PART 2

From Individual Choices to Market Outcomes

Whether we are consumers or producers of a good or service, we can usually improve on our own well-being by engaging in some form of economic exchange. There are "gains from trade" to be had when buyers and sellers meet face-to-face, online, or through representatives to exchange goods and services. These trades take place in markets. Markets can have a physical location—such as weekly farmers' markets and the New York Stock Exchange—or they can be "virtual"—such as NASDAQ, eBay, and Amazon.

In Part 2, we show how people's individual economic choices provide the foundation upon which markets operate. We develop a supply-and-demand framework to predict the price at which a good is exchanged as well as the total amount of the good that is traded in the market. Based on this approach, we can predict how changes in the economic environment are likely to affect these prices and quantities; how gains from trade are shared between buyers and sellers; and how some government policies—such as price controls—can lead to unintentional and sometimes adverse market outcomes that ultimately reduce people's well-being.

CHAPTER

6

Willingness to Pay and the Demand for Goods and Services

"People are always making a fuss over my $15–20 million salaries. Believe me, the amount is meaningless once my wife finds out about it. She's already spent half of my salary from Terminator *7!"*

Arnold Schwarzenegger, actor and former governor of California

So far, we have looked at how to apply our marginal benefit and marginal cost framework of analysis to the everyday economic decisions we all face. We have come quite far in our ability to make predictions about people's choices using this relatively simple approach. These predictions focused on whether a person's consumption of a good would be likely to increase or decrease when there is a specific change in the economic environment.

However, we have sidestepped the question of how we would actually value the benefit that a person receives from each unit of a specific good or service. This measurement question is not easy to resolve. After all, how do we measure happiness, security, satisfaction, pleasure, comfort, or convenience? Yet each of these feelings can be an important component of the well-being we get from allocating our scarce resources in a particular way.

People somehow manage to intuitively value the economic benefit they would derive from each alternative they consider. We see this when it comes to the purchasing decisions that people make. Have you ever chosen to pay more for Reese's peanut butter than the Safeway brand? Somehow, you've decided that the extra money is "worth" spending on Reese's rather than spending it on something else. If we are to spend our money in a way that maximizes our sense of well-being, we must be able to value the options at hand.

When people decide how much they are willing to pay for each unit of a particular good, they have, in effect, "monetized" the benefit they will receive from each unit. This gives them a basis upon which to decide how much, if any, of the good to purchase. Even when people barter one good for another—shoes for dental work, math tutoring for a meal, and so forth—each party to the trade must somehow value the benefits he expects to receive to compare them to the opportunity cost of what he will be giving up in the exchange.

6.1 Willingness to Pay and Reservation Price

People often enjoy different amounts of well-being from the same good because of differences in preferences and in the availability of alternatives. There is no reason to believe, for example, that you and your parents get the same economic benefit from attending the symphony or the latest Black Eyed Peas concert. This means that even when two people have the same income, different tastes will likely lead to differences in their **willingness to pay** for a particular good.

WILLINGNESS TO PAY The maximum amount of money that a person is willing and able to pay for each unit of a good.

EXAMPLE A person who lives on a 300-acre farm is likely to be willing to pay more for a John Deere riding lawn mower than a person who lives in an apartment in New York City.

EXAMPLE Meat eaters are willing to pay substantially more for a McDonald's Quarter Pounder than vegetarians.

Economists sometimes refer to your willingness to pay as your **reservation price**.

RESERVATION PRICE Willingness to pay; the maximum amount that a person is willing and able to pay for each unit of a good.

Suppose that the only cost of making a purchase is the price of the good: that is, transportation, information, and other transaction costs are negligible. When this is the case, a person's reservation price equals the monetary value she places on the economic benefits she derives from the good. This means that when the good's price exactly equals this reservation price, the *net* benefit the consumer receives (value of benefits − price) equals zero. She would be *indifferent* to buying the good or not. If the good's price is greater than her reservation price, then the net benefit resulting from buying the good is negative. A rational decision maker would walk away without making a purchase in this case.

There have been numerous studies of people's willingness to pay for a variety of goods and services. Recently, researchers estimated the amount that parents would pay to protect their children and grandchildren from the effects of global warming. People were asked how much more money they would be willing to pay for their electricity service each month to cover the costs of significantly reducing greenhouse gases, which have been linked to climate change. Although the answers varied a great deal, the majority of respondents were indifferent to addressing the problem of global warming when the cost they would bear exceeded $18.75 per month.[1]

ECONOMIC FALLACY People's willingness to pay to extend their lives an additional day is infinite.

False. We know from observing people's behavior that they often make choices that increase their risk of dying. They drive at high speeds, step out into streets, ride roller-coasters, smoke, and actively engage in other risky activities. This means

[1]"The Indifference Point on Global Warming." *St. Louis Post-Dispatch,* June 30, 2009.

that the value they place on living an additional day is not infinite—they are willing to incur some probability of dying in return for the net benefit that risky activities generate. Although it is true that a large percentage of total medical outlays take place in the final six months of a person's life, we cannot take this as a sign that the willingness to pay to continue living is infinite. After all, these end-of-life costs are typically paid by insurance companies or the government, not the patient or his family.

Willingness to Pay Implies Ability to Pay

When economists talk about *willingness to pay,* they are actually talking only about instances in which this willingness can be translated into an actual payment. That is, a person must not only be willing but also able to pay for the good or service desired. Although you might place a high dollar value on the benefits of owning a Porsche Boxster, your *willingness to pay* from an economic standpoint equals the amount you can actually hand over for the car. The fact that our ability to pay for some desired purchases often falls short explains why sellers frequently offer attractive financing plans to help buyers purchase such big-ticket items as homes and cars.

Diminishing Marginal Benefit and Willingness to Pay

An interesting question to ask is whether someone's willingness to pay for the first unit of a good differs from his willingness to pay for the second unit of the same good. What about his willingness to pay for the third unit of the good?

Consistent with the principle of diminishing marginal benefit—which says that the benefit a person gets from the first unit of a good is greater than from the second unit, which is greater than the benefit enjoyed from the third unit—it would make sense that a person's willingness to pay declines as he acquires more and more of a good. Another way to put this is that the **marginal willingness to pay** for each additional unit consumed declines.

MARGINAL WILLINGNESS TO PAY The maximum willingness to pay for each additional unit of a good.

EXAMPLE You may be willing to pay $11 to see a long-awaited movie at your local theater but only $6 to see it again with friends.

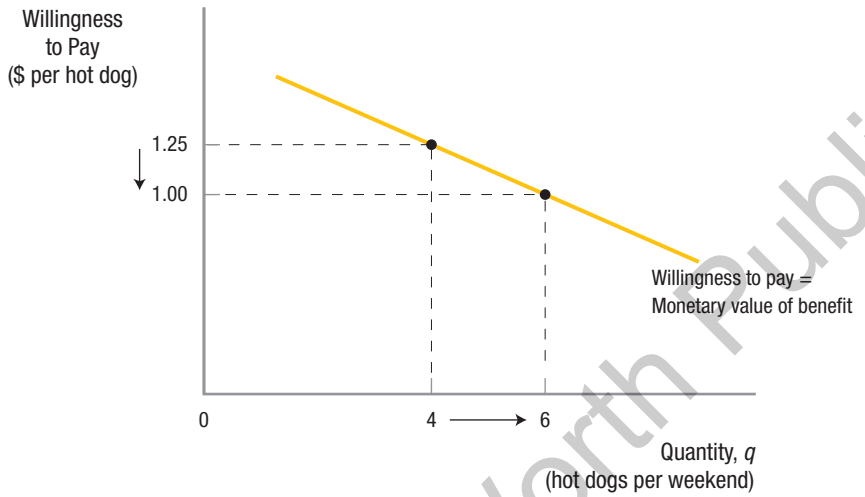
EXAMPLE On a hot summer day, you may be willing to pay $4.25 for a 32-ounce soft drink at the ball game but only $1 for a refill.

In **Figure 6.1**, we graphically show someone's willingness to pay for each hot dog purchased from a street vendor during a weekend visit to New York City. The vertical axis represents the visitor's willingness to pay—her reservation price—for *each and every* hot dog.

We adopt the convention here of using a small letter q to represent the quantity demanded by one consumer. Later in this chapter, we use a capital Q to represent the total quantity demanded by all consumers in a market.

We see in Figure 6.1 that there is an inverse relationship between each hot dog's reservation price and the total number of hot dogs consumed. That is, the reservation price for an additional hot dog is less than for the one before. This is why the graph shown in Figure 6.1 is downward sloping. The principle of diminishing marginal benefit "guarantees" this result.

FIGURE 6.1 A Person's Willingness to Pay for Street Vendor Hot Dogs



According to our principle of diminishing marginal benefit, the NYC visitor's willingness to pay for each incremental, or marginal, hot dog is declining. If, for example, the price of a hot dog falls from $1.25 to $1, she is willing to increase her purchases from four to six hot dogs.

Let's say that our tourist can buy as many hot dogs as she wants at $1.25, the going price charged by NYC street vendors. At this price, we see that she will buy a total of four hot dogs during her weekend stay. We know this because her reservation price for each of the first three hot dogs is greater than $1.25, the price that she must actually pay for each hot dog. But when it comes to the fourth hot dog, her reservation price of $1.25 is just equal to the price she must pay, which means that the fourth hot dog yields zero *net* benefit. Therefore, the buyer is *indifferent* to consuming the fourth hot dog. We know with certainty that she will not buy any more hot dogs beyond the fourth hot dog because her reservation price for these additional hot dogs is less than $1.25, resulting in a negative net benefit.

You have seen this type of economic decision making before. If the only cost of purchasing a good is its price, then this is the marginal cost (*MC*) of consuming each unit. And, if the willingness to pay for each unit is the "monetized" value of the benefit received, then this will represent the marginal benefit (*MB*) derived from each unit. Applying our previously developed model of economic choice, we expect that a person will maximize the net benefits she receives by consuming a particular good up to the point where the price of that good is just equal to the willingness to pay—the reservation price—for the last unit purchased.

What would happen if the price of hot dogs dropped from $1.25 to $1? We see that our buyer will buy two additional hot dogs over the weekend—for a total of six during her NYC visit—because her reservation price for the fifth hot dog is greater than $1 and just equal to $1 for the sixth hot dog. Now she is indifferent about the sixth hot dog. As this result suggests, there is an *inverse* relationship between a good's price and the quantity that a person will buy: when price falls, the quantity purchased will typically increase, as long as nothing else changes.

How Convenience Affects a Consumer's Reservation Price

In reality, we know that a good's price often represents only a portion of the total cost that a buyer will incur in making a purchase. There are likely to be other costs—both explicit and implicit—that must be factored in when a buyer sets his reservation price. A Boxster buyer, for example, is likely to incur costs beyond the car's $50,000 price tag. These include the opportunity cost of the time invested in researching alternative sports cars and dealer inventories, as well as the time spent negotiating a deal. And then there are the sales taxes and higher insurance premium the buyer will pay when he switches from his old car to the Boxster.

When such transaction costs exist, we expect that a buyer will reduce his reservation price by the amount of these additional costs. Why? Suppose the maximum you are willing to pay to attend an upcoming concert is $100. Let's say the city in which the concert is being held decides to charge each ticket holder a $5 gate entry fee to pay for the extra security provided for the event. How much would you now be willing to pay for the ticket itself? $95. In other words, your reservation price for a ticket drops by the amount of other costs incurred in making the purchase. The same thing happens when you have to pay shipping on an Amazon.com purchase: you are willing to pay less for the item itself than if there was free shipping.

This tells us that there is an inherent trade-off between your reservation price and other costs incurred in making a purchase. In fact, you can see this trade-off reflected in people's everyday decisions. Think of how many people you know who purchase bottles of soda or water from on-campus machines at a far higher price than if these were purchased at the supermarket. The fact that these on-campus purchases are made tells us that the willingness to pay for these drinks is at least equal to the higher price that is being charged. Does this behavior make economic sense?

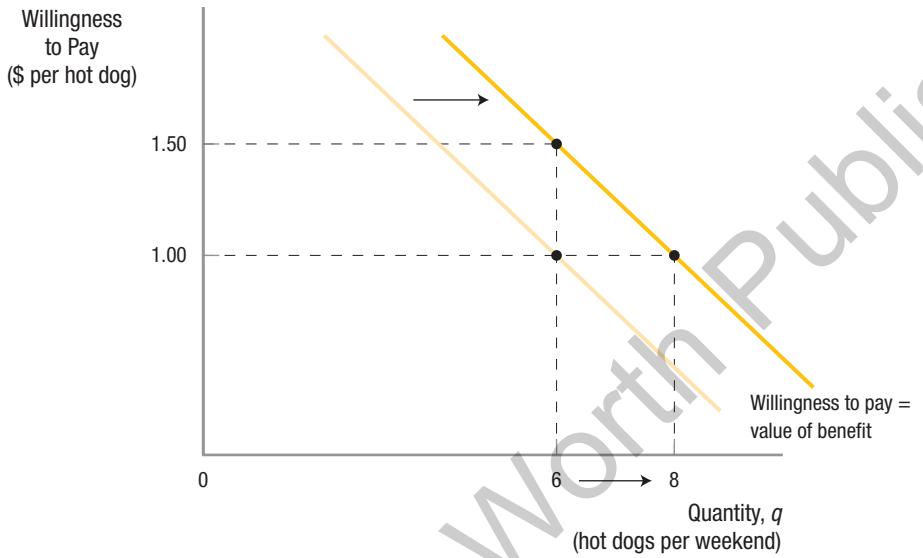
On-campus machines are convenient and readily accessible between classes; they eliminate the costs of running to a convenience store off campus. Therefore, students who drink bottled soda or water are willing to pay more for the on-campus drinks. In other words, they will pay more to avoid other transaction costs, in this case, the time required to drive off campus, park the car, stand in the checkout line, find a new parking spot on campus, and so on. This is the same reason that many people—especially those who place a high value on their time—are willing to pay additional "handling fees" to buy concert tickets online rather than standing in line at the box office window or redialing Ticketmaster for hours on end. What we are saying is what you already know—convenience comes at a price.

Suppose, for example, that buyers had to wait in long lines for upwards of 30 minutes to purchase hot dogs from a NYC hot dog street vendor. Our hot dog consumer's willingness to pay for each hot dog purchased will fall, reflecting the additional time costs incurred to purchase each hot dog. She will now purchase fewer hot dogs at the going price of $1.25 because her reservation price for each hot dog has dropped.

What if, instead, street vendors agreed to deliver the hot dogs to your hotel? We would expect our buyer's reservation price for each hot dog to increase—especially in the most bitter winter months—as shown in **Figure 6.2**. At $1.25, more hot dogs are now purchased.

