

# 18 Tax Incidence

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## FOCUS QUESTIONS

- 1 What is meant by the incidence of a tax? Why is it that those who ultimately bear the burden of a tax may differ markedly from those upon whom the tax is legally imposed?
  - 2 What determines who bears the burden of taxes? How does it depend on the elasticity of demand and supply? On whether markets are competitive or not? Why might it differ between the short run and the long run?
  - 3 Why are some taxes that appear to be markedly different really equivalent?
  - 4 Who bears the burden of taxation in the United States?
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When Congress or a state legislature enacts a new tax, the debate usually includes some opinions about who should pay for running the government or for the particular program being supported by the tax. For example, when Congress adopted the social security tax to pay for the social security system, it levied half the tax on the employer and half on the employee. It thought that both parties should share in the costs of the social security system.

But economic reality—for better or worse—does not always follow the laws passed by legislatures. Thus, economists distinguish between those who bear the **burden** of a tax and those on whom a tax is imposed or levied. The

*tax burden* is the true economic weight of a tax. It is the difference between the individual's real income before and after the tax has been imposed, taking full account of how wages and prices may have adjusted. Economists use a more neutral word to describe the effects of taxation—they ask, what is the **incidence** of the tax? Who actually pays, in the sense that their real income is lowered? This chapter studies the incidence of various taxes.

The actual incidence of the tax may differ markedly from the intended incidence. Consider two taxes that are imposed on firms, the employer-paid portion of the social security tax and the corporation income tax. As a result of either tax, wages might fall or prices might rise. If wages fall, we say that the tax has been **shifted backward** (to a factor of production, labor): if wages fall by the full amount of the tax, we say that they have been fully shifted; if wages fall by less than the amount of the tax, we say they have been partially shifted. If prices rise, we say that the tax has been **shifted forward** (to consumers). Most economists believe that most of the employer-paid portion of the social security tax is shifted backward and that the effect of the tax officially levied on employers is essentially the same as that levied on workers. Thus, although the government levied only half of the tax on employees, they bear the full (or almost the full) burden of the tax in the form of lower wages.

There is considerable controversy over the incidence of the corporation income tax. While one reason why the tax is popular is that ostensibly firms and their shareholders pay the tax, most economists believe that a substantial portion of the tax is shifted. If firms raise their prices as a result of the tax, the tax is borne by consumers. If, as a result of the tax, demand for labor falls and wages fall, the tax is partially borne by workers, not investors. If the tax makes investing in the corporate sector less attractive, capital will move out of the sector, driving down the return to capital in the unincorporated sector. Thus, part of the burden of the corporate tax is on capital as a whole, not just capital in the corporate sector.

The study of tax incidence is one of the most important and difficult topics in the economics of the public sector. In the last chapter, we saw that one of the principles of a desirable tax system is that it should be *fair*. But fairness depends not on whom the tax is imposed, but on who actually pays the tax—on the incidence of the tax. If it were decided, for instance, that fairness dictated that owners of capital should pay higher taxes, but the tax was levied in such a way that the owners of capital could shift the tax onto consumers or workers, then the tax would not have achieved its goal. Economics, not Congress, often determines who actually bears the burden of a tax, though in designing the tax Congress can often affect the outcome: two taxes, both imposed on corporations but differently designed, can have markedly different consequences.

Just as two taxes that look similar, in that both are imposed on, say, corporations, can have markedly different effects, two taxes that look different, in that they are imposed in quite different ways, can have identical effects. Such taxes are said to be **equivalent**.

In Chapter 17 we saw that another principle of a desirable tax system, besides fairness, is transparency. This has two implications. First, it is prefer-

able to impose taxes whose incidence is clear. Second, because most individuals do not understand incidence analysis, it is preferable to impose taxes in a manner which makes the apparent incidence of a tax correspond to the actual incidence. Thus, imposing half of the social security tax on the employer contributes to the lack of transparency, as it makes workers believe that the employer actually bears half the burden of the tax.

The incidence of a tax depends on a number of factors—most importantly, on whether the economy is competitive; and if it is competitive, on the shape of the demand and supply curves. This chapter is divided into five sections. The first and second analyze incidence in perfectly competitive markets and in markets in which there is imperfect or no competition. The third analyzes some important equivalent tax structures. In the fourth section, some other important determinants of incidence are discussed, examining a tax on capital in the corporate sector. In the final section, we discuss briefly the implications of our analysis for the overall incidence of taxation in the United States.

While this chapter focuses on the incidence of taxes, it should be clear that precisely the same issues arise in discussing subsidies and other benefits, such as those discussed in earlier chapters on government expenditures. If corn is subsidized, it may not be corn growers who really benefit: if the price of corn falls, the benefit is shifted forward to consumers; if the price of land on which corn is grown increases, the benefit is shifted backward to the owners of land. The principles elucidated here apply equally to the analysis of government benefit programs.

## TAX INCIDENCE IN COMPETITIVE MARKETS

In this section, we will show that it makes no difference whether a tax on a commodity is legally imposed on the commodity's consumers or on its producers—it makes no difference whether producers of beer or its consumers “pay” the tax. What does make a difference is the shape of the demand and supply curves.

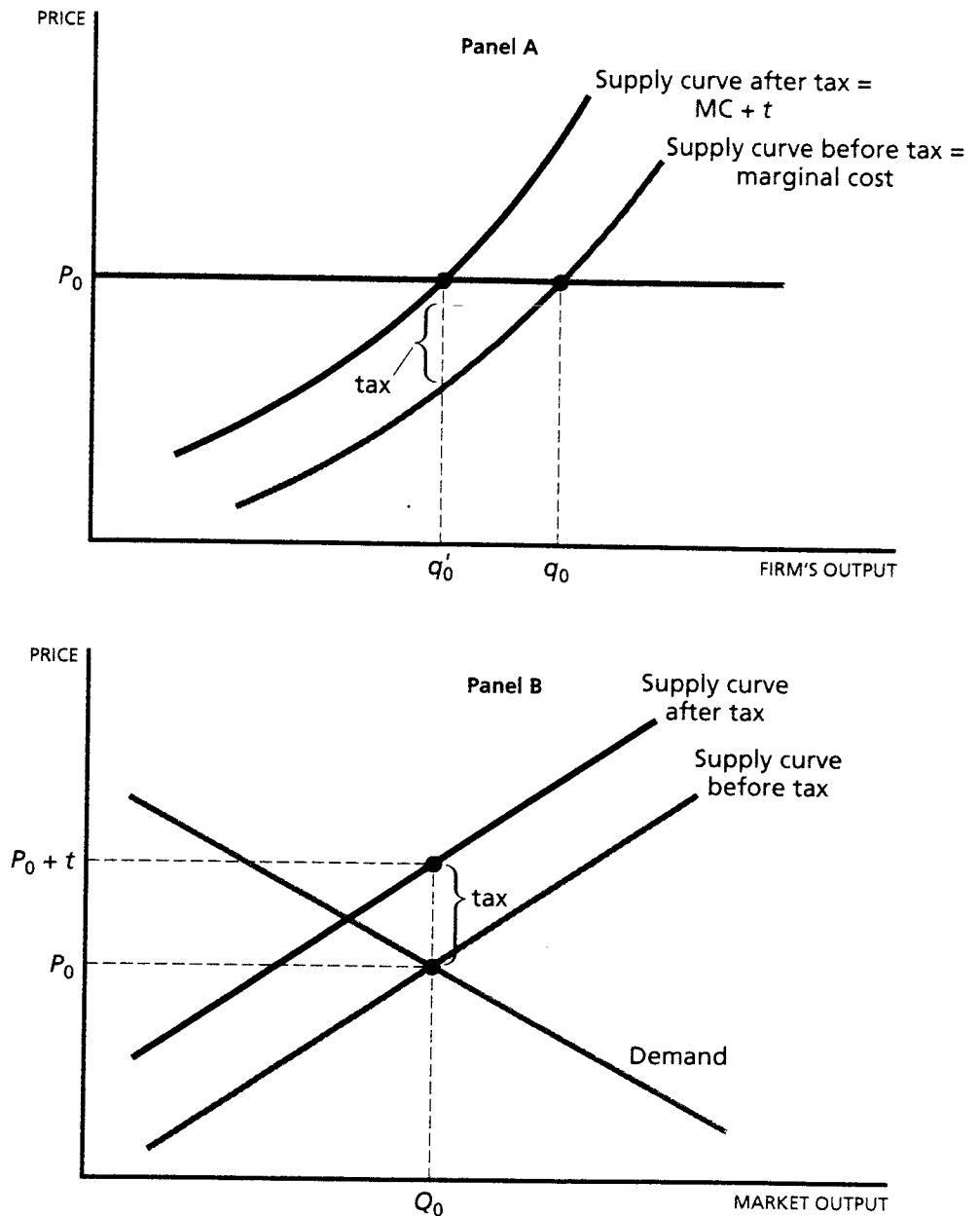
### EFFECT OF TAX AT THE LEVEL OF A FIRM

Consider a commodity tax imposed at a fixed rate per unit of the good (so many cents per can of beer) which the firm must pay. Figure 18.1 illustrates the effect of the tax on the firm's production decision. In competitive markets, firms produce at the level where price equals marginal costs.<sup>1</sup> If the firm has to pay the tax, then its effective cost of production has been increased, *by the amount of the tax*. Accordingly, the amount it is willing to supply at the price  $p_0$  is reduced.

The firm's supply curve gives the amount the firm is willing to supply at each price. Its supply curve is shifted, as illustrated in panel A of Figure 18.1. This is, of course, true for *every* firm. The *market* supply curve gives the

<sup>1</sup> At lower levels of output, increasing output increases revenues by more than the increased costs, so profits increase. The converse occurs at higher levels of output.

**TAX INCIDENCE IN  
COMPETITIVE MARKETS**



**FIGURE 18.1** The Effect of a Commodity Tax on Supply Panel A shows the effect of a commodity tax on the quantity supplied by a firm. At any price,  $p_0$ , the firm will supply a lower quantity. The tax can be thought of as increasing the marginal cost of production. Output supplied is reduced from  $q_0$  to  $q'_0$ . Panel B shows the effect of a commodity tax on the market supply curve and equilibrium. At each price the market is willing to supply less (the supply curve shifts to the left); or equivalently, the price required to elicit a given supply out of the market is higher, by an amount exactly equal to the tax.

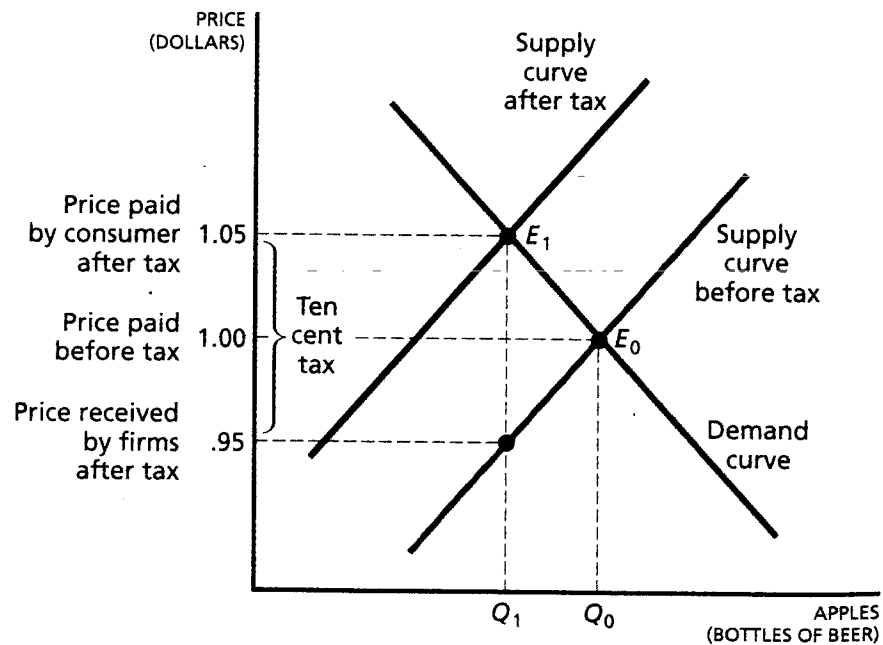
total amount that *all* firms are willing to supply at each price. It is simply the “sum” of the supply curves of each firm. Equivalently, we can think of the market supply curve as telling us what the market price must be in order for

firms to be willing to produce a given level of output. The market supply curve, like the individual firm supply curves, is shifted, as illustrated in panel B of Figure 18.1. The amount of the shift is easy to ascertain. If  $t$  is the tax rate, then the net amount received by the firm when the price is  $p_0 + t$  after the tax is the same as it would have received when the price was just  $p_0$  before the tax; the quantity that each firm is thus willing to supply at the price  $p_0 + t$  after the tax is the same as it would have been willing to supply at the price  $p_0$  before the tax. In effect, the supply curve is shifted up by the amount of the tax.

