

# Competitive Dynamics and Government

*There is no resting place for an enterprise in a competitive economy.*

—Alfred P. Sloan, American businessman

Usually, when we wish to acquire goods and services—a fresh loaf of bread, a pair of shoes in the right size and style, a last-minute holiday package to a Caribbean island—they can be bought quickly and conveniently. In this chapter, we will analyze in more detail the ways in which competitive markets accomplish this task. In particular, we will look at the concept of elasticity and its effect on the interplay of demand and supply. We will also see how governments may choose to intervene in particular markets by establishing price controls. As this example will show, the dynamics of competitive markets can help or hinder government policies in important ways.

## ○ LEARNING OBJECTIVES

In this chapter, you will:

- 1 learn about the price elasticity of demand, its relation to other demand elasticities, and its impact on sellers' revenues
- 2 learn about the price elasticity of supply and the links between production periods and supply
- 3 examine how price elasticities of demand and supply determine the impact of an excise tax on consumers and producers
- 4 consider how governments use price controls to override the “invisible hand” of competition



## Perfectly Elastic and Perfectly Inelastic Demand

**perfectly elastic demand:** demand for which a product's price remains constant regardless of quantity demanded

**perfectly inelastic demand:** demand for which a product's quantity demanded remains constant regardless of price

**total revenue:** the total income earned from a product, calculated by multiplying the product's price by its quantity demanded

There are two extreme cases of demand elasticity. When a product has **perfectly elastic demand**, its price remains constant whatever quantities are demanded. Because price never varies, the demand curve is horizontal, as shown in Figure 3.2, on the left. Consider the example of an individual producer, a soybean farmer, who is a *price-taker*. This means that the farmer has no influence over the market price of soybeans, since the farmer's operations are too insignificant to affect the market. This farmer would face demand as illustrated by the demand curve  $D_3$ . Because the same price of \$100 per tonne of soybeans applies at all possible amounts demanded, the farmer faces a perfectly elastic demand curve. In contrast, when a product has **perfectly inelastic demand**, its quantity demanded is completely unaffected by price. This situation creates a vertical demand curve, as shown in Figure 3.2, on the right. An example is the demand for insulin: since this product is essential to people who have diabetes, they are willing to pay any price for a certain quantity of insulin. This means that the market demand curve for insulin ( $D_4$ ) is vertical at a given quantity demanded, such as 1000 L.

## Price Elasticity of Demand and Total Revenue

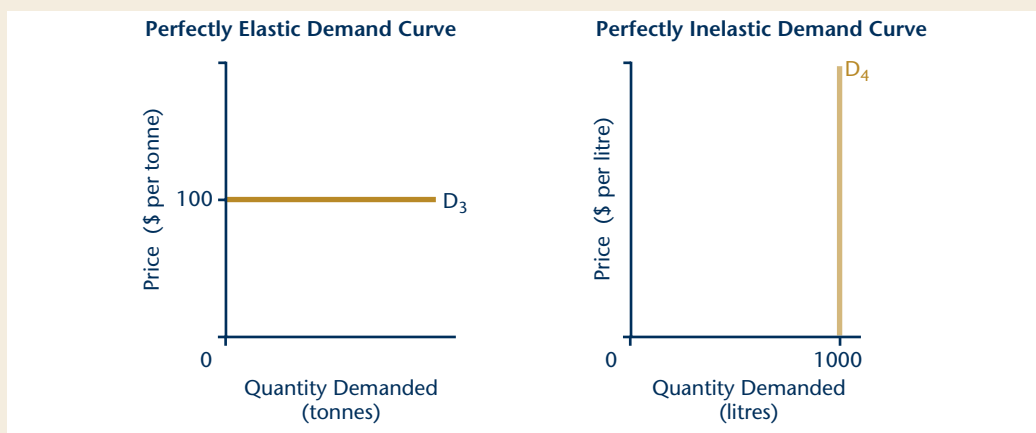
Demand elasticity plays a role in determining what effect a price change has on **total revenue** (TR). Total revenue is defined, either for an individual business or for all businesses producing the same product, as the price of a product multiplied by its quantity demanded:

$$TR = P \times Q_d$$

For example, if the price of a certain product is \$4 and 1000 units are purchased, then the total revenue generated is \$4000 ( $= \$4 \times 1000$ ).

Consider how a rise in a product's price affects the total revenue of businesses selling the product. The higher price, by itself, increases the revenue pocketed by the sellers, but the accompanying decrease in quantity demanded has the opposite effect. It is the price elasticity of demand that determines which of these two effects—the increase in price or the decrease in quantity demanded—has the greater influence on the sellers' total revenue.

**Figure 3.2** Perfectly Elastic and Perfectly Inelastic Demand



A single soybean farmer might face a perfectly elastic demand curve, as shown on the left graph, with a constant price. In contrast, a producer of insulin might face a vertical or perfectly inelastic demand curve, as shown on the right graph, with the quantity demanded constant.

## THINKING ABOUT ECONOMICS

*Is the slope of the demand curve related to the price elasticity of demand?*

There is no automatic connection between the slope of the demand curve and a product's price elasticity of demand. This is because the slope of the demand curve reflects the change in price divided by the change in quantity demanded, while elasticity is expressed in terms of *percentage* changes in price and quantity demanded. There is a loose connection between the two concepts, however, as shown

in Figure 3.1. When two demand curves—one fairly flat and one more steep—are drawn on the same set of axes, the flatter curve ( $D_1$ ) is more elastic than the steeper curve ( $D_2$ ) over a given price range. This is because the flatter curve ( $D_1$ ) is associated with a greater adjustment in quantity demanded and hence a more elastic demand.

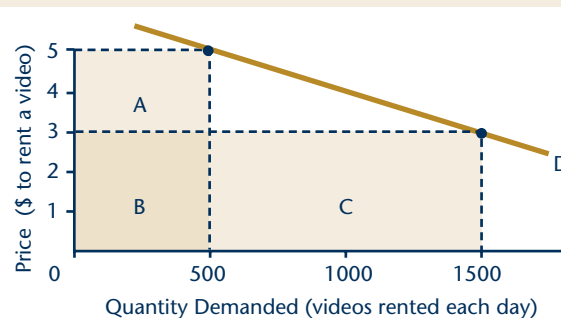
**Question**

Is there an automatic connection between the slope of the demand curve and the price elasticity of demand in the case of perfectly elastic and perfectly inelastic demand curves?

**ELASTIC DEMAND**

If demand for a product is elastic, price changes cause large variations in quantity demanded. Since a price increase of a certain percentage causes an even bigger percentage decrease in quantity demanded, the sellers' total revenue is reduced. Likewise, a price decrease of a certain percentage causes an even bigger percentage increase in quantity demanded, thus raising total revenue for the sellers. So, when demand is elastic, total revenue and price have an inverse relationship—total revenue changes in the opposite direction to the change in price.

Let us take a look at an example. All-U-Want Videos faces an elastic demand for video rentals, as shown in Figure 3.3. At a price of \$5 per video, 500 videos are rented each day. The store's total revenue at this point on the demand curve is \$2500 (= \$5 × 500 videos). This total revenue is represented by the area of the shaded rectangle AB. At a price of \$3 per video, 1500 videos are rented each day, pushing up total revenue to \$4500 (\$3 × 1500 videos), which is represented by the shaded area BC. Therefore, a decrease in price raises the store's total revenue because the effect of the price decrease is outweighed by the effect of the increased quantity demanded.

**Figure 3.3** Revenue Changes with Elastic Demand

With elastic demand, a 40 percent decrease in the rental price from \$5 to \$3 causes a larger 200 percent increase in daily rentals. Total revenue for the business increases from the area AB to the area BC. Thus, the changes in price and total revenue are in opposite directions. (Note that area C is greater than area A.)

### INELASTIC DEMAND

When the demand for a product is inelastic, changes in price have less effect on quantity demanded. Since an increase in price leads to a smaller percentage decrease in quantity demanded, the sellers' total revenue increases. Similarly, a decrease in price causes a smaller percentage increase in quantity demanded, thus causing total revenue to fall. Therefore, when demand is inelastic, price and total revenue have a direct relationship—total revenue shifts in the same direction as the change in price. Take, for example, a ride at an amusement park that has inelastic demand, as shown in Figure 3.4. With a price of \$2, there are 10 000 riders a day. Total revenue for the ride's operator, therefore, is \$20 000, as shown by the shaded area FG. If price increases to \$3, there are 8000 riders a day and a total revenue of \$24 000, as shown by the shaded area EF. Therefore, an increase in price adds to the total revenue because the price increase more than compensates for the reduced quantity demanded.

### UNIT-ELASTIC DEMAND

**unit-elastic demand:** demand for which a percentage change in price causes an equal change in quantity demanded

In the case of **unit-elastic demand**, a percentage change in price causes an *equal* percentage change in quantity demanded. Thus, when demand is unit-elastic, a price change leaves total revenue unchanged. This is because the revenue gain caused by a price increase is precisely offset by the lost revenue due to the decrease in quantity demanded. The effect of a price change on total revenue in this case is summarized, along with all other possible cases, in Figure 3.5.

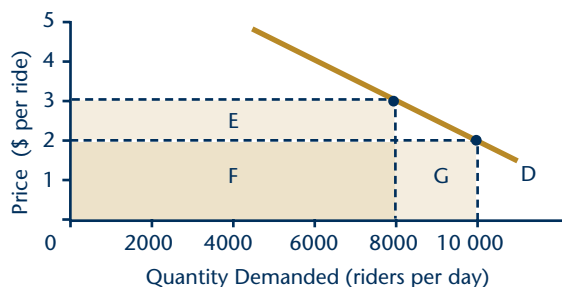
## Factors That Affect Price Elasticity of Demand

Four factors affect a product's price elasticity of demand: the portion of consumer incomes devoted to buying the product, consumer access to substitutes, whether the product is a necessity or a luxury, and the time consumers have to adjust to price changes.

### PORTION OF CONSUMER INCOMES

If the price of a product represents a hefty portion of consumer incomes, consumers will be more responsive to price changes. For those consumers who are deciding whether or not to buy a stereo, for example, a price change can often determine

**Figure 3.4** Revenue Changes with Inelastic Demand



Because demand is inelastic, a 50 percent rise in the price of the ride causes a smaller 20 percent drop in daily ridership. As a result, total revenue for the ride's operator grows from area FG to area EF. The changes in price and total revenue are, therefore, in the same direction. (Note that area E is greater than area G.)

**Figure 3.5** Price Elasticity of Demand and Changes in Total Revenue

	Price Change	Change in Total Revenue
Elastic Demand	up	down
	down	up
Inelastic Demand	up	up
	down	down
Unit-Elastic Demand	up	unchanged
	down	unchanged

whether or not they make the purchase. If stereo prices are cut in half, quantity demanded will rise by a considerably higher percentage. In contrast, consumers who are deciding how much sugar to buy pay little attention to price; a 50 percent drop in the price will cause a much smaller percentage increase in the amount of sugar purchased. The demand for big purchases, therefore, tends to be more elastic than the demand for smaller purchases.