On a much larger scale, we have seen the willingness to pay for convenience soar as the value of people's time has increased. This has been most noticeable with the trend toward greater workforce participation by women during the latter half of the twentieth century. People's willingness to pay for a range of goods and services—dry cleaning, child care, frozen and microwaveable foods, and so on—has increased. Families are now willing to pay more to lessen the amount of time they must devote

FIGURE 6.2 **The Impact of Convenience on a Person's Willingness to Pay: A Hot Dog Vendor Who Delivers**



If there is a hot dog vendor who delivers to a visitor's hotel during bad winter weather, then the visitor's willingness to pay for each hot dog will increase (from $1 to $1.50 for the 6th hot dog). This leads to a rightward shift in her willingness to pay curve.

to maintaining their households. Many of the most successful product innovations in recent decades have capitalized on our growing willingness to pay to save time; these include electric toothbrushes and dishwashers; fast-food and pharmacy drive-throughs; iPhones; individually packaged cookies and chips; and Jiffy Lube no-wait car maintenance. Taking advantage of this trend, some doctors have even introduced "concierge" medicine where, for a few thousand dollars a year, patients are seen immediately without having to wait or schedule an appointment months in advance.

In conclusion, then, a person's willingness to pay for a good will increase when the transaction costs of making the purchase fall. This means that more of the good will be purchased at any given price.

6.2 Deriving a Person's Demand Curve

Our analysis of willingness to pay tells us that a person will decide whether to buy a good and, if so, how much to buy based on a comparison between his reservation price and the good's price. This doesn't mean that everyone gets out their calculator or fires up a special "app" on their iPhones before buying lunch or chewing gum, but the idea is that we do, using some internal calculator, act *as if* we are comparing our willingness to pay to the prices we face. This comparison establishes a relationship between a person's reservation price and a good's price, as well as the **quantity** of the good that is **demanded**.

QUANTITY DEMANDED The number of units of a good that a person is willing and able to buy at a specific price.

EXAMPLE When the round-trip airfare from Los Angeles to Washington, D.C. is $350, you are willing to buy three round-trip tickets a year.

EXAMPLE When the price of gasoline is $3 a gallon, you are willing to fill up your tank (16 gallons) once a week.

Notice that quantity demanded is measured in *physical units*—that is, number of trips, gallons, and so on. The units that we use to measure quantity—for example, whether we count up one-way trips or round-trips demanded—will have an obvious impact on the number of units you demand. In the first example, you demanded three round-trip tickets a year, which is the equivalent of six one-way tickets when the round-trip airfare is $350.

We must also specify the time over which the quantity is demanded. Say that you purchase 4 pizzas a month when they cost $9 each. You are likely to purchase somewhere around 48 pizzas a *year* at the same price. This tells us that the quantity demanded of a good or service typically increases the longer the period in question.

Suppose we can collect information on the quantity of some good—say, gasoline—that you would demand at different prices. We assume that nothing else changes except for the good's price, so we can attribute any changes in your quantity demanded to price alone. We call this your **demand** for the good.

DEMAND Quantity demanded at *each and every* price, assuming that all else remains unchanged.

EXAMPLE When the round-trip airfare from Los Angeles to Washington, D.C. is $350, you are willing to buy three round-trip tickets a year. When the fare drops to $250, you are willing to buy five round-trip tickets. And when the fare is $450, you are willing to buy two round-trip tickets.

EXAMPLE When the price of gasoline is $3 a gallon, you use up one tank (16 gallons) of gas a week. When the price drops to $2 a gallon, you use up two tanks of gas a week. And when it rises to $5 a gallon, you use up only one tank of gas a month.

We can represent the demand for a good by creating a **demand schedule** that shows the quantity demanded at each and every price.

DEMAND SCHEDULE A table that shows the quantity demanded at each and every price.

Table 6.1 shows the number of courses that Janet, a college student, is willing to "buy" each semester. We see that as the price of a course drops, she will enroll in more classes each semester. Why does this make sense? Notice that Janet's willingness to pay for each additional course is falling; a direct result of our principle of diminishing marginal benefit. Therefore, the price of a course must also drop to entice Janet to take another class. If, instead, the price per course were to rise, say from $600 to $900, Janet will reduce the number of courses she takes each semester from four to three because her willingness to pay for the fourth course is less than $900.

Table 6.1 Janet's Demand Schedule for College Courses

Price per Course	Number of Courses Demanded per Semester
$1,500	1
1,200	2
900	3
600	4

We can graph Janet's demand schedule to arrive at her **demand curve**.

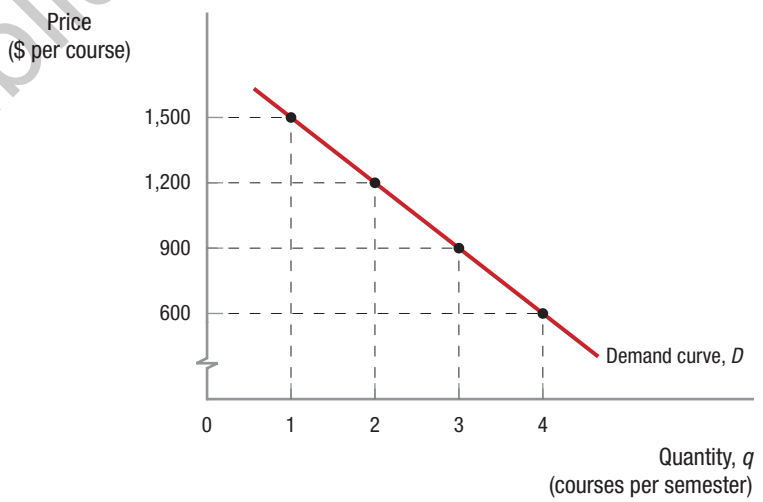
DEMAND CURVE A graphical representation of a demand schedule. The demand curve plots various price–quantity combinations that a buyer is willing to accept.

Figure 6.3 is a graphical depiction of the data in Table 6.1. By convention, the price per unit of the good is on the vertical axis, and the number of units, or quantity demanded (q) by a single consumer, is on the horizontal axis.

Even though this graph is called a demand "curve," it is often depicted as a straight line. The actual shape of a person's demand curve depends on how he responds to price changes in terms of changes in quantity demanded. Irrespective of its actual shape, a demand curve must always slope downward because, as we've already shown, a person's willingness to pay for each additional unit declines. So when the price of a good goes down, you are willing to buy more of it, and when its price goes up, you are willing to buy less of it, as long as nothing else changes.

LAW OF DEMAND The price of a good and the quantity demanded are inversely related. When price rises, the quantity demanded falls, and when price falls, the quantity demanded rises, assuming that nothing else has changed.

FIGURE 6.3 Demand Curve for College Courses



As the price per course drops, Janet will take more classes. The lower price "matches" her lower willingness to pay for additional classes.

The points shown in Figure 6.3 are the four price and quantity demanded pairs taken from Table 6.1. But, instead of just showing the demand relationship as these distinct points, we can connect the "dots." That is, we can introduce additional price and quantity demanded combinations so that the graph becomes increasingly smooth.

The demand curve reveals two very important pieces of information. If we pick a value for the quantity demanded, the *height* of the demand curve at this point represents Janet's willingness to pay for the very last, or marginal, unit demanded. For example, if we read *up* to the demand curve at three courses a semester, we see that Janet's willingness to pay for a third course is $900. We know this must be the case because she is willing to enroll in this third course at a price of $900.

If, instead, we read *over* to the demand curve from the vertical price axis at $900, we can read off the *total* quantity (three courses) that Janet demands at this price. In other words, Janet will enroll in courses up to the point where the price per class is just equal to her willingness to pay.

Movements along the Demand Curve

We have demonstrated that when the price of a course increases, Janet will enroll in fewer courses each semester. When the price goes down, she will enroll in a greater number of classes. Once again, this is because of the diminishing marginal benefit that Janet receives from each additional course. Janet's response to a change in price, assuming nothing else has changed, is to move up or down her demand curve. This is referred to as a **movement along her demand curve**.

MOVEMENT ALONG THE DEMAND CURVE Increase or decrease in quantity demanded when only the price of the good changes.

EXAMPLE While you typically download five songs a day to your MP3 player when the price per song is $2, you increase your number of downloads to eight a day when the price per download drops to $1. You have moved *down* your demand curve for downloaded music in response to the price change (assuming nothing else has changed).

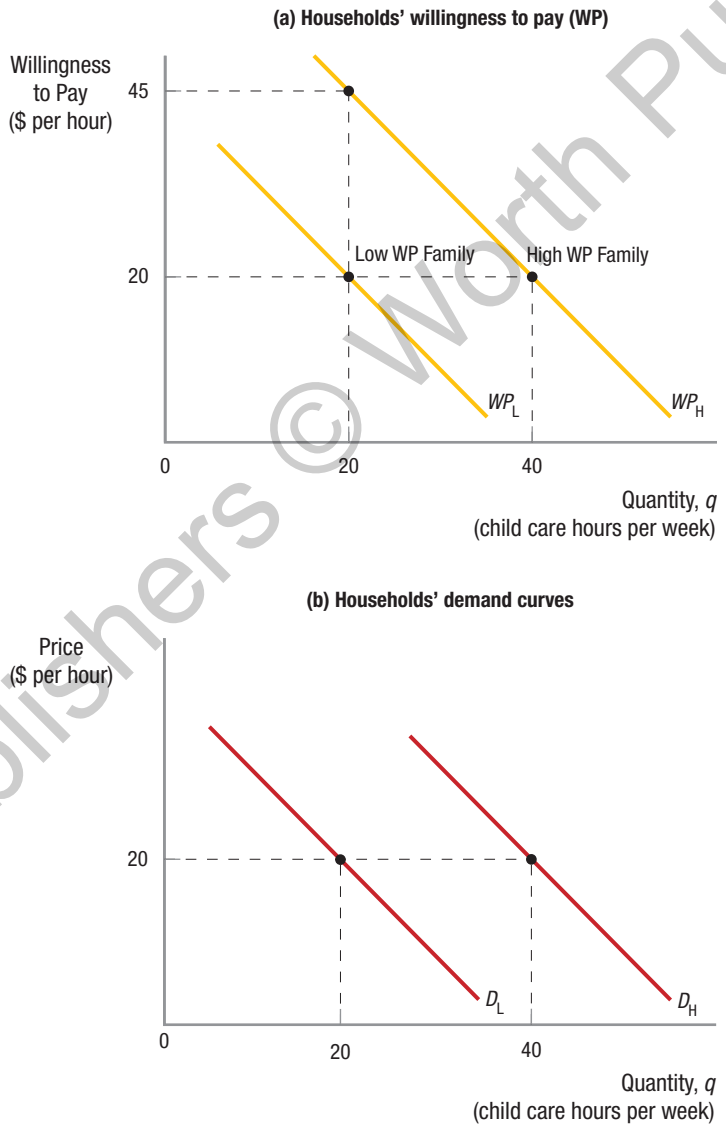
EXAMPLE When the price of pedicures is $13, your sister gets one every week. When the price increases to $18, she cuts back to one every other week. She has moved *up* her demand curve for pedicures in response to the price change (assuming nothing else has changed).

6.3 Movements along a Demand Curve versus Shifts in the Curve

We have already noted that even when people have the same income, they are unlikely to have the same willingness to pay for a particular good. This means that the demand curve for a specific good will likely differ across individuals. For example, when it comes to new cars, people who do not have a driver's license—perhaps due to a medical condition or age—have a reservation price of zero and will not purchase even one car no matter what the price. Another person with 17-year-old triplets in her household is likely to be willing to pay a substantial amount for one or more cars. Still others, such as people living in New York City, enjoy low-cost, convenient mass transit and will have a relatively low reservation price for a car. As these situations demonstrate, the willingness to pay for cars depends on many factors.

Suppose we compare the demand curves for weekly child care for a household where both adults work versus one in which only one adult works, assuming that the total household income is the same for both families. Arguably, a family's willingness to pay for each hour of child care is greater when both adults work. We can illustrate this in **Figure 6.4**. In panel (a), we show each family's willingness to pay each week for child care. Panel (b) translates these results into each family's demand curve for

FIGURE 6.4 Willingness to Pay and Two Households' Demand Curves for Child Care



Panel (a) shows that the willingness to pay for child care is higher for each and every hour for the two-earner household. This is represented by a willingness to pay curve that is "higher" than the curve for the one-earner household. This means that the quantity demanded at each and every price will be higher for the two-earner household than for the one-earner household: panel (b) illustrates this for a market price of $20 per hour.

weekly child care. A household with a greater willingness to pay for child care will have a demand curve that sits to the right of the demand curve of a household that has a lower willingness to pay. To verify this, recall that the vertical distance up to the demand curve at any given quantity level reflects the willingness to pay for the last unit consumed. In this case, if we look at 20 hours of child care a week, we see that the willingness to pay for the 20th hour is, in fact, higher for the demand curve to the right. And, because this is so, the demand curve on the right indicates that more child care will be purchased at each and every market price. For instance, if the price of child care is $20 per hour, Figure 6.4 shows that the household with the greater willingness to pay will demand 40 hours of child care per week, compared with 20 hours per week demanded by the household with the lower willingness to pay.

As you can see, these families differ in their willingness to pay even though their incomes are the same. The reason for this is that the opportunity cost of taking care of one's own children is higher for one family versus the other because in one case both adults work outside the home.

We can generalize this result: a demand curve that is to the right of another reflects a greater willingness to pay for each unit of the good in question. This means that if a person's willingness to pay for a good increases for some reason, her demand curve will shift to the right. At each and every price, a greater quantity is demanded. Conversely, if her willingness to pay for each unit declines, her demand curve will shift to the left. At every price, a smaller quantity is demanded.

A person's willingness to pay for a good can change for many reasons. For example, we have already discussed how increases in the opportunity cost of our time have increased our willingness to pay for convenience goods. This, then, leads to a rightward shift in the demand curve for these goods: *at each and every price*, a higher quantity is now demanded. We call this a **shift in the demand curve**.

SHIFT IN DEMAND CURVE A movement of the demand curve to the left or right. This movement reflects the change in quantity demanded at each and every price due to a change in something other than the good's price.

EXAMPLE When a city builds a conveniently accessible subway system, each commuter's demand curve for gasoline shifts to the left.

EXAMPLE After a heavy snow, people's demand curves for shovels and road salt shift to the right.

In our earlier example about Janet's demand for college courses each semester, we saw that a change in the price of a course led her to increase or decrease the number of courses she demanded. Why don't these price changes cause a shift in Janet's demand curve? No shift occurs because her willingness to pay for each course has not changed; *only the price has changed*. For a demand curve to shift, something *other than* the good's price must change; something that alters a buyer's willingness to pay for each unit of the good.

6.4 Why a Change in Income Shifts the Demand Curve

When income rises, it is likely to increase a person's willingness to pay for units of a particular good, such as vacations and dinners out. This then translates into rightward shift in the individual's demand curve for these goods. Why? First of all, we

know that your income ultimately determines your ability to pay, which is a necessary prerequisite for willingness to pay (recall that wishful thinking itself doesn't translate into willingness to pay). Second, as your income increases, you may be able to splurge on goods that you would otherwise be unable to afford. Conversely, if your income falls, you are likely to do without some goods as you "tighten your belt."

How exactly does a change in income affect your willingness to pay and corresponding demand curve? It depends on the kind of good we are talking about.

