

Section 3

Elasticity of Demand

Preview

Objectives

After studying this section you will be able to:

1. Explain how to calculate elasticity of demand.
2. Identify factors that affect elasticity.
3. Explain how firms use elasticity and revenue to make decisions.

Section Focus

Elasticity of demand describes how consumers will react to a change in the price of a good. Their reaction depends on the original price of the good and the way that good is used by consumers.

Key Terms

elasticity of demand
inelastic
elastic
unitary elastic
total revenue

elasticity of demand
a measure of how consumers react to a change in price

inelastic describes demand that is not very sensitive to a change in price

elastic describes demand that is very sensitive to a change in price

Are there some goods that you would always find money to buy, even if the price were to rise drastically? Are there other goods that you would cut back on, or even stop buying altogether, if the price were to rise just slightly?

Economists describe the way that consumers respond to price changes as **elasticity of demand**. Elasticity of demand dictates how drastically buyers will cut back or increase their demand for a good

when the price rises or falls, respectively. Your demand for a good that you will keep buying despite a price increase is **inelastic**, or relatively unresponsive to price changes. In the second example, in which you buy much less of a good after a small price increase, your demand is **elastic**. A consumer with highly elastic demand for a good is very responsive to price changes.

Calculating Elasticity

To compute elasticity of demand, take the percentage change in the demand of a good, and divide this number by the percentage change in the price of the good. You can find the equation for elasticity in Figure 4.7 on page 92. The law of demand implies that the result will always be negative. This is because an increase in the price of a good will always decrease the quantity demanded, and a decrease in the price of a good will always increase the quantity demanded. For the sake of simplicity, economists drop the negative sign.

Price Range

The elasticity of demand for a good varies at every price level. Demand for a good can be highly elastic at one price and inelastic at a different price. For example, demand



"After taxes, operating expenses and profits to stockholders, I'm lucky if I see a nickel of it!"

▲ Misspelling "lemonade" might not be this entrepreneur's only mistake. How many people will buy lemonade if the price rises to \$25.00 a glass?

for a glossy magazine will be inelastic when the price rises 50 percent from 20 cents to 30 cents. The price is still very low, and people will buy almost as many copies as they did before. However, when the price increases 50 percent from \$4.00 to \$6.00, demand will be much more elastic. Many readers will refuse to pay \$2.00 more for the magazine. Yet in percentage terms, the change in the magazine's price is exactly the same as when the price rose from 20 cents to 30 cents.

Values of Elasticity

We have been using the terms *inelastic* and *elastic* to describe consumers' responses to price changes. These terms have precise mathematical definitions. If the elasticity of demand for a good at a certain price is *less* than 1, we describe demand as inelastic. If the elasticity is *greater* than one, demand is elastic. If elasticity is exactly equal to 1, we describe demand as **unitary elastic**.

When elasticity of demand is unitary, the percentage change in quantity demanded is exactly equal to the percentage change in the price. Suppose the elasticity of demand for a magazine at \$2 is unitary. When the price of the magazine rises by 50 percent to \$3, the newsstand will sell exactly half as many copies as before.

Think back to Ashley's demand schedule for pizza in Section 1. Ashley's demand schedule shows that if the price per slice were to rise from \$1.00 to \$1.50, her quantity demanded would fall from 4 slices to 3 slices per day. The change in price from \$1.00 to \$1.50 is a 50 percent increase. The change in quantity demanded from 4 to 3 slices is a 25 percent decrease. Dividing the 25 percent decrease in quantity demanded by the 50 percent increase in price gives us an elasticity of demand of 0.5.

Since Ashley's elasticity of demand at prices of \$1.00 to \$1.50 is less than 1, we say that Ashley's demand for pizza is inelastic. In other words, a price increase has a relatively small effect on the number of slices of pizza she buys.

