CHAPTER 4

Price Controls and Quotas: Meddling with Markets

What You Will Learn in This Chapter

- The meaning of **consumer surplus** and its relationship to the demand curve
- The meaning of **producer surplus** and its relationship to the supply curve
- The meaning and importance of **total surplus** and how it can be used to measure the gains from trade
- How **price controls** and **quantity controls** create problems and can make a market inefficient
- What **deadweight loss** is
- Who benefits and who loses from market interventions, and why they are used despite their well-known problems

LearningCurve | interactive activity

BIG CITY, NOT-SO-BRIGHT IDEAS

New York City: an empty taxi is hard to find.

NEW YORK CITY IS A PLACE where you can find almost anything—that is, anything except a taxicab when you need one or a decent apartment at a rent you can afford. You might think that New York's notorious shortages of cabs and apartments are the inevitable price of big-city living. However, they are largely the product of government policies—specifically, of government policies that have, one way or another, tried to prevail over the market forces of supply and demand.

In Chapter 3, we learned the principle that a market moves to equilibrium—that the market price rises or falls to the level at which the quantity of a good that people are willing to supply is equal to the quantity that other people demand.

But sometimes governments try to defy that principle. Whenever a government tries to dictate either a market price or a market quantity that's different from the equilibrium price or quantity, the market strikes back in predictable ways. Our ability to predict what will happen when governments try to defy supply and demand shows the power and usefulness of supply and demand analysis itself.

The shortages of apartments and taxicabs in New York are two examples that illuminate what happens when the logic of the market is defied.

New York's housing shortage is the result of *rent control,* a law that prevents landlords from raising rents except when specifically given permission. Rent control was introduced during World War II to protect the interests of tenants, and it still remains in force. Many other American cities have had rent control at one time or another, but with the notable exceptions of New York and San Francisco, these controls have largely been done away with.

Similarly, New York's limited supply of taxis is the result of a licensing system introduced in the 1930s. New York taxi licenses are known as "medallions," and only taxis with medallions are allowed to pick up passengers. Although this system was originally intended to protect the interests of both drivers and customers, it has generated a shortage of taxis in the city. The number of medallions remained fixed for nearly 60 years, with no significant increase until 2004 and only a trickle since.

We begin this chapter by looking at *consumer surplus,* the benefit from being able to purchase a good or a service. We will then look at a corresponding measure, *producer surplus,* which shows the benefit sellers receive from being able to sell a good. We move on to examine what happens when governments try to control prices in a competitive market, keeping the price in a market either below its equilibrium level—a *price ceiling* such as rent control—or above it—a *price floor* such as the minimum wage paid to workers in many countries. We then turn to schemes such as taxi medallions that attempt to dictate the quantity of a good bought and sold.

A consumer's **willingness to pay** for a good is the maximum price at which he or she would buy that good.

Consumer Surplus and the Demand Curve

The market in used textbooks is a big business in terms of dollars and cents—several billion dollars each year. More importantly for us, it is a convenient starting point for developing the concepts of consumer and producer surplus. We'll use the concepts of consumer and producer surplus to understand exactly how buyers and sellers benefit from a competitive market and how big those benefits are. In addition, these concepts play important roles in analyzing what happens when competitive markets don't work well or there is interference in the market.

So let's begin by looking at the market for used textbooks, starting with the buyers. The key point, as we'll see in a minute, is that the demand curve is derived from their tastes or preferences—and that those same preferences also determine how much they gain from the opportunity to buy used books.

Willingness to Pay and the Demand Curve

A used book is not as good as a new book—it will be battered and coffee-stained, may include someone else's highlighting, and may not be completely up to date. How much this bothers you depends on your preferences. Some potential buyers would prefer to buy the used book even if it is only slightly cheaper than a new book, but others would buy the used book only if it is considerably cheaper.

Let's define a potential buyer's **willingness to pay** as the maximum price at which he or she would buy a good, in this case a used textbook. An individual won't buy the book if it costs more than this amount but is eager to do so if it costs less. If the price is just equal to an individual's willingness to pay, he or she is indifferent between buying and not buying. For the sake of simplicity, we'll assume that the individual buys the good in this case.

Table 4-1 shows five potential buyers of a used book that costs $100 new, listed in order of their willingness to pay. At one extreme is Aleisha, who will buy a second-hand book even if the price is as high as $59. Brad is less willing to have a used book and will buy one only if the price is $45 or less. Claudia is willing to pay only $35; Darren, only $25. And Edwina, who really doesn't like the idea of a used book, will buy one only if it costs no more than $10.

TABLE 4-1 Consumer Surplus When the Price of a Used Textbook Is $30

Potential buyer	Willingness to pay	Price paid	Individual consumer surplus = Willingness to pay – Price paid
Aleisha	$59	$30	$29
Brad	45	30	15
Claudia	35	30	5
Darren	25	—	—
Edwina	10	—	—
All buyers			**Total consumer surplus = $49**

How many of these five students will actually buy a used book? It depends on the price. If the price of a used book is $55, only Aleisha buys one; if the price is $40, Aleisha and Brad both buy used books, and so on. So the information in the table on willingness to pay also defines the *demand schedule* for used textbooks.

Willingness to Pay and Consumer Surplus

Suppose that the campus bookstore makes used textbooks available at a price of $30. In that case Aleisha, Brad, and Claudia will buy books. Do they gain from their purchases, and if so, how much?

The answer, also shown in Table 4-1, is that each student who purchases a book does achieve a net gain but that the amount of the gain differs among students.

Aleisha would have been willing to pay $59, so her net gain is $59 – $30 = $29. Brad would have been willing to pay $45, so his net gain is $45 – $30 = $15. Claudia would have been willing to pay $35, so her net gain is $35 – $30 = $5. Darren and Edwina, however, won't be willing to buy a used book at a price of $30, so they neither gain nor lose.

The net gain that a buyer achieves from the purchase of a good is called that buyer's **individual consumer surplus.** What we learn from this example is that whenever a buyer pays a price less than his or her willingness to pay, the buyer achieves some individual consumer surplus.

The sum of the individual consumer surpluses achieved by all the buyers of a good is known as the **total consumer surplus** achieved in the market. In Table 4-1, the total consumer surplus is the sum of the individual consumer surpluses achieved by Aleisha, Brad, and Claudia: $29 + $15 + $5 = $49.

Economists often use the term **consumer surplus** to refer to both individual and total consumer surplus. We will follow this practice; it will always be clear in context whether we are referring to the consumer surplus achieved by an individual or by all buyers.

Total consumer surplus can be represented graphically. As we saw in Chapter 3, we can use the demand schedule to derive the market demand curve shown in Figure 4-1. Because we are considering only a small number of consumers, this curve doesn't look like the smooth demand curves of Chapter 3, where markets contained hundreds or thousands of consumers.

This demand curve is stepped, with alternating horizontal and vertical segments. Each horizontal segment—each step—corresponds to one potential buyer's willingness to pay. Each step in that demand curve is one book wide and represents one consumer. For example, the height of Aleisha's step is $59, her willingness to pay. This step forms the top of a rectangle, with $30—the price she actually pays for a book—forming the bottom. The area of Aleisha's rectangle, ($59 – $30) × 1 = $29, is her consumer surplus from purchasing one book at $30. So the individual consumer surplus Aleisha gains is the *area of the dark blue rectangle* shown in Figure 4-1.

In addition to Aleisha, Brad and Claudia will also each buy a book when the price is $30. Like Aleisha, they benefit from their purchases, though not as much, because they each have a lower willingness to pay. Figure 4-1 also shows the consumer surplus gained by Brad and Claudia; again, this can be measured by the areas of the appropriate rectangles. Darren and Edwina, because they do not buy books at a price of $30, receive no consumer surplus.

Individual consumer surplus is the net gain to an individual buyer from the purchase of a good. It is equal to the difference between the buyer's willingness to pay and the price paid.

Total consumer surplus is the sum of the individual consumer surpluses of all the buyers of a good in a market.

The term **consumer surplus** is often used to refer to both individual and total consumer surplus.

FIGURE 4-1 Consumer Surplus in the Used-Textbook Market

At a price of $30, Aleisha, Brad, and Claudia each buy a book but Darren and Edwina do not. Aleisha, Brad, and Claudia receive individual consumer surpluses equal to the difference between their willingness to pay and the price, illustrated by the areas of the shaded rectangles. Both Darren and Edwina have a willingness to pay less than $30, so they are unwilling to buy a book in this market; they receive zero consumer surplus. The total consumer surplus is given by the entire shaded area—the sum of the individual consumer surpluses of Aleisha, Brad, and Claudia—equal to $29 + $15 + $5 = $49.

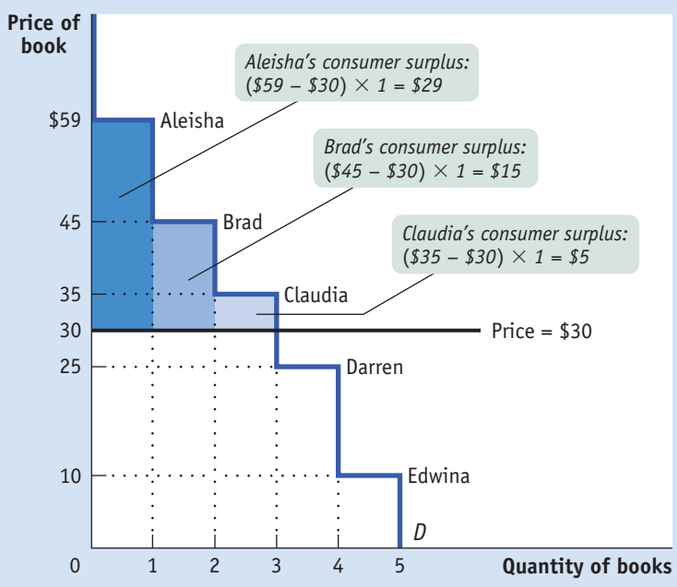
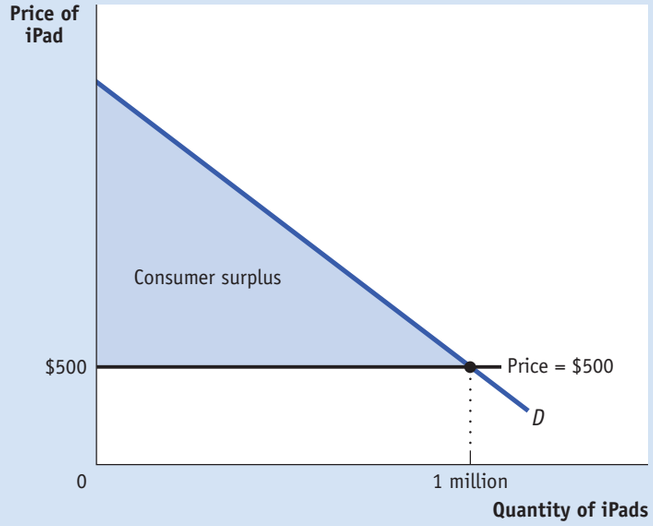


FIGURE 4-2 Consumer Surplus



The demand curve for iPads is smooth because there are many potential buyers. At a price of $500, 1 million iPads are demanded. The consumer surplus at this price is equal to the shaded area: the area below the demand curve but above the price. This is the total net gain to consumers generated from buying and consuming iPads when the price is $500.

The total consumer surplus achieved in this market is just the sum of the individual consumer surpluses received by Aleisha, Brad, and Claudia. So total consumer surplus is equal to the combined area of the three rectangles—the entire shaded area in Figure 4-1. Another way to say this is that total consumer surplus is equal to the area below the demand curve but above the price.

Figure 4-1 illustrates the following general principle: *the total consumer surplus generated by purchases of a good at a given price is equal to the area below the demand curve but above that price*. The same principle applies regardless of the number of consumers.

When we consider large markets, this graphical representation becomes extremely helpful. Consider, for example, the sales of iPads to millions of potential buyers. Each potential buyer has a maximum price that he or she is willing to pay. With so many potential buyers, the demand curve will be smooth, like the one shown in Figure 4-2.

Suppose that at a price of $500, a total of 1 million iPads are purchased. How much do consumers gain from being able to buy those 1 million iPads? We could answer that question by calculating the consumer surplus of each individual buyer and then adding these numbers up to arrive at a total. But it is much easier just to look at Figure 4-2 and use the fact that the total consumer surplus is equal to the shaded area. As in our original example, consumer surplus is equal to the area below the demand curve but above the price. (To refresh your memory on how to calculate the area of a right triangle, see the appendix to Chapter 2.)

LaunchPad | interactive activity

Producer Surplus and the Supply Curve

Just as some buyers of a good would have been willing to pay more for their purchase than the price they actually pay, some sellers of a good would have been willing to sell it for less than the price they actually receive. So just as there are consumers who receive consumer surplus from buying in a market, there are producers who receive producer surplus from selling in a market.

TABLE 4-2 Producer Surplus When the Price of a Used Textbook Is $30

Potential seller	Cost	Price received	Individual producer surplus = Price received – Cost
Andrew	$ 5	$30	$25
Betty	15	30	15
Carlos	25	30	5
Donna	35	—	—
Engelbert	45	—	—
All sellers			**Total producer surplus = $45**

Cost and Producer Surplus

Consider a group of students who are potential sellers of used textbooks. Because they have different preferences, the various potential sellers differ in the price at which they are willing to sell their books. Table 4-2 shows the prices at which several different students would be willing to sell. Andrew is willing to sell the book as long as he can get at least $5; Betty won't sell unless she can get at least $15; Carlos, unless he can get $25; Donna, unless she can get $35; Engelbert, unless he can get $45.

A seller's **cost** is the lowest price at which he or she is willing to sell a good.

The lowest price at which a potential seller is willing to sell has a special name in economics: it is called the seller's **cost.** So Andrew's cost is $5, Betty's is $15, and so on.

Using the term *cost*, which people normally associate with the monetary cost of producing a good, may sound a little strange when applied to sellers of used textbooks. The students don't have to manufacture the books, so it doesn't cost the student who sells a book anything to make that book available for sale, does it?

Yes, it does. A student who sells a book won't have it later, as part of his or her personal collection. So there is an *opportunity cost* to selling a textbook, even if the owner has completed the course for which it was required. And remember that one of the basic principles of economics is that the true measure of the cost of doing something is always its opportunity cost. That is, the real cost of something is what you must give up to get it.

So it is good economics to talk of the minimum price at which someone will sell a good as the "cost" of selling that good, even if he or she doesn't spend any money to make the good available for sale. Of course, in most real-world markets the sellers are also those who produce the good and therefore do spend money to make the good available for sale. In this case the cost of making the good available for sale *includes* monetary costs, but it may also include other opportunity costs.

Getting back to the example, suppose that Andrew sells his book for $30. Clearly he has gained from the transaction: he would have been willing to sell for only $5, so he has gained $25. This net gain, the difference between the price he actually gets and his cost—the minimum price at which he would have been willing to sell—is known as his **individual producer surplus.**

As in the case of consumer surplus, we can add the individual producer surpluses of sellers to calculate the **total producer surplus,** the total net gain to all sellers in the market. Economists use the term **producer surplus** to refer to either total or individual producer surplus. Table 4-2 shows the net gain to each of the students who would sell a used book at a price of $30: $25 for Andrew, $15 for Betty, and $5 for Carlos. The total producer surplus is $25 + $15 + $5 = $45.