#### ACCESS TO SUBSTITUTES

If there are many close substitutes for a product, consumers will be more responsive to changes in the product's price because they have more options and can easily change their buying patterns. The demand for a particular brand of athletic shoes, for example, will be more elastic than the demand for athletic shoes in general. If only one brand becomes more expensive, its quantity demanded will plummet as consumers substitute cheaper brands. A rise in the price of all athletic shoes, however, will not radically affect quantities purchased. As this example illustrates, the more narrowly a product is defined, the more elastic its demand will be.

#### NECESSITIES VERSUS LUXURIES

Recall that necessities are essential items—such as bread and milk—that satisfy basic wants. Consumers tend to buy similar amounts of necessities, regardless of their price; thus, necessities tend to have inelastic demand. In contrast, such products as tourist travel, expensive sports cars, and yachts are luxuries that buyers can easily live without. Because these items are expendable, their demand tends to be elastic.

#### TIME

Demand tends to become elastic over time. In the short run, consumers do not generally respond greatly to price. For example, immediately after a price increase, consumers of nachos will not modify their buying habits significantly, and users of furnace oil will continue to purchase furnace oil, regardless of price. Over time, however, consumers change their habits and needs: nacho-eaters might reduce their consumption, and home-owners might change their furnaces so as to use less fuel.

### Calculating Price Elasticity of Demand

It is possible to quantify elasticity—that is, give it a numerical value. The larger this numerical value ( $e_d$ ), the greater the price sensitivity—or price elasticity—of the

product's demand. If  $e_d$  is greater than 1, then quantity demanded is sensitive to price changes, and demand is elastic. If  $e_d$  is less than 1, the quantity demanded is comparatively unresponsive to price changes, and demand is inelastic. If  $e_d$  is 1, then the product is unit-elastic.

Recall the case of All-U-Want Videos (Figure 3.3), which rents out 500 videos a day at a price of \$5 each and 1500 videos when the price drops to \$3. All-U-Want Videos can use the following formula to calculate the price elasticity of demand. In the formula,  $Q_d$  stands for quantity demanded, and  $\Delta$  stands for change. (The symbol  $\Delta$  is the Greek capital letter "delta," which signifies a change in some variable.)

$$\begin{aligned}
 e_d &= \frac{\Delta Q_d \div \text{average } Q_d}{\Delta \text{ price} \div \text{average price}} \\
 &= \frac{(1500 - 500) \div [(1500 + 500) \div 2]}{(\$3 - \$5) \div [(\$3 + \$5) \div 2]} \\
 &= \frac{1000 \div 1000}{-\$2 \div \$4} \\
 &= \frac{1}{-1/2} \\
 &= (-)2
 \end{aligned}$$

Recall that we identified whether demand curves were elastic or inelastic by comparing percentage changes in quantity demanded and price. To calculate these percentage changes, we divided the absolute changes in both quantity demanded and in price by their respective initial values. While this is the simplest procedure, it is not sufficiently exact when calculating numerical values for elasticity. Instead of using the initial values for quantity demanded and price, we incorporate the average values of these two variables in our formula. Over a given range of a demand curve, these average values are the same no matter whether we are moving up or down the demand curve. This useful property does not apply to the initial values of either quantity demanded or price, which are different depending on where we start on the demand curve.

So, in the numerator and denominator of this formula, the changes in quantity demanded and price, respectively, are divided by each variable's average value. The average quantity demanded is the value at the midpoint between the old and new quantities demanded, and is found by adding together the new and old quantities demanded and then dividing by 2. The same method is used to derive the average price, which is the value at the midpoint between the old and new prices, and is the sum of the new and the old prices divided by 2. Therefore, in the example of All-U-Want Videos,  $e_d$  is 2, which means that a certain percentage change in price (calculated using average price) causes twice that percentage change in quantity demanded (calculated using average quantity demanded). Note that the answer is a pure number with no units attached. Also, it always has a negative sign, because its formula's numerator and denominator necessarily have different signs. Because it is customary to define the numerical value of the price elasticity of demand in terms of the number's absolute value, this negative sign is usually cancelled out of the final answer. The negative sign is ignored, so the number is always considered to be positive.

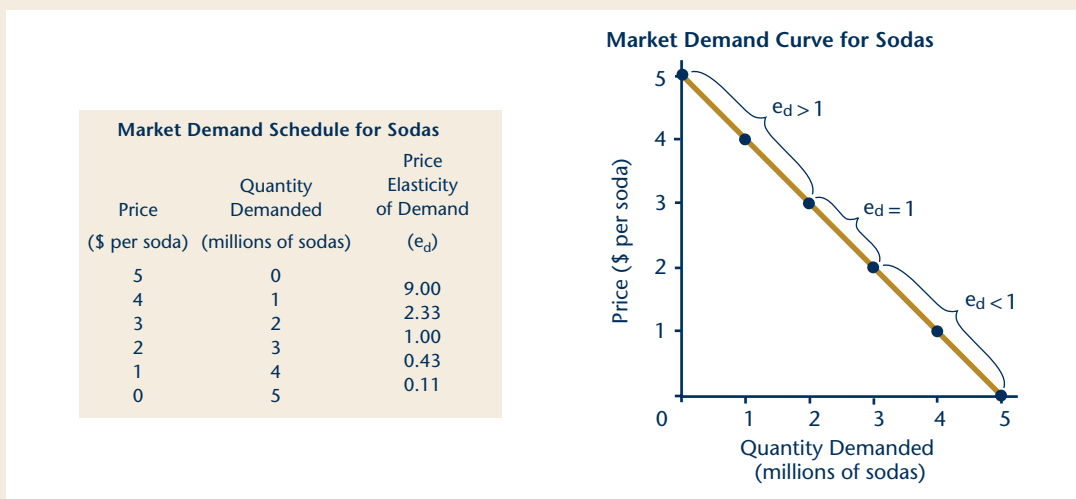
## Elasticity and Linear Demand Curves

It is possible to calculate the price elasticity for various ranges along a linear demand curve. A linear demand curve's slope is constant, given the definition of slope as the change in price over change in quantity demanded—the “rise” over the “run.” We can see this in Figure 3.6, which shows a hypothetical market demand curve for sodas. Anywhere along this curve, quantity demanded rises by 1 million sodas for each \$1 drop in price, giving a slope of  $-1$  millionth. But the curve's elasticity coefficient, which is the ratio of the relative changes in quantity demanded and price, varies as we move along the curve. Between prices \$5 and \$4, the coefficient has a value of  $(-9)$ . Then, for each new lower pair of prices, the coefficient drops—to 2.33 (between \$4 and \$3), 1 (between \$3 and \$2), 0.43 (between \$2 and \$1), and finally 0.11 (between \$1 and \$0).

The reason for the varying values of price elasticity is that at high prices (such as \$5 and \$4), the \$1 price change is made smaller when dividing by average price (\$4.50). At the same time, the change in quantity demanded (1 million sodas) is made larger when compared with average quantity demanded (500 000). The result is an elasticity coefficient greater than 1, with the curve being elastic in its upper range. But further down the demand curve, the relationship between price and quantity is reversed. At low values of price (such as \$1 and \$0), the same \$1 price change is made larger when compared with average price (\$0.50), while the high values for quantity demanded (4 million and 5 million sodas) mean the change in quantity demanded of 1 million sodas is made smaller relative to the average quantity (4.5 million sodas). The elasticity coefficient is, therefore, less than 1, and the curve is inelastic in its lower range. Finally, in the curve's middle range, the relative changes in price and quantity demanded just balance one another so that the curve in this range is unit-elastic.

The implication of this illustration is clear: it is best to be careful when referring to a linear demand curve as either elastic or inelastic.

**Figure 3.6** Elasticity and a Linear Demand Curve



The slope of this linear demand curve is always  $-1$  millionth. But at any price range above \$3, this linear demand curve is elastic, with a price elasticity ( $e_d$ ) greater than 1. Between prices \$3 and \$2, the curve is unit-elastic, given an  $e_d$  equal to 1. Finally, at any price range below \$2, the curve is inelastic, and  $e_d$  is less than 1.

## Income and Cross-Price Elasticities

The price elasticity of demand is not the only elasticity concept relating to demand. One can also measure the extent to which a product's quantity demanded varies with changes in consumer income or the price of another product.

**income elasticity:** the responsiveness of a product's quantity demanded to a change in average consumer income

**Income elasticity** ( $e_i$ ) is defined as the responsiveness of a product's quantity demanded to an adjustment in consumer income and is calculated as the ratio of the changes in quantity demanded and consumer income, with each change divided by its respective average value. The formula for income elasticity is, therefore, similar to the mathematical expression for the price elasticity of demand. It is the ratio of the change in quantity demanded ( $\Delta Q_d$ ) divided by its average value, over the change in consumer income ( $\Delta I$ ) divided by its average value.

$$e_i = \frac{\Delta Q_d \div \text{average } Q_d}{\Delta I \div \text{average } I}$$

Unlike the case of the price elasticity of demand, the income elasticity's sign is important. For an inferior product, this elasticity is negative because changes in consumer incomes and quantity demanded are in opposite directions. To illustrate, lower consumer incomes increase purchases of canned meat, giving a negative denominator and positive numerator in the formula. In contrast, income elasticity is positive for a normal product because changes in consumer income and the product's quantity demanded are in the same direction. For example, higher consumer incomes mean more purchases of normal products, such as television sets, giving both a positive numerator and a positive denominator. While the income elasticity of normal products that are necessities, such as milk and bread, is positive but relatively low (between 0 and 1), for luxuries, such as caviar or expensive jewellery, the income elasticity is higher (greater than 1).

**cross-price elasticity:** the responsiveness of a product's quantity demanded to a change in the price of another product

Another demand-related elasticity is **cross-price elasticity** ( $e_{xy}$ ), defined as the responsiveness of quantity demanded of one product (x) to a change in price of another (y). In mathematical terms, the formula for cross-price elasticity is the ratio of the changes in quantity demanded of product x ( $\Delta Q_d$ ) and the price of product y ( $\Delta P_y$ ) with each change divided by the respective average value.

$$e_{xy} = \frac{\Delta Q_d \div \text{average } Q_d}{\Delta P_y \div \text{average } P_y}$$

The cross-price elasticity's sign differs, depending on whether products x and y are substitutes or complementary. When one product is a substitute for the other, the cross-price elasticity is positive. This is because the changes in both x's quantity demanded and y's price are in the same direction—as in the case of a fall in the quantity demanded of cassette tapes caused by a drop in the price of CDs. On the other hand, the cross-price elasticity for complementary products is negative. An increase in the quantity demanded of DVDs, for example, might be caused by a fall in the price of DVD players.

## Brief Review

1. Price elasticity of demand is the responsiveness of a product's quantity demanded to changes in the product's price. When demand is elastic, a given percentage change in price causes a larger percentage change in quantity demanded. When demand is inelastic, a given percentage change in price causes a smaller percentage change in quantity demanded.
2. Demand is perfectly elastic when the price of a product is constant at all quantities demanded. Demand is perfectly inelastic when the quantity demanded of a product is constant at all prices. Demand is unit-elastic when a percentage change in price causes an equal percentage change in quantity demanded.
3. Price and total revenue have an inverse relationship when demand is elastic but a direct relationship when demand is inelastic. When demand is unit-elastic, total revenue is constant, regardless of price.
4. Four factors affect the price elasticity of demand of a product: the portion of consumer incomes the product accounts for, access to substitute products, whether the product is a luxury or a necessity, and the amount of time that elapses after a price change.
5. Other demand-related elasticity concepts include income elasticity, which measures the sensitivity of a product's quantity demanded to a change in consumer income, and cross-price elasticity, which measures the sensitivity of a product's quantity demanded to a change in another product's price.

