

>> Consumer and Producer Surplus

MAKING GAINS BY THE BOOK

HERE IS A LIVELY MARKET IN SECOND-HAND college textbooks. At the end of each term, some students who took a course decide that the money they can make by selling their used books is worth more to them than keeping the books. And some students who are taking the course next term prefer to buy a somewhat battered but less expensive used textbook rather than pay full price for a new one.

Textbook publishers and authors are not happy about these transactions, because they cut into sales of new books. But both the students who sell used books and those who buy them clearly benefit from the existence of the market. That is why many college bookstores facilitate their trade, buying used textbooks and selling them alongside the new books.

But can we put a number on what used textbook buyers and sellers gain from these transactions? Can we answer the question, “How much do the buyers and sellers of textbooks gain from the existence of the used-book market?”

Yes, we can. In this chapter we will see how to measure benefits, such as those to buyers of used textbooks,

from being able to purchase a good—known as *consumer surplus*. And we will see that there is a corresponding measure, *producer surplus*, of the benefits sellers receive from being able to sell a good.

The concepts of consumer surplus and producer surplus are extremely useful for analyzing a wide variety of economic issues. They let us calculate how much benefit producers and consumers receive from the existence of a

market. They also allow us to calculate how the welfare of consumers and producers is affected by changes in market prices. Such calculations play a crucial role in evaluating many economic policies.

What information do we need to calculate consumer and producer surplus? Surprisingly, all we need are the demand and supply curves for a good.

That is, the supply and demand model isn't just a model of how a competitive market works—it's also a model of how much consumers and producers gain from participating in that market. So our first step will be to learn how consumer and producer surplus can be derived from the demand and supply curves. We will then see how these concepts can be applied to actual economic issues.



How much am I willing to pay for that used textbook?

David Young-Wolff/PhotoDisc

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 both to measure the gains from trade and to illustrate why markets work so well
- ▶ The critical importance of **property rights** and prices as **economic signals** to the smooth functioning of a market
- ▶ Why markets typically lead to efficient outcomes and why markets sometimes fail

Consumer Surplus and the Demand Curve

The market in used textbooks is a big business in terms of dollars and cents—approximately \$1.9 billion in 2004–2005. 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 one, while 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 good 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.

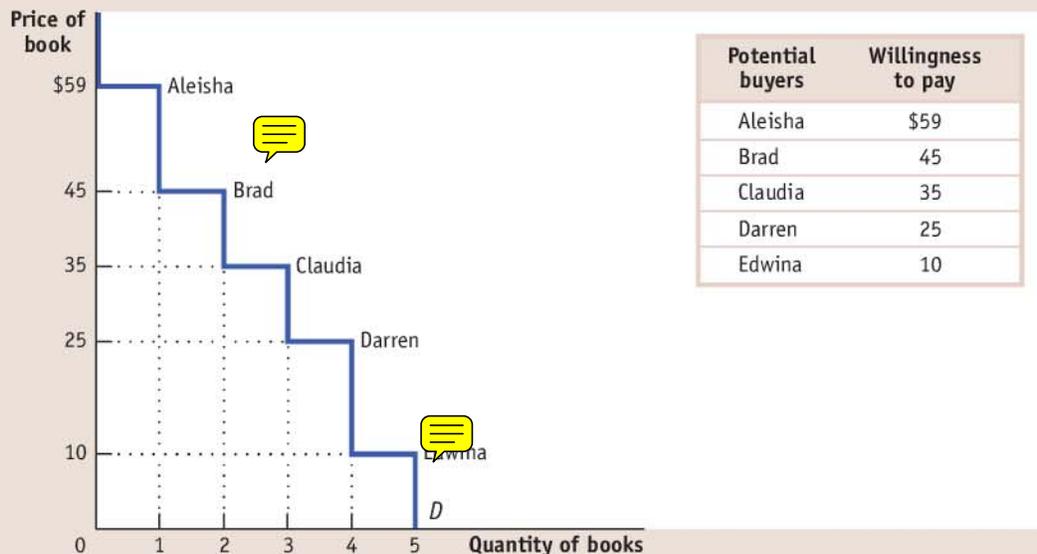
The table in Figure 4-1 shows five potential buyers of a used book that costs \$100 new, listed in order of their willingness to pay. At one extreme is Aleisha, who will buy a second-hand book even if the price is as high as \$59. Brad is less willing to have a used book and will buy one only if the price is \$45 or less. Claudia is willing to pay only \$35 and 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.

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 can be used to construct the *demand schedule* for used textbooks.

As we saw in Chapter 3, we can use this 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 step-shaped, with alternating horizontal and vertical segments. Each horizontal segment—each step—corresponds to one potential buyer's willingness to pay. However, we'll see shortly that for the analysis of consumer surplus it doesn't matter whether the demand curve is step-shaped, as in this figure, or whether there are many consumers, making the curve smooth.

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

FIGURE 4-1 The Demand Curve for Used Textbooks



With only five potential consumers in this market, the demand curve is step-shaped. Each step represents one consumer, and its height indicates that consumer's willingness to pay—the maximum price at which each will buy a used textbook—as indicated in the table. Aleisha has the highest willingness to pay at \$59, Brad has the next

highest at \$45, and so on down to Edwina with the lowest willingness to pay at \$10. At a price of \$59, the quantity demanded is one (Aleisha); at a price of \$45, the quantity demanded is two (Aleisha and Brad); and so on until you reach a price of \$10, at which all five students are willing to purchase a book.

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, 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.

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

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 to total consumer surplus.

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. Figure 4-2 reproduces the demand curve from Figure 4-1. 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, $(\$59 - \$30) \times 1 = \$29$, 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 4-2.

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 4-2 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.

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 4-2. Another way to say this is that total consumer surplus is equal to the area below the demand curve but above the price.

FIGURE 4-2

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 get 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 .

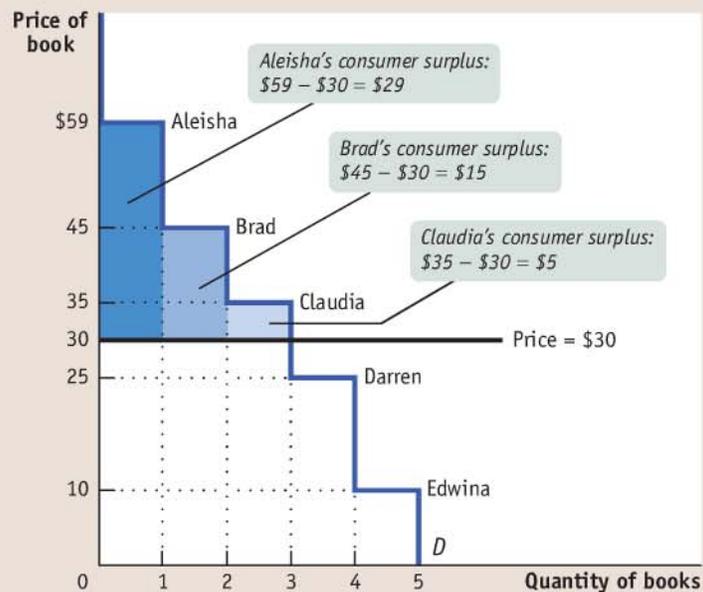
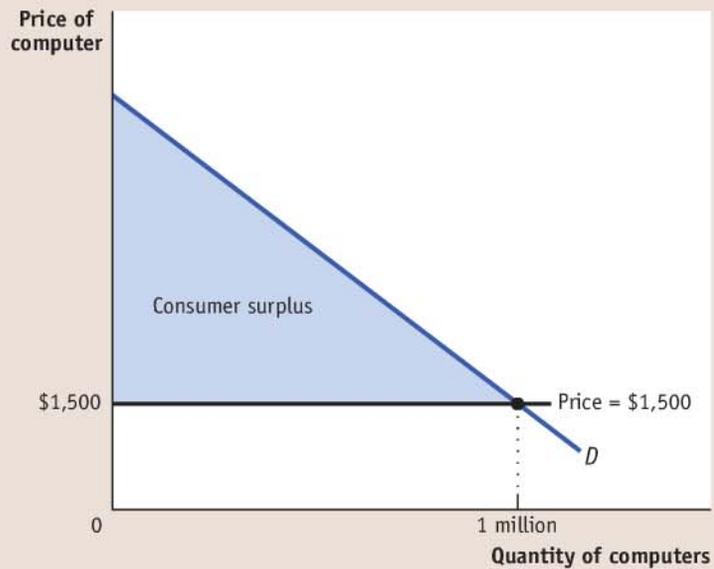


FIGURE 4-3

Consumer Surplus

The demand curve for computers is smooth because there are many potential buyers. At a price of \$1,500, 1 million computers 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 computers when the price is \$1,500.



