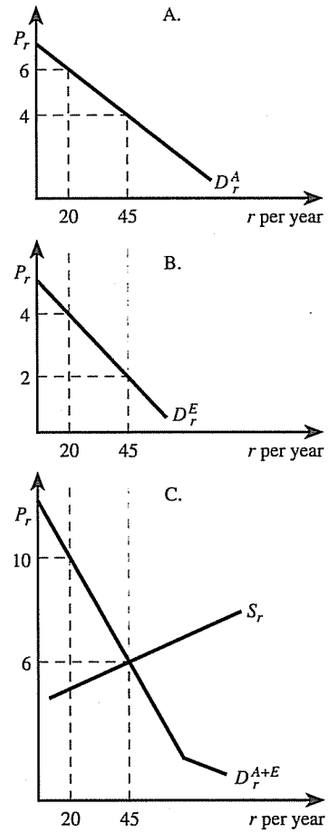

Figure 4.4
Efficient provision of a public good
The efficient quantity is found where total willingness to pay (derived by vertically summing individuals' demand curves) intersects the supply curve.

consume the same amount of the public good, its efficient provision requires that the *total* valuation they place on the last unit provided—the sum of the *MRS*s—equal the incremental cost to society of providing it—the *MRT*.

Problems in Achieving Efficiency

As stressed in Chapter 3, under a reasonably general set of conditions, a decentralized market system provides private goods efficiently. Do market forces lead to the efficient level of public goods ($r = 45$) in Figure 4.4? The answer depends in part on the extent to which Adam and Eve reveal their true preferences for fireworks. When a private good is exchanged in a competitive market, an individual has no incentive to lie about how much he or she values it. If Eve is willing to pay the going price for a fig leaf, then she has nothing to gain by failing to buy one.

However, people may have incentives to hide their true preferences for a public good. Adam may falsely claim that fireworks mean nothing to him. If he can get Eve to foot the entire bill, he can still enjoy the show and yet have more money to spend on apples and fig leaves. Someone who lets other people pay while enjoying the benefits himself is known as a **free rider.** Of course, Eve also would like to be a free rider. Hence, the market may fall short of providing the efficient amount of the public good. No automatic tendency exists for markets to reach the efficient allocation in Figure 4.4.

free rider

The incentive to let other people pay for a public good while you enjoy the benefits.

Even if consumption is excludable, market provision of a nonrival good is likely to be inefficient. Suppose now that the fireworks display is excludable; people cannot see the show without purchasing an admission ticket to a very large coliseum. A profit-maximizing entrepreneur sells tickets. For a fireworks display of a particular size, the additional cost of another person viewing it is zero (because the display is nonrival). Efficiency requires that every person be admitted who values the display at more than zero; that is, people should be admitted as long as the benefit to them exceeds the incremental cost of zero. Hence, efficiency requires a price of zero. But if the entrepreneur charges everyone a price of zero, then she cannot stay in business.

Is there a way out? Suppose the following two conditions hold: (1) the entrepreneur knows each person's demand curve for the public good; and (2) it is difficult or impossible to transfer the good from one person to another. Under these two conditions, the entrepreneur could charge each person an individual price based on willingness to pay, a procedure known as **perfect price discrimination.** People who valued the rocket display at only a penny would pay exactly that amount; even they would not be excluded. Thus, everyone who put any positive value on the show would attend, which is an efficient outcome.[8] However, because those who valued the display a lot would pay a very high price, the entrepreneur would be able to stay in business.

perfect price discrimination

When a producer charges each person the maximum he or she is willing to pay for the good.

Perfect price discrimination may seem to be the solution until we recall that the first condition requires knowledge of everybody's preferences. But if individuals' demand curves were known, there would be no problem in determining the optimum provision in the first place.[9] We conclude that even if a nonrival commodity is excludable, private provision is likely to lead to efficiency problems.

