Consumer and Producer Surplus

MAKING GAINS BY THE BOOK

Here is a lively market in second-hand university textbooks. At the end of each term, some students who took a course decide that the money they can get 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 inexpensive used textbook rather than pay the 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 university 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.
Consumer Surplus And The Demand Curve

The market in used textbooks is not a big business in terms of dollars and cents. But it is a convenient starting point for developing the concepts of consumer and producer surplus.

So let’s look 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 own preferences. Some potential buyers would prefer to buy the used book if it is only slightly cheaper than a new book, 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 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.

The table in Figure 6-1 shows five potential buyers of a used book that costs $100 new, listed in order of their willingness to pay. At one extreme is Anne, who will buy a second-hand book even if the price is as high as $59. Brad is less willing to have a

<table>
<thead>
<tr>
<th>Potential buyers</th>
<th>Willingness to pay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anne</td>
<td>$59</td>
</tr>
<tr>
<td>Brad</td>
<td>45</td>
</tr>
<tr>
<td>Carolyn</td>
<td>35</td>
</tr>
<tr>
<td>Darren</td>
<td>25</td>
</tr>
<tr>
<td>Erica</td>
<td>10</td>
</tr>
</tbody>
</table>

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 student will buy a used textbook, as indicated in the table. Anne has the highest willingness to pay at $59, Brad has the next highest at $45, and so on down to Erica with the lowest at $10. At a price of $59 the quantity demanded is one (Anne); at a price of $45 the quantity demanded is two (Anne and Brad), and so on until you reach a price of $10 at which all five students are willing to purchase a book.
used book, and will buy one only if the price is $45 or less. Carolyn is willing to pay only $35, Darren only $25. And Erica, 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 Anne buys one; if the price is $40, Anne 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.

As we saw in Chapter 3, we can use this demand schedule to derive the market demand curve shown in Figure 6-1. Because we are considering only a small number of consumers, this curve doesn’t look like the smooth demand curves of earlier chapters, 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 stepped, as in this figure, or whether there are many consumers, making the curve smooth.

Willingness to Pay and Consumer Surplus

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

The answer, shown in Table 6-1, is that each student who purchases a book does achieve a net gain but that the amount of the gain differs among students.

Anne 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. Carolyn would have been willing to pay $35, so her net gain is $35 − $30 = $5. Darren and Erica, 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 every buyer of a good 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 6-1, the total consumer surplus is the sum of the individual consumer surpluses achieved by Anne, Brad, and Carolyn: $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.

### Table 6-1

<table>
<thead>
<tr>
<th>Potential buyer</th>
<th>Willingness to pay</th>
<th>Price paid</th>
<th>Individual consumer surplus $= \text{willingness to pay} − \text{price paid}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ann</td>
<td>$59</td>
<td>$30</td>
<td>$29</td>
</tr>
<tr>
<td>Brad</td>
<td>45</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>Carolyn</td>
<td>35</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>Darren</td>
<td>25</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Erica</td>
<td>10</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

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.

The term consumer surplus is often used to refer to both individual and total consumer surplus.
Total consumer surplus can be represented graphically. Figure 6-2 reproduces the demand curve from Figure 6-1. Each step in that demand curve is one book wide and represents one consumer. For example, the height of Anne’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 Anne’s rectangle, ($59 – $30) × 1 = $29, is her consumer surplus from purchasing a book at $30. So the individual consumer surplus Anne gains is the area of the dark blue rectangle shown in Figure 6-2.

In addition to Anne, Brad and Carolyn will also buy books when the price is $30. Like Anne, they benefit from their purchases, though not as much, because they each have a lower willingness to pay. Figure 6-2 also shows the consumer surplus gained by Brad and Carolyn; again, this can be measured by the areas of the appropriate rectangles. Darren and Erica, 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 Anne, Brad, and Carolyn. So total consumer surplus is equal to the combined area of the three rectangles—the entire shaded area in Figure 6-2. Another way to say this is that total consumer surplus is equal to the area that is under the demand curve but above the price.

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 6-3.

Suppose that at a price of $800, 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 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 6-3 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.

**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 an expansion of fish farming makes salmon 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 increase consumer surplus?

The answer is illustrated in Figure 6-4. 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. Each of the students who would have bought books at $30—Anne, Brad, and Carolyn—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 $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 means 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 $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 6-4 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 the total consumer surplus—increases. Figure 6-5 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 $800, 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 6-5 corresponds to the dark blue area in Figure 6-4: it is the gain to the 200,000 people who would 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.

