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CHAPTER 4

# Elasticity: A Measure of Responsiveness

**In every large city in the United States, the public bus system runs a deficit: Operating costs exceed revenues from passenger fares.** Suppose your city wants to reduce its bus deficit and is trying to decide whether to increase fares by 10 percent. Consider the following exchange between two city officials:

BUSTER: "A fare increase is a great idea. We'll collect more money from bus riders, so revenue will increase, and the deficit will shrink."

BESSIE: "Wait a minute, Buster. Haven't you heard about the law of demand? The increase in the bus fare will decrease the number of passengers taking buses, so we'll collect *less* money, not more, and the deficit will grow."

Who is right? As we'll see in this chapter, we can't predict how an increase in price will affect total revenue unless we know

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just how responsive consumers are to an increase in price. Like other consumers, bus riders obey the law of demand, but that doesn't necessarily mean that total fare revenue will fall.

## APPLYING THE CONCEPTS

1. How does the elasticity of demand vary over time?
   *A Closer Look at the Elasticity of Demand for Gasoline*
2. How can we use the price elasticity of demand to predict the effects of public policies?
   *Smoking, Drinking, and Elasticity*
3. If demand is inelastic, how does an increase in price affect total expenditures?
   *Vanity Plates and Elasticity of Demand*
4. If demand is inelastic, how does a decrease in supply affect total expenditures?
   *Drug Prices and Property Crime*
5. How does a change in demand affect the equilibrium price?
   *Metropolitan Growth and Housing Prices*
6. How does a change in supply affect the equilibrium price?
   *An Import Ban and Shoe Prices*



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In Chapter 3, we discussed the law of demand, which states that an increase in price decreases the quantity demanded, *ceteris paribus*. The law of demand is useful, but sometimes we need to know the numbers behind the law of demand. That is, we need to know exactly how much less will be demanded at a higher price. In this chapter, we will quantify the law of demand, exploring the responsiveness of consumers to changes in price. Suppose your student film society has decided to increase the price for its tickets from $10 to $11. You know from the law of demand that you'll sell fewer tickets, but the question is "How many fewer tickets?" As we'll see, you can use the concept of elasticity to predict how many tickets you'll sell and how much money you'll collect in total. Similarly, in the case of hiking the bus fare, we can use the concept of elasticity to determine whether Buster or Bessie is correct.

Switching to the supply side of the market, the law of supply tells us that an increase in price increases the quantity supplied, *ceteris paribus*. Sometimes the question is "By how much?" We'll quantify the law of supply, showing how to predict just how much more of a product will be supplied at a higher price. For example, if the world price of oil increases from $70 to $80 per barrel, we know from the law of supply that domestic producers will supply more oil, but the question is "How much more?" We can use the concept of elasticity to predict how much more domestic oil will be supplied at the higher price.

## 4.1 THE PRICE ELASTICITY OF DEMAND

**price elasticity of demand ($E_d$)** A measure of the responsiveness of the quantity demanded to changes in price; equal to the absolute value of the percentage change in quantity demanded divided by the percentage change in price.

The **price elasticity of demand ($E_d$)** measures the responsiveness of the quantity demanded to changes in price. To compute the price elasticity of demand, we divide the percentage change in the quantity demanded by the percentage change in price, and then take the absolute value of the ratio:

$$E_d = \left| \frac{\text{percentage change in quantity demanded}}{\text{percentage change in price}} \right|$$

The vertical bars indicate that we take the absolute value of the ratio, so the price elasticity is always a positive number. For example, suppose the price of milk *increases* by 10 percent and the quantity demanded *decreases* by 15 percent. The price elasticity of demand is 1.5:

$$E_d = \left| \frac{\text{percentage change in quantity demanded}}{\text{percentage change in price}} \right| = \left| \frac{-15\%}{10\%} \right| = 1.50$$

The law of demand tells us that price and quantity demanded move in opposite directions. Therefore, the percentage change in quantity will always have the opposite sign of the percentage change in price. In our example, a positive 10 percent change in price results in a negative 15 percent change in quantity. The ratio of the percentage changes is –1.50, and taking the absolute value of this ratio, the elasticity is 1.50. Although it is conventional to use the absolute value to compute the price elasticity, the practice is not universal. So you may encounter a negative price elasticity, which means that the elasticity is reported as its numerical value rather than its absolute value.