### IMPACT ON MARKET EQUILIBRIUM

We can now easily see the impact of the tax on prices and output. Figure 18.2 shows the equilibrium before taxes, at the intersection of the demand and supply curve, where  $Q_0$  bottles of beer are produced in equilibrium, at a price of \$1 each.

Assume that the tax on each producer is 10 cents per bottle of beer. The supply curve shifts up by that amount, and the price rises. Although the tax was nominally imposed on producers, consumers are forced to pay a part of the increased cost, through higher prices. But notice that in this example, the price rises by less than 10 cents, to \$1.05. Producers cannot shift the entire cost of the tax to consumers because as the price rises, the quantity demanded falls.



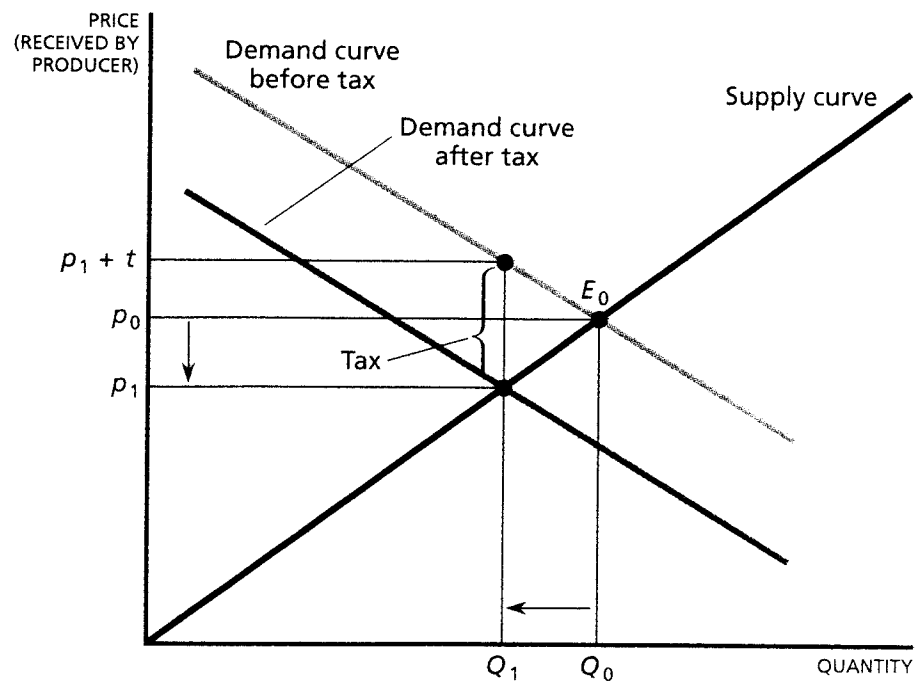
**FIGURE 18.2** Effect of Tax on Prices and Quantities The tax shifts the supply curve up by the amount of tax. This lowers the quantity consumed and raises the price paid by consumers.

**DOES IT MATTER  
WHETHER THE TAX IS  
LEVIED ON CONSUMERS  
OR ON PRODUCERS?**

Each firm now receives the higher price of \$1.05, and faces additional costs of 10 cents per bottle. The firms in Figure 18.2 produce less than before the tax, but more than they would have if consumers did not bear part of the additional cost.

Consider now what would happen if Congress passed a beer tax, but this time said that consumers would have to pay the tax. For each bottle of beer purchased, consumers would have to pay a 10-cent tax. What consumers care about, of course, is not who receives the money they pay, but simply the total cost of the beer—just as what producers care about is how much they receive. Return to Figure 18.2, which showed the effect of a 10-cent tax imposed on producers. At the new equilibrium output  $Q_1$ , producers receive, after tax, \$.95 and consumers pay \$1.05. In that situation, the producers mail the government a check for 10 cents for every bottle of beer. But nothing would change if consumers, or the retailers from whom they buy beer, had to send a check in for the same amount. Producers would then pay no *direct* attention to the tax. They would sell the beer to consumers for 95 cents, and at that price they would be willing to produce  $Q_1$ . Consumers would pay the producers 95 cents and pay the government 10 cents for a total price of \$1.05. At the total price of \$1.05, they are willing to purchase  $Q_1$ , so at  $Q_1$ , and a consumer price of \$1.05 and a producer price of \$.95, demand equals supply.

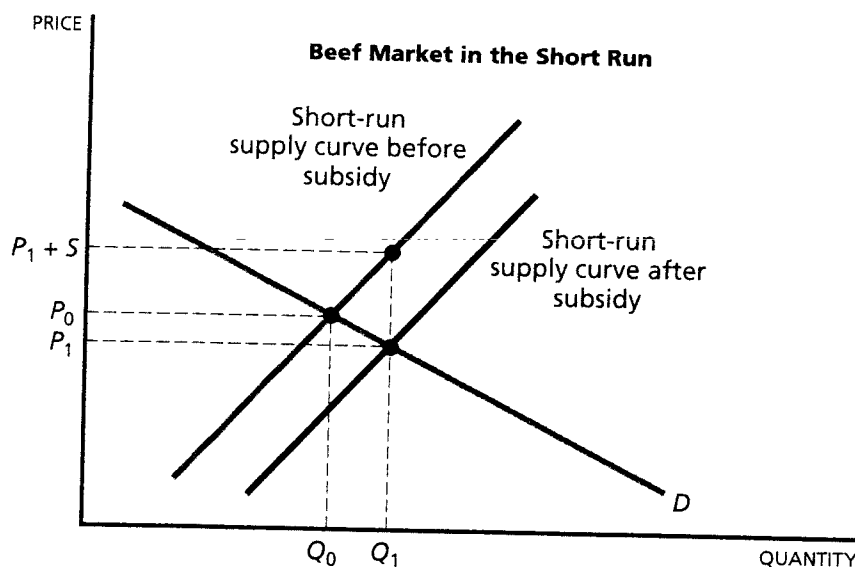
This situation is depicted diagrammatically in Figure 18.3. If we now interpret the price on the vertical axis to be the price received by the pro-



**FIGURE 18.3** Alternate Views of a Tax The effects of a tax can be viewed as either a downward shift in the demand curve or an upward shift in the supply curve (compare with Figure 18.2).

# THE INCIDENCE OF GOVERNMENT BENEFITS

The framework we have developed for analyzing the incidence of taxes can be used to analyze the incidence of a government program or subsidy. Consider a subsidy for beef. For simplicity, assume the government subsidizes beef at \$1.00 a pound. In the short run, the supply curve is relatively inelastic, as depicted in the first figure below. That means there is a small quantity response, but a large price response: in the short run much of the benefit does go to farmers.



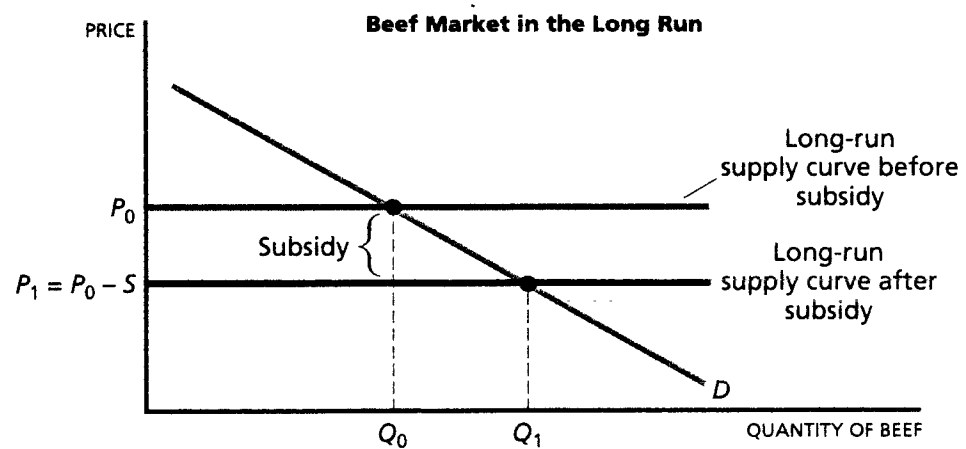
ducer (rather than the price paid by the consumer), the tax on consumers can be represented by a downward shift in the demand curve, by the amount of the tax. That is, if the producer receives  $p_1$ , the consumer must pay  $p_1 + t$ , and the level of demand is  $Q_1$ , just as it would be if, in the before-tax situation, producers had charged  $p_1 + t$ . It should be apparent that it makes no difference whether Congress imposes the tax on the producers of beer or on the consumers of beer.

## AD VALOREM VERSUS SPECIFIC TAXES

Not only does it make no difference on whom the tax is levied, it makes no difference whether the tax is levied as a given percentage of the price or as a fixed amount per unit output. The former is called an **ad valorem tax**, the latter a **specific tax**.

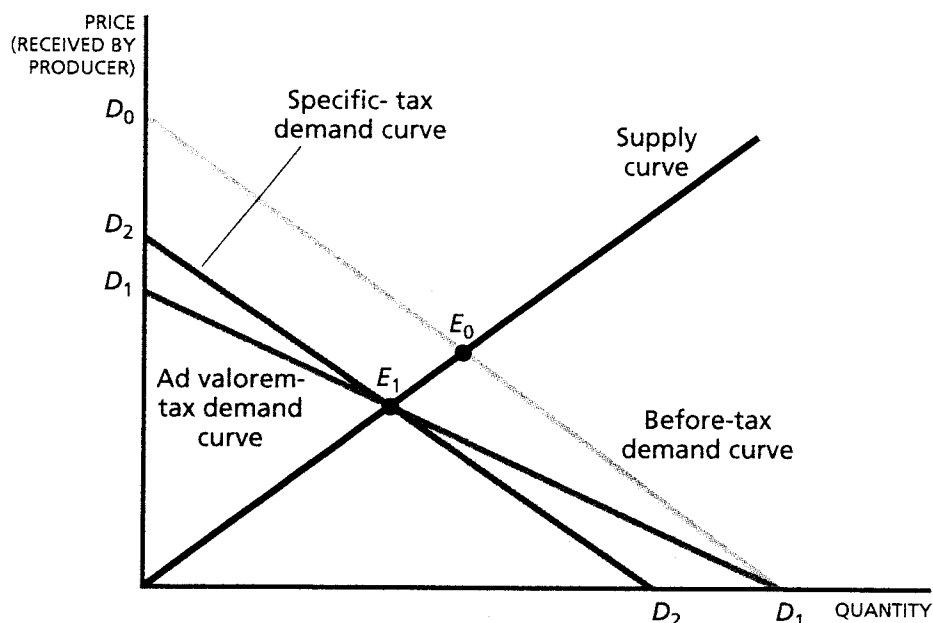
The ad valorem tax can be thought of as shifting down the demand curve, with the amount by which it is shifted down depending on the price, as illustrated in Figure 18.4. At a zero price (where the demand curve intersects the horizontal axis) there is no tax. The manufacturer receives a fixed

But in the long run, as entry occurs and producers can expand their facilities, the supply curve for beef becomes relatively flat; there is a large supply of acreage that can be used for pasture, and though it takes time to breed cattle, they can be bred, and the costs of breeding and feeding are roughly fixed. The figure below for the long-run beef market shows a horizontal supply curve combined with a downward-sloping demand curve, and the before-subsidy equilibrium at  $Q_0$ . The subsidy can be thought of as shifting the supply curve as depicted. The new equilibrium entails a larger quantity, but the price received by farmers remains unchanged. In the long run, all the benefit of the subsidy is received by meat consumers, none by farmers.



percentage of the price paid by the consumer, say 95 percent (if the ad valorem tax rate is 5 percent).  $E_1$  is the after-tax equilibrium, at the intersection of the after-tax demand curve  $D_1D_1$  and the supply curve. In the figure, the after-tax demand curve is also drawn for the case of a specific tax *which is of the same magnitude at the equilibrium  $E_1$* . With the tax at the same level at the equilibrium, the demand curve is shifted down by the same amount at that level of output, and thus the equilibrium output, tax revenues, prices paid by consumers, and prices received by manufacturers are all the same.