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 increased from $800 to $5,000. This would lead to a fall in consumer surplus, equal to the shaded area in Figure 6-5. This loss consists of two parts. The

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**Figure 6-4**

**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—Anne, Brad, and Carolyn—receives an increase in consumer surplus equal to the total fall 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 rectangle: 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.
A fall in the price of a computer from $5,000 to $800 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 area: the total area below the demand curve but 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 $4,200. The light blue area represents the increase in consumer surplus for those willing to buy at a price equal to or greater than $800 but less than $5,000. Similarly, a rise in the price of a computer from $800 to $5,000 generates a decrease in consumer surplus equal to the sum of the two shaded areas.

The pharmaceutical industry is constantly introducing new prescription drugs. Some of these drugs do the same thing as other, existing drugs, but a bit better—for example, pretty good allergy medicines have been around for years, but newer versions that are somewhat more effective or have fewer side effects keep emerging. Other drugs do something that was previously considered impossible—a famous example from the late 1990s was Propecia, the pill that slows and in some cases reverses hair loss.

Such innovations raise a difficult question for the people who are supposed to measure economic growth: how do you calculate the contribution of a new product to the economy? You might at first say that it’s just a matter of dollars and cents. But that could be wrong, in either direction. A new painkiller that is just slightly better than aspirin might have huge sales, because it would take over the painkiller market—but it wouldn’t really add much to consumer welfare. On the other hand, the benefits of a drug that cures the previously incurable might be much larger than the money actually spent on it—after all, people would have been willing to pay much more.

Consider, for example, the benefits of antibiotics. When penicillin was introduced in 1941, it transformed the treatment of infectious disease; illnesses that had previously crippled or killed millions of people were suddenly easy to treat. Presumably most people would be willing to pay a lot not to go back to the days before penicillin. Yet the average Canadian spends only a few dollars per year on antibiotics. The right way to measure the gains from a new drug—or any new product—is therefore to try to figure out what people would have been willing to pay for the good, and subtract what they actually pay. In other words, the gains from a new drug should be measured by calculating consumer surplus!
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 pays a price that is less than the amount he or she would have been willing 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 price. But that hasn’t always been true. For example, during World War II many goods in Canada were rationed in order to make resources available for the war effort. To buy sugar, eggs, butter, or gasoline and many other goods, you not only had to pay cash; you also had to present stamps or coupons from special books that were issued to each family by the government. These pieces of paper, which represented nothing but the right to buy goods at the market price, quickly became valuable commodities in themselves. As a result, black markets in sugar 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 black market, you still had to pay the regular price of gasoline to fill your tank. So what you were buying on the black market was not the good but the right to buy the good—that is, people who bought ration coupons on the black market were paying for the right to get some consumer surplus.

——> CHECK YOUR UNDERSTANDING 6-2

1. Consider the market for cheese-stuffed jalapeno peppers. There are two consumers, Casey and Josie, and their willingness to pay for each pepper is given in the accompanying table. 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.

<table>
<thead>
<tr>
<th>Quantity of peppers</th>
<th>Casey’s willingness to pay</th>
<th>Josie’s willingness to pay</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st pepper</td>
<td>$0.90</td>
<td>$0.80</td>
</tr>
<tr>
<td>2nd pepper</td>
<td>0.70</td>
<td>0.60</td>
</tr>
<tr>
<td>3rd pepper</td>
<td>0.50</td>
<td>0.40</td>
</tr>
<tr>
<td>4th pepper</td>
<td>0.30</td>
<td>0.30</td>
</tr>
</tbody>
</table>

Solutions appear at back of book.

Producer Surplus And The Supply Curve

Just as buyers of a good would have been willing to pay more for their purchase than the price they actually pay, 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 6-6 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 anything more than $5; Betty won’t sell unless she can get at

——> QUICK REVIEW

> The demand curve for a good is determined by the willingness to pay of each potential consumer.

> 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 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.
least $15; Charles, unless he can get $25; Donna, unless she can get $35; Ethan, unless he can get $45.

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 a 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 anything is always its opportunity cost—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 expend 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 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 6-6 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.

