CHAPTER 10

Using the Competitive Model

The competitive model can be used to analyze a wide range of industries and the effects on them of government intervention. One example involves the manner in which taxicabs are licensed in many major city governments.

Chapter Outline

Learning Objectives

- Show how changes in market conditions or government policies affect the welfare of consumers, producers, and market participants as a whole.
- Analyze the effects of an excise tax on a specific good on the welfare of consumers, producers, and market participants as a whole.
- Detail how regulation of the U.S. airline industry affected fares, airline company profits, and service quality.
- Explain how the entry restrictions imposed by most major U.S. cities on taxis affects fares and the profits earned by licensed taxi owners.
- Understand the effects of international trade on consumer and producer surplus and why a net gain results to a country from either imports or exports.
- Explore how government-specified maximum quantities, or quotas, on sugar imports affect consumers, domestic producers, and the net welfare of the United States as well as other countries that produce sugar.

This chapter builds on the theory established in the previous chapter to show how the competitive model can be used to analyze particular industries and the effects on them of government intervention. The examples we will explore include gasoline taxes, airline regulation, taxicab licensing, and import quotas. The broad range of applications should illustrate the usefulness of the perfectly competitive model. The applications themselves will also indicate that while government intervention may be justified on the grounds of helping people, the effects of such intervention may end up being precisely counter to the objectives of the proponents of the intervention.

10.1 THE EVALUATION OF GAINS AND LOSSES

Changes in market conditions or government policies always result in either gains or losses for participants in the market. For example, rent controls (that have been used in many cities) often benefit at least some tenants at the expense of landlords. But how large is the benefit to tenants and how large is the cost to landlords? In total, do the benefits outweigh the losses, or is the reverse true? To answer questions like these, we need a way to measure the gains and losses felt by market participants. In this section we will explain how we can use the concepts of consumer surplus and producer surplus to measure such gains and losses.

CONSUMER SURPLUS a measure of the net gain to a consumer or group of consumers from purchasing a good arising from cost being below the maximum that consumers are willing to pay

PRODUCER SURPLUS gains to producers from the sale of output to consumers, arising from price exceeding the minimum necessary to compensate the seller

We have already explained the concept of consumer surplus. Recall that **consumer surplus** is a measure of the net gain to a consumer (or group of consumers) from purchasing a good. (You may wish to review how it is shown by areas under the demand curve; see Section 4.5.) The concept of producer surplus is an analogous measure of the net gain to those involved in producing and selling a good. Because this is a new concept, we will begin by explaining how it is related to the competitive supply curve.

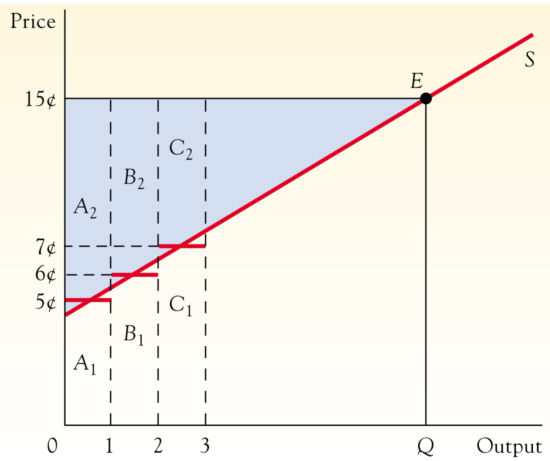
Producer Surplus

Producers of goods often secure gains, called **producer surplus**, from the sale of output to consumers. The gain results because the price often exceeds the minimum amount that would be necessary to compensate the seller. To see how we can show the producer surplus in a competitive market, consider the long-run supply of sugar curve *S* in Figure 10.1. Assume that the sugar industry is at point *E* on the supply curve, output is *Q*, and sugar is being

FIGURE 10.1

Producer Surplus

Producer surplus is a measure of the net gain to producers from operating in a given market, and is shown as the area between the price line and the supply curve. It can be thought of as the sum of rectangles like A_2, B_2, and C_2, each of which is the net gain associated with the sale of a particular unit.



sold at a price of 15 cents per pound. What we will show is that the shaded triangular area is a measure of the net gain to sugar suppliers.

To explain this point, we begin by assuming that the industry takes a very simple form. Assume that each firm consists of only one person (the owner-manager-worker) who can produce only one unit of output. (We will drop this assumption later.) Now, consider the derivation of the supply curve, starting with an output of zero. At a price lower than 5 cents, no firm produces sugar—all potential firms can do better employing their resources elsewhere. At a price of 5 cents, firm A enters the market and produces one unit. At that price, firm A is just barely induced into this market, and so it makes no net gain from operating in this industry. If the price is 6 cents, however, firm B enters the market and produces one unit (so total output is two units). Firm B could have earned 6 cents elsewhere and so secures no net gain if the market price remains at 6 cents. Other firms enter the market at higher prices; in this way we trace out the industry supply curve as a step-like relationship.

Now consider the situation when the market price is 15 cents. At that price, firms A, B, C, and several more are selling one unit each at a price of 15 cents. How much does each firm benefit from selling in this market? Firm A would have been willing to sell one unit for a minimum of 5 cents; this is shown as rectangular area A_1. However, firm A sells the unit for 15 cents, shown as the rectangular area A_1 plus A_2, so it receives a net benefit of 10 cents—shown as area A_2. Area A_2 is the producer surplus realized by firm A. By similar reasoning, firm B receives a net benefit, or producer surplus, of area B_2 (9 cents) because its revenues are 15 cents and it would have been willing to sell for 6 cents. The net gain for each firm is therefore shown as a rectangular area like A_2, B_2, C_2, and so on. The sum of all these areas for the firms operating in the market is the total producer surplus realized by all the firms. Of course, if we assume more realistically that one unit of output is small relative to total output Q, so the rectangles become much narrower, then the supply curve approaches the smooth curve S. In that case, the total producer surplus is shown as the shaded area between the supply curve and the price line.

When we drop the assumption of one-person firms and consider the general case of a competitive industry, the triangular area shown continues to represent the total producer surplus. Now, however, we have to reconsider exactly who gets this surplus. Recall that economic profits are zero at every point on a long-run supply curve; producer surplus is not the same as economic profit. Indeed, owners of the firms may not receive any producer surplus at all. Producer surplus is the total net gain that goes to *anyone* involved in producing the good, and that includes the suppliers of inputs to the industry. To see what this implies, suppose that the sugar industry has an upward-sloping supply curve of labor, but a horizontal supply curve of every other input used to produce sugar. In this case, the sugar industry supply curve will be upward-sloping, as in Figure 10.1, because the wage rate will rise as the industry expands and employs more workers. What is producer surplus here? It is the net gain to the workers who would have been willing to work at the lower wage rates (when the industry output was smaller), but who are now receiving wage rates higher than the minimum necessary to induce them to work in the sugar industry. This total net gain will be shown by the shaded triangular area above the product supply curve for this market. No other input owners receive any producer surplus in this situation; only the workers.

Thus, the area between the product supply curve and the price line identifies the total producer surplus that accrues to *someone* engaged in the production of the good. Even though this area identifies the total net gain to "producers," we cannot tell from the supply curve alone exactly who receives this benefit. In general, producer surplus will accrue to some of the owners of inputs that have upward-sloping supply curves to the industry. Owners of inputs with horizontal supply curves to the industry receive no producer surplus. (Note that this conclusion implies there is no aggregate producer surplus for a constant-cost competitive industry when it is in long-run equilibrium.)

APPLICATION 10.1 THE ALLOCATION OF PRODUCER SURPLUS IN TRUCKING

From 1935 to 1975, federal regulation of interstate trucking included rate setting and strict controls on new entry into the industry. The regulation raised rates above competitive levels and generated producer surplus for regulated firms.

Based on a study of workers' wages following the deregulation of interstate trucking in the late 1970s, it appears that unionized workers, represented by the powerful Teamsters Union, captured at least two-thirds of the producer surplus created by the regulation.[1] According to the study, deregulation resulted in annual losses of around $1.7 billion for the Teamsters ($6,729 in 2002 dollars per Teamsters driver). The remaining one-third of the producer surplus generated by federal regulation of interstate trucking appears to have accrued to the owners of interstate trucking firms.

[1]Nancy L. Rose, "Labor Rent Sharing and Regulation: Evidence from the Trucking Industry," *Journal of Political Economy*, 95 No. 6 (December 1987), pp. 1146–1178.

Consumer Surplus, Producer Surplus, and Efficient Output

In general, consumers and producers benefit from participation in a competitive market, and the size of that benefit is measured by their consumer surplus and producer surplus as seen in Figure 10.2a. The competitive equilibrium is at an output of Q and a price of $5. The net gain to consumers is shown as the shaded triangular area A between their demand curve and the price line. Similarly, the net gain to producers is shown as the shaded triangular area B above the supply curve up to the price line. The total net gain to those who participate in this market is therefore the sum of consumer surplus and producer surplus—area A plus area B. The sum of producer and consumer surplus is called the **total surplus**.

TOTAL SURPLUS the sum of producer and consumer surplus

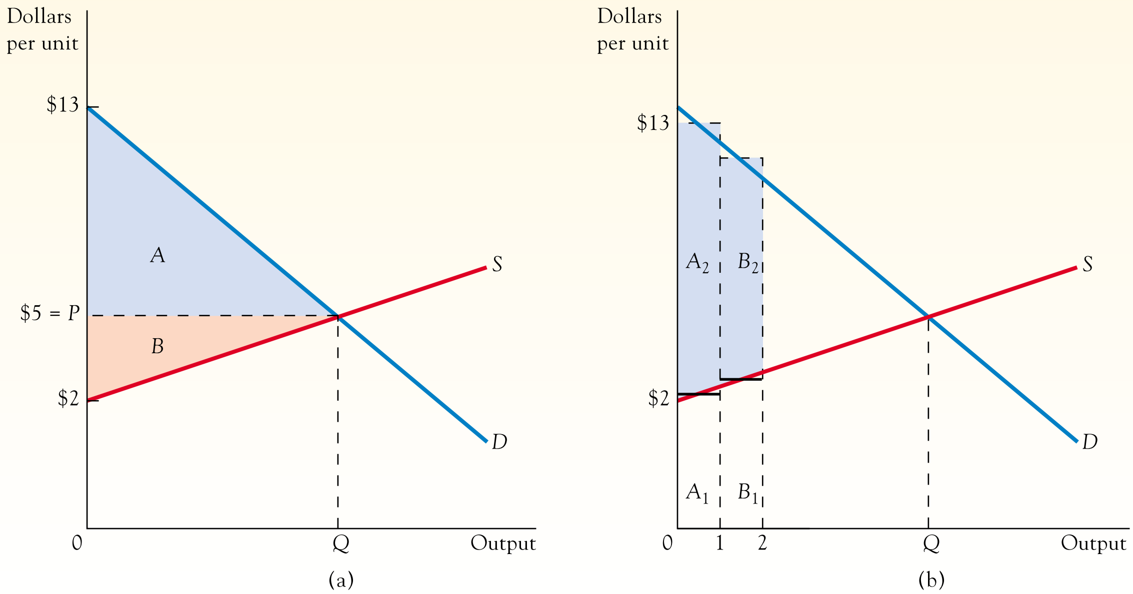
The total surplus, area A plus B in Figure 10.2a, is a measure of the aggregate net gain that is realized by participants in this market. Because it is the sum of the way the market affects the well-being of everyone participating in it, total surplus is often used as a measure of how well the market functions relative to its potential. The amount of total surplus will often be changed by government policies or by changes in market structure (e.g., if the market becomes monopolized). The change in total surplus in such cases is often taken as a measure of the gain or loss in well-being to market participants.

There is an alternative way to see that the sum of areas A and B in Figure 10.2a is equal to total surplus. This is illustrated in Figure 10.2b. The equilibrium quantity is once again Q. To identify the total surplus, we consider the net gain associated with each unit of output from zero to Q. It is important to recall that the height of the demand curve can be interpreted as showing the marginal benefit of the good and the height of the supply curve can be interpreted as showing the marginal cost. Now consider the production of one unit. For the moment, we will think of the demand and supply curves as discrete, step-like relationships. The first unit received by consumers has a marginal benefit of $13, the sum of rectangular areas A_1 and A_2. Producers must be compensated by a minimum of $2; the marginal cost of the first unit is $2, shown as area A_1. The marginal benefit of the first unit is $11 greater than its marginal cost; there is a net gain associated with the first unit of $11, shown as area A_2, the difference between the marginal benefit of that unit and its marginal cost. The net gain is, of course, the total surplus associated with the first unit of output. Note, however, that this procedure does not identify who receives this surplus—producers or consumers.

Similarly, we see that there is a net gain from the second unit of output of area B_2, equal to the excess of marginal benefit over marginal cost for that unit. The sum of areas A_2 and

FIGURE 10.2

Competition Maximizes Total Surplus
(a) Consumer surplus equals area *A* and producer surplus equals area *B*; total surplus is the sum of consumer and producer surplus. (b) Total surplus can be thought of as the sum of the net gains (excess of marginal benefit over marginal cost) associated with the production of each unit of output from zero to *Q*.



B_2 is the total surplus when two units are produced. By identifying the rectangular areas of net gain of each unit from zero to the quantity actually produced and summing the net gains over all units, we can determine the total surplus for quantity *Q*. When we let units of output become small relative to total output, the rectangles become narrower, and the demand and supply curves become the smooth curves shown as *S* and *D*. Then the sum of the net gains, the total surplus, will be shown as the shaded area in Figure 10.2b. Note that the total surplus arrived at by this reasoning is the same as that shown as the sum of consumer and producer surplus in Figure 10.2a.

We have explained two different ways of identifying the total surplus associated with the functioning of a market. The first way, illustrated in Figure 10.2a, involves determining the surpluses realized by producers and consumers separately and then adding them together. This approach has the advantage of showing how the overall net gain is distributed between consumers and producers (but recall it doesn't identify which producers benefit). The second way, illustrated in Figure 10.2b, involves determining the total surplus associated with each unit of output and summing over all units of output. It has the advantage of often being an easier procedure to use (as we will see later), but the disadvantage of not identifying the distribution of the net gain between producers and consumers.

EFFICIENCY IN OUTPUT
the condition in which output is expanded to the point where marginal benefit equals marginal cost

Figure 10.2b shows why the equilibrium output of a competitive industry is also the efficient level of output. **Efficiency in output** requires that output be expanded to the point where the marginal benefit equals marginal cost. To say that the output level is efficient, moreover, is the same thing as saying that the net gain, or total surplus, from producing the good is as large as possible. Let's check to see if that is the case when output is *Q* in Figure

10.2b. If output is expanded beyond Q, then the marginal benefit of additional units will be less than their marginal cost, so the net gain of these units is negative—that is, there is a net loss in total surplus associated with production beyond Q. Thus, the total surplus will be smaller than at output Q; it will be the shaded area minus the net loss on units in excess of Q. Any expansion of output beyond Q will therefore reduce the total surplus. Similarly, if output is less than Q, the total surplus will also be smaller than the shaded area. For example, if output is 2, the total surplus is the area between the demand and supply curves up to an output of 2 (roughly, the sum of rectangular areas A_2 and B_2), which is clearly smaller than the shaded area. Thus, an output of Q will maximize the total surplus, or net gain, of participants in the market. A competitive market achieves this result.