## 3.1 Practice Questions

1. Annual purchases of laptop computers in a certain market are 10 000 at a price of \$3000, 20 000 at a price of \$2000, and 30 000 at a price of \$1000.
  - a. Find producers' total revenue at each price.
  - b. On the basis of your answer to part a., is the market demand curve for laptops elastic or inelastic in the price range \$3000 to \$2000? in the price range \$2000 to \$1000?
  - c. Calculate the numerical values of demand elasticity in the two relevant price ranges.
  - d. Are your answers to parts b. and c. consistent?
  - e. Using EconGraphKit (at <http://www.mcgrawhill.ca/olc/lovelwell>), draw the demand curve for laptops and highlight the rectangles showing total revenue at each of the three prices. Are the changes in these areas consistent with your answers to parts b. and c.? Explain.
2. Calculate the appropriate elasticity coefficient in each of the following cases.
  - a. A drop in the price of hydrogen-powered cars from \$25 000 to \$20 000 causes purchases of gasoline-powered cars to fall from 1 million to 750 000 per year.
  - b. Monthly purchases of cellphones rise from 15 000 to 17 500 when the average price of cellphones decreases from \$120 to \$90.
  - c. A fall in average consumer incomes from \$80 000 to \$50 000 raises weekly purchases of canned sardines from 2000 to 3000 cans.

## 3.2 Price Elasticity of Supply

**price elasticity of supply:** the responsiveness of a product's quantity supplied to a change in price

**elastic supply:** supply for which a percentage change in a product's price causes a larger percentage change in quantity supplied

**inelastic supply:** supply for which the percentage change in a product's price causes a smaller percentage change in quantity supplied

LO 3.2

Just as the price elasticity of demand measures the responsiveness of consumers to a change in a product's price, the **price elasticity of supply** (also called supply elasticity) measures the responsiveness of producers (and the quantities they supply) to changes in the product's own price.

### Elastic and Inelastic Supply

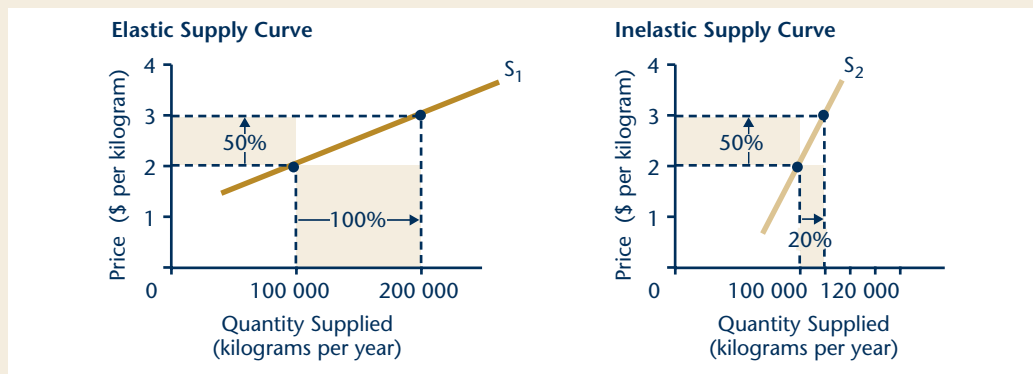
In the case of **elastic supply**, a certain percentage change in the product's price leads to a larger percentage change in its quantity supplied. In other words, the quantity that producers are willing to offer for sale is very responsive to price changes. Consider the example of a tomato producer, as in Figure 3.7. As shown on the graph on the left, if the price of tomatoes increases by 50 percent, from \$2 to \$3 per kilogram, the quantity of tomatoes supplied annually increases from 100 000 to 200 000 kg—a 100 percent increase. If, as shown on the graph on the right, the identical 50 percent price increase for tomatoes causes a much smaller 20 percent increase in quantity supplied—from 100 000 to 120 000 kg—then we have **inelastic supply**. In other words, if a product has inelastic supply, a given percentage change in price results in a smaller percentage change in quantity supplied.

As in the case of the price elasticity of demand, the price elasticity of supply is not the same as the slope of the supply curve. However, when two supply curves are drawn on the same set of axes, as in Figure 3.6, then—over a certain price range—the flatter curve ( $S_1$ ) is more likely to be elastic than the steeper curve ( $S_2$ ).

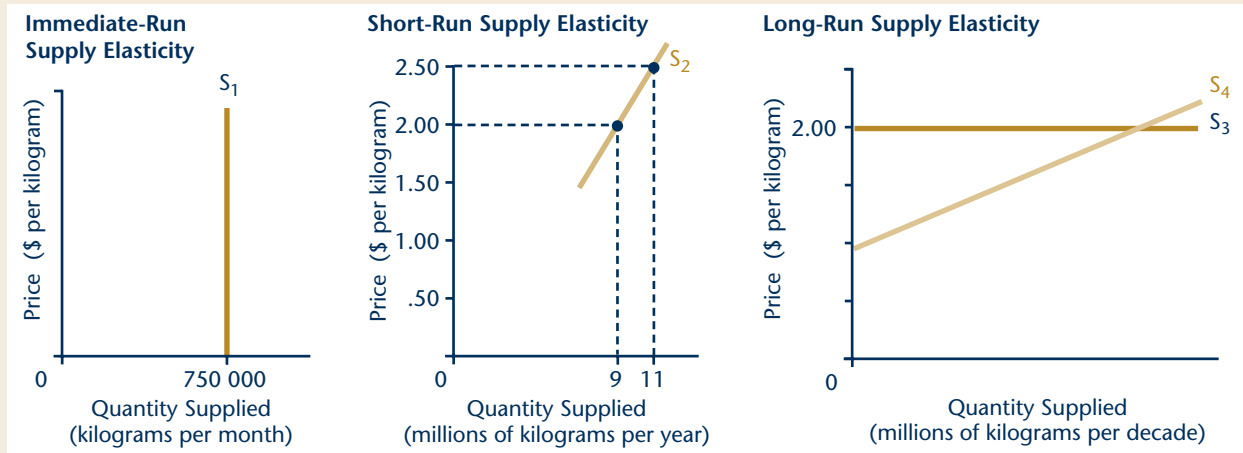
### Factors That Affect Price Elasticity of Supply

The main factor that affects the price elasticity of supply is the passage of time. In competitive markets, three production periods can be distinguished: the immediate run, the short run, and the long run. The price elasticity of supply differs in each period. In Figure 3.8, we illustrate elasticity for each of the three production periods in the market for strawberries.

**Figure 3.7** Elastic and Inelastic Supply



An elastic supply curve ( $S_1$ ) is shown on the left. A 50 percent increase in price leads to a greater 100 percent increase in quantity supplied. The graph on the right shows an inelastic demand curve ( $S_2$ ). The same 50 percent increase in price now leads to a smaller 20 percent increase in quantity supplied.

**Figure 3.8** Time and Price Elasticity of Supply

The immediate-run supply curve  $S_1$  is perfectly inelastic, since a price change does not affect quantity supplied. The short-run supply curve  $S_2$  is either elastic or inelastic, with quantity supplied varying in the same direction as price. The long-run supply curve  $S_3$  shows the case of a constant-cost industry, where supply is perfectly elastic, since price is constant for every possible quantity supplied. The long-run supply curve  $S_4$  shows the case of an increasing-cost industry, where price rises as quantity supplied expands.

### THE IMMEDIATE RUN

**immediate run:** the production period during which none of the resources required to make a product can be varied

**perfectly inelastic supply:** supply for which a product's quantity supplied remains constant regardless of price

**short run:** the production period during which at least one of the resources required to make a product cannot be varied

The **immediate run** is the period during which businesses in a certain industry can make no changes in the quantities of resources they use. In the case of strawberry farming, the immediate run may be a month. For example, if the price of strawberries suddenly jumps as a result of an increase in demand, then, during the immediate run, farmers are unable to increase their production. Because quantity supplied is constant, the supply curve ( $S_1$ ), shown on the left, is vertical at a quantity, such as 750 000 kg. Thus, for the immediate run, the supply is said to be **perfectly inelastic**.

### THE SHORT RUN

The **short run** is the period during which the quantity of at least one of the resources used by businesses in an industry cannot be varied. In the case of strawberry farming, a period of less than a single growing season is bound to be short run. If there is a rise in the price of strawberries from \$2 to \$2.50, then during the short run, farmers can increase their production by, for example, using more labour and maximizing the crop with mulch or fertilizers, but they cannot bring more land into production until the next growing season. In this case, illustrated on the middle graph, the price rise causes an increase in quantity supplied from 9 to 11 million kilograms. The supply curve ( $S_2$ ) for the short run may be either elastic or inelastic. This depends on whether a given percentage change in price causes a bigger or smaller percentage variation in quantity supplied.

### THE LONG RUN

**long run:** the production period during which all resources required to make a product can be varied, and businesses may either enter or leave the industry

In the **long run**, the quantities of all resources used in an industry can be varied. Also, businesses may enter or leave the industry. In the case of strawberry farming, the long run is a period longer than a single growing season—perhaps as long as a decade. Over this period, a rise in the price of strawberries will cause a temporary increase in strawberry farmers' profits beyond what they have been in the past. The lure of these greater profits

leads to more resources being devoted to strawberry production. Not only will existing farmers expand their operations, but new farmers will enter the market. Both these changes increase the quantity supplied of strawberries. Two results are then possible, depending on what happens to price in the long run at the new, higher production levels.

**constant-cost industry:** an industry that is not a major user of any single resource

If strawberry farming is a **constant-cost industry**, which is one that is not a major user of any resource, the increase in quantity supplied following a short-run rise in the price of strawberries has no effect on resource prices. The lure of extra profits keeps production expanding, and the price of strawberries falling, until this price is finally driven back to its original level. Thus, the price of strawberries always returns to the same level in the long run, regardless of quantity supplied. This means that a constant-cost industry, as shown on the right in Figure 3.8, exhibits a horizontal long-run supply curve ( $S_3$ ). For the long run, then, supply is said to be **perfectly elastic**.

**perfectly elastic supply:** supply for which a product's price remains constant, regardless of quantity supplied

If strawberry farming is an **increasing-cost industry**, it is a major user of at least one resource. Therefore, a greater quantity supplied leads to an increase in the price of this single resource, such as land or farm machinery. Again, a short-run rise in the price of strawberries causes production to grow as farmers take advantage of extra profits. As long as the lure of profits remains, price is driven down in the long run to its lowest possible level, but price is now above its initial level, since farmers face higher per-unit costs. Hence, the long-run supply curve ( $S_4$ ) has a positive (upward) slope but is very elastic, showing that quantities supplied are highly sensitive to price changes.

**increasing-cost industry:** an industry that is a major user of at least one resource

## Calculating the Price Elasticity of Supply

The numerical value of the price elasticity of supply ( $e_s$ ) is calculated in a similar way to the price elasticity of demand. When  $e_s$  has a value greater than 1, quantity supplied is sensitive to price changes, and supply is elastic. If  $e_s$  is less than 1, quantity supplied is comparatively unresponsive to price changes, and supply is inelastic.