As in the case of consumer surplus, we can add the individual producer surpluses of sellers to calculate the total producer surplus, the total gains to sellers in the market. Economists use the term producer surplus to refer to either total or individual producer surplus. Table 6-2 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 Charles. 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 6-7 reproduces the supply curve from Figure 6-6. 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) × 1 = $25, is his producer surplus. So the producer surplus

**TABLE 6-2**

<table>
<thead>
<tr>
<th>Potential seller</th>
<th>Cost</th>
<th>Price received</th>
<th>Individual producer surplus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andrew</td>
<td>$5</td>
<td>$30</td>
<td>$25</td>
</tr>
<tr>
<td>Betty</td>
<td>15</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>Charles</td>
<td>25</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>Donna</td>
<td>35</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Ethan</td>
<td>45</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Total producer surplus: $45

**Figure 6-7**

**Producer Surplus in the Used-Textbook Market**

At a price of $30, Andrew, Betty, and Charles each sell a book but Donna and Ethan do not. Andrew, Betty, and Charles get individual producer surpluses equal to the difference between the price and their cost, illustrated here by the shaded rectangles. Donna and Ethan each have a cost that is greater than the price of $30, so are unwilling to sell a book and therefore 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 Charles, equal to $25 + $15 + $5 = $45.

Total producer surplus in a market is the sum of the individual producer surpluses of all the sellers of a good. Economists use the term producer surplus to refer both to individual and to total producer surplus.
Andrew 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 Charles 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. Charles 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 6-7, 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 6-8 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.

**Changes in Producer Surplus**

If the price of a good rises, 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 6-9 is the supply counterpart of Figure 6-5. It shows the effect on producer surplus of a rise in the price of wheat from $5 to $7 per bushel. The increase in pro-
producer surplus is the entire shaded area, which consists of two parts. First, there is a 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 pink 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 whole story would run in reverse. The whole shaded area would now be the decline in producer surplus, the fall 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 red rectangle) and the loss to farmers who decide not to grow wheat because of the lower price (the pink triangle).

**economics in action**

**Gaining from Disaster**

On September 28, 2003, Hurricane Juan hit Nova Scotia, destroying many homes and cutting electricity throughout the province. It was weeks before many Nova Scotians had power restored, and many businesses, especially agricultural businesses, were badly affected.

Hurricane Juan was one of the most powerful and damaging hurricanes to ever affect Canada. But as bad as it was, Juan was only a category 1 hurricane (with gusts measured at 129 kilometres per hour). Imagine, then, what it must have been like to be in Florida on August 21, 1992, when Hurricane Andrew hit. Andrew was a category 5 hurricane, with winds gusting at 284 kilometres per hour. It carved through Florida, causing as much as $26.5 billion in damage.

Florida quickly began rebuilding, with the help of thousands of construction workers who temporarily moved there. These construction workers were not motivated mainly by sympathy for Florida residents. They were lured by the high wages available there—and they took home billions of dollars.
But how much did the temporary workers actually gain? Certainly we should not count all the money they earned in Florida as a net benefit. For one thing, most of these workers would have earned something—though not as much—if they had stayed home. In addition to this opportunity cost, the temporary move to Florida had other costs: the expense of motel rooms and of transportation, the wear and tear of being away from families and friends.

Clearly the workers viewed the benefits as being larger than the costs—otherwise they wouldn’t have gone to Florida in the first place. But the producer surplus earned by those temporary workers was much less than the money they earned.

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**CHECK YOUR UNDERSTANDING 6-2**

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. Use the table (i), to construct the supply schedule for pepper 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.

<table>
<thead>
<tr>
<th>Quantity of peppers</th>
<th>Cara’s cost</th>
<th>Jamie’s cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st pepper</td>
<td>$0.10</td>
<td>$0.30</td>
</tr>
<tr>
<td>2nd pepper</td>
<td>0.10</td>
<td>0.50</td>
</tr>
<tr>
<td>3rd pepper</td>
<td>0.40</td>
<td>0.70</td>
</tr>
<tr>
<td>4th pepper</td>
<td>0.60</td>
<td>0.90</td>
</tr>
</tbody>
</table>

Solutions appear at back of book.

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**Consumer Surplus, Producer Surplus, And The Gains From Trade**

One of the nine 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 go back to the market in used textbooks but now consider a much bigger market—say, one at a university the size of the University of Toronto or the University of British Columbia—where there are many potential buyers and sellers. Let’s line up incoming students—who are potential buyers of the 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 6-10. 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.

Let’s abstract from any markup charged by the bookstore. For simplicity, we’ll suppose it is a non-profit store run by the student union, and offering its services for free. 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.

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**QUICK REVIEW**

- The supply curve for a good is determined by the cost to each potential 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 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 even at the original, lower 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.

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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.
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 Efficiency of Markets: A Preliminary View

Markets produce gains from trade, but in Chapter 1 we made a bigger claim: that markets are usually efficient. That is, we claimed that once the market has produced its gains from trade, there is usually no way to make some people better off without making others worse off (with some well-defined exceptions).