Suppose that we survey another customer and find that, when the price of pizza rises by 40 percent, this person's quantity demanded falls by 60 percent. The change in the quantity demanded of 60 percent is divided by the change in price of 40 percent, equaling an elasticity of demand of 1.5 (60 percent/40 percent = 1.5). Since this result is greater than 1, this customer's demand is elastic. In other words, this customer is very sensitive to changes in the price of pizza.

unitary elastic
describes demand whose elasticity is exactly equal to 1

Factors Affecting Elasticity

Why is the demand for some goods so much less elastic than for other goods? Rephrase the question and ask yourself, "What is essential to me? What goods must I have, even if the price rises greatly?" The goods you list might have some traits that set them apart from other goods and make your demand for those goods less elastic. Several different factors can affect a person's elasticity of demand for a specific good.

Availability of Substitutes

If there are few substitutes for a good, then even when its price rises greatly, you might still buy it. You feel you have no good alternatives. For example, if your favorite musical group plans to give a concert, and you want to attend, there really is no substitute for a ticket. You could go to a concert to hear some other band, but that would not be as good. You've got to have



Global Connections

Elasticity in the Kitchen Cooking varies from country to country, and so does **elasticity of demand** for certain foods. If the price of a gallon of milk or a pound of ground beef doubled in the United States, consumers might demand intervention by the government. Do you think this would happen if the price rise affected onions and potatoes? These two vegetables are essential to Indian cooking, and when floods ruined crops in India, their prices more than doubled. In November 1998, angry citizens voted the ruling party out of office in several states in part because of the high price of onions.

Figure 4.7 Elasticity of Demand

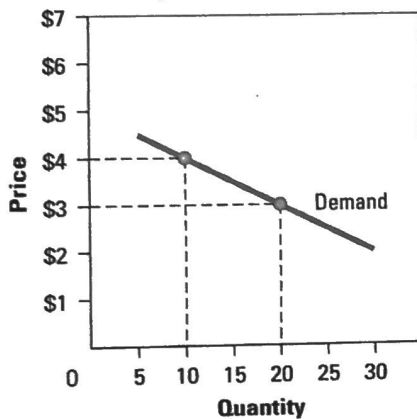
Elasticity is determined using the following formula:

$$\text{Elasticity} = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}}$$

To find the percentage change in quantity demanded or price, use the following formula: Subtract the new number from the original number, and divide the result by the original number. Ignore any negative signs, and multiply by 100 to convert this number to a percentage:

$$\text{Percentage change} = \frac{\text{Original number} - \text{New number}}{\text{Original number}} \times 100$$

Example 1: Elastic Demand



If demand is elastic, a small change in price leads to a relatively large change in the quantity demanded. Follow this demand curve from left to right.

The price decreases from \$4 to \$3, a decrease of 25 percent.

$$\frac{\$4 - \$3}{\$4} \times 100 = 25$$

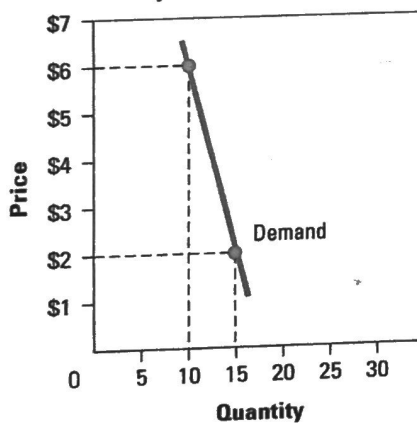
The quantity demanded increases from 10 to 20. This is an increase of 100 percent.

$$\frac{10 - 20}{10} \times 100 = 100$$

Elasticity of demand is equal to 4.0. Elasticity is greater than 1, so demand is elastic. In this example, a small decrease in price caused a large increase in the quantity demanded.

$$\frac{100\%}{25\%} = 4.0$$

Example 2: Inelastic Demand



If demand is inelastic, consumers are not very responsive to changes in price. A decrease in price will lead to only a small change in quantity demanded, or perhaps no change at all. Follow this demand curve from left to right as the price decreases sharply from \$6 to \$2.

