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ECONOMICS of the PUBLIC SECTOR

Second Edition

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Public Goods and Publicly Provided Private Goods

Few question whether the government should be involved in supplying public goods. How much should be spent on public goods, however, is frequently a matter of heated debate. There are those, for instance, who believe that the public sector is too large, that it spends too much on public goods. Others believe that the nation is insufficiently responsive to public needs that exist in a society of private affluence.

In this chapter we examine in detail two sets of questions:

1. What are public goods and how do they differ from conventional private goods?

2. What do statements such as "There is an undersupply of a public good" or "There is an oversupply of a public good" mean? How can we characterize the efficient level of supply of public goods? To what extent does the efficient level depend on distributional considerations or the system of taxes used to finance the public goods?

DEFINITION OF PUBLIC GOODS

Pure public goods have two critical properties. The first is that it is not *feasible* to ration their use. The second is that it is not *desirable* to ration their use.

schedules, one drawn under the assumption that the government does not provide public goods and the other under the assumption that it does. Compare point *A* to point *E*. At *A*, with the government providing public goods, everyone is better off than at *E*, where it does not. (Recall the definition of the utility possibilities schedule: it gives—under a particular set of circumstances—the maximum level of utility of one group or individual consistent with the level of utility attained by the others.) But once the power of coercion is granted, unless it is somehow circumscribed, it is clearly possible for some group to take advantage of this power to extract resources from some other group, a situation corresponding to point *B* in Figure 5.1. Thus, granting the government the power to coerce has the potential of making all individuals better off; it also has the potential of making some individuals better off at the expense of others.

Free rider problems arise, of course, in a variety of other contexts. There are often members of a family who fail to pull their own weight; for example, spoiled children who attempt to avoid doing the household errands that have to be done. These children know that it is unlikely that the quantity of the services they receive will be significantly affected by their actions. Somebody else will pick up the slack and make sure everything gets done.

Most of the goods provided within the family are provided in much the same manner that public goods are: individuals normally do not pay for the food they eat at home in the way they would if they were buying it in a restaurant, nor do they get paid for the services they perform. Exclusion is costly, if not impossible, just as it is for public goods. The costs of administering a price system within a family would be prohibitive—imagine charging a family member for each morsel of food he consumed, or each time he made use of a room. As a result, families often face the same kinds of free rider problems that communities do. But while social sanctions (such as parental disapproval) mitigate the effects of the free rider problem within the family, more explicit coercion usually must be employed both at the local and national level.

Goods for Which Rationing Is Undesirable

The second property of a public good is that it is not desirable to exclude any individual: one individual's consumption does not reduce the amount that is available for others to consume. Equivalently, the marginal cost of supplying the good to an additional individual is zero. If the government creates a military establishment that protects us from attack, it protects all of us; national defense costs are essentially unaffected when an additional baby is born or an additional individual immigrates to the United States. This is in sharp contrast to private goods. If I am sitting on a chair, I deprive others of being able to sit on that chair. If I eat an ice cream cone, you cannot eat the same ice cream cone. It is important to distinguish the marginal cost of producing the good from the marginal cost of an additional individual enjoying the good. It costs more to build more lighthouses, but it costs no more for an additional ship to make use of a lighthouse when sailing by.

IMPURE PUBLIC GOODS

National defense is one of the few *pure* public goods, satisfying both conditions: the impossibility and undesirability of exclusion. Lighthouses provide another example of an almost pure public good: it is difficult (but not impossible) to exclude those who do not contribute to the support of the lighthouse from enjoying its benefits. The lighthouse owner could, of course, turn off his light upon the approach of a noncontributing ship, provided that there was not, at the same time, a contributing ship in the vicinity. In nineteenth-century England there were, in fact, some private lighthouses. But the marginal cost of an extra ship receiving the benefits of the lighthouse is zero.

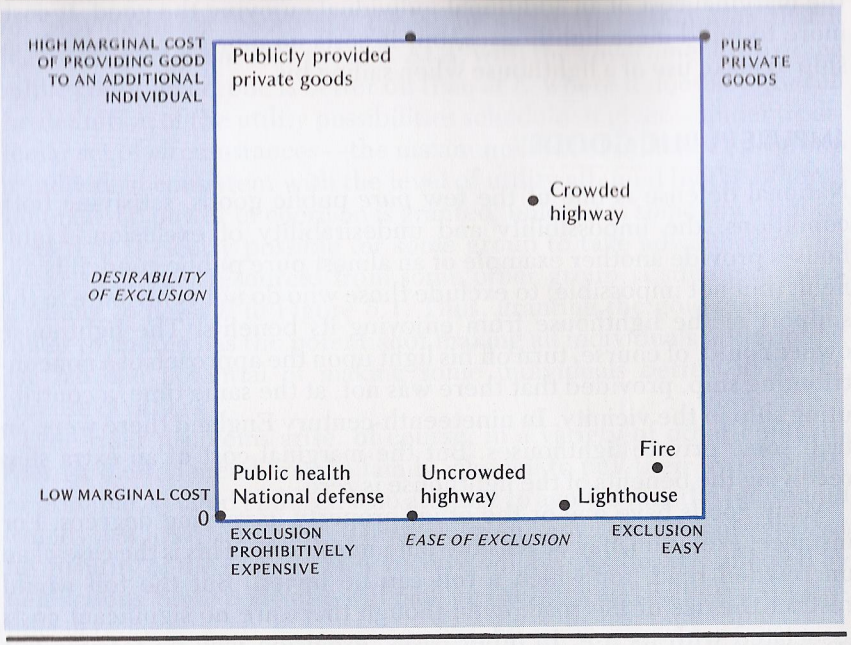
Many goods have one or the other property in varying degrees. For instance, exclusion may be feasible but undesirable. This is the case of an uncrowded road, for which a toll can be levied. But the toll would restrict the use of the road, even though there are no significant costs associated with its use. In other cases, exclusion may be feasible but costly. For instance, some communities provide water free of charge; though it is possible to install water meters, the costs exceed the benefits. (The marginal costs associated with supplying water to an extra household are small, though not zero.)

Figure 5.2 shows the ease of exclusion along the horizontal axis, and the (marginal) cost of an additional individual using the commodity along the vertical axis. The lower left-hand corner represents a pure public good, where the cost of exclusion is prohibitive and the marginal cost of an additional individual enjoying the good is zero. The upper right-hand corner is a pure private good, where the cost of exclusion is low and the marginal cost of an additional individual using the commodity is high.

In the diagram are several "impure" cases. The marginal cost of usage of an uncongested road is close to zero, but there is a cost of exclusion (the toll collectors, and the loss in time to pay the toll). For a congested road, on the other hand, there may be a large social marginal cost associated with an additional individual using the road.

Most of the time, firemen are not engaged in fighting fires but are waiting for calls. Protecting an additional individual then has little extra cost. Only in that rare event when two fires break out simultaneously will there be a significant cost to extending the protection to an additional individual. On the other hand, the costs of excluding an individual from the services of the fire department are relatively low.[1]

[1] There may be disagreements about precisely where a particular program should lie. We have represented public health programs as being close to pure public goods. A program that results in the elimination of some disease (such as polio) from the population benefits everyone in society; it would not be