Consider the case of the tomato industry with an elastic supply curve (Figure 3.7). When the price of tomatoes rises from \$2 to \$3 a kilogram, the quantity supplied by farmers increases from 100 000 to 200 000 kg. The value of the price elasticity of supply for this industry can be found using the following formula, in which  $Q_s$  stands for quantity supplied.

## THINKING ABOUT ECONOMICS

### *Do decreasing-cost industries exist?*

Yes, they do. For example, some industries in the information technology sector have witnessed a marked decrease in product costs as the industries have expanded. The example of computer chips is particularly telling. According to Moore's Law, developed in 1965 by one of the founders of chipmaker Intel, the processing power of computer chips doubles every twelve months. So far, Moore's Law has been correct, reducing the real price of processing power since the

1960s by 99.9999 percent, and there is no reason why this pace of growth cannot continue. But the problem in extending the analysis of long-run supply elasticity to this scenario is that industries with a pattern of decreasing costs will probably not be perfectly competitive: the advantages of "bigness" for the leading businesses in the industry are simply too large to be ignored.

### Question

Presuming a decreasing-cost industry is perfectly competitive, what would the slope of its long-run supply curve be?

$$\begin{aligned}
 e_s &= \frac{\Delta Q_s \div \text{average } Q_s}{\Delta \text{ price} \div \text{average price}} \\
 &= \frac{(200\,000 - 100\,000) \div [(200\,000 + 100\,000) \div 2]}{(\$3 - \$2) \div [(\$3 + \$2) \div 2]} \\
 &= \frac{100\,000 \div 150\,000}{\$1 \div \$2.50} \\
 &= \frac{0.667}{0.4} \\
 &= 1.67
 \end{aligned}$$

Therefore, the tomato suppliers face a price elasticity of supply of 1.67, which means that a certain percentage change in price causes a percentage change in quantity supplied that is 1.67 times as large (when both percentage changes are calculated using average values). Because there is a direct relationship between price and quantity supplied, the changes in these two variables are always in the same direction. Thus, the numerator and the denominator of the supply elasticity formula are either both positive or both negative, giving a final answer that is always positive. Like the numerical value of demand elasticity, this is a pure number with no units attached.

## Brief Review

1. Price elasticity of supply is the responsiveness of a product's quantity supplied to changes in the product's price.
2. When supply is elastic, a given percentage change in price causes a larger percentage change in quantity supplied. When supply is inelastic, a given percentage change in price causes a smaller percentage change in quantity supplied.
3. Price elasticity of supply is dependent mainly on the production period. In the immediate run, supply is perfectly inelastic, meaning, a change in price has no effect on quantity supplied. In the short run, supply may be elastic or inelastic.
4. In the long run, price elasticity of supply depends on the industry's use of resources. In a constant-cost industry (not a major user of any one resource), supply in the long run is perfectly elastic, with a constant price at all possible quantities supplied. In an increasing-cost industry (a major user of at least one resource), the long-run supply is very elastic, with price rising gradually at higher quantities supplied.

## 3.2 Practice Question

In a certain lettuce market, the price rises from \$1 to \$1.20 per head. For each case below, determine the value of  $e_s$  and describe the shape of the supply curve.

- a. In the immediate run, monthly quantity supplied remains constant at 80 000 heads.
- b. In the short run, annual quantity supplied rises from 1 million to 1.2 million heads.
- c. In the long run, the price of lettuce returns to \$1 as quantity supplied continues to expand.
- d. Based on your answer to part c., is this a constant-cost or increasing-cost industry?
- e. Using EconGraphKit (at <http://www.mcgrawhill.ca/college/lovewell>), draw the three supply curves.

### 3.3 Excise Taxes

#### LO 3.3

**excise tax:** a tax on a particular product expressed as a dollar amount per unit of quantity

### The Impact of an Excise Tax

One common application of elasticity is in analyzing the effect of an **excise tax**, which is a tax on a particular good or service expressed as a dollar amount per unit of quantity. For example, a tax of \$1 per kilogram may be imposed in the market for strawberries highlighted in the previous chapter. Figure 3.9 shows its impact. The supply curve for producers remains at  $S_0$ , because the price producers see does not include the tax. But the supply curve facing consumers becomes  $S_1$ , since the price consumers see now includes an extra amount of \$1 per kilogram at every possible quantity level. For example, at the initial quantity of 9 million kilograms, the price of strawberries seen by producers is \$2, found at point  $c$  on  $S_0$ . Meanwhile, the price seen by consumers is \$3, found at the corresponding point  $b$  on  $S_1$ .

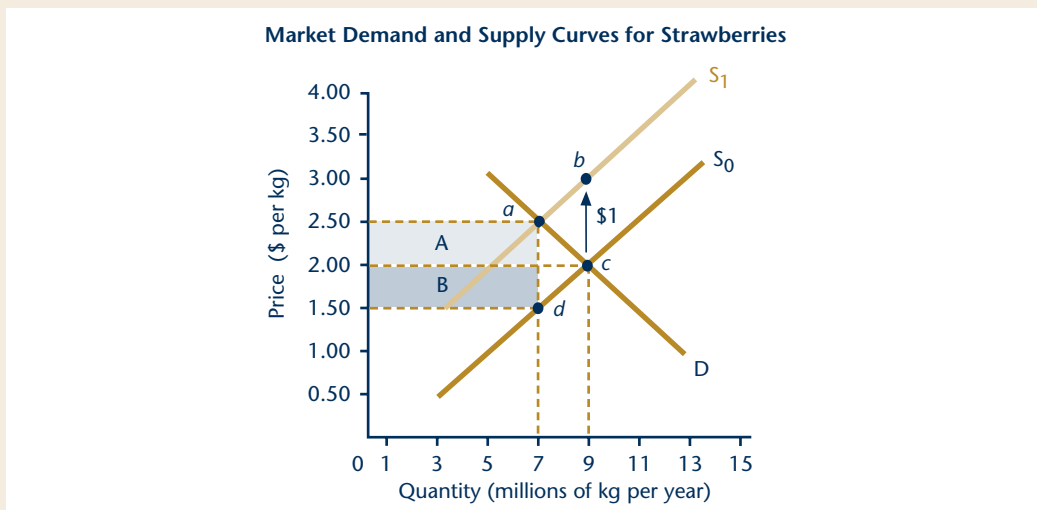
The after-tax equilibrium is at point  $a$ , where the demand curve  $D$  crosses the new supply curve  $S_1$  at a quantity of 7 million kilograms. Equilibrium quantity therefore drops because of the tax. For consumers, price is now \$2.50, as shown by point  $a$ . For producers, price is \$1 less at \$1.50, shown by the corresponding point  $d$  on  $S_0$ .

In this market, half the tax is paid by consumers and half by producers. Graphically, the \$7 million tax payment is shown by the shaded area  $AB$  in Figure 3.9. Area  $A$  represents the \$3.5 million payment by consumers, found by multiplying the tax-induced \$0.50 price rise by the quantity of 7 million kilograms of strawberries. Likewise, area  $B$  represents the \$3.5 million paid by producers, found by multiplying the corresponding \$0.50 price drop by the quantity of 7 million kilograms.

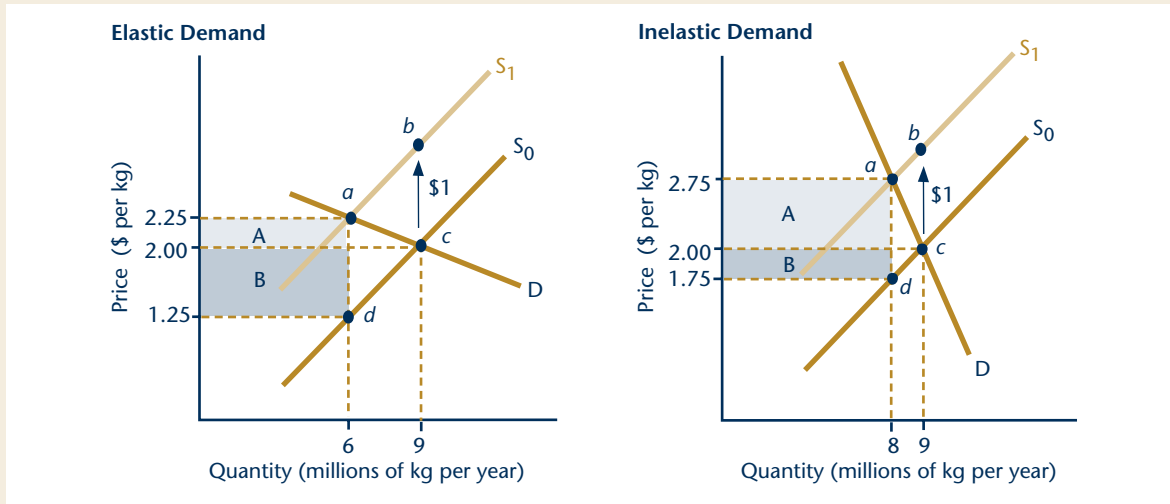
### The Effect of Price Elasticity of Demand

The division of the tax burden is not always equal. One factor that affects this division is the price elasticity of the market demand curve. Figure 3.10 shows two possible demand

**Figure 3.9** The Impact of an Excise Tax



A \$1 excise tax per kg causes the supply curve seen by strawberry consumers to shift to  $S_1$ . At the initial equilibrium, consumers pay a price of \$3 (point  $b$ ) and producers receive a price of \$2 (point  $c$ ). At the new equilibrium, consumers pay a price of \$2.50, producers receive a price of \$1.50, and the total tax payment is equally divided—area  $A$  paid by consumers and area  $B$  by producers.

**Figure 3.10** Excise Taxes and Demand Elasticity

In the left-hand graph, a \$1 excise tax causes supply as seen by consumers to shift to  $S_1$ . Initially consumers see a price of \$3 (point  $b$ ). At the new equilibrium, consumers pay a price of \$2.25 (point  $a$ ) while producers receive a price of \$1.25. Because  $D$  is elastic, producers pay more of the tax (area  $B$ ) than do consumers (area  $A$ ). When  $D$  is inelastic, as in the right-hand graph, however, consumers pay more of the tax (area  $A$ ) than do producers (area  $B$ ).