As with consumer surplus, the producer surplus gained by those who sell books can be represented graphically. Just as we derived the demand curve from the willingness to pay of different consumers, we first derive the supply curve from the cost of different producers. The step-shaped curve in Figure 4-3 shows the supply curve implied by the cost shown in Table 4-2. Each step in that supply

Individual producer surplus is the net gain to an individual seller from selling a good. It is equal to the difference between the price received and the seller's cost.

Total producer surplus is the sum of the individual producer surpluses of all the sellers of a good in a market.

Economists use the term **producer surplus** to refer to either total or individual producer surplus.

FIGURE 4-3 Producer Surplus in the Used-Textbook Market

At a price of $30, Andrew, Betty, and Carlos each sell a book but Donna and Engelbert do not. Andrew, Betty, and Carlos get individual producer surpluses equal to the difference between the price and their cost, illustrated here by the shaded rectangles. Donna and Engelbert each have a cost that is greater than the price of $30, so they are unwilling to sell a book and so receive zero producer surplus. The total producer surplus is given by the entire shaded area, the sum of the individual producer surpluses of Andrew, Betty, and Carlos, equal to $25 + $15 + $5 = $45.

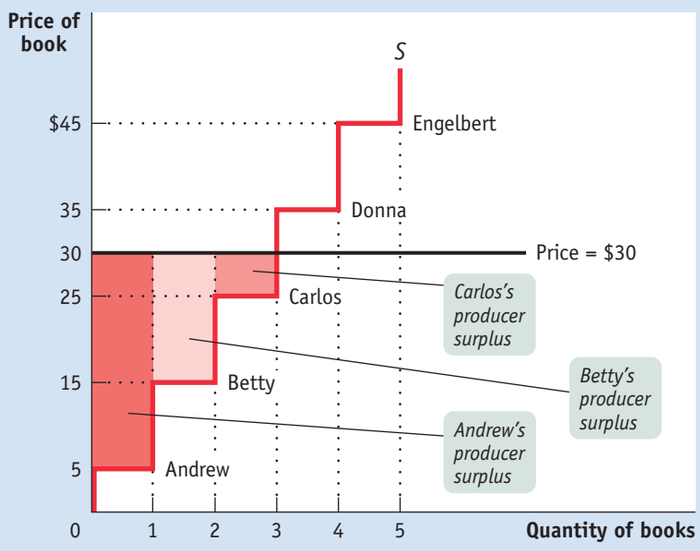
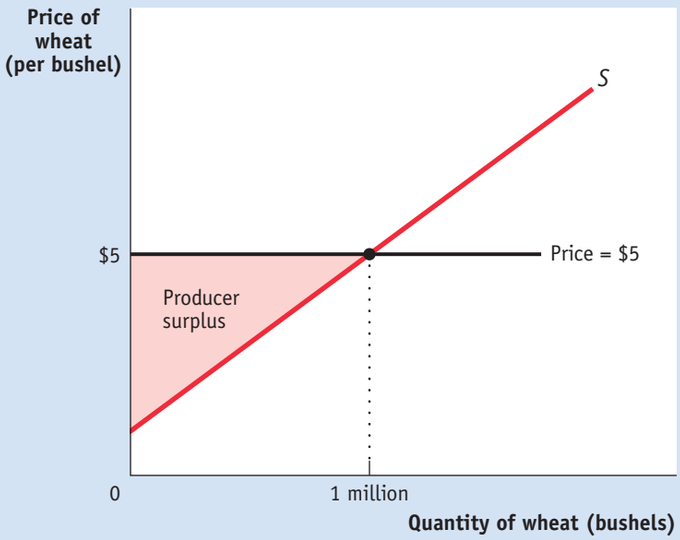


FIGURE 4-4 Producer Surplus

Here is the supply curve for wheat. At a price of $5 per bushel, farmers supply 1 million bushels. The producer surplus at this price is equal to the shaded area: the area above the supply curve but below the price. This is the total gain to producers—farmers in this case—from supplying their product when the price is $5.



curve is one book wide and represents one seller. The height of Andrew's step is $5, his cost. This forms the bottom of a rectangle, with $30, the price he actually receives for his book, forming the top. The area of this rectangle, ($30 – $5) × 1 = $25, is his producer surplus. So the producer surplus Andrew gains from selling his book is the *area of the red rectangle* at far left shown in the figure.

Let's assume that the campus bookstore is willing to buy all the used copies of this book that students are willing to sell at a price of $30. Then, in addition to Andrew, Betty and Carlos will also sell their books. They will also benefit from their sales, though not as much as Andrew, because they have higher costs. Andrew, as we have seen, gains $25. Betty gains a smaller amount: since her cost is $15, she gains only $15. Carlos gains even less, only $5.

Again, as with consumer surplus, we have a general rule for determining the total producer surplus from sales of a good: *The total producer surplus from sales of a good at a given price is the area above the supply curve but below that price.*

This rule applies both to examples like the one shown in Figure 4-3, where there are a small number of producers and a step-shaped supply curve, and to more realistic examples, where there are many producers and the supply curve is more or less smooth.

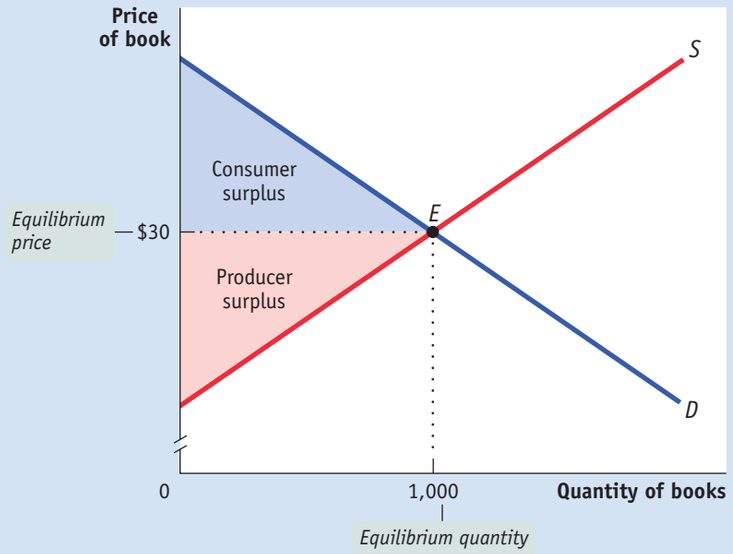
Consider, for example, the supply of wheat. Figure 4-4 shows how producer surplus depends on the price per bushel. Suppose that, as shown in the figure, the price is $5 per bushel and farmers supply 1 million bushels. What is the benefit to the farmers from selling their wheat at a price of $5? Their producer surplus is equal to the shaded area in the figure—the area above the supply curve but below the price of $5 per bushel.

The Gains from Trade

Let's return to the market in used textbooks, but now consider a much bigger market—say, one at a large state university. There are many potential buyers and sellers, so the market is competitive. Let's line up incoming students who are potential buyers of a book in order of their willingness to pay, so that the entering student with the highest willingness to pay is potential buyer number 1, the student with the next highest willingness to pay is number 2, and so on. Then we can use their willingness to pay to derive a demand curve like the one in Figure 4-5.

FIGURE 4-5 Total Surplus

In the market for used textbooks, the equilibrium price is $30 and the equilibrium quantity is 1,000 books. Consumer surplus is given by the blue area, the area below the demand curve but above the price. Producer surplus is given by the red area, the area above the supply curve but below the price. The sum of the blue and the red areas is total surplus, the total benefit to society from the production and consumption of the good.



Similarly, we can line up outgoing students, who are potential sellers of the book, in order of their cost—starting with the student with the lowest cost, then the student with the next lowest cost, and so on—to derive a supply curve like the one shown in the same figure.

As we have drawn the curves, the market reaches equilibrium at a price of $30 per book, and 1,000 books are bought and sold at that price. The two shaded triangles show the consumer surplus (blue) and the producer surplus (red) generated by this market. The sum of consumer and producer surplus is known as the **total surplus** generated in a market.

The **total surplus** generated in a market is the total net gain to consumers and producers from trading in the market. It is the sum of the consumer and the producer surplus.

ECONOMICS in Action

Take the Keys, Please

LaunchPad | interactive activity

"Airbnb was really born from a math problem," said its co-founder, Joe Gebbia. "We quit our jobs to be entrepreneurs, and the landlord raised our rent beyond our means. And so we had a math problem to solve. It just so happened that coming weekend, a design conference came to San Francisco that just wiped out the hotels in the city. We connected the dots. We had extra space in our apartment. So thus was born the air bed-and-breakfast."

From that bout of desperation-induced ingenuity sprang a company that now connects more than half a million listings in more than 34,000 cities and 192 countries available for short-term rentals. Airbnb is the most famous and successful purveyor in what is now often called "the sharing economy": companies that provide a marketplace in which people can share the use of goods. And there are many others: Relay-Rides and Getaround let you rent cars from their owners, Boatbound facilitates boat rentals, Desktime office space, ParkAtMyHouse parking spaces. SnapGoods allows people to borrow consumer goods like power tools from others in their neighborhood or social network.

Justin Sullivan/Getty Images

Owners use marketplaces like Airbnb to turn unused resources into cash.

Quick Review

- The demand curve for a good is determined by each potential consumer's **willingness to pay.**
- A fall in the price of a good increases **consumer surplus** through two channels: a gain to consumers who would have bought at the original price and a gain to consumers who are persuaded to buy by the lower price. A rise in the price of a good reduces consumer surplus in a similar fashion.
- The supply curve for a good is determined by the **cost** of each seller.
- When the price of a good rises, **producer surplus** increases through two channels: the gains of those who would have supplied the good at the original price and the gains of those who are induced to supply the good by the higher price. A fall in the price of a good similarly leads to a fall in producer surplus.
- **Individual consumer surplus** is the net gain to an individual consumer from buying a good.
- The **total consumer surplus** in a given market is equal to the area under the market demand curve but above the price.
- The difference between the price and cost is the seller's **individual producer surplus.**
- The **total producer surplus** is equal to the area above the market supply curve but below the price.
- **Total surplus** measures the gains from trade in a market.

What's motivating all this sharing? Well, it isn't an outbreak of altruism—it's plain dollars and cents. If there are unused resources sitting around, why not make money by renting them to someone else? As Judith Chevalier, a Yale School of Management economist, says, "These companies let you wring a little bit of value out of . . . goods that are just sitting there." And generating a bit more surplus from your possessions leads to a more efficient use of those resources. Why now? Clearly, because of the ease by which people can be matched online. As a result, says Arun Sundararajan, a professor at the NYU Stern School of Business, "That makes it possible for people to rethink the way they consume."

Check Your Understanding 4-1

1. Two consumers, Casey and Josey, want cheese-stuffed jalapeno peppers for lunch. Two producers, Cara and Jamie, can provide them. The accompanying table shows the consumers' willingness to pay and the producers' costs. Note that consumers and producers in this market are not willing to consume or produce more than four peppers at any price.

Quantity of peppers	Casey's willingness to pay	Josey's willingness to pay	Cara's cost	Jamie's cost
1st pepper	$0.90	$0.80	$0.10	$0.30
2nd pepper	0.70	0.60	0.10	0.50
3rd pepper	0.50	0.40	0.40	0.70
4th pepper	0.30	0.30	0.60	0.90

a. Use the table to construct a demand schedule and a supply schedule for prices of $0.00, $0.10, and so on, up to $0.90.
b. Find the equilibrium price and quantity in the market for cheese-stuffed jalapeno peppers.
c. Find consumer, producer, and total surplus in equilibrium in this market.

2. Show how each of the following three actions reduces total surplus:
a. Having Josey consume one fewer pepper and Casey one more pepper than in the market equilibrium.
b. Having Cara produce one fewer pepper and Jamie one more pepper than in the market equilibrium.
c. Having Josey consume one fewer pepper and Cara produce one fewer pepper than in the market equilibrium.

Solutions appear at back of book.

Why Governments Control Prices

You learned in Chapter 3 that a market moves to equilibrium—that is, the market price moves to the level at which the quantity supplied equals the quantity demanded. But this equilibrium price does not necessarily please either buyers or sellers.

After all, buyers would always like to pay less if they could, and sometimes they can make a strong moral or political case that they should pay lower prices. For example, what if the equilibrium between supply and demand for apartments in a major city leads to rental rates that an average working person can't afford? In that case, a government might well be under pressure to impose limits on the rents landlords can charge.

Sellers, however, would always like to get more money for what they sell, and sometimes they can make a strong moral or political case that they should receive higher prices. For example, consider the labor market: the price for an hour of a worker's time is the wage rate. What if the equilibrium between supply and demand for less skilled workers leads to wage rates that yield an income below the poverty level? In that case, a government might well be

pressured to require employers to pay a rate no lower than some specified minimum wage.

In other words, there is often a strong political demand for governments to intervene in markets. And powerful interests can make a compelling case that a market intervention favoring them is "fair." When a government intervenes to regulate prices, we say that it imposes **price controls.** These controls typically take the form either of an upper limit, a **price ceiling,** or a lower limit, a **price floor.**

Unfortunately, it's not that easy to tell a market what to do. As we will now see, when a government tries to legislate prices—whether it legislates them down by imposing a price ceiling or up by imposing a price floor—there are certain predictable and unpleasant side effects.

Price controls are legal restrictions on how high or low a market price may go. They can take two forms: a **price ceiling,** a maximum price sellers are allowed to charge for a good or service, or a **price floor,** a minimum price buyers are required to pay for a good or service.

Price Ceilings

Aside from rent control, which you read about in the opening story, there are not many price ceilings in the United States today. But at times they have been widespread. Price ceilings are typically imposed during crises—wars, harvest failures, natural disasters—because these events often lead to sudden price increases that hurt many people but produce big gains for a lucky few.

The U.S. government imposed ceilings on many prices during World War II: the war sharply increased demand for raw materials, such as aluminum and steel, and price controls prevented those with access to these raw materials from earning huge profits. Price controls on oil were imposed in 1973, when an embargo by Arab oil-exporting countries seemed likely to generate huge profits for U.S. oil companies. Price controls were instituted again in 2012 by New York and New Jersey authorities in the aftermath of Hurricane Sandy, as gas shortages led to rampant price gouging.

Rent control in New York is a legacy of World War II: it was imposed because wartime production produced an economic boom, which increased demand for apartments at a time when the labor and raw materials that might have been used to build them were being used to win the war instead. Although most price controls were removed soon after the war ended, New York's rent limits were retained and gradually extended to buildings not previously covered, leading to some very strange situations.

You can rent a one-bedroom apartment in Manhattan on fairly short notice—if you are able and willing to pay several thousand dollars a month and live in a less desirable area. Yet some people pay only a small fraction of this for comparable apartments, and others pay hardly more for bigger apartments in better locations.

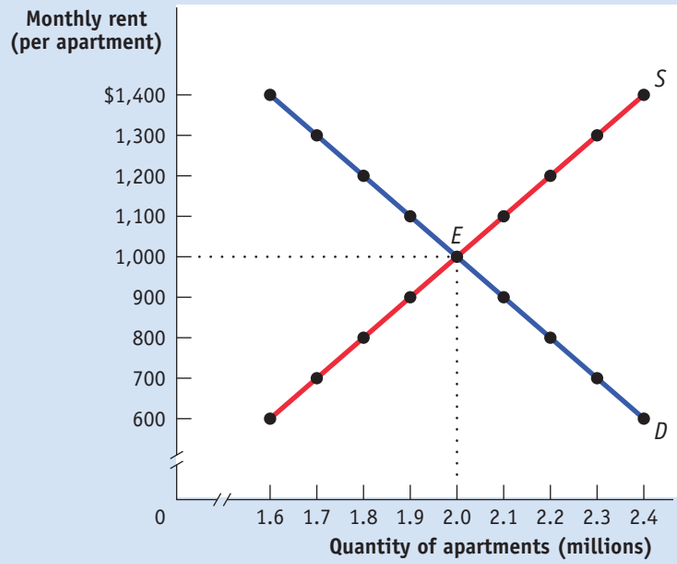
Aside from producing great deals for some renters, however, what are the broader consequences of New York's rent-control system? To answer this question, we turn to the model we developed in Chapter 3: the supply and demand model.