5.2 PURE AND IMPURE PUBLIC GOODS Goods differ in the ease and desirability of exclusion.

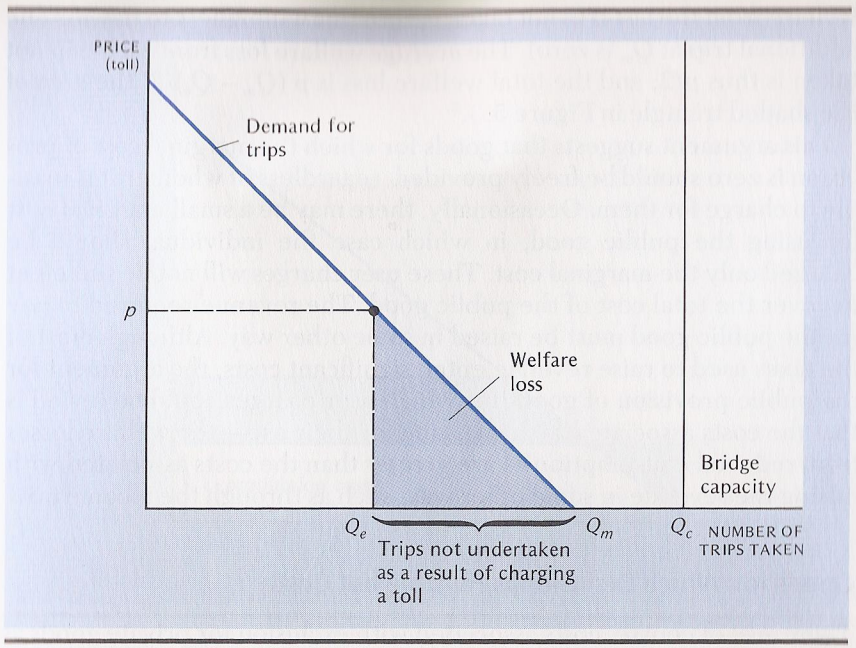
Inefficiencies from the Private Provision of Public Goods

As we have noted, it is possible to charge for many goods for which the marginal cost of an additional person enjoying them is (close to) zero. These goods can be provided privately. The argument for public provision is that it is more efficient to have them publicly provided.

When there is no marginal cost to an additional individual using the good, then, as we have said, it should not be rationed. But if it is to be privately provided by a firm, the firm must charge for its use; and any charge for its use will discourage individuals from using it. Thus when public goods are privately provided, an *underutilization* of these goods will result.

This is illustrated in Figure 5.3 for the case of a bridge. We have drawn the demand curve for the bridge, describing the number of trips taken as a function of the toll charged. Lowering the toll results in increased demand for the bridge. The capacity of the bridge is Q_c; for any demand below Q_c, there is no congestion and no marginal cost associated with use of the bridge. Since the marginal cost of usage is zero, efficiency requires that the price for usage be zero. But clearly, the revenue raised by the bridge will then be zero.

feasible or desirable to exclude any individual from the benefits. On the other hand, the public health service provides other services that are like private goods—e.g., the provision of yellow fever vaccinations, which benefits primarily those who travel internationally.



5.3 BRIDGES: GOODS WHERE EXCLUSION IS POSSIBLE BUT NOT NECESSARILY DESIRABLE It is feasible to charge a toll for crossing a bridge, but if the capacity of the bridge is large enough, it is not desirable to do so. The shaded area provides a measure of the welfare loss from charging a toll of p.

Exclusion is, however, feasible: a private firm could construct the bridge and charge any toll it desired. It might, in particular, be possible for it to charge a toll that would more than cover the cost of construction. But whenever it charges a toll, the usage of the bridge will be reduced, and some trips, the benefits of which exceed the social cost (zero), will not be undertaken. We can measure the loss in welfare by the shaded triangle in Figure 5.3. This is referred to as the *deadweight loss*. To see this, we recall that the points on the demand curve measure the individual's marginal willingness to pay for an extra trip at different quantities. Assume a price, p, was charged for the use of the bridge. The number of trips taken would then be Q_e. At Q_e, the individual's marginal willingness to pay (the price he is willing to pay) for an extra trip is just p. The cost of providing an extra trip is zero. The welfare loss from not taking the trip is the difference between what he is willing to pay (his marginal benefit) and the marginal cost; thus the welfare loss is just p. At slightly higher levels of usage, the loss is still the marginal willingness to pay, but this is now smaller. To find the total welfare loss, we simply add up the welfare loss associated with each of the trips *not* taken as a result of charging the toll. At a zero price, Q_m trips are taken. At a price of p, Q_e trips are taken. Hence, the toll results in $(Q_m - Q_e)$ trips not being taken. The loss in welfare from the first trip not taken is, of course, p; the loss in

welfare from the last trip not taken is zero (his willingness to pay for one additional trip at Q_m is zero). The *average* welfare loss from each trip not taken is thus $p/2$; and the total welfare loss is $p(Q_m - Q_e)/2$, the area of the shaded triangle in Figure 5.3.[2]

This argument suggests that goods for which the marginal cost of provision is zero should be freely provided, regardless of whether it is feasible to charge for them. Occasionally, there may be a small marginal cost for using the public good, in which case the individual should be charged only the marginal cost. These **user charges** will not be sufficient to cover the total cost of the public good. The revenue required to pay for the public good must be raised in some other way. Although most of the taxes used to raise revenue entail significant costs, the argument for the public provision of goods for which user charges could be levied is that the costs associated with charging for their use—the welfare losses from reduced consumption— are *greater* than the costs associated with raising the revenue in some other way, such as through the income tax.

Goods for Which Exclusion Is Feasible but Costly

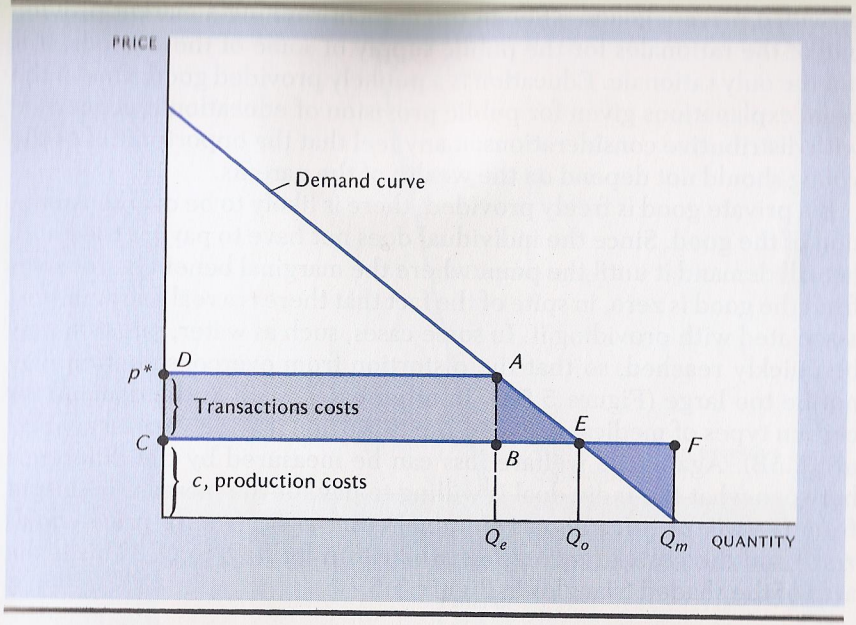
There are, of course, costs associated with exclusion for private goods as well as for public goods; that is, there are costs associated with running the price system. For example, the checkout clerks at grocery stores and the collectors of tolls along toll highways and at toll bridges are part of the administrative costs associated with operating a price mechanism. But while the costs of exclusion are relatively small for most private goods, they may be large (prohibitive) for some publicly provided goods.

Even when there is a marginal cost associated with each individual using a good, if the costs of running the price system are very high, it may be more efficient simply to provide the good publicly and finance the good through general taxation.

We illustrate this in Figure 5.4, where we have depicted a good with constant marginal costs of production, c. (It costs the firm $\$c$ to produce each unit of the good.)[3] However, to sell the good entails certain **transaction costs**. Transaction costs include all the costs required to complete an economic transaction, such as the costs of the checkout clerk at a grocery store or salespeople. Transaction costs raise the price to p^*. Assume now the government supplied the good freely. This eliminates the transaction costs, and the entire lightly shaded area $ABCD$ is saved. There is a further gain as consumption increases from Q_e to Q_o, since individuals' marginal valuations exceed the marginal costs of production. The heavily shaded area ABE measures the gain. On the other hand, if individuals consume the good until the marginal value is zero, in expanding consumption form Q_o to Q_m, the marginal willingness to pay is less than the cost of production. This is obviously inefficient. To decide whether the good should be provided publicly, we must compare the savings in transaction costs plus the gain from increasing consumption from Q_e to Q_o with (1) the loss from the excessive consumption of the good (the shaded area EFQ_m in Figure 5.4), plus (2) the loss from the distortions created by the taxes used to raise the revenue required to finance the provision of the good.