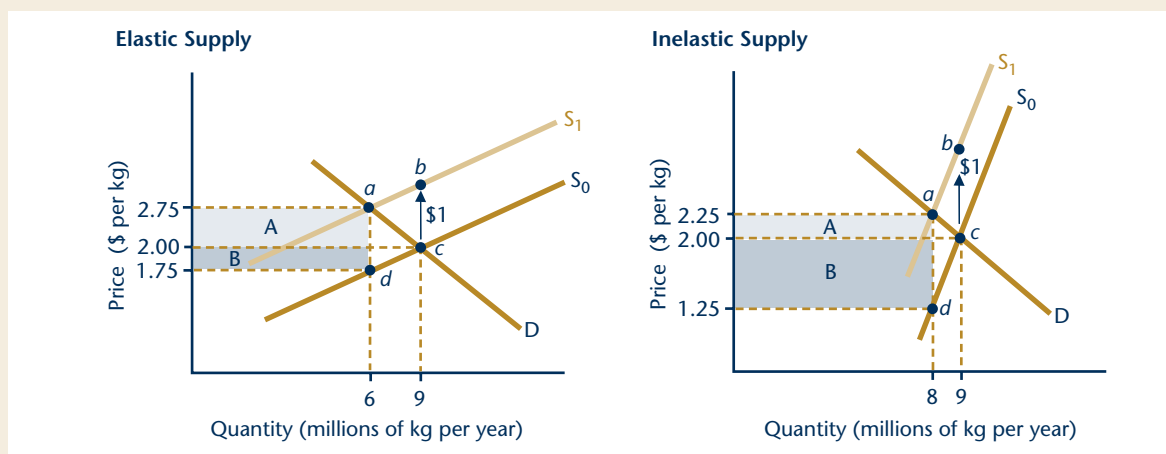
curves for strawberries. In the left-hand graph, the relevant range of the demand curve is relatively elastic. In this case, the tax portion paid by consumers, as represented by area  $A$ , is smaller than that paid by producers, represented by area  $B$ . In contrast, the right-hand graph has a demand curve that is relatively inelastic in the relevant range. Consequently, the portion paid by consumers (area  $A$ ) is larger than that paid by producers (area  $B$ ). As a general rule, whenever supply is given, a more inelastic demand curve means a greater portion of an excise tax is paid by consumers.

### The Effect of Price Elasticity of Supply

The division of the tax burden also depends on the price elasticity of supply, as shown in Figure 3.11. In the left-hand graph, supply is relatively elastic. Here the tax portion paid by consumers (area  $A$ ), exceeds that paid by producers (area  $B$ ). In the right-hand graph, the relatively inelastic supply curve means that the tax portion paid by consumers is now exceeded by that paid by producers. This is shown by the fact that area  $B$  exceeds area  $A$ . As a general rule, when demand is given, a more inelastic supply curve means a greater portion of an excise tax is paid by producers.

### The Role of Elasticity in Tax Policy

These two general rules governing the relative burdens of an excise tax for consumers and producers explain why public authorities are so interested in estimating price elasticities of both demand and supply when considering an excise tax. The combined impact of the price elasticities of demand and supply determine which group ends up paying the bulk of the tax.

**Figure 3.11** Excise Taxes and Supply Elasticity

In the left-hand graph, consumers initially pay a price of \$3 (point *b*) after an excise tax shifts supply as seen by consumers to  $S_1$ . At the new equilibrium, the price for consumers is \$2.75 and for producers is \$1.75. Because  $S$  is elastic, consumers pay more of the tax (area *A*) than do producers (area *B*). However, if  $S$  is inelastic, as in the right-hand graph, producers pay more of the tax (area *B*) than do consumers (area *A*).

## Brief Review

1. The division of the payment of an excise tax between consumers and producers depends on the extent to which the resulting price rise seen by consumers compares with the price drop seen by producers.
2. With supply given, a more inelastic demand means that a larger portion of an excise tax is paid by consumers.
3. With demand given, a more inelastic supply means that a larger portion of an excise tax is paid by producers.

## 3.3 Practice Questions

1. Using EconGraphKit (at <http://www.mcgrawhill.ca/olc/lovewell>), draw a graph portraying a market with an inelastic demand curve and an elastic supply curve. Then show how an excise tax affects this market. Do consumers or producers pay the greater burden of this tax? Explain.
2. Again using EconGraphKit (at <http://www.mcgrawhill.ca/olc/lovewell>), draw a graph displaying a market with an elastic demand curve and an inelastic supply curve. Now show how an excise tax affects this market. Do consumers or producers pay the greater burden? Explain.

## 3.4 Price Controls

### LO 3.4

**price floor:** a legal minimum price

**price ceiling:** a legal maximum price

Sometimes, governments see fit to control prices, thus overriding the forces of demand and supply and the “invisible hand” of competition. There are two types of price controls. A **price floor** is a legal minimum price. To be effective, such a floor must be set above the price that would otherwise exist in equilibrium. A **price ceiling** is a legal maximum price. This ceiling will be effective only if set below the equilibrium price. An example is rent controls. Notice that “floor” and “ceiling” have special meanings in economics. Unless a price floor is higher than equilibrium, it will have no effect on the price prevailing in the market. Similarly, a price ceiling must be lower than equilibrium to be relevant.

Demand and supply can be used to analyze the effects of government programs to control prices. Because analyzing price controls also involves weighing one goal against another, the analysis depends on value judgements and so is part of normative economics.

## Agricultural Price Supports

Agricultural markets provide a useful example of the potential difficulties encountered by competitive producers.

Given the nature of demand and supply for most agricultural products, farmers face product prices that can fluctuate widely. Such products as milk and wheat are viewed as necessities by consumers, so demand curves for these items are inelastic, especially in the short run. Similarly, the short-run supply curves for most agricultural products are inelastic because farmers find it difficult to vary quantity supplied over brief time periods.

Inelastic demand and supply in agricultural markets mean that changes in either demand or supply lead to relatively large price changes. This is illustrated in Figure 3.12, using a hypothetical market for wheat. A decrease in the supply of wheat, due to unfavourable weather, leads to a fairly small decrease in the equilibrium quantity but a considerable rise in price.

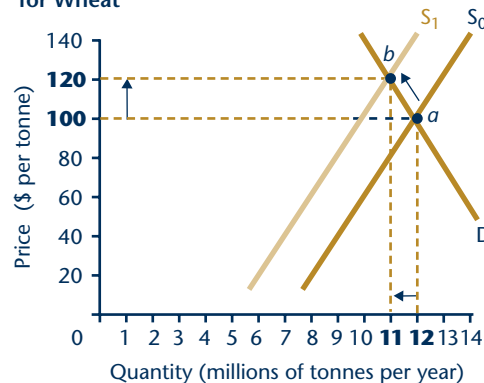
Unstable prices, therefore, can cause large fluctuations in farmers’ incomes. In the years when prices are high, farmers can make substantial revenues, but low prices cause revenues to plummet. Over the long term, farmers also face pressures from the introduction of more

**Figure 3.12** Price Fluctuations in Agriculture

**Market Demand and Supply Schedules for Wheat**

Price (\$ per tonne)	Quantity Demanded (D) (millions of tonnes)	Quantity Supplied (S <sub>0</sub> ) (S <sub>1</sub> ) (millions of tonnes)
\$140	10	14 → 12
<b>120</b>	<b>11</b>	13 → <b>11</b>
<b>100</b>	<b>12</b>	12 → 10
80	13	11 → 9
60	14	10 → 8

**Market Demand and Supply Curves for Wheat**



Because both the demand and the supply for wheat are inelastic in the short run, a decrease in supply caused by such a factor as unfavourable weather has a relatively large effect on price, with its equilibrium value rising 20 percent. At the same time, equilibrium quantity adjusts by a smaller percentage.

sophisticated and expensive production techniques, which make small producers less able to compete with large agribusinesses, especially when they are forced to sell to one of a few food-processing companies that dominate many agricultural markets. Consequently, many Canadian farmers have decided that the returns from agriculture are no longer worth the effort. The total number of Canadian farms is undergoing a gradual but persistent decline, as shown in Figure 3.13.

To counter these difficulties, farmers often request that governments intervene in markets to stabilize prices at favourable levels. In the past, federal and provincial governments have usually responded positively to these demands, not only out of a desire to stabilize prices and farm incomes but also because the family farm represents a traditional institution that many Canadians wish to see maintained through government intervention.

One type of government program is price supports, illustrated by a hypothetical market for milk in Figure 3.14. Without government intervention, this market would reach an equilibrium price of \$1.10 per litre and an associated quantity of 60 million litres sold per year. A government agency pays a minimum or floor price, such as \$1.30, which is above the equilibrium level. The floor price has two effects: quantity demanded decreases from 60 to 59 million litres, and quantity supplied increases from 60 to 62 million litres. Both effects lead to a surplus of the commodity of 3 million litres per year (= 62 million – 59 million), which the government agency purchases.

### WINNERS AND LOSERS

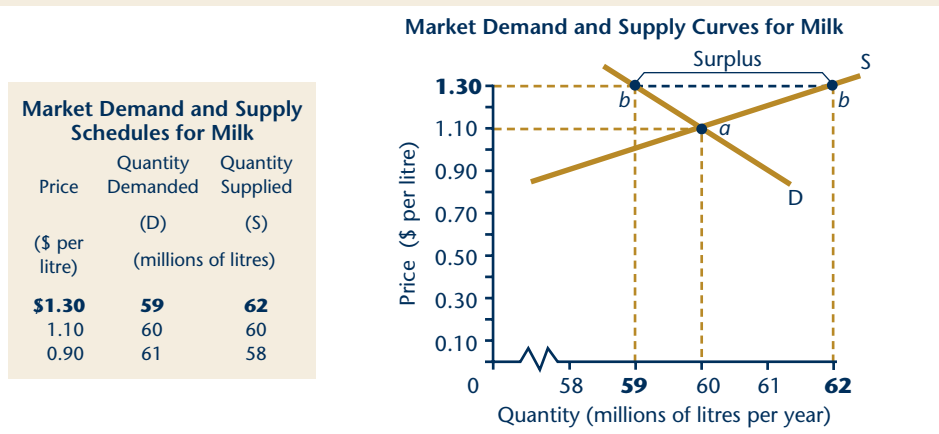
Farmers are the obvious winners from price supports. The program causes both price and quantity supplied to increase and also raises farmers' revenues. Consumers lose because of the higher prices they pay, while taxpayers lose because they must foot the bill for the government agency's purchases of surplus products. Finally, by causing economic resources to be devoted to the production of unneeded agricultural surpluses, this program also works to the disadvantage of society as a whole. Are the benefits to

**Figure 3.13** Total Number of Farms in Canada (thousands)

Year	Canada	Nfld	PEI	NS	NB	Que	Ont	Man	Sask	Alta	BC
1931	728.6	n.a.	12.9	39.4	34.0	136.0	192.2	54.2	136.5	97.4	26.1
1941	732.8	n.a.	12.2	33.0	31.9	154.7	178.2	58.0	138.7	99.7	26.4
1951	623.1	3.6	10.1	23.5	26.4	134.3	150.0	52.4	112.0	84.3	26.4
1956	575.0	2.4	9.4	21.1	22.1	122.6	140.6	49.2	103.4	79.4	24.8
1961	480.9	1.8	7.3	12.5	11.8	95.8	121.3	43.3	94.0	73.2	20.0
1966	430.5	1.7	6.4	9.6	8.7	80.3	109.9	39.7	85.6	69.4	19.1
1971	366.1	1.0	4.5	6.0	5.5	61.3	94.7	35.0	77.0	62.7	18.4
1976	338.6	0.9	3.7	5.4	4.6	51.6	88.8	32.1	71.0	61.1	19.4
1981	318.4	0.7	3.2	5.1	4.1	48.1	82.4	29.4	67.3	58.1	20.0
1986	293.1	0.7	2.8	4.2	3.5	41.5	72.7	27.3	63.4	57.8	19.1
1991	280.1	0.7	2.4	3.9	3.2	38.1	68.6	25.7	60.8	57.2	19.2
1996	276.6	0.7	2.2	4.5	3.4	36.0	67.5	24.4	57.0	59.0	21.9
2001	246.9	0.6	1.8	3.9	3.0	32.1	59.7	21.1	50.6	53.7	20.3

The total number of Canadian farms has fallen consistently since 1931. This trend is also reflected in each of the provinces, although there have been several periods during which the number of farms in some provinces has stayed constant or even increased.