In practice the two taxes often differ, because tax authorities cannot adjust appropriately for differences in qualities of goods. When the government levies a specific tax—say, so many cents per pack of cigarettes—the tax is the same regardless of the quality of the product. Thus, the tax is a higher percentage of the price for low-quality goods than it is for higher-quality goods. In effect, the specific tax discriminates against lower-quality goods. While in principle the government could adjust the specific tax rate to offset this bias, in fact it seldom does so.



**FIGURE 18.4** **Ad Valorem and Specific Commodity Taxes** In competitive markets, an ad valorem tax (a tax which is a fixed percentage of the price) and a specific tax (a tax which is a fixed amount per unit purchased) which raise the same revenue have the same effect on output.

On the other hand, it is often easier to monitor the quantity of a good sold than to monitor its price, particularly when firms sell more than one commodity. If these commodities are taxed at different ad valorem rates, there is an incentive to strike deals in which the higher-taxed commodity is underpriced on invoices, and the tax administrator may not be able to detect this. This kind of administrative problem has been the principal determinant of the form of taxation.

## TAX INCIDENCE

The incidence of a tax describes who actually bears the tax. It does not depend on who writes the check to the government.

It makes no difference whether a commodity tax is levied on producers or consumers.

It makes no difference whether the social security tax (payroll tax) is paid half by the employer and half by the employee, or entirely paid by one or the other.

In a competitive market, the incidences of an ad valorem and an equivalent specific tax are identical.

## THE EFFECT OF ELASTICITY

The amount by which price rises—the extent to which consumers bear a tax—depends on the shape of the demand and supply curves, not on whom the tax is levied. In two limiting cases, the price rises by the full 10 cents, so the entire burden is borne by consumers. This occurs when the supply curve is perfectly horizontal, as in Figure 18.5, panel A, or when the demand curve is perfectly vertical (individuals insist on consuming a fixed amount of beer, regardless of price), as in panel B.

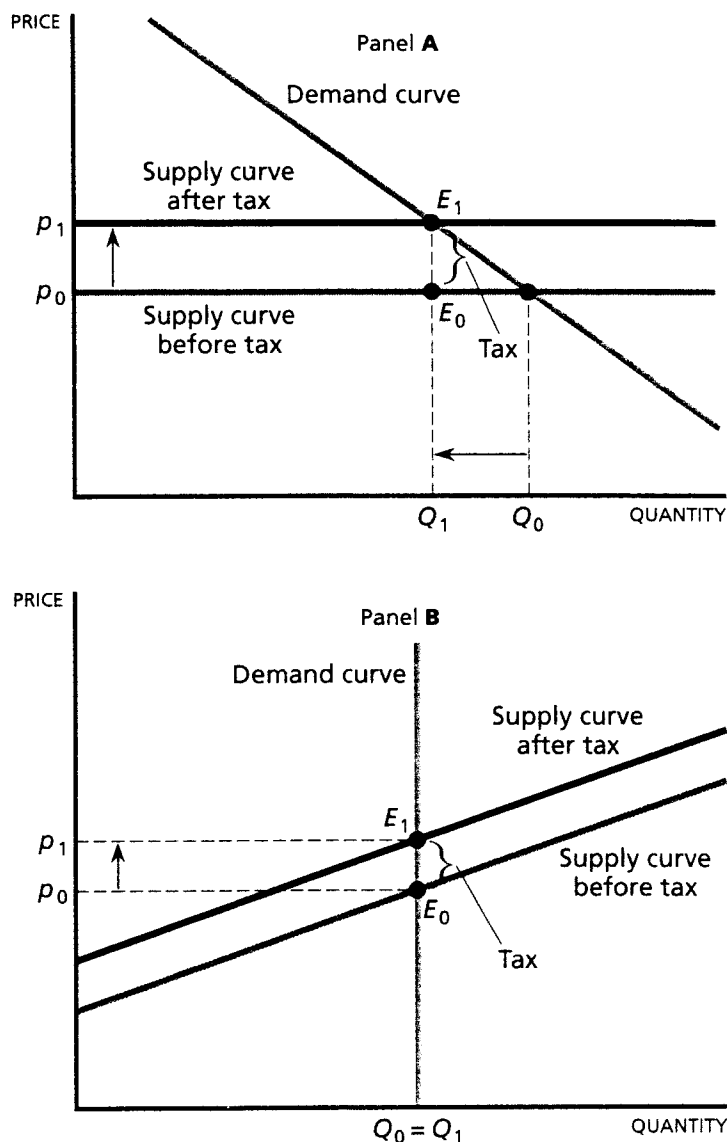
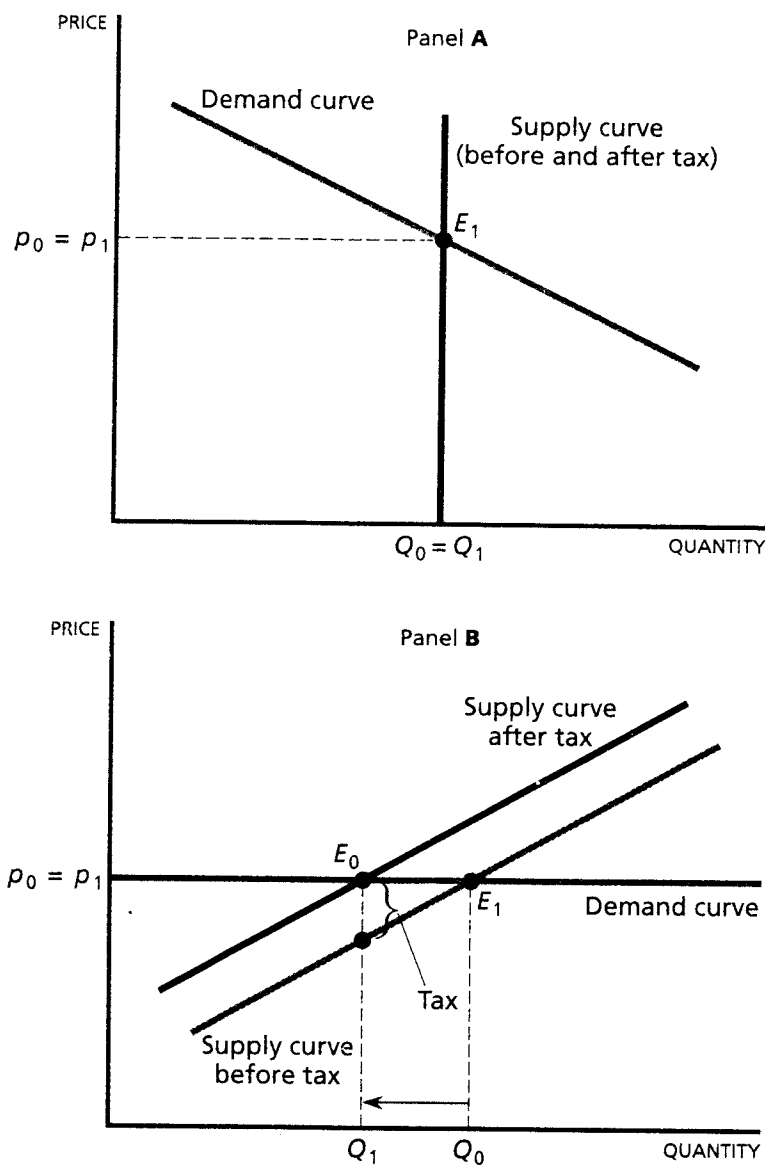


FIGURE 18.5

**Elasticity of Supply and Demand: Tax Borne by Consumers** (A) Perfectly elastic supply curve: With a perfectly elastic supply curve (horizontal supply curve), the price rises by the full amount of the tax; the entire burden of the tax is on consumers. (B) Perfectly inelastic demand: With a perfectly inelastic demand curve, the price rises by the full amount of the tax; the entire burden of the tax is on the consumers.

There are also two cases in which the price paid by consumers does not rise at all—that is, in which the tax is borne entirely by producers, as shown in panels A and B of Figure 18.6. This occurs when the supply curve is perfectly vertical—the amount supplied does not depend at all on price—or when the demand curve is perfectly horizontal.

More generally the steeper the demand curve or the flatter the supply curve, the more the tax will be borne by consumers; the flatter the de-



**FIGURE 18.6** Elasticity of Supply and Demand: Tax Borne by Producers (A) Perfectly inelastic supply curve: With a perfectly inelastic supply curve, the price does not rise at all; the full burden of the tax is on producers. (B) Perfectly elastic demand: With a perfectly elastic (horizontal) demand curve, the price does not rise at all; the entire burden of the tax is on producers.

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## INCIDENCE IN COMPETITIVE MARKETS

In competitive markets, incidence depends on the elasticity of demand and supply.

A commodity tax is not borne at all by consumers if the demand curve is perfectly elastic, or by producers if the supply curve is perfectly elastic. It is borne completely by consumers if the demand curve is perfectly inelastic, or by producers if the supply curve is perfectly inelastic.

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mand curve or the steeper the supply curve, the more the tax will be borne by producers. We measure the steepness of a demand curve by the **elasticity of demand**; the elasticity of demand gives the percentage change in the quantity of the good consumed due to a percentage change in its price. We thus say that the horizontal demand curve, where a small reduction in the price results in an enormous increase in demand, is infinitely elastic; and we say that the vertical demand curve, where demand does not change at all with a reduction in price, has zero elasticity.

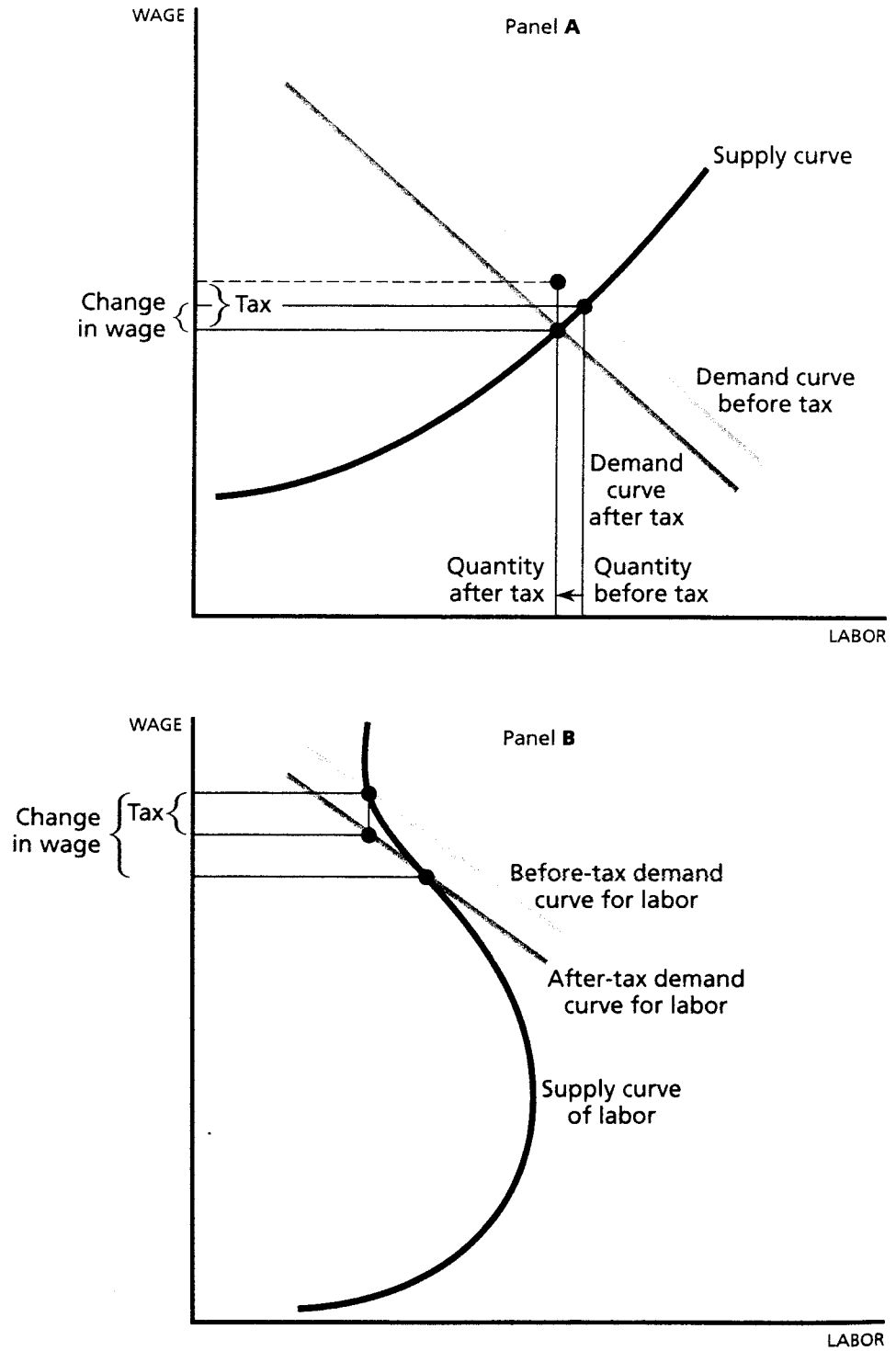
Similarly, we measure the steepness of a supply curve by the **elasticity of supply**; the elasticity of supply gives the percentage change in the quantity of the good supplied due to a percentage change in its price. We thus say that a vertical supply curve, where the supply does not change at all with a change in price, has zero elasticity, while a horizontal supply curve has infinite elasticity.