[2] Recall from Chapter 4 that this is only an approximation for the deadweight loss. The correct calculation entails using, as we did in Figure 4.10, the *compensated* demand schedule, not the ordinary demand schedule. However, if the fraction of income spent on traveling across the bridge is negligible, the two demand curves differ by very little.

[3] We assume, moreover, that the demand curve does not shift significantly as we raise taxes.



5.4 TRANSACTION COSTS When transaction costs are sufficiently high, it may be more efficient to supply the good publicly than to have the good supplied by private markets.

The high costs of private markets providing insurance has been used as one of the arguments for the public provision of insurance. For many kinds of insurance, the administrative costs (including the selling costs) associated with providing the insurance privately are more than 20 percent of the benefits paid out, in contrast with the administrative costs associated with public insurance, which (ignoring the distortions associated with the taxes required to finance the social insurance programs) are usually less than 10 percent of the value of the benefits.

PUBLICLY PROVIDED PRIVATE GOODS

Publicly provided goods for which there is a large marginal cost associated with supplying additional individuals are referred to as **publicly**

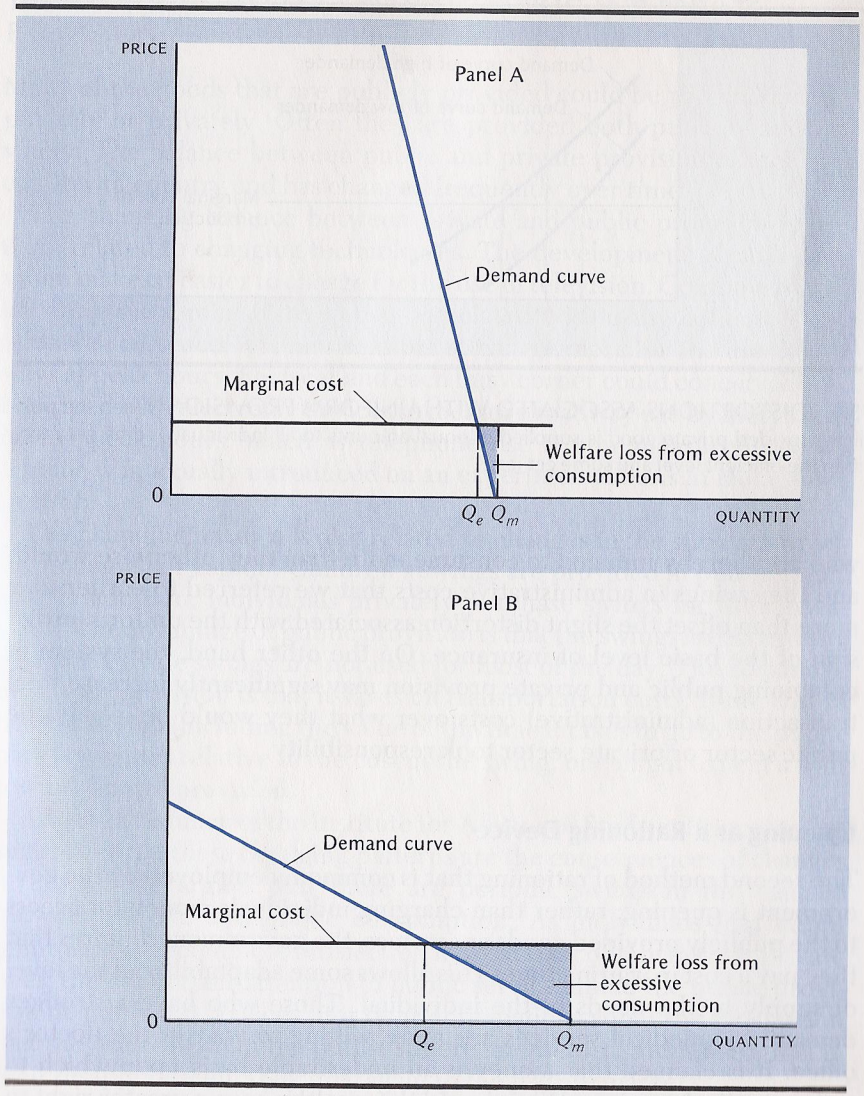
provided private goods. Though the costs of running a market provide one of the rationales for the public supply of some of these goods, it is not the only rationale. Education is a publicly provided good. One of the usual explanations given for public provision of education is concerned with distributive considerations; many feel that the opportunities of the young should not depend on the wealth of the parents.

If a private good is freely provided, there is likely to be overconsumption of the good. Since the individual does not have to pay for the good, he will demand it until the point where the marginal benefit he receives from the good is zero, in spite of the fact that there is a real marginal cost associated with providing it. In some cases, such as water, satiation may be quickly reached, so that the distortion from overconsumption may not be too large (Figure 5.5A). In other cases, such as the demand for certain types of medical services, the distortion may be very large (Figure 5.5B). Again, the welfare loss can be measured by the difference between what the individual is willing to pay for the increase in output from Q_e (where price equals marginal cost) to Q_m (where price equals zero) and the costs of increasing production form Q_e to Q_m. This is the area of the shaded triangles in Figure 5.5.

Rationing Devices for Publicly Provided Private Goods: Uniform Provision

It is likely, then, that some method for controlling consumption of publicly provided private goods will have to be used. Any method restricting consumption of a good is called a **rationing system.** Prices provide one rationing system. We have already discussed how user charges may be used to limit demand. Another commonly employed way of rationing publicly provided goods is to supply the same quantity of the good to everyone. Thus, typically, we provide a uniform level of education to all individuals, even though some individuals would like to have more and some less. (Those who would like to purchase more may be able to purchase supplemental educational services on the private market, such as tutoring.) This, then, is the major disadvantage of the public provision of private goods; it does not allow for the adaptation to differences in individuals' needs and desires as does the private market.

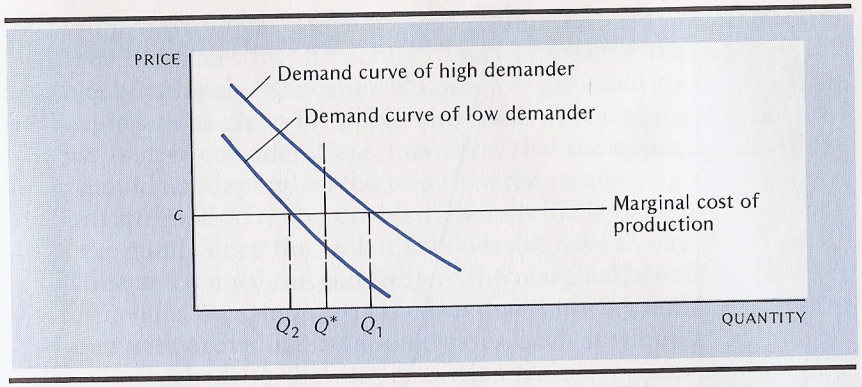
This is illustrated in Figure 5.6, where we have drawn the demand curves for two different individuals. If the good was privately provided, Individual 1, the high demander, would consume Q_1, while Individual 2, the low demander, would consume the much smaller quantity Q_2. The government chooses to supply each individual with a quantity that is somewhere in between, Q^*. At this level of consumption, the high demander is consuming less than he would like; his marginal willingness to pay exceeds the marginal cost of production. On the other hand, the low demander is consuming more than the efficient level; his marginal willingness to pay is less than the marginal cost. (But since he does not



5.5 DISTORTIONS ASSOCIATED WITH SUPPLYING GOODS FREELY (A) For some goods, such as water, supplying the good freely rather than at marginal costs results in relatively little additional consumption. (B) For other goods, such as certain medical services, supplying the good freely rather than at marginal costs results in extensive overconsumption.

have to pay anything for it, and still values the good positively, he, of course, consumes up to Q^*.)