Source: Statistics-Canada "Total Number of Farms in Canada (thousands)," adapted from the Statistics Canada publication "Historical Overview of Canadian Agriculture (data and analytical products: 1996 Census of Agriculture)," Catalogue 93-358, August 1997, pp. 2-43 and "Farm Data for the 2001 Census of Agriculture (Initial release)," Catalogue 95F0301, May 15, 2003, Table 3.

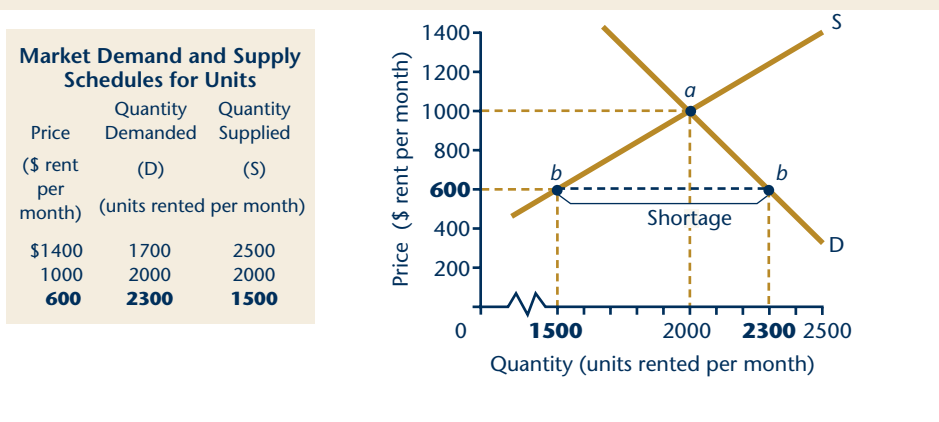
**Figure 3.14** Effects of Price Supports

Because the equilibrium price for milk (point a) is considered too low, the government agency imposes a price floor. This creates a milk surplus, at points b. As long as the demand and supply curves remain the same, this surplus will recur each year, and the government agency's stock of milk will increase.

farmers worth the costs to consumers, taxpayers, and the rest of society? The answer to this question depends on how important you consider the stability and health of the farming sector to be in relation to the costs of supporting the agricultural sector.

## Rent Controls

Another way that governments override the “invisible hand” of competition is with price ceilings, which are upper limits to a price, such as rent. For example, a rent-control program was imposed on rental housing in Ontario in the 1970s due to pressure from tenant lobby groups, with capped rent increases kept below the rate of inflation. The effect of rent controls in a hypothetical large community with a competitive rental market is shown in Figure 3.15, assuming that all rental units in this market are identical. Without a rent-control program, equilibrium in the market would occur at a monthly

**Figure 3.15** Effects of Rent Controls

Rent controls force price below the equilibrium level, from point a to points b. Quantity demanded rises at the new price, while quantity supplied falls. The price ceiling thus causes a shortage.

rent per unit of \$1000 and a total of 2000 units rented per month. Controls push rents below the equilibrium level, to a value of \$600. Consequently, quantity demanded increases from 2000 to 2300 units as more consumers enter the market. At the same time, quantity supplied falls from 2000 to 1500 units as landlords find it profitable to provide fewer units than before.

Quantity supplied is reduced in two ways: new rental construction is cut back, and some existing buildings are demolished or converted to other uses. The result of this artificially low rent is a shortage of 800 ( $= 2300 - 1500$ ) rental units. This shortage makes itself felt through a low vacancy rate for units. This means an unusually small percentage of units are available for rent at any given time.

As a rule, shortages foster underground markets. In the case of rental housing, some landlords and tenants who are subletting their apartments to other tenants charge a fee for preference among people on waiting lists. These fees, or bribes, are known as “key money” and are illegal. To get around the law, key money often takes imaginative forms, such as forced purchases of furnishings at exorbitant prices.

### WINNERS AND LOSERS

According to critics, even though rent controls may appear to offer tenants some short-run protection, in the long run they harm society as a whole by driving economic resources away from an important housing market and creating a shortage. Because of the restraints placed on landlords in setting their own price, they are particularly hurt by such controls. Some tenants gain from controls, especially middle-class tenants who have the connections and credentials to acquire the most desirable units. However, the shortage caused by controls pushes many poorer tenants into unregulated units, such as basement flats and rooming houses, with rents that are often higher than for units in the controlled market. Therefore, not only do rent controls lower the stock of rental housing, but they can affect different income groups unfairly.

## Brief Review

1. For various reasons, governments sometimes choose to intervene in markets to override the “invisible hand” of competition. Price controls are one form of intervention and take the form of price floors and price ceilings.
2. Setting a price floor, or a minimum allowable price, in a competitive market tends to cause surpluses.
3. Setting a price ceiling, or a maximum allowable price, in a competitive market tends to cause shortages.

## 3.4 Practice Question

For each of the following price controls, outline the costs and benefits for consumers and producers.

- a. A rent ceiling of \$500 per month is imposed in a market where equilibrium rent would otherwise be \$650.
- b. A price floor of \$2 per kg is set in a market for cheddar cheese. Without this program, the equilibrium price for cheddar cheese would be \$1.50.
- c. A rent ceiling of \$700 per month is imposed in a market where the equilibrium rent would otherwise be \$600.

## LASTWORD

This chapter has extended the basics of demand and supply studied in Chapter 2 to examine in more detail how buyers and sellers interact in private markets. The concept of elasticity has allowed us to see how consumer decisions affect the sellers' total revenue and how supply factors affect price and quantity in various production periods. We then looked at some

of the ways that government chooses to intervene in private markets—either by levying excise taxes or by imposing price controls. In the following chapters, we will further explore the ways in which businesses and consumers interact in particular markets and examine other forms of intervention that governments use to amend market outcomes

### Key Concepts

constant-cost industry 64	inelastic demand 53	price ceiling 69
cross-price elasticity 60	inelastic supply 62	price elasticity of demand 53
elastic demand 53	long run 63	price elasticity of supply 62
elastic supply 62	perfectly elastic demand 54	price floor 69
excise tax 66	perfectly elastic supply 64	short run 63
immediate run 63	perfectly inelastic demand 54	total revenue 54
income elasticity 60	perfectly inelastic supply 63	unit-elastic demand 56
increasing-cost industry 64		

### Questions

1. Explain whether demand for each of the following is likely to be inelastic, elastic, or unit-elastic. Given your answers, outline whether the sellers' total revenue will increase, decrease, or stay constant if each item's price increases.
  - a. Milk
  - b. A particular computer model
  - c. Yachts
2. In each case below, determine the effect on the sellers' total revenue and identify whether the demand curve is elastic, inelastic, or unit-elastic:
  - a. Price falls from \$2 to \$1.50 along the market demand curve for strawberries ( $D_m$ ) shown in Figure 2.2 in Chapter 2.
  - b. Price rises from \$150 to \$200 along the original demand for skis ( $D_0$ ) shown in Figure 2.4 in Chapter 2.
  - c. Price drops from \$12 to \$8 along the demand curve for CDs shown on p. xxv of the Skills Resource.

#### Market Demand and Supply Schedules for Leather Jackets

Price (\$ per jacket)	Quantity Demanded (jackets per year)	Quantity Supplied (jackets per year)
\$300	69 000	108 000
250	77 000	77 000
200	86 000	53 000
150	94 000	31 000
100	103 000	19 000

3. a. Use the table displayed above to draw a graph showing the market demand curve and supply curve ( $D_0$  and  $S_0$ ) for a hypothetical market for leather jackets. On your graph, indicate the equilibrium price and quantity.

- b. Due to an increase in the number of producers in this market, the annual quantity supplied in this market increases by 33 000 jackets at every price. On the same graph you have drawn in part a., show the new market supply curve ( $S_1$ ) and indicate the new equilibrium price and quantity.
- c. Calculate the change in total revenue for producers in this market due to the shift from  $S_0$  to  $S_1$ . Is the demand for leather jackets between the old and new equilibrium points inelastic or elastic? Explain.

#### Market Demand Schedule for Canoes

Price (\$ per canoe)	Quantity Demanded (canoes per month)
\$800	400
600	800
400	1200
200	1600

4.
  - a. Use the market demand schedule for canoes shown above to find the total revenue at each given price.
  - b. On the basis of your answer to part a., state whether the market demand for canoes is elastic, inelastic, or unit-elastic in the three price ranges \$800 to \$600, \$600 to \$400, and \$400 to \$200.
  - c. Compute the numerical values of the price elasticity of demand in the three relevant price ranges.
  - d. Are your answers to parts b. and c. consistent? Explain.
  - e. Graph the market demand curve for canoes (D) and calculate the numerical value of its slope. Does a demand curve with a constant slope have a constant numerical elasticity? Explain.
5. Calculate the appropriate elasticity coefficient in each of the following cases:
  - a. Annual purchases of computers rise from 200 000 to 300 000 when average consumer incomes increase from \$50 000 to \$70 000.
  - b. Consumer A's monthly magazine purchases fall from 4 to 3 magazines when the price she pays each month for unlimited access to the Internet decreases from \$20 to \$10.
  - c. Weekly purchases of packs of chewing gum rise from 1.2 million to 1.7 million packs when their price declines from \$1 to 85 cents.
  - d. A fall in the average price of DVDs from \$30 to \$25 increases purchases of DVD players from 10 000 to 15 000 per month.
  - e. A rise in the price of wheat from \$110 to \$135 per tonne increases the amount supplied by wheat farmers from 8 million to 9 million tonnes.
6. In the silver market, 1 million ounces are offered for sale each month by producers at the initial price of \$6 per ounce. The price then rises to \$8.
  - a. What happens to the quantity supplied of silver in the immediate run at the new \$8 price? Sketch the immediate-run supply curve to explain your answer.
  - b. In what direction will the quantity supplied of silver change in the short run at the new \$8 price? Sketch the short-run supply curve to explain your answer.
  - c. How will the price of silver change in the long run if this is a constant-cost industry? an increasing-cost industry? Sketch long-run supply curves to explain your answers.

7. a. Compute the numerical values of the price elasticity of supply for the market supply curve for strawberries (S) shown in Figure 2.5 in the two price ranges \$1.50 to \$2, and \$2 to \$2.50.  
 b. Is the supply elastic, inelastic, or unit-elastic between prices \$1.50 and \$2.50?  
 c. Must a supply curve with a constant slope have a constant numerical elasticity? Explain.