The price decreases from \$6 to \$2, a decrease of about 67 percent.

$$\frac{\$6 - \$2}{\$6} \times 100 = 67$$

The quantity demanded increases from 10 to 15, an increase of 50 percent.

$$\frac{10 - 15}{10} \times 100 = 50$$

Elasticity of demand is about 0.75. The elasticity is less than 1, so demand for this good is inelastic. The increase in quantity demanded is small compared to the decrease in price.

$$\frac{50\%}{67\%} \approx 0.75$$

Unitary elastic demand is a special case. When demand is unitary elastic, an increase (or decrease) in price will be met by an equal percentage decrease (or increase) in quantity demanded. Elasticity of demand is exactly 1.



Elasticity of demand describes how strongly consumers will react to a change in price.
Supply and Demand If a good's elasticity of demand is 0.2, how will consumers react to an increase in price?

tickets for this concert, and nothing else will do. Under these circumstances, a moderate change in price is not going to change your mind. Your demand is inelastic.

Similarly, demand for life-saving medicine is usually inelastic. For many prescription drugs, the only possible substitute is to try an unproven treatment. For this reason, people with an illness will continue to buy as much needed medicine as they can afford, even when the price goes up.

If the lack of substitutes can make demand inelastic, a wide choice of substitute goods can make demand elastic. The demand for a particular brand of apple juice is probably elastic because people can choose from dozens of good substitutes if the price of their preferred brand rises.

Relative Importance

A second factor in determining a good's elasticity of demand is how much of your budget you spend on the good. If you already spend a large share of your income on a good, a price increase will force you to make some tough choices. Unless you want to cut back drastically on the other goods in your budget, you must reduce consumption of that good by a significant amount to keep your budget under control. The

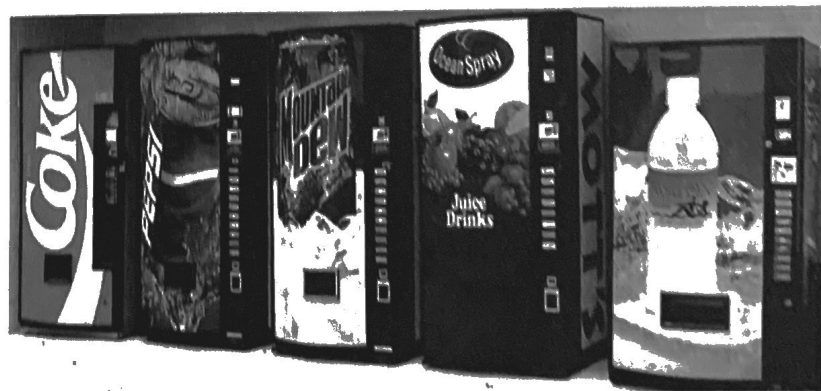
higher the jump in price, the more you will have to adjust your purchases.

If you currently spend half of your budget on clothes, then even a modest increase in the cost of clothing will probably cause a large reduction in the quantity you purchase. In other words, your demand will be elastic.

However, if the price of shoelaces doubled, would you cut back on your shoelace purchases? Probably not. You may not even notice the difference. Even if you spend twice as much on shoelaces, they will still account for only a tiny part of your overall budget. Your demand for shoelaces is inelastic.

Necessities Versus Luxuries

The third factor in determining a good's elasticity varies a great deal from person to person, but it is nonetheless important. Whether a person considers a good to be a necessity or a luxury has a great impact on the good's elasticity of demand for that person. A necessity is a good people will always buy, even when the price increases. Parents often regard milk as a necessity. They will buy it at any reasonable price. If the price of a gallon of milk rises from \$2.49 to \$4.49, they will still buy as much milk as their children need to stay healthy. Their demand for milk is inelastic.