Modeling a Price Ceiling

To see what can go wrong when a government imposes a price ceiling on an efficient market, consider Figure 4-6, which shows a simplified model of the market for apartments in New York. For the sake of simplicity, we imagine that all apartments are exactly the same and so would rent for the same price in an unregulated market.

The table in Figure 4-6 shows the demand and supply schedules; the demand and supply curves are shown on the left. We show the quantity of apartments on the horizontal axis and the monthly rent per apartment on the vertical axis. You can see that in an unregulated market the equilibrium would be at point *E*: 2 million apartments would be rented for $1,000 each per month.

FIGURE 4-6 The Market for Apartments in the Absence of Price Controls



Monthly rent (per apartment)	Quantity of apartments (millions)	
	Quantity demanded	Quantity supplied
$1,400	1.6	2.4
1,300	1.7	2.3
1,200	1.8	2.2
1,100	1.9	2.1
1,000	2.0	2.0
900	2.1	1.9
800	2.2	1.8
700	2.3	1.7
600	2.4	1.6

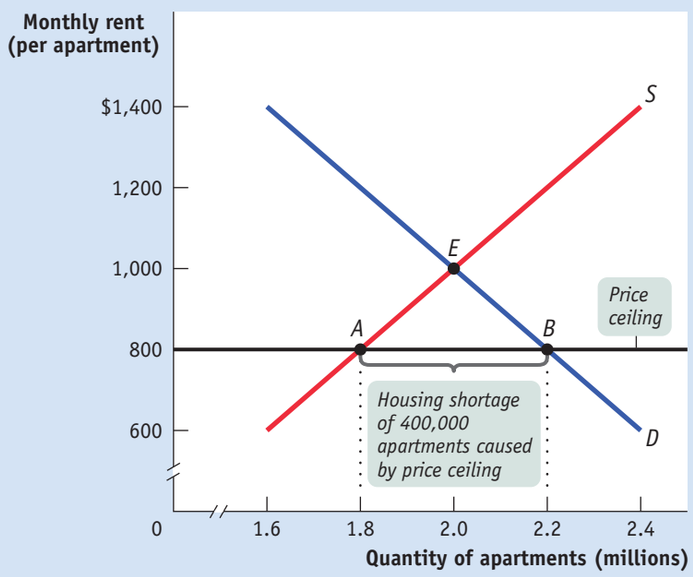
Without government intervention, the market for apartments reaches equilibrium at point *E* with a market rent of $1,000 per month and 2 million apartments rented.

Now suppose that the government imposes a price ceiling, limiting rents to a price below the equilibrium price—say, no more than $800.

Figure 4-7 shows the effect of the price ceiling, represented by the line at $800. At the enforced rental rate of $800, landlords have less incentive to offer apartments, so they won't be willing to supply as many as they would at the equilibrium rate of $1,000. They will choose point *A* on the supply curve,

FIGURE 4-7 The Effects of a Price Ceiling

The black horizontal line represents the government-imposed price ceiling on rents of $800 per month. This price ceiling reduces the quantity of apartments supplied to 1.8 million, point *A*, and increases the quantity demanded to 2.2 million, point *B*. This creates a persistent shortage of 400,000 units: 400,000 people who want apartments at the legal rent of $800 but cannot get them.



offering only 1.8 million apartments for rent, 200,000 fewer than in the unregulated market.

At the same time, more people will want to rent apartments at a price of $800 than at the equilibrium price of $1,000; as shown at point *B* on the demand curve, at a monthly rent of $800 the quantity of apartments demanded rises to 2.2 million, 200,000 more than in the unregulated market and 400,000 more than are actually available at the price of $800. So there is now a persistent shortage of rental housing: at that price, 400,000 more people want to rent than are able to find apartments.

Do price ceilings always cause shortages? No. If a price ceiling is set above the equilibrium price, it won't have any effect. Suppose that the equilibrium rental rate on apartments is $1,000 per month and the city government sets a ceiling of $1,200. Who cares? In this case, the price ceiling won't be *binding*—it won't actually constrain market behavior—and it will have no effect.

How a Price Ceiling Causes Inefficiency

The housing shortage shown in Figure 4-7 is not merely annoying: like any shortage induced by price controls, it can be seriously harmful because it leads to inefficiency. In other words, there are gains from trade that go unrealized.

Rent control, like all price ceilings, creates inefficiency in at least four distinct ways.

1. It reduces the quantity of apartments rented below the efficient level.
2. It typically leads to inefficient allocation of apartments among would-be renters.
3. It leads to wasted time and effort as people search for apartments.
4. It leads landlords to maintain apartments in inefficiently low quality or condition.

In addition to inefficiency, price ceilings give rise to illegal behavior as people try to circumvent them.

We'll now look at each of these inefficiencies caused by price ceilings.

Inefficiently Low Quantity Because rent controls reduce the number of apartments supplied, they reduce the number of apartments rented, too.

Figure 4-8 shows the implications for total surplus. Recall that total surplus is the sum of the area above the supply curve and below the demand curve. If the only effect of rent control was to reduce the number of apartments available, it would cause a loss of surplus equal to the area of the shaded triangle in the figure.

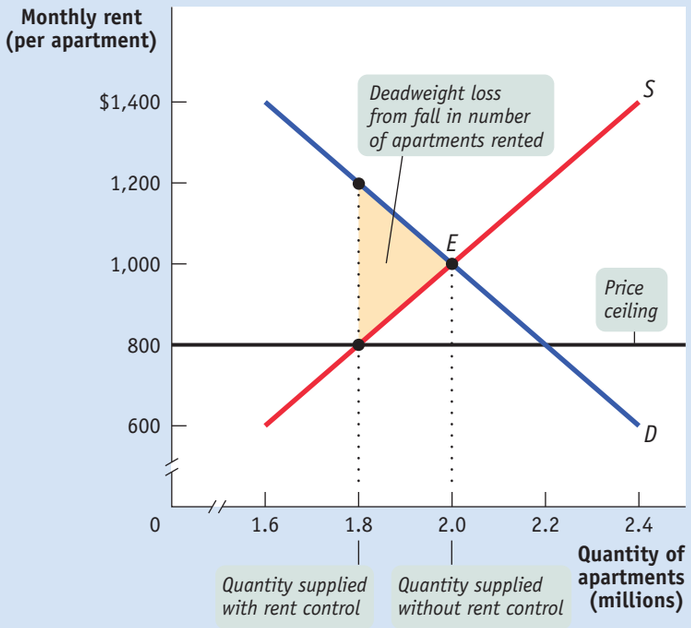
The area represented by that triangle has a special name in economics, **deadweight loss:** the lost surplus associated with the transactions that no longer occur due to the market intervention. In this example, the deadweight loss is the lost surplus associated with the apartment rentals that no longer occur due to the price ceiling, a loss that is experienced by both disappointed renters and frustrated landlords. Economists often call triangles like the one in Figure 4-8 a *deadweight-loss triangle*.

Deadweight loss is a key concept in economics, one that we will encounter whenever an action or a policy leads to a reduction in the quantity transacted below the efficient market equilibrium quantity. It is important to realize that deadweight loss is a *loss to society*—it is a reduction in total surplus, a loss in surplus that accrues to no one as a gain. It is not the same as a loss in surplus to one person that then accrues as a gain to someone else, what an economist would call a *transfer* of surplus from one person to another. For an example of how a price ceiling can create deadweight loss as well as a transfer of surplus between renters and landlords, see the upcoming For Inquiring Minds.

Deadweight loss is the loss in total surplus that occurs whenever an action or a policy reduces the quantity transacted below the efficient market equilibrium quantity.

FIGURE 4-8 A Price Ceiling Causes Inefficiently Low Quantity

A price ceiling reduces the quantity supplied below the market equilibrium quantity, leading to a deadweight loss. The area of the shaded triangle corresponds to the amount of total surplus lost due to the inefficiently low quantity transacted.



Deadweight loss is not the only type of inefficiency that arises from a price ceiling. The types of inefficiency created by rent control go beyond reducing the quantity of apartments available. These additional inefficiencies—inefficient allocation to consumers, wasted resources, and inefficiently low quality—lead to a loss of surplus over and above the deadweight loss.

Inefficient Allocation to Consumers Rent control doesn't just lead to too few apartments being available. It can also lead to misallocation of the apartments that are available: people who badly need a place to live may not be able to find an apartment, but some apartments may be occupied by people with much less urgent needs.

In the case shown in Figure 4-7, 2.2 million people would like to rent an apartment at $800 per month, but only 1.8 million apartments are available. Of those 2.2 million who are seeking an apartment, some want one badly and are willing to pay a high price to get it. Others have a less urgent need and are only willing to pay a low price, perhaps because they have alternative housing.

An efficient allocation of apartments would reflect these differences: people who really want an apartment will get one and people who aren't all that anxious to find an apartment won't. In an inefficient distribution of apartments, the opposite will happen: some people who are not especially anxious to find an apartment will get one and others who are very anxious to find an apartment won't.

Because people usually get apartments through luck or personal connections under rent control, it generally results in an **inefficient allocation to consumers** of the few apartments available.

Price ceilings often lead to inefficiency in the form of **inefficient allocation to consumers:** some people who want the good badly and are willing to pay a high price don't get it, and some who care relatively little about the good and are only willing to pay a low price do get it.

To see the inefficiency involved, consider the plight of the Lees, a family with young children who have no alternative housing and would be willing to pay up to $1,500 for an apartment—but are unable to find one. Also consider George, a retiree who lives most of the year in Florida but still has a lease on the New York apartment he moved into 40 years ago. George pays $800 per month for this apartment, but if the rent were even slightly more—say, $850—he would give it up and stay with his children when he visits New York.

FOR INQUIRING MINDS | Winners, Losers, and Rent Control

Price controls create winners and losers: some people benefit from the policy but others are made worse off.

In New York City, some of the biggest beneficiaries of rent control are affluent tenants who have lived for decades in choice apartments that would now command very high rents. These winners include celebrities like actor Al Pacino and singer and songwriter Cyndi Lauper. Similarly, in 2014, there were stories in the news citing the cases of rent-controlled tenants who also own million-dollar-plus properties in places like Palm Beach or Geneva. Ironically, in cases like these, the losers are the working-class renters the system was intended to help.

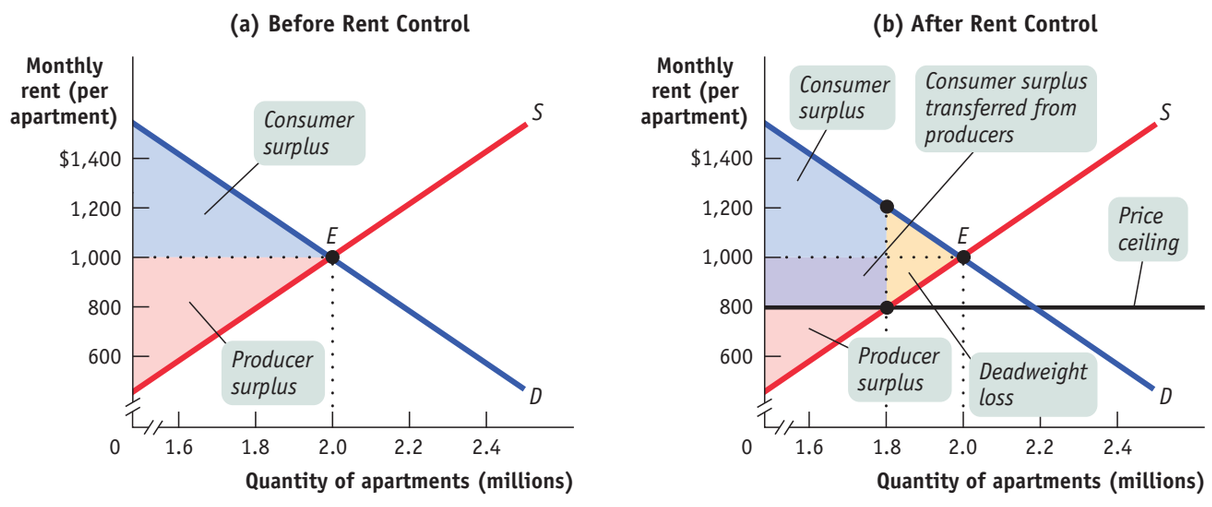
We can use the concepts of consumer and producer surplus to graphically evaluate the winners and the losers from rent control. Panel (a) of Figure 4-9 shows the consumer surplus and producer surplus in the equilibrium of the unregulated market for apartments—before rent control. Recall that the consumer surplus, represented by the area below the demand curve and above the price, is the total net gain to consumers in the market equilibrium. Likewise, producer surplus, represented by the area above the supply curve and below the price, is the total net gain to producers in the market equilibrium.

Panel (b) of this figure shows the consumer and producer surplus in the market after the price ceiling of $800 has been imposed. As you can see, for consumers who can still obtain apartments under rent control, consumer surplus has increased. These renters are clearly winners: they obtain an apartment at $800, paying $200 less than the unregulated market price. These people receive a direct transfer of surplus from landlords in the form of lower rent. But not all renters win: there are fewer apartments to rent now than if the market had remained unregulated, making it hard, if not impossible, for some to find a place to call home.

Without direct calculation of the surpluses gained and lost, it is generally unclear whether renters as a whole are made better or worse off by rent control. What we can say is that the greater the deadweight loss—the larger the reduction in the quantity of apartments rented—the more likely it is that renters as a whole lose.

However, we can say unambiguously that landlords are worse off: producer surplus has clearly decreased. Landlords who continue to rent out their apartments get $200 a month less in rent, and others withdraw their apartments from the market altogether. The deadweight-loss triangle, shaded yellow in panel (b), represents the value lost to both renters and landlords from rentals that essentially vanish thanks to rent control.

FIGURE 4-9 Winners and Losers from Rent Control



Price ceilings typically lead to inefficiency in the form of **wasted resources:** people expend money, effort, and time to cope with the shortages caused by the price ceiling.

Price ceilings often lead to inefficiency in that the goods being offered are of **inefficiently low quality:** sellers offer low-quality goods at a low price even though buyers would prefer a higher quality at a higher price.

This allocation of apartments—George has one and the Lees do not—is a missed opportunity: there is a way to make the Lees and George both better off at no additional cost. The Lees would be happy to pay George, say, $1,200 a month to sublease his apartment, which he would happily accept since the apartment is worth no more than $849 a month to him. George would prefer the money he gets from the Lees to keeping his apartment; the Lees would prefer to have the apartment rather than the money. So both would be made better off by this transaction—and nobody else would be made worse off.

Generally, if people who really want apartments could sublease them from people who are less eager to live there, both those who gain apartments and those who trade their occupancy for money would be better off. However, subletting is illegal under rent control because it would occur at prices above the price ceiling.

The fact that subletting is illegal doesn't mean it never happens. In fact, chasing down illegal subletting is a major business for New York private investigators. An article in the *New York Times* described how private investigators use hidden cameras and other tricks to prove that the legal tenants in rent-controlled apartments actually live somewhere else, and have sublet their apartments at two or three times the controlled rent.