### Market Demand and Supply Schedules for Milkshakes

Price (\$ per bottle)	Quantity Demanded (millions of shakes per year)	Quantity Supplied (millions of shakes per year)
	D	$S_0$
\$2.00	2	14
1.90	6	12
1.80	10	10
1.70	14	8
1.60	18	6
1.50	22	4
1.40	24	2

8. a. Using the table above, draw a graph showing the demand curve (D) and the initial supply curve ( $S_0$ ) for milkshakes. Identify the equilibrium price and quantity before the imposition of an excise tax.  
 b. In order to raise funds for the government, an excise tax of 30 cents per milkshake is imposed in this market. Draw the new supply curve  $S_1$  facing consumers, and find the new equilibrium point. Then calculate the total tax payment made by consumers and producers. Which group pays most of the tax? Why?
9. a. Sketch a graph showing a market with a perfectly elastic supply curve. If an excise tax is levied in this market, how is the burden of payment shared between consumers and producers? Explain.  
 b. Now sketch a graph showing a market with a perfectly elastic demand curve. How is the burden of payment of an excise tax shared between consumers and producers in such a market? Explain.

### Market Demand and Supply Schedules for Cream Cheese

Price (\$ per kilogram)	Quantity Demanded (thousands of kilograms per year)	Quantity Supplied (thousands of kilograms per year)
	$D_0$	$S_0$ $S_1$
\$4.50	560	1350      →      1890
4.00	590	1130      →      1420
3.50	630	890      →      960
3.00	670	670      →      670
2.50	700	440      →      380

10. a. Using the table above, draw a graph showing the demand curve ( $D_0$ ) and the short-run supply curve ( $S_0$ ) for cream cheese. Identify the equilibrium price and quantity in the absence of government intervention and calculate the consumers' total expenditure and the total revenue received by producers.  
 b. After lobbying by the dairy industry, government imposes a price support for cream cheese of \$4 per kilogram and agrees to purchase any unsold portion of the product at the \$4 price. Outline the short-run effect of this program on consumers and producers.

- c. In the long run, the annual supply curve for cream cheese becomes  $S_1$ . How do the long-run effects of the \$4 price support differ from the short-run effects on consumers and producers?
- d. Is the price-support program more costly to taxpayers in the short run or in the long run? Explain.

**Market Demand and Supply Schedules for Apartments**

Price (\$ per month)	Quantity Demanded (thousands of units rented per month)		Quantity Supplied (thousands of units rented per month)
	$D_0$	$D_1$	$S_0$
\$800	14.5	→ 18.4	18.4
700	17.3	→ 21.2	17.3
600	19.5	→ 23.4	16.4
500	22.0	→ 25.9	15.6
400	23.7	→ 27.6	14.2

- 11. For the schedules above, draw a graph showing the original demand curve ( $D_0$ ) and supply curve ( $S_0$ ) for apartments in a particular community.
  - a. Identify the equilibrium price and quantity in the absence of government intervention.
  - b. Using your graph, outline how a \$500 price ceiling imposed by government affects this market. In your answer, make sure to distinguish between tenants who are able to find apartments at the ceiling price and those who are unable to do so.
  - c. An increase in the price of single-family dwellings in the community causes the demand for apartments to shift from  $D_0$  to  $D_1$ . Draw this demand curve on your graph and explain how it influences the impact of the \$500 ceiling price on tenants.
- 12. (Advanced Question)
 

The total annual revenue for producers of a given product called widgets is always \$10 million, regardless of the price.

  - a. On the basis of this information, plot the market demand curve for widgets.
  - b. How would you describe the elasticity of this demand curve? Explain.

- 13. (Policy Discussion Question)
 

Access the online article *How Rent Control Drives Out Affordable Housing* (at <http://www.cato.org/pubs/pas/pa-274.html>).

  - a. Using the arguments in the article, explain how low-income tenants are often hurt by rent controls,
  - b. Outline why rent controls become more difficult to eliminate the longer they have been in existence in a particular community.
  - c. Though the article makes a case against rent controls, can you think of any arguments that can be made against abolishing rent controls that are already in place?



[http:// www.cato.org/ pubs/ pas/pa-274.html](http://www.cato.org/pubs/pas/pa-274.html)

**Internet Application Question**



[http://www.statcan.ca/ english/Estat/ licence.htm](http://www.statcan.ca/english/Estat/ licence.htm)

- 1. Access Statistics Canada’s E-STAT site (at <http://www.statcan.ca/english/Estat/licence.htm>).
  - a. On the basis of the information found in “Agriculture,” generate a map showing the average age of farmers in each Canadian province at the time of the last census.
  - b. In which province(s) is the average age of farmers the lowest? the highest?

## PROPHET OF CAPITALISM'S DOOM

### The Economic Theories of Karl Marx

#### Marx and His Influence

Karl Marx (1818–1883) is best known as the founder of the international socialist and communist movements. He was born in the German state of Prussia, studied philosophy, and worked as a journalist before beginning his career as a political activist. Exiled from both Germany and France, he moved to England where, with his close friend Friedrich Engels (1820–1895), he applied his revolutionary views to the fields of philosophy, history, and economics.

Of these three subjects, it was what he called “the confounded ramifications of political economy” that gave him the most headaches. In his mammoth three-volume work, *Das Kapital*, Marx developed his theory of economics. He concluded that capitalism, by its very nature, was unjust.

#### Marx's View of Capitalism

Marx's years in England allowed him to witness first-hand the effects of the British Industrial Revolution. By the mid-1800s, manufacturing was the mainstay of Britain's economy, and a large portion of the population had moved from rural areas to the burgeoning new cities in the hope of finding jobs in manufacturing. In the long run, the industrial transformation experienced in Britain enhanced the economic well-being of the majority of citizens of industrialized countries. But in Marx's day, the benefits of the Industrial Revolution seemed to be limited to the wealthier members of society. Living conditions were horrendous for the labouring classes in the rapidly expanding urban areas:

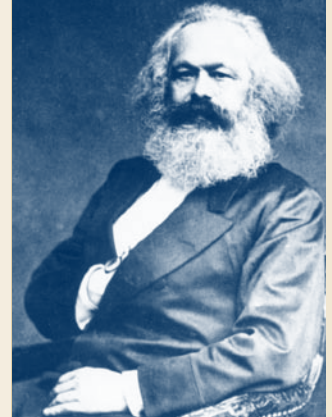
And what cities! It was not merely that smoke hung over them and filth impregnated them, that the elementary public services—water-supply, sanitation, street-cleaning, open spaces, and so on—could not keep pace with the mass migration of men into cities, thus producing, especially after 1830, epidemics of cholera, typhoid and an appalling constant toll [from] air pollution and water pollution... The new city populations...[were] pressed into overcrowded and bleak slums, whose very sight froze the heart of the observer.<sup>1</sup>

#### Marx's Theory of Capitalism

**The Labour Theory of Value** Marx blamed these conditions on capitalism itself. His attack was based on his “labour theory of value,” in which prices of products depend on how much labour goes into producing them. According to this theory, only company owners (whom Marx called capitalists) have the financial resources to hire workers and sell the resulting output. By paying wages that are less than the value workers contribute to production, company owners are able to skim off a portion of value for themselves. By doing this, they engage in capitalist exploitation of their workforce.

**The Theory of Exploitation** An example will help explain Marx's theory. It may take a worker four hours to make a shirt and eight hours to make a suit. According to Marx, the price of the shirt should then be half that of the suit; say, the prices of the two products are \$40 and \$80, respectively. If so, workers producing either two shirts or one suit in an eight-hour day create \$80 of value. Let us assume that daily wages in the textile trade are \$50 and that the cost of materials plus daily wear and tear on the machines each

ADVANCING  
ECONOMIC  
THOUGHT

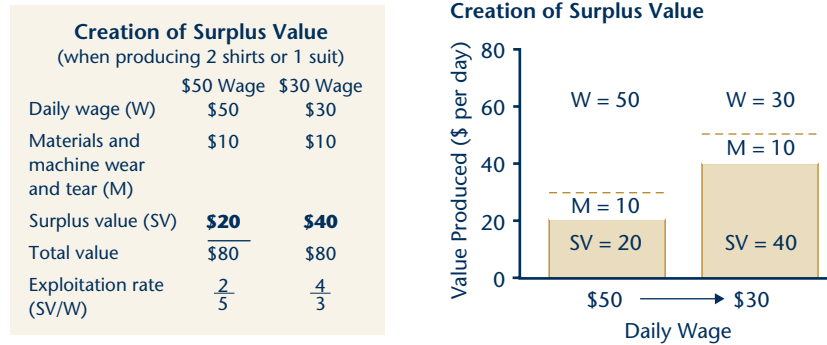


**Karl Marx**

Source: ©Bettmann/CORBIS/Magma

ADVANCING  
ECONOMIC  
THOUGHT

**Figure A** Marx's Theory of Exploitation



If daily wages are reduced from \$50 to \$30, daily surplus value extracted from each worker is increased (the shaded portions on the bar graphs). As a result, surplus value as a proportion of daily wages also increases.

Source: From *Evolution of Economic Thought*, 6th ed. by Brue. © 2000. Reprinted with permission of South-Western, a division of Thomson Learning: [www.thomsonrights.com](http://www.thomsonrights.com).

worker uses is \$10. The portion of value kept by the capitalist, or each worker's "surplus value," is, therefore, \$20 [= \$80 - (\$50 + \$10)] as shown in Figure A.

## Dynamics of Capitalism

With time, Marx argued, the rate of exploitation by capitalists would worsen, meaning surplus value would increase as a proportion of the daily wage. This could happen either through further decreases in wages or a lengthening of the workday.

**Decreased Wages** Capitalists try to slash wages as much as possible. The daily wage in our example could drop from \$50 to \$30, while the cost of materials, plus the wear and tear on machines, remains constant at \$10. As a result, surplus value would rise to \$40 [= \$80 - (\$30 + \$10)]. Surplus value as a proportion of the daily wage would then increase from \$20/\$50 to \$40/\$30.

**Lengthening of the Workday** Capitalists also have an incentive to raise the number of hours workers put in each day. This expands the daily value created by each worker. As long as the daily wage remains the same, surplus value as a proportion of this wage would again rise.

## Communist Revolution

Marx believed that capitalist exploitation would worsen the living standards of workers until, finally, workers would violently revolt, first in the nations of Western Europe, which were most industrialized at the time Marx was writing, and later in other parts of the world. The overthrow of capitalism would usher in a socialist age based on common ownership of property. Once socialist ownership had been consolidated, true communism would arrive. Governments would disappear and people would be able to live in complete liberty. Society's guiding principle would then be "from each according to his abilities, and to each according to his needs."<sup>2</sup>

## Relevance for Today

Marx's theories have been the source of continuing controversy. His detractors challenge the usefulness of the labour theory of value and the notion of surplus value. They argue that other economic resources, such as capital and entrepreneurship, make their own contributions to production and that owners of these resources must receive a payment so that they will keep supplying their resources to businesses.

At the same time, Marx's theories had a significant impact throughout the 20th century. Socialists—who advocate that the community as a whole own and control the means of production, distribution, and exchange—have held power in many parts of the world. Among socialists, communists have accepted the bulk of Marx's theories and applied them in countries subject to communist rule. In most nations, however, Marx's influence has been less direct. Labour movements, for example, owe much to Marx's theories of capitalist exploitation. Through gradual reform, rather than revolution, socialists in such countries as Canada have played a major part in social reform and in creating modern mixed economies in which governments are much more important than they were a century or more ago.

### Notes

<sup>1</sup> Adapted from *Industry and Empire: From 1750 to the Present Day* by E.J. Hobsbawm, (Penguin Books, 1969). Copyright © E.J. Hobsbawm, 1968, 1969. Reprinted by permission.