The more elastic the demand curve and the less elastic the supply curve, the more the tax is borne by producers; the less elastic the demand curve and the more elastic the supply curve, the more the tax will be borne by consumers.

### TAXATION OF FACTORS

The basic principles we have just derived apply to all taxes in competitive markets, including taxes on factors of production.

**TAX INCIDENCE AND THE DEMAND AND SUPPLY FOR LABOR** Figure 18.7A depicts the market demand and supply curves for labor. It makes no difference whether a tax on labor is imposed on consumers (in this case, the firms which pay for the use of labor) or on producers (in this case, the individuals who are selling their labor services); the incidence of the tax is the same. The distinction made by Congress, that half of the social security tax should be paid by the employer and half by the employee, makes absolutely no difference for the effect of the tax. The consequences would have been the



**FIGURE 18.7** Comparing the Effects of a Tax on the Demand for Labor (A) The effect of a tax on labor is to shift the demand curve for labor down. A tax on labor will lead to a lower wage and a lower level of employment. (B) With a backward-bending supply schedule, the wage may fall by more than the amount of the tax.

same had Congress said that firms must pay the entire tax or that individuals must pay the entire tax.<sup>2</sup>

Who effectively pays the tax depends on the elasticity of demand and supply for labor. If, as is frequently claimed, the supply of labor is relatively inelastic (i.e., almost vertical), most of the burden of the tax falls on workers, regardless of the legal imposition of the tax.

Some economists believe that the supply curve of labor actually is backward-bending, as illustrated in Figure 18.7B. As the wage rises above a certain level, the supply of labor actually decreases. Individuals decide that, at the higher standards of living that they can attain with the higher wages, they prefer to work less. Thus, higher wages reduce the supply of labor rather than increase it. In this case, a tax on labor may result in a reduction in the wage rate that is greater than the tax itself, as the decrease in wages induces a larger labor supply, which drives down the wage further.

**TAXATION OF INELASTIC FACTORS** As we have noted, if the supply elasticity of labor or of a commodity is zero, the tax is borne fully by the supplier. The classic example of a commodity with a zero supply elasticity is unimproved land. The supply of land is fixed. Thus, if a tax is imposed on unimproved land, the total burden of the tax will fall on the landowners.

Unfortunately, it is difficult to distinguish the value of land from the value of improvements to it. In many parts of the United States, for instance, land in the wilderness, with no access to roads, sewers, or water, has almost no commercial value. It is difficult to ascertain how much of the value of land in urban areas is inherent in the land and how much is attributable to improvements. Because the supply elasticity of land improvements is large, a land tax may be largely shifted.

Another example of a factor in long-run inelastic supply is crude oil. Hence, a tax on oil is borne primarily by the owners of oil deposits. Since a disproportionate share of the world's oil is owned by those outside of the major consuming nations, the consuming nations have strong incentives to impose taxes on oil. Of course, owners of oil wells in the United States actively resist these taxes, and they are a sufficiently powerful lobby group to have done so quite successfully. In the United States, taxes on oil are far lower than those in most Western European nations.

<sup>2</sup> There may be a short-run difference. If Congress had imposed the entire tax on firms, it is unlikely that wages would have fallen immediately. In the short run, the labor market would not have been in equilibrium, and firms would have absorbed a large part of the social security tax.

There are also some differences arising out of the income tax. While the employee's contribution to social security is included in his income (upon which he must pay income tax), the employer's contribution to social security is not. Also, if the individual works for more than one employer and pays more than the maximum social security, he can claim a refund of the excess, but the employer is not entitled to any refund.

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## THE PHILADELPHIA WAGE TAX

Many cities, including Philadelphia, Pennsylvania, levy a wage tax. A careful look at the incidence of the tax suggests that the burden of the tax is largely upon landowners in Philadelphia. The supply curves for other factors, in particular for labor and capital, are relatively flat *in the long run*. Workers have a choice of working in Philadelphia or elsewhere. If their after-tax wage income is not commensurate with what they can receive elsewhere (taking into account the special amenities of Philadelphia), they will leave Philadelphia for employment elsewhere, and firms will not be able to recruit new workers. Thus, if a city such as Philadelphia imposes a wage tax, in the long run wages must rise to fully offset the tax. Similarly, owners of capital have a choice of investing in Philadelphia or elsewhere. If their return is not commensurate with what they receive elsewhere they will not invest in Philadelphia. Thus, after-tax wages and after-tax returns to capital are unaffected by the tax. Who then pays the tax?

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**TAXATION OF PERFECTLY ELASTIC FACTORS** Just as taxes imposed on perfectly inelastic factors of production are borne totally by the factor, taxes on perfectly elastic factors are not borne at all by the taxed factor; they are entirely shifted. This simple observation has important implications for tax policy. The supply of capital to a small country is usually thought of as being highly elastic: just as a small firm must take the price it pays for capital as given, so too does a small country in an open, global market. The country cannot induce capital to flow in if it pays less than the market rate of interest; but at the market rate, it can obtain all the capital it could possibly absorb. Figure 18.8 plots the demand and supply of capital depending on the interest rate. With a tax on interest, the interest paid differs from the interest received. But the capital owner must receive the market rate, or she supplies nothing. The users of capital must make up the difference, paying  $i + t$ . In the figure, the vertical axis represents the interest rate re-

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### TAXATION OF FACTORS

The incidence of a tax on a factor in a competitive market depends on the elasticity of supply and demand for the factor.

The incidence of a tax on a factor whose supply is perfectly inelastic is borne completely by the factor.

A tax on a factor whose supply is perfectly elastic is completely shifted.

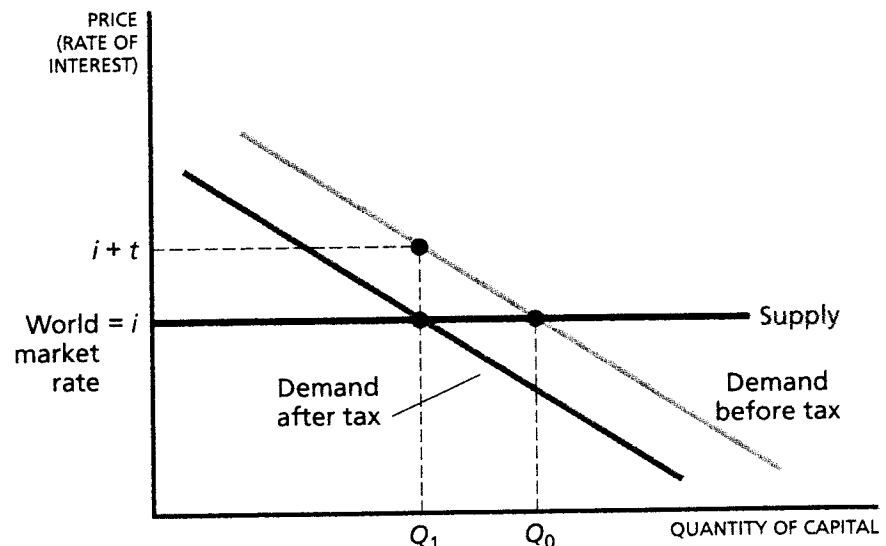
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Only factors which are not mobile. Land, in particular, is not only not mobile; it is in inelastic supply. Thus land bears the brunt of the tax.

Pittsburgh, across the state, takes a different route from Philadelphia, taxing unimproved land directly, and at a much higher rate than it taxes improvements. Pittsburgh is the only major U.S. city that uses a graded property tax—where land and buildings are taxed at different rates. In 1979 and 1980, Pittsburgh restructured its property tax system so that land was taxed at more than five times the rate on buildings (or improvements).\*

\*For more discussion of the property tax in Pittsburgh and the economic effects of this property tax experiment, see Wallace E. Oates and Robert M. Schwab, "The Impact of Urban Land Taxation: The Pittsburgh Experience," *National Tax Journal* 50, no. 1 (March 1997): 1–21.

ceived, so the supply curve remains unchanged. The tax shifts the demand curve for capital down. At the new equilibrium, the interest rate received is unchanged. A tax on interest in this situation is fully shifted from capital owners to capital users.



**FIGURE 18.8** **Perfectly Elastically Supplied Factor** The incidence of a tax imposed on a perfectly elastically supplied factor is always fully shifted. The demand curve is shifted down by the amount of tax, leaving the price received by suppliers unchanged.

## TAX INCIDENCE IN ENVIRONMENTS WITHOUT PERFECT COMPETITION

The effect of the imposition of a tax depends critically on the nature of the market. The analysis in the preceding section assumed that markets are competitive. But if markets are less than fully competitive—if, for instance, the industry consists of a monopoly, or of firms acting collusively, so that their combined behavior is similar to that of a monopoly—the effect of a tax could be markedly different.

In the absence of a tax, a monopolist will choose that level of output such that the cost of producing any additional output (the marginal cost) is just equal to the additional sales revenue he would receive (his marginal revenue). To maximize profits, the monopolist thus sets his **marginal cost** equal to his **marginal revenue**.

Figure 18.9 depicts the demand curve for aluminum, the marginal revenue curve, and the marginal cost of production. The marginal revenue curve lies below the demand curve. It represents the extra revenue the firm receives from selling an extra unit of output. The marginal revenue is the price the firm receives for that extra unit, minus the loss it sustains on the other units it sells, because as it attempts to sell more, it must lower the price.<sup>3</sup> The monopolist chooses  $Q_0$  as his level of output, the quantity where the marginal cost and marginal revenue curves intersect. To find the price charged by the monopolist, we go up to the demand curve and locate price  $p_0$ .

A tax on aluminum can be viewed simply as an increase in the cost of production, which is to say a shift upward in the marginal cost curve. This will reduce output to  $Q_1$  and increase the price to  $p_1$ .