We’re not yet ready to carry out a full discussion of the efficiency of markets—that will have to wait until we’ve looked in more detail at the behaviour of producers and consumers. However, we can get an intuitive sense of the efficiency of markets by noticing a key feature of the market equilibrium shown in Figure 6-10: the maximum possible total surplus is achieved at market equilibrium. That is, the market equilibrium allocates the consumption of the good among potential consumers and sales of the good among potential sellers in a way that achieves the highest possible gain to society.

How do we know this? By comparing the total surplus generated by the consumption and production choices in the market equilibrium to the surplus generated by a different set of consumption and production choices. We can show that any change from the market equilibrium reduces total surplus.

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

1. **Reallocate consumption among consumers**—take the good away from buyers who would have purchased the good in the market equilibrium, and instead give it to potential consumers who would not have bought it in equilibrium.
2. Reallocation of sales among sellers—take sales away from sellers who would have sold the good in the market equilibrium, and instead compel potential sellers who would not have sold the good in equilibrium to sell it.

3. Change the quantity traded—compel consumers and producers to transact either more or less than the equilibrium quantity.

It turns out that each of these actions will not only fail to increase the total surplus; in fact, each will reduce the total surplus.

Figure 6-11 shows why reallocation of consumption of the good among consumers will reduce the total surplus. Points A and B show the positions on the demand curve of two potential buyers of a used book, Ana and Bob. As we can see from the figure, Ana is willing to pay $35 for a book, but Bob is willing to pay only $25. Since the equilibrium price is $30, Ana buys a book and 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 value it the most.

A similar argument, illustrated by Figure 6-12, holds for producer 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 price of $30, Xavier would sell his book but Yvonne would not. If we reallocated sales, forcing Xavier to keep his book and forcing Yvonne to give up 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 equilibrium has a lower cost than any student who
does not, so reallocating sales among sellers necessarily increases total cost and reduces producer surplus. In this way the market equilibrium generates the highest possible producer surplus: it ensures that those who sell their books are those who most value the right to sell them.

Finally, changing the quantity bought and sold reduces the sum of producer and consumer surplus. Figure 6-13 shows all four students: potential buyers Ana and Bob, and potential sellers Xavier and Yvonne. To reduce sales, we would have to
prevent someone like Xavier, who would have sold the book in equilibrium, from making the sale; and the book would then not be made available to someone like Ana who would have bought it in equilibrium. As we’ve have seen, however, Ana would be willing to pay $35, but Xavier’s cost is only $25. So preventing this sale would reduce 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 equilibrium has a cost of less than $30, and any student who would have purchased the book in equilibrium would be willing to pay more than $30, so preventing any sale that would have taken place in equilibrium reduces total surplus.

Finally, to increase sales would mean forcing someone like Yvonne, who would not have sold her book in equilibrium, to sell it, and giving it to someone like Bob, who would not have bought a book in equilibrium. Because Yvonne’s cost is $35 but Bob is only willing to pay $25, this 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 is willing to pay less than $30, and anyone who wouldn’t have sold has a cost of more than $30.

What we have shown is that the market equilibrium maximizes total surplus—the sum of producer and consumer surplus. It does this because the market performs four important functions:

1. It allocates consumption of the good to the potential buyers who value it the most, 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.

A caveat: it’s important to realize that although the market equilibrium maximizes the total surplus, this does not mean that it is the best outcome for every individual consumer and producer. Other things being equal, each buyer would like to pay less, and each seller would like to receive more. So some people would benefit from the price controls discussed in Chapter 4. A price ceiling that held down the market price would leave some consumers—those who managed to make a purchase—better off than they would be at equilibrium. A price floor that kept the price up would benefit some sellers—those who managed to make a sale.

But in the market equilibrium there is no way to make some people better off without making others worse off—and that’s the definition of efficiency.

A Few Words of Caution

Markets are an amazingly effective way to organize economic activity; we’ve just demonstrated that, under certain conditions, a market is actually efficient—there is literally no way to make some people better off without making others worse off.

But how secure is this result? Are markets really that good?

The answer is “not always”. As we discussed briefly in Chapter 1 in our ninth and final principle of economics (when markets don’t achieve efficiency, government intervention can improve society’s welfare), markets can fail to be efficient for a number of reasons. When a market is not efficient, we have what is known as a case of market failure. We will examine various causes of market failure in depth in later chapters;
for now, let’s review the three main reasons why markets sometimes fall short of efficiency in reality.

First, markets can fail when, in an attempt to capture more resources, 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 and 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.

For example, suppose a monopolist were to take over the student-run bookstore. The monopolist might decide that the best way to maximize its profits would be to charge a big markup—say, buying books for $5 and selling them for $40. This price manipulation would prevent many mutually beneficial trades from occurring.