POLICY PERSPECTIVE

Global Positioning System

The Global Positioning System (GPS), a satellite navigation system developed by the US Department of Defense, is another example of a nonrival, yet excludable, good. GPS satellites send radio signals that can be picked up by receivers, allowing their users to determine their precise location. These receivers are sold on the private market. GPS is used to aid navigation, map-making and land surveying,

[8] The outcome is efficient because the price paid by the *marginal* consumer equals marginal cost.

[9] A number of mechanisms have been designed to induce people to reveal their true preferences to a government agency. See the appendix to this chapter.

earthquake research, and military targeting, among other functions. The GPS signal is a nonrival good, because people can take advantage of the radio signal without diminishing others' ability to use it. Because the marginal cost of letting another person receive the signal is zero, efficiency requires that every person who values the GPS signal should be allowed to receive it.

In the case of GPS, though, security objectives have at times dominated efficiency concerns. The US military, which operates the satellites, originally excluded users by intentionally introducing errors in the location information sent to receivers held by the private individuals. The accurate signals were encrypted and thus only available to the US military and its allies. While this may have enhanced security, it was clearly inefficient because it denied the benefits of GPS to many users who valued it above its zero marginal cost. Therefore, in 2000, President Clinton made accurate GPS signals available to civilians. Since then, the military has developed the ability to locally deny the GPS signal to hostile forces in specific areas without affecting the signal to the rest of the world.

The Free Rider Problem

Some suggest that the free rider problem necessarily leads to inefficient levels of public goods; therefore, efficiency requires government provision of such goods. The argument is that the government can somehow find out everyone's true preferences, and then, using its coercive power, force everybody to pay for public goods. If all this is possible, the government can avoid the free rider problem and ensure that public goods are optimally provided.

Tedarik

It must be emphasized that free ridership is not a *fact;* it is an implication of the *hypothesis* that people maximize a utility function that depends only on their own consumption of goods. To be sure, one can find examples in which public goods are not provided because people fail to reveal their preferences. On the other hand, in many instances individuals can and do act collectively without government coercion. Fund drives spearheaded by volunteers have led to the establishment and maintenance of churches, music halls, libraries, scientific laboratories, art museums, hospitals, and other such facilities. There is even some evidence of successful private provision of that classic public good, the lighthouse [Coase, 1974]. One prominent economist has argued, "I do not know of many historical records or other empirical evidence which show convincingly that the problem of correct revelation of preferences has been of any practical significance."[10]

These observations do not prove that free ridership is irrelevant. Although some goods that appear to have public characteristics are privately provided, others that "ought" to be provided (on grounds of efficiency) may not be. Moreover, the quantity of those public goods that are privately provided may be insufficient. The key point is that the importance of the free rider problem is an empirical question whose answer should not be taken for granted.

A number of laboratory experiments have been conducted to investigate the importance of free rider behavior. In a typical experiment, each of several subjects

[10] See Johansen [1977, p. 147] for further discussion along these lines.

is given a number of tokens that they can either keep or donate to a "group exchange." For each token he keeps, a subject receives some payoff, say $4. Further, every time someone in the group donates to the group exchange, *everyone* in the group collects some amount of money, say $3, including the person who makes the donation. Clearly, all the subjects would be better off if everyone donated all their tokens to the group exchange. Note, however, that donations to the group exchange provide a nonrival and nonexcludable payoff. The free rider theory suggests that the subjects therefore might very well decide to make no contributions to the group exchange, so that they could benefit from everyone else's donations while putting nothing in themselves.

What do the results show? The findings vary from experiment to experiment, but there are some consistent findings.[11] On average, people contribute roughly 50 percent of their resources to the provision of the public good. Some free riding therefore is present in the sense that the subjects fail to contribute all their tokens to the group exchange. On the other hand, the results contradict the notion that free riding leads to zero or trivial amounts of a public good. Some other important results are that (1) the more people repeat the game, the less likely they are to contribute; (2) when players have the opportunity to communicate prior to the game, cooperation is fostered; and (3) the contribution rates decline when the opportunity cost of giving goes up (i.e., when the reward for keeping a token increases).