When the price elasticity is listed as a positive number, the interpretation of the elasticity is straightforward. If the elasticity number is large, it means that the demand for the product is very elastic, or very responsive to changes in price. In contrast, a small number indicates that the demand for a product is very inelastic.

### Computing Percentage Changes and Elasticities

As we saw in the appendix to Chapter 1, we can compute a percentage change in two ways. Using the initial-value method, we divide the change in the value of a variable by its initial value. For example, if a price increases from $20 to $22, the percentage change is $2 divided by $20, or 10 percent:

$$\text{percent change with initial value} = \frac{22-20}{20} \times 100 = \frac{2}{20} \times 100 = 10\%$$

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Alternatively, we could use the midpoint method. We divide the change in the variable by its average value, that is, the midpoint of the two values. For example, if the price increases from \$20 to \$22, the average or midpoint value is \$21 and the percentage change is \$2 divided by \$21, or 9.52 percent:

$$\text{percent change with midpoint value} = \frac{2}{\frac{20 + 22}{2}} \times 100 = \frac{2}{21} \times 100 = 9.52\%$$

The advantage of the midpoint approach is that it generates the same absolute percentage change whether the variable has increased or decreased. The reason is that the denominator is the same in both cases. In contrast, the initial-value computation is based on the initial value, so our answer there depends on the direction of the change—which of the two values is the initial value.

Table 4.1 shows the calculation of the price elasticity of demand with the two approaches. When the price increases from \$20 to \$22, the quantity demanded decreases from 100 to 80 units. Using the initial-value method, we get an elasticity of 2.0, equal to the 20 percent change in quantity divided by the 10 percent change in price. As shown in the lower part of the table, the midpoint method generates an elasticity of 2.33.

**TABLE 4.1 COMPUTING PRICE ELASTICITY WITH INITIAL VALUES AND MIDPOINTS**

| | | Price | Quantity |
|---|---|---|---|
| Data | Initial | \$20 | 100 |
| | New | 22 | 80 |
| | | Price | Quantity |
| Computation with Initial-value method | Percentage change | $10\% = \frac{\$2}{\$20} \times 100$ | $-20\% = -\frac{20}{100} \times 100$ |
| | Price elasticity of demand | $2.0 = \left\lvert\frac{-20\%}{10\%}\right\rvert$ | |
| | | Price | Quantity |
| Computation with midpoint method | Percentage change | $9.52\% = \frac{\$2}{\$21} \times 100$ | $-22.22\% = -\frac{20}{90} \times 100$ |
| | Price elasticity of demand | $2.33 = \left\lvert\frac{-22.22\%}{9.52\%}\right\rvert$ | |

Why do the two approaches generate different elasticity numbers? The midpoint approach measures the percentage changes more precisely, so we get a more precise measure of price elasticity. In this case, the percentage changes are relatively small, so the two elasticity numbers are close to one another. If the percentage changes were larger, however, the elasticity numbers generated by the two approaches would be quite different, and it would be wise to use the midpoint approach. In this book, we use the initial-value approach because it generates nice round numbers and allows us to focus on economics rather than arithmetic. But any time you want to be more precise, you can use the midpoint formula.

## Price Elasticity and the Demand Curve

Figure 4.1 shows five different demand curves, each with a different elasticity. We can divide products into five types, depending on their price elasticities of demand.

- **Elastic demand** (Panel A). In this case, a 20 percent increase in price (from \$5 to \$6) decreases the quantity demanded by 40 percent (from 20 to 12), so the price elasticity of demand is 2.0. When the price elasticity is greater than 1.0, we say

• **elastic demand**
The price elasticity of demand is greater than one, so the percentage change in quantity exceeds the percentage change in price.