For certain types of insurance (say, social security for retirement), the government provides a basic, uniform level. Again, those who wish to purchase more can do so, but those who wish to purchase less cannot. The distortion here may not, however, be very great; if the uniform level provided is sufficiently low, then there will be relatively few individuals



5.6 DISTORTIONS ASSOCIATED WITH UNIFORM PROVISION When the publicly provided private good is supplied in equal amounts to all individuals, some get more than the efficient level and some get less.

who are thereby induced to consume more than they otherwise would, and the savings in administrative costs that we referred to earlier may more than offset the slight distortion associated with the uniform provision of the basic level of insurance. On the other hand, the system of combining public and private provision may significantly increase total transaction (administrative) costs over what they would be if only the public sector or private sector took responsibility.

Queuing as a Rationing Device

The second method of rationing that is commonly employed by the government is queuing: rather than charging individuals money for access to the publicly provided goods or services, the government requires that they pay a cost in waiting time. This allows some adaptability of the level of supply to the needs of the individual. Those who have a stronger demand for medical services are more willing to wait in the doctor's office. It is claimed that money is an undesirable basis upon which to ration medical services: Why should the wealthy have a greater right to good health than the poor? Queues, it is argued, may be an effective device for discriminating between the truly needy (who are willing to wait in line) and those who are less needy of medical care. But queues are a far from perfect way of determining who is deserving of medical care since those who are unemployed or retired, but are not so needy of medical care, may be more willing to wait in the queue than either the busy corporate executive or the low-paid worker holding down two jobs. In effect, we are replacing willingness to pay as a criterion for allocating medical services by willingness to wait in the doctor's office. There is, in addition, a real social cost to using queuing as a rationing device—the waste of time spent queuing; this is a cost that could be avoided if prices were used as a rationing device.

THE CHANGING BALANCE BETWEEN PUBLIC AND PRIVATE PROVISION

Many of the goods that are publicly provided could be provided either publicly or privately. Often they are provided both publicly and privately. The balance between public and private provision differs from country to country and has changed frequently over time.

The changing balance between private and public provision is partially related to changing technologies. The development of cable television makes it easier to charge for the use of television. Computers have lowered the administrative costs associated with many collection systems. For instance, it is now feasible to charge more for the use of subways at peak hours. Each car and each busy corner could conceivably be equipped with electronic devices to measure roadway use by individuals during peak hours, much as telephone use is now measured. Such a scheme was actually introduced on an experimental basis in Hong Kong in 1985.

The changing balance is also related to changes in the standard of living (income per capita). Children's swings are provided in public parks, and, in addition, individuals privately purchase swings for their backyards. The advantage of public provision is that the swings are more fully utilized. Private swings are not used for most of the day. The advantage of private provision is that it saves on transportation costs. If the cost of transportation (including the value of the time it takes to go to the public park) increases relative to the cost of the swing, one might expect a shift toward private provision.

Albert Hirschman of the Institute for Advanced Study at Princeton has suggested that these changing patterns are the consequences of changes in tastes.[4] He argues that there are periodic swings in the balance between private and public consumption. As individuals find disappointment or incomplete satisfaction in what they obtain in their private lives, they turn their attention to public service and to the public provision of goods and services. But their anticipations about the satisfaction that they can obtain in the public sphere are, in turn, unfulfilled, and in their disappointment they turn again to the private market.

EFFICIENCY CONDITIONS FOR PUBLIC GOODS

A central question of concern is how large the supply of public goods should be. What does it mean to say that the government is supplying too few or too many public goods? In Chapter 3 we provided a criterion that enables us to answer this question; a resource allocation is Pareto efficient if no one can be made better off without making someone else worse off. There we established that Pareto efficiency in private markets

[4] A. O. Hirschman, *Shifting Involvements* (Princeton, NJ: Princeton University Press, 1981).

requires, among other criteria, that the individual's marginal rate of substitution is equal to the marginal rate of transformation.

In contrast, *pure public goods are efficiently supplied when the sum of the marginal rates of substitution (over all individuals) is equal to the marginal rate of transformation.* The *marginal rate of substitution* of private goods for public goods tells how much of the private good each individual is willing to give up to get one more unit of the public good. The sum of the marginal rates of substitution thus tells us how much of the private good all the members of society, together, are willing to give up to get one more unit of the public good (which will be jointly consumed by all). The *marginal rate of transformation* tells us how much of the private good must be given up to get one more unit of the public good. Efficiency requires, then, that the total amount individuals are willing to give up—the sum of the marginal rates of substitution—must equal the amount that they have to give up—the marginal rate of transformation.

Let's apply this efficiency condition to national defense. Assume that when we increase our production of guns (national defense) by one, we must reduce our production of butter by one pound (the marginal rate of transformation is unity). Guns used for national defense are a public good. We consider a simple economy with two individuals: Crusoe and Friday. Crusoe is willing to give up one-third of a pound of butter for an extra gun. But his one-third pound alone does not buy the gun. Friday is willing to give up two-thirds of a pound of butter for an extra gun. The total amount of butter that this small society would be willing to give up, were the government to buy one more gun, is

$$\frac{1}{3}+\frac{2}{3}=1.$$

The total amount they would *have* to give up to get one more gun is also 1. Thus, the sum of the marginal rates of substitution equals the marginal rate of transformation; their government has provided an efficient level of national defense. If the sum of the marginal rates of substitution exceeded unity, then, collectively, individuals would be willing to give up more than they had to; we could ask each of them to give up an amount slightly less than the amount that would make them indifferent, and it would still be possible to increase the production of guns by one unit. Thus they could all be made better off by increasing the production of the public good (guns) by one.

Demand Curves for Public Goods

In Chapter 3 we described a market equilibrium for a private good (ice cream cones) as the intersection of a demand and a supply curve (see Figure 3.2). We showed that at this point, the marginal benefit of producing an extra unit was equal to the marginal cost. That is why the market equilibrium was Pareto efficient.

We can use a similar apparatus to describe the efficient level of production of public goods. We can derive each individual's demand curve for public goods in the same way we can derive his demand curve for private goods.