This 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 personal computers 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 4-3.

Suppose that at a price of \$1,500, a total of 1 million computers are purchased. How much do consumers gain from being able to buy those 1 million computers? We could answer that question by calculating the individual consumer surplus of each buyer and then adding these numbers up to arrive at a total. But it is much easier just to look at Figure 4-3 and use the fact that 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. (You can refresh your memory on how to calculate the area of a right triangle by turning to the appendix to Chapter 2.)

How Changing Prices Affect Consumer Surplus

It is often important to know how much consumer surplus *changes* when the price changes. For example, we may want to know how much consumers are hurt if a frost in Florida drives up orange prices or how much consumers gain if the introduction of fish farming makes salmon steaks less expensive. The same approach we have used to derive consumer surplus can be used to answer questions about how changes in prices affect consumers.

Let's return to the example of the market for used textbooks. Suppose that the bookstore decided to sell used textbooks for \$20 instead of \$30. How much would this fall in price increase consumer surplus?

The answer is illustrated in Figure 4-4 on the next page. As shown in the figure, there are two parts to the increase in consumer surplus. The first part, shaded dark blue, is the gain of those who would have bought books even at the higher price of \$30.

Each of the students who would have bought books at \$30—Aleisha, Brad, and Claudia—now pays \$10 less, and therefore each gains \$10 in consumer surplus from the fall in price to \$20. So the dark blue area represents the $\$10 \times 3 = \30 increase in consumer surplus to those three buyers. The second part, shaded light blue, is the gain to those who would not have bought a book at \$30 but are willing to pay more than \$20. In this case that gain goes to Darren, who would not have bought a book at \$30 but does buy one at \$20. He gains \$5—the difference between his willingness to pay of \$25 and the new price of \$20. So the light blue area represents a further \$5 gain in consumer surplus. The total increase in consumer surplus is the sum of the shaded areas, \$35. Likewise, a rise in price from \$20 to \$30 would decrease consumer surplus by an amount equal to the sum of the shaded areas.

Figure 4-4 illustrates that when the price of a good falls, the area under the demand curve but above the price—which we have seen is equal to total consumer surplus—increases. Figure 4-5 shows the same result for the case of a smooth demand curve, the demand for personal computers. Here we assume that the price of computers falls from \$5,000 to \$1,500, leading to an increase in the quantity demanded from 200,000 to 1 million units. As in the used-textbook example, we divide the gain in consumer surplus into two parts. The dark blue rectangle in Figure 4-5 corresponds to the dark blue area in Figure 4-4: it is the gain to the 200,000 people who would have bought computers even at the higher price of \$5,000. As a result of the price reduction, each receives additional surplus of \$3,500. The light blue triangle in Figure 4-5 corresponds to the light blue area in Figure 4-4: it is the gain to people who would not have bought the good at the higher price but are willing to do so at a price of \$1,500. For example, the light blue triangle includes the gain to someone who would have been willing to pay \$2,000 for a computer and therefore gains \$500 in consumer surplus when it is possible to buy a computer for only \$1,500. As before, the total gain in consumer surplus is the sum of the shaded areas, the increase in the area under the demand curve but above the price.



FIGURE 4-4

Consumer Surplus and a Fall in the Price of Used Textbooks

There are two parts to the increase in consumer surplus generated by a fall in price from \$30 to \$20. The first is given by the dark blue rectangle: each person who would have bought at the original price of \$30—Aleisha, Brad, and Claudia—receives an increase in consumer surplus equal to the total reduction in price, \$10. So the area of the dark blue rectangle corresponds to an amount equal to $3 \times \$10 = \30 . The second part is given by the light blue area: the increase in consumer surplus for those who would *not* have bought at the original price of \$30 but who buy at the new price of \$20—namely, Darren. Darren's willingness to pay is \$25, so he now receives consumer surplus of \$5. The total increase in consumer surplus is $3 \times \$10 + \$5 = \$35$, represented by the sum of the shaded areas. Likewise, a rise in price from \$20 to \$30 would decrease consumer surplus by an amount equal to the sum of the shaded areas.

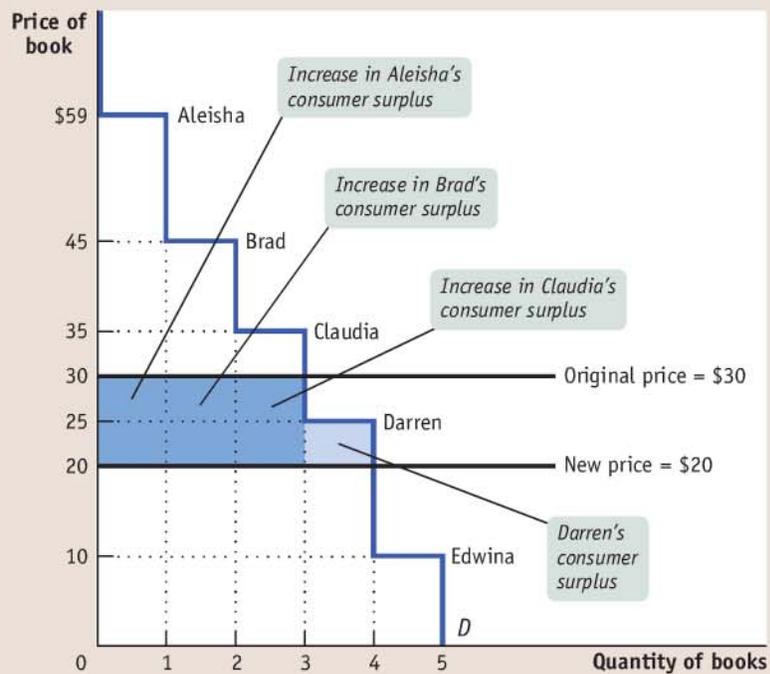
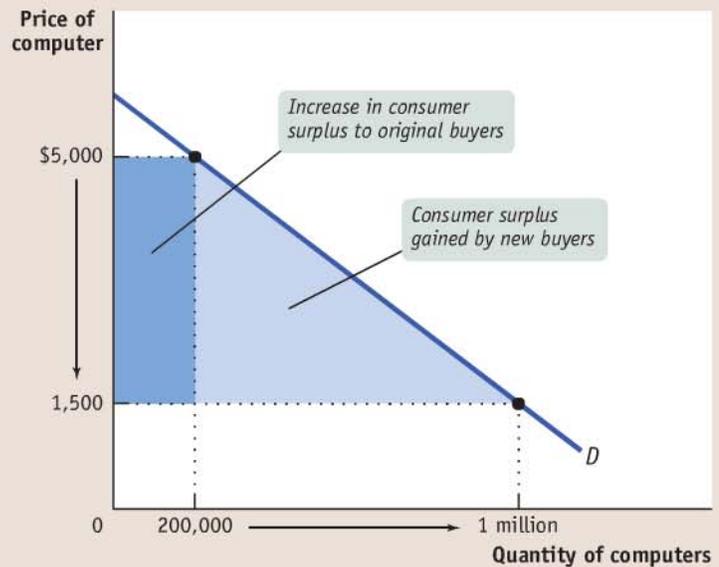


FIGURE 4-5

A Fall in the Price Increases Consumer Surplus

A fall in the price of a computer from \$5,000 to \$1,500 leads to an increase in the quantity demanded and an increase in consumer surplus. The change in total consumer surplus is given by the sum of the shaded areas: the total area below the demand curve and between the old and new prices. Here, the dark blue area represents the increase in consumer surplus for the 200,000 consumers who would have bought a computer at the original price of \$5,000; they each receive an increase in consumer surplus of \$3,500. The light blue area represents the increase in consumer surplus for those willing to buy at a price equal to or greater than \$1,500 but less than \$5,000. Similarly, a rise in the price of a computer from \$1,500 to \$5,000 generates a decrease in consumer surplus equal to the sum of the two shaded areas.