The Deadweight Loss of a Price Ceiling

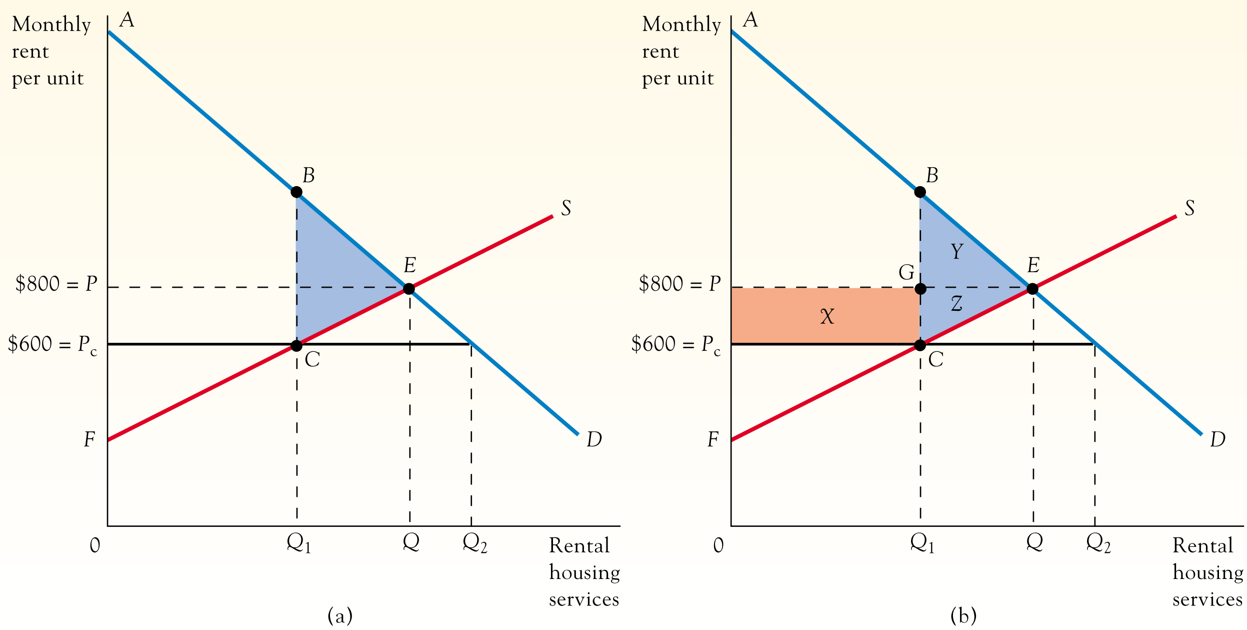
To illustrate the use of these measures of surplus, we will consider again a price ceiling applied to rental housing, a policy we first examined in Section 2.4. In Figure 10.3a, the initial equilibrium involves a monthly price of $800 and a quantity of Q. The government then mandates a maximum price of $600. At that price, suppliers reduce output to Q_1, but consumers would like to purchase an amount of Q_2; the difference is the excess demand, or shortage, caused by the price ceiling.

How does the price ceiling affect the total surplus realized in this market? As we explained, there are different ways of evaluating total surplus and changes in it. The easiest

FIGURE 10.3

A Price Ceiling Reduces Total Surplus

(a) The price ceiling of P_C results in output of Q_1; there is a deadweight loss associated with producing less than the competitive output that is shown as area *BEC*. (b) The price ceiling results in a gain in consumer surplus shown by area *X* minus area *Y*, and a loss in producer surplus shown by area *X* plus area *Z*. Total surplus falls by the sum of the changes in consumer and producer surplus, area *Y* plus area *Z*.



DEADWEIGHT LOSS also called welfare cost, a measure of the aggregate loss in well-being of participants in a market resulting from an inefficient output level

way, based on the Figure 10.2b approach, is to evaluate total surplus without regard to its distribution between producers and consumers. Thus, in Figure 10.3a, total surplus before the price ceiling was area *AEF*, but after the price ceiling, when only Q_1 units are actually produced, total surplus is area *ABCF*, the sum of the net gains on each unit from zero to Q_1.[2] Total surplus is therefore smaller under the price ceiling; the decrease in the size of total surplus is the area *BEC*. The loss in total surplus, area *BEC*, is the **deadweight loss** (also known as the welfare cost) of the price ceiling. As mentioned in Chapter 5, the deadweight loss is a measure of the aggregate loss in well-being of market participants. In this case, it is a measure of the loss due to production of an inefficient quantity of rental housing services.

Instead of comparing the total surplus with and without the price ceiling (for outputs Q and Q_1), we can arrive at the same conclusion by considering the change in total surplus caused by the reduction in output from Q to Q_1. Consider the units not produced (because of the price ceiling) between Q and Q_1. The marginal benefit of each of these units is shown by the height of the demand curve between Q and Q_1; similarly, the marginal cost is shown by the height of the supply curve. As you can see, each unit not produced has a marginal benefit greater than its marginal cost, so there is a net loss from not producing these units. The net loss is the difference between marginal benefit and marginal cost, and if these net losses are summed we arrive at area *BEC* as the aggregate net loss, or deadweight loss, of the price ceiling. (It may help if you think of the narrow rectangles, like area B_2 in Figure 10.2b, that make up the area *BEC* in Figure 10.3a.)

An alternative way to proceed, based on the approach used in Figure 10.2a, considers the effect on consumers and producers separately. This is illustrated in Figure 10.3b. Before the price ceiling, total consumer surplus was area *AEP*. After the price ceiling, when consumers are purchasing Q_1 units at a price of P_C, total consumer surplus is area $ABCP_C$, which is the sum of the net gain (marginal benefit less price) on each of the Q_1 units. Compared with the situation without the price ceiling, consumers have gained area X (rectangular area $PGCP_C$) and lost area Y (triangular area *BEG*). As drawn, area X is larger than area Y, so total consumer surplus has increased (by $X - Y$). Note that area X is the gain that consumers obtain from being able to purchase the Q_1 units at a lower price; the height of the rectangle is the reduction in price. But that is not the only way consumers are affected; they also end up consuming a lower quantity than before the price ceiling. Area Y is the consumer surplus they previously received on consumption from Q_1 to Q; they lose this net gain due to reduced production under the price ceiling. The net impact on consumer welfare depends on the size of these two separate effects.[3]

The effect on producers is easier to understand. Producer surplus before the price ceiling was area *PEF*. After the price ceiling, producer surplus is P_CCF. Thus, producer surplus falls by the sum of areas X and Z (the area of $PECP_C$). Producer surplus is unequivocally reduced by the price ceiling.

Because total surplus is the sum of consumer and producer surplus, we can determine the change in total surplus by summing the changes in consumer and producer surplus. In this case, the change in consumer surplus is $X - Y$, and the change in producer surplus is $-X - Z$ (where a minus sign indicates a loss in surplus). Thus, the sum of the changes in consumer and producer surplus is $-Y - Z$. Total surplus falls by the sum of areas Y and Z, so that

[2]This does assume that the smaller quantity is rationed among consumers in such a way that the consumers who place the highest value on the rental housing actually get it. This may not be the case in the absence of a higher (i.e., black market) price to ration the rental housing among consumers. Then the total surplus under the price ceiling will be smaller than area *ABCF*.

[3]Whether area X is larger than area Y depends on the height of the price ceiling and the elasticities of the demand and supply curves. As these curves are drawn in Figure 10.3b, area X is larger, but it is possible for area Y to be larger (for example, imagine a price ceiling set below the level *F0*).

triangular area *BEC* identifies the loss in total surplus, or the deadweight loss, due to the price ceiling. Note that this is the same area identified in Figure 10.3a; these strategies are just different approaches to measuring the same thing.

One advantage to evaluating consumer and producer surplus changes separately is that it makes clear who gains and who loses. In this case, consumers gain area $X - Y$ and producers lose area $X + Z$; the gain to consumers is less than the loss to producers by area $Y + Z$—that is, the aggregate loss in total surplus. From this we see that finding a deadweight loss is not the same as saying that everyone is worse off. A deadweight loss measures the overall efficiency loss when the effects on everyone are summed, but the distribution of gains and losses may also be important to consider. If you view the well-being of consumers as sufficiently more important than the well-being of producers, you might favor the price ceiling in this case despite the fact that it produces a deadweight loss. (On the other hand, it is unlikely that all consumers benefit even here; the gain in consumer surplus is an aggregation over all consumers, some of whom may be made worse off by the rent control because they cannot find housing at the legal price.)

10.2 EXCISE TAXATION

The competitive model and the concept of efficiency introduced in the preceding section can be employed to analyze the effects of government policies on a wide variety of industries. Among the policies are the excise taxes levied on specific goods such as gasoline, cigarettes, and alcohol. For example, the 1993 Budget Reconciliation Bill increased the federal excise tax on gasoline by 4.3 cents per gallon. The increase has raised over $50 billion in government revenue since 1993. State and local governments also use excise taxes. Such excise taxes applied to competitively produced products are easily analyzed using the industry supply and demand curves. It is instructive, however, to develop the analysis step by step, showing how the tax affects individual firms as well as the market, and examining how the short-run effects differ from those of the long run.

Let us analyze the federal government's excise tax on gasoline. In Figure 10.4, we assume that the industry is initially in long-run competitive equilibrium. Most government studies in fact indicate that the industry is close to perfectly competitive. Figure 10.4a shows a typical firm, Mobil, making zero economic profit at the market-determined price of $1.25 per gallon of gasoline. Price equals short-run and long-run marginal cost at Mobil's initial output of q_1. (We have not drawn in the long-run marginal cost curve or the short-run average cost curve. Throughout the analysis, we use only the relationships essential to the important points to avoid cluttering the diagrams.) Figure 10.4b identifies the original equilibrium price and output for the industry at $1.25 and Q_1, which is determined by the intersection of the long-run supply curve *LS* and the demand curve *D* at point *A*. The short-run supply curve *SS* passes through point *A* because it is the sum of the firms' *SMC* curves. Recall that *SS* is more inelastic than the long-run supply curve because expanding (or reducing) output is more costly in the short run (when some inputs are fixed) than in the long run (when all inputs are variable).

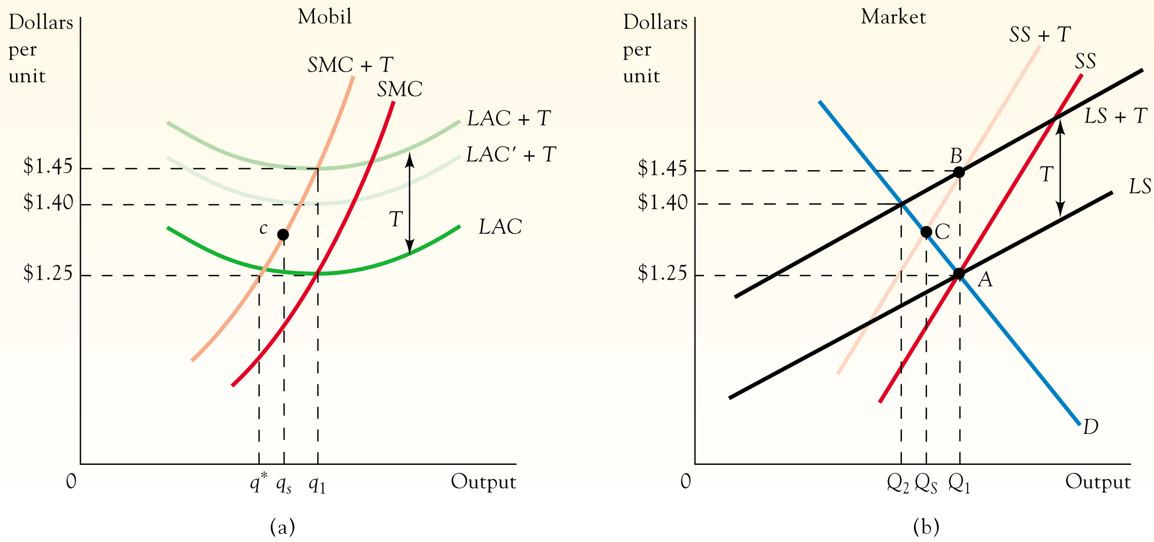
Now suppose that the government unexpectedly taxes each firm in the industry 20 cents per gallon of gasoline sold. Such a tax is a per-unit excise tax.[4] Let us first consider the immediate impact of the tax on the individual firm, Mobil. Before the tax, long-run average

[4]Another common form of excise tax is an *ad valorem* excise tax. An ad valorem tax is levied as a certain percentage of the market price. In contrast, a per-unit tax does not depend on the market price. The important economic effects of the two types of excise taxes are the same, however, and the per-unit tax is slightly easier to analyze.

FIGURE 10.4

Effects of a Per-Unit Excise Tax

(a) The firm's cost curves shift upward by the amount of the tax, and, in the short run, the firm reduces output. (b) The industry supply curves also shift upward by the amount of the tax, and industry output declines. Output decreases by more in the long run so the price rises above its short-run level.



cost at output q_1 is \$1.25, but the tax increases Mobil's average cost of providing that output to \$1.45. In fact, at every possible output, average cost is 20 cents higher than before. Note that the tax does not affect the cost of the inputs needed to produce the product but simply adds 20 cents per gallon to their cost. In Figure 10.4a, the 20 cent tax is shown as a parallel upward shift in the *LAC* curve to *LAC* + *T*, where *T* equals the 20 cent per-unit tax. All other per-unit cost curves, including the marginal cost curve, shift vertically upward also, because all per-unit production costs are increased by the amount of the tax.

If we temporarily assume that the gasoline price is unaffected, two important effects of the tax on the individual firm can be identified. First, Mobil will operate at an economic loss at q_1 because average cost (\$1.45) exceeds price (\$1.25). Second, at q_1, marginal cost, which has increased to \$1.45 at that output, exceeds the price. Mobil's immediate response will be to cut its loss by reducing output along its new short-run marginal cost curve *SMC* + *T* to q^*, where marginal cost equals (the assumed unchanged) price. Mobil still incurs a loss at q^*, but the loss is smaller than if it keeps output at q_1.

Because the tax applies to all firms in the industry, they all incur a loss and have an incentive to cut output; this will affect the market price. Earlier, we assumed for the moment that the price was unchanged to trace out the individual firm's immediate response to the tax. Now let's see what happens to price when all firms in an industry reduce output. In Figure 10.4b, the initial short-run industry supply curve *SS* is the sum of the individual firms' *SMC* curves. Because the tax shifts the firms' marginal cost curves vertically upward by 20 cents, the *SS* curve also shifts vertically upward by 20 cents to *SS* + *T* (distance *BA* equals 20 cents); *SS* + *T* is the sum of the firms' *SMC* + *T* curves. In other words, for the industry to supply any given rate of output, the price must be 20 cents higher than before because the tax has added 20 cents to unit costs. Of course, the industry will not continue to supply Q_1 gallons. In the short run, as firms cut output along their *SMC* + *T* curves, industry output falls along the *SS* + *T* curve. The short-run equilibrium occurs at point *C*, where *SS* + *T* intersects *D*. Industry output is lower than the pre-tax equilibrium (Q_S versus Q_1) and price is higher (CQ_S versus AQ_1). In Figure 10.4a, Mobil is at point *c* on its *SMC* + *T* curve and is still incurring a short-run loss.

This completes the analysis of the short-run adjustment to the excise tax. Because firms are still taking losses, however, we have not yet reached a position of long-run equilibrium. The losses provide an incentive for firms to exit the industry altogether, allowing resources to move to other industries where normal profits can be made. We can identify the new long-run equilibrium from the long-run supply curve. Like the short-run supply curve, the tax shifts the long-run supply curve vertically upward by 20 cents because it adds 20 cents to all per-unit costs, short- and long-run. Thus, the long-run supply curve becomes *LS* + *T*, passing through point *B* where distance *BA* equals 20 cents in Figure 10.4b. In the short run, the tax causes the industry to restrict output along *SS* + *T*; in the long run, the industry restricts production along *LS* + *T*. The final long-run equilibrium occurs at a price of $1.40 and an output of Q_2, where *LS* + *T* intersects the unchanged demand curve. In the long run, the decrease in industry output is greater than in the short run (because firms have time to exit the industry and/or adjust their scales of plant), and consequently the price to consumers is higher.