Although caution must be exercised in interpreting the results of laboratory experiments, the results suggest that people may derive a "warm glow" feeling of satisfaction from giving that works counter to the pursuit of narrow self-interest.

▸ THE PRIVATIZATION DEBATE

privatization

The process of turning services that are supplied by the government over to the private sector for provision and/or production.

Countries throughout the world are debating the virtues of privatizing governmental functions. **Privatization** means taking services that are supplied by the government and turning them over to the private sector for provision and/or production. In this section, we first discuss issues relating to *provision* and then turn to *production*.

Public versus Private Provision

Sometimes the services provided by publicly provided goods can be obtained privately. The commodity "protection" can be obtained from a publicly provided police force. Alternatively, to some extent, protection can also be gained by purchasing strong locks, burglar alarms, and bodyguards, which are obtained privately. Indeed, there are now three times as many privately hired policemen in the United States than public ones [*Economist,* April 19, 1997, p. 21]. A large backyard can serve many of the functions of a public park. Even substitutes for services provided by public courts of law can be obtained privately. For example, because of the enormous costs of using the government's judicial system, companies sometimes bypass the courts and instead settle their disputes before mutually agreed-upon neutral advisers.

Over time, the mix between public and private modes of provision has changed substantially. During the 19th century, there was much greater private responsibility

[11] Cinyabuguma, Page, and Putterman [2005] provide a review of the experimental findings.

for education, police protection, libraries, and other functions than there is now. However, there appears to be a trend back to the private sector for provision of what we have come to consider publicly provided goods and services. For example, as a result of budget cuts that reduce sanitation collections, businesspeople in several cities band together and hire their own refuse collectors to keep their streets clean. In some communities, individual homeowners contract with private companies to provide protection against fires. Indeed, in Denmark about two-thirds of the country's fire service is provided by a private firm.

What is the right mix of public and private provision? To approach this question, think of publicly and privately provided goods as inputs into the production of some output that people desire. Teachers, classrooms, textbooks, and private tutors are inputs into the production of an output we might call educational quality. Assume that what ultimately matters to people is the level of output, educational quality, not the particular inputs used to produce it. What criteria should be used to select the amount of each input? There are several considerations.

Relative Wage and Materials Costs If the public and private sectors pay different amounts for labor and materials, then the less expensive sector is to be preferred on efficiency grounds, all other things equal. For example, the input costs faced by public schools exceed those in private schools when public sector teachers are unionized while their private sector counterparts are not.

Administrative Costs Under public provision, any fixed administrative costs can be spread over a large group of people. Instead of everyone spending time negotiating an arrangement for garbage collection, the negotiation is done by one office for everybody. The larger the community, the greater the advantage to being able to spread these costs. Similarly, a public school system that provides the same education in every school saves parents the time and effort involved in researching schools to figure out which are the good ones.

Diversity of Tastes Households with and without children have very different views about the desirability of high-quality education. People who store jewels in their homes may value property protection more than people who do not. To the extent such diversity is present, private provision is more efficient because people can tailor their consumption to their own tastes. As President Reagan put it, "Such a strategy ensures production of services that are demanded by consumers, not those chosen by government bureaucrats." Clearly, the benefits to allowing for diversity must be weighed against any possible increases in administrative costs.

Distributional Issues The community's notions of fairness may require that some commodities be made available to everybody, an idea sometimes referred to as **commodity egalitarianism.** Commodity egalitarianism may help explain the wide appeal of publicly provided education—people believe everyone should have access to at least some minimum level of schooling. This notion also arises in the ongoing debate over medical care.

commodity egalitarianism

The idea that some commodities ought to be made available to everybody.