Although landlords and legal agencies actively discourage the practice of illegal subletting, the problem of inefficient allocation of apartments remains.

Wasted Resources

Another reason a price ceiling causes inefficiency is that it leads to **wasted resources:** people expend money, effort, and time to cope with the shortages caused by the price ceiling. Back in 1979, U.S. price controls on gasoline led to shortages that forced millions of Americans to wait in lines at gas stations for hours each week. The opportunity cost of the time spent in gas lines—the wages not earned, the leisure time not enjoyed—constituted wasted resources from the point of view of consumers and of the economy as a whole.

Because of rent control, the Lees will spend all their spare time for several months searching for an apartment, time they would rather have spent working or in family activities. That is, there is an opportunity cost to the Lees' prolonged search for an apartment—the leisure or income they have to forgo.

If the market for apartments worked freely, the Lees would quickly find an apartment at the equilibrium rent of $1,000, leaving them time to earn more or to enjoy themselves—an outcome that would make them better off without making anyone else worse off. Again, rent control creates missed opportunities.

Inefficiently Low Quality

Yet another way a price ceiling creates inefficiency is by causing goods to be of inefficiently low quality. **Inefficiently low quality** means that sellers offer low-quality goods at a low price even though buyers would rather have higher quality and would be willing to pay a higher price for it.

Again, consider rent control. Landlords have no incentive to provide better conditions because they cannot raise rents to cover their repair costs but are able to find tenants easily. In many cases, tenants would be willing to pay much more for improved conditions than it would cost for the landlord to provide them—for example, the upgrade of an antiquated electrical system that cannot safely run air conditioners or computers. But any additional payment for such improvements would be legally considered a rent increase, which is prohibited. Indeed, rent-controlled apartments are notoriously badly maintained, rarely painted, subject to frequent electrical and plumbing problems, sometimes even hazardous to inhabit. As one former manager

of Manhattan buildings described: "At unregulated apartments we'd do most things that the tenants requested. But on the rent-regulated units, we did absolutely only what the law required. . . . We had a perverse incentive to make those tenants unhappy."

This whole situation is a missed opportunity—some tenants would be happy to pay for better conditions, and landlords would be happy to provide them for payment. But such an exchange would occur only if the market were allowed to operate freely.

A **black market** is a market in which goods or services are bought and sold illegally—either because it is illegal to sell them at all or because the prices charged are legally prohibited by a price ceiling.

Black Markets In addition to these four inefficiencies there is a final aspect of price ceilings: the incentive they provide for illegal activities, specifically the emergence of **black markets.** We have already described one kind of black market activity—illegal subletting by tenants. But it does not stop there. Clearly, there is a temptation for a landlord to say to a potential tenant, "Look, you can have the place if you slip me an extra few hundred in cash each month"—and for the tenant to agree if he or she is one of those people who would be willing to pay much more than the maximum legal rent.

What's wrong with black markets? In general, it's a bad thing if people break any law, because it encourages disrespect for the law in general. Worse yet, in this case illegal activity worsens the position of those who are honest. If the Lees are scrupulous about upholding the rent-control law but other people—who may need an apartment less than the Lees—are willing to bribe landlords, the Lees may never find an apartment.

So Why Are There Price Ceilings?

We have seen three common results of price ceilings:

- A persistent shortage of the good
- Inefficiency arising from this persistent shortage in the form of inefficiently low quantity (deadweight loss), inefficient allocation of the good to consumers, resources wasted in searching for the good, and the inefficiently low quality of the good offered for sale
- The emergence of illegal, black market activity

Given these unpleasant consequences of price ceilings, why do governments still sometimes impose them? Why does rent control, in particular, persist in New York?

One answer is that although price ceilings may have adverse effects, they do benefit some people. In practice, New York's rent-control rules—which are more complex than our simple model—hurt most residents but give a small minority of renters much cheaper housing than they would get in an unregulated market. And those who benefit from the controls are typically better organized and more vocal than those who are harmed by them.

Also, when price ceilings have been in effect for a long time, buyers may not have a realistic idea of what would happen without them. In our previous example, the rental rate in an unregulated market (Figure 4-6) would be only 25% higher than in the regulated market (Figure 4-7): $1,000 instead of $800. But how would renters know that? Indeed, they might have heard about black market transactions at much higher prices—the Lees or some other family paying George $1,200 or more—and would not realize that these black market prices are much higher than the price that would prevail in a fully unregulated market.

A last answer is that government officials often do not understand supply and demand analysis! It is a great mistake to suppose that economic policies in the real world are always sensible or well informed.

ECONOMICS in Action

LaunchPad | interactive activity

Price Controls in Venezuela: "You Buy What They Have"

By all accounts, Venezuela is a rich country—one of the world's top oil producers in a time of high energy prices. But in late 2013, the chronic lack of basic items—toilet paper, rice, coffee, corn, flour, milk, meat—had hit a nerve. "Empty shelves and no one to explain why a rich country has no food. It's unacceptable," said Jesús López, a 90-year-old farmer.

Reuters/Daniel Aguilar/Landov

Venezuela's food shortages offer a lesson in why price ceilings, however well intentioned, are usually never a good idea.

The origins of Venezuela's food shortages can be traced to the policies put in place by former Venezuelan president Hugo Chávez and continued by his successor, Nicolás Maduro. Chávez came to power in 1998 on a platform denouncing the country's economic elite and promising policies that favored the poor and working class, including price controls on basic foodstuffs. These price controls led to shortages that began in 2003 and became severe by 2006. Prices were set so low that farmers reduced production. For example, Venezuela was a coffee exporter until 2009 when it was forced to import large amounts of coffee to make up for a steep fall in production. Venezuela now imports more than 70% of its food.

In addition, generous government programs for the poor and working class led to higher demand. The combination of price controls and higher demand led to sharply rising prices for goods that weren't subject to price controls or that were bought on the black market. The result was a big increase in the demand for price-controlled goods.

Worse yet, a sharp decline in the value of the Venezuelan currency made foreign imports more expensive. And it increased the incentives for smuggling: when goods are available at the government-mandated price, Venezuelans buy them and then resell them across the border in Colombia, where a bottle of milk is worth seven or eight times more. Not surprisingly, fresh milk and butter are rarely seen in Venezuelan markets.

Venezuelans, queuing for hours to purchase goods at state-run stores, often come away empty handed. Or, as one shopper, Katherine Huga, said, "Whatever I can get. You buy what they have." While items can often be found on the black market at much higher prices, Chávez's price-control policies have disproportionately hurt the lower- and middle-income consumers he sought to help. One shopper in a low-income area who waited in line for hours said, "It fills me with rage to have to spend the one free day I have wasting my time for a bag of rice. I end up paying more at the resellers. In the end, all these price controls proved useless."

Quick Review

- **Price controls** take the form of either legal maximum prices—**price ceilings**—or legal minimum prices—**price floors.**
- A price ceiling below the equilibrium price benefits successful buyers but causes predictable adverse effects such as persistent shortages, which lead to four types of inefficiencies: **deadweight loss, inefficient allocation to consumers, wasted resources,** and **inefficiently low quality.**
- A deadweight loss is a loss of total surplus that occurs whenever a policy or action reduces the quantity transacted below the efficient market equilibrium level.
- Price ceilings also lead to **black markets,** as buyers and sellers attempt to evade the price controls.

Check Your Understanding 4-2

1. On game days, homeowners near Middletown University's stadium used to rent parking spaces in their driveways to fans at a going rate of $11. A new town ordinance now sets a maximum parking fee of $7. Use the accompanying supply and demand diagram to explain how each of the following corresponds to a price-ceiling concept.

a. Some homeowners now think it's not worth the hassle to rent out spaces.

b. Some fans who used to carpool to the game now drive alone.

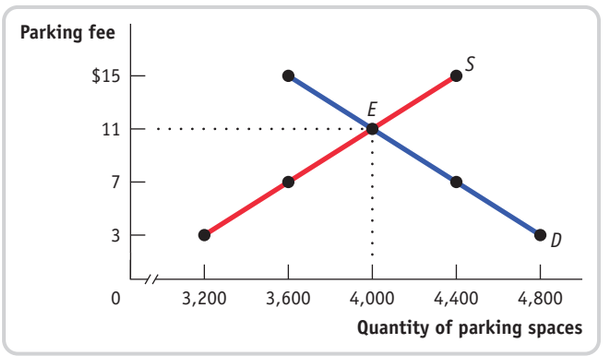
c. Some fans can't find parking and leave without seeing the game.

Explain how each of the following adverse effects arises from the price ceiling.

d. Some fans now arrive several hours early to find parking.

e. Friends of homeowners near the stadium regularly attend games, even if they aren't big fans. But some serious fans have given up because of the parking situation.

f. Some homeowners rent spaces for more than $7 but pretend that the buyers are nonpaying friends or family.



2. True or false? Explain your answer. A price ceiling below the equilibrium price of an otherwise efficient market does the following:

a. Increases quantity supplied

b. Makes some people who want to consume the good worse off

c. Makes all producers worse off

3. Which of the following create deadweight loss? Which do not and are simply a transfer of surplus from one person to another? Explain your answer.

a. You have been evicted from your rent-controlled apartment after the landlord discovered your pet boa constrictor. The apartment is quickly rented to someone else at the same price. You and the new renter do not necessarily have the same willingness to pay for the apartment.

b. In a contest, you won a ticket to a jazz concert. But you can't go to the concert because of an exam, and the terms of the contest do not allow you to sell the ticket or give it to someone else. Would your answer to this question change if you could not sell the ticket but could give it to someone else?

c. Your school's dean of students, who is a proponent of a low-fat diet, decrees that ice cream can no longer be served on campus.

d. Your ice-cream cone falls on the ground and your dog eats it. (Take the liberty of counting your dog as a member of society, and assume that, if he could, your dog would be willing to pay the same amount for the ice-cream cone as you.)

Solutions appear at back of book.

Price Floors

Sometimes governments intervene to push market prices up instead of down. *Price floors* have been widely legislated for agricultural products, such as wheat and milk, as a way to support the incomes of farmers. Historically, there were also price floors—legally mandated minimum prices—on such services as trucking and air travel, although these were phased out by the U.S. government in the 1970s. If you have ever worked in a fast-food restaurant, you are likely to have encountered a price floor: governments in the United States and many other countries maintain a lower limit on the hourly wage rate of a worker's labor; that is, a floor on the price of labor called the **minimum wage.**

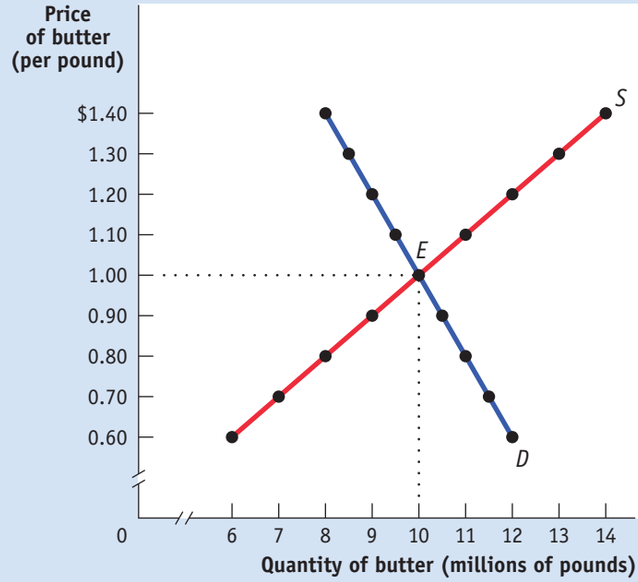
Just like price ceilings, price floors are intended to help some people but generate predictable and undesirable side effects. Figure 4-10 shows hypothetical supply and demand curves for butter. Left to itself, the market would move to equilibrium at point *E*, with 10 million pounds of butter bought and sold at a price of $1 per pound.

Now suppose that the government, in order to help dairy farmers, imposes a price floor on butter of $1.20 per pound. Its effects are shown in Figure 4-11, where the line at $1.20 represents the price floor. At a price of $1.20 per pound, producers would want to supply 12 million pounds (point *B* on the supply curve) but consumers would want to buy only 9 million pounds (point *A* on the demand curve). So the price floor leads to a persistent surplus of 3 million pounds of butter.

Does a price floor always lead to an unwanted surplus? No. Just as in the case of a price ceiling, the floor may not be binding—that is, it may be irrelevant. If the equilibrium price of butter is $1 per pound but the floor is set at only $0.80, the floor has no effect.

The **minimum wage** is a legal floor on the wage rate, which is the market price of labor.

FIGURE 4-10 The Market for Butter in the Absence of Government Controls



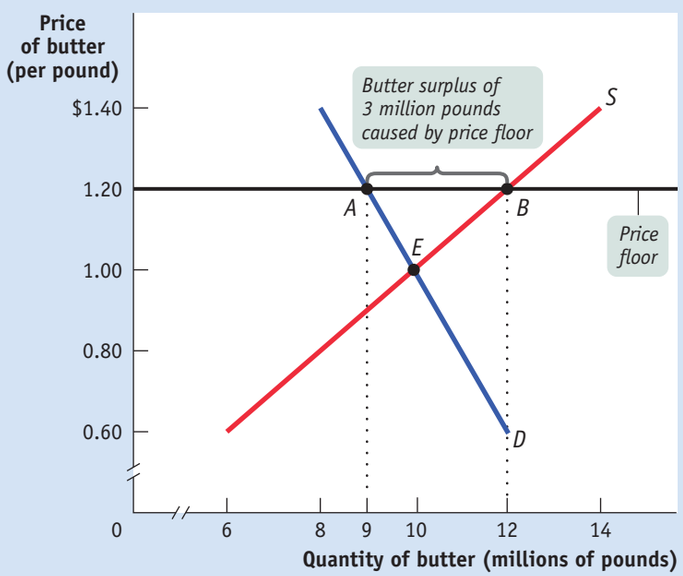
Price of butter (per pound)	Quantity of butter (millions of pounds)	
	Quantity demanded	Quantity supplied
$1.40	8.0	14.0
1.30	8.5	13.0
1.20	9.0	12.0
1.10	9.5	11.0
1.00	10.0	10.0
0.90	10.5	9.0
0.80	11.0	8.0
0.70	11.5	7.0
0.60	12.0	6.0

Without government intervention, the market for butter reaches equilibrium at a price of $1 per pound with 10 million pounds of butter bought and sold.

But suppose that a price floor is binding: what happens to the unwanted surplus? The answer depends on government policy. In the case of agricultural price floors, governments buy up unwanted surplus. As a result, the U.S. government has at times found itself warehousing thousands of tons of butter, cheese, and other farm products. (The European Commission, which administers price floors

FIGURE 4-11 The Effects of a Price Floor

The black horizontal line represents the government-imposed price floor of $1.20 per pound of butter. The quantity of butter demanded falls to 9 million pounds, and the quantity supplied rises to 12 million pounds, generating a persistent surplus of 3 million pounds of butter.



for a number of European countries, once found itself the owner of a so-called butter mountain, equal in weight to the entire population of Austria.) The government then has to find a way to dispose of these unwanted goods.

Some countries pay exporters to sell products at a loss overseas; this is standard procedure for the European Union. The United States gives surplus food away to schools, which use the products in school lunches. In some cases, governments have actually destroyed the surplus production. To avoid the problem of dealing with the unwanted surplus, the U.S. government typically pays farmers not to produce the products at all.