What would happen if the price of a good were to rise instead of fall? We would do the same analysis in reverse. Suppose, for example, that for some reason the price of computers rises from \$1,500 to \$5,000. This would lead to a fall in consumer surplus, equal to the sum of the shaded areas in Figure 4-5. This loss consists of two parts. The dark blue rectangle represents the loss to consumers who would still buy a computer, even at a price of \$5,000. The light blue triangle represents the loss to consumers who decide not to buy a computer at the higher price.

FOR INQUIRING MINDS

A Matter of Life and Death

Each year, about 4,000 people in the United States die while waiting for a kidney transplant. In 2007, some 70,000 more were wait-listed. Since the number of those in need of a kidney far exceeds availability, what is the best way to allocate available organs? A market isn't feasible. For understandable reasons, the sale of human body parts is illegal in this country. So the task of establishing a protocol for these situations has fallen to the nonprofit group United Network for Organ Sharing (UNOS).

Under current UNOS guidelines, a donated kidney goes to the person who has been waiting the longest. According to this system, an available kidney would go to a 75-year-old who has been waiting for 2 years instead of to a 25-year-old who has been

waiting 6 months, even though the 25-year-old will likely live longer and benefit from the transplanted organ for a longer period of time.

To address this issue, UNOS is devising a new set of guidelines based on a concept it calls "net benefit." According to these new guidelines, kidneys would be allocated on the basis of who will receive the greatest net benefit, where net benefit is measured as the expected increase in lifespan from the transplant. And age is by far the biggest predictor of how long someone will live after a transplant. For example, a typical 25-year-old diabetic will gain an extra 8.7 years of life from a transplant, but a typical 55-year-old diabetic will gain only 3.6 extra years. Under the current system,

based on waiting times, transplants lead to about 44,000 extra years of life for recipients; under the new system, that number would jump to 55,000 extra years. The share of kidneys going to those in their 20s would triple; the share going to those 60 and older would be halved.

What does this have to do with consumer surplus? As you may have guessed, the UNOS concept of "net benefit" is a lot like individual consumer surplus—the individual consumer surplus generated from getting a new kidney. In essence, UNOS has devised a system that allocates donated kidneys according to who gets the greatest individual consumer surplus. In terms of results, then, its proposed "net benefit" system operates a lot like a competitive market.

> ECONOMICS IN ACTION

When Money Isn't Enough

The key insight we get from the concept of consumer surplus is that purchases yield a net benefit to the consumer, because the consumer typically pays a price less than his or her willingness to pay for the good. Another way to say this is **that the right to buy a good at the going price is a valuable thing in itself.**

Most of the time we don't think about the value associated with the right to buy a good. In a market economy, we take it for granted that we can buy whatever we want, as long as we are willing to pay the market price. But that hasn't always been true. For example, during World War II the demands of wartime production created shortages of consumer goods when these goods were sold at pre-war prices. Rather than allow prices to rise, government officials created a system of rationing many goods. To buy sugar, meat, coffee, gasoline, and many other goods, you not only had to pay cash; you also had to present stamps or coupons from special books issued to each family by the government. These pieces of paper, which represented the right to buy goods at the government-regulated price, quickly became valuable commodities in themselves. As a result, illegal markets in meat stamps and gasoline coupons sprang into existence. Moreover, criminals began stealing coupons and even counterfeiting stamps.

The funny thing was that even if you had bought a gasoline coupon on the illegal market, you still had to pay to purchase gasoline. So what you were buying on the illegal market was not the good but *the right to buy the good* at the government-regulated price. That is, people who bought ration coupons on the illegal market were paying for the right to get some consumer surplus. ▲

>> QUICK REVIEW

- ▶ The demand curve for a good is determined by each potential consumer's **willingness to pay**.
- ▶ **Individual consumer surplus** is the net gain an individual consumer gets 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.
- ▶ 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.

> CHECK YOUR UNDERSTANDING 4-1

1. Consider the market for cheese-stuffed jalapeno peppers. There are two consumers, Casey and Josey, and their willingness to pay for each pepper is given in the accompanying table. (Neither is willing to consume more than 4 peppers at any price.) Use the table (i) to construct the demand schedule for peppers for prices of \$0.00, \$0.10, and so on, up to \$0.90, and (ii) to calculate the total consumer surplus when the price of a pepper is \$0.40.

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

Solutions appear at back of book.

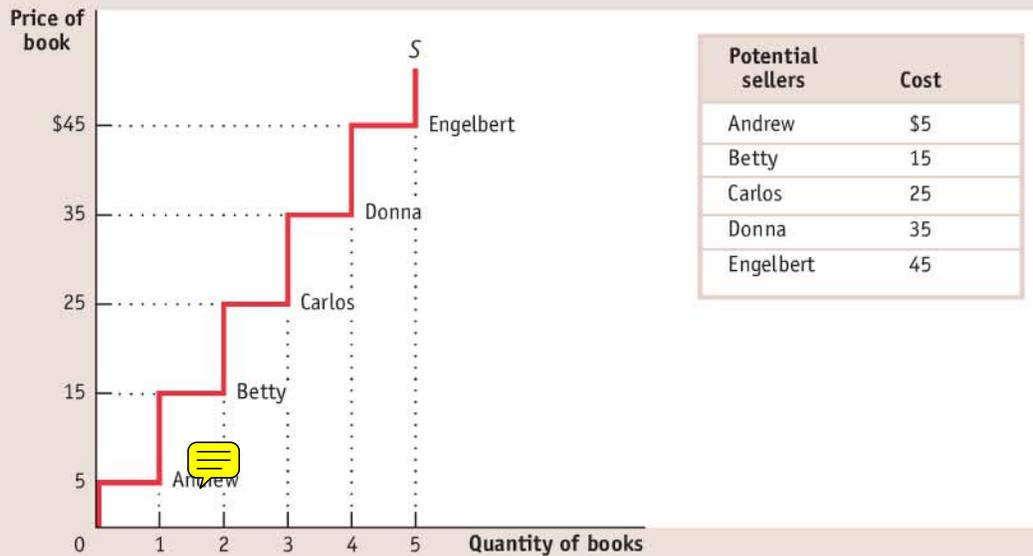
Producer Surplus and the Supply Curve

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. We can therefore carry out an analysis of producer surplus and the supply curve that is almost exactly parallel to that of consumer surplus and the demand curve.

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. The table in Figure 4-6 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.

FIGURE 4-6 The Supply Curve for Used Textbooks



The supply curve illustrates sellers' cost, the lowest price at which a potential seller is willing to sell the good, and the quantity supplied at that price. Each of the five students has one book to sell and each has a different cost, as indicated in the

accompanying table. At a price of \$5 the quantity supplied is one (Andrew), at \$15 it is two (Andrew and Betty), and so on until you reach \$45, the price at which all five students are willing to sell.

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**.

Just as we derived the demand curve from the willingness to pay of different consumers, we can derive the supply curve from the cost of different producers. The step-shaped curve in Figure 4-6 shows the supply curve implied by the costs shown in the accompanying table. At a price less than \$5, none of the students are willing to sell; at a price between \$5 and \$15, only Andrew is willing to sell, and so on.

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

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 in a market 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 both to individual and to total producer surplus.

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

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. Figure 4-7 reproduces the supply curve from Figure 4-6. Each step in that supply 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, $(\$30 - \$5) \times 1 = \$25$, is his producer surplus. So the producer surplus gains from selling his book is the *area of the dark red rectangle* 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

FIGURE 4-7

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 .