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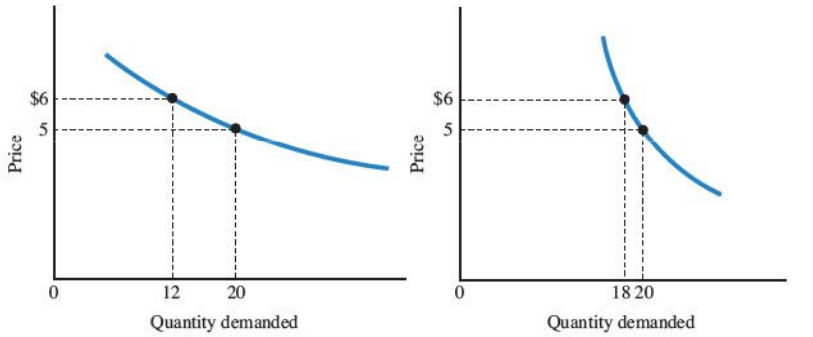
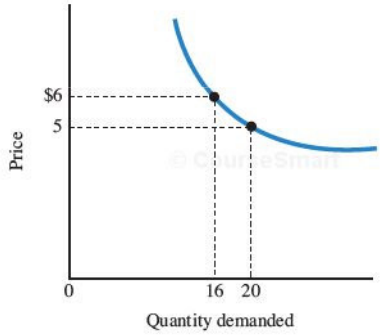
• **inelastic demand**
The price elasticity of demand is less than one, so the percentage change in quantity is less than the percentage change in price.

that demand is *elastic*, or highly responsive to changes in price. Some examples of goods with elastic demand are restaurant meals, air travel, and movies.

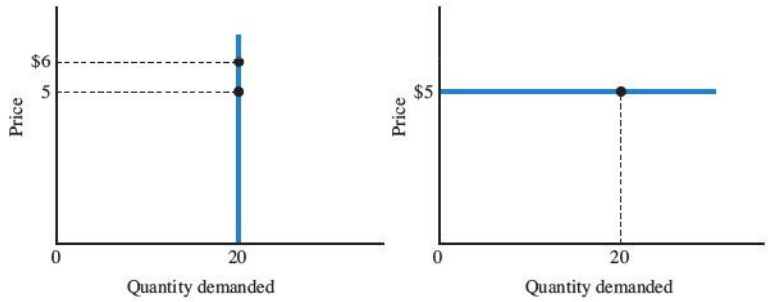
- **Inelastic demand** (Panel B). The same 20 percent increase in price decreases the quantity demanded by only 10 percent (from 20 to 18), so the price elasticity of demand is 0.50. When the elasticity is less than 1.0, we say that demand is




(A) Elastic Demand: $E_d = \left|\frac{-40\%}{20\%}\right| = 2.0 > 1$ (B) Inelastic Demand: $E_d = \left|\frac{-10\%}{20\%}\right| = 0.50 < 1$




(C) Unit Elastic Demand: $E_d = \left|\frac{-20\%}{20\%}\right| = 1$




(D) Perfectly Inelastic Demand: $E_d = \left|\frac{0\%}{20\%}\right| = 0$ (E) Perfectly Elastic Demand: $E_d = \infty$

▲ FIGURE 4.1
Elasticity and Demand Curves

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*inelastic*, or not very responsive to changes in price. Some examples of goods with inelastic demand are salt, eggs, coffee, and cigarettes.

- **Unit elastic demand** (Panel C). A 20 percent increase in price decreases the quantity demanded by exactly 20 percent, so the price elasticity of demand is 1.0. Some examples of goods with *unit elasticity* are housing and fruit juice.
- **Perfectly inelastic demand** (Panel D). When demand is *perfectly inelastic*, the quantity doesn't change as the price changes, so the demand curve is vertical at the fixed quantity. The price elasticity of demand is zero. This extreme case is rare because for most products, consumers can either switch to a substitute good or do without. For example, although there are no direct substitutes for household water, as the price of water rises, people install low-flow showerheads and water their lawns and clean their cars less frequently. The rare cases of perfectly inelastic demand are medicines—such as insulin for diabetics—that have no substitutes.
- **Perfectly elastic demand** (Panel E). In the case of *perfect elasticity*, the price elasticity is infinite and the demand curve is horizontal, meaning that only one price is possible. At that price, the quantity demanded could be any quantity, from one unit to millions of units. If the price were to increase even a penny, the quantity demanded would drop to zero. As we'll see later in the book, firms in a perfectly competitive market face this sort of demand curve. For example, each wheat farmer can sell as much as he or she wants at the market price but would sell nothing at any price above the market price.