Normal versus Inferior Goods

Let's say that your income increases substantially. Instead of earning $16,000 a year working for a fast-food restaurant, you land a manager's job that pays $23,000 a year. If this happens, do you think you would continue to buy the very same things you did before? Would you continue to buy all of your clothes at a secondhand shop? Would you continue to wait until a movie comes out on DVD before you see it? Or would you start to shop at retail clothing stores and take in a few movies when they first open at the local movie theater? Economists have noticed that when people's incomes change—whether up or down—their buying habits also change. How these purchasing patterns change depends on each individual's preferences for specific goods. Some people may consider secondhand clothes to be the ultimate in chic, while others wouldn't be caught dead in recycled-clothing stores if they had the money to shop elsewhere.

As a general rule, when an increase in income leads to an increase in a person's willingness to pay for each unit of a good, we say that this is a **normal good**.

NORMAL GOOD A good that a person is willing to pay more for as her income increases and less for when her income declines.

EXAMPLE Most people treat eating out at a restaurant as a normal good.

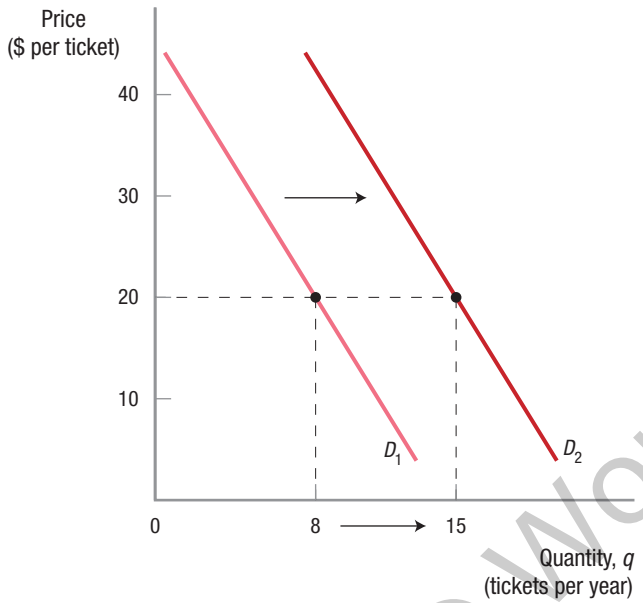
EXAMPLE Most couples treat children as a normal good.

EXAMPLE Most readers treat books as a normal good.

When we look at how a person's buying habits change in response to a change in income, we assume that nothing else has changed except for income. This means that there has not been a coinciding change in the individual's preferences, the alternatives that he faces, or the price of the good. This is important because it means that we can attribute any change in purchases that we observe *solely* to the person's change in income.

When it comes to normal goods, people are willing to pay more for each unit when their incomes rise and less when their incomes fall. We can show graphically the impact of a change in income on the demand curve for a normal good. A normal good's demand curve *shifts to the right* when a person's income increases. It *shifts to the left* when his income decreases. We can illustrate this effect in **Figure 6.5**, which shows Dan's demand for tickets to Boston Red Sox baseball games. At his initial level of income, say $10,000 a year, his demand curve for Red Sox tickets is D_1. At a price of $20, Dan is willing and able to buy a ticket to 8 games. If Dan's income were to increase to $15,000 a year, his demand curve for Red Sox tickets shifts right to D_2 assuming that Dan treats these tickets as a normal good. At a price of $20, Dan is now willing and able to buy a ticket to 15 games. Notice that

FIGURE 6.5 The Demand for a Normal Good Following an Increase in Income



When Dan's income increases, the quantity of Red Sox tickets demanded at each and every price also increases. This results in a rightward shift in his demand curve for tickets. Dan treats Red Sox tickets as a normal good.

Dan's willingness to pay for each and every ticket is now greater than it was before his income increased.

Not all goods are normal goods. In some cases, when income rises, a person's willingness to pay for each unit of a particular good falls. And conversely, when income drops, a person's willingness to pay for each unit rises. Whether this happens or not *depends solely on a person's preferences* about the good in question. When this does happen, we call this an **inferior good**.

INFERIOR GOOD A good that a person is willing to pay less for as her income increases, and more for when her income declines.

EXAMPLE Secondhand clothing and used cars are usually inferior goods.

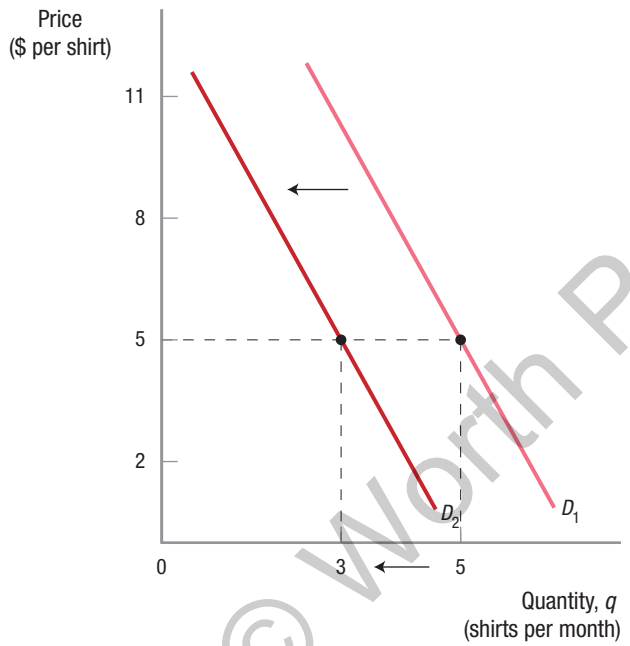
EXAMPLE Day-old bakery bread is typically an inferior good.

EXAMPLE "Staycations" (vacations spent at home) are usually inferior goods.

When someone treats a good as inferior, she purchases *less* of it at every price when her income rises and *more* of it when her income falls.

In **Figure 6.6**, we show the relationship between income and the demand curve for an inferior good, in this case, Pam's demand for secondhand clothing. At her initial level of income, Pam's demand curve for secondhand clothes is represented by the curve D_1. If the price of a secondhand shirt is \$5, Pam buys five shirts each month. Now suppose that Pam's income increases, and her demand curve for secondhand

FIGURE 6.6 The Demand for an Inferior Good Following an Increase in Income



When Pam's income increases, she prefers to shop for new, brand-name clothes and reduce her dependence on secondhand clothing. As a result, her demand curve for secondhand shirts shifts to the left. She treats these shirts as an inferior good.

shirts shifts leftward to D_2, which is a sign that she treats these shirts as an inferior good. We see that at the $5 price, the number of secondhand shirts that she is willing and able to buy drops to three. In fact, *at each and every price*, the quantity of secondhand shirts that Pam demands is lower than before her income increased. In other words, Pam's willingness to pay for each secondhand shirt is less than it was before her income increased.

As a rule, an inferior good's demand curve shifts to the *left* when a person's income increases. It shifts *right* when the person's income falls.

It is very important to understand that inferior goods are still economic "goods"—that is, they contribute positively to a person's sense of well-being. Also, the term "inferior" has nothing to do with the inherent quality or chemical composition of the good. It is simply an economic term used to describe a person's preferences about a good and indicate how changes in income will affect his demand for it. We often observe distinct differences around the world in what people perceive to be normal or inferior goods. For example, in some countries, processed baby formula is considered a normal good while breast milk is considered an inferior good. In the United States, the reverse is true for many mothers. Many people in the United States consider used cars to be inferior goods. In Mexico, used cars that are exported from the United States are considered normal goods.

People's perceptions about whether a good is inferior or not can change over time. For many years, most people considered purebred puppies to be normal goods. In contrast, older and mixed-breed dogs were considered to be inferior goods. As family

incomes grew, people sought out breeders of pricey purebred puppies rather than adopting dogs from the local pound. Over the past few decades, however, these perceptions have changed radically. In wealthy communities such as Aspen, Colorado, it has become an "in" thing to adopt animals rescued from the streets and local puppy mills. The ASPCA, local media outlets, and Animal Planet programs have all brought about this change in preferences by shining a spotlight on the benefits to be had from adopting rescued dogs. As a result, these dogs are now viewed by many as normal rather than inferior goods: families adopt more rescued dogs and puppies when their incomes increase.

In the retail sector, Walmart has embarked on an ambitious campaign to change people's perceptions that it carries "inferior" clothing and home decor. Concerned with the flight of higher-income shoppers to its primary competitor (Target), Walmart has revamped its product lines, store displays, and advertising to distance itself from its image as "cheap and low priced." The goal is for people to remain Walmart shoppers even when their incomes rise and they can shop elsewhere.

ECONOMIC FALLACY Although the price of gasoline declined after an unprecedented run-up to over $4 per gallon, this has not led to a resurgence in purchases of big SUVs. This means that consumers' preferences have changed, and smaller cars are now considered preferable to larger, gas-guzzlers.

False. Consumers have long memories. They recall what it was like to be "stuck" in a previous, costly decision to drive a large gas-guzzler when gasoline prices soared over $3 a gallon. The fact that there has been no movement back to these large cars with the fall in gasoline prices most probably indicates that people believe that gas prices will increase again in the near future. When gas prices spiked higher in the 1970s, people did not return to large cars until over a decade after gas prices once again subsided. After they did, however, they did so in a *big* way: this was the period when SUVs and minivans were first introduced into the market.

In the United States, many consumers treat name-brand detergents such as Tide and Cheer as normal goods. In contrast, "private-label" or store-brand detergents are viewed as inferior goods. The same is true for name-brand versus store-brand soda, chips, toilet paper, and ibuprofen. Generally speaking, when people's incomes rise, their purchases of name-brand products increase while their purchases of store brands decline. We see ample evidence of this buying pattern. Companies that produce name-brand consumer products—such as Procter and Gamble, Kellogg's, and Pepsi—experience higher sales volume when people's incomes are growing. In contrast, store-brand manufacturers do better when people's incomes are shrinking or stagnant. This is why the stock prices of many name-brand producers fall during economic recessions—when personal income is lagging—and rise during economic expansions.

Transitory versus Permanent Changes in Income

When a person views a change in income as **transitory** in nature, his demand curve for a good may respond differently than if the income change is expected to be permanent.

TRANSITORY INCOME Short-term or one-time increases or decreases in income.

EXAMPLE Wage bonuses, temporary job layoffs, one-time tax assessments or tax refunds, and lottery winnings are all transitory changes in income.

Often, transitory declines in income are offset by using savings or borrowing money, whereas transitory increases in income may be banked or used for one-time "splurges" such as a vacation. In such instances, the demand curve for a normal good might not shift at all despite the change in current income.

6.5 Why Changes in Property Rights Can Shift a Demand Curve

Just as changes in income affect a person's willingness to pay and his demand curve, changes in property rights can have a similar impact. Consider the following situation. When the Supreme Court ruled in 2005 that downloading music without permission violated publishers' copyright protections, there was an increase in many music listeners' willingness to pay for legal downloads. This meant that the demand curve for iTunes downloads, for example, shifted to the right—more downloads were demanded at each and every price because the free alternatives were now illegal.

In general, changes in property rights affect a person's willingness to pay for units of a good because they change the value of the benefits derived from the good. The value of legal iTunes downloads increased when the free alternative became illegal. In contrast, when the U.S. Supreme Court refused to hear an appeal of a lower court's ruling granting public access to California beaches,[2] the willingness to pay of home buyers for California beachfront homes declined. Beachfront home owners suffered a loss of privacy and exclusive use of the beach. As a result, the demand curve for California beachfront properties shifted to the left. Whenever property rights are redefined in a way that reduces the perceived value of the benefits derived from a good, the demand curve will shift to the left. Conversely, when a change in property rights increases a good's perceived benefits, the demand curve will shift to the right.

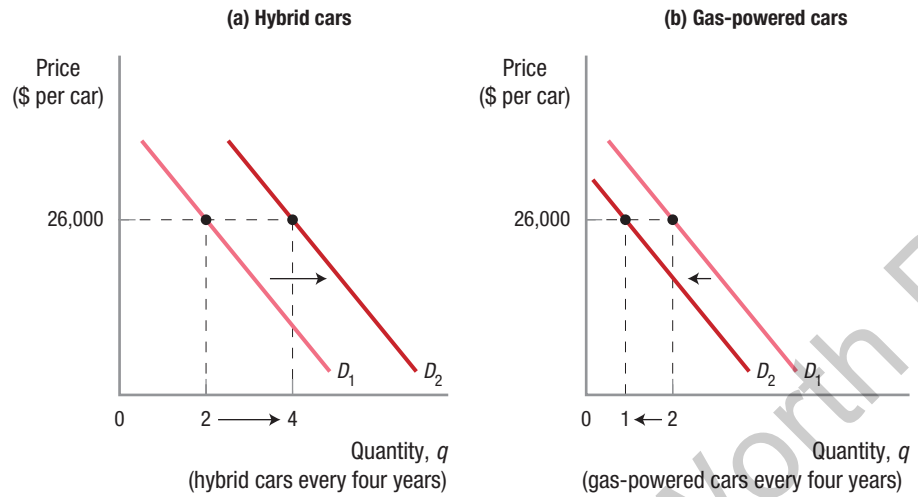
Often, a change in property rights will affect the demand curve for more than one good. For example, to reduce automobile emissions and encourage people to purchase fuel-efficient cars, the state of Virginia passed a law in 2000 that allowed single-occupant hybrid (gasoline-powered and electric-powered) vehicles to use the less-congested carpool (high-occupancy vehicle, HOV) highway lanes. California followed with similar legislation in 2004. As a result, the property rights associated with owning a hybrid became more valuable. Drivers gained an added benefit from driving a hybrid—the amount of time they now saved commuting on congested highways. This increased their willingness to pay for these types of cars. At the same time, the opportunity cost of driving traditional 100 percent gasoline-powered cars rose, thereby reducing people's willingness to pay for these types of cars.

We can illustrate how the change in property rights related to access to HOV lanes affected the demand for hybrids and 100 percent gasoline-powered cars. In panel (a) of **Figure 6.7**, we depict a California family's demand for hybrids before they could individually use HOV lanes. At some price, say $26,000, we show that the family is willing to buy two hybrid cars every four years. Panel (b) shows the demand for gasoline-powered cars during the same period. At the same ($26,000) price, the family is willing to also buy two gas-powered cars every four years.

Once individual drivers of hybrids are allowed in the HOV lanes, the willingness to pay for hybrids increases while, at the same time, the willingness to pay for gasoline-powered cars declines. This leads to a rightward shift in the demand curve

[2]Barbara Whitaker, "Ruling Clears Way to Ease Beach Access in California." *New York Times*, October 23, 2002.

FIGURE 6.7 The Effect of a Change in Property Rights: HOV Lanes and the Demand for Hybrid versus Gas-Powered Cars



States that allow individual drivers of hybrids to use the HOV lanes have increased the benefits of owning these vehicles by reducing drivers' commuting times. As a result, the demand curve for hybrids shifts to the right—more are demanded at each and every price. At the same time, the demand curve for gas-powered cars shifts to the left—fewer are demanded at each and every price—because the opportunity cost of driving these cars has risen.

for hybrids and a shift to the left in the demand curve for gasoline-powered cars. Now, the number of hybrids the family is willing to purchase at the $26,000 price increases to four, while the number of gasoline-powered cars purchased at the same price drops to one. In other words, the family's willingness to pay for each and every gasoline-powered car falls while, at the same time, its willingness to pay for hybrids rises. This example illustrates that changes in property rights can change people's perceptions about the value, or net benefit, of purchasing a good.