Public versus Private Production

Airport security became a major object of concern after September 11. While there was a consensus that the security system had failed miserably and had to be

upgraded, there was a contentious debate on how to accomplish this. Some argued that airport security workers should be federalized; that is, they should be employees of the federal government. Others argued that while the government should pay for airport security, it would best be left to private firms, which would be monitored and held accountable for mistakes.

This debate highlights the fact that people can agree that certain items should be provided by the public sector, but still disagree over whether they should be produced publicly or privately. Part of the controversy stems from fundamental differences regarding the extent to which government should intervene in the economy (see Chapter 1). Part is due to differences of opinions about the relative costs of public and private production. Some argue that public sector managers, unlike their private sector counterparts, do not have to worry about making profits or becoming the victims of takeovers or bankruptcy. Hence, public sector managers have little incentive to monitor the activities of their enterprises carefully. This notion has an ancient pedigree. In 1776 Adam Smith argued:

> In every great monarchy in Europe the sale of the crown lands would produce a very large sum of money which, if applied to the payments of the public debts, would deliver from mortgage a much greater revenue than any which those lands have ever afforded to the crown . . . When the crown lands had become private property, they would, in the course of a few years, become well improved and well cultivated.[12]

Anecdotal evidence for this viewpoint abounds. One celebrated case involved New York City, which spent $12 million attempting to rebuild the ice-skating rink in Central Park between 1980 and 1986. The main problem was that the contractors were trying to use a new technology for making ice, and it did not work. In 1986, after spending $200,000 on a study to find out what went wrong, city officials learned they would have to start all over. In June 1986, real estate developer Donald J. Trump offered to take over the project and have it completed by December of that year for about $2.5 million. Trump finished the rink three weeks ahead of schedule and $750,000 under projected cost. When Chicago replaced city crews with private towing companies to haul away abandoned cars, the net annual savings were estimated at $2.5 million. In 1998, a private company took over the South Florida State Psychiatric Hospital, which had long been viewed as a dumping ground where patients were treated poorly. While advocates for the mentally ill were initially horrified at this development, a year later they agreed that conditions at the hospital had improved. Further, the company said that it was making a profit. And in 2002, a US government study estimated that the Internal Revenue Service was failing to pursue at least $200 billion in unpaid taxes, and that much of these taxes could easily be collected if the task were turned over to private collection agencies [McKinnon, 2002, p. A1].

Opponents of privatization respond that these examples overstate the cost savings of private production. In fact, there is surprisingly little systematic evidence on the cost differences between private and public production. An important reason for this is that the *quality* of the services provided in the two modes may be different, which makes comparisons difficult. Perhaps, for example, private hospitals have lower costs than their public counterparts because the former refuse to admit patients with illnesses that are expensive to treat. This brings us to the central argument of opponents of private production: Private contractors produce inferior products.

[12] Quoted in Sheshinski and Lopez-Calva [1999].

Incomplete Contracts A possible response to this criticism is that the government can simply write a contract with the private provider, completely specifying the quality of the service that the government wants. However, as Hart, Shleifer, and Vishny [1997] note, it is sometimes impossible to write a contract that is anywhere near being complete because one cannot specify in advance every possible contingency. For example, a "government would not contract out the conduct of its foreign policy because unforeseen contingencies are a key part of foreign policy, and a private contractor would have enormous power to maximize its own wealth (by, for instance, refusing to send troops somewhere) without violating the letter of the contract" (p. 3). On the other hand, for certain relatively routine activities (garbage collection, snow removal), incomplete contracts are not a serious impediment to private production. In short, in cases where the private sector cost is lower than that in the public sector and relatively complete contracts can be written, a strong case can be made for private production.

Advocates of privatization believe that, even if it is impossible to write a complete contract, there are other mechanisms for getting private firms to refrain from engaging in inefficient cost reductions. To the extent consumers buy the good themselves and there are a number of suppliers, then they can switch if their current supplier provides shoddy service. Nursing homes are one example. In addition, reputation-building may be important—a private supplier who wants more contracts in the future has an incentive to avoid inefficient cost reductions in the present. Shleifer [1998] argues that the desire to build a good reputation has been of some importance among private producers of prisons.