▲ Demand for prescription drugs is inelastic because the patient has few alternatives. Demand for any one of these drinks would be much more elastic because a consumer can easily find a less expensive choice.



▲ Many people consider lobster a luxury and can easily cut it out of their budget.

The same parents may regard steak as a luxury. When the price of steak increases by a little bit, say 20 percent, parents may cut their monthly purchases of steak by more than 20 percent, or skip steak altogether. Steak is a luxury, and consumers can easily reduce the quantity they consume. Because it is easy to reduce the quantity of luxuries demanded, demand is elastic.

Change over Time

When a price changes, consumers often need time to change their shopping habits. Consumers do not always react quickly to a price increase because it takes time to find substitutes. Because they cannot respond quickly to price changes, their demand is inelastic in the short term. Demand sometimes becomes more elastic over time, however, because people can eventually find substitutes that allow large adjustments to what they buy.

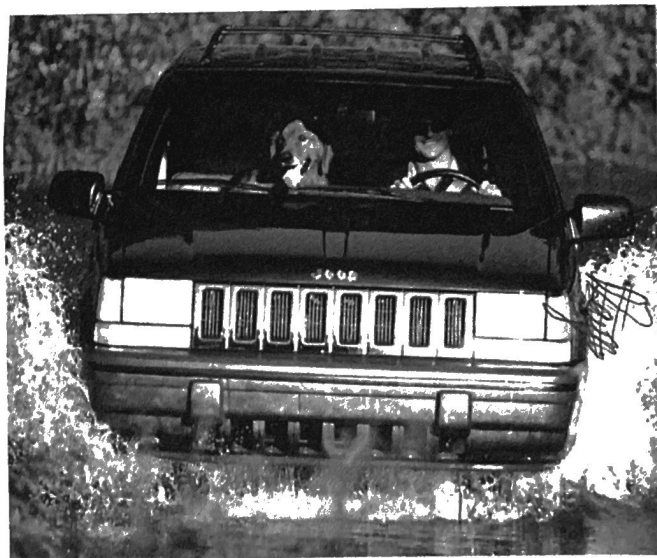
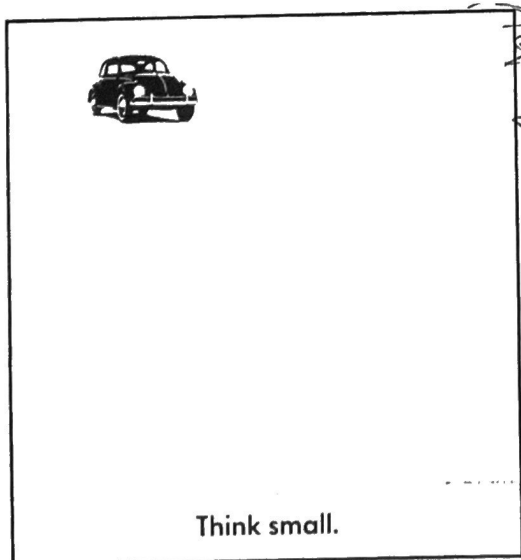
Consider the example of gasoline. When a person purchases a vehicle, he or she might choose a large vehicle that requires a greater volume of gasoline per mile to run. This same person might work at a job many miles away from home and shop at a

supermarket that is far from both work and home. These factors determine how much gasoline this person demands, and none can be changed easily.

In the early 1970s, several oil-rich countries cut their oil exports to the United States, and gasoline prices rose quickly. In the short run, there was very little that people could do to reduce their consumption of gasoline. They still needed to drive to school and work. At first, drivers were more likely to pay more for the same amount of gasoline than they were to buy fuel-efficient cars or move closer to their schools and workplaces.

However, because gas prices stayed high for a considerable period of time, some people eventually switched to more fuel-efficient cars. Others formed car pools, walked or rode bicycles, and used public transportation. In the long run, people reduced their consumption of gasoline by finding substitutes. Demand for gasoline, inelastic in the short term, is more elastic in the long term.