When the government is not prepared to purchase the unwanted surplus, a price floor means that would-be sellers cannot find buyers. This is what happens when there is a price floor on the wage rate paid for an hour of labor, the minimum wage: when the minimum wage is above the equilibrium wage rate, some people who are willing to work—that is, sell labor—cannot find buyers—that is, employers—willing to give them jobs.

How a Price Floor Causes Inefficiency

The persistent surplus that results from a price floor creates missed opportunities—inefficiencies—that resemble those created by the shortage that results from a price ceiling. Like a price ceiling, a price floor creates inefficiency in at least four ways:

1. It creates deadweight loss by reducing the quantity transacted to below the efficient level.
2. It leads to an inefficient allocation of sales among sellers.
3. It leads to a waste of resources.
4. It leads to sellers providing an inefficiently high quality level.

In addition to inefficiency, like a price ceiling, a price floor leads to illegal behavior as people break the law to sell below the legal price.

Inefficiently Low Quantity Because a price floor raises the price of a good to consumers, it reduces the quantity of that good demanded; because sellers can't sell more units of a good than buyers are willing to buy, a price floor reduces the quantity of a good bought and sold below the market equilibrium quantity and leads to a deadweight loss. Notice that this is the same effect as a price ceiling. You might be tempted to think that a price floor and a price ceiling have opposite effects, but both have the effect of reducing the quantity of a good bought and sold (as you can see in the following Pitfalls).

Since the equilibrium of an efficient market maximizes the sum of consumer and producer surplus, a price floor that reduces the quantity below the equilibrium quantity reduces total surplus. Figure 4-12 shows the implications for total surplus of a price floor on the price of butter. Total surplus is the sum of the area above the supply curve and below the demand curve. By reducing the quantity of

PITFALLS

CEILINGS, FLOORS, AND QUANTITIES

A price ceiling pushes the price of a good *down*. A price floor pushes the price of a good *up*. So it's easy to assume that the effects of a price floor are the opposite of the effects of a price ceiling. In particular, if a price ceiling reduces the quantity of a good bought and sold, doesn't a price floor increase the quantity?

No, it doesn't. In fact, both floors and ceilings reduce the quantity bought and sold. Why? When the quantity of a good supplied isn't equal to the quantity demanded, the actual quantity sold is determined by the "short side" of the market—whichever quantity is less. If sellers don't want to sell as much as buyers want to buy, it's the sellers who determine the actual quantity sold, because buyers can't force unwilling sellers to sell. If buyers don't want to buy as much as sellers want to sell, it's the buyers who determine the actual quantity sold, because sellers can't force unwilling buyers to buy.

FIGURE 4-12 A Price Floor Causes Inefficiently Low Quantity

A price floor reduces the quantity demanded below the market equilibrium quantity and leads to a deadweight loss.

butter sold, a price floor causes a deadweight loss equal to the area of the shaded triangle in the figure. As in the case of a price ceiling, however, deadweight loss is only one of the forms of inefficiency that the price control creates.

Inefficient Allocation of Sales Among Sellers Like a price ceiling, a price floor can lead to *inefficient allocation*—in this case, an **inefficient allocation of sales among sellers:** sellers who are willing to sell at the lowest price are unable to make sales, while sales go to sellers who are only willing to sell at a higher price.

One illustration of the inefficient allocation of selling opportunities caused by a price floor is the problem of unemployment and the black market for labor among the young in many European countries—notably France, Spain, Italy, and Greece. In these countries, a high minimum wage has led to a two-tier labor system, composed of the fortunate who have good jobs in the formal labor market that pay at least the minimum wage, and the rest who are locked out without any prospect of ever finding a good job.

Either unemployed or underemployed in dead-end jobs in the black market for labor, the unlucky ones are disproportionately young, from the ages of 18 to early 30s. Although eager for good jobs in the formal sector and willing to accept less than the minimum wage—that is, willing to sell their labor for a lower price—it is illegal for employers to pay them less than the minimum wage.

The inefficiency of unemployment and underemployment is compounded as a generation of young people is unable to get adequate job training, develop careers, and save for their future. These young people are also more likely to engage in crime. And many of these countries have seen their best and brightest young people emigrate, leading to a permanent reduction in the future performance of their economies.

Price floors can lead to **inefficient allocation of sales among sellers:** sellers who are willing to sell at the lowest price are unable to make sales while sales go to sellers who are only willing to sell at a higher price.

Wasted Resources Also like a price ceiling, a price floor generates inefficiency by *wasting resources*. The most graphic examples involve government purchases

of the unwanted surpluses of agricultural products caused by price floors. The surplus production is sometimes destroyed, which is pure waste; in other cases, the stored produce goes, as officials euphemistically put it, "out of condition" and must be thrown away.

Price floors also lead to wasted time and effort. Consider the minimum wage. Would-be workers who spend many hours searching for jobs, or waiting in line in the hope of getting jobs, play the same role in the case of price floors as hapless families searching for apartments in the case of price ceilings.

Price floors often lead to inefficiency in that goods of **inefficiently high quality** are offered: sellers offer high-quality goods at a high price, even though buyers would prefer a lower quality at a lower price.

Inefficiently High Quality Again like price ceilings, price floors lead to inefficiency in the quality of goods produced.

We saw that when there is a price ceiling, suppliers produce products that are of inefficiently low quality: buyers prefer higher-quality products and are willing to pay for them, but sellers refuse to improve the quality of their products because the price ceiling prevents their being compensated for doing so. This same logic applies to price floors, but in reverse: suppliers offer goods of **inefficiently high quality.**

How can this be? Isn't high quality a good thing? Yes, but only if it is worth the cost. Suppose that suppliers spend a lot to make goods of very high quality but that this quality isn't worth much to consumers, who would rather receive the money spent on that quality in the form of a lower price. This represents a missed opportunity: suppliers and buyers could make a mutually beneficial deal in which buyers got goods of lower quality for a much lower price.

A good example of the inefficiency of excessive quality comes from the days when transatlantic airfares were set artificially high by international treaty. Forbidden to compete for customers by offering lower ticket prices, airlines instead offered expensive services, like lavish in-flight meals that went largely uneaten. At one point the regulators tried to restrict this practice by defining maximum service standards—for example, that snack service should consist of no more than a sandwich. One airline then introduced what it called a "Scandinavian Sandwich," a towering affair that forced the convening of another conference to define *sandwich*. All of this was wasteful, especially considering that what passengers really wanted was less food and lower airfares.

Since the deregulation of U.S. airlines in the 1970s, American passengers have experienced a large decrease in ticket prices accompanied by a decrease in the quality of in-flight service—smaller seats, lower-quality food, and so on. Everyone complains about the service—but thanks to lower fares, the number of people flying on U.S. carriers has grown from 130 billion passenger miles when deregulation began to approximately 900 billion in 2014.

Illegal Activity In addition to the four inefficiencies we analyzed, like price ceilings, price floors provide incentives for illegal activity. For example, in countries where the minimum wage is far above the equilibrium wage rate, workers desperate for jobs sometimes agree to work off the books for employers who conceal their employment from the government—or bribe the government inspectors. This practice, known in Europe as "black labor," is especially common in Southern European countries such as Italy and Spain.

So Why Are There Price Floors?

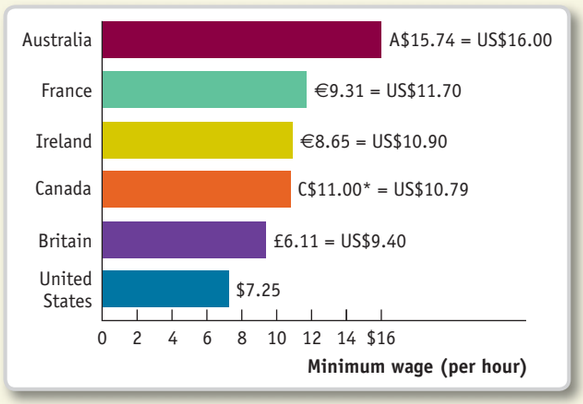
To sum up, a price floor creates various negative side effects:

- A persistent surplus of the good
- Inefficiency arising from the persistent surplus in the form of inefficiently low quantity (deadweight loss), inefficient allocation of sales among sellers, wasted resources, and an inefficiently high level of quality offered by suppliers
- The temptation to engage in illegal activity, particularly bribery and corruption of government officials

GLOBAL COMPARISION

Check Out Our Low, Low Wages!

The minimum wage rate in the United States, as you can see in this graph, is actually quite low compared with that in other rich countries. Since minimum wages are set in national currency—the British minimum wage is set in British pounds, the French minimum wage is set in euros, and so on—the comparison depends on the exchange rate on any given day. As of 2015, Australia had a minimum wage over twice as high as the U.S. rate, with France, Canada, and Ireland not far behind. You can see one effect of this difference in the supermarket checkout line. In the United States there is usually someone to bag your groceries—someone typically paid the minimum wage or at best slightly more. In Europe, where hiring a bagger is a lot more expensive, you're almost always expected to do the bagging yourself.



Data from: Organization for Economic Cooperation and Development (OECD).
*The Canadian minimum wage varies by province from C$9.95 to C$11.00.

So why do governments impose price floors when they have so many negative side effects? The reasons are similar to those for imposing price ceilings. Government officials often disregard warnings about the consequences of price floors either because they believe that the relevant market is poorly described by the supply and demand model or, more often, because they do not understand the model. Above all, just as price ceilings are often imposed because they benefit some influential buyers of a good, price floors are often imposed because they benefit some influential sellers.

ECONOMICS in Action

LaunchPad | interactive activity

The Rise and Fall of the Unpaid Intern

The best-known example of a price floor is the minimum wage. Most economists believe, however, that the minimum wage has relatively little effect on the overall job market in the United States, mainly because the floor is set so low. In 1964, the U.S. minimum wage was 53% of the average wage of blue-collar production workers; by 2013, it had fallen to about 37%. However, there is one sector of the U.S. job market where it appears that the minimum wage can indeed be binding: the market for interns.

Internships are temporary work positions typically reserved for younger workers still in college or recent graduates. The sluggish U.S. economy of recent years has produced poor job prospects for workers 20 to 24 years old. The unemployment rate for this age group was almost 12% at the start of 2014. One result of this has been a rise in the availability of internships, which look increasingly appealing to enthusiastic young workers unable to find well-paid permanent jobs.

Internships fall into two broad categories: paid interns, who are formally hired as temporary workers, and must be paid at least the minimum wage, and unpaid interns, who perform tasks but are not legally designated employees and aren't covered by minimum wage laws. Because internships offer the promise of valuable work experience and credentials that can later prove very valuable, young workers are often willing to accept them at a low wage or even no wage. According to Robert Shindell, an executive at the consulting firm Intern Bridge, more than a million

American students a year do internships; a fifth of those positions pay zero and provide no course credits.

Not surprisingly, some companies are tempted to use unpaid interns to perform work that in reality has little or no educational value but that directly benefits the company.

To guard against such practices, the Department of Labor (DOL), the federal agency that monitors compliance with minimum wage laws, issued several criteria in 2010 to help companies determine whether their unpaid internships are legally exempt from minimum wage requirements. Among them are: (1) Is the experience primarily for the benefit of the intern and not the employer? (2) Is the internship comparable to training offered by an educational environment? and (3) Is there no displacement of a regular employee by the intern? If the answer to such questions is yes, then the DOL considers the internship to be a form of education that is exempt from minimum wage laws. However, if the answer to any of the questions is no, then the DOL may determine that the unpaid internship violates minimum wage laws, in which case, the position must either be converted into a paid internship that pays at least the minimum wage or be eliminated.

Aaron Bacall/www.Cartoonstock.com

"We have an opening for a part-time upaid intern, which could lead to a full-time unpaid internship."

In 2012 and 2013, a spate of lawsuits brought by former unpaid interns claiming they were cheated out of wages brought the matter to public attention. In 2013, the movie company Fox Searchlight Pictures was found guilty of breaking federal minimum wage laws for employing two interns at zero pay. A common thread in these complaints is that interns were assigned "grunt work" that had no educational value—such as tracking lost cell phones. In some cases, unpaid interns complained that they were given the work of full-salaried employees.

As a result, many lawyers who advise companies on labor laws have been advising companies to either pay their interns minimum wage or shut down their internships. While some have axed their programs altogether, others—such as Fox Searchlight and NBC News—have converted their unpaid internships to paid ones. Some observers worry that the end of the unpaid internships means that programs that once offered valuable training will be lost. But as one lawyer commented, "The law says that when you work, you have to get paid [at least the minimum wage]."

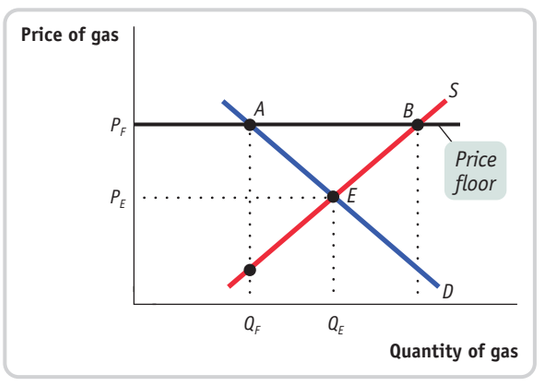
Quick Review

- The most familiar price floor is the **minimum wage.** Price floors are also commonly imposed on agricultural goods.
- A price floor above the equilibrium price benefits successful sellers but causes predictable adverse effects such as a persistent surplus, which leads to four kinds of inefficiencies: deadweight loss from inefficiently low quantity, **inefficient allocation of sales among sellers,** wasted resources, and **inefficiently high quality.**
- Price floors encourage illegal activity, such as workers who work off the books, often leading to official corruption.

Check Your Understanding 4-3

1. The state legislature mandates a price floor for gasoline of P_F per gallon. Assess the following statements and illustrate your answer using the figure provided.

- **a.** Proponents of the law claim it will increase the income of gas station owners. Opponents claim it will hurt gas station owners because they will lose customers.
- **b.** Proponents claim consumers will be better off because gas stations will provide better service. Opponents claim consumers will be generally worse off because they prefer to buy gas at cheaper prices.
- **c.** Proponents claim that they are helping gas station owners without hurting anyone else. Opponents claim that consumers are hurt and will end up doing things like buying gas in a nearby state or on the black market.



Solutions appear at back of book.

A **quantity control,** or **quota,** is an upper limit on the quantity of some good that can be bought or sold. The total amount of the good that can be legally transacted is the **quota limit.**

A **license** gives its owner the right to supply a good.

Controlling Quantities

In the 1930s, New York City instituted a system of licensing for taxicabs: only taxis with a "medallion" were allowed to pick up passengers. Because this system was intended to assure quality, medallion owners were supposed to maintain certain standards, including safety and cleanliness. A total of 11,787 medallions were issued, with taxi owners paying $10 for each medallion.

In 1995, there were still only 11,787 licensed taxicabs in New York, even though the city had meanwhile become the financial capital of the world, a place where hundreds of thousands of people in a hurry tried to hail a cab every day. An additional 400 medallions were issued in 1995, and after several rounds of sales of additional medallions, today there are 13,437 medallions. The result of this restriction is that a New York City taxi medallion is a very valuable item: if you want to operate a taxi in the city, you must lease a medallion from someone else or buy one, with a current price today of $750,000.

It turns out that this story is not unique; other cities introduced similar medallion systems in the 1930s and, like New York, have issued few new medallions since. In San Francisco and Boston, as in New York, taxi medallions trade for six-figure prices.

A taxi medallion system is a form of **quantity control,** or **quota,** by which the government regulates the quantity of a good that can be bought and sold rather than the price at which it is transacted. A quota is another way—along with price ceilings and price floors—that government intervenes in markets. The total amount of the good that can be transacted under the quantity control is called the **quota limit.** Typically, the government limits quantity in a market by issuing **licenses;** only people with a license can legally supply the good.