Ironically, Virginia's program to stimulate hybrid-car purchases by giving individual drivers access to HOV lanes has resulted in traffic congestion in HOV lanes that is now just as great as in the non-HOV lanes. The same is beginning to prove true in California. As a result, both states are now grappling with ways to ration HOV permits for hybrid vehicles. To the extent that this benefit is curtailed, so too will be the demand for hybrids.

6.6 Why the Price of a Substitute Good Can Shift a Demand Curve

Two goods are said to be substitutes if a buyer perceives that they approximate each other in terms of use and economic benefit. For example, you may treat coffee from Dunkin' Donuts as a good substitute for Starbucks coffee. Close substitutes are viewed as stand-ins for each other when it comes to the choices people make. When two goods are close substitutes, small changes in the price of one can have a substantial impact on demand for the other. Whether a good is a close substitute for another depends solely on an individual's preferences. Some people would never drink Pepsi instead of Coke, whereas others are relatively indifferent between the two cola drinks.

In economics, we define substitute goods in a specific way: two goods are said to be **substitutes** if an increase in the price of one of them (say, Dunkin' Donuts coffee) results in rightward shift in the demand curve of the other (Starbucks coffee). That is, more of one good (Starbucks) is demanded at each and every price when the price of the substitute (Dunkin' Donuts) increases. Conversely, if two goods are substitutes, a decrease in the price of one (Dunkin' Donuts coffee) reduces demand for the other (Starbucks coffee) *at each and every price*, resulting in leftward shift in its demand curve.

SUBSTITUTE GOODS Goods that are related in such a way that an increase in the price of one increases demand for the other; conversely, a decrease in the price of one decreases demand for the other.

EXAMPLE When tuition at the nearby private university rises, some students substitute toward the local public university. This results in a shift to the right in their demand curves for public-university courses.

EXAMPLE When the price of Nike athletic shoes drops, some people substitute Nike shoes for Reeboks. This results in a shift to the left in their demand curves for Reeboks.

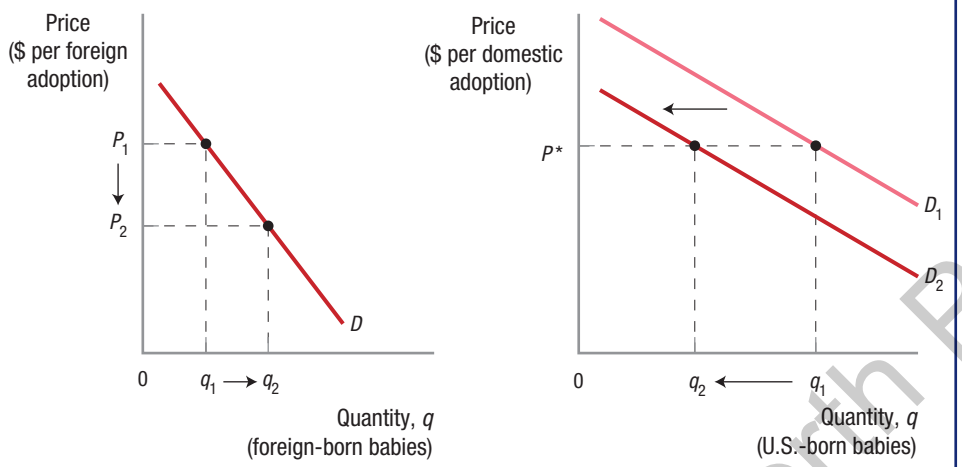
What we are saying is that a student's willingness to pay for each class at the public university increases when the tuition at the private university rises. This happens because the *net* benefit she gets from each private-university course falls due to the price increase. At the same time, the net benefit she gets from each public-university course rises because its opportunity cost (in terms of alternatives forgone) has fallen. This is the case even though the public university's tuition rates *have not changed.*

One way we can assess the degree of substitutability between two goods is by observing the amount by which one good's price must increase before people begin to switch from that good to another. For example, it may take a very dramatic increase in the price of gasoline for people to switch from driving their own cars to using mass transit. This would lead us to predict that gasoline and mass transit are "weaker" substitutes for one another than, for instance, fuel-efficient cars versus gas-guzzling SUVs.[3]

To see the impact that the price of a substitute can have on another good's demand curve, consider the following situation. The price of adopting babies born in Russia and Romania fell with the demise of the Soviet Union in 1991. As the price of adopting foreign babies fell, U.S. couples moved *down* their demand curve for these children, as illustrated in panel (a) of **Figure 6.8**. That is, the decline in price led to an increase in the quantity of babies demanded from Russia and Romania. Meanwhile, the cost of adopting children born in the United States remained unchanged. This meant that the price of adopting a child from the United States rose *relative to the price* of adopting from Russia or Romania. For those adoptive parents who viewed U.S.-born and Russian-born children as close substitutes, the fall in price for foreign-born babies resulted in a leftward shift in the demand curve for U.S.-born babies, as shown in panel (b). The quantity of U.S.-born babies demanded at each and every price declined because a close substitute had become relatively less expensive.

[3]"One-Third of Consumers Looking at More Fuel-Efficient Cars." www.consumeraffairs.com. May 24, 2006; John Machacek, "Demand for Fuel-Efficient Cars Puts Pressure on Congress." *USA Today,* July 9, 2006.

FIGURE 6.8 Effects of a Decrease in a Substitute Good's Price



When the price of adopting foreign babies falls, people move down their demand curves for these babies—more are demanded at the lower price. At the same time, the demand curve for U.S.-born babies shifts to the left—fewer are demanded at each and every price because their opportunity cost has risen.

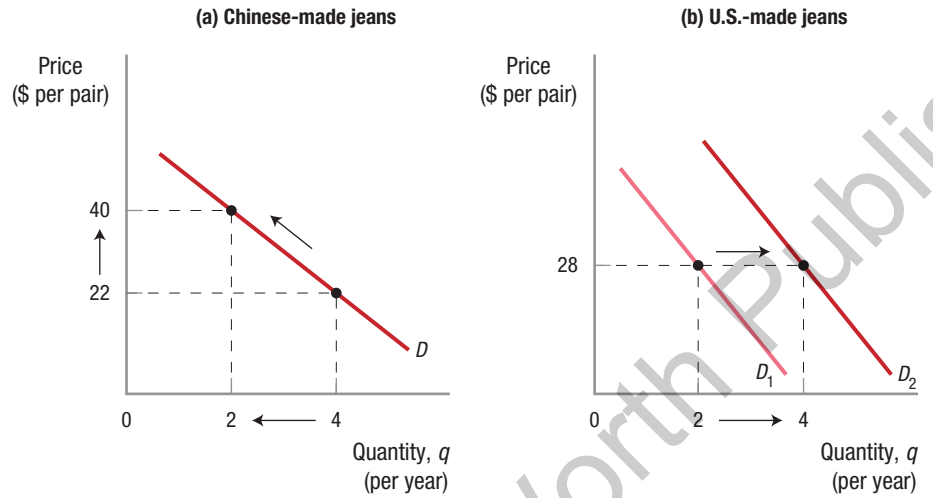
We often hear about the impact that a change in one good's price has on the demand for a substitute when government trade policies are discussed. You might hear arguments that "cheap" imported goods threaten jobs in U.S. industries. Political pressure inevitably arises to enact protectionist trade policies that will increase the price of imports in the United States. This will reduce the quantity of imports demanded by U.S. consumers and result in a rightward shift in demand for U.S.-made products.

Suppose, for example, that at a price of $28, you are willing and able to buy two pairs of jeans each year that are made in the United States. This is depicted in panel (b) of **Figure 6.9**, which shows your demand curve for U.S.-manufactured jeans. You are also willing and able to purchase four pairs of jeans made in China, which are selling for $22, as illustrated in panel (a).

If U.S.-made and foreign-made jeans are reasonably close substitutes, then a change in the price of foreign-made jeans will affect your demand for jeans manufactured in the United States, and vice versa. What if the U.S. government wants to stimulate purchases of U.S.-made clothing? One way to do this is to enact trade policies that cause the price of foreign-made jeans to rise to $40. This price change decreases the quantity of foreign-made jeans you demand, so you will move *up* your demand curve for foreign-made jeans, as indicated in panel (a). But because U.S.-made jeans are a close substitute, this price increase will cause the demand curve for U.S.-made jeans to shift to the right. Your willingness to pay for each pair of U.S.-made jeans increases because the opportunity to purchase foreign-made jeans has become more expensive. With the price of U.S.-made jeans unchanged at $28, the quantity demanded at this price will increase.

A common way for the federal government to increase the price of foreign-made jeans or other imported goods is to impose a tax (called a *tariff*) on these imports. At one time or another, tariffs have been imposed on steel and automobile imports, as well as on toys and imported clothing. American manufacturers and their workers benefit

FIGURE 6.9 Effects of Imposing a Tariff on Chinese-Made Jeans



The imposition of a tariff on Chinese-made jeans increases their price, which causes a buyer to move up his demand curve for these jeans. At the same time, the person's demand curve for U.S.-made jeans shifts to the right—at each and every price, a greater quantity will be demanded. This occurs because the opportunity cost of purchasing U.S.-made jeans has fallen, and these are considered to be close substitutes for the Chinese-made jeans.

at the expense of foreign producers and workers. At the same time, American consumers "lose" because a lower-priced alternative has disappeared. They will now have to spend more of their income on jeans, cars, toys, and so on than before the tariffs were imposed. In effect, tariffs reduce the purchasing power of American consumers.

Producers may also substitute one input for another when an input price changes. Consider the local grocery store that pays a full-time checker $20 an hour, including any payroll taxes for which the employer is responsible. How will the store owner respond if there is an increase in the price of labor due, perhaps, to a new federal law that requires employers to pay an additional 9 percent of wages to fund a public health-insurance program? The store owner's new price of labor will be $21.80, including this new tax. How will she respond in terms of the number of work hours she demands from her employees? The increase in the price of labor causes the store owner to move up her demand curve for labor, leading to a reduction in the quantity of labor demanded. This would translate into shorter workdays or layoffs. At the same time, what if there is a substitute available for the grocery checkers?

During the past few decades, self-checkout scanning technology has become readily available to grocery stores and other retail outlets. Reacting to the increasing price of labor, many grocery store owners have increased their purchases of self-checkout scanners. That is, each store owner's demand curve for self-checkout scanners has shifted to the right. In fact, according to the Food Marketing Institute, nearly half of U.S. supermarkets offered a self-checkout option in 2005, compared with only 6 percent in 1999.[4] In other words, grocery-store owners have substituted away from

[4]Doug Desjardins, "Shoppers Tapping into High Tech." *DSN Retailing Today*, January 10, 2005.

checkout workers and toward scanners in response to upward pressures on the price of labor.

A similar response to wage pressures occurred in the fast-food industry during the 1990s, when a booming economy put upward pressure on the wages of unskilled workers. Many fast-food chains turned to self-serve soda machines and automatic fryers to reduce the quantity of labor demanded. In other words, they moved up their demand curve for labor while their demand curve for new types of labor-saving equipment shifted to the right.

6.7 Why the Price of a Complementary Good Can Shift a Demand Curve

Some goods are not treated as substitutes for each other but, rather, as **complements**. By this we mean that the goods tend to "go together" when they are consumed. Obvious examples include hot dog buns and hot dogs, or shoe laces and shoes.

COMPLEMENTARY GOODS Goods that are usually consumed with one another.

EXAMPLE Cell phones and call minute plans are complementary goods.

EXAMPLE iPods and iTunes are complementary goods.

EXAMPLE Chips and dip are complementary goods.

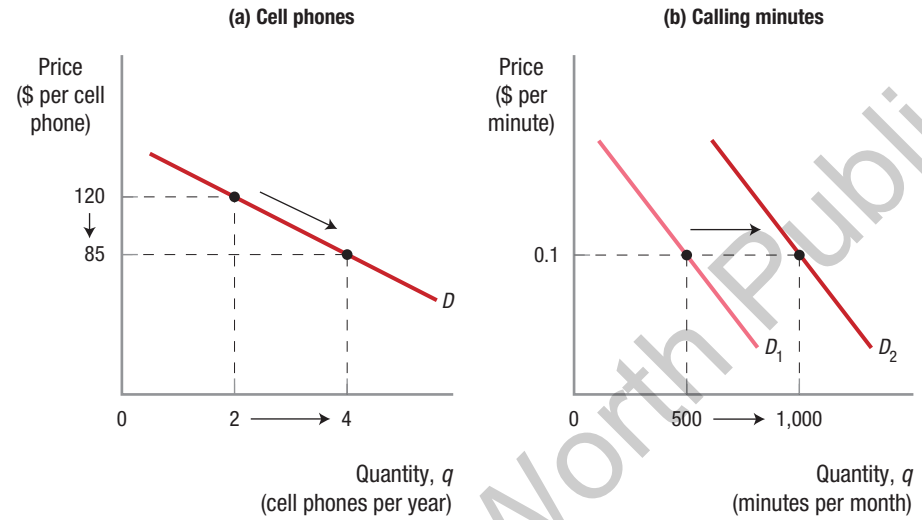
What happens to a good's demand curve if the price of a complementary good changes? For example, how would a family's demand curve for calling minutes change if the price of cell phones dropped?

Figures 6.10 shows a family's demand curve for cell phones and its demand curve for calling minutes. At an initial price of $120 per phone, the quantity of phones demanded is two per year as depicted in panel (a). When the price of phones drops, say to $85, the quantity of cell phones demanded increases, from two to four per year. In other words, the family moves *down* its demand curve for cell phones. But notice what happens to the demand curve for calling minutes. Because cell phones and calling minutes are complements, the decline in the price of cell phones causes the family's demand curve for calling minutes to shift to the right, as shown in panel (b). At a price of ten cents per minute, the family is now willing to purchase 1,000 minutes per month instead of 500 minutes.

The fact that cell phones have become cheaper means that the family is now willing to give additional members of the family a cell phone, which leads them to increase their call minutes plan. This complementarity between phones and minutes goes a long way toward explaining why wireless services such as AT&T and Sprint benefit when they align themselves with low-cost cell-phone manufacturers. In fact, we often find wireless providers heavily subsidizing the purchase of cell phones to encourage people to switch to their calling plans. For example, Verizon recently offered free Blackberry Storms—retailing at $499.99—to new calling-plan subscribers.

This finding also explains why cell-phone makers are actively involved in political initiatives to reduce or eliminate taxes and other government fees that have been imposed on wireless-service providers. As a seller, it can sometimes be more "politically correct" to lobby for favorable tax and regulatory treatment of a complementary good than for your own good.