As another example, consider what happened to gasoline prices from the early 1980s through the 1990s. Adjusting for inflation, the price of a gallon of gas fell



▲ When gas prices rose in the 1970s, auto manufacturers advertised how little fuel their cars used. Gas prices were low in the 1990s, so new advertising emphasized strength and size, even though those cars used more gasoline.

considerably from its highs in the 1970s. In addition, gasoline prices remained low for many years. At first, people continued to seek out fuel-efficient cars. Over time, however, many Americans switched back to larger vehicles that get fewer miles to the gallon. Because the price of gas remained low, people gradually adjusted their habits to use more and more gasoline. Just as demand for gasoline responded slowly to an increase in price, it also responded slowly to a decrease in price.

Elasticity and Revenue

Elasticity is important to the study of economics because elasticity helps us measure how consumers respond to price changes for different products. Elasticity is also an important tool for business planners like the pizzeria owner described in Sections 1 and 2. The elasticity of demand determines how a change in prices will affect a firm's total revenue or income.

Computing a Firm's Total Revenue

A company's **total revenue** is defined as the amount of money the company receives by selling its goods. This is determined by two factors: the price of the goods and the quantity sold. If a pizzeria sells 125 slices of pizza per day at \$2.00 per slice, total revenue would be \$250 per day.

Total Revenue and Elastic Demand

The law of demand tells us that an increase in price will decrease the quantity demanded. When a good has an elastic demand, raising the price of each unit sold by 20 percent will decrease the quantity sold by a larger percentage, say 50 percent. The quantity sold will drop enough to actually *reduce* the firm's total revenue. Figure 4.8, drawn from the demand curve for the pizzeria, shows how this can happen. An increase in price from \$2.50 to \$3.00, or 20 percent, decreases the quantity sold from 100 to 50, or 50 percent. As a result, total revenue drops from \$250 to \$150.

Figure 4.8 Revenue Table

Price of a slice of pizza	Quantity demanded per day	Total revenue
\$.50	300	\$150
\$1.00	250	\$250
\$1.50	200	\$300
\$2.00	150	\$300
\$2.50	100	\$250
\$3.00	50	\$150



Setting prices too high or too low can hurt revenue. **Markets and Prices** When the price doubles from \$0.50 to \$1.00, is demand elastic, unitary elastic, or inelastic?

The same process can also work in reverse. If the firm were to reduce the price by a certain percentage, the quantity demanded could rise by an even greater percentage. In this case, total revenues could rise.

It may surprise you that a firm could lose revenue by raising the price of its goods. But if the pizzeria started selling pizza at \$10 a slice, it would not stay in business very long. Remember that elastic demand comes from one or more of these factors:

1. availability of substitute goods
2. a limited budget that does not allow price changes
3. the perception of the good as a luxury item

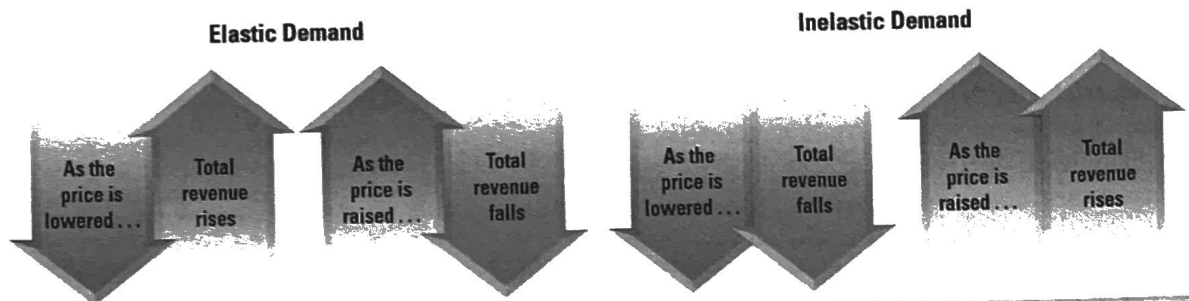
If these conditions are present, then the demand for the good is elastic, and a firm may find that a price increase reduces its total revenue.