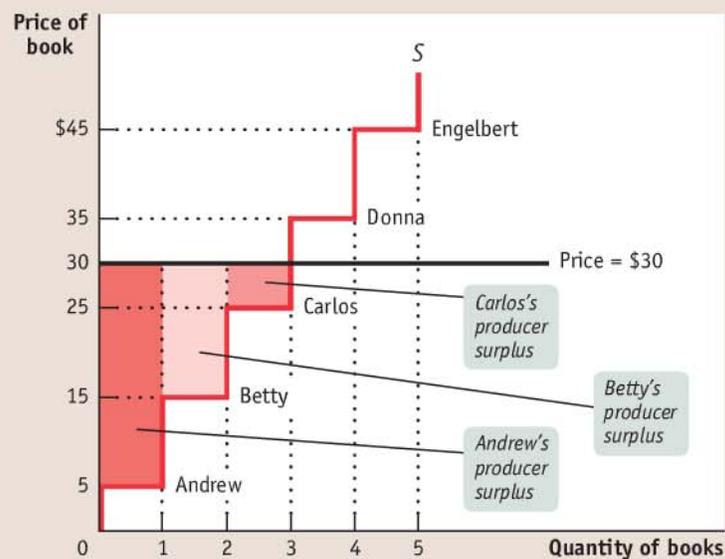
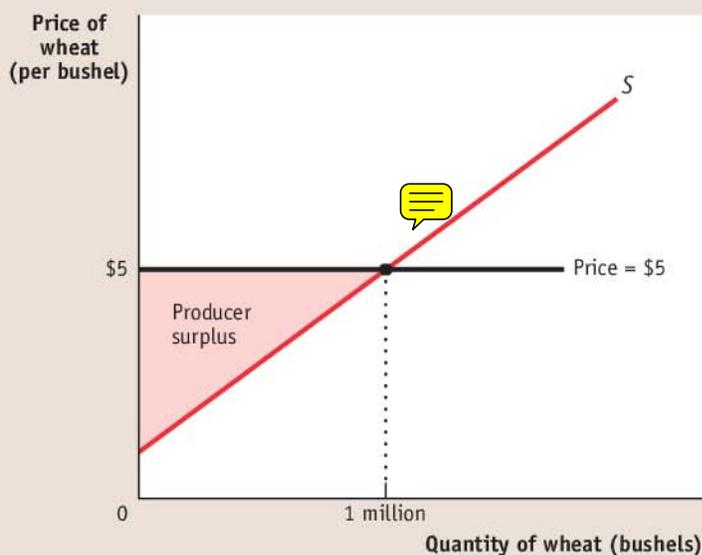


FIGURE 4-8

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.



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 4-7, 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 4-8 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.

How Changing Prices Affect Producer Surplus

As in the case of consumer surplus, a change in price alters producer surplus. However, although a fall in price increases consumer surplus, it reduces producer surplus. Similarly, a rise in price reduces consumer surplus but increases producer surplus.

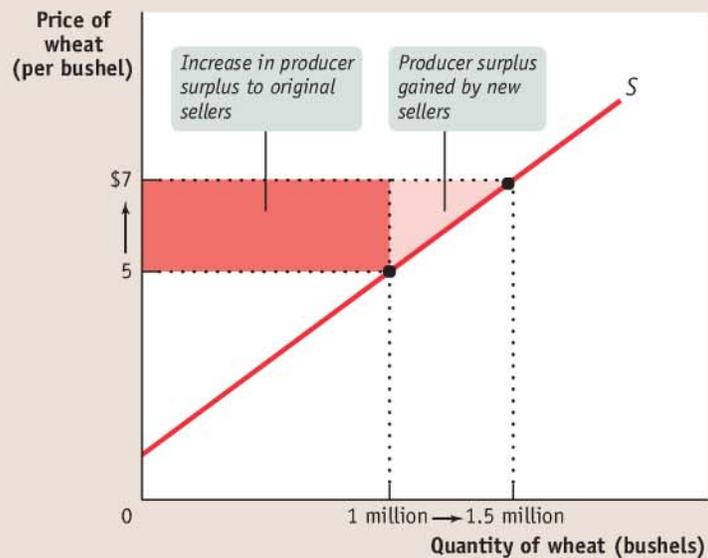
To see this, let's first consider a rise in the price of the good. Producers of the good will experience an increase in producer surplus, though not all producers gain the same amount. Some producers would have produced the good even at the original price; they will gain the entire price increase on every unit they produce. Other producers will enter the market because of the higher price; they will gain only the difference between the new price and their cost.

Figure 4-9 on the next page is the supply counterpart of Figure 4-5. It shows the effect on producer surplus of a rise in the price of wheat from \$5 to \$7 per bushel. The increase in producer surplus is the sum of the shaded areas, which consists of two parts. First, there is a dark red rectangle corresponding to the gains to those farmers who would have supplied wheat even at the original \$5 price. Second, there is an additional light red

FIGURE 4-9

A Rise in the Price Increases Producer Surplus

A rise in the price of wheat from \$5 to \$7 leads to an increase in the quantity supplied and an increase in producer surplus. The change in total producer surplus is given by the sum of the shaded areas: the total area above the supply curve but between the old and new prices. The dark red area represents the gain to the farmers who would have supplied 1 million bushels at the original price of \$5; they each receive an increase in producer surplus of \$2 for each of those bushels. The triangular light red area represents the increase in producer surplus achieved by the farmers who supply the additional 500,000 bushels because of the higher price. Similarly, a fall in the price of wheat generates a reduction in producer surplus equal to the sum of the shaded areas.



triangle that corresponds to the gains to those farmers who would not have supplied wheat at the original price but are drawn into the market by the higher price.

If the price were to fall from \$7 to \$5 per bushel, the story would run in reverse. The sum of the shaded areas would now be the decline in producer surplus, the decrease in the area above the supply curve but below the price. The loss would consist of two parts, the loss to farmers who would still grow wheat at a price of \$5 (the dark red rectangle) and the loss to farmers who decide to no longer grow wheat because of the lower price (the light red triangle).

►ECONOMICS IN ACTION

When the Corn Is High

The average value of farmland in Iowa hit a record high in 2006. A lot of people, it seems, wanted to be Iowa farmers. And there was no mystery why: it was all about the ethanol.

Let's explain: ethanol—the same kind of alcohol that's in beer and other alcoholic drinks—can also fuel automobiles. And in recent years government policy, at both the federal and state levels, has encouraged the use of gasoline that contains a percentage of ethanol. There are a couple of reasons for this policy, including some benefits in fighting air pollution and the hope that using more ethanol will reduce U.S. dependence on imported oil.

But where is the ethanol to come from? Ethanol advocates look to the example of Brazil, which has shifted much of its fuel consumption from gasoline to ethanol. Brazil gets its ethanol by fermenting sugarcane, then distilling out the alcohol. The United States can't follow the same strategy: we don't grow enough sugarcane to satisfy our own sweet tooth, let alone run our cars. But we do produce an awful lot of corn. And corn can also be turned into ethanol.

One result of the shift to ethanol fuel has been a rise in the demand for corn, leading to a surge in corn prices, which rose from \$1.85 a bushel in late 2005 to about \$4 a bushel in early 2007. And there's no place like Iowa for growing corn. Iowa farmers gained from high prices both because they could sell the corn they would have

grown even at lower prices for more money, and because they could shift land away from other crops—especially soybeans—to corn.

What does this have to do with the price of land? A person who buys a farm in Iowa buys the producer surplus that farm generates. And higher prices for corn, which raise the producer surplus of Iowa farmers, make Iowa farmland more valuable. According to the U.S. Department of Agriculture, Iowa farmland went from an average of \$1,800 per acre in 2000 to \$2,930 per acre in 2006, a 63% increase. ▲

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▶ CHECK YOUR UNDERSTANDING 4-2

1. Consider the market for cheese-stuffed jalapeno peppers. There are two producers, Cara and Jamie, and their costs of producing each pepper are given in the accompanying table.

(Neither is willing to produce more than 4 peppers at any price.) Use the table (i) to construct the supply schedule for peppers for prices of \$0.00, \$0.10, and so on, up to \$0.90, and (ii) to calculate the total producer surplus when the price of a pepper is \$0.70.

Quantity of peppers	Cara's cost	Jamie's cost
1st pepper	\$0.10	\$0.30
2nd pepper	0.10	0.50
3rd pepper	0.40	0.70
4th pepper	0.60	0.90

Solutions appear at back of book.

>> QUICK REVIEW

- ▶ The supply curve for a good is determined by the **cost** of each seller.
- ▶ 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.
- ▶ 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.