FIGURE 6.10 Effects of a Decrease in the Price of a Complementary Good: Cell Phones and Calling Minutes



When the price of cell phones falls, a family will move down its demand curve for these phones and demand a greater quantity at the lower price. As a result, the family's demand curve for calling minutes will shift to the right—at each and every price, they will demand more minutes.

Our example of cell phones and cell minutes suggests that goods that are strongly complementary may be sold together. We call this "bundling." There are many examples of bundling, such as motherboards and disk drives (but not always monitors), cell phones and charger cords, and picture frames and glass. Because both goods are usually required if either is to be used, bundling them together serves as a convenience to buyers. For many years, Microsoft bundled its spreadsheet and word-processing software with its Windows operating system and distributed the bundle to computer manufacturers to install before selling the computers. This practice ended when the federal government sued Microsoft, arguing that this bundling had only one objective—to monopolize the market for computer software. Today, most PC buyers get a computer with the Windows operating system already installed, but must elect—often at an additional cost—to have the suite of Microsoft software also installed.

An intriguing economic question is why some complementary goods are bundled together all the time, others bundled some of the time, and still others never bundled together. Men's suits, which bundle a jacket and pants, are popular retail offerings. In contrast, "separates" tend to dominate women's clothing lines. Men's pants rarely come with belts, while women's pants often do.

One possible explanation for the observed increase in demand for bundled goods is that the opportunity cost of our time has increased. As a result, the cost of the time required to purchase complementary goods separately has also risen, leading to a higher willingness to pay for bundled goods. Today's grocery shelves are full of these goods, including packaged crackers and cheese, premade sandwiches and salads,

Table 6.2 A Review: Factors That Can Shift a Person's Demand Curve

▶ A person's demand curve shifts to the right when:
1. His preferences change, thereby increasing the net benefit derived from the good.
2. The price of a complementary good decreases.
3. The price of a substitute good increases.
4. For normal goods, his income increases.
5. For inferior goods, his income decreases.
6. Property rights change and increase the net benefit of the good.
◀ A person's demand curve shifts to the left when:
1. His preferences change, thereby reducing the net benefit derived from the good.
2. The price of a complementary good increases.
3. The price of a substitute good decreases.
4. For normal goods, his income decreases.
5. For inferior goods, his income increases
6. Property rights change and reduce the net benefit of the good.

and new versions of the original bundled meal—frozen TV dinners. At the same time, other bundled goods such as laundry detergent with fabric softener, and peanut butter and jelly blended in one jar have not fared as well. For bundled goods to succeed in the marketplace, consumers must derive a net benefit from the bundling. This in turn depends on whether the value of the benefit gained from the bundling outweighs the higher price that is usually paid for the bundled good relative to the sum of the prices of the unbundled goods.

We've discussed many factors that can shift a person's demand curve. **Table 6.2** summarizes them.

6.8 From Individual to Market Demand Curves

So far, we have talked exclusively about a single consumer's demand curve for various goods. But most economic discussions focus on the total demand that groups of buyers have for a particular good and how this demand responds to some change in the economic environment. It is not uncommon to hear analysts asking such questions as:

- How have unit sales of SUVs fared in Minneapolis since gasoline prices started to rise in 2008?
- How many units of single-family houses have been purchased in Phoenix, Arizona, since the beginning of the 2007 Great Recession?
- What has happened to unit sales of laptops since the introduction of the iPad tablet?

It is quite straightforward—both conceptually and computationally—to "add together" individual demand schedules to arrive at a group demand schedule that shows the total quantity demanded at each and every price. In a similar way, we can add together individual demand curves to get a total demand curve for the group.

Table 6.3 The Demand Schedule for College Credit Hours

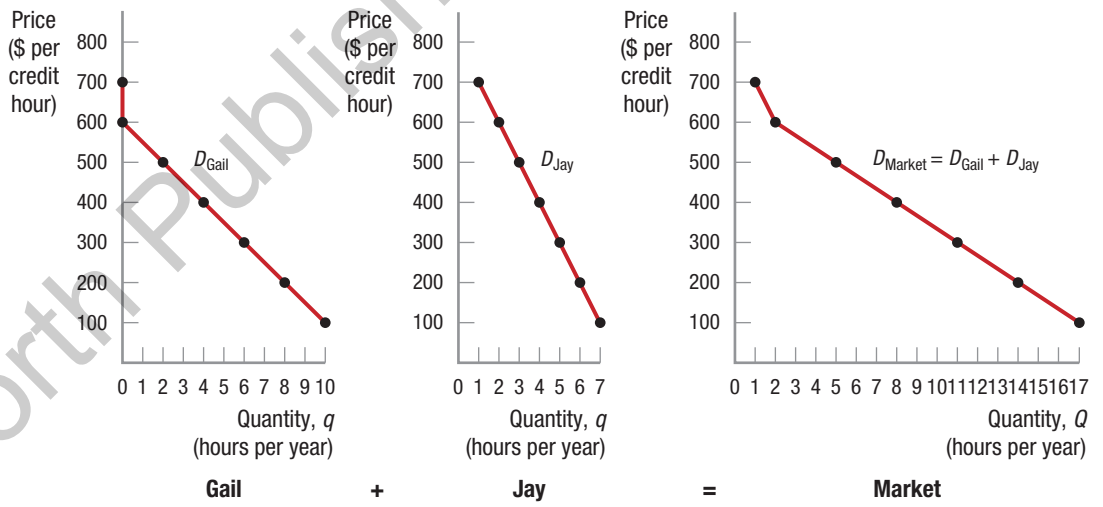
Price per Credit Hour	$100	$200	$300	$400	$500	$600	$700
Number of credits demanded per year by Gail (q_1)	10	8	6	4	2	0	0
Number of credits demanded per year by Jay (q_2)	7	6	5	4	3	2	1
Total credits (Q) demanded per year by both Gail and Jay	17	14	11	8	5	2	1

We illustrate this approach with a simple example: consider a world in which there are only two college students, Gail and Jay. Now suppose each has the demand schedule for college credits reported in **Table 6.3**.

To calculate the total quantity demanded for college credits at each price, we *add* together the quantity demanded by each student at that price. Graphically, this translates into a *horizontal* summation of the two demand curves, as illustrated in **Figure 6.11**. Notice that because we are now talking about the quantity demanded by more than one person, we use the capital letter Q to represent quantity demanded, where Q equals the sum of q_1 and q_2 at each price.

One of the things we know right away about this total demand curve is that it must be downward sloping because each of the individual demand curves that we "summed over" is downward sloping.

FIGURE 6.11 Deriving the Market Demand Curve for Credit Hours



To find the market demand for credit hours, we add together the quantity demanded by Gail and Jay at each price. For example, at $600 per credit hour, the total number of credit hours demanded equals 0 + 2 = 2 credit hours. We repeat this calculation for each and every price per credit hour to get the market demand curve. This process is sometimes referred to as a *horizontal* summation of the two demand curves.

Obviously there are more students who demand college credits in the real world than just Gail and Jay. To find the total demand for college credits when there are more than two students, we follow the same approach. By adding up the quantity demanded by each student at each price, we end up with a demand schedule and demand curve for the total credit hours demanded by all of these students at each and every price.

Market Demand

Suppose we want to shed some light on the question of how the total demand for single-family houses in Phoenix has changed since the beginning of the 2007 Great Recession. To address this question, we have to know something about the total demand for single-family houses in Phoenix before and after the recession began. Based on our previous discussion, we could simply add up the demand of all potential buyers of Phoenix single-family houses, both before and after the recession began. Notice that we have not added in the demand for single-family houses in Tucson or Boston. Neither have we added in the demand for condominiums or horse ranches in Phoenix. We have not done so because we are solely interested in how total demand *for single-family houses in Phoenix* has changed over time.

Generally speaking, economists are interested in looking at the total demand of consumers who are purchasing the same good in the same market. By **market**, we mean a physical or virtual place such as eBay where buyers and sellers meet to voluntarily exchange goods and services.

MARKET A place or circumstance in which buyers and sellers meet, either directly or through representatives, to voluntarily exchange goods and services.

EXAMPLE The New York Stock Exchange (NYSE) is located in New York City. It is filled with traders who "match" buyers and sellers of shares of stock in companies listed on the exchange.

EXAMPLE Amazon.com is an international virtual Web site that brings together buyers and sellers of a diverse array of goods, including books, music, shoes, and movies.

EXAMPLE Most cities have weekly farmers' markets, where local farmers sell their produce to local residents.

For any given good and any given market—such as single-family houses in Phoenix—we can derive the total quantity demanded at each and every price by adding together the individual demand schedules of buyers in the market. From this market schedule, we can derive a **market demand curve**.

MARKET DEMAND CURVE A graphical representation of the relationship between a good's price and the total quantity demanded in the market, at each and every price.

EXAMPLE At a price of $4 per gallon, 1 million gallons of gasoline are demanded each week in the greater Los Angeles area.

EXAMPLE Two million cans of Coke are demanded nationwide each month when the price is $1 per can.

In many instances, calculating market demand is much harder than it sounds. It isn't always easy to know which individual demand schedules should be added together to create the market demand schedule and corresponding demand curve. Can one person's demand for chunky peanut butter be added to another's demand for reduced-fat peanut butter? Is there, in fact, a single market demand curve for peanut butter, or are there separate demand curves for different types of peanut butter?

Some of us who buy hot, delivered pizzas are sensitive to a change in the price of frozen, premium pizzas—we tend to buy a lot fewer delivered pizzas when the price of the premium frozen pizzas drops. Does this mean there is only one pizza market, or are there several distinct pizza markets—frozen, delivered, handmade, and so on—each with its own market demand schedule? You may think that this distinction is simply academic. If so, you might be surprised to learn that the question of how to define the pizza market was *the* central issue in a Wisconsin court case. The judge was asked to rule on whether a proposed merger between a boxed-pizza manufacturer and a frozen-pizza producer would reduce competition in "the" pizza market.

Our pizza example highlights that the *degree of substitutability* between goods can be an important factor in determining which goods actually "belong" in the same market. We can ask the same question about brand-name sneakers. Do consumers consider Nike and Reebok shoes to be pretty much the same good—brand-name athletic shoes—such that each individual's demand for Nike *and* Reebok shoes can be added together to obtain the market demand for brand-name athletic shoes?

Another complication that can arise in estimating the market demand for a good is that the market may be geographically defined. We know, for example, that people who work in New York City are much more likely to demand housing in New York, New Jersey, and Connecticut than in Phoenix (except perhaps for the snowbirds). People living in Missouri will demand gasoline that can be purchased in Missouri (and possibly Illinois and Kansas) but not in California. In other words, *where* a good is purchased can be an important factor when it comes to deriving the market demand for a good. This is particularly true when the good is costly to transport. This goes a long way toward explaining why international Internet retailers such as eBay predominantly trade goods with low shipping costs—DVDs, jewelry, and SIM cards—while more localized trading sites such as Craigslist specialize in heavier items—furniture, large fish tanks, and cars—that are costly to transport long distances. While eBay faces an international market demand curve encompassing individual demand schedules from around the world, the market demand curve for Craigslist tends to primarily reflect the demand schedules of local residents.

With all of these issues in mind, we must assume that we can accurately define a market and identify those individual demand schedules that contribute to this market's total demand schedule. One thing we do know is that the "adding up" process used to compute market demand ensures that the quantity demanded at each price

will increase when we add more individual demand schedules. So, the corresponding market demand curve must shift to the right when additional buyers "enter" the market. More units of the good are now demanded at each price. Conversely, when the number of buyers in the market declines, the market demand curve will shift to the left.

Consider what happened when the federal government introduced college grant and loan programs. Because of these programs, more people were able to attend college. Adding the demand schedules of these new students to the preexisting market demand led to an increase in the total quantity of courses demanded at every price. Graphically speaking, there were new individual demand curves to add to the preexisting market demand curve. The end result was that the market demand curve for college credits shifted to the right.

Another example of how adding new buyers shifts the market demand curve to the right relates to recent regulatory changes in Mexico that now allow older U.S. cars to be imported into Mexico. Adding in the individual demand schedules of Mexican buyers shifts the market demand curve for older U.S. cars to the right. More generally, whenever international markets are "opened" by free-trade agreements that eliminate barriers to trade, the market demand curve for exported goods shifts to the right. American farmers experienced a substantial increase in market demand for their products when NAFTA (the North American Free Trade Agreement) was introduced in 1992. At the same time, however, the market demand curve for industrial parts manufactured in the United States shifted to the left, with buyers instead taking advantage of lower-priced industrial parts made in Mexico.[5]

Factors That Shift the Market Demand Curve

As you can probably guess, market demand curves shift *in the same direction* as their underlying individual demand curves. In other words, market demand curves are affected by the same factors that shift individual demand curves. Recall that these include changes in income, in the price of a substitute or complementary good, in preferences, and in property rights. To understand why this is the case, remember that the market demand curve is simply the sum of the underlying individual demand curves. So if individual demand curves shift to the right, for whatever reason, then the market demand curve must also shift to the right (a greater quantity of the good will be demanded at each and every price). Even if only one person's demand curve shifts due to a change in the economic environment, the market demand curve must also shift in the same direction. However, this shift is likely to be imperceptible because each individual is only one of numerous buyers who contribute to market demand.

Short-Run versus Long-Run Changes in Individual and Market Demand Curves

It is important to realize that it may take some time for people to alter their purchasing habits in response to changes in the economic environment. Therefore, individual and market movements along the demand curve, as well as shifts in individual

[5]Elizabeth Becker, et al., "Free Trade at Age 10: The Growing Pains Are Clear." *New York Times*, December 27, 2003.

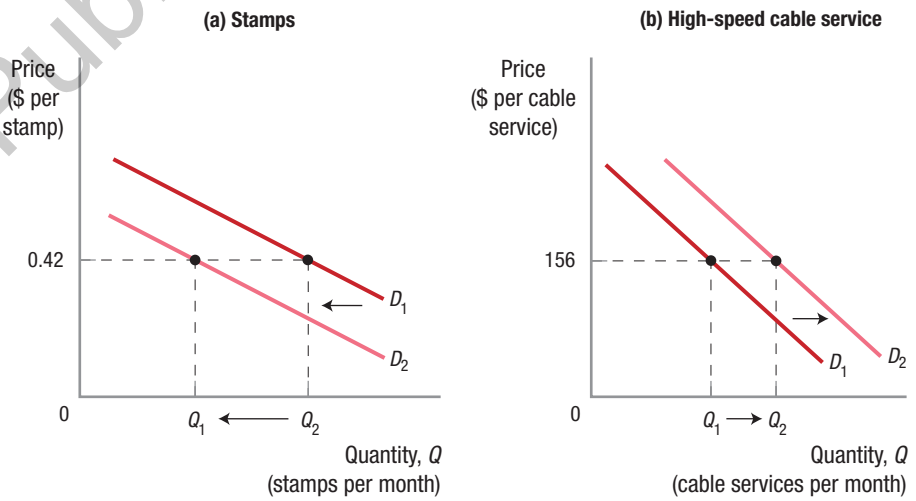
and market demand curves, may not be instantaneous. Consider what happens when the price of gasoline rises. In the short run, a person might not be able to reduce his gas consumption and move up his demand curve for gasoline because he is limited by where he lives and works, and the type of car he owns. In the long run, however, he can relocate, change jobs, or trade in his car, thereby moving up his demand curve for gas and buying less of it at the higher price. In a similar fashion, if one of the workers in a two-income household loses his job, it may take time for the household to actually reduce its demand for child care. If the family has entered into a 12-month contract with its child-care provider, then the family's demand curve cannot actually shift during the period of the contract. Only in the long run, when the contract expires, is the household able to act upon its new circumstances and purchase less child care at each and every price, which results in a leftward shift in its demand curve for child care.