POLICY PERSPECTIVE

Should Airport Security Be Produced Publicly or Privately?

The contracting framework provides a nice vehicle for thinking about airport security, an issue that was mentioned earlier. Those who favored private production of airport security argued that it is quite possible to write complete contracts for routine tasks such as screening luggage. The government could set standards and monitor performance. Profit-maximizing private firms would have an incentive to take advantage of technology to keep labor costs down. Further, they argued that a private system run by local firms would be more accountable than a federal system. They noted that Israel, which has some of the best airport security in the world, replaced its national government employees with private ones under contract to the airport authority. The Israeli government sets and enforces standards for security, but the airport operator is in charge of operations and accountable for mistakes (see Tierney [2001]).

On the other hand, those who believed that airport security should be publicly produced argued that it is impossible to write a contract to cover all eventualities and that private firms would skimp on training for their workers in order to increase profits. They point to the system in place on September 11, 2001, in which airport security was funded by airlines and security personnel received low pay and little training (see Krugman [2001]). An additional criticism was that a privatized system would lead to different airports having different levels of security [Uchitelle, 2001, p. WK3].

Ultimately, the debate was won by those who favored public production of airport security. In November of 2001, airport security was put under the supervision of a new federal agency, the Transportation Security Administration (TSA), and

security screeners became members of the federal workforce. While only a few studies have examined the effectiveness of the TSA, the limited evidence suggests that it has failed to increase security. In one study, the Government Accountability Office found that the five US airports that were allowed to keep private security personnel performed better at stopping undercover agents from smuggling fake weapons onto airplanes. On the cost side, the inspector general for the Homeland Security Department found that the TSA engaged in wasteful spending, such as over $250,000 for artwork and over $30,000 for silk plants for its new crisis management center.

Market Environment A final issue that is important in the privatization debate is the market environment in which the public or private enterprise operates. A privately owned monopoly may produce very inefficient results from society's standpoint, while a publicly owned operation that has a lot of competition may produce quite efficiently. With respect to this latter possibility, consider the case of Phoenix, Arizona. Dissatisfaction with the cost and performance of its public works department led Phoenix to allow private companies to bid for contracts to collect garbage in various neighborhoods. The public works department was allowed to bid as well. At first, the public works department was unsuccessful, because the private firms were able to do the job better and more cheaply. But over time, it tried various experiments such as having drivers redesign garbage collection routes, and eventually it was able to win back the contracts.

The Phoenix story suggests that public versus private ownership is less important than whether competition is present. Along the same lines, in their study of international data on privatization, Dewenter and Malatesta [2001] found that while government firms are less profitable than private firms, there is not much evidence that privatization per se improves profitability. Rather, profitability begins improving a few years before privatization—substantial restructuring occurs before the firms are sold to the private sector. To explain this finding, Dewenter and Malatesta suggest that although governments are capable of improving efficiency, over time such gains can be dissipated because governments do not face competitive pressures to maintain them. If this is the case, then the real benefit of privatization is to perpetuate the gains.

▸ PUBLIC GOODS AND PUBLIC CHOICE

The use of the word *public* to describe commodities that are nonrival and nonexcludable almost seems to prejudge the question of whether they ought to be provided by the public sector. Indeed, we have shown that private markets are unlikely to generate pure public goods in Pareto efficient quantities. Some collective decision must be made regarding the quantity to be supplied. However, in contrast to a pure public good like national defense, sometimes there may be private substitutes for a publicly provided good. But community decision making is also needed in these cases, this time to choose the extent to which public provision will be used. Thus, the subjects of public goods and public choice are closely linked. In Chapter 6 we discuss and evaluate a number of mechanisms for making collective decisions.