As drawn in Figure 10.4b, the price to consumers has risen by only 15 cents (from $1.25 to $1.40) even though the per-unit tax is 20 cents. Thus, firms receive only $1.20 per unit ($1.40 minus 20 cents per unit) after paying the tax, less than they received before the tax was levied. Does this mean that firms are operating at a loss so that Q_2 is not really a long-run zero-profit equilibrium? No. We have assumed that the industry is an increasing-cost industry (with an upward-sloping long-run supply curve), which implies that some input prices fall as fewer of these resources are used. As a result, firms' cost curves shift downward as the industry contracts along its long-run supply curve. Figure 10.4a shows the situation from Mobil's viewpoint. As input prices fall, the *LAC* + *T* curve shifts downward to *LAC*′ + *T*, so Mobil makes zero economic profit at the $1.40 price.[5]

This step-by-step analysis shows how we can start with a firm's cost curves and determine the effects of a tax on an industry's supply and demand curves. It is possible, however, to analyze the effects by using just the demand and supply curves at the industry level. For example, if we are interested in only the industry-level effects in the long run, all we need to do is examine the effects of the shift in the long-run supply curve from *LS* to *LS* + *T* in Figure 10.4b. This immediately identifies the outcome: a lower output and higher price. However, the more systematic approach we have used helps reinforce the nature of the long-run adjustment process and emphasizes how the process affects individual firms. This is useful since it is not always obvious how an industry's supply curves will be affected; in many cases, it is important to develop the analysis by first examining how individual firms are affected.

Let's return to the economic effects of an excise tax and review two implications of the analysis. First, even though the tax is levied on and collected from firms, consumers bear a cost as a result of the higher price they pay for gasoline at the pump. In our specific example, the price to consumers rises by 15 cents in response to the 20-cent tax. As we will explain in

[5]Whether firms produce more or less than before the tax depends on how their *LAC* curves shift downward. If with lower input prices the minimum point on *LAC*′ + *T* occurs at the same output as before the tax (q_1), as drawn in the graph, firm output is the same as before the tax. The reduction in industry output then results from some firms exiting the industry. The minimum point on *LAC*′ + *T*, however, can occur at a higher or lower output, depending on which input prices fall and the nature of a firm's production function.

the following subsection, the exact amount by which the price to consumers rises depends on the relative elasticities of the demand and (long-run) supply curves.

Second, after the long-run adjustment to the tax, firms once again make zero economic profits and do not suffer continuing losses. (In the short run they do lose money, but the losses are temporary.) After paying the tax, however, the firms net only $1.20 per gallon, less than they received before the tax was levied, so someone must suffer a continuing loss on the supply side of the market. But who? We can't say specifically, but we know that it will be the owners of inputs that are in less than perfectly elastic supply to the industry, because the owners of these inputs will receive lower prices for the services they provide. That is, as firms cut production and demand fewer inputs in response to the tax, prices for inputs with upward-sloping supply curves will fall. Consequently, in the increasing-cost case, the long-run burden of the tax is borne by consumers and certain input owners.

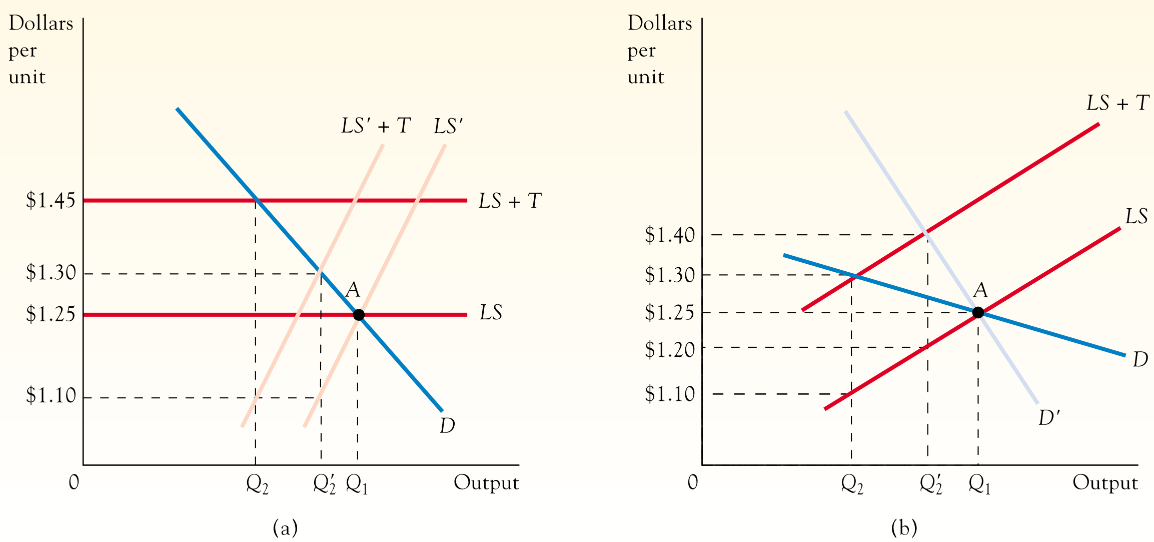
Who Bears the Burden of the Tax?

Our analysis shows that excise taxes reduce the output of the taxed good and increase its cost to consumers, but what determines *how much* output falls and *how much* the price to consumers rises? Asking how much the price to consumers rises is, of course, equivalent to asking how much of the tax burden is borne by consumers and how much by input owners. In our example we found that, in the long run, the price to consumers rose by 15 cents and the price to producers fell by 5 cents (to $1.20). In such a case economists would say that consumers bear 75 percent of the tax burden ($0.15 out of each $0.20 collected) and producers (more precisely, owners of inputs that are in less than perfectly elastic supply) bear the other 25 percent.

As we will see next, the quantitative effects on price and output depend on the elasticities of demand and supply, which we can show by using the industry demand and supply curves. Let's concentrate on the long-run effects. In Figure 10.5a, we examine how the

FIGURE 10.5

How Elasticities Affect the Tax Burden
(a) With the more elastic supply curve, *LS*, the price increase to consumers is greater. With a perfectly elastic supply curve, such as *LS*, the price rises by the amount of the tax. (b) With the more elastic demand curve, *D*, the price increase to consumers is smaller.



elasticity of supply affects the outcome. Suppose that the industry is a constant-cost industry and has the horizontal long-run supply curve shown as *LS*. An excise tax shifts the supply curve vertically upward to $LS + T$. With the demand curve *D*, the tax reduces output to Q_2 and increases price to $1.45. In contrast to our earlier example, the price rises by the full amount of the per-unit tax, and firms continue to net $1.25 after remitting the tax to the government. Why are the effects of the tax different for a constant-cost industry? Recall that in the constant-cost case, when output is reduced, per-unit production costs do not decline, so output will continue to fall until the price has risen by the amount of the tax; only after this adjustment takes place will a new zero-profit equilibrium be achieved.

To illustrate the influence that different supply elasticities have on the distribution of the tax burden between buyers and sellers, consider Figure 10.5a once again and suppose that at the initial equilibrium point *A* the supply curve is less elastic, like LS'.[6] A tax of 20 cents per unit shifts LS' vertically upward to $LS' + T$. (Note that the vertical difference between each set of supply curves is the same; we are using the same tax per unit but varying the supply elasticity to isolate the effect of different supply elasticities on price.) In this case, equilibrium output declines to Q_2', the price to consumers rises to $1.30, and the net-of-tax price received by firms falls to $1.10. The consumer price does not rise by the full amount of the tax because as output falls, per-unit production costs decline and firms can make zero economic profits at a net-of-tax price lower than the initial $1.25 price. This also means that output does not have to fall as much to restore long-run equilibrium as in the constant-cost case.

These results suggest the following generalization: for a given demand curve and tax per unit, the more inelastic the supply curve, the smaller is the tax burden on consumers (price rises by less), the larger is the tax burden on producers (meaning the relevant input suppliers), and the smaller is the output reduction. The only significant exception is in the unlikely case of a vertical demand curve. If the demand curve is vertical, the price to consumers rises by the amount of the tax, regardless of the elasticity of the supply curve.

Now let's see how the *elasticity of demand* affects the outcome. In this case, we work with a given supply curve and tax per unit and then vary the demand elasticity. Figure 10.5b illustrates this analysis. Initially, we have the supply curve *LS* and demand curve *D*, so the before-tax equilibrium price and quantity are $1.25 and Q_1, respectively. The tax shifts the supply curve to $LS + T$, the price to consumers rises to $1.30, the net-of-tax price to producers falls to $1.10, and output declines to Q_2. Alternatively, suppose that demand is less elastic at the initial equilibrium point *A*, as shown by the D' curve. Then the price to consumers rises by more (to $1.40), the price to producers falls by less (to $1.20), and output falls by less (to Q_2').

These results suggest the following generalization: For a given supply curve and tax per unit, the more inelastic the demand curve, the greater is the tax burden on consumers, the smaller is the tax burden on producers, and the smaller is the reduction in output. The only significant exception is in the case of a perfectly elastic supply curve—the constant-cost case. In this case, the price to consumers rises by the amount of the tax per unit, regardless of the elasticity of the demand curve.

In summary, the proportion of any excise tax borne by consumers depends on the relative sizes of the elasticities of demand and supply. These elasticities indicate how well consumers and producers can "substitute away" from a tax. The higher the elasticity, the greater the availability of substitutes in consumption or production, and the greater the ability to substitute away from the tax and impose the burden of the tax on the other party.

[6]It is important not to confuse slope and elasticity, but when we compare the elasticities of two curves at the same price-quantity combination, as we are doing here at point *A*, the steeper curve is the less elastic curve.

APPLICATION 10.2 WHY CIGARETTE COMPANY PROFITS DID NOT GET SMOKED BY A RECENT PUNITIVE-DAMAGES AWARD

In July 2000, a Florida jury levied a $145 billion punitive-damages award against cigarette companies—the largest damage award in U.S. history—in a national class-action lawsuit brought on behalf of all addicted smokers injured by cigarettes.[7] Tobacco company stocks, however, hardly budged after news of the damage award broke.

Some analysts think that cigarette company shares did not fall in the wake of the bad news because investors had already anticipated the jury award and believed that it would eventually be overturned on appeal. Other analysts attribute the absence of a negative stock effect to the fact that tobacco companies will not be the ones bearing the cost of the jury's damages award. Since the demand for cigarettes is much less elastic than the supply, cigarette companies can more easily substitute away from the burden imposed by the jury's award than can consumers (the elasticity of demand for cigarettes is estimated to be roughly 0.3 while supply is close to perfectly elastic). Because smokers are so much less able than tobacco companies to run away from the punitive-damages "tax" levied by the Florida jury, it is they, and not the tobacco companies, who will end up bearing the burden of the tax.

[7]"Tobacco Companies Rail Against Verdict, Plan to Appeal $144.87 Billion Award," *Wall Street Journal*, July 17, 2000, pp. A3 and A6; "Yes, $145 Billion Deals Tobacco a High Blow, But Not a Killing One," *Wall Street Journal*, July 17, 2000, pp. A1 and A8; and Daniel A. Sumner and Michael K. Wohlgeront, "Effects of an Increase in the Federal Excise Tax on Cigarettes," *American Journal of Agricultural Economics*, Vol. 67, May 1985, pp. 235–242.

The Deadweight Loss of Excise Taxation

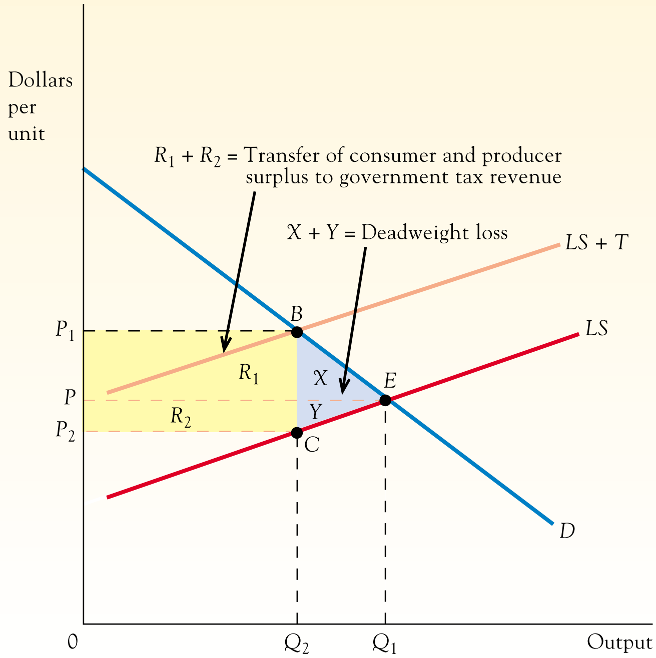
As explained in Section 10.1, any deviation in output from the competitive level is inefficient and results in a deadweight loss. Because an excise tax results in an output that is lower than in the unfettered competitive market, it produces a deadweight loss. Let's consider why in more detail. Originally, price is P and output is Q_1 in Figure 10.6. An excise tax of T per unit causes the long-run supply curve to shift to $LS + T$, and the result is a reduction in quantity to Q_2 and an increase in price to P_1.

The easiest way to see that there is a deadweight loss is to consider the marginal benefit and cost associated with the change in output from Q_1 to Q_2. When output declines, each unit no longer produced has a marginal benefit that varies from P to P_1 to consumers. However, the cost saving associated with not producing each of these units is lower, ranging from P to P_2. Thus, there is a net loss associated with each of the units that is not produced (the marginal benefit sacrificed is greater than the marginal cost saved), and the sum of these net losses is shown as the triangular area BEC. Area BEC is the deadweight loss, and results from the excise tax because output is restricted to a level where the product's marginal benefit (P_1) exceeds the marginal cost of production (P_2); consumers would benefit from a higher output but the tax inhibits production of additional units beyond Q_2.

In explaining the deadweight loss, note that we continue to interpret the original supply curve as showing the marginal cost of production. From the firms' point of view, marginal cost is given by $LS + T$, but the tax is not a real cost to society. The tax simply transfers funds from market participants to the government; it does not reflect a use of scarce resources in production. Consider that if output was reduced from Q_1 to Q_2 before the tax, there would have been a cost saving (shown by the LS curve) in the form of less labor, capital, raw materials, and so on. When a tax leads to the same output reduction, the cost saving in terms of the value of resources no longer employed in the market is identical. The tax is

FIGURE 10.6

The Deadweight Loss of an Excise Tax
The excise tax reduces consumer surplus by area R_1 plus area X and producer surplus by area R_2 plus area Y. Part of the loss is transferred to the government as tax revenue, shown as R_1 plus R_2. The excise of the loss over the gain to the government is the decrease in total surplus or the deadweight loss, the triangular area X plus Y.



not a real cost to society, but it does influence firms' and consumers' decisions and that is why it produces a deadweight loss.

The deadweight loss of the tax can also be derived by relying on the concepts of consumer and producer surplus. The tax increases the price to consumers from P to P_1, thus decreasing consumer surplus by area P_1BEP. In addition, the tax reduces the net price received by producers from P to P_2, decreasing producer surplus by area $PECP_2$. Combining these two, we see that the reduction in consumer plus producer surplus equals area P_1BECP_2. However, of this loss, area P_1BCP_2 is received as tax revenue by the government. The tax revenue is also shown as the sum of rectangular areas R_1 and R_2, where R_1 is the direct burden of the tax on consumers and R_2 is the direct burden on producers.