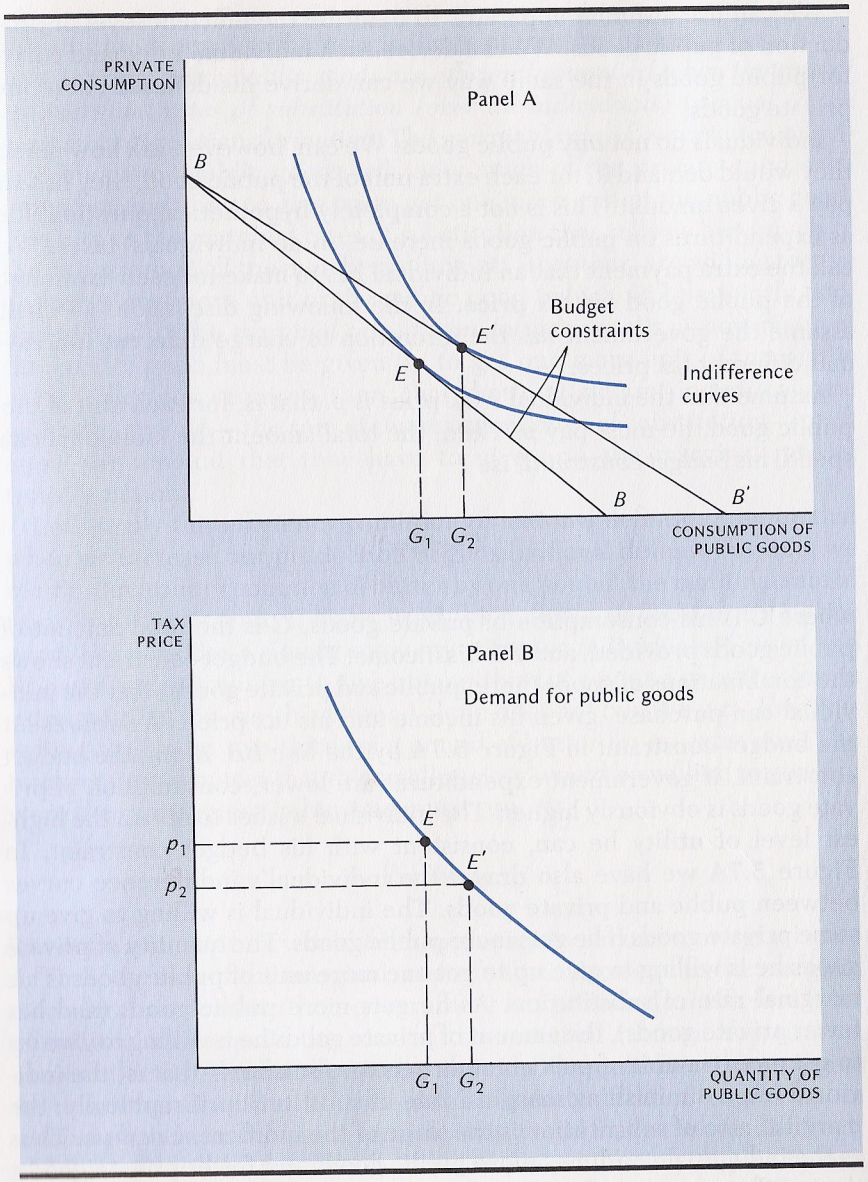
Individuals do not buy public goods. We can, however, ask how much they would demand if, for each extra unit of the public good, they had to pay a given amount. This is not a completely hypothetical question, for as expenditures on public goods increase, so do individuals' taxes. We call the extra payment that an individual has to make for each extra unit of the public good his **tax price.** In the following discussion, we shall assume the government has the discretion to charge different individuals different tax prices.

Assume that the individual's tax price is p, that is, for each unit of the public good, he must pay p. Then, the total amount the individual can spend, his *budget constraint,* is:

$$C+pG=Y,$$

where C is his consumption of private goods, G is the total amount of public goods provided, and Y is his income. The budget constraint shows the combinations of goods (here, public and private goods) that the individual can purchase, given his income and his tax price. We represent the budget constraint in Figure 5.7A by the line *BB*. Along the budget constraint, if government expenditures are lower, consumption of private goods is obviously higher. The individual wishes to obtain the highest level of utility he can, consistent with his budget constraint. In Figure 5.7A we have also drawn the individual's indifference curves between public and private goods. The individual is willing to give up some private goods if he gets more public goods. The quantity of private goods he is willing to give up to get one more unit of public goods is his marginal rate of substitution. As he gets more public goods (and has fewer private goods), the amount of private goods he is willing to give up to get an extra unit of public goods becomes smaller—that is, the individual has a diminishing marginal rate of substitution. Graphically, the marginal rate of substitution is the slope of the indifference curve. Thus as the individual consumes more public goods and fewer private goods, the indifference curve becomes flatter.

The individual's highest level of utility is attained at the point of tangency between the indifference curve and the budget constraint, point E in Panel A. At this point, the slope of the budget constraint and the slope of the indifference curve are identical. The slope of the budget constraint tells us how much in private goods the individual must give up to get one more unit of public goods; it is equal to the individual's tax price. The slope of the indifference curve tells us how much in private goods the individual is willing to give up to get one more unit of public goods. Thus at the individual's most preferred point, the amount that he



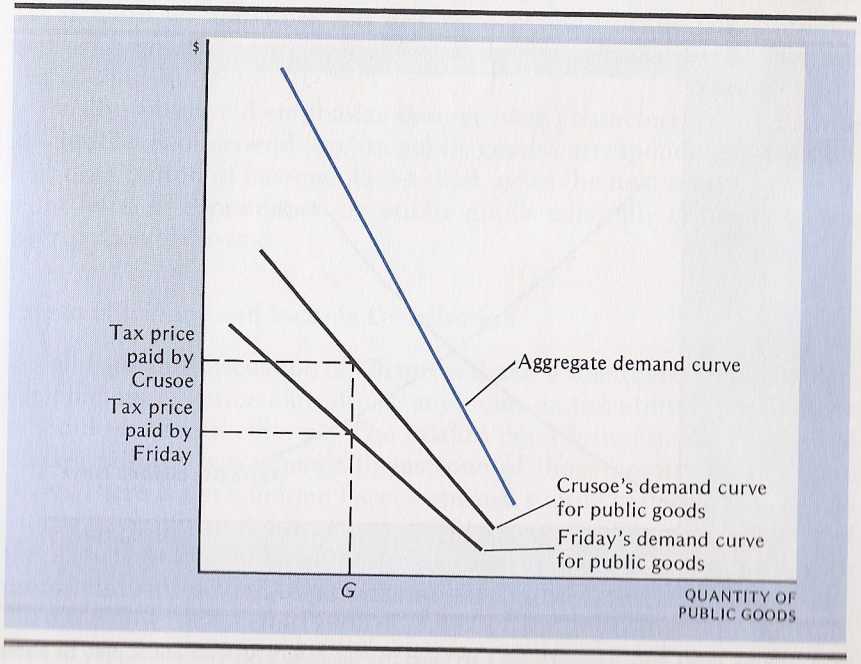
5.7 DEMAND CURVE FOR PUBLIC GOODS The individual's most preferred level of expenditure is the point of tangency between the indifference curve and the budget constraint. As the tax price decreases (the budget constraint shifts from BB to BB'), the individual's most preferred level of public expenditure increases, generating the demand curve of Panel B.

is *willing* to give up to get an additional unit of public goods is just equal to the amount he *must* give up to get one more unit of the public good. As we lower the tax price, the budget constraint shifts out (from BB to BB'), and the individual's most preferred point moves to point E'. The individual's demand for public goods will normally increase.

By raising and lowering the tax price, we can trace out a demand curve for public goods, in the same way that we trace out demand curves for private goods. In Figure 5.7B we have plotted the demand curve corresponding to Panel A. Points E and E', from Panel A, show the quantity of public goods demanded at tax prices p_1 and p_2. We could trace more points for Panel B by shifting the budget constraint further in Panel A.

We can use this approach to trace out the demand curves for public goods of Crusoe and Friday. Then we can add them *vertically* to derive the aggregate demand curve in Figure 5.8. Vertical summation is appropriate because a pure public good is necessarily provided in the same amount to all individuals. Rationing is infeasible and is also undesirable, since one individual's usage of the public good does not detract from any other individual's enjoyment of it.