Second, actions of individuals sometimes have side effects on the welfare of other individuals that markets don’t take into account. The best-known example of such an externality is pollution. We’ll see in Chapter 19 that pollution and other externalities also give rise to inefficiency.

Third, markets for some goods can fail because these goods, by their very nature, are unsuited for efficient management by markets. In Chapter 18, we will analyze goods that fall under this category because of problems of private information—information about a good that some people possess but others don’t. In Chapter 20, we will encounter other types of goods that fall under this category—public goods, common resources, and artificially scarce goods. These are goods for which markets fail because of problems in limiting people’s access to and consumption of the good. And in Chapter 22 we will learn about information goods: goods like a downloaded tune, which are costly to create but, once created, cost nothing to consume. But even with these caveats, it’s remarkable how well markets work at maximizing the gains from trade.

**economics in action**

**eBay and Efficiency**

Garage sales are an old Canadian tradition: they are a way for families to sell items they don’t want to other families that have some use for them, to the benefit of both parties. But many potentially beneficial trades were missed. For all Mr. Smith knew, there was someone 1,000 miles away who would have really loved that 1930s gramophone he had in the basement; for all Ms. Jones knew, there was someone 1,000 miles away who had that 1930s gramophone she had always wanted. But there was no way for Mr. Smith and Ms. Jones to find each other.

Enter eBay, the online auction service. eBay was founded in 1995 by Pierre Omidyar, a programmer whose fiancée was a collector of Pez candy dispensers and wanted a way to find potential sellers. The company, which says that its mission is “to help practically anyone trade practically anything on earth”, provides a way for would-be buyers and would-be sellers of unique or used items to find each other, even if they don’t live in the same neighbourhood or even the same city.

“I got it from eBay”
The potential gains from trade were evidently large: in 2003, 95 million people were registered by eBay, and in the same year almost $24 billion in goods were bought and sold using the service. The Omidyars now possess a large collection of Pez dispensers. They are also billionaires.

\[ \text{CHECK YOUR UNDERSTANDING 6-3} \]

1. Using the tables in Check Your Understanding 6-1 and 6-2, find the equilibrium price and quantity in the market for cheese-stuffed jalapeno peppers. What is total surplus in the equilibrium in this market, and who receives it?

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

Solutions appear at back of book.

Applying Consumer And Producer Surplus:
The Efficiency Costs Of A Tax

The concepts of consumer and producer surplus are extremely useful in many economic applications. Among the most important of these is assessing the efficiency cost of taxation.

In Chapter 4 we introduced the concept of an excise tax, a tax on the purchase or sale of a good. We saw that such a tax drives a wedge between the price paid by consumers and that received by producers: the price paid by consumers rises, and the price received by producers falls, with the difference equal to the tax per unit. The incidence of the tax—how much of the burden falls on consumers, how much on producers—does not depend on who actually writes the cheque to the government. Instead, as we saw in Chapter 5, the burden of the tax depends on the price elasticity of supply and demand: the higher the price elasticity of demand, the greater the burden on producers; the higher the price elasticity of supply, the greater the burden on consumers.

We also learned that there is an additional cost of a tax, over and above the money actually paid to the government. A tax causes a deadweight loss to society, because less of the good is produced and consumed than in the absence of the tax. As a result, some mutually beneficial trades between producers and consumers do not take place. Now we can complete the picture, because the concepts of consumer and producer surplus are what we need to pin down precisely the deadweight losses that an excise tax imposes.

Figure 6-14 shows the effects of an excise tax on consumer and producer surplus. In the absence of the tax, the equilibrium is at \( E \), and the equilibrium price and quantity are \( P_E \) and \( Q_E \), respectively. An excise tax drives a wedge equal to the amount of the tax between the price received by producers and the price paid by consumers, reducing the quantity bought and sold. In this case, where the tax is \( T \) dollars per unit, the quantity bought and sold falls to \( Q_T \). The price paid by consumers rises to \( P_C \), the demand price of the reduced quantity, \( Q_T \), and the price received by producers falls to \( P_P \), the supply price of that quantity. The difference between these prices, \( P_C - P_P \), is equal to the excise tax, \( T \).

What we can now do, using the concepts of producer and consumer surplus, is show exactly how much surplus producers and consumers lose as a result of the tax.

We saw earlier, in Figure 6-5, that a fall in the price of a good generates a gain in consumer surplus that is equal to the sum of the areas of a rectangle and a triangle. A price increase causes a loss to consumers that looks exactly the same. In the case
of an excise tax, the rise in the price paid by consumers causes a loss equal to the sum of the area of the dark blue rectangle labelled A and the area of the light blue triangle labelled B in Figure 6-14.