Summary

- Public goods are characterized by nonrivalness and nonexcludability in consumption. Thus, each person consumes the same amount, but not necessarily the preferred amount, of the public good.
- Efficient provision of public goods requires that the sum of the individual *MRS*s equal the *MRT*, unlike private goods where each *MRS* equals the *MRT*.
- Market mechanisms are unlikely to provide nonrival goods efficiently, even if they are excludable.
- Casual observation and laboratory studies indicate that people do not fully exploit free-riding possibilities. Nonetheless, in certain cases, free riding is a significant problem.
- Public goods can be provided privately, and private goods can be provided publicly.
- Even in cases where public provision of a good is selected, a choice between public and private production must be made. A key factor in determining whether public or private production will be more efficient is the market environment. Another important question is the extent to which complete contracts can be written with private sector service providers.

Discussion Questions

1. Which of the following do you consider pure public goods? Private goods? Why?
   a. Wilderness areas
   b. Satellite television
   c. Medical school education
   d. Public television programs
   e. An Internet site providing information on airplane schedules
2. Indicate whether each of the following statements is true, false, or uncertain, and justify your answer.
   a. Efficient provision of a public good occurs at the level at which each member of society places the same value on the last unit.
   b. If a good is nonrival and excludable, it will never be produced by the private sector.
   c. A road is nonrival because one person's use of it does not reduce another person's use of it.
   d. Larger communities tend to consume greater quantities of a nonrival good than smaller communities.
3. Tarzan and Jane live alone in the jungle and have trained Cheetah both to patrol the perimeter of their clearing and to harvest tropical fruits. Cheetah can collect 3 pounds of fruit an hour and currently spends 6 hours patrolling, 8 hours picking, and 10 hours sleeping.
   a. What are the public and private goods in this example?
   b. If Tarzan and Jane are each currently willing to give up one hour of patrol for 2 pounds of fruit, is the current allocation of Cheetah's time Pareto efficient? Should he patrol more or less?
4. The US government spends about $1.5 billion for research on alternative medicine, such as herb and "energy field" therapy. Is such research a public good? Is it sensible for the government to pay for such research?
5. The aircraft company Airbus receives much of its funding from European governments. Airbus recently decided to build a new 550-seat mega-jetliner, with duty-free shopping courts and restaurants on board. The project has experienced production delays as well as cost overruns, and it now appears that there will be very few buyers. An industry expert says the idea from the start was "nonsense" [Aboulafia, 2006]. Is public sector production of aircrafts ever justified? Explain why it could lead to the apparently ill-advised decision to build the mega-jetliner.

6. It has been estimated that private prisons are about 10 percent cheaper, on a per prisoner basis, than public prisons [Hart, Shleifer, and Vishny, 1997]. On this basis, would you recommend that prisons be privatized? If not, what other information would you require?
7. Several years ago, some citizens of the town of Manchester, Vermont, decided to launch a school fundraising campaign. A private group of citizens decided how much every household and business should contribute, and there was a good deal of social pressure to pay the full amount. One flier urged, "We cannot sit back and wait for our neighbors to carry the load" [Tomsho, 2001, p. A1]. Use the experimental results on free riding discussed in this chapter to predict the outcome of this campaign.
8. Italy's great art treasures are owned and managed by the government. However, Italy's cultural institutions are in trouble because of inadequate government funding. (The Uffizi Gallery in Florence, one of the world's greatest museums, did not have enough cash to provide paper towels in the bathrooms.) In response, in 2002 the government set up a new state agency whose purpose was to value Italy's cultural treasures and decide what could be sold or leased to private firms [*Economist,* November 28, 2002, p. 55]. Is it appropriate for a nation to privatize its museums? Base your answer on the criteria for public versus private production discussed in the chapter.
9. Suppose that there are only two fishermen, Zach and Jacob, who fish along a certain coast. They would each benefit if lighthouses were built along the coast where they fish. The marginal cost of building each additional lighthouse is $100. The marginal benefit to Zach of each additional lighthouse is $90 - Q$, and the marginal benefit to Jacob is $40 - Q$, where Q equals the number of lighthouses.
   a. Explain why we might not expect to find the efficient number of lighthouses along this coast.
   b. What is the efficient number of lighthouses? What would be the net benefits to Zach and Jacob if the efficient number were provided?
10. Thelma and Louise are neighbors. During the winter, it is impossible for a snowplow to clear the street in front of Thelma's house without clearing the front of Louise's. Thelma's marginal benefit from snowplowing services is $12 - Z$, where Z is the number of times the street is plowed. Louise's marginal benefit is $8 - 2Z$. The marginal cost of getting the street plowed is $16.