A taxi medallion is just such a license. The government of New York City limits the number of taxi rides that can be sold by limiting the number of taxis to only those who hold medallions. There are many other cases of quantity controls, ranging from limits on how much foreign currency (for instance, British pounds or Mexican pesos) people are allowed to buy to the quantity of clams New Jersey fishing boats are allowed to catch.

In the real world, quantity controls set an upper limit on the quantity of a good that can be transacted.

Some attempts to control quantities are undertaken for good economic reasons, some for bad ones. In many cases, as we will see, quantity controls introduced to address a temporary problem become politically hard to remove later because the beneficiaries don't want them abolished, even after the original reason for their existence is long gone. But whatever the reasons for such controls, they have certain predictable—and usually undesirable—economic consequences.

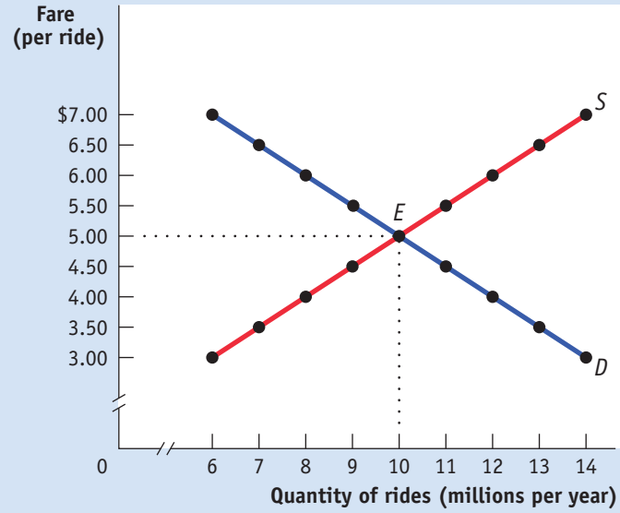
The Anatomy of Quantity Controls

To understand why a New York taxi medallion is worth so much money, we consider a simplified version of the market for taxi rides, shown in Figure 4-13. Just as we assumed in the analysis of rent control that all apartments are the same, we now suppose that all taxi rides are the same—ignoring the real-world complication that some taxi rides are longer, and so more expensive, than others.

The table in the figure shows supply and demand schedules. The equilibrium—indicated by point *E* in the figure and by the shaded entries in the table—is a fare of $5 per ride, with 10 million rides taken per year. (You'll see in a minute why we present the equilibrium this way.)

The New York medallion system limits the number of taxis, but each taxi driver can offer as many rides as he or she can manage. (Now you know why New York taxi drivers are so aggressive!) To simplify our analysis, however, we will

FIGURE 4-13 The Market for Taxi Rides in the Absence of Government Controls



Fare (per ride)	Quantity of rides (millions per year)	
	Quantity demanded	Quantity supplied
$7.00	6	14
6.50	7	13
6.00	8	12
5.50	9	11
5.00	10	10
4.50	11	9
4.00	12	8
3.50	13	7
3.00	14	6

Without government intervention, the market reaches equilibrium with 10 million rides taken per year at a fare of $5 per ride.

assume that a medallion system limits the number of taxi rides that can legally be given to 8 million per year.

Until now, we have derived the demand curve by answering questions of the form: "How many taxi rides will passengers want to take if the price is $5 per ride?" But it is possible to reverse the question and ask instead: "At what price will consumers want to buy 10 million rides per year?" The price at which consumers want to buy a given quantity—in this case, 10 million rides at $5 per ride—is the **demand price** of that quantity. You can see from the demand schedule in Figure 4-13 that the demand price of 6 million rides is $7 per ride, the demand price of 7 million rides is $6.50 per ride, and so on.

Similarly, the supply curve represents the answer to questions of the form: "How many taxi rides would taxi drivers supply at a price of $5 each?" But we can also reverse this question to ask: "At what price will suppliers be willing to supply 10 million rides per year?" The price at which suppliers will supply a given quantity—in this case, 10 million rides at $5 per ride—is the **supply price** of that quantity. We can see from the supply schedule in Figure 4-13 that the supply price of 6 million rides is $3 per ride, the supply price of 7 million rides is $3.50 per ride, and so on.

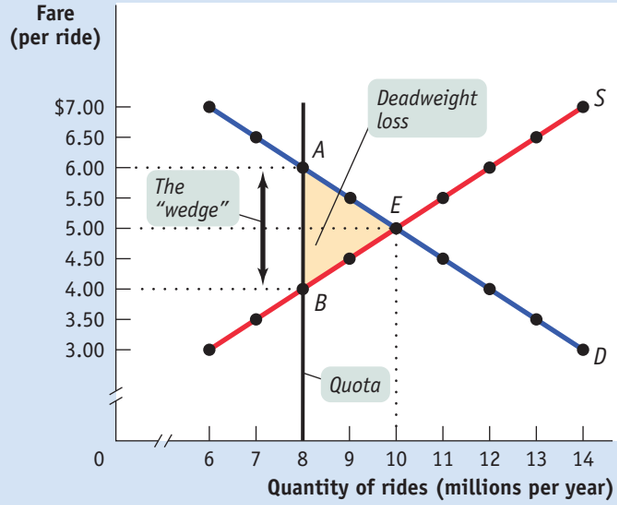
Now we are ready to analyze a quota. We have assumed that the city government limits the quantity of taxi rides to 8 million per year. Medallions, each of which carries the right to provide a certain number of taxi rides per year, are made available to selected people in such a way that a total of 8 million rides will be provided. Medallion-holders may then either drive their own taxis or rent their medallions to others for a fee.

Figure 4-14 shows the resulting market for taxi rides, with the black vertical line at 8 million rides per year representing the quota limit. Because the quantity of rides is limited to 8 million, consumers must be at point *A* on the demand curve, corresponding to the shaded entry in the demand schedule: the demand price of 8 million rides is $6 per ride. Meanwhile, taxi drivers must be at point *B* on the supply curve, corresponding to the shaded entry in the supply schedule: the supply price of 8 million rides is $4 per ride.

The **demand price** of a given quantity is the price at which consumers will demand that quantity.

The **supply price** of a given quantity is the price at which producers will supply that quantity.

FIGURE 4-14 Effect of a Quota on the Market for Taxi Rides



Fare (per ride)	Quantity of rides (millions per year)	
	Quantity demanded	Quantity supplied
$7.00	6	14
6.50	7	13
6.00	8	12
5.50	9	11
5.00	10	10
4.50	11	9
4.00	12	8
3.50	13	7
3.00	14	6

The table shows the demand price and the supply price corresponding to each quantity: the price at which that quantity would be demanded and supplied, respectively. The city government imposes a quota of 8 million rides by selling licenses for only 8 million rides, represented by the black vertical line. The price paid by consumers rises to $6 per ride, the demand price of 8 million rides, shown by point *A*. The supply price of 8 million rides is only $4 per ride, shown by point *B*. The difference between these two prices is the quota rent per ride, the earnings that accrue to the owner of a license. The quota rent drives a wedge between the demand price and the supply price. And since the quota discourages mutually beneficial transactions, it creates a deadweight loss equal to the shaded triangle.

But how can the price received by taxi drivers be $4 when the price paid by taxi riders is $6? The answer is that in addition to the market in taxi rides, there is also a market in medallions. Medallion-holders may not always want to drive their taxis: they may be ill or on vacation. Those who do not want to drive their own taxis will sell the right to use the medallion to someone else. So we need to consider two sets of transactions here, and so two prices: (1) the transactions in taxi rides and the price at which these will occur, and (2) the transactions in medallions and the price at which these will occur. It turns out that since we are looking at two markets, the $4 and $6 prices will both be right.

To see how this all works, consider two imaginary New York taxi drivers, Sunil and Harriet. Sunil has a medallion but can't use it because he's recovering from a severely sprained wrist. So he's looking to rent his medallion out to someone else. Harriet doesn't have a medallion but would like to rent one. Furthermore, at any point in time there are many other people like Harriet who would like to rent a medallion. Suppose Sunil agrees to rent his medallion to Harriet. To make things simple, assume that any driver can give only one ride per day and that Sunil is renting his medallion to Harriet for one day. What rental price will they agree on?

To answer this question, we need to look at the transactions from the viewpoints of both drivers. Once she has the medallion, Harriet knows she can make $6 per day—the demand price of a ride under the quota. And she is willing to rent the medallion only if she makes at least $4 per day—the supply price of a ride under the quota. So Sunil cannot demand a rent of more than $2—the difference between $6 and $4. And if Harriet offered Sunil less than $2—say, $1.50—there would be other eager drivers willing to offer him more, up to $2. So, in order to

get the medallion, Harriet must offer Sunil at least $2. Since the rent can be no more than $2 and no less than $2, it must be exactly $2.

It is no coincidence that $2 is exactly the difference between $6, the demand price of 8 million rides, and $4, the supply price of 8 million rides. In every case in which the supply of a good is legally restricted, there is a **wedge** between the demand price of the quantity transacted and the supply price of the quantity transacted.

A quantity control, or quota, drives a **wedge** between the demand price and the supply price of a good; that is, the price paid by buyers ends up being higher than that received by sellers.

This wedge, illustrated by the double-headed arrow in Figure 4-14, has a special name: the **quota rent.** It is the earnings that accrue to the license-holder from ownership of a valuable commodity, the license. In the case of Sunil and Harriet, the quota rent of $2 goes to Sunil because he owns the license, and the remaining $4 from the total fare of $6 goes to Harriet.

The difference between the demand and supply price at the quota limit is the **quota rent,** the earnings that accrue to the license-holder from ownership of the right to sell the good. It is equal to the market price of the license when the licenses are traded.

So Figure 4-14 also illustrates the quota rent in the market for New York taxi rides. The quota limits the quantity of rides to 8 million per year, a quantity at which the demand price of $6 exceeds the supply price of $4. The wedge between these two prices, $2, is the quota rent that results from the restrictions placed on the quantity of taxi rides in this market.

But wait a second. What if Sunil doesn't rent out his medallion? What if he uses it himself? Doesn't this mean that he gets a price of $6? No, not really. Even if Sunil doesn't rent out his medallion, he could have rented it out, which means that the medallion has an *opportunity cost* of $2: if Sunil decides to use his own medallion and drive his own taxi rather than renting his medallion to Harriet, the $2 represents his opportunity cost of not renting out his medallion. That is, the $2 quota rent is now the rental income he forgoes by driving his own taxi.

In effect, Sunil is in two businesses—the taxi-driving business and the medallion-renting business. He makes $4 per ride from driving his taxi and $2 per ride from renting out his medallion. It doesn't make any difference that in this particular case he has rented his medallion to himself!

So regardless of whether the medallion owner uses the medallion himself or herself, or rents it to others, it is a valuable asset. And this is represented in the going price for a New York City taxi medallion: in 2015, New York City taxi medallions sold for $700,000 to $800,000. According to Simon Greenbaum, a broker of New York taxi medallions, an owner of a medallion who leases it to a driver can expect to earn about $2,500 per month, or a 3% return—an attractive rate of return compared to other investments.

Notice, by the way, that quotas—like price ceilings and price floors—don't always have a real effect. If the quota were set at 12 million rides—that is, above the equilibrium quantity in an unregulated market—it would have no effect because it would not be binding.

The Costs of Quantity Controls

Like price controls, quantity controls can have some predictable and undesirable side effects. The first is the by-now-familiar problem of inefficiency due to missed opportunities: quantity controls create deadweight loss by preventing mutually beneficial transactions from occurring, transactions that would benefit both buyers and sellers. Looking back at Figure 4-14, you can see that starting at the quota limit of 8 million rides, New Yorkers would be willing to pay at least $5.50 per ride when 9 million rides are offered, 1 million more than the quota, and that taxi drivers would be willing to provide those rides as long as they got at least $4.50 per ride. These are rides that would have taken place if there were no quota limit.

The same is true for the next 1 million rides: New Yorkers would be willing to pay at least $5 per ride when the quantity of rides is increased from 9 to 10 million, and taxi drivers would be willing to provide those rides as long as

they got at least $5 per ride. Again, these rides would have occurred without the quota limit.

Only when the market has reached the unregulated market equilibrium quantity of 10 million rides are there no "missed-opportunity rides." The quota limit of 8 million rides has caused 2 million "missed-opportunity rides."

Generally, *as long as the demand price of a given quantity exceeds the supply price, there is a deadweight loss.* A buyer would be willing to buy the good at a price that the seller would be willing to accept, but such a transaction does not occur because it is forbidden by the quota. The deadweight loss arising from the 2 million in missed-opportunity rides is represented by the shaded triangle in Figure 4-14.

And because there are transactions that people would like to make but are not allowed to, quantity controls generate an incentive to evade them or even to break the law. New York's taxi industry again provides clear examples. Taxi regulation applies only to those drivers who are hailed by passengers on the street. A car service that makes prearranged pickups does not need a medallion. As a result, such hired cars provide much of the service that might otherwise be provided by taxis, as in other cities. In addition, there are substantial numbers of unlicensed cabs that simply defy the law by picking up passengers without a medallion. Because these cabs are illegal, their drivers are completely unregulated, and they generate a disproportionately large share of traffic accidents in New York City.

In fact, in 2004 the hardships caused by the limited number of New York taxis led city leaders to authorize an increase in the number of licensed taxis by 900. The city auctioned off an additional 368 medallions in 2013, bringing the total number up to the current 13,437 medallions—a move that certainly cheered New York riders.

But those who already owned medallions were less happy with the increase; they understood that adding new taxis would reduce or eliminate the shortage of taxis. As a result, taxi drivers anticipated a decline in their revenues because they would no longer always be assured of finding willing customers. And, in turn, the value of a medallion would fall. So to placate the medallion owners, city officials also raised taxi fares: by 25% in 2004, by a smaller percentage in 2006, and again by 17% in 2012. Although taxis are now easier to find, a ride costs more—and that price increase slightly diminished the newfound cheer of New York taxi riders.

In sum, quantity controls typically create the following undesirable side effects:

- Deadweight loss because some mutually beneficial transactions don't occur
- Incentives for illegal activities

ECONOMICS in Action

LaunchPad | interactive activity

Crabbing, Quotas, and Saving Lives in Alaska

Alaskan king and snow crab are considered delicacies worldwide. And crab fishing is one of the most important industries in the Alaskan economy. So many were justifiably concerned when, in 1983, the annual crab catch fell by 90% due to overfishing. In response, marine biologists set a *total catch quota system,* which limited the amount of crab that could be harvested annually in order to allow the crab population to return to a healthy, sustainable level.

Notice, by the way, that the Alaskan crab quota is an example of a quota that was justified by broader economic and environmental considerations—unlike the New York taxicab quota, which has long since lost any economic rationale. Another important difference is that, unlike New York taxicab medallions,

owners of Alaskan crab boats did not have the ability to buy or sell individual quotas. So although depleted crab stocks eventually recovered with the total catch quota system in place, there was another, unintended and deadly consequence.

The Alaskan crabbing season is fairly short, running roughly from October to January, and it can be further shortened by bad weather. By the 1990s, Alaskan crab fishermen were engaging in "fishing derbies," made famous by the Discovery Channel's *Deadliest Catch*. To stay within the quota limit when the crabbing season began, boat crews rushed to fish for crab in dangerous, icy, rough water, straining to harvest in a few days a haul that could be worth several hundred thousand dollars. As a result, boats often became overloaded and capsized. Crews were pushed too hard, with many fatalities from hypothermia or drowning.