Meanwhile, the fall in the price received by producers causes a fall in producer surplus. This, too, is the sum of the areas of a rectangle and a triangle. The loss in producer surplus is the sum of the areas of the red rectangle labelled C and the pink triangle labelled F in Figure 6-14.

Of course, although consumers and producers are hurt by the tax, the government gains revenue. The revenue the government collects is equal to the tax per unit sold, \( T \), multiplied by the quantity sold, \( Q_T \). This revenue is equal to the area of a rectangle \( Q_T \times T \), which is given by the sum of the areas \( A \) and \( C \). Areas \( B \) and \( F \) represent the losses to consumer and producer surplus that are not collected by the government as revenue; they are the deadweight loss to society of the tax.

But there is a part of the loss to producers and consumers from the tax that is not offset by a gain to the government—specifically, the two triangles labelled \( B \) and \( F \). The deadweight loss caused by the tax is equal to the combined area of these triangles. It represents the total surplus that would have been generated by transactions that do not take place because of the tax.

Figure 6-15 is a version of the same picture, leaving out the shaded rectangles—which represent money shifted from consumers and producers to the government—and showing only the deadweight loss, this time as a triangle shaded yellow. The base of that triangle is the tax wedge, \( T \); the height of the triangle is the reduction in the quantity sold, \( Q_E - Q_T \). Notice that if the excise tax didn’t reduce the quantity bought and sold in this market—if \( Q_T \) weren’t less than \( Q_E \)—the deadweight loss represented by the yellow triangle would disappear. This observation ties in with the explanation given in Chapter 4 of why an excise tax generates a deadweight loss to society: the tax causes inefficiency because it discourages mutually beneficial transactions between buyers and sellers.

The idea that deadweight loss can be measured by the area of a triangle recurs in many economic applications. Deadweight-loss triangles are produced not only by excise taxes but also by other types of taxation. They are also produced by other kinds of distortions of markets, such as monopoly. If a monopolist took over the student bookstore and charged
enormous markups on the sale of used books, the effect would very similar to that of the excise tax we’ve just analysed. And triangles are often used to evaluate other public policies—for example, decisions about whether to build new highways.

The general rule for economic policy is that, other things equal, you want to choose the policy that produces the smallest deadweight loss. This principle gives valuable guidance on everything from the design of the tax system to environmental policy. But how can we predict the size of the deadweight loss associated with a given policy? For the answer to that question, we return to a familiar concept: elasticity.

**Deadweight Loss and Elasticities**

The deadweight loss from an excise tax arises because it prevents some mutually beneficial transactions from occurring. In particular, the producer and consumer surplus that is forgone from these missing transactions is equal to the size of the deadweight loss itself. This means that the larger the number of transactions that are impeded by the tax, the larger the deadweight loss.

This gives us an important clue in understanding the relationship between elasticity and the size of deadweight loss from a tax. Recall that when demand or supply is elastic, it means that the quantity demanded or the quantity supplied is relatively responsive to price. So a tax imposed on a good for which either demand or supply, or both, is elastic will cause a relatively large decrease in the quantity bought and sold and a large deadweight loss. And when we say that demand or supply is inelastic, we mean that the quantity demanded or the quantity supplied is relatively unresponsive to price. As a result, a tax imposed when demand or supply, or both, is inelastic will cause a relatively small decrease in the quantity bought and sold and a small deadweight loss.

The four panels of Figure 6-16 illustrate the positive relationship between price elasticity of either demand or supply and the deadweight loss of taxation. In each panel, the size of the deadweight loss is given by the area of the shaded triangle. In panel (a), the deadweight-loss triangle is large because demand is relatively elastic—a large number of transactions fail to occur because of the tax. In panel b., the same supply curve is drawn as in panel (a), but demand is now relatively inelastic; as a result the triangle is small because only a small number of transactions are forgone. Likewise, panels (c) and (d) contain the same demand curve but different supply curves. In panel (c),
an elastic supply curve gives rise to a large deadweight-loss triangle, but in panel (d) an inelastic supply curve gives rise to a small deadweight-loss triangle.

As the following story illustrates, the implication of this result is clear: if you want to lessen the efficiency costs of taxation, you should devise taxes to fall on goods for which either demand or supply, or both, is relatively inelastic. And this lesson carries a flip side: using a tax to purposely decrease the amount of a harmful activity, such as underage drinking, will have the most impact when that activity is elastically demanded or supplied. In the extreme case in which demand is perfectly inelastic (a vertical demand curve), the quantity demanded is unchanged by the imposition of
the tax. As a result, the tax imposes no deadweight loss. Similarly, if supply is perfectly inelastic (a vertical supply curve), the quantity supplied is unchanged by the tax and there is also no deadweight loss.