    Sketch the two marginal benefit schedules and the aggregate marginal benefit schedule. Draw in the marginal cost schedule, and find the efficient level of provision for snowplowing services.

Appendix: Preference Revelation Mechanisms

Markets generally fail to induce individuals to reveal their true preferences for nonexcludable public goods, and, hence, a price system fails to provide them in efficient amounts. Is there some way, short of forcing everyone to take a lie detector test, to get people to tell the truth? Several procedures have been suggested for inducing people to reveal their true preferences. We now describe one based on the work of Groves and Loeb [1975].[13]

Imagine a government agent approaches Eve and says, "Please tell me your demand curve for rocket displays. I will use this information plus the information I receive from Adam to select a Pareto efficient quantity of rockets and to assign each of you a tax. But before you give me your answer, I want you to realize that you will be taxed in the following way: Whenever the level of public good provision increases by a unit, the change in your tax bill will be the incremental cost of that unit, minus the value that everyone else puts on the increase."

After the agent departs, the first thing Eve does is to represent the tax structure algebraically. If ΔT^{Eve} is the change in her tax bill when provision of the public good is expanded by one unit, MRT_{ra} is the incremental resource cost of the one unit, MRS_{ra}^{Total} is the marginal value of one more unit to Adam and Eve, and MRS_{ra}^{Eve} is the marginal value to Eve alone, then

$$\Delta T^{\text{Eve}} = MRT_{ra} - (MRS_{ra}^{\text{Total}} - MRS_{ra}^{\text{Eve}}) \tag{4A.1}$$

Faced with Equation (4A.1), Eve has to decide whether or not to tell the truth, that is, to reveal her true marginal valuation for every level of rocket display provision. She knows that from her selfish point of view, production should continue up to the point where the marginal benefit of consuming one more unit, MRS_{ra}^{Eve}, equals the marginal cost to her, which is just the increase in her tax bill. Thus, Eve would like to see the public good provided in an amount such that

$$\Delta T^{\text{Eve}} = MRS_{ra}^{\text{Eve}} \tag{4A.2}$$

Substituting from Equation (4A.1) for ΔT^{Eve} gives us

$$MRT_{ra} - (MRS_{ra}^{\text{Total}} - MRS_{ra}^{\text{Eve}}) = MRS_{ra}^{\text{Eve}}$$

Adding $(MRS_{ra}^{\text{Total}} - MRS_{ra}^{\text{Eve}})$ to both sides of the equation yields

$$MRT_{ra} = MRS_{ra}^{\text{Total}} \tag{4A.3}$$

Because conditions (4A.2) and (4A.3) are equivalent, it would be in Eve's interest to tell the truth if she knew the government would use her information to achieve the allocation corresponding to Equation (4A.3).

But then she realizes this is exactly what the government agent will do. Why? Remember the agent promised to select a Pareto efficient provision given the information he receives. Such a provision is characterized by Equation (4.2) in the text. Since, by definition, $MRS_{ra}^{\text{Total}} = MRS_{ra}^{\text{Adam}} + MRS_{ra}^{\text{Eve}}$, Equations (4A.3) and (4.2) are identical. Thus, the government's provision of rocket displays will satisfy Equation (4A.3), and Eve has an incentive to tell the truth. Provided that Adam is confronted with the same kind of tax structure, he too has an incentive to be truthful. The free rider problem appears to have been solved.