This means that individuals and, consequently, the market, may be adjusting to a change in the economic environment over an extended period of time. For example, government policies that lower mortgage rates may not translate into a higher demand for new homes and an increase in building permits for months or even years into the future. Compare this to government food subsidies for low-income pregnant women, which tend to stimulate an immediate increase in the quantity of food demanded at each and every price.

SOLVED PROBLEM

Q Using market demand curves, show the impact of e-mail and instant messaging on (1) the high-speed cable services market, and (2) the postage-stamp market.

A E-mail and instant messaging are substitutes for mailed letters. Therefore, the introduction of electronic communications has resulted in a shift to the left in the market demand curve for "snail mail" (and, hence, postage stamps), as illustrated in panel (a) below. In contrast, e-mail and instant messaging have led to a rightward shift in the market demand for complementary goods, in this case, high-speed cable access to the Internet, as illustrated in panel (b). At each and every price, more cable services will be demanded.



6.9 Summarizing the Factors That Shift Demand

We have identified several factors that lead to shifts in the individual and market demand curves for a good. To reiterate, one of these factors is *not* a change in the price of the good itself: a change in the price of a good moves you along (up or down) the good's demand curve, changing the quantity demanded. What causes the demand curve to shift? **Table 6.4** summarizes the factors that lead to a shift in an individual's demand curve and the corresponding market demand curve.

ECONOMIC FALLACY The price of housing rose rapidly until recently and with it, the number of housing units purchased. This shows that demand curves can slope upward.

False. In the past decade, falling interest rates gave more people the ability to pay for housing through low-interest mortgages. Also, the number of people willing and able to pay for more expensive housing increased due to the baby boomers coming into their peak earning years, as well as an influx of wealthier immigrants. Both of these factors caused the market demand curve for housing to *shift* to the right—not slope upward.

Table 6.4 Factors That Lead to a Shift in the Market Demand Curve

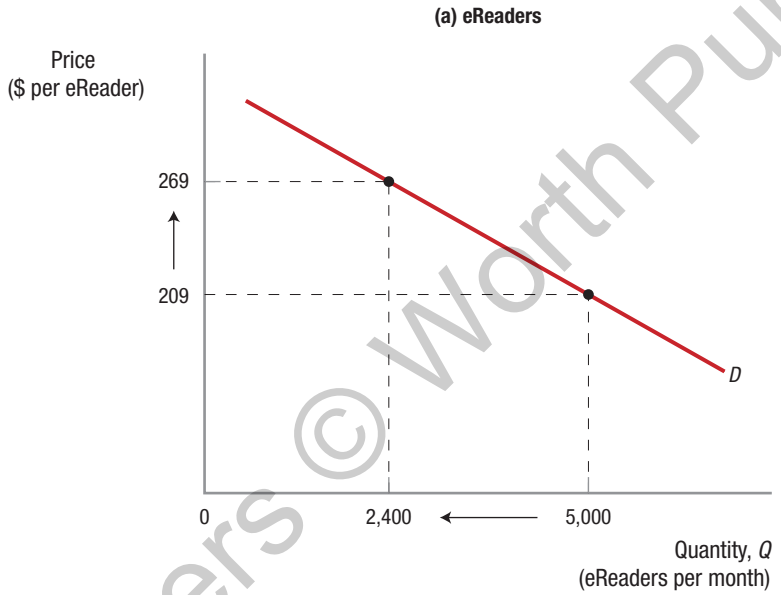
Income changes
▶ to the right if the good is normal, and incomes increase;
◀ to the left if the good is normal, and incomes decrease;
▶ to the right if the good is inferior, and incomes decrease;
◀ to the left if the good is inferior, and incomes increase.
Preferences change
▶ to the right if the good becomes more valued;
◀ to the left if the good becomes less valued.
Price of a complementary good changes
▶ to the right if a complementary good's price decreases;
◀ to the left if a complementary good's price increases.
Price of a substitute good changes
▶ to the right if a substitute good's price increases;
◀ to the left if a substitute good's price decreases.
Change in Property rights
▶ to the right if the change increases the value of the good;
◀ to the left if the change decreases the value of the good.
Number of buyers changes
▶ to the right when the number of buyers increases;
◀ to the left when the number of buyers decreases.

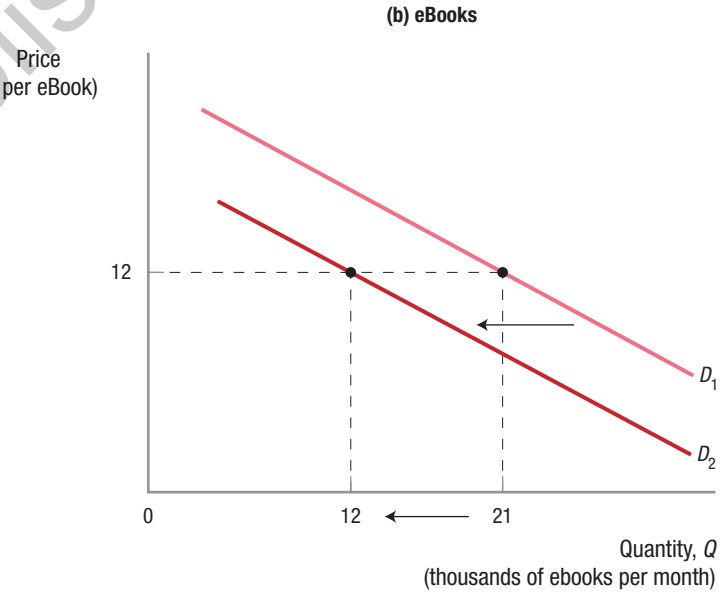
SOLVED PROBLEM

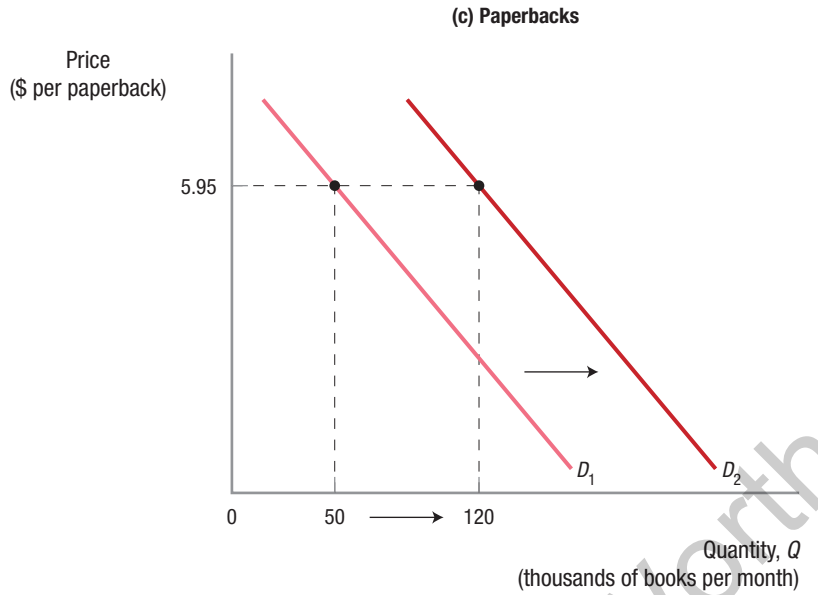
Q Suppose that due to a parts shortage, there is a run-up in the price of eReaders (electronic-book readers). Using a separate market demand curve for each good, show

the impact of this price increase on (1) the demand for eReaders, (2) the demand for electronic books (e-books), and (3) the demand for paperback books.

A As the following figure shows, buyers will move up their demand curves for eReaders: the quantity demanded at the higher price will be less than before the price increase. And, because e-books are complements to eReaders, the market demand for these e-books will shift to the left—fewer e-books will be demanded *at each and every price*. Finally, because paperback books are substitutes for e-books and eReaders, the market demand for them will shift to the right—more paperback books will be demanded *at each and every price*.







6.10 Derived Demand

Suppliers usually use inputs in their production process. For instance, carpenters require nail guns and saws, and car producers require steel. Even workers require food and sleep if they are to supply labor services. These production requirements create a demand for *inputs into production*.

The quantity of an input demanded at each and every price depends critically on the demand for the end product. In other words, a producer's willingness to pay for various inputs depends on the willingness of consumers to pay for his output. This is why the demand for inputs is referred to as a **derived demand**.

DERIVED DEMAND The demand for an input, which is dependent upon the demand for the good(s) that it is used to produce.

EXAMPLE When the demand for cars dropped in the previous recession, the derived demand for autoworkers declined, and some autoworkers lost their jobs.

EXAMPLE When the demand for laptops increased, the derived demand for lithium batteries also increased.

To illustrate the concept of derived demand, consider the impact that the aging population in Japan has on Japan's future demand for grade-school teachers. It is well-known that the population in Japan is getting older and that there are fewer children being born there. This means that the demand for grade-school education will decline in the future, resulting in a leftward shift in the demand curve for grade-school education. Because there will be fewer students, this reduction in demand for

education will also reduce the derived demand for teachers. One way that teachers' unions can counteract this trend is to successfully lobby for regulations that reduce student–teacher ratios, thereby preserving the same number of classes as before. Absent this, the demand curve for teachers will shift to the left as well.

Generally speaking, when a good's demand curve shifts to the right, the derived demand curve for each input into its production also shifts in the same direction. This interdependence between the demand for inputs and outputs explains why workers—who supply labor services—and other input suppliers are often strong advocates for policies that increase the demand for the goods they help to produce. It should come as no surprise that U.S. steelworkers often lobby alongside U.S. steel companies to impose tariffs on imported steel products. And why the United Automobile Workers (UAW) and auto-part manufacturers strongly supported the 2009 "Cash for Clunkers" subsidy program to stimulate the purchase of new cars. After all, these workers' own economic survival was closely linked to the market demand for the goods they produced.

WHAT YOU SHOULD HAVE LEARNED FROM CHAPTER 6

- That the principle of diminishing marginal benefits means that the marginal willingness to pay for additional units of a good declines.
- That because the marginal willingness to pay falls, consumers will buy more of an item when its price falls and less when its price rises.
- That a demand schedule reflects the number of units of a good that a person will purchase at each and every price, assuming that nothing else has changed.
- That the height of the demand curve represents a person's willingness to pay for different units of a good.
- That the demand curve also indicates the number of units of a good that an individual will purchase at each price.
- That when there is a change in the price of a good, a buyer will move up or down his demand curve, thereby adjusting the quantity of the good he demands.
- That a demand curve will shift to the left or right if something other than the good's price changes.
- That the demand curve for normal and inferior goods will respond differently to changes in a person's income.
- That a substitute good is a close replacement for another, based solely on individual perceptions; changes in the price of a substitute will shift the demand curve for the other good.
- That a complementary good is typically consumed with another good (hot dogs and hot dog buns; cars and gasoline), and changes in the price of one complement will shift the demand curve for the other good.
- That a market is a place where buyers and sellers get together directly or indirectly to voluntarily exchange goods and services.
- That a market demand curve will move in the same direction as its underlying individual demand curves in response to a change in the economic environment.
- That a market demand curve will shift right if more individual demanders are added to the market, and it will shift to the left if individual demanders leave the market.
- That the demand for inputs into production is dictated by the demand for goods produced using these inputs.

KEY TERMS

Willingness to pay, p. 128
Reservation price, p. 128
Marginal willingness to pay, p. 129
Quantity demanded, p. 132
Demand, p. 133
Demand schedule, p. 133
Demand curve, p. 134
Law of demand, p. 134
Movement along the demand curve, p. 135
Shift in the demand curve, p. 137
Normal good, p. 138
Inferior good, p. 139
Transitory income, p. 141
Substitute goods, p. 144
Complementary goods, p. 147
Market, p. 151
Market demand curve, p. 151
Derived demand, p. 157

QUESTIONS AND PROBLEMS

1. The use of dry cleaners has declined in the United States during the past few decades, even though people's incomes have increased. Is this sufficient information to conclude that dry-cleaning services are an inferior good? Why or why not? Explain.
2. True, False, or Uncertain. During economic expansions (when income is high), demand for higher education declines. Therefore, higher education is an inferior good. Explain your answer.
3. For the following markets, indicate whether there is a movement along the demand curve or a rightward or leftward shift in the demand curve, in response to an increase in gasoline prices:
   a) SUV market
   b) Mass-transit market
   c) Gasoline market
   d) Automobile tire market
   e) Telecommuting software
4. Over the past decade, the "green" movement has campaigned against the purchase of bottled water because the plastic is not biodegradable. Using two individual demand curves, show the impact of this campaign on:
   a) The demand for bottled water
   b) The demand for refillable bottles

   In your opinion, has the campaign been successful in changing individual preferences about bottled water?
5. Show the impact that the adoption of Chinese babies by U.S. families has on the market demand curve for Chinese au pairs (young people who travel to the United States to take care of children).
6. Indicate how the following events affect the market demand curve for hard-copy college textbooks:
   a) The federal government cuts its funding of college Pell grants and loans.
   b) The price of hard-copy college textbooks falls.
   c) The price of electronic textbooks falls.
   d) The courts rule that students may not resell their hard-copy textbooks.
7. Identify two U.S. industries (other than those already discussed) that were "helped" by NAFTA. Identify two U.S. industries that were "hurt." Why do you think this was the case? Explain your answer.
8. Suppose that a person must have a medication—such as insulin or nitroglycerin—to survive. What would his demand curve for this medication look like? Explain.

9. The Taxpayer Relief Act of 1997 exempted from taxation the first $500,000 of profits received when an owner-occupied home is sold. Show the impact that this policy change had on the market demand curve for owner-occupied housing.
10. Using one individual demand curve for gasoline and a second for recreational vehicle rentals, show the impact of an increase in the price of gasoline on the:
    a) quantity of gasoline demanded.
    b) quantity of RV rentals demanded.
11. With the weakening of the American dollar versus most foreign currencies, foreigners have enjoyed an increase in their purchasing power for American goods. The exact opposite has happened for Americans purchasing foreign goods. Using a separate market demand curve for each of these goods, show how this has affected the market demand curve for:
    a) vacations in the United States by foreign tourists.
    b) vacations in Europe by U.S. tourists.
12. When an individual demand curve shifts because of a change in income, will the new demand curve always be parallel to the old one? Why or why not? Would your answer change if we were talking about a shift in the demand curve resulting from a change in the price of a substitute or a complement? Explain your answer.
13. Transplant surgeons have become ardent proponents for laws that would make organs more widely available. Why do you think this is the case? Explain your answer.
14. Log on to Amazon.com and compare the prices of a specific book (1) when shipping is free, and (2) when there is a shipping and/or handling charge. Is the price of the book with free shipping higher, lower, or the same as the one that has a shipping charge? Explain your findings.
15. Retailers often cluster together in indoor malls or strip malls—even when they are direct competitors, such as Eddie Bauer and American Eagle. And, car sellers often locate on the same street even though they are competing for the same buyers. Explain why this makes good business sense.
16. In such European cities as Barcelona, local shop owners close their stores between 1 P.M. and 4 P.M. for a lengthy lunch break. They then reopen and close at 9 P.M. International chains such as Gap and Walmart that are located in the same cities remain open during these lunch breaks. If all else were the same, which type of store would you predict to have higher prices? Suppose you conduct a study to test your prediction and you find out that the local merchants have higher prices. Is this consistent with your prediction? If not, why do you think you were wrong? Explain your answer.