<sup>2</sup> Karl Marx, *Critique of the Gotha Program*, 1875.

1. For the textile industry example given previously, imagine that each worker's wages are raised from \$50 to \$60 per day, while other costs remain the same. Create a bar graph to show the resulting change in surplus value per worker. How does surplus value change as a proportion of the daily wage?
2. Imagine that the daily wage of a textile worker remains at \$50, but the workday is lengthened to 12 hours, causing each worker to raise production to \$120 per day and increasing the other costs (materials and wear on machines) to \$15 per worker.
  - a. Create a bar graph to show the new surplus value per worker.
  - b. Explain how surplus value changes as a proportion of the daily wage.
  - c. Explain whether company owners are worse off or better off as a result of the lengthened workday.
3. Average living standards for workers in most capitalist countries have risen significantly since the period when Marx was writing. Outline two reasons why Marx's prediction of falling living standards for workers in these countries has proven to be incorrect.



ADVANCING  
ECONOMIC  
THOUGHT

## For the Public Good

### The Economic Role of Government

So far, we have looked at some of the ways government intervenes in private markets. But in mixed economies, such as Canada's, government also has an independent economic role. In Canada, this role is a relatively recent creation. Before the 1930s, federal and provincial governments maintained the legal system and provided education up to the secondary school level. But health care and universities were left largely in the hands of the private sector, and unemployment insurance was not available. In comparison to the present, a *laissez faire* attitude characterized the relationship between the public sector and the business sector.

Change began with the Great Depression of the 1930s. Faced with widespread unemployment and deprivation, government officials were forced to attend to the economic welfare of Canadian citizens. From the 1930s to the 1990s, the role of Canadian governments continued to expand. Now, the public sector in Canada provides a host of programs: payments to adults with children, retirement funds for the elderly, insurance for unemployed workers, welfare payments for those who cannot work, subsidies for higher education, free health care, free schooling, and subsidized public housing for low-income families. These programs are provided by all three levels of government, though the federal and provincial governments take the leading role.

#### Federal Spending Programs

There are four main federal spending programs for households. These are known as transfer payments, since funds are transferred as a way of increasing households' economic welfare rather than in exchange for products or the supply of resources. The Seniors Benefit provides monthly payments to Canadian residents 65 years and over, with higher dollar amounts for those with the lowest incomes. The Child Tax Credit provides payments to low-income parents of children under 18 years old. Employment Insurance (EI) is a federally run insurance program, funded by compulsory contributions from employees and their employers, to aid people unemployed

because of layoffs, temporary sickness, or the birth or adoption of a child. Finally, the Quebec and Canada Pension Plans (QPP and CPP) provide workers in Quebec and the rest of Canada with payments after retirement, financed by compulsory contributions from employees and their employers.

#### Other Spending Programs

Provincial and territorial governments finance the costs of health care, provide subsidies for post-secondary education that translate into reduced tuition fees for students, and (with the help of municipalities) offer welfare services to single-parent families with low incomes, individuals who are unable to find work due to disabilities, and families in crisis. Under the Canada Health and Social Transfer (CHST), the federal government pays for a portion of these costs by providing cash grants and personal income tax revenues to provincial and territorial governments.

Figure A shows the expenditures of the three levels of government. For the federal government, the most important category of expenditure is transfer payments to persons, followed by transfer payments to provinces and local governments. The expenditures of provincial and local governments are more heavily weighted towards purchases of goods and services, although transfers to persons are also an important component of total provincial spending.

#### Taxation

To pay for their spending, Canadian governments use five main types of taxation: personal income taxes, sales taxes, excise taxes, property taxes, and corporate income taxes.

#### Personal Income Taxes

Personal income taxes are collected by the federal government, proceeds being shared with the provinces and territories (except in Quebec, where federal and provincial income taxes are collected separately). Households pay taxes not only on their income from supplying resources but also on any transfer payments they receive. Households also pay income tax on capital gains, which are earnings from selling an asset, such as a bond or a piece of land at a higher price than it was purchased for.

Households may be allowed a variety of deductions (such as contributions to registered

**Figure A** Government Expenditures

Federal (2005) (\$ billions)		Provincial (2005) (\$ billions)		Local (2005) (\$ billions)	
Goods and services	55.3	Goods and services	163.5	Goods and services	85.8
Transfers to		Transfers to		Transfers to	
Persons	67.5	Persons	31.9	Persons	3.9
Businesses	5.4	Businesses	10.3	Businesses	1.4
Non-residents	4.3	Governments	39.4	Governments	0.1
Provinces and local	56.1	Debt charges	<u>27.3</u>	Debt charges	<u>3.3</u>
Debt charges	<u>31.4</u>		272.5		94.5
	219.9				

Federal government spending is dominated by transfers to persons and to provinces and local governments, which together make up over half of federal spending. The main components of provincial spending are expenditures on goods and services, and transfers to municipalities and persons. Expenditures on goods and services dominate local government spending.

Source: Statistics Canada, CANSIM II database <http://cansim2.statcan.ca>, Table 380-0007.

retirement savings plans) that reduce the dollar amount on which they are taxed. This amount, known as taxable income, is the basis on which income tax is determined. The tax a household pays rises with taxable income, with tax rates also gradually rising as a household's taxable income increases. These rates are called marginal tax rates, meaning they are calculated as percentages of each extra dollar of taxable income. There are four marginal tax rates in the federal income tax system—16 percent on income up to approximately \$36 000, 22 percent on income between \$36 000 and approximately \$71 000, 26 percent on income between \$71 000 and approximately \$116 000, and 29 percent on income in excess of \$116 000. Once total tax owing has been calculated, households may also claim a variety of tax credits, which directly reduce their tax bill.

Before 2000, all provinces except Quebec levied provincial income taxes as a percentage of the federal tax bill added onto the taxpayer's tax bill. But by 2001, this setup ended, as all provinces moved to levy their own income taxes independently of those set by the federal government. Newfoundland has the highest taxes for high-income earners, with these households paying a combined federal and provincial tax rate of 48.64 percent in 2002. In contrast, residents of Nunavut enjoy the lowest rate for high-income earners, with these households paying a combined rate of 40.5 percent in 2002.

As shown in Figure B, personal income taxes are the most important tax in terms of overall revenue.

### Sales and Excise Taxes

Sales and excise taxes are levied by both federal and provincial governments on goods and services.

**Figure B** Tax Revenues for All Levels of Government (2005)

	Percent of Gross Domestic Product	Percent of Total Taxes
Personal income taxes	11.6	39.0
Sales and excise taxes	7.6	25.5
Property taxes	3.4	11.4
Corporate income taxes	3.3	11.2
Miscellaneous taxes	<u>3.8</u>	<u>12.7</u>
	29.8	100.0

Personal income taxes are the most important single source of revenue for the state, followed by sales and excise taxes, property taxes, and corporate taxes.

Source: Karin Treff and David B. Perry, *Finances of the Nation 2005* (Toronto: Canadian Tax Foundation, 2006) A:2.

Unlike excise taxes, which are placed on particular products, such as gasoline or tobacco, and are expressed as a dollar amount per unit of quantity, sales taxes are usually charged on a wide range of goods and services and are calculated as a percentage of the prices of these products.

### Property Taxes

Property taxes are charged by local governments on buildings and land. For taxation purposes, these assets are assigned a value—often not their potential price in the real estate market, but some arbitrary dollar amount set in the past. Then, each year, the local government establishes a tax rate in terms of mills (or thousands) of property value. For example, a mill rate of 80 means that property owners are charged \$80 for each \$1000 in property value.

### Corporate Income Taxes

Corporate income taxes are paid by corporations to governments as a percentage of their annual profits. As with personal income taxes, corporations are allowed to make deductions from their total income in calculating taxable profit. The resulting dollar amount is then taxed at a constant marginal rate by the federal government (21 percent in 2005), with most provincial governments “piggybacking” on this rate.

## Debates over Government’s Economic Role

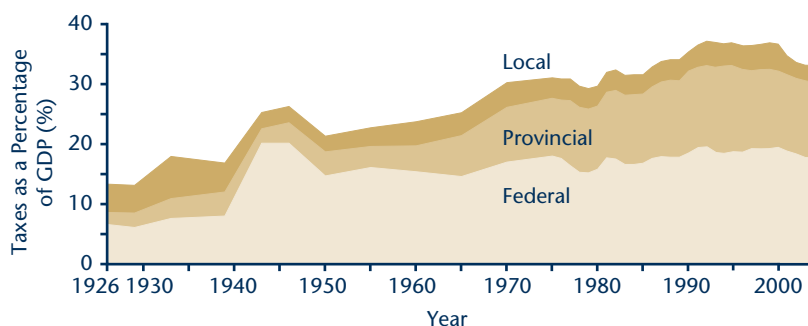
As shown in Figure C, taxes by all three levels of government in Canada have increased considerably over the past decades in relation to the size of the entire economy.

Are the amounts we pay in taxes well spent? This is a question subject to perennial debate, not just in Canada but in other countries as well.

Critics of government argue that its economic role suffers from a variety of serious problems. Most importantly, the supply of economic resources can be reduced by government’s economic involvement. By reducing the income gained from productive activity, taxes can sometimes discourage employment and business investment. Moreover, spending programs, such as welfare and employment insurance, can have their own effect on the economic decisions we make. For example, welfare recipients may receive more income from welfare than they would upon initially entering the workforce, while habitual claimants of employment insurance may be reluctant to move from occupations and regions of the country in which there is considerable risk of unemployment.

Government spending is criticized for other reasons as well. Some programs, such as

**Figure C** Government Taxes and the Canadian Economy



Since the 1920s, the increasing importance of the public sector in the Canadian economy has led to increased taxes (including contributions for such programs as Employment Insurance and CPP/QPP) in relation to the size of the economy. While taxes represented just over 10 percent of Gross Domestic Product (GDP) in 1926, they represented one-third by 2004.

Sources: Statistics-Canada “Government Taxes and the Canadian Economy,” data adapted from the Statistics Canada publication “National Income and Expenditure Accounts: Annual Estimates,” 1926–1986, Catalogue 13-531, April 1989 and from the Statistics Canada CANSIM II database <http://cansim2.statcan.ca>, Table 380-0007.

employment insurance, are paid both to well-off individuals as well as those in need, making the programs more expensive than necessary. Government programs can also be hampered by overlapping bureaucracies, high administrative costs, and a lack of focus. Critics contend that these inefficiencies mean that government spending is often wasteful and badly managed.

Other observers are willing to admit that Canada's mix of public spending and taxation is

not as effective as it could be. But they also argue that we need to see these problems in perspective, especially when we realize that private markets, too, are subject to a variety of flaws. When viewed in this light, government's economic role is something that must be improved rather than necessarily reduced. Regardless of these arguments, there is no doubt that government's role in the economy will continue to be a vital one in the foreseeable future.

1. Which form of taxation do you think has the greatest disincentive effect on productive activity in the economy? Which form of taxation do you think has the least disincentive effect?
2. Provincial tax levels have grown rapidly in the past few decades, as shown in Figure C. Can you make any argument for why provincial governments have needed to increase their spending so rapidly during this period?