- **unit elastic demand** The price elasticity of demand is one, so the percentage change in quantity equals the percentage change in price.
- **perfectly inelastic demand** The price elasticity of demand is zero.
- **perfectly elastic demand** The price elasticity of demand is infinite.

## Elasticity and the Availability of Substitutes

The key factor in determining the price elasticity for a particular product is the availability of substitute products. Consider the substitution possibilities for insulin and cornflakes. There are no good substitutes for insulin, so diabetics are not very responsive to changes in price. When the price of insulin increases, they cannot switch to another medicine, so the demand for insulin is inelastic. In contrast, there are many substitutes for cornflakes, including different types of corn cereals, as well as cereals made from wheat, rice, and oats. Faced with an increase in the price of cornflakes, consumers can easily switch to substitute products, so the demand for cornflakes is relatively elastic.

Table 4.2 on page 86 shows the price elasticities of demand for various products. The different elasticities illustrate the importance of substitutes in determining the price elasticity of demand. Because there are no good substitutes for water and salt, it is not surprising that the elasticities are small. For example, the price elasticity of demand for water is 0.20, meaning that a 10 percent increase in price decreases the quantity demanded by 2 percent. The demand for coffee is inelastic (0.30), because although there are alternative beverages and caffeine-delivery systems (tea, infused soft drinks, sports drinks, and pills), coffee provides a unique combination of taste and caffeine. Although there is an artificial substitute for eggs (for people concerned about dietary cholesterol), there are no natural substitutes, so the demand for eggs is relatively inelastic (0.30).

Alternative brands of a product are good substitutes for one another, so the demand for a specific brand of a product is typically elastic. For example, the elasticity of demand for a specific brand of coffee is 5.6, compared to an overall elasticity for coffee of 0.30. This means that a 10 percent increase in the price of coffee in general (all brands) will decrease the quantity of coffee sold by 3 percent, but a 10 percent increase in the price of a specific brand will decrease the quantity of that brand sold by 56 percent. Each brand of coffee is a substitute for all the other brands, so consumers are very responsive to a change in the price of a specific brand. Similarly, the demand for specific brands of tires is more elastic than the demand for tires in general.

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TABLE 4.2 PRICE ELASTICITIES OF DEMAND FOR SELECTED PRODUCTS[1]

| | Product | Price Elasticity of Demand |
|---|---|---|
| Inelastic | Salt | 0.1 |
| | Food (wealthy countries) | 0.15 |
| | Weekend canoe trips | 0.19 |
| | Water | 0.2 |
| | Coffee | 0.3 |
| | Physician visits | 0.25 |
| | Sport fishing | 0.28 |
| | Gasoline (short run) | 0.25 |
| | Eggs | 0.3 |
| | Cigarettes | 0.3 |
| | Food (poor countries) | 0.34 |
| | Shoes and footwear | 0.7 |
| | Gasoline (long run) | 0.6 |
| Unit elastic | Housing | 1.0 |
| | Fruit juice | 1.0 |
| Elastic | Automobiles | 1.2 |
| | Foreign travel | 1.8 |
| | Motorboats | 2.2 |
| | Restaurant meals | 2.3 |
| | Air travel | 2.4 |
| | Movies | 3.7 |
| | Specific brands of coffee | 5.6 |

The availability of substitutes increases over time, so the longer the time consumers have to respond to a price change, the more elastic the demand. Because it often takes time for consumers to respond to price changes, the short-run price elasticity of demand is typically smaller than the long-run elasticity. For example, when the price of gasoline increases, consumers can immediately drive fewer miles in their existing cars or switch to public transportation. As shown in Table 4.2, the short-run price elasticity of demand for gasoline is 0.25. In the long run, consumers can buy more fuel-efficient cars and move closer to workplaces. As time passes, consumers have more options to cut gasoline consumption—more substitution possibilities—so demand becomes more elastic. In Table 4.2, the long-run price elasticity of demand for gasoline is 0.60, over twice as large as the short-run elasticity.

## Other Determinants of the Price Elasticity of Demand

Two other factors help determine the price elasticity of demand for a product. First, the elasticity is generally larger for goods that take a relatively large part of a consumer's budget. If a good represents a small part of the budget of the typical consumer, demand is relatively inelastic. For example, suppose the price of pencils is 20 cents and then increases by 10 percent, or 2 cents. Because the price change is tiny compared to the income of the typical consumer, we would expect a relatively small decrease in the quantity of pencils demanded. In contrast, if the price of a car is $20,000 and then increases 10 percent ($2,000), we would expect a bigger response because the change in price is large relative to the income of the typical consumer.