To see intuitively why the system works, consider the right-hand side of Equation (4A.1), which shows how Eve's tax bill is determined. Note that $(MRS_{ra}^{\text{Total}} - MRS_{ra}^{\text{Eve}})$ is the sum of everyone's marginal benefit but Eve's. Hence, the increase in Eve's tax bill when output expands does not depend on her own marginal benefit, and therefore she has no incentive to lie about it.

[13] See also Tideman and Tullock [1976].

There are several problems with this mechanism, many of which are shared by other devices to solve the free rider problem. First, taxpayers may not be able to understand the system. (If you don't think this is a problem, try to explain it to a friend who has not had any economics courses.) Second, even if the scheme can be made comprehensible, taxpayers have to be willing to make the effort to compute their entire demand curves and report them to the government. People may feel it is not worth their time. Third, given that millions of people are involved in governmental decisions, the costs of gathering and assimilating all the information would be prohibitive.[14] (For relatively small groups like social clubs, this would not be as much of a problem.) We conclude that although preference revelation mechanisms of this kind provide interesting insights into the structure of the free rider problem, they are not a practical way for resolving it, at least for public sector decision making.

[14] There are some additional technical problems. The taxes collected may not balance the budget, and it may be possible for coalitions to form and thwart the system. See Tideman and Tullock [1976].

Chapter Five

EXTERNALITIES

When man is happy, he is in harmony with himself and his environment.

—OSCAR WILDE

As a by-product of their activities, paper mills produce the chemical dioxin. It forms when the chlorine used for bleaching wood pulp combines with a substance in the pulp. Once dioxin is released into the environment, it ends up in everyone's fat tissue and in the milk of nursing mothers. According to some scientists, dioxin is responsible for birth defects and cancer, among other health problems.

Economists often claim that markets allocate resources efficiently (see Chapter 3). Dioxin is the outcome of the operation of markets. Does this mean that having dioxin in the environment is efficient? To answer this question, it helps to begin by distinguishing different ways in which people can affect each other's welfare.

Suppose large numbers of suburbanites decide they want to live in an urban setting. As they move to the city, the price of urban land increases. Urban property owners are better off, but the welfare of tenants already there decreases. Merchants in the city benefit from increased demand for their products, while their suburban counterparts are worse off. By the time the economy settles into a new equilibrium, the distribution of real income has changed substantially.

In this migration example, all the effects are transmitted *via changes in market prices*. Suppose that before the change in tastes, the allocation of resources was Pareto efficient. The shifts in supply and demand curves change relative prices, but competition guarantees that these will be brought into equality with the relevant marginal rates of substitution. Thus, the fact that the behavior of some people affects the welfare of others does *not* necessarily cause market failure. As long as the effects are transmitted via prices, markets are efficient.[1]

The dioxin case embodies a different type of interaction from the urban land example. The decrease in welfare of the dioxin victims is not a result of price changes. Rather, the output choices of the paper mill factories directly affect the utilities of the neighboring people. When the activity of one entity (a person or a firm) directly affects the welfare of another in a way that is outside the market mechanism, that effect is called an **externality** (because one entity directly affects the welfare of another entity that is "external" to the market). Unlike effects that are transmitted through market prices, externalities adversely affect economic efficiency.

externality

An activity of one entity that affects the welfare of another entity in a way that is outside the market mechanism.

[1] Of course, the new pattern of prices may be more or less desirable from a distributional point of view, depending on one's ethical judgments as embodied in the social welfare function. Effects on welfare that are transmitted via prices are sometimes referred to as pecuniary externalities. Mishan [1971] argues convincingly that because such effects are part of the normal functioning of the market, this is a confusing appellation. It is mentioned here only for the sake of completeness and is ignored henceforth.