Consumer Surplus, Producer Surplus, and the Gains from Trade

One of the 12 core principles of economics we introduced in Chapter 1 is that markets are a remarkably effective way to organize economic activity: they generally make society as well off as possible given the available resources. The concepts of consumer surplus and producer surplus can help us deepen our understanding of why this is so.

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 4-10 on the next page. 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 striking thing about this picture is that both consumers and producers gain—that is, both consumers and producers are better off because there is a market in this good. But this should come as no surprise—it illustrates another core principle of economics: **There are gains from trade.** These gains from trade are the reason everyone is better off participating in a market economy than they would be if each individual tried to be self-sufficient.

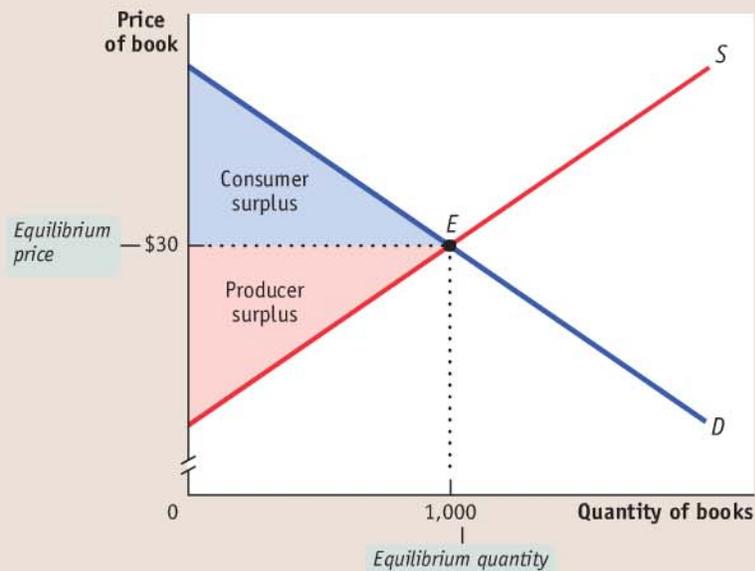
But are we as well off as we could be? This brings us to the question of the efficiency of markets.

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 producer and the consumer surplus.

FIGURE 4-10

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.

**The Efficiency of Markets**

Markets produce gains from trade, but in Chapter 1 we made an even bigger claim: that **markets are usually efficient**. That is, we claimed that **once the market has produced its gains from trade, there is no way to make some people better off without making other people worse off, except** under some well-defined conditions.

The analysis of consumer and producer surplus helps us understand why markets are usually efficient. To gain more intuition into why this is so, consider the fact that **market equilibrium is just one way** of deciding who consumes the good and who sells the good. There are other possible ways of making that decision. Consider, for example, the case of kidney transplants, discussed earlier in *For Inquiring Minds*. There you learned that available kidneys currently go to the people who have been waiting the longest, rather than to those most likely to benefit from the organ for longer. To address this inefficiency, a new set of guidelines is being devised to determine eligibility for a kidney transplant based on “net benefit,” a concept an awful lot like consumer surplus: kidneys would be allocated largely on the basis of who will benefit from them the most.

Similarly, **imagine a committee charged with improving on the market equilibrium by deciding who gets and who gives up a used textbook. The committee’s ultimate goal: to bypass the market outcome and come up with another arrangement that would produce higher total surplus.**

Let’s consider the three ways in which the committee might try to increase the total surplus:

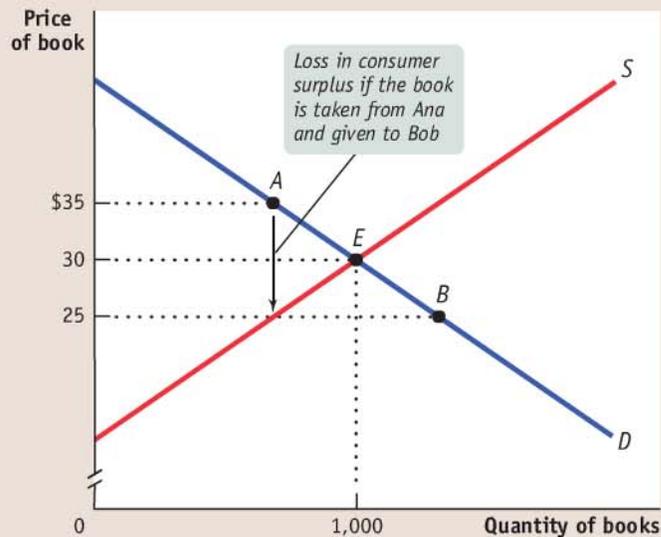
1. Reallocate consumption among consumers
2. Reallocate sales among sellers
3. Change the quantity traded

Reallocate Consumption Among Consumers The committee might try to increase total surplus by selling books to different consumers. Figure 4-11 shows why this will result in lower surplus compared to the market equilibrium outcome. Points A and B show the positions on the demand curve of two potential buyers of used books, Ana and Bob. As we can see from the figure, Ana is willing to pay \$35 for a book, but

FIGURE 4-11

Reallocating Consumption Lowers Consumer Surplus

Ana (point *A*) has a willingness to pay of \$35. Bob (point *B*) has a willingness to pay of only \$25. At the market equilibrium price of \$30, Ana purchases a book but Bob does not. If we rearrange consumption by taking a book from Ana and giving it to Bob, consumer surplus declines by \$10 and, as a result, total surplus declines by \$10. The market equilibrium generates the highest possible consumer surplus by ensuring that those who consume the good are those who most value it.



Bob is willing to pay only \$25. Since the market equilibrium price is \$30, under the market outcome Ana gets a book and Bob does not.

Now suppose the committee reallocates consumption. This would mean taking the book away from Ana and giving it to Bob. Since the book is worth \$35 to Ana but only \$25 to Bob, this change *reduces total consumer surplus* by $\$35 - \$25 = \$10$. Moreover, this result doesn't depend on which two students we pick. Every student who buys a book in the market equilibrium has a willingness to pay of \$30 or more, and every student who doesn't buy a book has a willingness to pay of less than \$30. So reallocating the good among consumers always means taking a book away from a student who values it more and giving it to one who values it less. This necessarily reduces total consumer surplus.

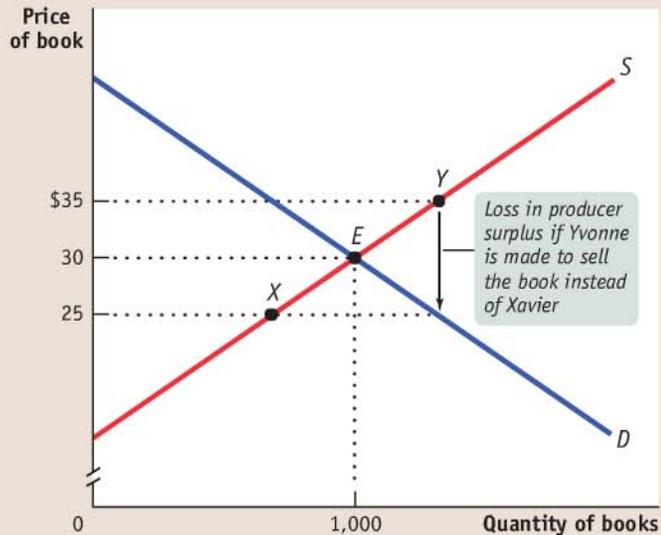
Reallocate Sales Among Sellers The committee might try to increase total surplus by altering who sells their books, taking sales away from sellers who would have sold their books in the market equilibrium and instead compelling those who would not have sold their books in the market equilibrium to sell them. Figure 4-12 on the next page shows why this will result in lower surplus. Here points *X* and *Y* show the positions on the supply curve of Xavier, who has a cost of \$25, and Yvonne, who has a cost of \$35. At the equilibrium market price of \$30, Xavier would sell his book but Yvonne would not sell hers. If the committee reallocated sales, forcing Xavier to keep his book and Yvonne to sell hers, total producer surplus would be reduced by $\$35 - \$25 = \$10$. Again, it doesn't matter which two students we choose. Any student who sells a book in the market equilibrium has a lower cost than any student who keeps a book. So reallocating sales among sellers necessarily increases total cost and reduces total producer surplus.