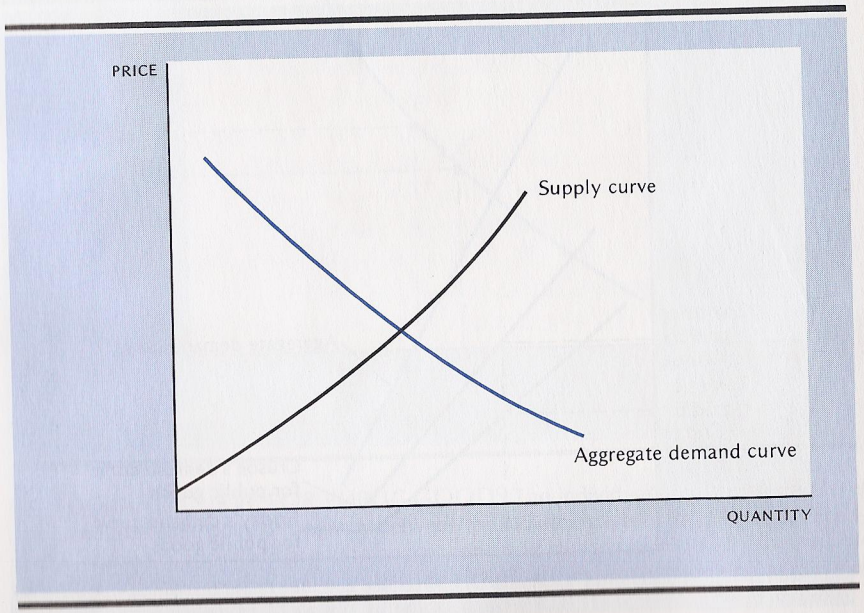
The demand curve can be thought of as a "marginal willingness to pay curve." That is, at each level of output of the public good, it says how much the individual would be willing to pay for an extra unit of the public good. (Remember, the tax price for the public good faced by the individual is set equal to his marginal rate of substitution, which simply gives how much of the private good he is willing to give up for one more unit of the public good.) Thus, the vertical sum of the demand curves is just



5.8 AGGREGATE DEMAND FOR PUBLIC GOODS Since at each point on the demand curve the price is equal to the marginal rate of substitution, by adding the demand curves vertically we obtain the sum of the marginal rates of substitution, the total amount of private goods that the individuals in society are willing to give up to get one more public good. The vertical sum thus can be thought of as the aggregate demand curve for the public good.

the sum of their marginal willingnesses to pay, that is, it is the total amount that all individuals together are willing to pay for an extra unit of the public good. Equivalently, since each point on the demand curve of an individual represents his marginal rate of substitution at that level of government expenditure, by adding the demand curves vertically we simply obtain the sum of the marginal rates of substitution (the total marginal benefit from producing an extra unit). The result is the aggregate demand curve shown in Figure 5.8.

We can draw a supply curve just as we did for private goods; for each level of output, the price represents how much of the other goods have to be foregone to produce one more unit of public goods; this is the marginal cost, or the marginal rate of transformation. At the output level where the aggregate demand is equal to the supply (Figure 5.9), the sum of the marginal willingnesses to pay (the sum of the marginal rates of substitution) is just equal to the marginal cost of production or the marginal rate of transformation. Since at this point, the marginal benefit from producing an extra unit of the public good equals the marginal cost, or the sum of the marginal rates of substitution equals the marginal rate of transformation, the output level described by the intersection of the aggregate demand curve and the supply curve for public goods is Pareto efficient.



5.9 EFFICIENT PRODUCTION OF PUBLIC GOODS An efficient supply of public goods occurs at the point of intersection of the demand curve and the supply curve. The aggregate demand curve gives the sum of what all individuals are willing to give up, at the margin, to have one more unit of public goods (one more gun), while the supply curve gives the amount of other goods that have to be given up to obtain one more unit of the public good.

Though we constructed each individual's demand curve for public goods in a manner analogous to the manner in which we could construct his demand curve for private goods, there are some important distinctions between the two. In particular, while market *equilibrium* occurs at the intersection of the demand and supply curves, we have not provided any explanation for why the equilibrium supply of public goods should occur at the intersection of the demand curve we have constructed and the supply curve. We have only established that if it did, the level of production of the public good would be Pareto efficient. Decisions about the level of public goods are made publicly, by governments, and not by individuals; hence, whether production occurs at this point depends on the nature of the political process, a subject we discuss at length in the next chapter.

Moreover, while in a competitive market for private goods, all individuals face the same prices, but consume different quantities (reflecting differences in tastes), a public good must be provided in the same amount to all affected individuals, and we have hypothesized that the government could charge different tax prices for the public good. One way of thinking about these prices is to suppose that each individual is told beforehand the *share* of public expenditures that he will have to bear. If some individual has to bear 1 percent of the cost of public expenditures, then an item that costs the government $1.00 costs him 1¢, while if an individual has to bear 3 percent of the cost of public expenditures, then an increase in public expenditures by $1.00 costs that individual 3¢.

Finally, we should emphasize that we have characterized the Pareto-efficient level of expenditure on public goods corresponding to a particular distribution of income. As we shall see in the next section, the efficient level of expenditure on public goods generally depends on the distribution of income.

Pareto Efficiency and Income Distribution

Recall from our discussion of Chapters 3 and 4 that there are many Pareto-efficient resource allocations; any point on the utilities possibilities schedule is Pareto efficient. The market equilibrium in the absence of market failures corresponds to just one of those points. By the same token, there is not a unique Pareto-optimal supply of public goods. The intersection of the demand and supply curves in Figure 5.9 is one of these Pareto-efficient levels of supply, but there are others as well, with different distributional implications.

To see how the efficient level of public goods depends on the distribution of income, assume the government transferred a dollar of income from Crusoe to Friday. This would normally shift Crusoe's demand for public goods (at any price) down and Friday's up. In general, there is no reason why these changes should exactly offset each other, so that the aggregate level of demand will normally change. With this new distribu-

tion of income, there is a new efficient level of public goods. But efficiency is still characterized by the sum of the marginal rates of substitution equaling the marginal rate of transformation. To put it another way, each point on the utilities possibilities schedule may be characterized by a different level of public goods, but at each point the sum of the marginal rates of substitution equals the marginal rate of transformation.

The fact that the efficient level of public goods depends, in general, on the distribution of income has one important implication: one cannot separate out efficiency considerations in the supply of public goods from distributional considerations. Any change in the distribution of income, say, brought about by a change in the income tax structure, will thus be accompanied by corresponding changes in the efficient levels of public-goods production.[5]

Limitations on Income Redistribution and the Efficient Supply of Public Goods

Governments, in evaluating the benefits of a public program, often seem to be particularly concerned with the question of *who* benefits from the program. They seem to *weight* benefits that accrue to the poor more highly than benefits that accrue to the rich. Yet the previous analysis suggested that one should simply add up the marginal rates of substitution, the amounts that each individual is willing to pay at the margin for an increase in the public good, treating the rich and the poor equally. How can these approaches be reconciled?

In Chapter 4, we showed how we could trace out the utility possibilities schedule simply by taking away resources from one individual and giving them to another. Recall our parable of the Robinson Crusoe economy, where in the process of transferring oranges from Crusoe to Friday some of the oranges are lost. In the U.S. economy, we use primarily the tax system and welfare system to redistribute resources. Not only are the administrative costs of running these systems large, but they have important incentive effects—for instance, on individuals' savings and work decisions. The fact that redistributing resources through the tax and welfare systems is costly implies that the government may look for alternative ways to achieve its redistributive goals; one way is to incorporate redistributive considerations into its evaluation of public projects.

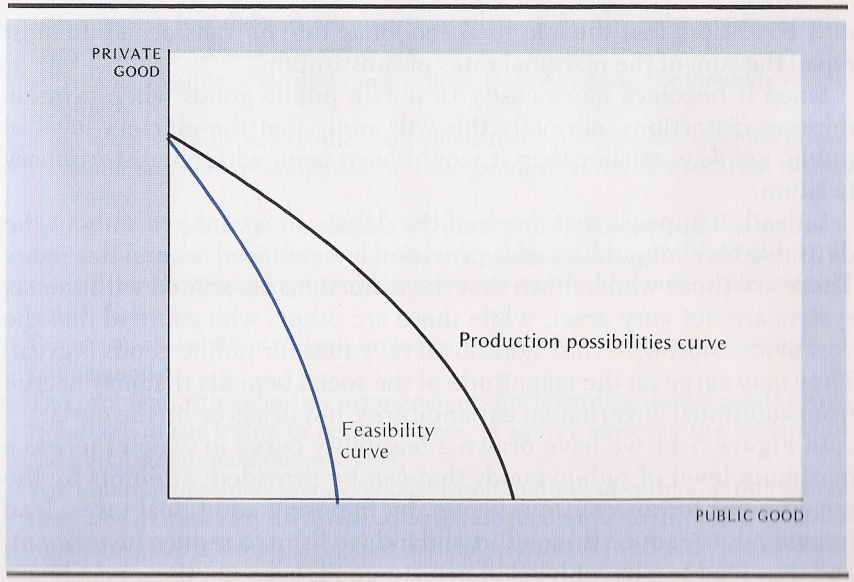
[5] Some economists have suggested that decisions concerning the efficient level of public-goods production and distribution of income can be separated; for instance, there is a view that concerns about the distribution of income should be reflected in tax schedules and welfare programs, but that decisions concerning the supply of public goods can and should be made quite independently of such considerations. There are some cases where the decisions can be separated (see Atkinson and Stiglitz, *Lectures in Public Economics* [New York: McGraw-Hill, 1980] or L. J. Lau, E. Sheshinski, and J. E. Stiglitz, "Efficiency in the Optimum Supply of Public Goods," *Econometrica* 46 [1978]: 269–84), but these are indeed special.