Part of the loss in consumer plus producer surplus is a gain to the government in the form of tax revenue. However, the tax revenue is smaller than the loss in consumer plus producer surplus by the area BEC. Area BEC is the decrease in the total surplus (in this case, consumer plus producer plus government surplus) or the deadweight loss of the excise tax. Consumers and producers bear a burden (the loss in consumer plus producer surplus) that is greater than the revenue collected by the tax. That is why the deadweight loss is sometimes referred to as an **excess burden** when it is produced by a tax.

EXCESS BURDEN another name for the deadweight loss produced by a tax

The excise tax produces a direct burden in the form of tax revenue collected, and also an additional, less obvious burden in the form of the deadweight loss (or excess burden). To get an intuitive understanding of the deadweight loss as something different from the burden of paying taxes, consider an excise tax that is so large that output falls to zero. In that case, there is no tax revenue collected. Nonetheless, there is a deadweight loss from the excise tax. What is the deadweight loss in this case? It is the total surplus that would have been generated by the market absent the tax.

Our analysis should not be taken to imply that excise taxes should be avoided. All taxes produce deadweight losses; they can't feasibly be avoided. However, the deadweight loss is still important because it tells us that if the public is to benefit from government expenditures, more than a dollar in benefit has to be produced per dollar of government expenditure. For example, suppose that the gasoline excise tax revenue is $100 billion and the deadweight loss of the tax is $40 billion. Only if the spending of the $100 billion in tax revenue produces a benefit valued by the public at more than $140 billion does the spending compensate the public for all the costs of the excise tax.

APPLICATION 10.3 THE LONG AND THE SHORT (RUN) OF THE DEADWEIGHT LOSS OF RENT CONTROL

By reducing output below the competitive equilibrium, rent control results in a deadweight loss. Employing the competitive model to compare the short- and long-run effects of rent control allows us to see how the deadweight loss associated with a government-imposed price ceiling depends on the supply elasticity.

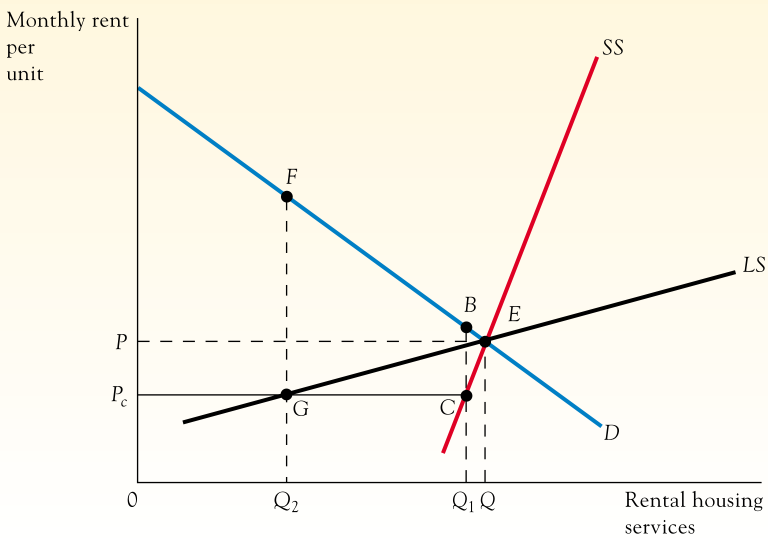
Figure 10.7 contrasts the short- and long-run effects of rent control. In the absence of a rent ceiling, the competitive (short- and long-run) equilibrium is a rent of *P* and quantity of *Q*. The short-run supply curve, *SS*, is drawn as being relatively price inelastic. This is so because if a city unexpectedly imposes rent control today, the quantity of rental units tomorrow will be virtually unaffected by the price change. It takes time for reduced construction and maintenance to have their full effects on durable goods like dwelling units. The adverse effects on the supply side thus are relatively small in the short run. In response to a rent ceiling of P_c, for example, output decreases only a little bit in the short run to Q_1 and the resulting deadweight loss is given by triangular area *BEC*. Area *BEC* is the difference between the marginal benefit (the height of the demand curve) and marginal cost (the height of the short-run supply curve) summed over each unit of output between Q_1 and the competitive equilibrium of *Q*.

The long-run output adjustment to the rent ceiling is more substantial and begins as new construction falls and existing units are allowed to deteriorate. In the graph this is depicted by the long-run supply curve, *LS*, being more price elastic than the short-run supply curve, *SS*. In response to the rent ceiling, P_c, there is a long-run output reduction to Q_2 and a deadweight loss equal to triangular area *FEG*. Area *FEG* is the difference between the marginal benefit (the height of the demand

FIGURE 10.7

Supply Elasticity and the Deadweight Loss of Rent Control

With the rent ceiling P_c, the reduction in output in the short run is small, from *Q* to Q_1, along the short-run supply curve *SS*. The associated deadweight loss, triangular area *BEC*, is also small. The long-run effects of the rent ceiling are more significant. Output declines to Q_2 along the more elastic long-run supply curve *LS*. The associated deadweight loss is depicted by triangular area *FEG*.



curve) and marginal cost (the height of the long-run supply curve) summed over each unit of output between Q_2 and the initial competitive equilibrium of Q.

As a result, rent control's deadweight loss is greater in the long run as suppliers have more time to reduce output in response to the price ceiling. All other things being equal, the greater the elasticity of supply and the larger the decline in output from the competitive equilibrium due to a price ceiling, the larger the deadweight loss. This suggests why elected local leaders may be less concerned than economists about rent control's adverse effects. Since city government officials typically hold office for only a few years, they are not around long enough to experience the long-run output adjustment to a rent ceiling. The relevant perspective on rent control to many elected officials may be closer to the one represented by the short-run supply curve in which the resulting deadweight loss is fairly small and the primary effect is a transfer of income from landlords to tenants. If tenants have more political clout than landlords, local policymakers may find the income transfer well worth the (small) short-run deadweight loss.

10.3 AIRLINE REGULATION AND DEREGULATION

Previously we mentioned that the perfectly competitive model remains extremely useful even if one or more of the conditions defining the model do not hold. In this section we show how this is the case in the U.S. experience with airline regulation and deregulation. During the period in which the domestic airline industry was regulated, entry into any given city-pair market in the industry was restricted. Carriers operating in a particular market were required to have an operating license from the Civil Aeronautics Board (CAB), and the CAB issued no new licenses to airlines requesting to enter an already served market. Even though the condition of free entry and exit was thus violated, the perfectly competitive model still can be employed to analyze the effects of regulation, as well as deregulation, on the airline industry.

From its formation in 1938 to the Congressional deregulation of the domestic airline industry in 1978, the CAB controlled, among other things, fares, routes that commercial airlines could serve, and entry of new firms into the industry. Analyzing the effects of CAB-imposed regulations makes clear why there was widespread support for deregulation.

Our analysis will focus on the pricing policy followed by the CAB. The CAB closely regulated the fares airlines charged, and, it turns out, kept those fares well above the level that would have prevailed in an open market. Even when some airlines requested fare reductions, they were regularly denied. In effect, the CAB imposed a *price floor*, keeping the price above the competitive level.

Throughout the regulation era, persuasive evidence existed that regulated airline fares were artificially high. The CAB regulated only airlines engaged in interstate transportation; intrastate airlines were beyond its reach. The existence of unregulated airlines made possible some illuminating comparisons. For instance, intrastate airlines operating in California flew the Los Angeles–San Francisco route, a distance approximately the same as the interstate route between Washington, D.C., and Boston. The CAB-controlled fares on the Washington–Boston route, though, were twice as high as the uncontrolled fares from Los Angeles to San Francisco. In addition to actual price comparisons, the federal government's General Accounting Office estimated that, on average, fares were 22 to 52 percent higher due to the CAB's actions.

From this we might conclude that the CAB designed the regulations to help the airlines at the expense of passengers. Airlines, after all, were receiving much higher fares as a result of the CAB's price-setting policy. Now, however, we encounter a startling fact: Airlines were not particularly profitable during the period of regulation. In fact, over the 20 years prior to deregulation in 1978, the airline industry's accounting profits were slightly below the national average for all industries.

What Happened to the Profits?

The apparent profits to airlines were dissipated in three ways. First, the CAB required airlines to operate some unprofitable routes. These routes generally provided service between sparsely populated areas where demand was insufficient for the airline to make a profit. The airlines had to balance the losses on these runs against the profits on other routes. Second, airline worker unions were in a position to demand and get higher wages when the CAB kept fares above competitive levels, and so some of the potential profits went to employees.

The third reason is perhaps the most interesting because it would, in theory, eliminate profits even in the absence of the other two. It is nonprice competition. In any market where prices are set and suppliers cannot compete on the basis of price, another form of competition will emerge, as we saw with rent control in Chapter 2. What happened in the airline industry?

Airlines can make large profits at high prices only if they attract passengers. Under regulation, however, they could not cut prices to attract passengers away from their competitors. Each airline faced the problem of making itself more attractive than its competitors by some other means than lower fares. The solution was obvious: change the nature of the product to make it more appealing. So, airlines began scheduling more frequent flights so passengers could fly at times convenient to them. In addition, competition evolved among airlines to provide "frills:" gourmet meals, movies, more and better attendants, complimentary Mickey Mouse ears for children flying to Disney World, and sometimes live entertainment. But all these things increased the cost of providing transportation. Costs rose, prices were fixed, and profits diminished. Indeed, economic theory would predict that in a competitive market the process would continue until airlines no longer made a profit at all. And so we see why the airline industry was not especially profitable despite artificially high prices.

Let's examine the process using graphs. Figure 10.8b shows the supply and demand curves for airline services. For simplicity, we assume the industry is constant-cost. (Economists call this a simplifying assumption: the results are not significantly different from the case of an increasing-cost industry, but the analysis is simpler.) In the absence of any regulation, price and quantity are P and Q, respectively. Then, the CAB sets the price P_{CAB}. Note that if the industry operated at point A on its supply curve, it would make a profit shown by the shaded area. Although this point is not the final outcome, it provides a convenient place to begin our analysis to understand why further adjustments must take place. Corresponding to point A in Figure 10.8b, a representative firm is at point a in Figure 10.8a, operating at the minimum point on its LAC and making a profit equal to the shaded area.

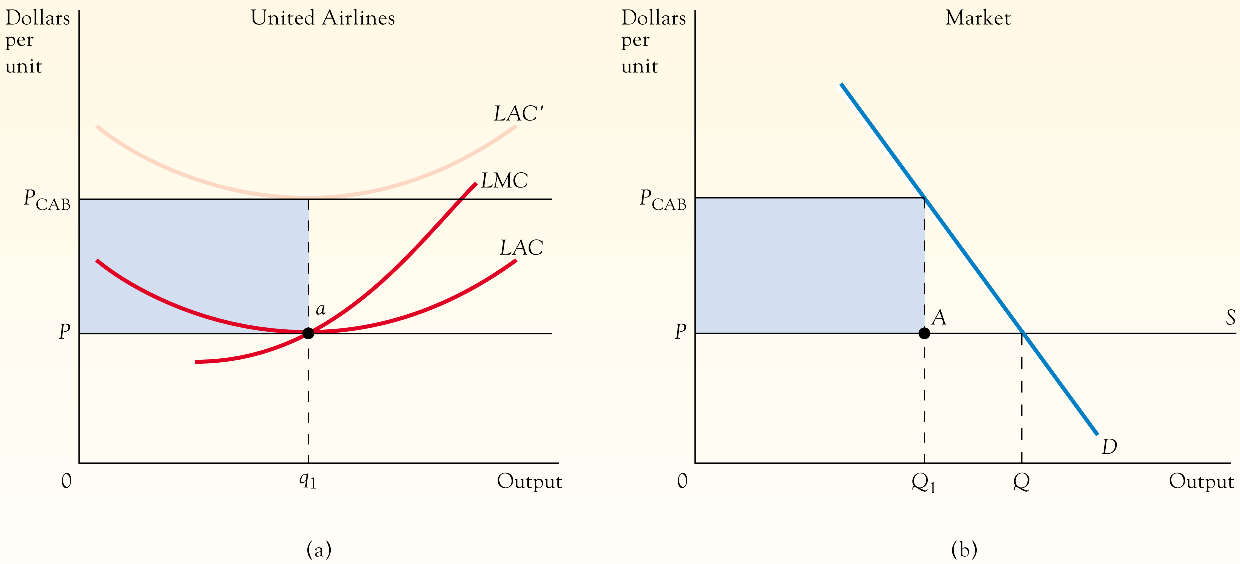
With all firms making a comfortable profit, why can't this point be an equilibrium? The answer is that each airline can make still more money if it expands output by drawing passengers away from other airlines. This is because an individual airline's profit-maximizing output is where LMC equals P_{CAB}. Because total quantity demanded is Q_1 and price cannot be lowered, an airline can gain passengers only by attracting them away from other airlines in some other way.

Suppose that the airline attempts to attract passengers by scheduling more frequent flights. Note that every airline has an incentive to initiate this practice, but more flights in total, with an unchanged total quantity demanded, means fewer passengers on each flight. Airlines will operate flights with empty seats, and to do so is in the interest of each airline. Why? At a price per passenger twice as high (P_{CAB}), it is profitable to schedule a flight even if only half the seats are filled. Flying half-filled planes, however, means a higher average cost per passenger. Thus, in Figure 10.8a the representative airline's LAC curve, showing

FIGURE 10.8

Airline Regulation by the CAB

A price floor of P_{CAB} implies that a representative firm (a) and the industry (b) can earn profits shown by the shaded areas. However, the profits are dissipated through nonprice competition, which leads to cost curves shifting upward (*LAC* to *LAC*′).



the cost per unit of output, shifts upward as the number of passengers per flight declines. This shift continues until economic profit is eliminated. The final result is an average cost curve like *LAC*′, with the typical airline just covering its cost at the higher CAB price and with total output unchanged.[8]

After Deregulation

Since the domestic airline industry was deregulated, several significant changes have taken place. First, as our analysis would suggest, the cost of air travel to consumers has fallen. In real terms, airline ticket prices are almost 40 percent lower today than they were at the time of deregulation. In part because of the fare reductions, the number of passengers flown has risen by 250 percent since 1977. And the annual value of consumer surplus generated by deregulation is estimated to be $25 billion (2002 dollars).[9]

Second, a major restructuring of the industry has taken place since deregulation. For 40 years the CAB denied access to would-be entrants. Within a year of deregulation the number of airlines in interstate service rose from 36 to 98. The rapid expansion was a mixed blessing, however. From 1980 to 1982, the industry lost $1.4 billion—more than in any other prior year. Several established carriers, including Braniff, Pan Am, and Eastern, de-

[8]This analysis neglects the way the quality change affects the demand curve. Presumably, more convenient flights with "frills" are worth more to consumers, so this practice shifts the demand curve rightward to some degree. Total industry output is then somewhat greater, but airlines still end up making zero economic profit.

[9]For a discussion of this and other consequences of airline deregulation, see Clifford Winston and Steven Morrison, *The Economic Effects of Airline Deregulation* (Washington, D.C.: Brookings Institution, 1997); and Adam D. Thierer, "20th Anniversary of Airline Deregulation: Cause for Celebration not Re-Regulation," Heritage Foundation Backgrounder, April 22, 1998.

clared bankruptcy. A few other financially troubled airlines have been absorbed by stronger competitors.