Change the Quantity Traded The committee might try to increase total surplus by compelling students to trade either more books or fewer books than the market equilibrium quantity. Figure 4-13 on the next page shows why this will result in lower surplus. It shows all four students: potential buyers Ana and Bob, and potential sellers Xavier and Yvonne. To reduce sales, the committee will have to prevent a transaction that would have occurred in the market equilibrium—that is, prevent Xavier from selling to Ana. Since Ana is willing to pay \$35 and Xavier's cost is \$25, preventing this transaction reduces total surplus by $\$35 - \$25 = \$10$. Once again, this result doesn't depend on which two students we pick: any student who would have sold the book in the market equilibrium has a cost of \$30 or less, and any student who would

FIGURE 4-12

Reallocating Sales Lowers Producer Surplus

Yvonne (point *Y*) has a cost of \$35, \$10 more than Xavier (point *X*), who has a cost of \$25. At the market equilibrium price of \$30, Xavier sells a book but Yvonne does not. If we rearrange sales by preventing Xavier from selling his book and compelling Yvonne to sell hers, producer surplus declines by \$10 and, as a result, total surplus declines by \$10. The market equilibrium generates the highest possible producer surplus by assuring that those who sell the good are those who most value the right to sell it.



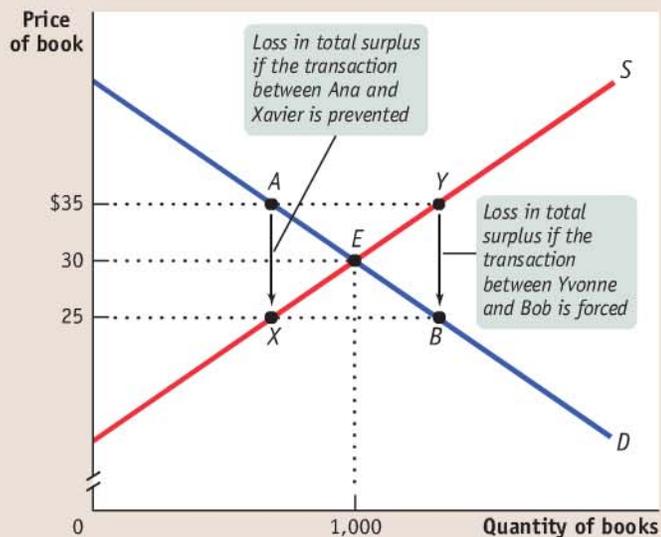
have purchased the book in the market equilibrium has a willingness to pay of \$30 or more. So preventing any sale that would have occurred in the market equilibrium necessarily reduces total surplus.

Finally, the committee might try to increase sales by forcing Yvonne, who would not have sold her book in the market equilibrium, to sell it to someone like Bob, who would not have bought a book in the market equilibrium. Because Yvonne's cost is \$35, but Bob is only willing to pay \$25, this transaction reduces total surplus by \$10. And once again it doesn't matter which two students we pick—anyone who wouldn't have bought the book has a willingness to pay of less than \$30, and anyone who wouldn't have sold has a cost of more than \$30.

FIGURE 4-13

Changing the Quantity Lowers Total Surplus

If Xavier (point *X*) were prevented from selling his book to someone like Ana (point *A*), total surplus would fall by \$10, the difference between Ana's willingness to pay (\$35) and Xavier's cost (\$25). This means that total surplus falls whenever fewer than 1,000 books—the equilibrium quantity—are transacted. Likewise, if Yvonne (point *Y*) were compelled to sell her book to someone like Bob (point *B*), total surplus would also fall by \$10, the difference between Yvonne's cost (\$35) and Bob's willingness to pay (\$25). This means that total surplus falls whenever more than 1,000 books are transacted. These two examples show that at market equilibrium, all mutually beneficial transactions—and only mutually beneficial transactions—occur.



The key point to remember is that once this market is in equilibrium, there is no way to increase the gains from trade. Any other outcome reduces total surplus. (This is why UNOS is trying, with its new guidelines based on “net benefit,” to reproduce the allocation of donated kidneys that would occur if there were a market for the organs.) We can summarize our results by stating that an efficient market performs four important functions:

1. It allocates consumption of the good to the potential buyers who most value it, as indicated by the fact that they have the highest willingness to pay.
2. It allocates sales to the potential sellers who most value the right to sell the good, as indicated by the fact that they have the lowest cost.
3. It ensures that every consumer who makes a purchase values the good more than every seller who makes a sale, so that all transactions are mutually beneficial.
4. It ensures that every potential buyer who doesn't make a purchase values the good less than every potential seller who doesn't make a sale, so that no mutually beneficial transactions are missed.

There are three caveats, however. First, although a market may be efficient, it isn't necessarily fair. In fact, fairness, or equity, is often in conflict with efficiency. We'll discuss this next.

The second caveat is that markets sometimes fail. As we mentioned in Chapter 1, under some well-defined conditions, markets can fail to deliver efficiency. When this occurs, markets no longer maximize total surplus. We provide a brief overview of why markets fail at the end of this chapter, reserving a more detailed analysis for later chapters.

Third, even when the market equilibrium maximizes total surplus, this does not mean that it results in the best outcome for every individual consumer and producer. Other things equal, each buyer would like to pay a lower price and each seller would like to receive a higher price. So if the government were to intervene in the market—say, by lowering the price below the equilibrium price to make consumers happy or by raising the price above the equilibrium price to make producers happy—the outcome would no longer be efficient. Although some people would be happier, society as a whole would be worse off because total surplus would be lower.

Equity and Efficiency

For many patients who need kidney transplants, the proposed UNOS guidelines, covered earlier, will be unwelcome news. Those who had waited years for a transplant will no doubt find these guidelines, which give precedence to younger patients, . . . well . . . unfair. And the guidelines raise other questions about fairness: Why limit potential transplant recipients to Americans? Why include younger patients with other chronic diseases? Why not give precedence to those who have made recognized contributions to society? And so on.

The point is that efficiency is about how to achieve goals, not what those goals should be. For example, UNOS decided that its goal is to maximize the life span of kidney recipients. Some might have argued for a different goal, and efficiency does not address which goal is the best. What efficiency does address is the best way to achieve a goal once it has been determined—in this case, using the UNOS concept of “net benefit.”

It's easy to get carried away with the idea that markets are always right and that economic policies that interfere with efficiency are bad. But that would be misguided because there is another factor to consider: society cares about equity, or what's “fair.” As we discussed in Chapter 1, there is often a trade-off between equity and efficiency; policies that promote equity often come at the cost of decreased efficiency, and policies that promote efficiency often result in decreased equity. So it's important to realize that a society's choice to sacrifice some efficiency for the sake of equity, however it defines equity, is a valid one. And it's important to understand that fairness, unlike efficiency, can be very hard to define. Fairness is a concept about which well-intentioned people often disagree.



Maximizing total surplus at your local hardware store.



We know that an **efficient market equilibrium maximizes total surplus**—the gains to buyers and sellers **in that market**. **Is there a comparable result for an economy as a whole, an economy composed of a vast number of individual markets?** The answer is **yes, but with qualifications**. When each and every market in the economy maximizes total surplus, then the economy as a whole is efficient. This is a very important result: just as it is impossible to make someone better off without making other people worse off in a single market when it is efficient, it is impossible to improve upon the outcome of a market economy when each and every market in that economy is efficient. However, it is important to realize that this is a *theoretical* result: it is virtually impossible to find an economy in which every market is efficient. For now, let's examine why markets and market economies typically work so well. Once we understand why, we can then briefly address why markets sometimes get it wrong.

Why Markets Typically Work So Well

Economists have written volumes about why markets are an effective way to organize an economy. In the end, well-functioning markets owe their effectiveness to two powerful features: *property rights* and the role of prices as *economic signals*.

By **property rights** we mean a system in which valuable items in the economy have specific owners who can dispose of them as they choose. In a system of property rights, by purchasing a good you receive “ownership rights”: the right to use and dispose of the good as you see fit. Property rights are what make the mutually beneficial transactions in the used-textbook market, or any market, possible.