International comparisons of the price elasticity of demand for food suggest that demand is more price elastic when the good represents a large part of the consumer's budget. As shown in Table 4.2, in wealthy countries, the price elasticity of demand for food is around 0.15. In poor countries, people spend a larger fraction of their budget on food, so they are more responsive to changes in food prices. In these poor countries, the price elasticity of demand is around 0.34.

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Another factor in determining the elasticity of demand is whether the product is a necessity or a luxury good. As shown in Table 4.2, the demand for food, a necessity, is relatively low in both wealthy and poor countries. Similarly, the demand for physician visits is inelastic (elasticity = 0.25). In contrast, the elasticity of demand for luxury goods such as restaurant meals, foreign travel, and motorboats is relatively elastic. Of course, not all goods that are considered luxuries have elastic demand. For example, the price elasticity of demand for weekend canoe trips is 0.19, and the demand elasticity for sport fishing is 0.28. These elasticities suggest that one person's luxury is another person's necessity.

Table 4.3 summarizes our discussion of the determinants of the price elasticity of demand. Demand is relatively elastic if there are many good substitutes, if we allow consumers a long time to respond, if spending on the product is a large part of the consumer's budget, and if the product is a luxury as opposed to a necessity.

**TABLE 4.3 DETERMINANTS OF ELASTICITY**

| Factor | Demand is relatively elastic if . . . | Demand is relatively inelastic if . . . |
|---|---|---|
| Availability of substitutes | there are many substitutes. | there are few substitutes. |
| Passage of time | a long time passes. | a short time passes. |
| Fraction of consumer budget | is large. | is small. |
| Necessity | the product is a luxury. | the product is a necessity. |

## APPLICATION 1

### A CLOSER LOOK AT THE ELASTICITY OF DEMAND FOR GASOLINE

**APPLYING THE CONCEPTS #1: How does the elasticity of demand vary over time?**

We've seen that the demand for gasoline is more elastic in the long run, when consumers have more opportunity to respond to changes in price. A recent study explores two sorts of response to higher gasoline prices. First, when the price increases, people drive fewer miles, so there are fewer cars on the road, As shown in the following table, the elasticity of traffic volume is 0.10 in the short run (within one year) and 0.30 in the long run (after five years). In other words, a 10 percent increase in the price of gasoline decreases the number of cars on the road by 1 percent in the short run and 3 percent in the long run. A second response to higher prices is to switch to more fuel-efficient cars. As shown in the table, the elasticity of fuel efficiency is 0.15 in the short run and 0.40 in the long run. **Related to Exercises 1.6 and 1.7.**

**TABLE 4.4 GASOLINE PRICES, TRAFFIC VOLUME, AND FUEL EFFICIENCY**

| Elasticity of | Short Run (1 year) | Long Run (5 years) |
|---|---|---|
| Traffic Volume | 0.10 | 0.30 |
| Fuel Efficiency | 0.15 | 0.40 |

SOURCE: Based on Phil Goodwin, Joyce Dargay, and Mark Hanly, "Elasticities of Road Traffic and Fuel Consumption with Respect to Price and Income: A Review," *Transport Review* 24, no. 3 (2004): 275–292.

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## 4.2 USING PRICE ELASTICITY TO PREDICT CHANGES IN QUANTITY

The price elasticity of demand is a very useful tool for economic analysis. If we know the elasticity of demand for a particular good, we can quantify the law of demand, predicting the change in quantity resulting from a change in price.