### RELATIONSHIP BETWEEN THE CHANGE IN THE PRICE AND THE TAX

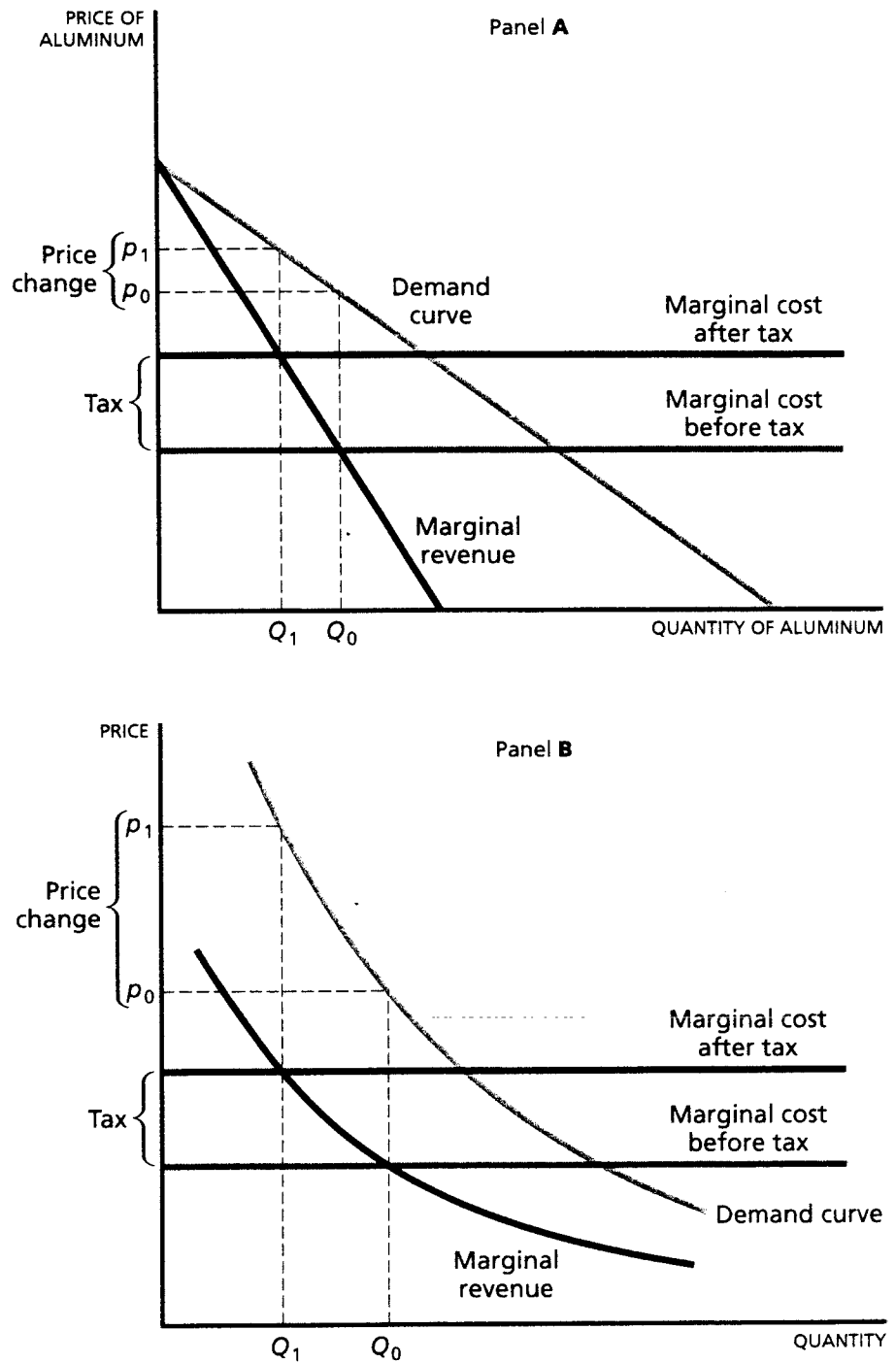
In the case of a competitive industry, we showed that the consumer price increased by an amount that normally was less than the tax, and that the magnitude of the price increase depended on the demand and supply elasticities. The results for a monopolist are more complicated.

First, the steeper the marginal cost curve, the smaller the change in output and hence the smaller the increase in price. With a perfectly vertical marginal cost schedule, there is no change in output and no change in price; the tax is borne by producers. A supply (or marginal cost) curve is perfectly vertical if no increase in price calls forth an increase in supply. This result parallels that for competitive markets.

On the other hand, with a horizontal marginal cost schedule, as in Figure 18.9, the extent to which producers or consumers bear the tax depends on the *shape* of the demand curve. (Contrast this to competitive markets, where the consumer would bear the entire tax.) Panels A and B of Figure 18.9 illustrate two possibilities. With a linear demand curve, as in panel A,

<sup>3</sup> Recall that, in contrast, a perfectly competitive firm must take the market price as fixed, but can sell any amount of output at that price. Its marginal revenue is simply the market price.

**TAX INCIDENCE IN ENVIRONMENTS WITHOUT PERFECT COMPETITION**



**FIGURE 18.9 Taxing a Monopoly** (A) With linear demand and horizontal marginal cost curves, the price paid by consumers rises by exactly half the tax; consumers and producers share the burden of the tax. (B) With constant elasticity demand curves, the price rises by more than the tax.

the price rises by exactly half the tax.<sup>4</sup> With a constant elasticity demand curve (where a 1 percent increase in the price results in, say, a 2 percent reduction in the demand, regardless of the price level), marginal revenue is a constant fraction of the price:<sup>5</sup>

$$MR = p(1 - 1/\eta^d),$$

<sup>4</sup> With a linear demand curve

$$p = a - bQ,$$

price and output are related linearly. Revenue,  $pQ$ , is given by

$$pQ = aQ - bQ^2,$$

so marginal revenue, MR, is

$$a - 2bQ.$$

This is set equal to marginal cost plus the tax:

$$a - 2bQ = MC + t$$

or

$$2a - 2bQ = 2p = a + MC + t$$

or

$$p = \frac{a + MC + t}{2}.$$

Hence if  $t$  increases by, say, \$2,  $p$  increases by \$1.

<sup>5</sup> This formula is general. In the case of a constant elasticity demand curve,  $\eta^d$  is constant. To derive the formula, recall that marginal revenue is the extra revenue received from producing one more unit. Revenue is just the price received per unit,  $p$ , times the number of units sold,  $Q$ . Thus, when a firm sells one more unit it receives  $p$ , but to sell the additional unit it must have reduced its price from its previous level. Denote the change in price by  $\Delta p$ . The firm loses this amount on all sales,  $Q$ . Thus the net gain is

$$MR = p + \Delta p \cdot Q = p \left( 1 + \frac{\Delta p}{p} \cdot Q \right).$$

Recall too that

$$-\frac{\Delta Q/Q}{\Delta p/p} = -\frac{\text{change in } Q/Q}{\text{change in } p/p}$$

is just the percent change in quantity as a result of a percent change in price, which is just the elasticity of demand.

Here, the change in quantity is just 1, that is  $\Delta Q = 1$ , so we can rewrite

$$-\frac{\Delta p}{p} \cdot Q = -\frac{\Delta p}{p} \cdot \frac{Q}{\Delta Q} = -\frac{\Delta p/p}{\Delta Q/Q} = \text{elasticity of demand} = \eta^d.$$

So,

$$MR = p \left( 1 - \frac{1}{\eta^d} \right).$$

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**TAX INCIDENCE IN  
ENVIRONMENTS WITHOUT  
PERFECT COMPETITION**

where  $\eta^d$  is the elasticity of demand (a constant). Since the monopolist sets marginal revenue equal to marginal cost,

$$MR = MC$$

or

$$p(1 - 1/\eta^d) = MC$$

or

$$p = MC/(1 - 1/\eta^d).$$

A tax has the same effect as raising the marginal cost of production, that is

$$p = (MC + t)/(1 - 1/\eta^d).$$

Hence price increases by a multiple  $[1/(1 - 1/\eta^d)]$  of the tax. If  $\eta^d$  is 2, then the increase in price is twice the tax.

**AD VALOREM VERSUS  
SPECIFIC TAXES**

There is another important difference between the taxation of competitive and monopolistic industries. In the case of competitive industries, the form in which the tax is levied makes no difference. We can choose between a specific tax, which is specified as a fixed amount per unit of output, and an ad valorem tax, which is specified as a percentage of the value of the output. All that matters for determining the effect of the tax is the magnitude of the difference (in equilibrium) between the price received by producers and the price paid by consumers, what we refer to as the wedge between the two.

In the case of monopolistic industries, however, ad valorem and specific taxes have quite different effects. We show in the appendix that for any given revenue raised by the government, the monopolist's output will be higher with an ad valorem tax than with a specific tax.

**TAX INCIDENCE IN  
OLIGOPOLIES**

Between the extremes of perfect competition and monopoly is the oligopoly market structure. In an **oligopoly**, such as the airline market and the rental car market, each producer interacts strategically with every other producer. If one producer changes its prices or output, the other producers may also change their prices or outputs, but these responses may be hard to predict.

There is no widely accepted theory of firm behavior in oligopoly, and so it is impossible to make any definite predictions about the incidence of taxation in this case. Some economists believe that oligopolists are not likely to raise the prices they charge consumers when taxes change. Each oligopolist may believe that if he raises his price, other firms will steal his market share. An opposite conclusion follows if each oligopolist expects that his competitors will match his price increase after a tax is imposed. In this case, all will raise their prices and thereby shift the burden of the tax to consumers.

Though economists have explored the incidence of taxes in an oligopoly under different specific behavioral assumptions, until they gain a better

## TAX INCIDENCE IN MONOPOLIES OR IMPERFECTLY COMPETITIVE MARKETS

In monopolies or imperfectly competitive markets, tax incidence depends on the shape of the demand and supply curves; there may be more than 100 percent shifting.

In a monopoly, with constant marginal cost, and with constant elasticity demand curves, there will always be more than 100 percent shifting of specific commodity taxes. With linear demand curves, price rises by half of the tax.

understanding of oligopolistic behavior, there can be no general theory of the incidence of a tax in an oligopolistic market.

### EQUIVALENT TAXES

In the discussion thus far, several instances have been pointed out where taxes appear to be different—a tax on employers to finance social security and a tax on employees; a tax on the producers of beer or a tax on beer consumers—but are really equivalent. There are many other examples of taxes that appear to be very different (and that from an administrative point of view *are* different) that are, from an economic point of view, equivalent.

#### INCOME TAX AND VALUE-ADDED TAX

An obvious example follows from the basic identity between national income (the total of what all the individuals in our society receive) and national output (the total of what they all produce). Since the value of income and the value of output must be the same, a uniform tax on income (a tax that taxes all sources of income at the same rate) and a uniform tax on output (a tax that taxes all outputs at the same rate) must be equivalent. A comprehensive uniform sales tax is a uniform tax on output and is thus equivalent to a uniform income tax.

The production of any commodity entails a large number of steps. The value of the final product represents the sum of the *value added* at each stage of production. We could impose the tax at the end of the production process, or at each stage along the way. A tax at the end of the production process is called a sales tax. A tax imposed at each stage of the production process is called a value-added tax. Thus, a uniform value-added tax and a comprehensive uniform sales tax are equivalent; and both are equivalent to a uniform income tax.

The value-added tax is used in most European countries, and there has been some discussion in the United States about introducing such a tax.

Since a uniform value-added tax is equivalent to a uniform (proportional) income tax, replacing our current income tax system with a value-added tax would be equivalent to replacing it with a proportional income tax system.

The value-added tax in Europe typically exempts investment goods. It is imposed only on consumption. Thus, the European form of the value-added tax is equivalent to a tax on consumption. Since consumption is equal to income minus savings, a consumption tax is equivalent to a tax on income in which savings are exempted.

### EQUIVALENCE OF CONSUMPTION AND WAGE TAXES

Suppose that individuals receive no inheritances and leave no bequests. Then a uniform tax on wages and a uniform tax on consumption are equivalent. To put it another way, a consumption tax is equivalent to an income tax in which interest and other returns to capital have been exempted. (Our present tax system, in which part of the return to capital is tax exempt, can be viewed as somewhere between a consumption tax and an income tax.)