Distortionary Taxation and the Efficient Supply of Public Goods

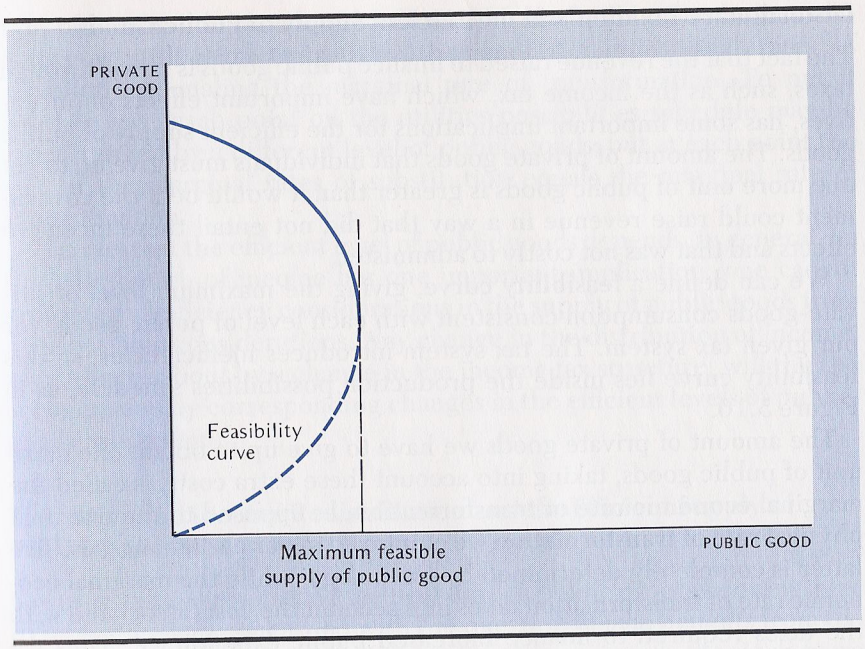
The fact that the revenue raised to finance public goods is raised through taxes, such as the income tax, which have important effects on incentives, has some important implications for the efficient supply of public goods. The amount of private goods that individuals must give up to get one more unit of public goods is greater than it would be if the government could raise revenue in a way that did not entail these incentive effects and that was not costly to administer.

We can define a **feasibility curve**, giving the maximum level of private-goods consumption consistent with each level of public goods, for our given tax system. The tax system introduces inefficiencies, so this feasibility curve lies inside the production possibilities schedule, as in Figure 5.10.

The amount of private goods we have to give up to obtain one more unit of public goods, taking into account these extra costs, is called the marginal **economic rate of transformation,** as opposed to the marginal **physical rate of transformation** we employed in our earlier analysis. The latter is completely determined by *technology*, while the marginal economic rate of transformation takes into account the costs associated with the taxes required to finance increased public expenditure. Thus we replace the earlier condition that the marginal physical rate of transformation must equal the sum of the marginal rates of substitution with the



5.10 THE FEASIBILITY CURVE The feasibility curve gives the maximum output (consumption) of private goods for any level of public goods, taking into account the inefficiencies that arise from the taxes that must be imposed to raise the requisite revenue. The feasibility curve lies below the production possibilities schedule.



5.11 THE LAFFER CURVE Raising tax rates beyond some level may so decrease incentives that output, and tax revenues, are actually reduced. There is then a maximum feasible level of government expenditure.

new condition, that the marginal economic rate of transformation must equal the sum of the marginal rates of substitution.

Since it becomes more costly to obtain public goods when taxation imposes distortions, normally this will imply that the efficient level of public goods is smaller than it would have been with nondistortionary taxation.

Indeed, it appears that much of the debate in recent years about the desirable level of public goods provision has centered around this issue. There are those who believe that the distortions associated with the tax system are not very great, while there are others who contend that the cost of attempting to raise additional revenues for public goods is great. They *may* agree on the magnitude of the social benefits that may accrue from additional government expenditures, but disagree on the costs.

In Figure 5.11 we have drawn a feasibility curve in which there is a maximum level of public goods that can be provided; attempts by the government to raise more revenue, by imposing additional taxes, lead individuals to reduce their effort and induce firms to reduce investment, and thus lead to a lower level of private-goods consumption *and* a lower level of tax revenue (and hence government expenditure). This curve has been popularized in recent years as the Laffer curve, after Arthur Laffer of the University of Southern California, although the possibility of the effect the curve describes had been noted by others earlier. It has provided one of the bases of what has come to be called **supply-side economics,** which claims that reducing tax rates would increase tax revenues. Although this is clearly theoretically possible, there is no evidence that this is a relevant concern at current tax rates, as we shall see in Chapter 19.

EFFICIENT GOVERNMENT AS A PUBLIC GOOD

One of the most important public goods is the management of the government: we all benefit from a better, more efficient, more responsive government. Indeed, "good government" possesses both of the properties of public goods we noted earlier: it is difficult and undesirable to exclude any individual from the benefits of a better government.

If the government is able to become more efficient and reduce taxes without reducing the level of government services, we all benefit. The politician who succeeds in doing this may get some return, but this return is only a fraction of the benefits that accrue to others. In particular, those who voted against the politician who succeeds in doing this gain as much as those who worked for his election, and the individual who did not vote, who attempted to free ride on the political activities of others, benefits as much as either.

SUMMARY

1. This chapter has defined an important class of goods, pure public goods. They have two critical properties:
   a) It is impossible to exclude individuals from enjoying the benefits of the goods.
   b) It is undesirable to exclude individuals from enjoying the benefits of the goods, since their enjoyment of these goods does not detract from that of others.
2. While there are a few examples of pure public goods, such as national defense, for most publicly provided goods exclusion is possible, although frequently costly. Imposing user charges may result in the underutilization of public facilities.
3. Private markets either will not supply or will provide an inadequate supply of public goods.
4. The problem with voluntary arrangements for providing public goods arises from individuals trying to be *free riders,* of simply enjoying the benefits of the public goods paid for by others.
5. For publicly provided private goods, some method of rationing other than the price system may be used; sometimes queuing is used, while at other times the good is simply provided in fixed quantities to all individuals. Both of these entail inefficiencies.
6. Pareto efficiency requires that a public good be supplied up to the point where the sum of the marginal rates of substitution equals the marginal rate of transformation. Different Pareto-efficient levels of consumption of the public good will be associated with different distributions of income.

7. The basic rule for the efficient level of supply of public goods must be modified when there are costs (distortions) associated with raising revenue and redistributing income.
8. Efficient management of the government is a public good itself.