If we have values for two of the three variables in the elasticity formula, we can compute the value of the third. The three variables are (1) the price elasticity of demand itself, (2) the percentage change in quantity, and (3) the percentage change in price. So if we know the values for the price elasticity and the percentage change in price, we can compute the value for the percentage change in quantity. Specifically, we can rearrange the elasticity formula:

$$\text{percentage change in quantity demanded} = \text{percentage change in price} \times E_d$$

For example, suppose you run a campus film series and you've decided to increase your admission price by 15 percent. If you know the elasticity of demand for your movies, you could use it to predict how many fewer tickets you'll sell at the higher

### APPLICATION 2

### SMOKING, DRINKING, AND ELASTICITY

**APPLYING THE CONCEPTS #2: How can we use the price elasticity of demand to predict the effects of public policy?**

We can use the concept of price elasticity to predict the effects of a change in the price of beer on drinking and highway deaths among young adults. The price elasticity of demand for beer among young adults is about 1.30. If a state imposes a beer tax that increases the price of beer by 10 percent, we would predict that beer consumption will decrease by 13 percent:

$$\begin{aligned}\text{percentage change in quantity demanded} &= \text{percentage change in price} \times E_d \\ &= 10\% \times 1.30 = 13\%\end{aligned}$$

The number of highway deaths among young adults is roughly proportional to their beer consumption, so the number of deaths will also decrease by 13 percent. According to a recent study, a doubling of the beer tax from $0.16 to $0.32 per six-pack would decrease highway deaths among 18- to 20-year-olds by about 12 percent. Raising the beer tax back to where it was in 1951 would cut highway deaths by 32 percent.

Another ongoing policy objective is to reduce smoking by teenagers. Under the 1997 federal tobacco settlement, cigarette prices increased by about 62 cents per pack, a percentage increase of about 25 percent. The demand for cigarettes by teenagers is elastic, with an elasticity of 1.3. Therefore, a 25 percent price hike will reduce teen smoking by 32.5:

$$\text{percentage change in quantity demanded} = 25\% \times 1.30 = 32.5\%$$

About half the decrease in consumption occurs because fewer teenagers will become smokers, and the other half occurs because each teenage smoker will smoke fewer cigarettes. **Related to Exercises 2.1, 2.2, 2.4, and 2.5.**

SOURCES: Based on Henry Saffer and Michael Grossman, "Beer Taxes, the Legal Drinking Age, and Youth Motor Vehicle Fatalities," *Journal of Legal Studies* 16 (June 1987): 351–374; Frank Chaloupka, Henry Saffer, and Michael Grossman, "Alcohol Control Policies and Motor Vehicle Fatalities," *Journal of Legal Studies* 22 (January 1993): 161–183; Michael M. Phillips and Suein L. Hwang, "Why Tobacco Pact Won't Hurt Industry," *Wall Street Journal*, September 12, 1997; Frank J. Chaloupka and Michael Grossman, "Price, Tobacco Control Policies, and Smoking Among Young Adults," *Journal of Health Economics* 16 (1997): 359–373.

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price. If the elasticity of demand is 2.0 and you increase the price by 15 percent, we would predict a 30 percent decrease in the quantity of tickets demanded:

$$\text{percentage change in quantity demanded} = \text{percentage change in price} \times E_d$$
$$= 15\% \times 2.0 = 30\%$$

## 4.3 PRICE ELASTICITY AND TOTAL REVENUE

Firms use the concept of price elasticity to predict the effects of changing their prices. A firm produces products to sell, and a firm's **total revenue** equals the money it generates from selling products. If a firm sells its product for the same price to every consumer, total revenue equals the price per unit times the quantity sold:

• **total revenue**
The money a firm generates from selling its product.

$$\text{total revenue} = \text{price per unit} \times \text{quantity sold}$$

Suppose a firm increases the price of its product. Will its total sales revenue increase or decrease? The answer depends on the price elasticity of demand for the product. If you know the price elasticity, you can determine whether a price hike will increase or decrease the firm's total revenue.

Let's return to the example of the campus film series. Suppose you are thinking about increasing the price of tickets by 10 percent, from $10 to $11. An increase in the ticket price brings good news and bad news:

- Good news: You get more money for each ticket sold.
- Bad news: You sell fewer tickets.

Your total revenue will decrease if the bad news (fewer tickets sold) dominates the good news (more money per ticket). The elasticity of demand tells us how the good news compares to the bad news. If demand is elastic, consumers will respond to the higher price by purchasing many fewer tickets, so although you will collect more money per ticket, you'll sell so few tickets that your total revenue will decrease.