Total Revenue and Inelastic Demand

Remember that if demand is inelastic, consumers' demand is not very responsive to price changes. Thus, if the firm raises its price by 25 percent, the quantity demanded will fall, but by less than 25 percent. The firm will have greater total revenues. In other words, the higher price makes up for the firm's lower sales, and the firm brings in more money.

total revenue the total amount of money a firm receives by selling goods or services

Figure 4.9 Elasticity and Revenue



Elasticity of demand determines the effect of a price change on total revenues. **Markets and Prices Why will revenue fall if a firm raises the price of a good whose demand is elastic?**

On the other hand, a decrease in price will lead to an increase in the quantity demanded if demand is inelastic. However, demand will not rise as much, in percentage terms, as the price fell, and the firm's total revenue will decrease.

Elasticity and Pricing Policies

Because of these relationships, a firm needs to know whether the demand for its product is elastic or inelastic at a given price. This knowledge helps the firm make

pricing decisions that lead to the greatest revenue. If a firm knows that the demand for its product is elastic at the current price, it knows that an increase in price would reduce total revenues. On the other hand, if a firm knows that the demand for its product is inelastic at its current price, it knows that an increase in price will increase total revenue. In the next chapter, you will read more about the choices producers make to reach an ideal level of revenue.

Section 3 Assessment

Key Terms and Main Ideas

1. Explain **elasticity of demand** in your own words.
2. Name a good with **elastic** demand at its current price.
3. Why is demand for home heating fuel **inelastic** in cold weather?
4. How do we calculate **total revenue**?

Applying Economic Concepts

5. **Math Practice** Use the formula in Figure 4.7 to calculate the exact elasticity of demand in the following examples. Then tell if, in each case, demand is elastic, inelastic, or unitary elastic. (a) When the price of a deluxe car wash rises from \$10.00 to \$11.00, the number of daily customers falls from 60 to 48. (b) A dentist with 80 patients cuts his fee for a cleaning from \$60.00 to \$54.00 and attracts two new patients.
6. **Try This** Interview a manager at a local restaurant or store. Ask if he or she has changed the price of any good or service in the past year, and if so, how sales were affected. Is demand for each of these goods or services elastic or inelastic? What factors might explain your answer?
7. **Critical Thinking** Think of a good, like gasoline, for which demand can become more elastic over time. What changes can take place in the long term to affect demand?



Take It to the NET

Petroleum and petroleum products are important to our everyday lives. Find out how much oil is demanded by North America and how much is demanded by one other continent. Is each demand elastic or inelastic? Use the links provided in the Social Studies area at the following Web site for help in completing this activity. www.phschool.com

Real-life Case Study

Entrepreneurs

What Makes a Person an Entrepreneur?

Entrepreneurs come in all shapes and sizes. Some have become very wealthy and well known, such as Andrew Carnegie who built a successful steel company in the 1800s, and Mary Kay Ash who founded Mary Kay Cosmetics. Most entrepreneurs, however, are involved in much smaller ventures, but all entrepreneurs have many things in common.

Traits Entrepreneurs have the ability to see a business opportunity where others do not. In other words, they recognize an existing or potential demand for which there is no supply. Most of all, entrepreneurs possess a willingness to take risks and an ability to learn from the mistakes that they make.