KEY CONCEPTS

Pure public goods
Exclusion
Free rider problem
User charges
Tax price
Transaction costs
Publicly provided private goods
Uniform provision
Rationing system
Marginal physical rate of transformation
Marginal economic rate of transformation
Feasibility curve
Laffer curve

QUESTIONS AND PROBLEMS

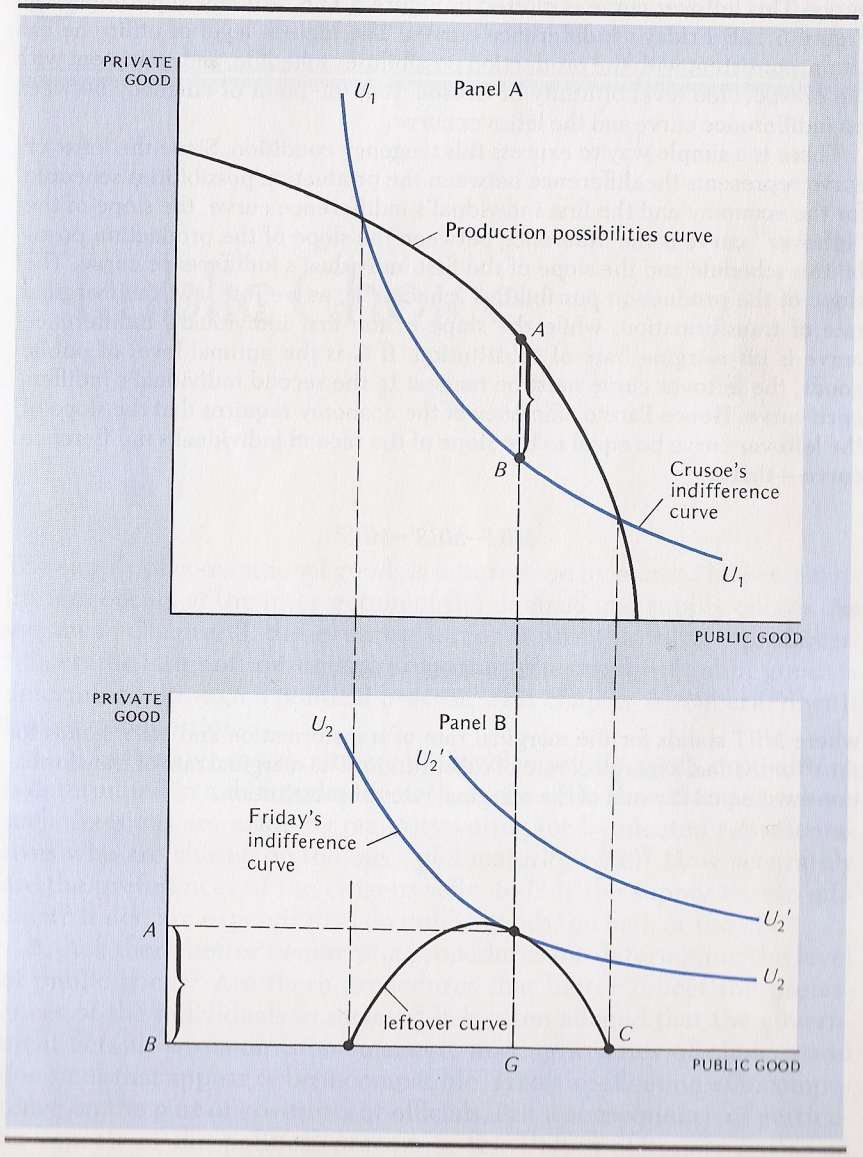
1. Where should each of the following goods lie in Figure 5.2? Explain why each is or is not a pure public good. Where applicable, note instances where the good is both publicly and privately provided:
   a) College education
   b) A local park
   c) Yosemite Park
   d) Sewage collection
   e) Water
   f) Electricity
   g) Telephone service
   h) Retirement insurance
   i) Medicine
   j) Police protection
   k) TV
   l) Basic research
   m) Applied research
2. What happens to the efficient allocation between public and private goods as an economy becomes wealthier? Can you think of examples of public goods, the consumption of which would increase more than proportionately to the increase in income? Less than proportionately to the increase in income?
3. The government rations a variety of publicly provided private goods and impure public goods (in which there is congestion) in a variety of ways. Discuss how each of these are rationed, and consider the effect of alternative rationing systems:
   a) Public higher education
   b) Health services in the U.K.
   c) Yellowstone National Park

   What happens to a publicly provided good in which congestion can occur (such as a highway or swimming pool on a hot, sunny day), but in which no direct rationing system is employed?
4. To what extent do you think differences in views between those who believe there should be less spending on public goods and those who believe there should be more spending can be attributed to differences in judgments concerning the marginal cost of public goods, including the increased distortions associated with the additional taxes required to finance public goods? What are other sources of disagreement?
5. What implications might the fact that efficient government is a public good have for the efficiency with which governments function?

APPENDIX: AN ALTERNATIVE EXPOSITION OF PUBLIC GOODS EFFICIENCY—THE LEFTOVER CURVE

In this appendix we provide an alternative, diagrammatic exposition for the basic efficiency condition for public goods:

Sum of marginal rates of substitution = Marginal rate of transformation.



5.12 DETERMINATION OF THE EFFICIENT LEVEL OF PRODUCTION OF PUBLIC GOODS (A) If the level of public goods is G, and the first individual is to get level of utility U_1, then the distance AB represents the amount of private goods left over for the second individual. (B) The second individual's welfare is maximized at the point of tangency of his indifference curve and the "leftover" curve.

In Figure 5.12A we have superimposed Crusoe's indifference curve on the production possibilities schedule. If the government provides a level of public goods G, and wishes, at the same time, to ensure that Crusoe attains the level of utility associated with the indifference curve U_1 drawn in the figure, then the amount of private good that is "leftover" for Friday is the vertical distance between the production possibilities schedule and the indifference curve. Accordingly, we call the (vertical) difference between the two the leftover curve. This leftover curve is plotted in Figure 5.12B. We now superimpose on Figure 5.12B Friday's indifference curves. The highest level of utility he can attain, consistent with the production possibilities schedule, and consistent with the prespecified level of utility of Crusoe, is at the point of tangency between his indifference curve and the leftover curve.

There is a simple way to express this tangency condition. Since the leftover curve represents the difference between the production possibilities schedule for the economy and the first individual's indifference curve, the slope of the "leftover" curve is the difference between the slope of the production possibilities schedule and the slope of the first individual's indifference curve. The slope of the production possibilities schedule is, as we just saw, the marginal rate of transformation, while the slope of the first individual's indifference curve is his marginal rate of substitution. If G is the optimal level of public goods, the leftover curve must be tangent to the second individual's indifference curve. Hence Pareto efficiency of the economy requires that the slope of the leftover curve be equal to the slope of the second individual's indifference curve—that is,

$$MRT - MRS^1 = MRS^2$$

or

$$MRT = MRS^1 + MRS^2,$$

where MRT stands for the marginal rate of transformation and MRS^i stands for the i^{th} individual's marginal rate of substitution. The marginal rate of transformation must equal the sum of the marginal rates of substitution.

6

Public Choice

The supply of conventional goods is determined by market forces. Equilibrium occurs at the intersection of the demand and supply curves. As we saw in Chapter 3, these market forces ensure that what is produced reflects the tastes of consumers. In contrast, the supply of public goods is determined through a political process. This chapter is concerned with two sets of questions:

1. What can we say about how the level of public-goods expenditure is determined in a democratic society, such as the United States, where such decisions are made by majority voting (or by elected representatives who are chosen on the basis of a majority vote)? How accurately are the preferences of the citizens reflected? Is the supply Pareto efficient? If not, are expenditures on public goods too high or too low?
2. Are there better democratic procedures for determining the level of public goods? Are there procedures that better reflect the preferences of the individuals in society? It is often alleged that the government acts in an inconsistent manner, making a series of choices and decisions that appear to be incompatible. Is this a reflection of incompetence on the part of government officials, is it a consequence of particular aspects of the political process in the United States, or is this an *inevitable* consequence of democratic decision making?

These questions bring us to the border between political science and economics. Our concern is understanding economic aspects of the political process. Traditional political science has been particularly con-