Third, after deregulation many of the industry's new entrants operated at significantly lower costs than the established carriers. One reason for the cost differential was the union pay scales negotiated during regulation. As we mentioned earlier, potential profits from higher-than-competitive fares can be dissipated by paying above-market wages to union members. Between 1970 and 1978, for example, the Consumer Price Index increased by 68 percent, yet airline workers' wages rose by over 100 percent and fringe benefits increased by 300 percent. After deregulation the contrast in salaries paid by established airlines and newcomers was striking. In 1983, the average worker (typically union) at the established airlines made $39,000 a year, whereas workers (typically nonunion) at new airlines made an average of $22,000. Top (union) pilots received $150,000 per year from the established airlines, whereas the new entrants to the market paid their pilots only $45,000.

In an attempt to reduce labor costs in the deregulated environment, the established carriers have cut their workforces by the thousands and implemented a two-tier wage scale that pays new employees 30 to 50 percent less than current ones. Already, labor costs as a share of all expenses have fallen from 39 percent in 1979 to 33 percent today. What this and other evidence makes clear is that unions were major beneficiaries of the CAB regulations and major losers from deregulation.

Fourth, service to small communities has, on average, increased with deregulation, but fares have gone up. Prior to deregulation, the CAB required airlines to provide service to small cities, but because the carriers used the same jets to serve small cities, they lost money on the small-city routes. After deregulation, the large carriers abandoned these unprofitable routes, but new commuter airlines using smaller, more fuel-efficient planes (e.g., turbo props and regional jets) have taken their place. In effect, the CAB regulations required airlines to use some of their potential profits to subsidize service to smaller communities, and deregulation ended the implicit subsidy.

APPLICATION 10.4 THE CONTESTABILITY OF AIRLINE MARKETS

Although deregulation has lowered fares, a question that has emerged—particularly in the wake of several recent mergers and bankruptcies—is, how many airlines are necessary in any city-pair market to ensure the competitive outcome? The number of existing suppliers may be irrelevant if airline markets are what economists term *contestable*. **Contestable markets** are those in which competition is so perfect that the market price is independent of the number of firms currently serving a market, because the mere possibility of entry suffices to discipline the actions of incumbent suppliers. (Remember that in perfect competition entry and exit are assumed to be frictionless so that incumbent suppliers must be wary of potential entry if they charge a price in excess of marginal cost.) For example, even though Delta Airlines may be the sole provider on the Atlanta–Birmingham (Alabama) air route, it will charge fares equal to marginal cost if the route is contestable. If Delta charged fares above marginal cost, other airlines could costlessly (that is, without friction) move into the market and take away Delta's passengers.

CONTESTABLE MARKETS
markets in which competition is so perfect that the market price is independent of the number of firms currently serving a market, because the mere possibility of entry suffices to discipline the actions of incumbent suppliers

Although competition may be vigorous under deregulation, the available evidence suggests that it is not perfect and that airline markets are not contestable in the strict sense of the term. For example, holding other factors constant, average fares on routes with two competitors were about 8 percent lower in 1990 than the fares on routes served by a single airline.[10] A third competitor was associated with an additional decline in fares of 8 percent.

In a more specific illustration, researchers have examined the stock market effects of a series of announcements by People Express during 1984 to 1985 regarding particular routes the then-new airline was about to enter.[11] The researchers found that incumbent airlines operating in those markets suffered significant financial losses in the wake of the news. Since the pending People Express entry presumably lowered the prices charged and profits earned by incumbent airlines, the markets could not have been contestable as defined, with incumbents' pricing strategies already shaped by the mere possibility of entry by other firms. Given the definition of perfect competition, the People Express illustration also suggests the existence of some frictions to entry and exit—some costs that impeded the ability of potential competitors to constrain the pricing and profits of incumbent firms. These costs may consist of the advertising that must be done to announce one's arrival in a market, gate space that must be acquired and modified to an entering airline's specifications, and local staff that must be hired and trained with regard to company procedures.

[10]Severin Borenstein, "The Evolution of U.S. Airline Competition," *Journal of Economic Perspectives*, 6 No. 2 (Spring 1992), pp. 45–73.

[11]Michael D. Whinston and Scott C. Collins, "Entry and Competitive Structure in Deregulated Airline Markets: An Event Study Analysis of People Express," *Rand Journal of Economics*, 23 No. 4 (Winter 1992), pp. 445–462.

Finally, the evidence suggests that there is an incentive in deregulated markets for additional entry—entry that will benefit consumers through lower prices. Recently, companies such as Southwest Airlines have made substantial inroads against more established firms because of their lower costs. For example, Southwest has achieved significantly lower operating costs than more established competitors by focusing on short-haul markets where the same type of fuel-efficient plane, a Boeing 737, can be used (thus lowering fuel, maintenance, and training costs); meals don't have to be served; expensive hubs and computerized reservations systems are unnecessary; and planes can be turned around quickly (in 20 minutes versus an hour or more for carriers such as United, American, and Delta, whose planes must sit on the ground at their hubs to await connecting passengers).

Lower costs have allowed Southwest to target underserved cities and offer frequent, low-fare service, often chasing out incumbents along the way. Until 1991, for example, TWA's one-way fare on the 255-mile St. Louis–Kansas City route was $295. Southwest jumped in with a fare of $59. Another example: in contrast to the existing one-way coach fare of $303 in the Los Angeles–San Francisco market, Southwest introduced a $20 fare between Oakland and Burbank in December 1990, virtually guaranteeing American Airlines' departure from the market. Southwest's success even prompted United Airlines to consider spinning itself off into one long-haul carrier plus four low-cost regional carriers modeled after the upstart airline.

The Push for Reregulation

Not everyone is happy with the results of airline deregulation, and in recent years proposals to reinstitute regulation have surfaced. Some of the support for reregulation is understandable since it comes from groups that have suffered financially, such as the established airlines and their employees. Some, however, comes from groups concerned with other questions they believe to be associated with deregulation—namely, greater congestion at airports and issues of airline safety.

Not surprisingly, airports have been more congested following the surge in passenger traffic after deregulation, and with the congestion have come more delayed flights, lost luggage, and service complaints. Because deregulation has increased the number of passengers, it has contributed to these problems. But is reregulation the best way to deal with them? Let's consider some alternatives. Airport capacity, for example, could be expanded to handle the increased traffic. Indeed, in a fully competitive market, this would occur automatically, but it hasn't because airlines don't control airports. Airports are owned and operated primarily by local governments, and since deregulation there has been no significant expansion in airport capacity despite the fact that nearly twice as many passengers are using them. Prior to the completion of the Pittsburgh airport in 1992 and the Denver airport in 1995, the last new big-city airport, at Dallas–Fort Worth, was built in 1974. Part of the problem with expanding capacity is that the expansion often generates political opposition from zoning authorities, environmental groups, nearby residents, and perhaps the dominant airlines at the existing airport (which fear an increase in competition if capacity is expanded).

But even if local governments are unable or unwilling to expand airport capacity, there are other ways to deal with congestion problems. For instance, flight delays are as much a consequence of how airports manage landings and departures as they are a result of increased passenger service. Airlines schedule flights when consumers want them most (early morning, midday, and late afternoon), and these are the times when congestion is the worst. The amount of air traffic during peak hours can differ from the nonpeak hours by a factor of 10. Currently, the landing and takeoff fees charged to airlines by airports are usually the same regardless of whether they occur during peak or nonpeak hours. Economists would suggest increasing the peak-hour fees. Such a price differential would induce airlines and passengers to rearrange their schedules and reduce congestion during peak travel hours. (This technique is called *peak-load pricing* and is discussed more fully in Chapter 12.)

Congestion is also related to airline safety, because the probability of accidents increases with the number of airplanes in the sky at a given time. As we have seen, however, congestion is not entirely the result of deregulation, but results in part from the way airports are managed and priced by local governments. Nonetheless, the news media often suggest a possible connection between safety and deregulation whenever reporting an accident or near-miss. Actually, airline safety procedures are still regulated by the Federal Aviation Administration (FAA), just as they were before deregulation. If safety problems exist, it is not necessary to control air fares and routes to deal with them—the FAA could simply raise safety standards. In fact, some economists argue that the FAA isn't needed at all because airlines have an incentive to take safety into account due to the enormous costs they bear in the event of an accident.

The heightened concern over safety in recent years is somewhat puzzling because the data show clearly that safety has improved in the years following deregulation—with the notable exception of 2001 when terrorists commandeered and crashed four commercial jetliners (acts that could have just as easily occured in a regulated as well as a deregulated environment). According to the Department of Transportation, both fatality and accident rates were lower in the years after deregulation than in the years before—even taking into account the tragic events of September 2001. Another indication that air travel is at least as safe after deregulation is that the companies that stand to lose the most financially from crashes—insurance companies that insure airline carriers—consistently lowered the rates they charge the major carriers up until the fall of 2001 when substantial war and terrorism clauses had to be added to most policies.

APPLICATION 10.5 LANGUISH AND ANGUISH AT LAGUARDIA

New York's LaGuardia Airport posts more delays than any other airport in the United States.[12] In certain recent months, LaGuardia has accounted for nearly 25 percent of the 40,000-plus delayed flights in the entire country. This problem was exacerbated in April 2000 when Congress passed a law allowing for 300 more flights to operate each day at LaGuardia. The law lifted decades-old restrictions on the number of flights into and out of LaGuardia and was intended to promote competition and expand service to smaller cities. It was

[12]This application is based on: "How the Government Turned LaGuardia into a Flier's Nightmare," *Wall Street Journal,* December 4, 2000, pp. A1 and A16; and Robert H. Frank, "'Scarce Slots? Hold an Auction," *New York Times,* December 13, 2000, p. A27.

passed despite the facts that LaGuardia is the smallest of New York City's three major airports and was one of the busiest airports in the nation with an already crowded roster of 1,000 daily flights.

Predictably, near gridlock set in, and the FAA had to step in several months later to roll back the number of flights to pre-April 2000 levels. Then, a lottery was held to dole out the permitted operating slots, with special preference given to nine small airlines serving smaller communities. While the rolled-back number of operating slots reduced congestion somewhat, the manner in which the permitted slots were doled out by government regulators resulted in considerable inefficiencies and continued frustration for area travelers. As noted by economist Robert Frank of Cornell University:

> Slots at crowded airports are a valuable economic resource, much like scarce seats on an oversold flight. History has taught us a valuable lesson about how best to allocate seats on oversold flights, one with a message for the problem of crowded airports. . . . Just as a plane can accommodate so many passengers, an airport can handle only so many operations. So every time a 19-seat Beechcraft 1900 uses LaGuardia, the FAA must deny permission to some larger plane—say, a Boeing 757 with several hundred passengers. Today, even among carriers currently authorized to use LaGuardia, delays and flight cancellations are legion. More important, a host of carriers would like to provide large-aircraft service . . . but are not authorized to use the airport. . . . That means some travelers have to use less convenient airports, just as someone has to wait when a flight is oversold. In both cases we have a strong interest in minimizing total inconvenience.
>
> On this score, the LaGuardia lottery is even worse than first-come, first-served. Not only does it make no attempt to minimize the number of diverted passengers, but it actively increases their number by setting aside special allocations for carriers that serve small communities with small aircraft.
>
> There are better ways to solve both problems. In 1979, the CAB called for carriers to offer cash payments, free tickets, or other rewards to induce volunteers to relinquish their seats on oversold flights. Passengers could decide for themselves how important it was to avoid waiting. . . . The CAB's proposal soon became widely recognized as both more fair and efficient than the earlier (first-come, first-served) system. Scarce operating slots at LaGuardia can be allocated in essentially the same way. Rather than give them away by lottery, the FAA could sell them to the highest-bidding airlines.

10.4 City Taxicab Markets

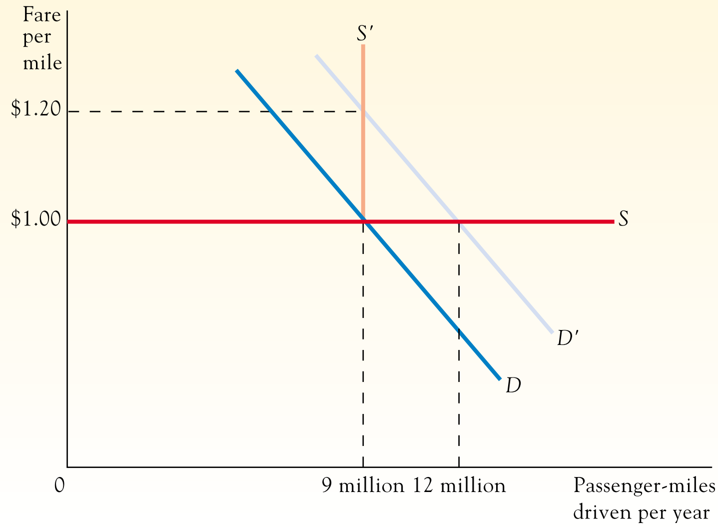
Most major U.S. cities regulate taxis in some way. Usually, the regulations require taxis to have city-issued licenses. The licenses look like and are often called *medallions*. Typically, cities issue a fixed number of medallions and new entrants must purchase one from a current driver or cab company. The supply of cabs thus is limited by the number of issued medallions. The effects of such an entry restriction can be analyzed through the perfectly competitive model—much as the model allowed us to analyze the impact of domestic airline regulations limiting entry into individual city-pair markets.

To examine the operation of a taxicab market with a restricted number of licenses, consider Figure 10.9, which shows the supply and demand curves—*S* and *D*, respectively—for taxi service absent any regulation. The supply curve is drawn as a horizontal line—a constant-cost industry. Although we make this assumption partly to simplify the analysis, it is reasonable to assume that the supply of taxi services within a city is highly, if not perfectly, elastic. With the market conditions as illustrated, competition results in a per-mile fare (price) of $1.00 and an annual output of 9 million passenger-miles. Suppose that this output is produced by 600 cabs, each of which transports passengers for 15,000 miles per year.

Next, suppose that the city requires taxis to have a medallion to operate, and it issues 600 medallions, giving one to each taxi. The medallions change nothing and have no effect on

FIGURE 10.9

Licensing Taxicabs
Taxicab licensing makes the supply curve vertical (under our assumptions) at an output of 9 million passenger-miles. The result is higher fares and lower output than under unregulated conditions.



the market as long as supply and demand conditions remain the same. Now suppose that over time the city's population grows and incomes rise, so demand shifts to *D*′. (The supply curve may also shift over time, but for simplicity we assume that it does not.) Because the number of taxis is limited by the number of medallions, the supply curve is vertical at 9 million passenger-miles, as shown by *S*′. (We are assuming that each taxi continues to operate for the same number of passenger-miles as before.) Fares rise to $1.20 per mile while output remains unchanged. In contrast, if the market had not been regulated, output would expand along *S* to 12 million passenger-miles and the per-mile price would remain at $1.00.

The practice of licensing taxicabs restricts entry to the market and leads to higher consumer prices. Persons on the supply side of the market tend to benefit, but exactly who they are and how they benefit deserves some further discussion. Note that in the situation just described, operating a taxi for a year (15,000 miles) generates a profit of $0.20 per mile, or an annual profit of $3,000. To realize that profit, however, a person must own a medallion, so it is the owners of medallions who tend to benefit from licensing. More precisely, those who were originally given the medallions receive most, if not all, of the benefit. Current owners of medallions may not receive anything but competitive returns.

To see why, let's consider the factors determining a medallion's price. Suppose that a driver from another city wishes to purchase a medallion from a driver who owns one. (If you owned a medallion, what would you sell it for?) Because ownership of the medallion brings with it an annual gain of $3,000 (assuming market conditions remain unchanged), its value is the same as an asset yielding $3,000 per year. If the prevailing interest rate is 10 percent, a person needs a $30,000 investment to generate an income of $3,000 per year. Thus, the value of the medallion itself is $30,000. Buyers are willing to pay this amount because they could get as good a return by investing $30,000 in a medallion as by investing it where it yields an interest income of $3,000 per year.