Appendix 6A An Indifference Curve Analysis of Consumer Choice

Chapter 6 showed how you can derive a person's downward sloping demand curve from our basic economic-choice model. As you already know, people engage in an activity up to the point where the marginal benefit they obtain from the last unit they consume is equal to its marginal cost. If the only cost of acquiring a good or service is its price, and willingness to pay reflects the benefits enjoyed from each unit of the good, then we can say that people will consume up to the point where their willingness to pay from the last unit consumed is equal to the good's price. Economists use *indifference curves* and *budget lines* to model this decision-making process in a more formal way in order to draw additional conclusions about how consumers respond to changes in the trade-offs they face. This appendix provides an overview of this analysis and the types of conclusions that can be drawn from it.

REPRESENTING A CONSUMER'S INCOME CONSTRAINT

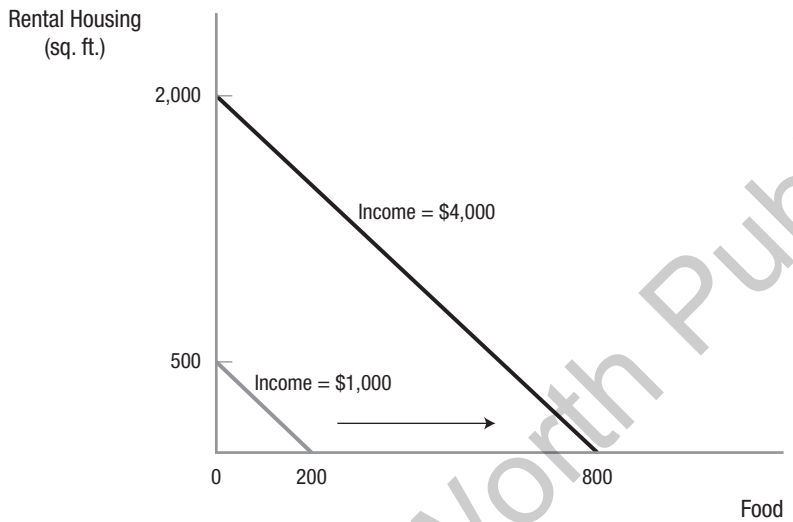
People's purchasing decisions are constrained by the income they have at their disposal. We have seen that when an individual's income changes, so does her demand curve. We can formalize a person's income constraint as follows: suppose a buyer has to decide how to divide her monthly income between two goods: food (X) and rental housing (Y). In reality, we know that there are lots of other goods she will buy each month, but for simplicity, we will assume here that there are only two goods. One of the implications of this assumption is that our buyer spends all of her income on food and rent each month because we do not allow for saving, which would be a third "good."

Table 6A.1 shows two sets of combinations of food and rent she can buy if her initial monthly income is $1,000 and then if her income grows to $4,000 a month. The actual amount of each good she can buy is dictated not only by her income but also by the good's price. Let's assume that the price of a unit (some standardized bundle) of food is $5. Let's also assume that price of rental housing is $2 per square foot per month.

Table 6A.1 Combinations of Food and Housing that Exhaust a Person's Income

Income = $1,000 per month	
Food Units	Rental Housing (sq. ft.)
200	0
150	125
100	250
40	400
0	500
Income = $4,000 per month	
Food Units	Rental Housing (sq. ft.)
800	0
600	500
400	1,000
160	1,600
0	2,000

FIGURE 6A.1 How an Increase in Income Affects a Consumer's Budget Constraint



In **Figure 6A.1**, we graph these two sets of food and rental housing combinations. The lower line shows how much of each good the consumer can buy with a monthly income of $1,000. The upper line shows the combinations if her income increases to $4,000. We call these lines **budget lines** or **budget constraints**.

BUDGET CONSTRAINT A line comprised of all bundles of goods that a person can afford at a given set of prices and income.

We call these budget *constraints* because, at the given prices, the buyer cannot buy more than the combinations shown. If her income is $4,000, for example, she cannot buy more than 800 units of food. If she spends all of her income on rental housing, she could buy no more than 2,000 square feet of housing.

However, if the consumer is willing to trade off some housing for food, then she will find herself somewhere *along* the budget constraint. And, because we are assuming she spends all of her income, she will not choose some combination inside this budget constraint. Finally, because the budget line indicates the maximum combinations of food and housing that the consumer can buy, she cannot choose some bundle outside of her budget line. So where along the budget line will the consumer end up?

Before we answer this question, a few questions about the budget constraint must be addressed. First, why is its slope negative? Recall that the slope of a line is measured as "the change in rise (Y) given a one unit change in run (X)." In the current context, this translates into the trade-off between food and housing—that is, how much additional housing (ΔY, where Δ means "change in") could be purchased if the consumer cut back on 1 unit of food (ΔX). The prices of the goods dictate this trade-off; it is completely independent of the consumer's preferences or income. We know that giving up 1 unit of food will "free up" $5 that can be used to rent 2.5 square feet more of housing. So less food yields more housing, which is consistent with the negative slope.

Second, why are the budget constraints parallel to one another? The lines are parallel because the market's trade-off between the two goods doesn't change with

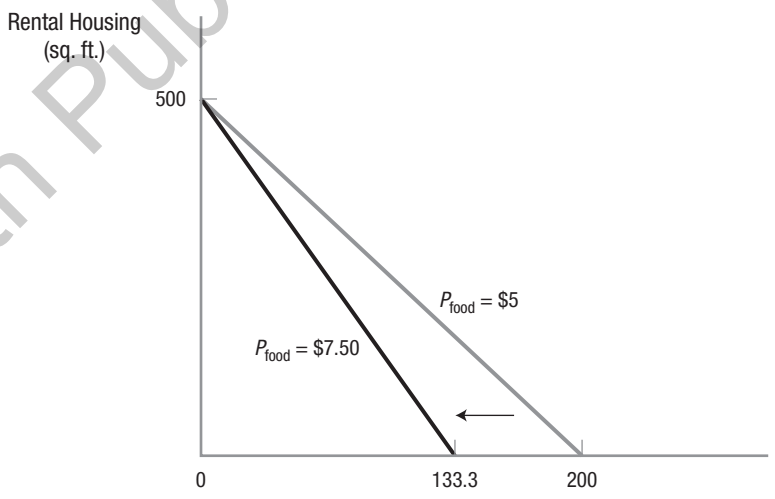
income. The trade-off, dictated by the relative prices of the two goods, remains constant: giving up 1 unit of food will free up 2.5 square feet of housing. The slope of both budget constraints ($\Delta Y/\Delta X$) equals -2.5. Because the slopes of the two budget constraints—one corresponding to $1,000 a month and the second to $4,000 a month—are the same, they must be parallel to one another.

What *does* happen when the consumer's income increases is that her budget line shifts to the right: at the higher income, more of one or both goods can be purchased. The *Y*-intercept in our example, which represents the maximum amount of rental housing that can be purchased if no income is spent on food, increases from 500 square feet ($1,000/$2 per sq. ft.) to 2,000 square feet ($4,000/$2 per sq. ft.). Similarly, the *X*-intercept increases from 200 to 800 units.

What if instead of an increase in income, there was an increase in the price of food, say from $5 to $7.50 per unit? If this consumer is spending all of her income on housing, then this price change wouldn't matter to her. That is, she can still purchase as much housing as she did before the increase in the price of food. Graphically, the *Y*-intercept of the budget line remains the same as before. However, if the consumer purchases any food at all, she will now be unable to purchase her original bundle of food and housing due to the price increase. She will have to cut back on food, housing, or both because her income has not changed.

Figure 6A.2 shows how the budget constraint associated with $1,000 per month "pivots" or rotates inward as a result of an increase in the price of food, *holding the price of housing and income unchanged*. The *X*-intercept, which was originally $1,000/$5, or 200 units of food, falls to $1,000/$7.50, or 133.3 units of food. Fewer units of food can now be purchased when all of the consumer's income is spent on food. We also can see that the budget line becomes steeper. This reflects the fact that the trade-off between food and housing has changed: for every unit of food given up, $7.50 is now freed up to be spent on housing, yielding an additional 3.75 square feet. Now the new trade-off between food and housing is 1:3.75, or

FIGURE 6A.2 How the Increase in the Price of a Good Affects a Consumer's Budget Constraint (Income = $1,000)



1 unit of food for 3.75 square feet of additional housing: the slope of the budget line has therefore increased from −2.5 to −3.75.

We can easily use the same approach to figure out what the new budget constraint would look like for different price changes in one or both goods.

Characteristics of Budget Constraints

We can summarize our findings about the budget constraint as follows:

- The budget constraint shifts parallel to the right when a person's income increases.
- The budget constraint shifts parallel to the left when a person's income decreases.
- The budget constraint "pivots" inward when the price of X increases (the Y-intercept remains unchanged) and outward when the price of X falls.
- The budget constraint "rotates" inward when the price of Y increases (the X-intercept remains unchanged) and rotates outward when the price of Y falls.
- The budget constraint will be the same for consumers who face the same prices and have the same incomes.

A GRAPHIC REPRESENTATION OF CONSUMERS' PREFERENCES

We know that consumers make choices based on both the price of various goods and their willingness to pay for each. Willingness to pay depends on personal *preferences*: vegetarians are not made better off when a juicy steak is placed before them. Similarly, most teenagers get little satisfaction from watching black-and-white silent movies.

This means that even when people have the same budget constraint, they are likely to make different purchasing decisions when it comes to such goods as food and rental housing. Suppose that a person can rank different combinations of food and rental housing according to the well-being he gets from them. Without worrying about putting an actual number on this level of well-being, he simply assigns a ranking: this bundle is preferred to that one. We call this an *ordinal ranking*. An ordinal ranking does not require a consumer to actually assign a value to the well-being received from each bundle, nor does he have to figure out how much more or less well-being (twice as much? half as much?) he gets from one bundle versus another.

Now suppose we want to group together various bundles of food and housing that yield the same level of well-being, say U_0, U_1, and U_2 (where U stands for "utility"). If, in fact, both food and housing generate well-being, then bundles with the least amount of *both* goods will generate the lowest level of utility. This is represented by the combinations yielding utility level U_0. By contrast, the highest level of utility is U_2 because its corresponding bundles offer the most units of both goods. These rankings are shown in **Table 6A.2**.

Table 6A.2 Combinations of Food and Housing that Yield the Same Level of Well-being

U_0	U_1	U_2
25, 100	50, 200	75, 300
30, 80	60, 160	90, 240
40, 60	80, 120	120, 180
60, 30	120, 60	180, 90

All of the combinations of food and housing in, say, ranking U_0 provide the same level of well-being. That is why the combination (25, 100) is under the U_0 heading along with the combination (60, 30). The term we use for this is *indifference*.

The idea is that the consumer is indifferent—the amount of well-being he derives is the same—whether he consumes the (25, 100) bundle of food and housing or the (60, 30) bundle.

We have all experienced indifference like this many times in our lives. Suppose you have a tuna sandwich for lunch, and your office mate has an egg-salad sandwich. When asked if you would trade half of your sandwich for half of your office mate's sandwich, you weigh the costs and benefits of making such a trade. If you view the new sandwich combination as making you no better or worse off, then you would rank this new lunch "bundle" the same as your original sandwich, and you would be *indifferent* to making the trade.

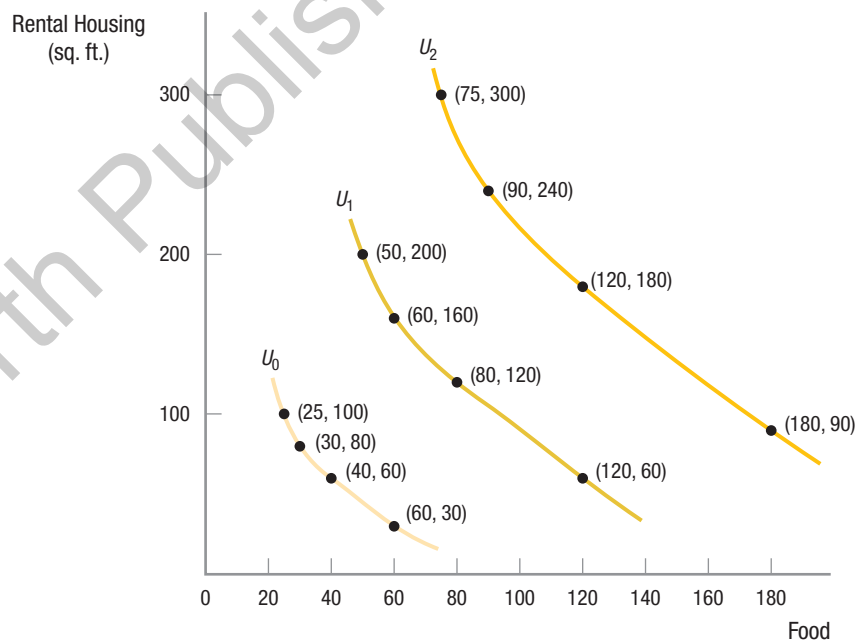
Returning to Table 6A.2, we would expect that our consumer of food and housing prefers all of the combinations in U_1 to those in U_0 because there is more food and/or housing in the bundles associated with U_1 than U_0. Of course, this assumes that more food or housing, or both, is better in terms of improving his well-being.

We can graphically illustrate these preferences. In **Figure 6A.3**, we plot each of the food/housing bundles for each of the "*U*s" from Table 6A.2. The curves that result are called **indifference curves**.

INDIFFERENCE CURVE A curve that shows all bundles of goods that yield the same level of well-being.

Each indifference curve shows all of the bundles of food and housing that generate the same level of well-being for the consumer. As you can see, there are separate indifference curves for each of the levels of well-being labeled U_0, U_1, and U_2. Because greater amounts of one or both goods increase well-being, these curves must move up and to the right.

FIGURE 6A.3 Three Consumer Indifference Curves



The first thing to notice is that the indifference curves slope downward. Why is this the case? If a person is given more of one good, say food, then he must give up some housing to remain indifferent. The second thing to notice is that the indifference curves are "convex to the origin." That is, they bow in toward the origin of the graph. This means that the slope of the indifference curve isn't constant. Why? Recall that the principle of diminishing marginal benefit states that the incremental well-being from additional units of a good declines as more of the good is consumed. What this means is that when a person has a large amount of housing and not much food, he will be willing to give up a lot more housing to obtain a little more food. A similar phenomenon occurs if he has a lot of food but no housing. He will be willing to give up a lot more food to obtain a little bit of housing. If the amount he is willing to trade didn't vary with how much of each good he had, the slope of the indifference curve would be constant and the indifference curve would be a straight line. As you can see, it's not.