**economics in action**

**In Canada, All That Glitters Is Taxed**

Most excise taxes in Canada are placed on goods with inelastic demand—the “sin” taxes (excise taxes on alcohol and cigarettes) being two of the most visible and important. This not only implies a relatively small deadweight loss but also means that the government does not undercut the source of its tax revenue by the imposition of the tax.

There is, however, one excise tax imposed on a luxury item—an item with relatively elastic demand—the 10% federal excise tax on jewellery. Combined with regular federal and provincial sales taxes, jewellery is subject to a tax rate of around 25%.

Because most luxury items have an elastic demand, one would expect that the high taxes imposed on jewellery would seriously reduce the amount of jewellery demanded, which would limit the tax revenue raised.

It appears to have done more than that. A recent report claimed that a very large part of Canada’s billion-dollar retail diamond industry has been driven underground. In major cities such as Toronto, Vancouver, and Montreal, where there are higher concentrations of diamond dealers, between 50 and 75% of trades are estimated to be under-the-table “black market” transactions. Because of the possibility of making illegal transactions, the elasticity of demand for “legal jewellery” is much greater than the overall elasticity of demand for jewellery.

Such avoidance of tax limits the size of the deadweight loss. But in looking at the cost of the tax, we should include the broader societal costs of encouraging illegal activity and organised crime. The Canadian Jewellers Association has lobbied strenuously for the repeal of the excise tax. It notes the inconsistency of applying a luxury tax to a $10 gold pin but not to a $50,000 automobile. It hopes the government realises that the tax is imposing high costs for relatively little gain in equity or in tax revenue.

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**CHECK YOUR UNDERSTANDING 6-4**

1. Suppose that an excise tax of $0.40 is imposed on cheese-stuffed jalapeno peppers, raising the price paid by consumers to $0.70, and lowering the price received by producers to $0.30. Compared to the market equilibrium without the tax from Check Your Understanding 6-3, calculate the following:
   a. The loss in consumer surplus and who loses consumer surplus
   b. The loss in producer surplus and who loses producer surplus
   c. The government revenue from this tax
   d. The deadweight loss of the tax

2. In each of the following cases, focus on the elasticity of demand and use a diagram to illustrate the likely size—small or large—of the deadweight loss resulting from a tax. Explain your reasoning.
   a. Gasoline
   b. Milk chocolate bars

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We have now almost completed our tour of the supply and demand model. But there is one more topic we need to address: how do producers and consumers make decisions? Up to now we have looked at simple situations where it is immediately clear what an individual should do. For example, a consumer should buy if the price is less than his or her willingness to pay. But not all situations are that simple. In the next chapter, we take a deeper look at how producers and consumers make decisions.
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 price and willingness to pay is the net gain to the consumer, the individual consumer surplus.

2. The total consumer surplus in a market, the sum of all individual consumer surpluses in a market, is equal to the area below the 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 both to individual and to 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. The total producer surplus, the sum of the individual producer surpluses, is equal to the area above the 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 both to the individual and to the total producer surplus.

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 rearrangement of consumption or sales, or change in the quantity bought and sold, reduces total surplus.

7. Under certain conditions, market failure occurs and markets fail to be efficient. This arises from three principal sources: attempts to capture more resources that create inefficiencies, side effects of some transactions, and problems in the nature of the good.

8. Economic policies can be evaluated by their effect on total surplus. For example, an excise tax generates revenue for the government but lowers total surplus. The loss in total surplus exceeds the tax revenue, resulting in a deadweight loss to society. The value of this deadweight loss is shown by the triangle that represents the value of the transactions discouraged by the tax. The greater the elasticity of demand or supply, or both, the larger the deadweight loss of a tax.

KEY TERMS

- Willingness to pay, p.??
- Individual consumer surplus, p.??
- Total consumer surplus, p.??
- Consumer surplus, p.??
- Cost, p.??
- Individual producer surplus, p.??
- Total producer surplus, p.??
- Producer surplus, p.??
- Total surplus, p.??
- Market failure, p.??

PROBLEMS

1. Determine the amount of consumer surplus generated in each of the following situations:
   a. Paul 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. At the cash register, he is told that his T-shirt is on sale for half the posted price.
   b. Robin goes to the CD store in town hoping to find a used copy of the Eagles Greatest Hits for up to $10. The store has one copy selling for $10.
   c. After soccer practice, Phil is willing to pay $2 for a bottle of mineral water. The 7-Eleven sells mineral water for $2.25 per bottle.