According to federal statistics, at the time Alaskan crab fishing was among the most dangerous of jobs, with an average of 7.3 deaths a year, about 80 times the fatality rate for an average worker. And after the brief harvest, the market for crab was flooded with supply, lowering the prices fishermen received.

Jean-Erick PASQUIER/Gamma-Rapho via Getty Images

The quota-share system protects Alaska's crab population and saves the lives of crabbers.

In 2006 fishery regulators instituted another quota system called *quota share*—aimed at protecting crabbers as well as Alaska's crabs. Under individual quota share, each boat received a quota to fill during the three month season. Moreover, the individual quotas could be sold or leased. These changes transformed the industry as owners of bigger boats bought the individual quotas of smaller boats, shrinking the number of crabbing boats dramatically: from over 250 a few years earlier to about 60 in 2012. Bigger boats are much less likely to capsize, improving crew safety.

In addition, by extending the fishing season, the quota-share system boosted the crab population and crab prices. In 2004, under the old system, the quota was reached in just 3 days, while in 2010 in took 20 days. With more time to fish, fishermen could make sure that juvenile and female crabs were returned to sea rather than harvested. And with a longer fishing season, the catch comes to the market more gradually, eliminating the downward plunge in prices when supply hits the market. In 2011, snow crab sold for close to $7 per pound, up from close to $3 per pound in 2005.

Predictably, an Alaskan crab fisherman earns more money under the quota-share system than under the total catch quota system. As one observer said in 2012, "The information we have on crabbers' income is anecdotal, but crewmen we surveyed said they're making about $100,000 a year and captains twice that. That's a lot more than a few years ago."

Check Your Understanding 4-4

1. Suppose that the supply and demand for taxi rides is given by Figure 4-13 but the quota is set at 6 million rides instead of 8 million. Find the following and indicate them on Figure 4-13.
   - **a.** The price of a ride
   - **b.** The quota rent
   - **c.** The deadweight loss
   - **d.** Suppose the quota limit on taxi rides is increased to 9 million. What happens to the quota rent? To the deadweight loss?
2. Assume that the quota limit is 8 million rides. Suppose demand decreases due to a decline in tourism. What is the smallest parallel leftward shift in demand that would result in the quota no longer having an effect on the market? Illustrate your answer using Figure 4-13.

Solutions appear at back of book.

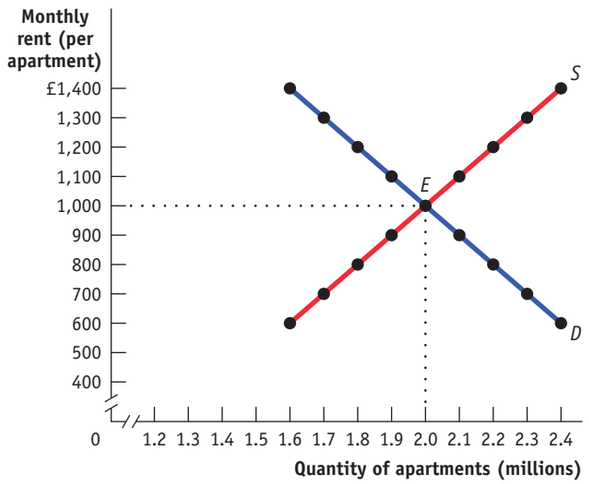
Quick Review

- **Quantity controls,** or **quotas,** are government-imposed limits on how much of a good may be bought or sold. The quantity allowed for sale is the **quota limit.** The government then issues a **license**—the right to sell a given quantity of a good under the quota.
- When the quota limit is smaller than the equilibrium quantity in an unregulated market, the **demand price** is higher than the **supply price**—there is a **wedge** between them at the quota limit.
- This wedge is the **quota rent,** the earnings that accrue to the license-holder from ownership of the right to sell the good—whether by actually supplying the good or by renting the license to someone else. The market price of a license equals the quota rent.
- Like price controls, quantity controls create deadweight loss and encourage illegal activity.

SOLVED PROBLEM The World's Second Most Expensive City

London is the second most expensive place in the world to rent an apartment (only Monte Carlo is more expensive). If you have ever visited London, you might have noticed an area around the city known as the "Green Belt." Zoning laws make it nearly impossible to build new residential housing on land designated as the Green Belt. Consider the following hypothetical market for apartments in London in the absence of zoning controls.

LaunchPad
for interactive tutorials with step-by-step guidance on how to solve problems



Monthly rent (per apartment)	Quantity of apartments (millions)	
	Quantity demanded	Quantity supplied
£1,400	1.6	2.4
1,300	1.7	2.3
1,200	1.8	2.2
1,100	1.9	2.1
1,000	2.0	2.0
900	2.1	1.9
800	2.2	1.8
700	2.3	1.7
600	2.4	1.6

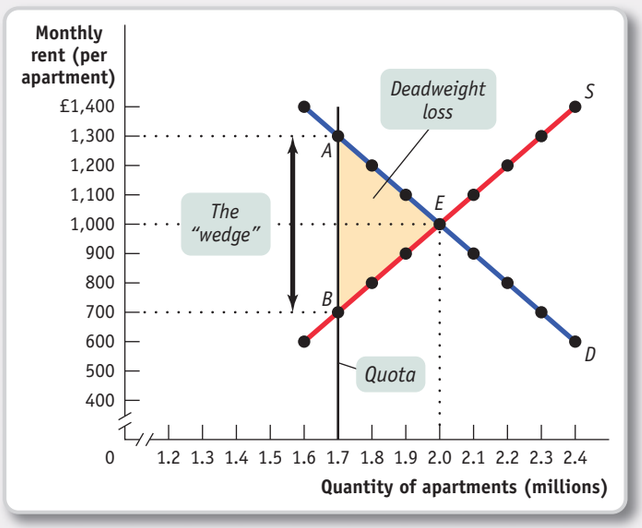
This figure should look familiar to you—it is Figure 4-6, but the currency is the British pound rather than the U.S. dollar. At the time of this writing, the British pound was worth about 1.5 dollars.

Now, let's go back to the reality of zoning controls in the Green Belt. Use a diagram to show the effect of a quota of 1.7 million apartments. What is the quota rent, and who gets it?

STEP 1 **Use a diagram to show the effect of a quota of 1.7 million apartments.**

Review pages 124–128.

In this figure, the black vertical line represents the quota limit of 1.7 million apartments. Because the quantity of apartments is limited, consumers must be at point A on the demand curve. The demand price of 1.7 million apartments is £1,300 each. The supply price, corresponding to point B on the diagram, of 1.7 million apartments is only £700 each, creating a "wedge" of £1300 – £700 = £600.



STEP 2 **What is the quota rent in this case, and who gets it?**

Review pages 124–128.

In the case of taxis, the quota rent is the earnings that accrue to the license-holder from ownership of the right to sell the good. In the case of apartments inside the Green Belt in London, the quota rent is the "wedge" of £600 created by the difference in the demand price and the supply price. The wedge goes to current owners of property or flats in London. Current owners benefit from the strict application of zoning laws.

SUMMARY

1. The demand curve is determined by each individual consumer's **willingness to pay.** When price is less than or equal to the willingness to pay, the consumer purchases the good. The difference between willingness to pay and price is the net gain to the consumer, the **individual consumer surplus. Total consumer surplus** in a market, the sum of all individual consumer surpluses in a market, is equal to the area below the market demand curve but above the price.
2. The supply curve is determined by the cost to each potential producer—the lowest price at which the producer is willing to produce a unit of that good. If the price of a good is above the producer's cost, a sale generates a net gain to the producer, known as the **individual producer surplus. Total producer surplus** in a market is the sum of the individual producer surpluses. This is equal to the area above the market supply curve but below the price.
3. **Total surplus,** the total gain to society from the production and consumption of a good, is the sum of consumer and producer surpluses.
4. Even when a market is efficient, governments often intervene to pursue greater fairness or to please a powerful interest group. Interventions can take the form of **price controls** or quantity controls, both of which generate predictable and undesirable side effects consisting of various forms of inefficiency and illegal activity.
5. A **price ceiling,** a maximum market price below the equilibrium price, benefits successful buyers but creates persistent shortages. Because the price is maintained below the equilibrium price, the quantity demanded is increased and the quantity supplied is decreased compared to the equilibrium quantity. This leads to predictable problems: inefficiencies in the form of **deadweight loss** from inefficiently low quantity, **inefficient allocation to consumers, wasted resources,** and **inefficiently low quality.** It also encourages illegal activity as people turn to **black markets** to get the good. Because of these problems, price ceilings have generally lost favor as an economic policy tool. But some governments continue to impose them either because they don't understand the effects or because the price ceilings benefit some influential group.
6. A **price floor,** a minimum market price above the equilibrium price, benefits successful sellers but creates persistent surplus. Because the price is maintained above the equilibrium price, the quantity demanded is decreased and the quantity supplied is increased compared to the equilibrium quantity. This leads to predictable problems: inefficiencies in the form of deadweight loss from inefficiently low quantity, **inefficient allocation of sales among sellers,** wasted resources, and **inefficiently high quality.** It also encourages illegal activity and black markets. The most well known kind of price floor is the **minimum wage,** but price floors are also commonly applied to agricultural products.
7. **Quantity controls,** or **quotas,** limit the quantity of a good that can be bought or sold. The quantity allowed for sale is the **quota limit.** The government issues **licenses** to individuals, giving them the right to sell a given quantity of the good. The owner of a license earns a **quota rent,** earnings that accrue from ownership of the right to sell the good. It is equal to the difference between the **demand price** at the quota limit, what consumers are willing to pay for that quantity, and the **supply price** at the quota limit, what suppliers are willing to accept for that quantity. Economists say that a quota drives a **wedge** between the demand price and the supply price; this wedge is equal to the quota rent. Quantity controls lead to deadweight loss in addition to encouraging illegal activity.

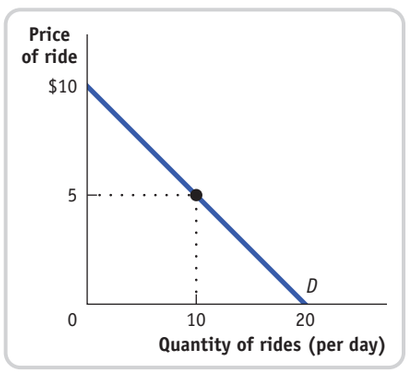
KEY TERMS

LaunchPad | interactive activity

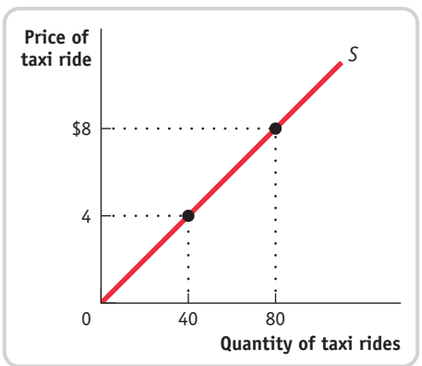
Willingness to pay, p. 102
Individual consumer surplus, p. 103
Total consumer surplus, p. 103
Consumer surplus, p. 103
Cost, p. 104
Individual producer surplus, p. 105
Total producer surplus, p. 105
Producer surplus, p. 105
Total surplus, p. 107
Price controls, p. 109
Price ceiling, p. 109
Price floor, p. 109
Deadweight loss, p. 111
Inefficient allocation to consumers, p. 112
Wasted resources, p. 114
Inefficiently low quality, p. 114
Black markets, p. 115
Minimum wage, p. 117
Inefficient allocation of sales among sellers, p. 120
Inefficiently high quality, p. 121
Quantity control, p. 124
Quota, p. 124
Quota limit, p. 124
License, p. 124
Demand price, p. 125
Supply price, p. 125
Wedge, p. 127
Quota rent, p. 127

PROBLEMS

1. Determine the amount of consumer surplus generated in each of the following situations.
   a. Leon goes to the clothing store to buy a new T-shirt, for which he is willing to pay up to $10. He picks out one he likes with a price tag of exactly $10. When he is paying for it, he learns that the T-shirt has been discounted by 50%.
   b. Alberto goes to the music store hoping to find a used record of *Nirvana's Nevermind* for up to $30. The store has one copy of the record selling for $30, which he purchases.
   c. After soccer practice, Stacey is willing to pay $2 for a bottle of mineral water. The 7-Eleven sells mineral water for $2.25 per bottle, so she declines to purchase it.
2. Determine the amount of producer surplus generated in each of the following situations.
   a. Gordon lists his old Lionel electric trains on eBay. He sets a minimum acceptable price, known as his reserve price, of $75. After five days of bidding, the final high bid is exactly $75. He accepts the bid.
   b. So-Hee advertises her car for sale in the used-car section of the student newspaper for $2,000, but she is willing to sell the car for any price higher than $1,500. The best offer she gets is $1,200, which she declines.
   c. Sanjay likes his job so much that he would be willing to do it for free. However, his annual salary is $80,000.
3. You are the manager of Fun World, a small amusement park. The accompanying diagram shows the demand curve of a typical customer at Fun World.



   a. Suppose that the price of each ride is $5. At that price, how much consumer surplus does an individual consumer get? (Recall that the area of a right triangle is ½ × the height of the triangle × the base of the triangle.)
   b. Suppose that Fun World considers charging an admission fee, even though it maintains the price of each ride at $5. What is the maximum admission fee it could charge? (Assume that all potential customers have enough money to pay the fee.)
   c. Suppose that Fun World lowered the price of each ride to zero. How much consumer surplus does an individual consumer get? What is the maximum admission fee Fun World could charge?
4. The accompanying diagram illustrates a taxi driver's individual supply curve (assume that each taxi ride is the same distance).



   a. Suppose the city sets the price of taxi rides at $4 per ride, and at $4 the taxi driver is able to sell as many taxi rides as he desires. What is this taxi driver's producer surplus? (Recall that the area of a right triangle is ½ × the height of the triangle × the base of the triangle.)
   b. Suppose that the city keeps the price of a taxi ride set at $4, but it decides to charge taxi drivers a "licensing fee." What is the maximum licensing fee the city could extract from this taxi driver?
   c. Suppose that the city allowed the price of taxi rides to increase to $8 per ride. Again assume that, at this price, the taxi driver sells as many rides as he is willing to offer. How much producer surplus does an individual taxi driver now get? What is the maximum licensing fee the city could charge this taxi driver?
5. In order to ingratiate himself with voters, the mayor of Gotham City decides to lower the price of taxi rides. Assume, for simplicity, that all taxi rides are the same distance and therefore cost the same. The accompanying table shows the demand and supply schedules for taxi rides.

	Quantity of rides (millions per year)	
Fare (per ride)	Quantity demanded	Quantity supplied
$7.00	10	12
6.50	11	11
6.00	12	10
5.50	13	9
5.00	14	8
4.50	15	7

   a. Assume that there are no restrictions on the number of taxi rides that can be supplied (there is no medallion system). Find the equilibrium price and quantity.

b. Suppose that the mayor sets a price ceiling at $5.50. How large is the shortage of rides? Illustrate with a diagram. Who loses and who benefits from this policy?

c. Suppose that the stock market crashes and, as a result, people in Gotham City are poorer. This reduces the quantity of taxi rides demanded by 6 million rides per year at any given price. What effect will the mayor's new policy have now? Illustrate with a diagram.

d. Suppose that the stock market rises and the demand for taxi rides returns to normal (that is, returns to the demand schedule given in the table). The mayor now decides to ingratiate himself with taxi drivers. He announces a policy in which operating licenses are given to existing taxi drivers; the number of licenses is restricted such that only 10 million rides per year can be given. Illustrate the effect of this policy on the market, and indicate the resulting price and quantity transacted. What is the quota rent per ride?