To see why property rights are crucial, imagine that students do not have full property rights in their textbooks and are prohibited from reselling them when the semester ends. This restriction on property rights would prevent many mutually beneficial transactions. Some students would be stuck with textbooks they will never reread when they would be much happier receiving some cash instead. Other students would be forced to pay full price for brand-new books when they would be happier getting slightly battered copies at a lower price.

Once a system of well-defined property rights is in place, the second necessary feature of well-functioning markets—**prices as economic signals**—can operate. An **economic signal** is any piece of information that helps people make better economic decisions. There are thousands of signals that businesses watch in the real world. For example, business forecasters say that sales of cardboard boxes are a good early indicator of changes in industrial production: if businesses are buying lots of cardboard boxes, you can be sure that they will soon increase their production.

But prices are far and away the most important signals in a market economy, because they convey essential information about other people's costs and their willingness to pay. **If the equilibrium price of used books is \$30, this in effect tells everyone both that there are consumers willing to pay \$30 and up and that there are potential sellers with a cost of \$30 or less.** The signal given by the market price ensures that total surplus is maximized by telling people whether to buy books, sell books, or do nothing at all. Each potential seller with a cost of \$30 or less learns from the market price that it's a good idea to sell her book; if she has a higher cost, it's a good idea to keep it. Likewise, each consumer willing to pay \$30 or more learns from the market price that it's a good idea to buy a book; if he is unwilling to pay \$30, then it's a good idea not to buy a book.

This example shows that the market price “signals” to consumers with a willingness to pay equal to or more than the market price that they should buy the good, just as it signals to producers with a cost equal to or less than the market price that they should sell the good. And since, in equilibrium, the quantity demanded equals the quantity supplied, all willing consumers will find willing sellers.

Prices can sometimes fail as economic signals. Sometimes a price is not an accurate indicator of how desirable a good is. When there is uncertainty about the quality of a good, price alone may not be an accurate indicator of the value of the good. For example, you can't infer from the price alone whether a used car is good or a

Property rights are the rights of owners of valuable items, whether resources or goods, to dispose of those items as they choose.

An **economic signal** is any piece of information that helps people make better economic decisions.

A market or an economy is **inefficient** if there are missed opportunities: some people could be made better off without making other people worse off.

Market failure occurs when a market fails to be efficient.



“lemon.” In fact, a well-known problem in economics is “the market for lemons,” a market in which prices don’t work well as economic signals. (We’ll learn about the market for lemons in Chapter 21.)

A Few Words of Caution

As we’ve seen, markets are an amazingly effective way to organize economic activity. But as we’ve noted, markets can sometimes get it wrong. We first learned about this in Chapter 1 in our fifth principle of interaction: *When markets don’t achieve efficiency, government intervention can improve society’s welfare.* When markets are **inefficient**, there are missed opportunities—ways in which production or consumption can be rearranged that would make some people better off without making other people worse off. In other words, there are gains from trade that go unrealized: total surplus could be increased. And when a market or markets are inefficient, the economy in which they are embedded is also inefficient.

Markets can be rendered inefficient for a number of reasons. Two of the most important are a lack of property rights and inaccuracy of prices as economic signals. When a market is inefficient, we have what is known as **market failure**. We will examine various types of market failure in later chapters; for now, let’s review the three main ways in which markets sometimes fall short of efficiency.

First, markets can fail when, in an attempt to capture more surplus, **one party prevents mutually beneficial trades from occurring**. This situation arises, for instance, when a market contains only a single seller of a good, known as a *monopolist*. In this case, the assumption we have relied on in supply and demand analysis—that no individual buyer or seller can have a noticeable effect on the market price—is no longer valid; the monopolist can determine the market price. As we’ll see in **Chapter 14**, this gives rise to inefficiency as a monopolist manipulates the market price in order to increase profits, thereby preventing mutually beneficial trades from occurring.

Second, actions of individuals sometimes have **side effects** on the welfare of others that markets don’t take into account. In economics, these side effects are known as *externalities*, and the best-known example is pollution. We can think of the problem of pollution as a problem of **incomplete property rights**; for example, existing property rights don’t guarantee a right to ownership of clean air. We’ll see in **Chapter 17** that **pollution and** other externalities also give rise to inefficiency.

Third, markets for **some goods fail because these goods, by their very nature, are unsuited for efficient management by markets**. In Chapter 21, we will analyze goods that fall into this category because of problems of **private information**—information about a good that some people possess but others don’t. The seller of a used car that is a “lemon” may have information that is unknown to potential buyers. In cases like this where there is private information, prices don’t always accurately reflect true value. In **Chapter 18**, we will encounter other types of goods that fall into the category of being unsuited for efficient management by markets—**public goods, common resources, and artificially scarce goods**. Markets for these goods fail because of problems in limiting people’s access to and consumption of the good; examples are fish in the sea and trees in the Amazonian rainforest. In these instances, markets generally fail due to incomplete property rights.

But even with these caveats, it’s remarkable how well markets work at maximizing the gains from trade.

► ECONOMICS IN ACTION

A Great Leap—Backward

Economies in which a central planner, rather than markets, makes consumption and production decisions are known as **planned economies**. Russia (formerly part of the U.S.S.R.), many Eastern European countries, and several Southeast Asian countries once had planned economies, and countries such as India and Brazil once had significant parts of their economies under central planning. China still does today.



Planned economies are notorious for their inefficiency, and what is probably the most compelling example of that is the so-called Great Leap Forward, an ambitious economic plan instituted in China during the late 1950s by its leader Mao Zedong. Its intention was to speed up the country's industrialization. Key to this plan was a shift from urban to rural manufacturing: farming villages were supposed to start producing heavy industrial goods such as steel.

Unfortunately, the plan backfired. Diverting farmers from their usual work led to a sharp fall in food production. Meanwhile, because raw materials for steel, such as coal and iron ore, were sent to ill-equipped and inexperienced rural producers rather than to urban factories, industrial output declined as well. The plan, in short, led to a fall in the production of everything in China.

Because China was a very poor country to start with, the results were catastrophic. The famine that followed is estimated to have reduced China's population by as much as 30 million. ▲

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► CHECK YOUR UNDERSTANDING 4-4

1. In some states that are rich in natural resources, such as oil, the law separates the right to above-ground use of the land from the right to drill below ground (called "mineral rights"). Someone who owns both the above-ground rights and the mineral rights can sell the two rights separately. Explain how this division of the property rights enhances efficiency compared to a situation in which the two rights must always be sold together.
2. Suppose that in the market for used textbooks the equilibrium price is \$30, but it is mistakenly announced that the equilibrium price is \$300. How does this affect the efficiency of the market? Be specific.
3. What is wrong with the following statement? "Markets are always the best way to organize economic activity. Any policies that interfere with markets reduce society's welfare."

Solutions appear at back of book.

►► A LOOK AHEAD...

We have now seen how to measure the gains producers and consumers receive by trading in a market, and we've also seen that, subject to certain caveats, a market equilibrium maximizes these gains. Nonetheless, governments sometimes object to the equilibrium price or equilibrium quantity arising from an efficient market, and they intervene to change the result. In the next chapter, we'll describe the usually unpleasant consequences of attempts to tell efficient markets what to do.]

SUMMARY

1. The **willingness to pay** of each individual consumer determines the demand curve. When price is less than or equal to the willingness to pay, the potential consumer purchases the good. The difference between willingness to pay and price is the net gain to the consumer, the **individual consumer surplus**.
2. **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. A rise in the price of a good reduces consumer surplus; a fall in the price increases consumer surplus. The term **consumer surplus** is often used to refer to both individual and total consumer surplus.
3. The **cost** of each potential producer, the lowest price at which he or she is willing to supply a unit of that good, determines the supply curve. If the price of a good is above a producer's cost, a sale generates a net gain to the producer, known as the **individual producer surplus**.
4. **Total producer surplus** in a market, the sum of the individual producer surpluses in a market, is equal to the area above the market supply curve but below the price. A rise in the price of a good increases producer surplus; a fall in the price reduces producer surplus. The term **producer surplus** is often used to refer to both individual and total producer surplus.