The transferability of medallions at prices determined by the expected profitability of operating a taxi means that those who received the medallions free when they were first issued may get all the benefit from the licensing policy. To take an extreme example, suppose that all the original cab operators sell their medallions to others. If this occurs, those who benefited from the licensing policy are no longer in the market, and those who now operate taxis will receive only a normal return on their investment. Nonetheless, the fare is still above the real cost of producing taxi services; if the city allowed free entry into the market, cab fares would fall to $1.00, as indicated by the intersection of S and D', and the value of the medallions would fall to zero. Such a deregulation of cab markets would impose a large loss on the current owners of medallions—a loss valued at $30,000 each in our example—yet these cabdrivers may never have received any benefit from the restrictive policy.

A difficult ethical dilemma is implicit in this analysis: is it fair to drivers to deregulate the market—that is, to allow unrestricted entry, lower prices, and higher output? Deregulation would impose a large loss on medallion owners, some of whom may never have shared in the economic profits created by the licensing policy. For example, in 2002 the price of a medallion in New York City was $200,000, so people who had invested their life savings or borrowed money to purchase a medallion would be devastated by a return to unrestricted entry, because that would leave them with no opportunity to earn the higher income that made the medallion worth the $200,000 they paid for it. If entry remains restricted, however, consumers continue to pay fares that are higher than necessary. As a further complication, the poor tend to be heavy users of taxis; they spend a larger portion of their incomes on taxi services than do higher-income groups, so they are especially burdened by higher fares.

We have emphasized the effects of the entry restriction created by taxicab licensing, but cities often regulate this market in other ways besides licensing. For instance, sometimes maximum fares are specified. This price ceiling creates shortages in certain parts of the city and at certain times of the day. For example, suppose that the maximum fare is $1.20 in Figure 10.9. Although that price might have no effect in the middle of the day, it can create a shortage during rush hour. At rush hour, congestion is greater and costs of operation are higher (traffic moves slower and it takes longer for a cab to travel a mile). Demand is also likely to be higher. If the quantity supplied is lower and the quantity demanded higher, and if a higher price is not permitted, a shortage results. Anyone who has tried to find a cab in New York City during rush hour knows what this means. Similarly, fare regulations can discourage cabs from operating in more remote or dangerous areas of a city. Because the regulated fares are not sufficiently high to cover the risk, drivers practice a form of nonprice rationing by avoiding passengers traveling to high-risk neighborhoods.

The Illegal Market

In many cities, licensing and fare regulations give rise to a thriving market in illegal transportation services. Illegal markets arise because of the mutual gains possible for their participants. As seen in Figure 10.9, taxi services can be profitably supplied at prices below $1.20 per mile (as shown by the horizontal supply curve S, which continues to show the cost of provision exclusive of the artificial medallion cost), and consumers also gain from a lower price.

By its very nature, an illegal market poses problems for investigators. This particular illegal market, however, is not as covert as some others are; the authorities tend to "look the other way," perhaps because transporting people without a taxi license is viewed as a crime without a victim. A Carnegie-Mellon study looked at the unlicensed (illegal) taxi market in Pittsburgh.[13] Two student "plants" got summer jobs driving illegal cabs—sometimes called *jitneys* or *gypsies*—and they kept records about fares, areas serviced, drivers, and customers. In addition, the researchers also conducted field research by acting as customers and collecting information in that way.

Among the study's findings is that the size of the illegal market is larger than imagined. There are more than twice as many illegal cabs operating in Pittsburgh as there are licensed cabs. (In New York City, estimates indicate 25,000 gypsies compared with 12,000 licensed

[13]Otto A. Davis and Norman J. Johnson, "The Jitneys: A Study of Grassroots Capitalism," *Journal of Contemporary Studies*, 7 (Winter 1984), pp. 81–102.

cabs.) The unlicensed cabs tend to provide service in areas, such as low-income neighborhoods, where the licensed cabs often do not operate. In addition, fares are lower for the unlicensed cabs. For instance, licensed cabs charged $2.52 (in 1980) for an average two-mile trip, while the same trip cost $2.00 in the unlicensed cabs. Tips are uncommon in the illegal market, which makes the effective price spread greater. Moreover, the service quality provided by the unlicensed cabs tends to be better.

One concern about the illegal market has always been that it might be unsafe. For example, a paid advertisement in the *New York Times* warned riders: "Ignore unlicensed cabs. You may be putting yourself in the care of a murderer, a thief, or even a rapist."[14] The Pittsburgh study, however, finds the warning unwarranted. Much of the illegal market is organized around station houses, which act as central clearinghouses in the neighborhoods. The study notes, "It is apparent that station managers work hard to please customers by having courteous, safe, and reliable drivers who will not cheat on fares." In addition, there was no difference in traffic accidents between the licensed and the unlicensed drivers.

Application 10.6 Gypsy Vans and Super Shuttles

Anyone who has recently landed at one of New York City's airports knows about the prevalence of gypsy cabs. Just outside the baggage claim area, between the terminal doors and the lines of licensed cabs, anxious-looking individuals query passenger after passenger: "Need a cab?"

Less commonly known around the "Big Apple" is the widespread presence of gypsy vans.[15] The privately operated vans race to scoop up passengers ahead of the city buses that are the only vehicles officially licensed to provide mass transit. Public officials estimate that over 2,500 private vans now operate in New York City. They charge passengers less than the city bus fare and deliver the passengers to their destinations ahead of scheduled city bus times. The phenomenon is spreading to other cities. In Miami, some of the 300 vans in operation even offer in-transit entertainment to their passengers consisting of soap opera videos.

A senior New York City Transit Authority official estimates that gypsy vans divert $30 million in annual revenue from public transportation. In 1991, van drivers were assessed fines of over $4 million for providing illegal mass transit services, although only $150,000 was collected on the assessed fines by city officials due to the failure of van drivers to appear at their court hearings.

Were it not for official sanctions, private vans would be more common providers of mass transit. This is evidenced by the spectacular growth of "Super Shuttles" when they have been allowed to ferry groups of different passengers to and from airports in certain major cities in the United States, such as Los Angeles and San Francisco. The Super Shuttles would provide even more wide-ranging mass transit services were they not restricted to routes where one of the endpoints of the route must be the city's airport.

[15]"Opportunistic Vans Are Running Circles Around City Buses," *Wall Street Journal*, July 24, 1991, pp. A1 and A17.

10.5 Consumer and Producer Surplus, and the Net Gains from Trade

So far, our look at the way markets work has not included international trade. However, it is a simple matter to incorporate such trade into the analysis. There are two important reasons to examine international trade. First, the economies of nations are becoming more

[14]Ibid., p. 97.

interdependent. In 1960, for example, foreign trade accounted for less than 5 percent of U.S. gross national product; today the proportion exceeds 12 percent. Second, there are constant claims made in the political arena and the media that free trade is harmful to a nation's welfare. Microeconomic analysis can help us analyze the validity of these claims.

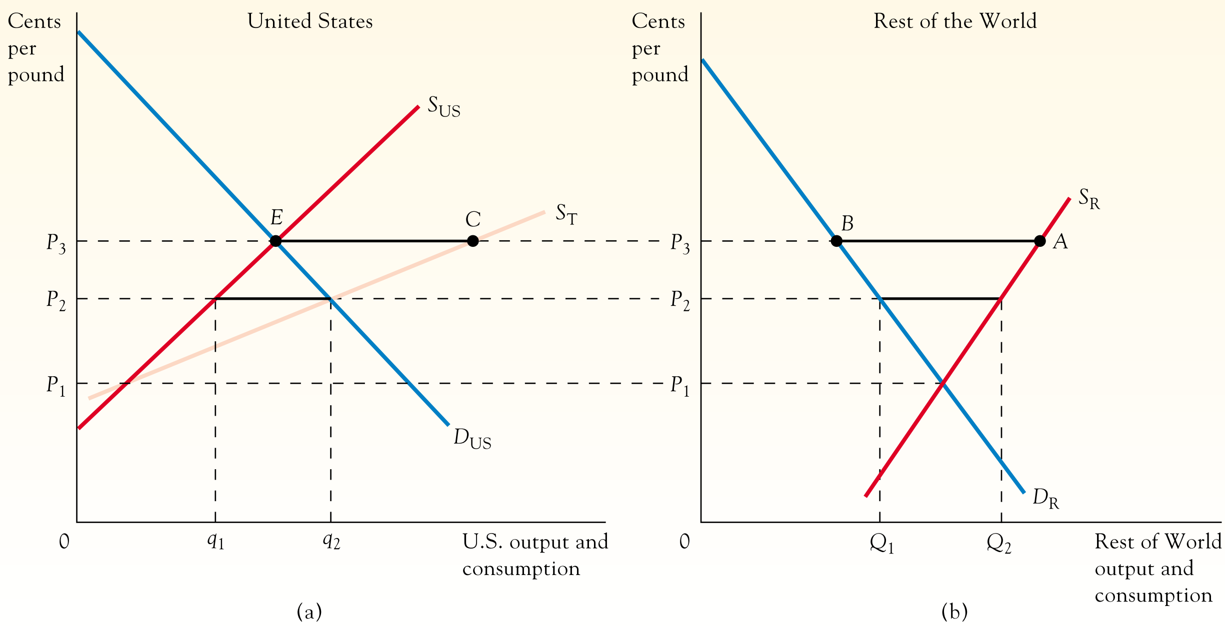
International trade arises because sellers and buyers located in different countries find it in their interests to deal with one another. To see what effects this has, consider Figure 10.10. In the left-hand panel we show the U.S. demand and supply curves for sugar as D_{US} and S_{US}, respectively. We assume that there is only one other country in the world, called Rest of the World (or RoW; this can be an aggregation of a number of other countries, of course). The right-hand panel shows the demand and supply curves for sugar in RoW as D_R and S_R, respectively. Without trade, each national market would attain equilibrium where its own demand and supply curves intersect. The result would be a price of P_3 in the United States and P_1 in RoW.

Now think about the incentives of buyers and sellers if trade becomes possible. Consumers in the United States have an incentive to buy sugar from RoW sellers, who are selling it at a lower price than U.S. sellers. Similarly, RoW sellers have an incentive to sell sugar in the United States, where the price is higher than they are getting in their domestic market. Therefore, we expect RoW producers to export sugar to the United States, and our task is to determine how much trade occurs and how it affects both markets. (Note that if the cost of transporting sugar is higher than P_3 minus P_1 per unit, there would be no trade. We will assume transportation costs are negligible.)

FIGURE 10.10

International Trade

The total supply curve of output available for sale in the United States is derived by adding to S_{US} an amount equal to the difference between quantity demanded and supplied in the RoW at each possible price; the result is S_T. The intersection of D_{US} and S_T determines price and total consumption in the United States; U.S. production is less than consumption by the amount of imports (q_2 minus q_1).



We will proceed by deriving the total supply curve, S_T, confronting U.S. consumers; this curve will show the total amount of sugar (from both U.S. and RoW producers together) that will be available in the United States at each possible price. Suppose that the price is P_3; how much will RoW producers offer to sell in the United States at that price? Figure 10.10b gives us the answer. At a price of P_3, RoW producers will produce at point *A* on their supply curve, a total amount of P_3A. Of this total, they will sell P_3B to consumers in RoW; the remainder, *BA*, is the amount they will export to the United States. The reason they sell P_3B to RoW consumers is that if they sold less, the price in RoW would be higher than P_3 and they would have an incentive to shift sales from the export market to their domestic market. Similarly, if they were selling more than P_3B to RoW consumers, the domestic price would be lower and they would have an incentive to shift sales to the export market. Thus, when the price is P_3, RoW producers will add *BA* to the output U.S. producers place on the market. Distance *EC* in Figure 10.10a is drawn equal to *BA*, so total output in the U.S. market is shown by the sum of domestic output, P_3E, and imports, *EC*, or P_3C. Point *C* is one point on the total supply curve, S_T, confronting U.S. consumers.

The remainder of S_T is derived in a similar fashion. At each possible price, we add to U.S. output (shown by S_{US}) the difference between the quantity that RoW producers would choose to sell at that price and the amount RoW buyers would purchase. The resulting curve S_T shows the total quantity available on the U.S. market at alternative prices. Note that this curve intersects the U.S. supply curve at P_1, the price that would prevail in the RoW in the absence of trade. This shows that if the U.S. price was the same as the RoW price in the absence of trade, there would be no exports from RoW to the United States. At a price lower than P_1, U.S. producers would become exporters of sugar.

Equilibrium can be identified by the intersection of S_T and D_{US} in Figure 10.10a. Thus, the U.S. price is P_2, and at that price U.S. consumers purchase q_2 units. However, U.S. producers are providing only q_1 units to U.S. consumers; the remaining q_1q_2 units represent imports. Trade lowers the price of all units sold in the United States because U.S. producers cannot sell sugar at a higher price than consumers can purchase it from the RoW, provided there is no difference in quality in the sugar produced by RoW and U.S. firms.

An important implication of this analysis is that both the U.S. and RoW markets must be in equilibrium. This is guaranteed by the way we constructed the S_T curve. Observe what has happened in RoW in Figure 10.10b. The price is P_2 in the RoW also. At that price, total output of RoW producers is Q_2, but consumption by RoW consumers is only Q_1. The difference, Q_1Q_2, is the amount exported to the United States. Q_1Q_2 in panel (b) is equal to q_1q_2 in panel (a); the amount that RoW producers want to export at P_2 is equal to the amount that U.S. consumers want to purchase as imports. Both markets are in equilibrium at a price of P_2, with production, consumption, and trade as indicated in the graphs. Note also that both markets can be in equilibrium only when the price is the same in both markets, because otherwise sellers in the lower-priced market would have an incentive to export to the higher-priced market.

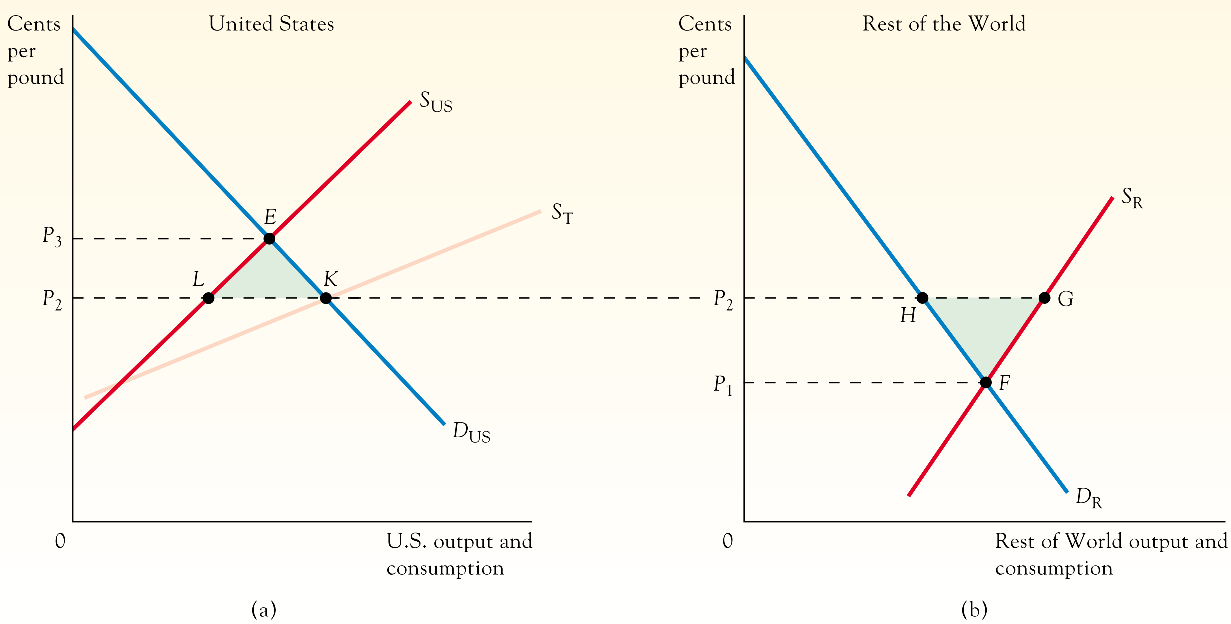
This is a versatile model, but it must be handled carefully. For example, any change in demand or supply conditions in the RoW will cause the S_T curve to shift. If demand increases in the RoW, for instance, S_T will shift to the left and the price of sugar in the United States will increase. Similarly, changes in U.S. supply or demand conditions will result in changes in the uniform world price, and that will cause changes in RoW output, consumption, and exports. When nations are linked by international trade, their markets are affected by one another in this way.