6. In the late eighteenth century, the price of bread in New York City was controlled, set at a predetermined price above the market price.

a. Draw a diagram showing the effect of the policy. Did the policy act as a price ceiling or a price floor?

b. What kinds of inefficiencies were likely to have arisen when the controlled price of bread was above the market price? Explain in detail.

One year during this period, a poor wheat harvest caused a leftward shift in the supply of bread and therefore an increase in its market price. New York bakers found that the controlled price of bread in New York was below the market price.

c. Draw a diagram showing the effect of the price control on the market for bread during this one-year period. Did the policy act as a price ceiling or a price floor?

d. What kinds of inefficiencies do you think occurred during this period? Explain in detail.

7. European governments tend to make greater use of price controls than does the U.S. government. For example, the French government sets minimum starting yearly wages for new hires who have completed *le bac,* certification roughly equivalent to a high school diploma. The demand schedule for new hires with *le bac* and the supply schedule for similarly credentialed new job seekers are given in the accompanying table. The price here—given in euros, the currency used in France—is the same as the yearly wage.

Wage (per year)	Quantity demanded (new job offers per year)	Quantity supplied (new job seekers per year)
€45,000	200,000	325,000
40,000	220,000	320,000
35,000	250,000	310,000
30,000	290,000	290,000
25,000	370,000	200,000

a. In the absence of government interference, what are the equilibrium wage and number of graduates hired per year? Illustrate with a diagram. Will there be anyone seeking a job at the equilibrium wage who is unable to find one—that is, will there be anyone who is involuntarily unemployed? (*Hint:* involuntary unemployment occurs when the current wage results in a surplus of labor.)

b. Suppose the French government sets a minimum yearly wage of €35,000. Is there any involuntary unemployment at this wage? If so, how much? Illustrate with a diagram. What if the minimum wage is set at €40,000? Also illustrate with a diagram.

c. Given your answer to part b and the information in the table, what do you think is the relationship between the level of involuntary unemployment and the level of the minimum wage? Who benefits from such a policy? Who loses? What is the missed opportunity here?

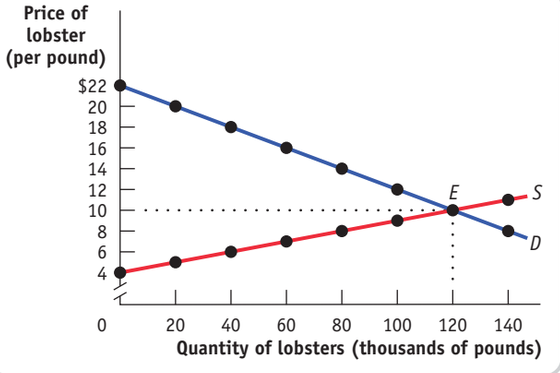
8. The waters off the North Atlantic coast were once teeming with fish. But because of overfishing by the commercial fishing industry, the stocks of fish are seriously depleted. In 1991, the National Marine Fishery Service of the U.S. government implemented a quota to allow fish stocks to recover. The quota limited the amount of swordfish caught per year by all U.S.-licensed fishing boats to 7 million pounds. As soon as the U.S. fishing fleet had met the quota limit, the swordfish catch was closed down for the rest of the year. The accompanying table gives the hypothetical demand and supply schedules for swordfish caught in the United States per year.

	Quantity of swordfish (millions of pounds per year)	
Price of swordfish (per pound)	Quantity demanded	Quantity supplied
$20	6	15
18	7	13
16	8	11
14	9	9
12	10	7

a. Use a diagram to show the effect of the quota on the market for swordfish in 1991. In your diagram, illustrate the deadweight loss from inefficiently low quantity.

b. How do you think fishermen will change how they fish in response to this policy?

9. In Maine, you must have a license to harvest lobster commercially; these licenses are issued yearly. The state of Maine is concerned about the dwindling supplies of lobsters found off its coast. The state fishery department has decided to place a yearly quota of 80,000 pounds of lobsters harvested in all Maine waters. It has also decided to give licenses this year only to those fishermen who had licenses last year. The following diagram shows the demand and supply curves for Maine lobsters.



a. In the absence of government restrictions, what are the equilibrium price and quantity?

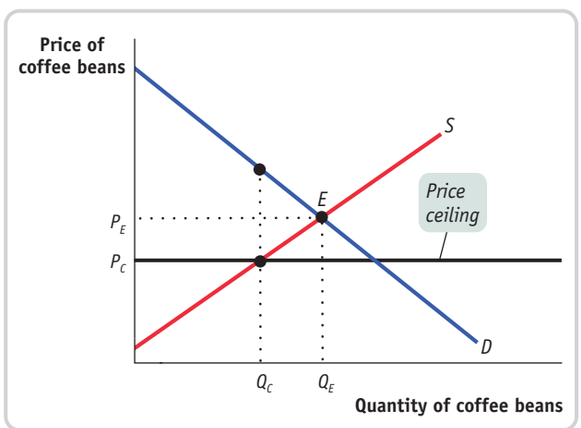
b. What is the *demand price* at which consumers wish to purchase 80,000 pounds of lobsters?

c. What is the *supply price* at which suppliers are willing to supply 80,000 pounds of lobsters?

d. What is the *quota rent* per pound of lobster when 80,000 pounds are sold? Illustrate the quota rent and the deadweight loss on the diagram.

e. Explain a transaction that benefits both buyer and seller but is prevented by the quota restriction.

10. The Venezuelan government has imposed a price ceiling on the retail price of roasted coffee beans. The accompanying diagram shows the market for coffee beans. In the absence of price controls, the equilibrium is at point E, with an equilibrium price of P_E and an equilibrium quantity bought and sold of Q_E.



a. Show the consumer and producer surplus before the introduction of the price ceiling.

After the introduction of the price ceiling, the price falls to P_C and the quantity bought and sold falls to Q_C.

b. Show the consumer surplus after the introduction of the price ceiling (assuming that the consumers with the highest willingness to pay get to buy the available coffee beans; that is, assuming that there is no inefficient allocation to consumers).

c. Show the producer surplus after the introduction of the price ceiling (assuming that the producers with the lowest cost get to sell their coffee beans; that is, assuming that there is no inefficient allocation of sales among producers).

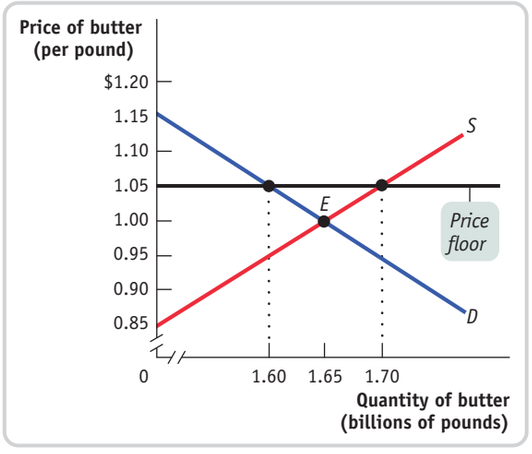
d. Using the diagram, show how much of what was producer surplus before the introduction of the price ceiling has been transferred to consumers as a result of the price ceiling.

e. Using the diagram, show how much of what was total surplus before the introduction of the price ceiling has been lost. That is, how great is the deadweight loss?

11. Assume that because of an increase in demand, the average domestic airline fare increased from $319.85 in the fourth quarter of 2013 to $328.12 in the first quarter of 2014, an increase of $8.27. The number of passenger tickets sold in the fourth quarter of 2013 was 151.4 million. Over the same period, the airlines' costs remained roughly the same: the price of jet fuel averaged around $2 per gallon in both quarters, and airline pilots' salaries remained roughly the same, averaging $117,060 per year in 2013).

Can you determine precisely by how much producer surplus has increased as a result of the $8.27 increase in the average fare? If you cannot be precise, can you determine whether it will be less than, or more than, a specific amount?

12. The U.S. Department of Agriculture (USDA) administers the price floor for butter, which the 2008 Farm Bill set at $1.05 per pound. At that price, according to data from the USDA, the quantity of butter supplied in 2010 was 1.7 billion pounds, and the quantity demanded was 1.6 billion pounds. To support the price of butter at the price floor, the USDA therefore had to buy up 100 million pounds of butter. The accompanying diagram shows supply and demand curves illustrating the market for butter.



a. In the absence of a price floor, how much consumer surplus is created? How much producer surplus? What is the total surplus?

b. With the price floor at $1.05 per pound of butter, consumers buy 1.6 billion pounds of butter. How much consumer surplus is created now?

c. With the price floor at $1.05 per pound of butter, producers sell 1.7 billion pounds of butter (some to consumers and some to the USDA). How much producer surplus is created now?

d. How much money does the USDA spend on buying up surplus butter?

e. Taxes must be collected to pay for the purchases of surplus butter by the USDA. As a result, total surplus (producer plus consumer) is reduced by the amount the USDA spent on buying surplus butter. Using your answers for parts b–d, what is the total surplus when there is a price floor? How does this compare to the total surplus without a price floor from part a?

13. The accompanying table shows hypothetical demand and supply schedules for milk per year. The U.S. government decides that the incomes of dairy farmers should be maintained at a level that allows the traditional family dairy farm to survive. So it implements a price floor of $1 per pint by buying surplus milk until the market price is $1 per pint.

	Quantity of milk (millions of pints per year)	
Price of milk (per pint)	Quantity demanded	Quantity supplied
$1.20	550	850
1.10	600	800
1.00	650	750
0.90	700	700
0.80	750	650

a. In a diagram, show the deadweight loss from the inefficiently low quantity bought and sold.

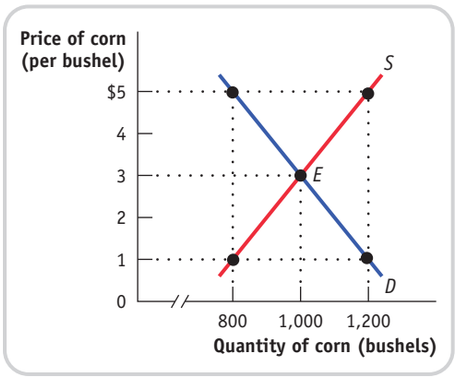
b. How much surplus milk will be produced as a result of this policy?

c. What will be the cost to the government of this policy?

d. Since milk is an important source of protein and calcium, the government decides to provide the surplus milk it purchases to elementary schools at a price of only $0.60 per pint. Assume that schools will buy any amount of milk available at this low price. But parents now reduce their purchases of milk at any price by 50 million pints per year because they know their children are getting milk at school. How much will the dairy program now cost the government?

e. Explain how inefficiencies in the form of inefficient allocation of sales among sellers and wasted resources arise from this policy.

14. For the last 80 years the U.S. government has used price supports to provide income assistance to American farmers. To implement these price supports, at times the government has used price floors, which it maintains by buying up the surplus farm products. At other times, it has used target prices, a policy by which the government gives the farmer an amount equal to the difference between the market price and the target price for each unit sold. Consider the market for corn depicted in the accompanying diagram.



a. If the government sets a price floor of $5 per bushel, how many bushels of corn are produced? How many are purchased by consumers? By the government? How much does the program cost the government? How much revenue do corn farmers receive?

b. Suppose the government sets a target price of $5 per bushel for any quantity supplied up to 1,000 bushels. How many bushels of corn are purchased by consumers and at what price? By the government? How much does the program cost the government? How much revenue do corn farmers receive?

c. Which of these programs (in parts a and b) costs corn consumers more? Which program costs the government more? Explain.

d. Is one of these policies less inefficient than the other? Explain.

15. In many European countries high minimum wages have led to high levels of unemployment and underemployment, and a two-tier labor system. In the formal labor market, workers have good jobs that pay at least the minimum wage. In the informal, or black market for labor, workers have poor jobs and receive less than the minimum wage.

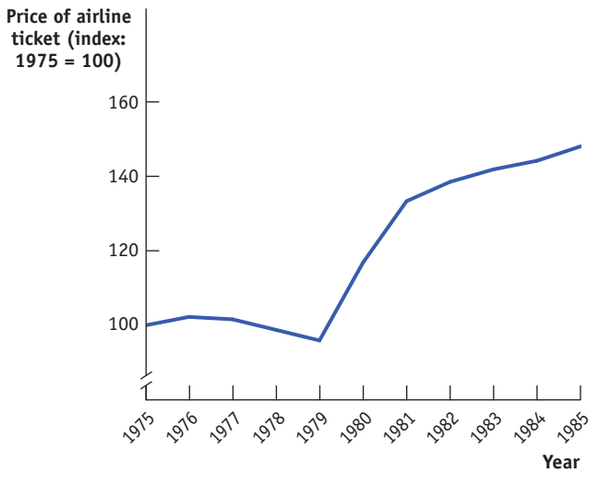
a. Draw a demand and supply diagram showing the effect of the imposition of a minimum wage on the overall market for labor, with wage on the vertical axis and hours of labor on the horizontal axis. Your supply curve should represent the hours of labor offered by workers according to the wage, and the demand curve represents the hours of labor demanded by employers according to the wage. On your diagram show the deadweight loss from the imposition of a minimum wage. What type of shortage is created? Illustrate on your diagram the size of the shortage.

b. Assume that the imposition of the high minimum wage causes a contraction in the economy so that employers in the formal sector cut their production and their demand for workers. Illustrate the effect of this on the overall market for labor. What happens to the size of the deadweight loss? The shortage? Illustrate with a diagram.

c. Assume that the workers who cannot get a job paying at least the minimum wage move into the informal labor market where there is no minimum wage. What happens to the size of the informal market for

labor as a result of the economic contraction? What happens to the equilibrium wage in the informal labor market? Illustrate with a supply and demand diagram for the informal market.

16. The accompanying diagram shows data from the U.S. Bureau of Labor Statistics on the average price of an airline ticket in the United States from 1975 until 1985, adjusted to eliminate the effect of *inflation* (the general increase in the prices of all goods over time). In 1978, the United States Airline Deregulation Act removed the price floor on airline fares, and it also allowed the airlines greater flexibility to offer new routes.



Data from: U.S. Bureau of Labor Statistics.

a. Looking at the data on airline ticket prices in the diagram, do you think the price floor that existed before 1978 was binding or nonbinding? That is, do you think it was set above or below the equilibrium price? Draw a supply and demand diagram, showing where the price floor that existed before 1978 was in relation to the equilibrium price.

b. Most economists agree that the average airline ticket price per mile traveled actually *fell* as a result of the Airline Deregulation Act. How might you reconcile that view with what you see in the diagram?

WORK IT OUT

LaunchPad | interactive activity

17. Hollywood screenwriters negotiate a new agreement with movie producers stipulating that they will receive 10% of the revenue from every video rental of a movie they authored. They have no such agreement for movies shown on on-demand television.

a. When the new writers' agreement comes into effect, what will happen in the market for video rentals—that is, will supply or demand shift, and how? As a result, how will consumer surplus in the market for video rentals change? Illustrate with a diagram. Do you think the writers' agreement will be popular with consumers who rent videos?

b. Consumers consider video rentals and on-demand movies substitutable to some extent. When the new writers' agreement comes into effect, what will happen in the market for on-demand movies—that is, will supply or demand shift, and how? As a result, how will producer surplus in the market for on-demand movies change? Illustrate with a diagram. Do you think the writers' agreement will be popular with cable television companies that show on-demand movies?