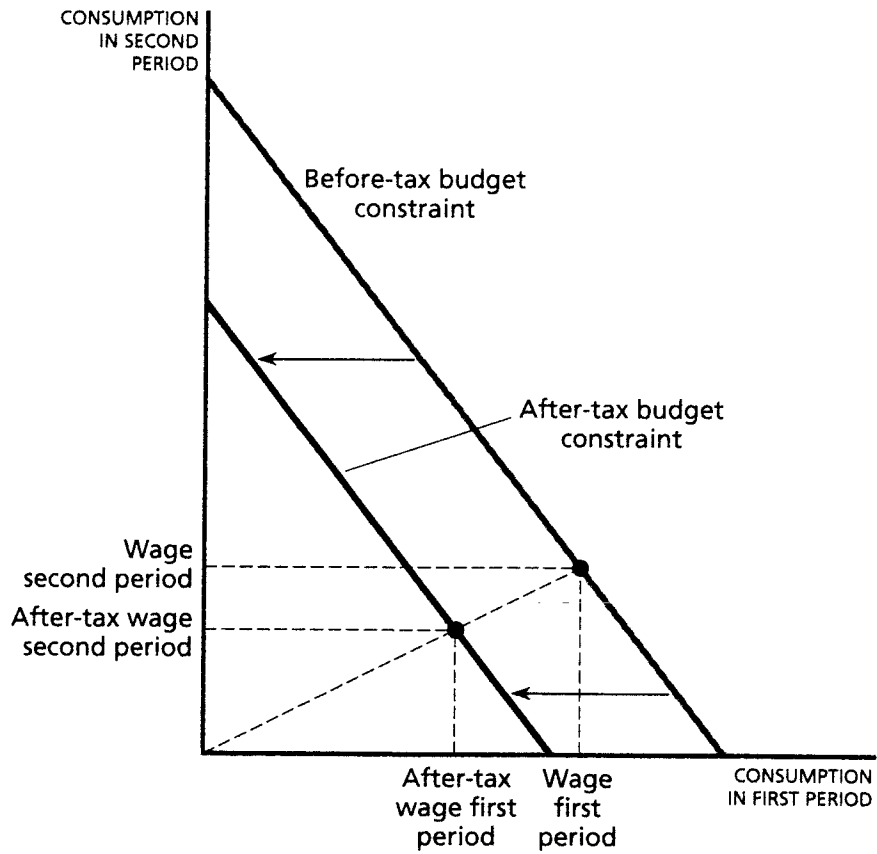
The equivalence may be seen most clearly by looking at the lifetime budget constraint of an individual (with no inheritances or bequests). For simplicity, we divide the life of the individual into two periods. Her wage income is  $w_1$  in the first period and  $w_2$  in the second. The individual has to decide how much to consume the first period of her life, while she is young, and how much while she is old. If she reduces her consumption today by a dollar and invests it, next period she will have  $1 + r$  dollars, where  $r$  is the rate of interest. With a 10 percent interest rate, she will have \$1.10. The budget constraint is a straight line, depicted in Figure 18.10.

Consider what happens to her budget constraint when a wage tax of 20 percent is imposed. The amount that she can consume shifts down. The slope of the budget constraint remains unchanged: it is still the case that by giving up \$1 of consumption in the first period, she can get \$1.10 next period.

Now consider what happens to her budget constraint when a 20 percent consumption tax is imposed. Just as before, the amount that she can consume shifts down, and the slope of the budget constraint remains unchanged. If the individual spends \$1 today, she gets 20 percent fewer goods because of the tax; but when she spends \$1 tomorrow, she also gets 20 percent fewer goods because of the tax. The trade-off between spending today and spending tomorrow remains unchanged. A wage tax and a consumption tax are equivalent.<sup>6</sup> Only the timing of the revenues to the government differs between the two taxes; this may be important if capital markets are imperfect.

There are, again, several ways that equivalent taxes can be imposed. We can impose a tax on wage income in each period, exempting all interest, dividends, and other returns on capital. Or we can tax consumption in each period, which can be calculated by having the individual report her total income minus total savings.

<sup>6</sup> If there are bequests and inheritances, a wage-plus-inheritance tax is equivalent to a consumption-plus-bequest tax. These equivalency relations require a perfect capital market but are true even if there is risk. See A. B. Atkinson and J. E. Stiglitz, *Lectures on Public Economics* (New York: McGraw-Hill, 1980), Lecture 3.



**FIGURE 18.10** Comparing the Effects of a Consumption Tax and Wage Tax A consumption tax and a wage tax have exactly the same effect on the individual's budget constraint.

**EQUIVALENCE OF  
LIFETIME  
CONSUMPTION AND  
LIFETIME INCOME  
TAXES**

This analysis has one other important interpretation. Continuing with our example in which the life of an individual is divided into two periods, we can write the budget constraint<sup>7</sup> as:

$$C_1 + \frac{C_2}{1+r} = w_1 + \frac{w_2}{1+r}.$$

<sup>7</sup> This can be seen in a slightly different way. An individual's savings (borrowings) are the difference between wages and consumption in the first period:

$$w_1 - C_1.$$

Consumption in the second period is thus second-period wage income plus the savings with its interest (minus borrowings, with interest):

$$C_2 = w_2 + (1+r)(w_1 - C_1).$$

Rearranging terms, we have

$$C_1(1+r) + C_2 = (1+r)w_1 + w_2.$$

Dividing by  $(1+r)$  we obtain the budget constraint in the form presented in the text.

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## EQUIVALENT TAXES

Two sets of taxes are equivalent if their incidence is exactly the same. Income taxes and value-added taxes (without exemption for investment) are equivalent.

Consumption taxes and value-added taxes with an exemption for investment are equivalent.

Consumption and wage taxes are equivalent.

Lifetime income and consumption taxes (in the absence of bequests and inheritances) are equivalent.

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The left-hand side of the equation is the present discounted value of the individual's consumption, and the right-hand side is the present discounted value of wage income. In the absence of bequests and inheritances, the present discounted value of consumption must equal the present discounted value of (wage) income. Thus, a lifetime consumption tax and a tax based on lifetime income are equivalent, as we saw in Chapter 17.

### **A CAVEAT ON EQUIVALENCE**

The fact that two taxes are equivalent does not mean that there are no effects when one tax is switched to the other (or from some third tax to either of the two). Equivalence only means that the two taxes have exactly the same effects in the long run; in the short run—including the transition period as the tax is adopted—the effects may differ markedly. Take, for example, a switch from a lifetime income tax to a lifetime consumption tax. Leaving aside the problems of transition, the result would be that the elderly would face double taxation: in their youth, they paid taxes on wages, in their retirement, they pay taxes on their consumption. Or say a value-added tax is imposed. In the short run, prices consumers face rise, and more of the burden of the tax in the short run may be shifted to consumers than if the same revenues were raised by an income tax.

### **OTHER FACTORS AFFECTING TAX INCIDENCE**

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So far we have shown that what determines who bears the burden of any tax is not who Congress says should bear it, but certain properties of demand and supply curves, and the nature of the market—whether it is competitive or monopolistic or oligopolistic.

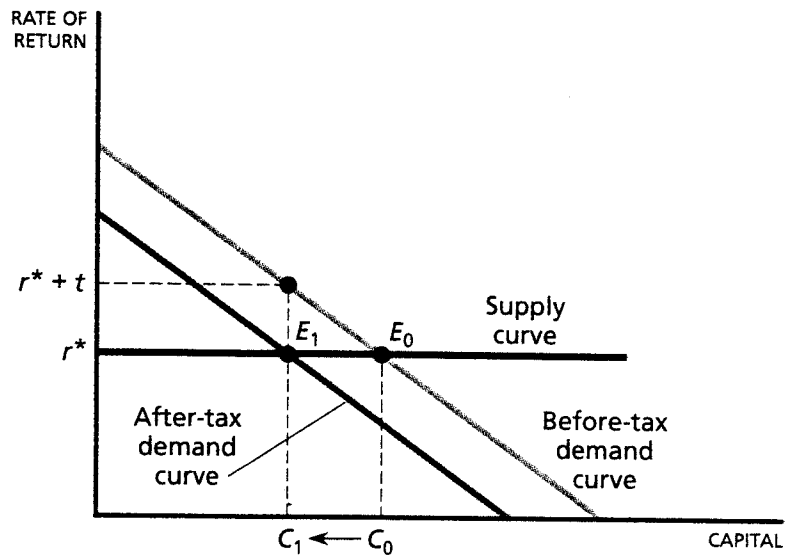
**TAX INCIDENCE UNDER  
PARTIAL AND  
GENERAL EQUILIBRIUM**

Several other important factors need to be taken into account in incidence analysis. First, there is an important distinction between a tax in a single industry and a tax affecting many industries. We considered above a tax on a small industry (beer). The presumption is that such a tax will not, for instance, have any significant effect on the wage rate. Though the reduction in the demand for beer will reduce the demand for labor in the beer industry, the assumption is that this industry is so small that workers released from their jobs can find employment elsewhere without any significant effect on the wage rate. We refer to this kind of analysis, where we assume that all prices and wages (other than those on which attention is explicitly focused) remain constant, as **partial equilibrium analysis**.

Unfortunately, many taxes affect many industries simultaneously. The corporate income tax affects all incorporated businesses. If, as a result of the tax, incorporated businesses reduce their demand for capital, the capital released cannot be absorbed by the rest of the economy (the unincorporated sector) without reducing the return to capital there. Thus, we cannot assume that what the corporate sector must pay to obtain capital is independent of the tax imposed on that sector. To analyze the impact of the corporation tax requires analyzing its effect on the equilibrium of the entire economy, not just the businesses on which the tax is imposed. Such an analysis is called a **general equilibrium analysis**. There are many instances where the general equilibrium impact of a tax may be markedly different from the partial equilibrium effect. For instance, if capital can be shifted relatively easily from the incorporated to the unincorporated sectors of the economy, the tax on corporate capital must be borne equally by capital in *both* sectors of the economy; they both must have the same after-tax return.

The overall incidence of the corporation income tax, like the tax on any factor, depends on the elasticity of demand and supply curves. While we will postpone until Chapter 23 a fuller discussion of the incidence of the corporation income tax, we can see why the general equilibrium impact may be markedly different from the apparent effect by considering the limiting case where the supply curve of capital is perfectly elastic. Savers insist on a return  $r^*$ , as depicted in Figure 18.11. Below  $r^*$ , they supply no capital; at  $r^*$ , they are willing to supply an arbitrarily large amount. That means that the *after-tax* return to capital—in both the corporate and the unincorporated sector—must be  $r^*$ , so the before-tax return in the corporate sector must be  $r^* + t$ . The tax simply raises the before-tax cost of capital in the corporate sector. This has two effects. First, it raises the price of the products produced in the corporate sector, reducing demand for them; demand is shifted to the unincorporated sector. And second, within the corporate sector, firms use more labor and less capital. In general, some of the tax is shifted to workers and some is shifted forward to consumers of the goods the corporate sector produces. But the magnitude of the effect on, say, workers, depends on, for instance, how easily firms in the corporate sector can substitute labor for capital and on the relative labor intensity of goods in the unincorporated and corporate sectors. If firms in the corporate sector can easily substitute labor for the more costly capital, and if goods in the

OTHER FACTORS AFFECTING  
TAX INCIDENCE



**FIGURE 18.11** Incidence of Tax on the Return to Capital in the Corporate Sector With an infinite elasticity of supply of capital, providers of funds must obtain the same after-tax return as they did before the tax was imposed. The tax is fully shifted.

unincorporated sector are relatively labor intensive, then the general equilibrium effects may lead to an overall increase in the demand for labor, so that wages actually increase, if labor is inelastically supplied. In that case, the burden of the corporate income tax lies on consumers of the goods produced by the corporate sector. Workers and owners of capital may both be adversely affected by the price increase, but the *relative* impact may depend as much on consumption patterns as on anything else. If owners of capital largely consume services produced by the unincorporated sector, while workers consume more manufactured goods, then more of the burden of the tax may be borne by workers.

Three important points emerge from this analysis:

- 1 Corporations don't bear taxes, people do: shareholders, workers, consumers.
- 2 Because of general equilibrium responses, the impacts of corporation taxes are felt not just in the corporate sector, but throughout the economy.
- 3 The effects may vary depending on the period of analysis and on various assumptions about the structure of the economy. Can we assume that the overall stock of capital is fixed, or that capital can be shifted from one use to another with some degree of ease or difficulty? Can labor be easily substituted for capital? Can labor and capital move from one sector of the economy to another? The answers to such questions are critical to determining the effects of the tax.

## **SHORT-RUN VERSUS LONG-RUN EFFECTS**

A distinction must also be made between the incidence of the tax in the long run and in the short run. Many things are fixed in the short run that in the long run can vary. While capital presently being used in one industry (like steel) cannot easily be shifted for use into another, in the long run new investment can be shifted to other industries. Thus a tax on the return to capital in the steel industry may have markedly different effects in the long run than in the short run.

If savings are taxed, the short-run effect may be minimal. But in the long run, the tax may discourage savings, and this may reduce the capital stock. The reduction in the capital stock will reduce the demand for (and productivity of) labor, and this in turn will lead to a lowering of wages. As a result, the *long-run incidence* of a tax on savings (or capital) may be on workers, even if the *short-run incidence* is not.

The short run may differ from the long run also because of dynamics of adjustment. For instance, even in fairly competitive markets, firms frequently set prices initially by certain rules of thumb, which entail a given markup over variable costs. The long-run equilibrium in these industries has the markup adjust to the competitive level. In the short run, the market may be out of equilibrium.

The distinction between short-run and long-run effects is important, because governments and politicians are often shortsighted. They observe the immediate effect of a tax without realizing that the full consequences may not be those that they intended.

There are a number of factors which affect the disparity between the short-run and long-run effects, and between the partial and general equilibrium effects.