### Elastic versus Inelastic Demand

The upper part of Table 4.5 shows an example of the effects of a price hike when the demand for a product is elastic. In this case, the price elasticity of demand is 2.0, so a 10 percent increase in price decreases the quantity demanded by 20 percent, from 100 to 80 tickets. Because the percentage decrease in quantity (the bad news) exceeds the percentage increase in price (the good news), total revenue decreases, from $1,000 to $880. In general, an elastic demand means that the percentage change in quantity (the bad news from a price hike) will exceed the percentage change in price (the good news), so an increase in price will decrease total revenue.

We get the opposite result if the demand for the good is inelastic: An increase in price increases total revenue. If demand is inelastic, consumers are not very responsive to

**TABLE 4.5 PRICE AND TOTAL REVENUE WITH DIFFERENT ELASTICITIES OF DEMAND**

Elastic Demand: $E_d = 2.0$

| Price | Quantity Sold | Total Revenue |
|---|---|---|
| $10 | 100 | $1,000 |
| 11 | 80 | 880 |

Inelastic Demand: $E_d = 0.50$

| Price | Quantity Sold | Total Revenue |
|---|---|---|
| 100 | 10 | $1,000 |
| 120 | 9 | 1,080 |

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an increase in price, so the good news (more money per unit sold) dominates the bad news (fewer units sold). The lower part of Table 4.5 shows an example of the effects of a price hike when demand is inelastic (equal to 0.50). Suppose that your campus bookstore starts with a textbook price of $100 and sells 10 books per minute. If the bookstore increases its price by 20 percent (from $100 to $120 per book) and the elasticity of demand for textbooks is 0.50, the quantity of textbooks sold will decrease by only 10 percent (from 10 to 9 per minute). Therefore, the store's total revenue will increase from $1,000 per minute ($100 × 10 books) to $1,080 per minute ($120 × 9 books). In general, an inelastic demand means that the percentage change in quantity will be smaller than the percentage change in price, so an increase in price will increase total revenue.

Table 4.6 summarizes the revenue effects of changes in prices for different types of goods:

- *Elastic demand.* The relationship between price and total revenue is negative: An increase in price decreases total revenue; a decrease in price increases total revenue.
- *Inelastic demand.* The relationship between price and total revenue is positive: An increase in price increases total revenue; a decrease in price decreases total revenue.
- *Unit elastic demand.* Total revenue does not vary with price.

**TABLE 4.6 PRICE ELASTICITY AND TOTAL REVENUE**

Elastic Demand: $E_d > 1.0$

| If price . . . | Total revenue . . . | Because the percentage change in quantity is . . . |
|---|---|---|
| ↑ | ↓ | Larger than the percentage change in price. |
| ↓ | ↑ | Larger than the percentage change in price. |

Inelastic: $E_d < 1.0$

| If price . . . | Total revenue . . . | Because the percentage change in quantity is . . . |
|---|---|---|
| ↑ | ↑ | Smaller than the percentage change in price. |
| ↓ | ↓ | Smaller than the percentage change in price. |

We can use the relationships summarized in Table 4.6 to work backward. If we observe the relationship between the price of a product and total sales revenue of the product, we can determine whether the demand for the product is elastic or inelastic. Suppose that when a music store increases the price of its CDs, its total revenue from CDs drops. The negative relationship between price and total revenue means that demand for the store's CDs is elastic: Total revenue decreases because consumers are very responsive to an increase in price, buying a much smaller quantity. In contrast, suppose that when a city increases the price it charges for water, the total revenue from water sales increases. The positive relationship between price and total revenue suggests that the demand for the city's water is inelastic: Total revenue increases because consumers are not very responsive to an increase in price.

## Market Elasticity versus Elasticity for a Firm

The manager of a DVD rental store has asked you to solve a puzzle. According to national studies of the DVD rental market, the price elasticity of demand for DVD rentals is 0.80: A 10 percent increase in price decreases the quantity of DVDs demanded by about 8 percent. In other words, the demand for DVDs is inelastic. Based on this information, the manager of the DVD store increased prices by 20 percent, expecting total revenue to increase. The manager expected the good news (more money per rental) to dominate the bad news (fewer rentals). But in fact total revenue decreased. Why?

The key to solving this puzzle is to recognize that the manager can't use the results of a national study to predict the effects of increasing a single store's price. The national study suggests that if all DVD stores in the nation increased their prices by