Table 6A.2 indicates that the *trade-off* between food and housing that keeps the person at the same level of well-being changes as the amounts of food and housing in the bundles change.

We actually know something more about this trade-off and the slope of the indifference curve. For every 1 unit reduction in food, the loss in well-being equals the marginal benefit generated by that unit (MB_{food}), which is also referred to as marginal utility (MU_{food}). How many square feet of housing are required to compensate the consumer for this loss in well-being? It depends on the marginal benefit that additional square feet of housing will yield. Therefore, the trade-off between food and housing that leaves the individual indifferent is equal to the ratio of the marginal benefit of the two goods, $MB_{food}/MB_{housing}$.

If, for example, the unit of food the consumer gives up reduces his well-being by 50 and an additional square foot of housing increases his well-being by 100, then .5 square feet of housing will compensate him for 1 less unit of food: $MB_{food}/MB_{housing}$ equals 50/100 or 1/2. We call this ratio the **marginal rate of substitution (MRS)**.

MARGINAL RATE OF SUBSTITUTION (MRS) The rate at which a consumer is willing to trade off one good for another and remain indifferent.

The principle of diminishing marginal benefit tells us that a consumer's MRS will decline (in absolute value) as he moves down his indifference curve: for every one unit increase in food, the amount of square feet given up gets smaller and smaller.

Characteristics of Indifference Curves

We can generalize our findings about indifference curves as follows:

- Indifference curves reflect people's individual preferences and are, therefore, likely to differ across people.
- The slope of an indifference curve represents the marginal rate of substitution between goods *X* and *Y*.
- A person's indifference curves will never intersect. (We know this because each curve represents a unique level of well-being, and no combination can yield more than one level of well-being. So there can be no bundle that lies on two indifference curves, which an intersection requires.)

HOW BUDGET CONSTRAINTS AND INDIFFERENCE CURVES, TOGETHER, DICTATE CONSUMER CHOICE

You may have noticed that our discussion about budget constraints ignored consumer preferences, and our discussion about consumer preferences ignored budget

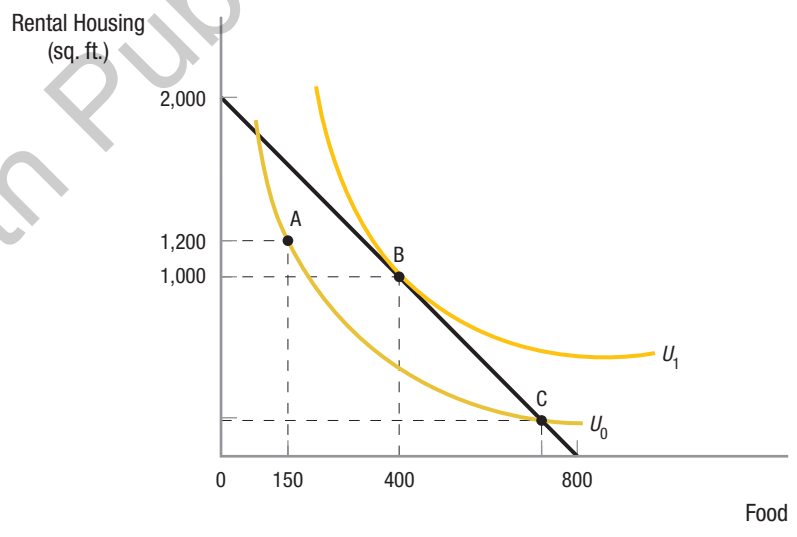
constraints. Budget constraints reflect the trade-off between food and housing that the market dictates through the prices it sets, irrespective of consumer preferences. Indifference curves reflect the trade-off between food and housing that is derived from a consumer's preferences, irrespective of market prices. To see this, look at the bundles that deliver the same U_0 level of well-being in Table 6A.2: they do not cost the same. Bundle (25, 100) costs $325, bundle (30, 80) costs $310, and bundle (60, 30) costs $360.

So how do budget lines and indifference curves come together to tell us something about a consumer's decision process? We know that people consider both their preferences and the prices they face when choosing the mix of goods that will maximize their well-being for any given level of scarce resources (in this case, income). If you were the consumer, what bundle of food and housing would you choose, given your income? Your decision can be illustrated by combining your budget constraint and indifference curves, as **Figure 6A.4** shows.

This figure shows a budget constraint corresponding to an income of $4000 and two indifference curves. The budget constraint reflects the maximum bundles of food and housing that can be purchased given their prices ($5 and $2, respectively) and your income. The two indifference curves, labeled U_0 and U_1, show bundles of food and housing associated with two levels of well-being. Of course, you would rather have the bundles lying along indifference curve U_1 than those lying along U_0 because you would prefer to have more of one or both of the goods rather than less of either or both.

Consider the bundle of food and housing (150, 1,200). This bundle puts you on indifference curve U_0. As you can see in Figure 6A.4, choosing this bundle puts you inside the budget constraint, which means that at the given prices, you could afford to buy more of one or both goods and doing so would increase your well-being. But how much more of each should you buy? Our model of consumer choice predicts that you will end up with the bundle marked by point B (400 units of food and 1,000 sq. ft. of housing) because this bundle satisfies two basic economic requirements. First, this

FIGURE 6A.4 **Combining a Consumer's Budget Constraint and Indifference Curves to Find the Ideal Bundle to Purchase**



bundle exhausts your income. You cannot buy more of either good given your budget constraint, nor would you want to buy less. In contrast, the bundles represented by points A and C are not "optimal" in terms of achieving your goal, which is to maximize your well-being. Second, the bundle at point B—and every other one on the indifference curve U_1—is preferable to any bundle on indifference curve U_0. However, the bundle at B *is the only bundle* on U_1 that you can purchase, given your income. Given your income and your personal preferences, this is the best you can do. Notice that this bundle is located at the point where your budget constraint is just *tangent* to your indifference curve U_1. Economists sometimes refer to this as a *tangency solution*.

Changes in an Individual's Income

What happens to a consumer's choice of bundle when there is a change in income? Look at **Figure 6A.5**. There we've replicated Figure 6A.4, leaving out the numbers. Figure 6A.5 shows an increase in your income, while holding prices and your preferences constant. At a higher level of income, your budget constraint shifts to the right. Now which bundle will you choose?

The bundle of food and housing at point B no longer maximizes your well-being. Because your income is higher, you can buy more of one or both goods until you've once again exhausted your income, landing you somewhere along your new, higher budget constraint *and* on a higher indifference curve. The bundle at which this occurs is located at point D. This bundle will maximize your well-being. How does this translate into your demand for food and housing? Your income increased and, given the original prices of food and housing, you bought more of each good to maximize your well-being. Therefore, both goods must be *normal goods*: your demand for each good will shift to the right when your income increases.

Changes in the Price of a Good

Suppose there is no change in your income or the price of housing, but the price of food increases. We already showed that this will cause the budget constraint to

FIGURE 6A.5 How an Increase in Income Changes a Consumer's Optimal Bundle

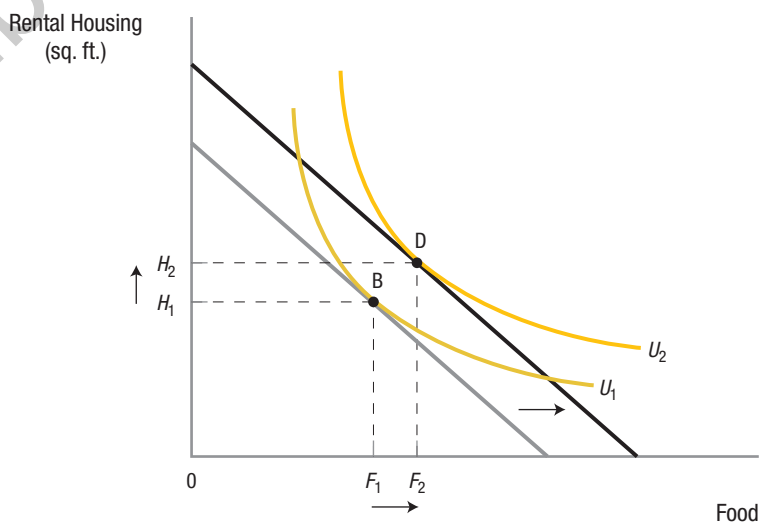
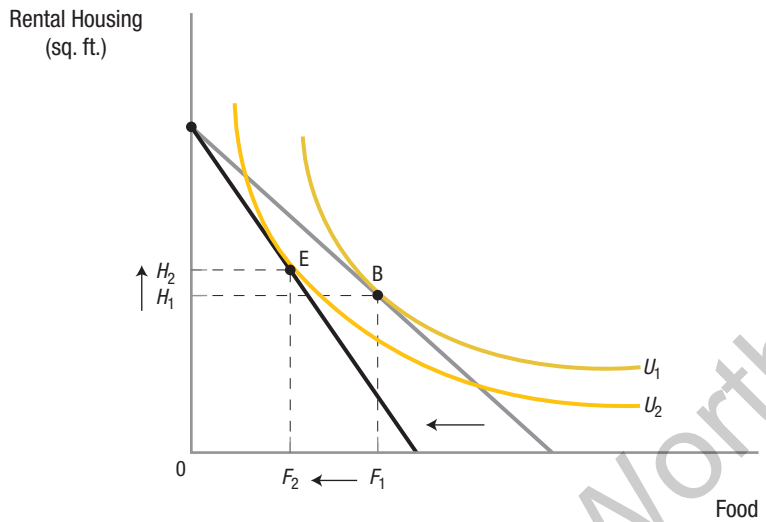


FIGURE 6A.6 How an Increase in the Price of a Good Changes a Consumer's Optimal Bundle



rotate inward; there will be no change in the Y-intercept, but the X-intercept will get smaller. **Figure 6A.6**, which shows this change in the budget constraint, reveals that your original bundle B is no longer attainable—it sits outside your new budget constraint. The highest indifference curve that you can now reach is lower than before the price increase.

This is an important but logical finding: a price increase reduces a consumer's well-being. We see that the best you can now do is to choose the bundle at point E, which is the point where your new budget constraint is just tangent to indifference curve U_2. The bundle at E contains less food. In other words, when the price of food increased, you bought less of it. This is exactly what the law of demand predicts. As it turns out, bundle E also contains more housing—whose price did not change—than before. In fact, your purchases of housing could have gone up or down, depending on how much more of your income you decided to spend on food to cover the price increase.

A MATHEMATICAL REPRESENTATION OF CONSUMER CHOICE

We can restate our analysis in mathematical terms.

Budget Constraints

Given the prices P_X and P_Y, all of the combinations of X and Y that would just exhaust the consumer's monthly income (I) can be represented by the following income constraint:

$$P_X X + P_Y Y = I \tag{6A.1}$$

We can graph this relationship—with X and Y on the horizontal and vertical axes, respectively—using the following equation derived directly from equation 6A.1:

$$Y = I/P_Y - P_X X/P_Y \tag{6A.2}$$

Equation 6A.2 is the equation for the budget constraint. I/P_Y is the Y-intercept, and I/P_X is the X-intercept. The intercept values tell us how many units of Y can be purchased (I/P_Y) if no income is spent on X, and how many units of X can be purchased (I/P_X) if no income is spent on Y. The slope of the equation ($-P_X/P_Y$) indicates the trade-off between Y and X: the higher the price of X, the greater the number of units of Y that can be purchased when 1 unit of X is sacrificed. When I changes in equation 6A.2, there is no change in the slope of the budget constraint. This means that the budget constraints of a consumer will always be parallel as long as the prices of the goods don't change.

Indifference Curves

Consider a person whose well-being, or utility, is a function of two goods, X and Y. That is,

$$U = f(X, Y) \tag{6A.3}$$

Changes in utility are directly related to changes in X and Y. If we differentiate our utility function we get

$$dU = dU/dX\ \mathrm{d}X + dU/dY\ \mathrm{d}Y \tag{6A.4}$$

This may look very complicated, but it actually isn't. What it is saying in "discrete" terms is that

$$\Delta U = MU_X\ (\Delta X) + MU_Y\ (\Delta Y) \tag{6A.5}$$

That is, a change in well-being (ΔU) occurs when there is a change in the amount of good X (ΔX) or good Y (ΔY) you have, weighted by their respective marginal utility (MU_X, MU_Y) or benefit you gain.

Along an indifference curve, ΔU is equal to zero. As a result, along an indifference curve, the following must hold:

$$0 = MU_X\ (\Delta X) + MU_Y\ (\Delta Y) \tag{6A.6}$$

Rearranging, we get

$$MU_X/MU_Y = -\Delta Y/\Delta X = -\text{slope of indifference curve} \tag{6A.7}$$

Utility Maximization

Given the income level I_0, what is the bundle of X and Y that will maximize a person's level of well-being? Mathematically speaking, we are looking for the values of X and Y to

$$\text{Maximize } U = f(X, Y)$$

such that

$$I_0 = P_X X + P_Y Y$$

We have already shown that the X, Y combination that yields the highest level of well-being is where the budget constraint is just tangent to the indifference curve. At

this point, the slope of the indifference curve is just equal to the slope of the budget constraint. That is,

$$P_X/P_Y = \text{MRS}_{X,Y} = MU_X/MU_Y \tag{6A.8}$$

This result is a necessary condition for *consumer equilibrium*. By equilibrium, we mean that a consumer will stop trading with the market and adjusting his bundle of goods when this equality is met.

Rearranging equation 6A.8, we get

$$MU_X/P_X = MU_Y/P_Y \tag{6A.9}$$

This tells us that a consumer has maximized her well-being only when the last dollar she spends on good *X* yields that same increase in well-being as the last dollar she spends on good *Y*. This result explains why, when the price of a good increases, a person will tend to buy fewer units of that good and more of other goods whose prices have not changed: the marginal benefit gained per dollar spent on these other goods is now greater than what is gained from spending these dollars on good *X*. In other words, your dollar doesn't "go as far" anymore when you buy *X*.

KEY TERMS

Budget constraint, p. 162

Indifference curve, p. 165

Marginal rate of substitution, p. 166

PRACTICE PROBLEMS

1. What would a consumer's indifference curve look like if she were choosing between a "good" and a "bad"—say, going to movies and sitting in traffic? Explain.
2. What would a person's indifference curve look like if she were choosing between two "perfect" complements that had to be used together in a specific combination—say, athletic shoes and shoelaces? Explain.
3. What does a straight-line indifference curve tell you about a person's preferences in terms of the two goods, *X* and *Y*? Explain. If the indifference curve was a straight line, what would this mean in terms of consumer equilibrium? Explain.
4. Could a budget constraint ever be curved? Explain.
5. What would the indifference curves look like for a drug addict who is choosing between cocaine and food? Explain.