►► QUICK REVIEW

- In a market economy, markets are interrelated. When each and every market in an economy is efficient, the economy as a whole is efficient. But in the real world, some markets in a market economy will almost certainly fail to be efficient.
- A system of **property rights** and the operation of prices as **economic signals** are two key factors that enable a market to be efficient. But under conditions in which property rights are incomplete or prices give inaccurate economic signals, markets can fail.
- Under certain conditions, **market failure** occurs and the market is **inefficient**: gains to trade are unrealized. The three principal ways in which markets fail are the prevention of mutually beneficial transactions caused by one party's attempt to capture more surplus, side effects that aren't properly accounted for, and problems in the nature of the goods themselves.

5. **Total surplus**, the total gain to society from the production and consumption of a good, is the sum of consumer and producer surplus.
6. Usually, markets are efficient and achieve the maximum total surplus. Any possible reallocation of consumption or sales, or change in the quantity bought and sold, reduces total surplus. However, society also cares about equity. So government intervention in a market that reduces efficiency but increases equity can be a valid choice by society.
7. An economy composed of efficient markets is also efficient, although this is virtually impossible to achieve in reality. The keys to the efficiency of a market economy are **property rights** and the operation of prices as **economic signals**. Under certain conditions, **market failure** occurs, making a market **inefficient**. Three principal sources of market failure are: attempts to capture more surplus that create inefficiencies, side effects of some transactions, and problems in the nature of the good.

KEY TERMS

Willingness to pay, p. 94	Individual producer surplus, p. 101	Economic signal, p. 111
Individual consumer surplus, p. 96	Total producer surplus, p. 102	Inefficient, p. 112
Total consumer surplus, p. 96	Producer surplus, p. 102	Market failure, p. 112
Consumer surplus, p. 96	Total surplus, p. 105	
Cost, p. 101	Property rights, p. 111	

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 CD store hoping to find a used copy of *Nirvana's Greatest Hits* for up to \$10. The store has one copy selling for \$10, 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. There are six potential consumers of computer games, each willing to buy only one game. Consumer 1 is willing to pay \$40 for a computer game, consumer 2 is willing to pay \$35, consumer 3 is willing to pay \$30, consumer 4 is willing to pay \$25, consumer 5 is willing to pay \$20, and consumer 6 is willing to pay \$15.
 - a. Suppose the market price is \$29. What is the total consumer surplus?
 - b. The market price decreases to \$19. What is the total consumer surplus now?
 - c. When the price fell from \$29 to \$19, how much did each consumer's individual consumer surplus change? How does total consumer surplus change?
4. a. In an auction, potential buyers compete for a good by submitting bids. Adam Galinsky, a social psychologist at Northwestern University, compared eBay auctions in which the same good was sold. He found that, on average, the higher the number of bidders, the higher the sales price. For example, in two auctions of identical iPods, the one with the higher number of bidders brought a higher selling price. According to Galinsky, this explains why smart sellers on eBay set absurdly low opening prices (the lowest price that the seller will accept), such as 1 cent for a new iPod. Use the concepts of consumer and producer surplus to explain Galinsky's reasoning.
 - b. You are considering selling your vintage 1969 convertible Volkswagen Beetle. If the car is in good condition, it is worth a lot; if it is in poor condition, it is useful only as scrap. Assume that your car is in excellent condition but that it costs a potential buyer \$500 for an inspection to learn the car's condition. Use what you learned in part a to explain whether or not you should pay for an inspection and share the results with all interested buyers.
5. According to the Bureau of Transportation Statistics, due to an increase in demand, the average domestic airline fare increased from \$367.17 in the fourth quarter of 2005 to \$381.99 in the first quarter of 2006, an increase of \$14.82.

The number of passenger tickets sold in the fourth quarter of 2005 was 178.1 million. Over the same period, the airlines' costs remained roughly the same: the price of jet fuel averaged around \$1.85 per gallon in both quarters (Source: Energy Information Administration), and airline pilots' salaries remained roughly the same (according to the Bureau of Labor Statistics, they averaged \$135,040 per year in 2005).

Can you determine precisely by how much producer surplus has increased as a result of the \$14.82 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?

6. 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 pay-per-view 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 pay-per-view movies substitutable to some extent. When the new writers' agreement comes into effect, what will happen in the market for pay-per-view movies—that is, will supply or demand shift, and how? As a result, how will producer surplus in the market for pay-per-view movies change? Illustrate with a diagram. Do you think the writers' agreement will be popular with cable television companies that show pay-per-view movies?
7. The accompanying table shows the supply and demand schedules for used copies of the first edition of this textbook. The supply schedule is derived from offers at amazon.com. The demand schedule is hypothetical.

Price of book	Quantity of books demanded	Quantity of books supplied
\$60	30	0
65	27	3
70	25	7
75	20	7
80	17	8
85	15	15
90	12	16
95	9	17
100	8	29
105	2	31
110	0	34

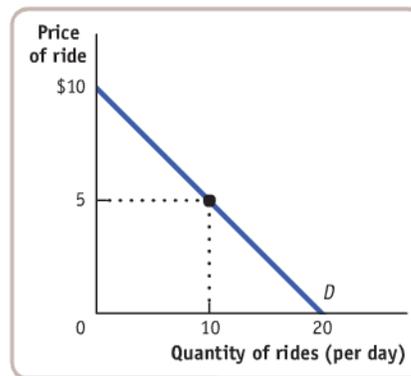
- a. Calculate consumer and producer surplus at the equilibrium in this market.

b. Now the second edition of this textbook becomes available. As a result, the willingness to pay of each potential buyer for a second-hand copy of the first edition falls by \$20. In a table, show the new demand schedule and again calculate consumer and producer surplus at the new equilibrium.

8. On Thursday nights, a local restaurant has a pasta special. Ari likes the restaurant's pasta, and his willingness to pay for each serving is shown in the accompanying table.

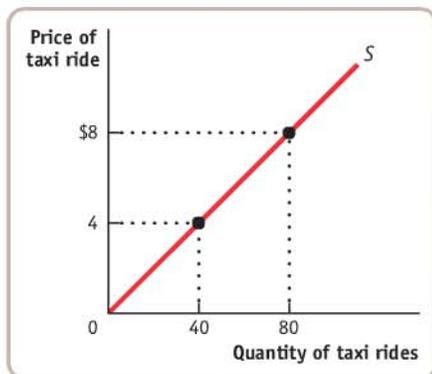
Quantity of pasta (servings)	Willingness to pay for pasta (per serving)
1	\$10
2	8
3	6
4	4
5	2
6	0

- a. If the price of a serving of pasta is \$4, how many servings will Ari buy? How much consumer surplus does he receive?
- b. The following week, Ari is back at the restaurant again, but now the price of a serving of pasta is \$6. By how much does his consumer surplus decrease compared to the previous week?
- c. One week later, he goes to the restaurant again. He discovers that the restaurant is offering an "all-you-can-eat" special for \$25. How much pasta will Ari eat, and how much consumer surplus does he receive now?
- d. Suppose you own the restaurant and Ari is a "typical" customer. What is the highest price you can charge for the "all-you-can-eat" special and still attract customers?
9. 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 $\frac{1}{2} \times$ the height of the triangle \times 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?
10. 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 $\frac{1}{2} \times$ the height of the triangle \times 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?
11. On November 18, 2006, the *New York Times* reported that "The Universal Music Group, the world's largest music company, filed a copyright infringement lawsuit yesterday against MySpace, the popular social networking Web site, for allowing users to upload and download songs and music videos. . . . In court papers, Universal noted that unauthorized copies of music and video from one of its biggest acts, U2, were easily available on the site, as is material from an unreleased album by the rap star Jay-Z." Allowing Internet users to download music and video for free limits Universal's right to dispose of the music and video as it chooses; in particular, it limits Universal's right to give access to its music only to those who have paid for it. In other words, it limits Universal's property rights.
- a. If everyone were to obtain music and video content for free from websites such as MySpace, instead of paying Universal, what would Universal's producer surplus be from music sales? What are the implications for Universal's incentive to produce music and video content in the future?
- b. If Universal loses the lawsuit and music can be freely downloaded from the Internet, what do you think will happen to mutually beneficial transactions (the producing and buying of music) in the future?

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