## **OPEN VERSUS CLOSED ECONOMY**

One of the most important is whether the economy is closed (does not trade with other countries) or open. If a small, open country like Switzerland imposed a tax on capital, the before-tax rate of return would have to adjust fully to offset the tax (or else investors would withdraw their funds from Switzerland and invest elsewhere); the tax would be borne by land and labor. Effectively, the supply schedule for capital is infinitely elastic. The same analysis applies, of course, to any state within the United States.

## **ASSOCIATED POLICY CHANGES**

The final aspect of incidence analysis that needs to be discussed here is that it is almost never possible for the government to change only one policy at a time. There is a basic government budget constraint, which says that tax revenues plus the increase in the size of the deficit (increased borrowing) must equal government expenditures. If the government raises some tax rate, it must either lower another, reduce its borrowing, or increase its expenditure. Different combinations of policies will have different effects. We cannot simply ask the question, what would happen if the government increased income taxes? We need to specify whether the income tax is to be accompanied by a reduction in some other tax, by an increase in government expenditure, or by a reduction in government borrowing. (Often the accompanying change is taken to be

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## FACTORS AFFECTING INCIDENCE

Time span: short run versus long run

- Demand and supply curves are likely to be more elastic in the long run than in the short run.

Open versus closed economy

- Supply curves of factors are more elastic in an open economy.

Mix of policy changes

- Differential tax analysis: one tax is substituted for another, keeping revenue constant.
  - Balanced budget analysis: expenditure is changed as tax revenues change.
  - Balanced growth analysis: a mix of policies which leaves capital accumulation unaffected.
- 

understood but not made explicit; e.g., if taxes are raised, there will be a smaller deficit.)

We call the analysis of a tax increase accompanied by a decrease in some other tax **differential tax incidence analysis**; we call the analysis of a tax increase accompanied by an increase in government expenditure a **balanced budget tax incidence analysis**. Such exercises have become particularly relevant in recent years as budgetary processes in the United States have been reformed in an attempt to control the deficit. Under what are called PAYGO rules, any increase in expenditure has to be matched by a decrease somewhere else, or by a new source of tax revenue.<sup>8</sup>

Sometimes we are interested in analyzing combinations of policies that leave some important economic variable unchanged. For example, a tax increase may lead to a reduction in output. We may want to distinguish the effects of a tax program on the level of output (and the effects that this

<sup>8</sup> Much of the focus on balanced budget incidence relates to macroeconomic consequences. Lower taxes or increased expenditures lead to higher levels of aggregate demand, unless offset by tighter monetary policy. Today, most analyses of tax and expenditure incidence assume that the monetary authorities will take offsetting actions to maintain the economy at full employment. These offsetting actions have, of course, distribution and other general equilibrium effects. Thus, a full analysis of the incidence of any set of tax or expenditure policies needs to take into account the consequences of the offsetting actions of the monetary authorities.

may have, say, on its distribution) from the direct effects of the tax itself; thus we may look at combinations of policies that leave the level of national output unaffected.

Similarly, many taxes have an effect on the level of capital accumulation. The fall in the capital stock in turn may lower wages. Again, one may want to distinguish the direct from the indirect effects of a tax resulting from its impact on capital accumulation. This is particularly the case if one believes that other instruments can be used to offset these indirect effects. If an inheritance tax reduces capital accumulation, for example, it may be possible to undo the effects by providing an investment tax credit. We may examine a set of policies whose effect is to leave capital accumulation unaffected; incidence analysis of this sort is called **balanced growth incidence analysis**.

## **INCIDENCE OF TAXES IN THE UNITED STATES**

In this chapter, we have explained why the actual burden of taxes does not necessarily fall upon those upon whom the tax is imposed. Officially, the United States, like most advanced countries, has a **progressive** tax system, one in which the rich are supposed to pay a higher proportion of their income in taxes than the poor. The income tax imposes a 40 percent tax rate on the rich, while poor families receive as much as a 40 percent subsidy (through the earned income tax credit). But there is a general consensus that, overall, the U.S. tax system is far less progressive than the official tax code might suggest. (A tax system is said to be **regressive** if the poor pay a higher percentage of their income in taxes than do the rich.)<sup>9</sup>

There are three reasons for this view. First, the income tax itself is less progressive than appears, because it has certain specific design features which allow certain types of income or categories of individuals at least partially to escape taxation. For instance, capital gains are taxed at lower rates than other forms of income, and there are a variety of special provisions, discussed later, which lower the **effective rate** even more. Individuals can put away savings into tax-exempt accounts, and richer individuals tend to avail themselves of this opportunity more than poor individuals. There may be, as we shall see, good reasons for these and other provisions of the tax code, but their net effect is to reduce the progressivity of the tax system.

<sup>9</sup> The discussion below considers progressivity in terms of the ratio of annual taxes to annual income. A more appropriate measure would be lifetime taxes relative to lifetime income or consumption. The distinction is important. Changes in tax policy that may look regressive in the annual measure may not be so in terms of the more fundamental measure, as we shall see in later chapters.

Second, the income tax itself is only one of several taxes; many of the other taxes, such as state and local sales taxes<sup>10</sup> and the payroll tax, are less progressive, or even regressive.<sup>11</sup>

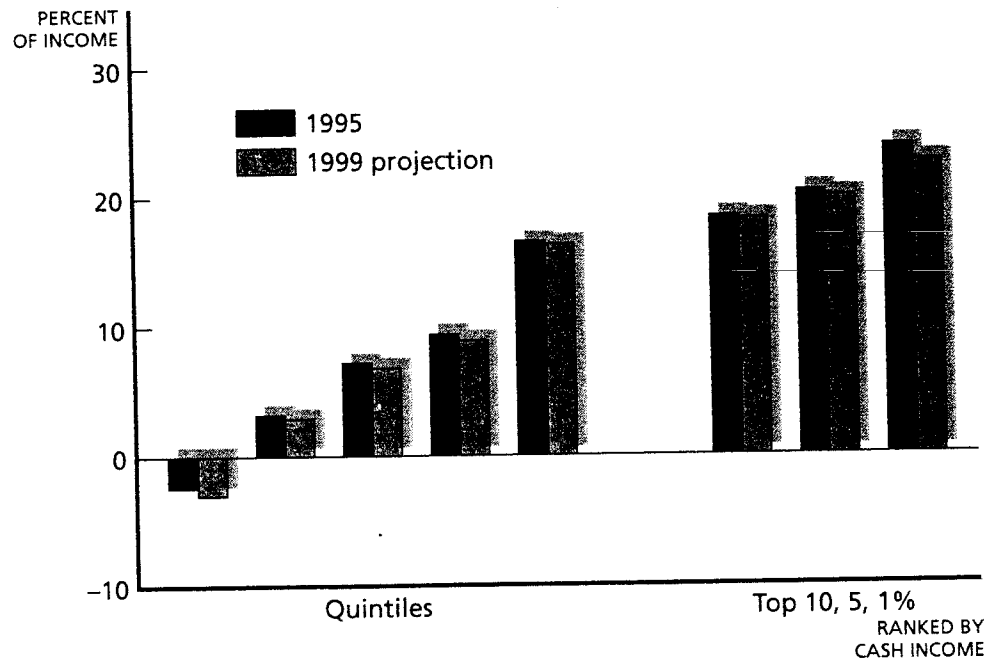
Third, the incidence of many taxes differs from those upon whom the tax is legislated; workers often bear the effect of taxes which are “intended” for others. As noted previously, there is a general consensus among economists that workers, not employers, bear the full burden of the employer share of the social security tax. There is also a general consensus that much of the corporation income tax is shifted, though there is disagreement both about the extent, and to whom it is shifted. As world capital markets have become more integrated, it becomes more likely that the tax is not borne by capital. Whether it is shifted forward to consumers or back to workers is less apparent; but in either case, its impact is less progressive than it would be if it were borne by the owners of corporations.

Precise estimates of the overall burden of the federal tax system clearly depend on assumptions concerning who bears the burden of various taxes, such as social security payroll taxes and the corporation income tax. Figure 18.12 looks at the effective federal individual income tax rates, while Figure 18.13 looks at the effective tax rates including all federal taxes, assuming that workers bear the full burden of payroll taxes (including those supposedly paid by employers) but that the corporation tax falls half on owners of capital, half on consumers. What is remarkable is that while the overall tax rates are clearly higher, the pattern is strikingly similar, with differences in tax rates from quintile to quintile being roughly comparable.

There is a high degree of progressivity at the bottom—the poorest 20 percent of the population paying approximately 8 percent of their income in taxes, half that of the next quintile. On the other hand, at the very top, progressivity is limited, with the top 1 percent paying only a few percentage points more in taxes than those in the top 10 percent. The data probably overstate the overall degree of progressivity of the U.S. tax system, since, as already noted, state and local taxes tend to be less progressive than federal taxes. Also, since only realized capital gains are included in income, the unrealized capital gains—which have been huge in recent years as a result of

<sup>10</sup> State and local sales taxes tend to be at fixed rates, but they are levied only on the purchases of certain goods. The fraction of income spent on those goods tends to be lower for richer individuals than for poor; in states where food is exempt, it is the middle-income individuals who pay the highest percentage of their income.

<sup>11</sup> The payroll tax is a fixed percentage of wage income, up to a cap. Thus, higher-wage individuals pay a tax on only a portion of their wage income; and since wealthier individuals, on average, derive a smaller fraction of their income from wages, payroll taxes are an even smaller percentage of total income for richer individuals. Interpreting whether the social security system is, as a result, regressive is, however, far more controversial, for we need to take into account not only the contributions, but also the benefits. Historically, as we saw in Chapter 14, richer individuals have gotten back far more in excess of what they contributed than did poorer individuals, but today, there is a close correspondence between contributions and payments, except for the poor, who receive back more than they contribute.

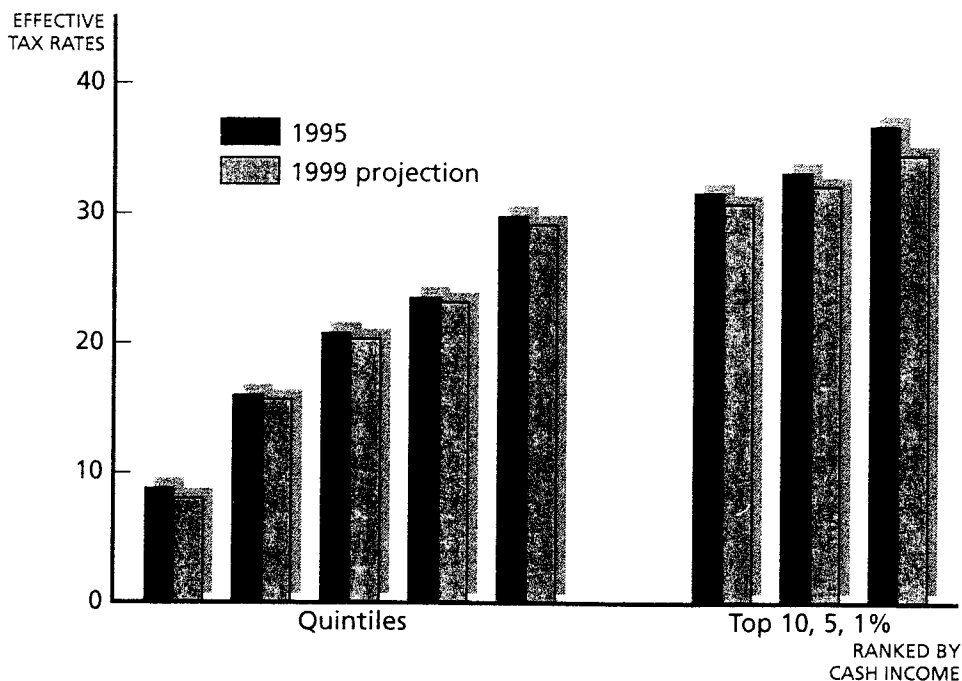


**FIGURE 18.12** **Progressivity of Federal Individual Income Tax** Effective tax rates on the individual income tax (the ratio of tax payments to incomes) were far lower than the legislated rates, as a result of a variety of special provisions. Still, the tax schedule exhibited considerable progressivity.

the large increase in the value of the stock market and other assets—are not included. To include them would result in a lower effective tax rate among the richest Americans. The 1997 tax law, by providing still further special treatment of capital gains, reduced the progressivity of the tax system, undoing some of the increase in progressivity that was introduced in 1993, when marginal tax rates on upper-income individuals were raised from 28 percent to close to 40 percent. (Taken together, the 1993 and 1997 changes shifted the burden of taxation *among* high-income individuals, increasing the effective tax rates of those who received high salaries, and lowering the effective tax rates of those deriving income from, say, real estate speculation.)<sup>12</sup>

<sup>12</sup> The increased flows of international capital suggest that more of the burden of the corporate income tax may be borne by consumers and less by capital than is reflected in the figure. In that case, the overall degree of progressivity is less than depicted.