The Gains from International Trade

In the political arena and the media we frequently hear assertions that trade is harmful to national welfare. We can use our supply–demand model to show that these assertions are

FIGURE 10.11 **The Gains from Free Trade**

(a) Trade increases consumer surplus in the United States by area P_3EKP_2 and decreases producer surplus by area P_3ELP_2. The difference, area *EKL*, is the net gain to the United States from trade. (b) For the RoW, the net gain from trade is shown by area *HGF.*



not well founded. Figure 10.11, based on the same supply and demand curves as Figure 10.10, illustrates the argument. The United States would be at point *E* in Figure 10.11a in the absence of trade. With trade, the price is reduced to P_2 and consumption increases, but domestic production falls. From the graph we see that consumer surplus increases by area P_3EKP_2—a trapezoid defined by the difference between the no-trade and with-trade price of sugar, P_3 minus P_2, from the vertical axis out to the domestic demand curve, D_{US}. Producer surplus falls by area P_3ELP_2—the difference between the no-trade and the with-trade price from the vertical axis out to the domestic supply curve, S_{US}. The gain in consumer surplus from the lower price exceeds the loss in producer surplus by area *EKL*. This area measures the net gain to the United States as a whole.

To say that there is a "net gain to the United States as a whole" does not mean, of course, that every U.S. citizen gains. Citizens involved in sugar production lose. That is why producer groups are among the most prominent supporters of trade restrictions. The gain to consumers is, however, larger than the loss to producers in the sense that consumers could fully compensate all those who lose on the supply side and still come out ahead (by area *EKL*). The fact that consumers could in principle pay compensation and still benefit is what the net gain from trade (in the case of an imported good) is all about. A fitting analogy involves any case of technological progress. For example, would an innovation such as the discovery of a low-cost cure for the common cold be a net gain for our country? The answer is yes in the same sense that free trade is a net gain for the United States: the cold cure would not benefit everyone (producers of aspirin and cold "remedies" would lose), but the gain in consumer surplus would exceed those losses.

APPLICATION 10.7 SHOULD IMPORTS OF SUNLIGHT BE BANNED?

To drive home the point that imports provide a net gain to a country as well as to satirize the frequent resistance by domestic producers to "unfair competition" from foreign suppliers, nineteenth-century French economist Frederic Bastiat penned the following hypothetical appeal from French candlemakers to the government.[16] The appeal asked for restrictions to be placed on the free sunlight driving French candlemakers out of business:

> We are subjected to the intolerable competition of a foreign rival, who enjoys, it would seem, such superior facilities for the production of light that he can inundate our national market at so exceedingly reduced a price, that, the moment he makes his appearance, he draws off all custom from us; and thus an important branch of French industry, with all its innumerable ramifications, is suddenly reduced to a state of complete stagnation. This rival is no other than the sun.
>
> Our petition is, that it would please your honorable body to pass a law whereby shall be directed the shutting up of all windows, dormers, skylights, shutters, curtains, in a word, all openings, holes, chinks, and fissures through which the light of the sun is used to penetrate into our dwellings, to the prejudice of profitable manufactures which we flatter ourselves we have been enabled to bestow in gratitude upon the country; which country cannot, therefore, without ingratitude, leave us now to struggle unprotected through so unequal a contest. . . .
>
> Does it not argue the greatest inconsistency to check as you do the importation of coal, iron, cheese, and goods of foreign manufacture, merely because . . . their price *approaches zero*, while at the same time you freely admit, and without limitation, the light of the sun, whose price is during the whole day *at zero*?

[16]Frederic Bastiat, *Economic Sophisms* (Princeton, N.J.: D. Van Nostrand Co., 1964), pp. 56–60.

Now let us turn to how trade affects our trading partner, RoW. This is shown in Figure 10.11b. RoW moves from its no-trade equilibrium at point *F* to a higher price of P_2, with production expanding and consumption falling. The gain in producer surplus is area P_2GFP_1—the difference between the with-trade and the no-trade price in RoW, P_2 minus P_1, from the vertical axis out to RoW's supply curve, S_R. The loss in consumer surplus is area P_2HFP_1—the difference between the with-trade and the no-trade price in RoW from the vertical axis out to RoW's demand curve, D_R. The gain in producer surplus exceeds the loss in consumer surplus by area *HGF*. This area measures the net gain to the RoW as a whole from trade in the same way that area *EKL* in Figure 10.11a measures the net gain for the United States. For the RoW, however, producers gain from trade, while in the United States consumers gain because in this case, RoW exports to the United States. In other industries, market conditions will result in the United States being an exporter. In that case, the effect on the U.S. market will be just like the effect on RoW in Figure 10.11b: trade will result in a gain in producer surplus that is larger than the loss in consumer surplus.

The Link Between Imports and Exports

Our analysis so far shows why both imports and exports make nations better off, on net, if supply and demand curves determine equilibrium prices and quantities. If the rest of the world is willing to supply a good at a lower price than would prevail without trade in the United States, our country as a whole is better off. And, if the rest of the world is willing to pay a higher price than would prevail in our domestic market without trade, our net national well-being is also enhanced.

Imports and exports, of course, are not independent of one another: any time we import the rest of the world's goods, the dollars used to pay international suppliers for those goods must come back, by necessity, to our economy in the form of international demand for U.S. exports. To see why, suppose that the opposite was true—namely, that the dollars used to pay for U.S. imports never came back. Suppose, for example, that foreigners either stuffed the U.S. import dollars under their mattresses or, worse yet, burned them. If this was the case, we could run a tremendous scam on the rest of the world by simply printing up more pieces of paper, calling them dollars, and using them to import valuable goods such as Japanese cars and oil from Saudi Arabia, for free.

The only reason the rest of the world is willing to accept dollars as payment for the goods we import from them is that those pieces of paper are worth something in return. Specifically, the dollars foreigners earn on U.S. imports can be used to purchase U.S. goods.

Contrary to politicians' statements about how dollars spent on foreign products are "lost" to the U.S., free trade causes no such dissipation of currency. Currency is neither created nor destroyed in the process. The only thing that is created when other countries' products are purchased is a net gain to the United States as a whole—a net gain not only from the imports themselves but also from the exports that those imports serve to promote.

The difference between the political and economic views of trade is aptly summarized by Milton Friedman:[17]

> *. . . public opinion [on foreign trade overemphasizes] the visible [versus the] . . . invisible effects of government policy . . . steelworkers whose jobs are threatened by imports from Japan are highly visible. They . . . can see clearly the benefit to them from restricting [steel] imports. . . . The cost is large but spread thinly. Tens of thousands of buyers of objects made with steel would pay a bit more because of the restriction. The Japanese would earn fewer dollars here and, as a result, purchase fewer U.S. goods. But that cost too is invisible. The man who might have had a job producing a product the Japanese would have purchased if they had been permitted to sell more steel here will have no way of knowing that he has been hurt.*
>
> *Workers . . . [producing] products . . . sold to Japan to earn the yen used to buy Japanese steel are producing steel for the U.S. just as much as the men who tend the open-hearth furnaces in Gary [Indiana]. . . . We could produce bananas in hothouses, and no doubt would if the tariff on bananas was high enough. Would that make sense? Obviously not—we can produce them more efficiently indirectly by trading export goods for bananas from Central America. . . .*
>
> *As Adam Smith [noted in]* The Wealth of Nations: *"What is prudence in the conduct of every private family, can scarce be folly in that of a great Kingdom. If a foreign country can supply us with a commodity cheaper than we ourselves can make it, better buy it of them with some part of the produce of our own industry, employed in a way in which we have some advantage. The general industry of the country . . . will not thereby be diminished . . . but only left to find out the way in which it can be employed to the greatest advantage.*

APPLICATION 10.8 PROTECTING STEEL JOBS STEALS JOBS

In early 2002, steel workers rallied outside the White House in favor of a 30-percent increase in tariffs (taxes) on steel imports.[18] The workers argued that the tariffs would save American jobs—an argument that both Congress and President George W. Bush found persuasive.

In contrast to policymakers' stated intent of saving domestic jobs, the increased tariffs actually ended up im-

[18]"Man of Steel?" *Wall Street Journal*, March 4, 2002, p. A14.

[17]Milton Friedman, "In Defense of Dumping," *Newsweek*, February 20, 1978.

posing a net job loss on the United States. They did this in two ways. First, the tariffs forced consumers to spend more on steel than they would otherwise have had to pay. Consumers ended up having less money to spend on other goods, many of which are associated with domestic jobs. Second, tariffs reduced imports of steel. Reduced imports decreased U.S. exports and associated domestic jobs since the dollars used to purchase imports by necessity come back to pay for U.S. exports.

Estimates indicated that the new steel tariffs cost eight American jobs for every one domestic steel job protected. Even Steel Belt states suffered a net job loss. Illinois lost five jobs for every one protected, Ohio three for every one, and Pennsylvania and Indiana two for one.

10.6 Government Intervention in Markets: Quantity Controls

QUOTAS government-imposed maximum quantities of goods

Price is not the only feature of markets that policymakers may wish to control. Quantity can also be the subject of government attention. For example, in Canada and much of Western Europe, there are government-specified maximum quantities, or **quotas**, on the amount of American-produced television that can be broadcast by local stations. In Singapore, annual new car purchases are limited to 50,000 in an attempt to relieve congestion and improve air quality. In the United States, there are either voluntary or mandatory quotas on imports of such goods as steel, sugar, cars, computer chips, dairy products, and textiles. There are also legal limits on the number of people who can immigrate to the United States from any other country in the world in a given year.

To illustrate how the competitive model can be employed to analyze quantity controls, we focus on government-imposed maximum quantities—more specifically, the quota placed on sugar imports by the United States. The effects observed in the case of the sugar import quota can be generalized to other cases of government-legislated quotas. Moreover, the competitive model allows us to see why some of the economic effects of the quota may be contrary to the intentions of the policymakers implementing the quota.

Sugar Policy: A Sweet Deal

The U.S. climate is not well suited to the production of sugar, just as it is unsuited to the production of coffee and bananas. In the case of sugar, however, there is a thriving domestic industry; in most years we import less than 20 percent of the sugar we use. Why don't we import all the sugar we use, as we do with bananas and coffee? The answer is to be found in the policies adopted by our government toward the sugar industry—policies that include restrictions on imports from other countries.

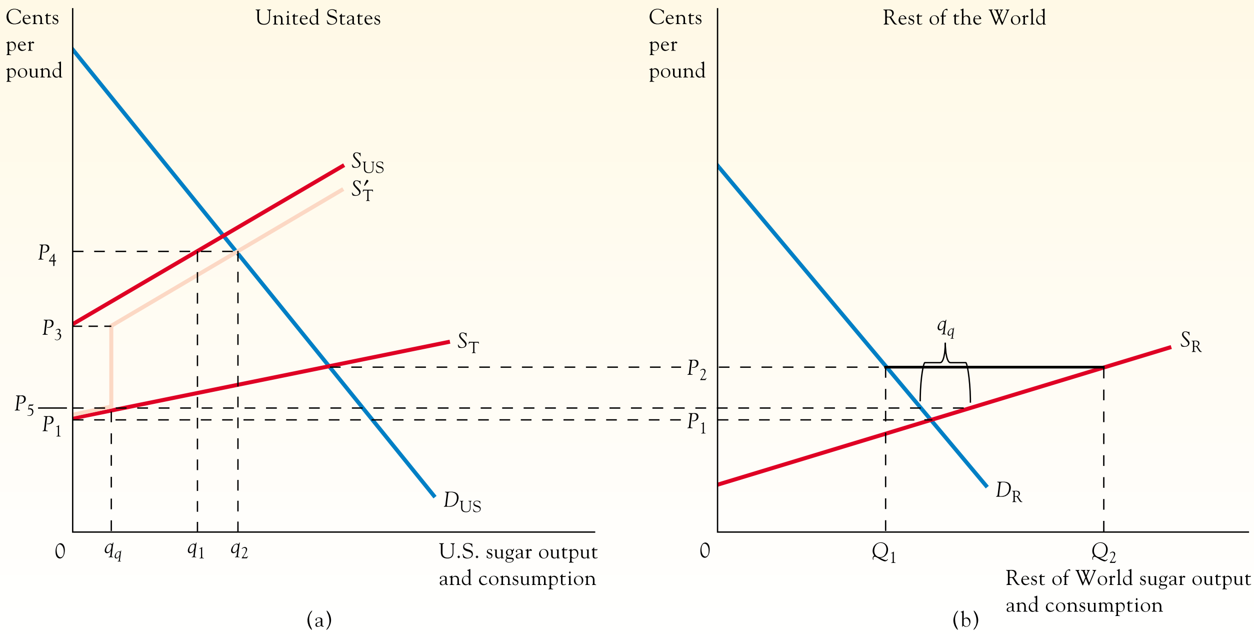
Let's see how the sugar market would operate in the absence of government policy. In Figure 10.12a we show the U.S. demand and domestic supply curves for sugar as D_{US} and S_{US}. Figure 10.12b gives the supply and demand curves for the Rest of the World (RoW) as S_R and D_R, respectively; these are aggregated across many producing and consuming countries. From these relationships we can derive the total supply curve confronting U.S. consumers when there is free trade. The total supply curve is shown as S_T in Figure 10.12a. It is derived as the horizontal gap between D_R and S_R in Figure 10.12b, above P_1. It consists entirely of imports over the relevant range, because sugar can be produced at lower cost overseas than in the United States. With free trade, equilibrium is established at the intersection of S_T and D_{US}. The resulting uniform world price is P_2, with the United States importing all its sugar, an amount equal to Q_1Q_2 per year as shown in Figure 10.12b. There is no U.S. production; P_2 is not high enough to cover the cost of domestic production.

Suppose that to help domestic sugar producers the government places a quota of q_q pounds per year on imports. Then the total supply curve becomes the kinked line S_T'. The new total supply curve is the same as the previous total supply curve without the quota, S_T,

FIGURE 10.12

The Sugar Import Quota

With free trade, the uniform world price of sugar is P_2, with the United States importing Q_1Q_2 units of sugar and producing none. (a) With an import quota of q_q, the price in the United States is P_4, production is q_1, consumption is q_2, and imports are q_1q_2. (b) The price on world markets falls to P_5.



out to the quota amount of q_q. At q_q, the new total supply curve becomes vertical until a sufficiently high price is reached, P_3, to encourage domestic production. Above P_3, the new total supply curve parallels the domestic supply curve, S_{US}, and has a magnitude that exceeds S_{US} by the amount of the quota, q_q.

The new total supply curve indicates that RoW suppliers will add an amount equal to q_q to domestic production at each possible price above P_1. Although RoW suppliers would like to sell more than this in the United States, they are not permitted to do so. The result of the import quota is a price for sugar of P_4 in the United States. This price is determined by the intersection of the U.S. demand curve, D_{US}, and the total supply curve, S'_T. At the price of P_4, U.S. sugar output is q_1, domestic consumption is q_2, and imports equal q_1q_2, or the quota amount of q_q.