2. Determine the amount of producer surplus generated in each of the following situations:
   a. Bob 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.
   b. Jenny 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.
   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. Hollywood writers have a new agreement with movie producers that the writers will receive 10% of the revenue from every video rental of a movie they worked on. They have no such agreement for movies shown on pay-per-view television.
   a. When the new writers’ agreement comes into effect, what happens 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 rental videos and pay-per-view movies substitutable to some extent. When the new
PART 1  INDIVIDUALS AND MARKETS

writer’s 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?

4. There are six potential consumers of computer games. 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 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?

5. In an effort to provide more affordable rental housing for low-income families, the city council of Belleville, Manitoba, decides to impose a rent ceiling well below the current market equilibrium rent.

a. Illustrate the effect of this policy in a diagram. Indicate consumer and producer surplus before and after the introduction of the rent ceiling.

b. Will this policy be popular with renters? With landlords?

c. An economist explains to the city council that this policy is creating a deadweight loss. Illustrate the deadweight loss in your diagram.

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

<table>
<thead>
<tr>
<th>Quantity of pasta (servings)</th>
<th>Willingness to pay for pasta (per serving)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$10</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
</tr>
</tbody>
</table>

a. If the price of a serving of pasta is $4, how many servings will Ted buy? How much consumer surplus does he receive?

b. The following week, Ted 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 Ted eat, and how much consumer surplus does he receive now?

d. Suppose you own the restaurant and Ted is a “typical” customer. What is the highest price you can charge for the “all you can eat” special, and still attract customers?

7. The accompanying diagram shows the market for cigarettes.

The current equilibrium price per pack is $4, and every day 40 million packs of cigarettes are sold. In order to recover some of the health care costs associated with smoking, the government imposes a tax of $2 per pack. This will raise the equilibrium price to $5 per pack, and reduce the equilibrium quantity to 30 million packs.

The economist working for the tobacco lobby claims that this tax will reduce the consumer surplus for smokers by $40 million per day, since 40 million packs now cost $1 more per pack. The economist working for the lobby for sufferers of second-hand smoke argues that this is an enormous overestimate, and that the reduction in consumer surplus is only $30 million per day, since after the imposition of the tax only 30 million packs of cigarettes will be bought and each of these packs now costs $1 more. They are both wrong. Why?

8. Consider the original market for pizza in Middleton, Ontario, illustrated in the accompanying table. Town officials decide to impose an excise tax on pizza of $4 per pizza.

<table>
<thead>
<tr>
<th>Price of pizza</th>
<th>Quantity of pizza demanded</th>
<th>Quantity of pizza supplied</th>
</tr>
</thead>
<tbody>
<tr>
<td>$10</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
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a. What is the quantity of pizza bought and sold after the imposition of the tax? What is the price paid by consumers? What is the price received by producers?
b. Calculate the consumer surplus and the producer surplus after the imposition of the tax. By how much has the imposition of the tax reduced consumer surplus? By how much has it reduced producer surplus?
c. How much tax revenue does Middleton earn from this tax?
d. Calculate the deadweight loss from this tax.

a. What is the quantity of pizza bought and sold after the imposition of the price floor?
b. Calculate the consumer surplus after the imposition of the price floor, and the producer surplus after the imposition of the price floor.

10. You are the manager of Fun World, a small amusement park in Beaver, British Columbia. 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 triangle is $\frac{1}{2} \times \text{base} \times \text{height}$.)
b. Suppose that Fun World considers charging an admission fee, while maintaining 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 therefore charge?

11. 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. What is this taxi driver’s producer surplus? (Recall that the area of a triangle is $\frac{1}{2} \times \text{base} \times \text{height}$.)
b. Suppose now 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. How much producer surplus does an individual taxi driver now get? What is the maximum licensing fee the city could charge this taxi driver?

12. The province needs to raise money, and the premier has a choice of imposing an excise tax of the same amount on one of two previously untaxed goods: the province can either tax sales of restaurant meals or sales of gasoline. Both the demand for and the supply of restaurant meals are more elastic than the demand for and the supply of gasoline. If the premier wants to minimize the deadweight loss caused by the tax, which good should be taxed? For each good, draw a diagram that illustrates the deadweight loss from taxation.

To continue your study and review of concepts in this chapter, please visit the Krugman/Wells website for quizzes, animated graph tutorials, web links to helpful resources, and more.

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