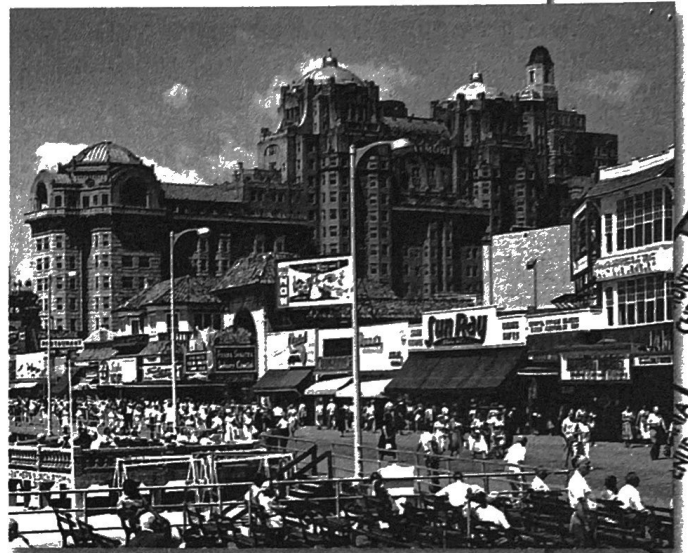
Vision A classic story of entrepreneurial success is that of Charles Darrow. In 1933, Darrow found himself out of work. To support his family, he took whatever odd jobs he could find, but he had a brilliant business idea. He wanted to create a compelling board game in which people could live the fantasy of acquiring land, houses, and hotels which they could rent or sell to fellow players. Recalling a vacation he had once taken in Atlantic City, New Jersey, Darrow named the real estate featured in his game after places in that city. He called the game Monopoly®.

Perseverance Although many people told him he was wasting his time, Darrow spent months developing Monopoly. He then took his game to Parker Brothers, a leading board game company, which rejected the game because it found 52 flaws in it. Undaunted, Darrow corrected every one of the flaws. Then, with help from a friend who was a printer, he produced several Monopoly sets, which he tried to sell to local stores.

Finally, after weeks of pounding the pavement, a Philadelphia department store agreed to buy 5,000 of the Monopoly sets. The store sold all of the games so quickly that Parker Brothers reconsidered and agreed to produce the game. Within a year, more than 800,000 sets were sold, and soon Charles Darrow became a millionaire. Since that time, some 100 million sets of Monopoly have been sold worldwide.

Applying Economic Ideas

1. What entrepreneurial traits did Darrow use to make Monopoly a success?
2. For Darrow, what were the benefits and drawbacks of being an entrepreneur?



▲ A vacation spent strolling the Boardwalk in Atlantic City gave Charles Darrow the idea for a game.

Chapter Summary

A summary of major ideas in Chapter 4 appears below. See also the **Guide to the Essentials of Economics**, which provides additional review and test practice of key concepts in Chapter 4.

Section 1 Understanding Demand (pp. 79–83)

Demand describes the ability and desire to buy a good or service. The **law of demand** says that the quantity demanded of a good will fall as the good's price increases. Two possible responses to a change in price, the **substitution effect** and the **income effect**, work together to create the law of demand. You can list demand for a good at all possible prices in a **demand schedule** and chart these points on a **demand curve**. Every individual has a demand schedule for a good, and you can find the demand schedule for the entire market by adding up all individual demand.

Section 2 Shifts of the Demand Curve (pp. 85–88)

A demand curve shows demand when price varies, but all other factors stay the same. When other factors change, the demand curve shifts to the left or to the right. When a rise in income leads a consumer to increase consumption of a good, that good is a **normal good**. If a higher income leads to lower consumption of a good, it is called an **inferior good**. Other factors that can affect demand are changes in population, tastes, and the prices of other goods.

Section 3 Elasticity of Demand (pp. 90–96)

Elasticity of demand describes how strongly buyers will react to a change in a good's price. When demand is **elastic**, buyers will make relatively big changes to their consumption of a good when its price rises or falls. When demand is **inelastic**, consumers will only change their consumption slightly relative to the change in price. Demand will be more elastic if the good has many substitutes, is considered a luxury, or accounts for a large share of the buyer's income. Entrepreneurs can estimate the elasticity of demand for some goods and use this number to make pricing decisions.