Domestic consumers, of course, bear the burden of the quota in the form of a higher price (P_4 versus P_2 in Figure 10.12a) for sugar. The estimated annual loss in consumer surplus from the quota is $4.2 billion as of 2002, about $53 per family. Domestic sugar producers benefit from the quota. The estimated annual increase in producer surplus is $421 million as of 2002. Thus, the quota's cost to consumers is about $10 for each $1 of producer surplus gained by suppliers. The reason that the producers' benefit is so much less than the consumers' cost is that much of the consumer cost simply covers the significantly higher production cost of sugar in this country. In sum, contrary to the statements made by many political advocates of the quota, the United States is worse off on net because of the quota: domestic consumers are harmed more than domestic producers are helped.

Given that the sugar import quota imposes a deadweight loss on the United States, why does this policy remain in effect? The likely answer relates to the extent to which the benefits and costs of the sugar import quota are distributed. Although U.S. sugar producers may gain far less surplus than U.S. consumers lose, there are relatively few sugar producers and many sugar consumers. The gains from the sugar quota are thus much more concentrated, and each of the relatively small number of sugar producers has a strong incentive to lobby policymakers to retain the quota. In contrast, practically every family in the United States consumes sugar. The estimated annual loss per family is only $53—not much of an incentive for the typical family to lobby policymakers to repeal the quota.

Because their export markets are limited, producers in other countries are also harmed by the U.S. sugar policy. In Figure 10.12b, we see that when the United States adopts the import quota, the price on the world market falls from P_2 to P_5 (P_5 is the price at which the gap between the RoW supply and demand curves for sugar is exactly equal to the quota, q_q). This benefits consumers in other countries, but harms producers, and, in particular, sugar-producing countries. Ironically, many of the countries that produce sugar are less-developed countries, such as the Philippines and Haiti, that U.S. policymakers generally try to help. Moreover, the effects are substantial, as is suggested by the fact that in some years the U.S. price has been more than five times the world market price!

The effects on producers in other countries are exacerbated by the fact that when certain less-developed countries are kept from more fully benefiting from trade, economic and social conditions conducive to the spawning of crime and terrorism are at times created. The sugar-cane growing area of Egypt, for example, was the breeding ground over the last decade for that country's main Islamic fundamentalist terrorist group, Gama Islamiyya. Terrorist group organizers found willing recruits and safe havens in the impoverished area.

The effects of the import quota also do not stop with the sugar market. For example, with the domestic price of sugar so far above world levels, importing food products with high sugar content has become profitable because these foods can be produced more cheaply abroad using sugar purchased on the world market. Because this reduces domestic sugar purchases and puts downward pressure on the price of sugar in the United States, political pressure to apply import restrictions on imported goods that contain sugar has arisen. In 1985, import quotas were placed on a number of these goods, such as cake and pancake mixes.

Beyond imports, other market forces in the form of substitutes are at work, making maintenance of the price so far above competitive levels increasingly difficult. For example, production of a major substitute for sugar called high-fructose corn syrup (HFCS) has increased enormously, and this product has replaced sugar in many uses. (Today, HFCS is the major sweetening ingredient in soft drinks; 15 years ago sugar played this role.) Because HFCS is made from corn, corn producers have benefited from the import quota. As a consequence, we now see grain growers from the cornbelt lobbying alongside sugar growers from the South for preserving the quota.

The tremendous disparity between sugar prices in the United States and the rest of the world also creates some unusual attempts to evade the import quotas. According to the Department of Agriculture, some companies make money by importing products such as iced tea mix, separating out the sugar once the mix has safely crossed the U.S. border, and throwing away the remainder of the product. The sugar can then be sold at a cost to buyers still lower than if it had been purchased directly from a domestic producer.

The varied methods foreign producers use in trying to get around U.S. import quotas are not peculiar to the case of sugar. For example, confronting limits on the number of computer chips they can sell in the U.S., foreign manufacturers get their chips into the United States in an indirect fashion. They install them into personal computers and then export the personal computers to the United States. In response to limits on U.S. textile imports from Hong Kong, manufacturers there may move their production facilities to Indonesia.

Faced with constraints on the number of immigrants that the United States will accept from Poland in any year, prospective Polish immigrants to the United States may first move to Canada or Italy, countries upon which the United States places less restrictive immigration quotas. And, under the "voluntary export restraints" on automobiles negotiated by the U.S. and Japanese governments, Japanese car producers have responded to the limit of 1.85 million cars that can be shipped to the U.S. market per year in a number of creative ways, including moving some of their production to the United States; tilting their product mix toward more luxurious car models such as Lexus and Acura with higher per-unit profit margins; making standard previously optional features such as air conditioning, and adding the fee for the features into the base sticker price; and calling certain sport-utility vehicles such as the Suzuki Samurai and Isuzu Trooper "trucks," thereby avoiding the export restraint on "cars."

APPLICATION 10.9 WHY SUGAR IMPORT QUOTAS WERE JOB LOSERS WITH RESPECT TO LIFESAVERS

In 2002, Kraft Foods, the maker of LifeSavers, announced that production facilities for its candy, which had been made in the United States for 90 years, would be moved to Canada.[19] The lost domestic jobs were the direct result, according to Kraft, of sugar import quotas that made sugar, the main ingredient of LifeSavers, at least twice as expensive at that time in the United States as Canada. During the same year, Brach's, another candy maker, moved its production facilities from Chicago to Mexico, where sugar could be purchased, as in Canada, at the world price. Brach's move to evade the effects of the U.S. sugar import quota resulted in 1,100 jobs being lost as its Chicago plant.

[19]George Will, "Protectionist Decisions Undercut Free Trade," *Dallas Morning News*, April 14, 2002, p. J4.

SUMMARY

- A broad range of applications shows that while government intervention may be justified on the grounds of helping people, its effects may be precisely counter to the objectives of those favoring the intervention.
- Producer surplus, analogous to consumer surplus, is the gain that producers can realize from the sale of output to consumers when the price exceeds the minimum amount necessary to compensate the seller. In general, producer surplus will accrue to some of the owners of inputs that have upward-sloping supply curves to the industry.
- Total surplus is the total net gain to those who participate in a market—that is, the sum of consumer surplus and producer surplus.
- Price ceilings result in a deadweight loss, or welfare cost, which is the aggregate loss in well-being of all participants in a market.
- Excise taxes produce different effects in the short run and in the long run. In the short run, all firms incur a loss and have an incentive to cut output, increasing price. In the long run, some firms exit the industry, output drops further, and the final price to consumers is higher than in the short run. In an increasing-cost industry, consumers and certain input owners bear the burden of the tax.
- For a given supply curve and per-unit excise tax, the more inelastic the demand curve, the greater the tax burden on consumers, the smaller the tax burden on producers, and the smaller the reduction in output.
- In the case of a perfectly elastic supply curve, the constant-cost case, the price to consumers rises by the amount of the tax per unit, regardless of the elasticity of the demand curve.

- Because an excise tax results in an output lower than in an unfettered competitive market, it produces a deadweight loss by restricting output to a level where the product's marginal benefit exceeds the marginal cost of production.
- During the period in which the U.S. airline industry was regulated, the Civil Aeronautics Board (CAB) imposed, in effect, a price floor that kept price above the competitive level. Since suppliers could not compete on the basis of price, nonprice competition was waged, increasing costs and reducing profit despite high prices.
- Airline deregulation has resulted in lower ticket prices, a major restructuring of the airline industry, and lower costs for the firms that remain.
- In most major U.S. cities the supply of cabs is limited by an entry restriction in the form of a fixed number of city-issued licenses, or medallions, making the supply curve of passenger-miles fixed and vertical. As demand increases, prices rise. In many cities licensing and other forms of entry restriction such as maximum fares (a form of price ceiling) give rise to illegal markets in transportation services.
- The supply–demand model shows that international trade is beneficial to the United States as a whole, although in some situations individual producers or consumers may lose.
- Imports and exports are fundamentally linked in that the dollars that foreigners earn on U.S. imports must ultimately be employed to purchase U.S. goods.
- Governments may control quantity as well as price. Quantity is controlled by quotas and other legislation, whose economic effects are sometimes contrary to the intentions of policymakers. Restrictions on sugar imports, for instance, impose a deadweight loss in that the gains to domestic sugar producers are outweighed by the cost to consumers caused by the significantly higher cost of domestic sugar.

Review Questions and Problems

Questions and problems marked with an asterisk have solutions given in Answers to Selected Problems at the back of the book (page xxx).

10.1. What is producer surplus? What is consumer surplus? What is total surplus? Explain how each is shown in a supply and demand graph.

10.2. What is the relationship between the efficient level of output of a good and the size of total surplus achieved? Is total surplus greater if the output of the good is greater than the competitive output?

10.3. Define deadweight loss. How is it related to the concept of total surplus?

10.4. Using long-run supply and demand curves, analyze the effects of an ad valorem excise tax equal to 20 percent of the market (selling) price of gasoline. How do the effects differ from those of the per-unit excise tax discussed in the text?

***10.5.** Suppose that the gasoline market is competitive and that the government grants a subsidy to the industry's firms of 20 cents per gallon. How will the subsidy affect price; output; and consumer, producer, government, and total surplus? Is there a deadweight loss associated with the subsidy? Does the price to consumers fall by more if the industry is increasing-cost or constant-cost? (*Hint:* This situation is the reverse of the excise tax analysis—the supply curve shifts down in height by 20 cents per gallon.)

10.6. Why is it not inconsistent to say that airline fares, as regulated by the CAB, were above the competitive level, and yet airlines did not realize economic profits?

10.7. The airlines generally favored CAB regulation and were opposed to fares being determined in open markets. Since airline profits apparently were not unusually high under CAB regulation, what reasons could account for this support?

***10.8.** Suppose that New York City deregulates its taxicab market and, to avoid great harm to medallion owners, buys up outstanding medallions at the prevailing market price. Is this policy preferable to simply deregulating the market without buying up the medallions? In your answer, identify who would be harmed by the two alternative methods of deregulation.

10.9. How would each of the following affect the operation of a regulated taxi market and the price of a medallion?

a. A reduction in the maximum fare cabs can charge.
b. An increase in the fares on subways and buses.
c. An increase in parking fees in the downtown area.
d. A police crackdown on the operation of illegal taxis.
e. Announcement that the market will be deregulated in five years.

10.10. Suppose that the gasoline industry is competitive and constant-cost. Suppose also that, due to an unexpected increase in demand, the industry's firms are making short-run economic profits. Using graphs, depict what would happen in the short and the long run if the government imposed a 50 percent "windfall profits tax" on the economic profits being earned by the industry's firms.

10.11. In the market for organs for transplant, such as kidneys and hearts, the price is constrained to equal zero. Opposition to any type of remuneration for donating organs has been all but absolute from physicians and legislators. Reliance on altruism, however, does not appear to be working. The number of people waiting for organ transplants (and dying if they do not receive them) is double the number of willing donors. Relying on graphs, explain the effect of the proscription of financial incentives for organ donations on the producer surplus and consumer surplus in this market.

10.12. Suppose that the low-skill job market is perfectly competitive and that the equilibrium wage and monthly output in the market absent government interference are $4.50 per hour and 1,000,000 hours, respectively. Assume that the demand and supply elasticity equal two and one, respectively. If the federal government mandates a minimum wage of $5.25 per hour, explain what happens to producer, consumer, and total surplus. Is there a deadweight loss associated with the minimum wage?

10.13. If all else is the same as in problem 10.12 but the demand elasticity equals zero, what is the effect of the minimum wage on producer, consumer, and total surplus? Is there a deadweight loss?

10.14. "Consumers understandably like lower prices, but they should understand there is a great difference between a lower price produced by a government price ceiling and a lower price that comes about through normal market channels; one benefits the consumer, the other may not." How does our analysis of rent control relate to this pronouncement?

10.15. Using a pair of graphs like Figure 10.10, illustrate a situation in which the United States would be an exporter of the good in question, and identify the equilibrium.

10.16. In the Figure 10.10 situation, assume that $P_3 - P_1$ equals 10 cents per pound, and that the cost of transporting sugar from the RoW to the United States is equal to 1 cent per pound. Explain the determination of equilibrium in this case.

10.17. If bad weather causes the supply of sugar in the RoW to fall, how will this affect the U.S. market if the import quota described by Figure 10.12 is in place? Does this explain why the U.S. and world prices can differ greatly from year to year?

10.18. Using Figure 10.12, show the effect on consumer and producer surplus of the sugar import quota (relative to free trade). Also show the changes in consumer and producer surplus in the RoW.

10.19. Suppose that sugar imports are completely prohibited by the U.S. government in Figure 10.12. What will be the new equilibrium in the United States and the RoW? Show the effect on consumer and producer surplus of the prohibition on imports (relative to free trade). Also show the changes in consumer and producer surplus in the RoW.

10.20. Mexico is a producer and exporter of crude oil. Since Mexico is a relatively small crude-oil-producing country, its actions do not affect world prices; as an exporter, Mexico faces a foreign demand curve that is perfectly elastic at a price of $15 per barrel. The equation for the domestic demand curve is $Q_d = 26 - P$, where price (P) is measured in dollars per barrel and quantity demanded (Q_d) is measured in billions of barrels per year. The equation for the domestic supply curve is $Q_s = 10 + P$, where quantity supplied (Q_s) is measured in billions of barrels per year.

a. Assuming free trade, show graphically how much crude oil will be produced, consumed, and exported by Mexico.

b. Graphically, show the gains from trade. Explain who wins and who loses, and show by how much in terms of producer and consumer surplus. Does everyone in Mexico benefit from free trade? Explain why or why not. Is Mexico as a whole better off? Explain.

c. Suppose that the Mexican government provides a $2 per-barrel subsidy for every barrel of Mexican crude oil bought by foreigners. Graphically, show the effects of the subsidy on domestic production; domestic consumption; exports; and the welfare of producers, consumers, the government, and Mexico as a whole.

10.21. If output is at an inefficient level, does it imply that consumer surplus is smaller than at the competitive output? Does it imply that producer surplus is smaller than at the competitive output?

10.22. Explain how an excise tax levied on a constant-cost industry produces a deadweight loss. Use a graph to show the loss in consumer and producer surplus from the excise tax. Is the loss in total surplus the same as the deadweight loss? If not, show the deadweight loss in the graph and explain the meaning of the remainder of the loss in total surplus.

10.23. States do not currently collect sales taxes on consumer purchases on the Internet. Who, consumers or suppliers, benefits from the absence of such taxes? Explain.

10.24. Most experts believe that electronic commerce cannot explain the low rate of price inflation in the United States. These experts point to the fact that online retail sales account for about 1 percent of total retail sales as of 2002. Using the trade model we developed in this chapter, explain the basis for the experts' conclusion that electronic commerce cannot be exercising a significant amount of downward pressure on the prices of most goods.

10.25. Assume that bananas from Latin America have two major consuming markets: North America and Europe. In such a scenario, explain the effects of strict quotas being placed by the European Union on banana imports into Europe (to give preference to producers in Europe's former African colonies) on producer, consumer, and total surplus in the European and North American banana markets.

10.26. Suppose that entry of new doctors in the U.S. medical market is limited through caps on medical school enrollments and licensing restrictions imposed by the American Medical Association. If the medical market is constant-cost and initially in long-run competitive equilibrium, what will be the effect of an increase in demand in the short and long run on: the number of hours worked by the average licensed doctor, the profits made by licensed doctors, and the prevailing price charged by doctors per unit of service?

10.27. How would your answers to the previous question differ if all the assumptions were the same but there were no entry restrictions imposed by the American Medical Association?