Since benefits are roughly commensurate with social security contributions, the *net* tax imposed by the social security system is only associated with its redistributions. Lower-income individuals receive somewhat more than they contribute, and higher-income individuals receive somewhat less. Figure 18.13 only looks at payroll taxes, not benefits.



**FIGURE 18.13** **Progressivity of Federal Tax Structure** When all taxes are included, effective tax rates are higher, and remain progressive.

The issue of incidence has played a major role in recent tax reforms. With each proposal, tables have been drawn up showing how effective tax rates would change. Since politicians find it hard to defend tax cuts for the very rich, a great deal of effort goes into trying to find alternative ways of characterizing the impact of a tax change. For instance, advocates of cutting capital gains tax rates—the main beneficiaries of which are the very rich—argue that such cuts will induce these individuals to sell more of their assets; and since capital gains are only taxed when the asset is sold, at least initially tax collections from the rich will go up—even if in the long run tax collections go down. Thus, advocates of capital gains tax cuts for upper-income individuals focused not on the cut in tax rates, but on the increases in tax payments in the initial years. More generally, controversies over incidence—for instance, over who really pays taxes such as the corporation income tax—play a key role in debates over whether particular reforms increase or decrease the progressivity of the tax system. At issue are matters of both theory and empirical analysis, and the impacts often depend on detailed provisions of the tax code. The following chapters of this book will elucidate many of the key issues in these debates.

# REVIEW AND PRACTICE

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## SUMMARY

- 1 It makes no difference whether a tax is imposed on the suppliers of a factor or commodity or on the consumers. Instead, who bears the burden of the tax depends on the demand and supply elasticities, and on whether the market is competitive or noncompetitive. Taxes induce changes in relative prices, and it is this market response that determines who bears the tax.
- 2 In a competitive market, if the supply is completely inelastic or if demand is completely elastic, the tax is borne by producers. If the supply is completely elastic or demand is completely inelastic, the tax is entirely borne by consumers.
- 3 A tax on a monopolist may be shifted more than 100 percent—that is, the price paid by consumers may rise by more than the tax.
- 4 The general equilibrium incidence of a tax, taking into account repercussions in all industries, may differ from the partial equilibrium incidence. The incidence of a tax may be different in the long run than in the short run.
- 5 It is almost never possible for the government to change one policy at a time. Differential tax incidence focuses on how substituting one tax for another will affect the distribution of the tax burden.
- 6 A tax on output (a uniform sales tax), a proportional income tax, and a uniform value-added tax are all equivalent. A uniform tax on wages and a uniform tax on consumption are equivalent.
- 7 Empirical studies of who bears the burden of the set of taxes imposed in the United States show that the degree of progressivity of the tax structure depends on assumptions concerning the incidence of taxes on corporation and on payrolls. The current United States tax structure has some progressivity, though less than appears “on paper.”

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## KEY CONCEPTS

Burden	Marginal revenue
Tax incidence	Oligopoly
Shifting backward	Partial equilibrium analysis
Shifting forward	General equilibrium analysis
Equivalent taxes	Differential tax incidence analysis
Ad valorem tax	Balanced budget tax incidence analysis
Specific tax	Balanced growth incidence analysis
Elasticity of demand	Progressive
Elasticity of supply	Regressive
Marginal cost	Effective tax rate

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**QUESTIONS  
AND PROBLEMS**

- 1 Consider a mineral that is in fixed supply,  $Q^S = 4$ . The demand for the mineral is given by  $Q^D = 10 - 2p$ , where  $p$  is the price per pound, and  $Q^D$  is the quantity demanded. The government imposes a tax of \$2 per pound on the consumer,
  - a What is the price paid by the consumer before the tax is imposed, and in the post-tax equilibrium?
  - b What is the price received by producers?
  - c How much revenue is raised?
- 2 Consider a small town in which workers are highly mobile (i.e., they can be induced to leave the town if opportunities elsewhere improve slightly). What do you think the incidence of a tax on wages in that town would be, compared to the incidence in a town in which workers are immobile?
- 3 It is frequently asserted that taxes on cigarettes and beer are regressive, because poor individuals spend a larger fraction of their income on such items than do better-off individuals. How would your estimate of the degree of regressivity be affected if you thought these commodities were produced by: (a) competitive industries with inelastic supply schedules; (b) a monopoly with a linear demand schedule; (c) a monopoly facing a constant elasticity demand schedule?
- 4 It is often asserted that gasoline taxes used to finance highway construction and maintenance are fair because they make users of roads pay for them. Who do you think bears the burden of such taxes?
- 5 If you believed that a proportional consumption tax was the best tax, what are various ways in which you could levy it? Might there be differences in administrative costs associated with levying such a tax in different ways?
- 6 In what ways may the actual incidence of a government expenditure program differ from the legislated intent? Why might the effects be different in the short run than in the long run? Illustrate with examples drawn from Part Four of the book, or with a discussion of the effects of government farm programs. Similarly, discuss how the short-run and long-run effects of a regulatory program, such as rent control, may differ.

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**APPENDIX****COMPARISON OF THE EFFECTS OF AN AD VALOREM AND SPECIFIC COMMODITY TAX ON A MONOPOLIST**

Suppose the government imposes a tax on the output of a monopolist. We asserted in the text that an ad valorem tax (a tax based on a fixed percentage of the value of sales) would reduce output less than a specific tax (a fixed tax on each unit sold) for any given revenue raised by the government.

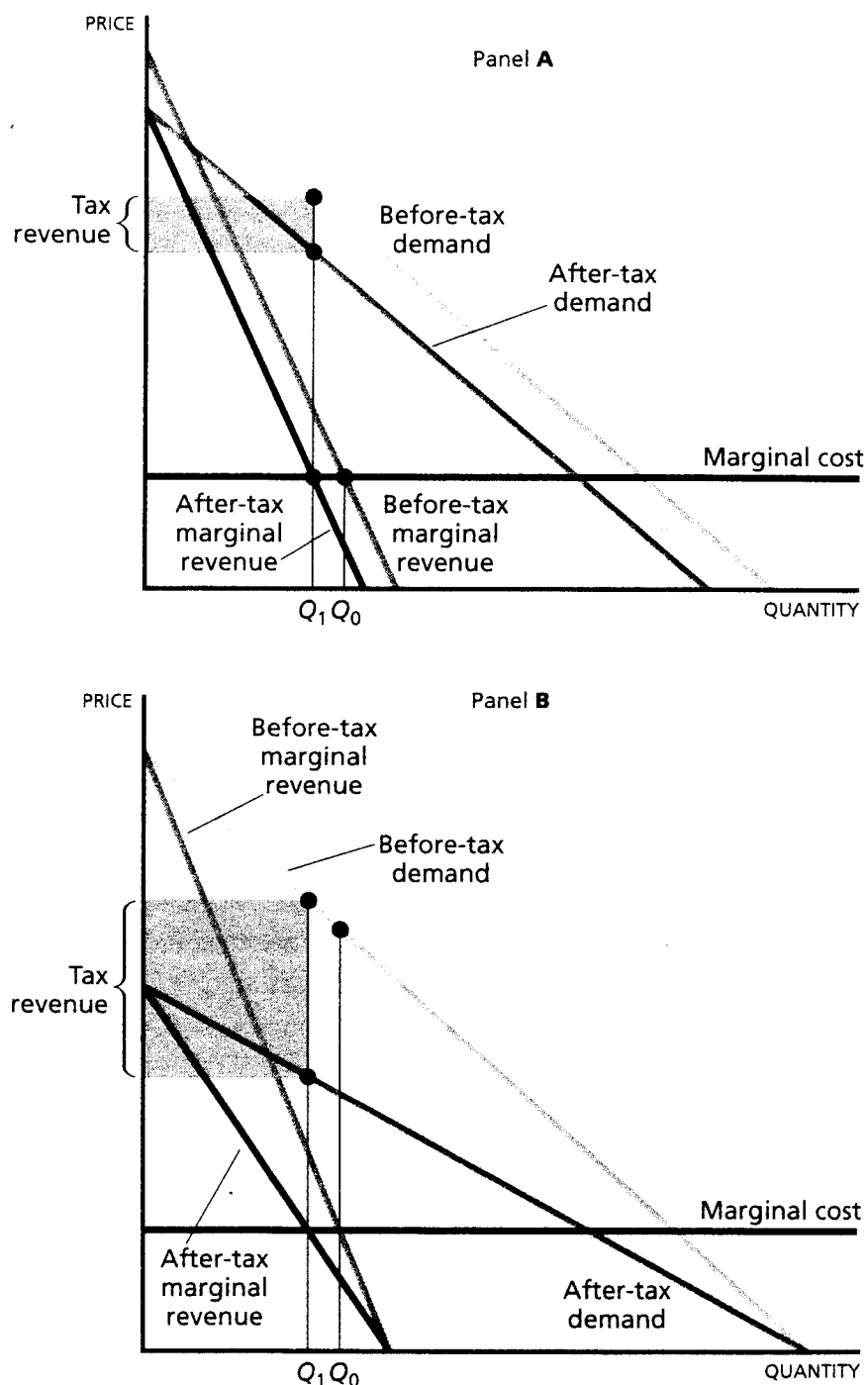
The reason is that the ad valorem tax reduces marginal revenues by less than the tax, while the specific tax reduces marginal revenues by exactly the amount of the tax. Since a monopolist sets marginal revenue equal to marginal cost, if marginal revenue is reduced by less, output is reduced by less.

We can see this diagrammatically in Figure 18.14. Panel A illustrates the effect of a specific commodity tax. Earlier, we represented the effects of such a tax by an increase in the marginal cost. Alternatively, we can represent the effects of this tax as a *decrease* in the price received by the firm at any given quantity sold, that is, as a downward shift in the demand schedule. Both the demand and marginal revenue schedules shift down by the magnitude of the tax,  $t$ .

With an ad valorem tax, if an individual pays a price  $p$  for a commodity the amount received by the producer is  $p(1 - \hat{t})$ , where  $\hat{t}$  represents the ad valorem tax rate. Thus the tax paid is a function of the market price. If the price were zero, there would be no tax paid, as we saw in the text. The effect of the tax is to rotate the demand curve as in panel B, rather than to shift it down uniformly as in panel A. The ad valorem tax at rate  $\hat{t}$  reduces revenue by a fixed percentage—to  $(1 - \hat{t})pQ$ —and therefore lowers marginal revenue by the same percentage, to  $(1 - \hat{t})MR_{bt}$ , that is to  $1 - \hat{t}$  times the before-tax level. The marginal revenue schedule too is rotated around the point where it intersects the horizontal axis.

The important point is that the marginal revenue is reduced by  $\hat{t} \times MR$  and since marginal revenue is less than the price, it is reduced by less than  $\hat{t} \times p$ , the tax revenue per unit of the product sold. By contrast, with the specific tax, marginal revenue is decreased by precisely the amount of the specific tax. Thus, for any given level of equilibrium output—for any given reduction in marginal revenue—the ad valorem tax raises more revenue, as shown in the figure; or equivalently, for any given tax revenue per unit ( $t = \hat{t} \times p$ ) output will be higher with an ad valorem tax and so price will be lower and total government revenue will be higher.

COMPARISON OF THE EFFECTS  
OF AN AD VALOREM AND  
SPECIFIC COMMODITY TAX  
ON A MONOPOLIST



**FIGURE 18.14** Comparing the Effects of a Specific Tax and an Ad Valorem Tax on a Monopolist (A) The effects of a specific commodity tax on a monopolist can be viewed either as a shift upward in the marginal cost schedule (as in the earlier diagrams) or, as here, a shift downward in the demand and marginal revenue schedules. (B) Analysis of the effects of an ad valorem tax on a monopolist. For any given level of output,  $Q_1$ , tax revenue is higher with an ad valorem tax than with a specific tax.