



3

PHYSICS AND PHYSICAL MEASUREMENT

3.1

Equilibrium

- Explain, using diagrams, how demand and supply interact to produce market equilibrium.
- Analyse, using diagrams and with reference to excess demand or excess supply, how changes in the determinants of demand and/or supply result in a new market equilibrium.



Having examined demand and supply separately, we can combine them to analyse markets more completely. When demand and supply are combined, there is a tendency for the market to reach an equilibrium state.

Equilibrium is defined as the state in which all contrasting forces cancel each other out, resulting in balance or stability. Market equilibrium is defined as the state in which the quantity supplied is equal to the quantity demanded. Supply and demand are balanced. The price at which the quantity supplied and demanded are equal is called the equilibrium price. At this price, the amount purchased is exactly equal to the amount sold. There is no surplus product available on the market, nor are there shortages of supply at that price. For this reason, the equilibrium price is also called the market-clearing price. Everything put on the market, at that price, is sold.

Returning to the bags of potato chips we used in Chapter 2, the total market schedule shows the equilibrium price is \$1.50 per bag (Table 3.1, overleaf). At that price, the amount



Market equilibrium occurs at the price where the quantity demanded and quantity supplied are equal (also called the market-clearing price).



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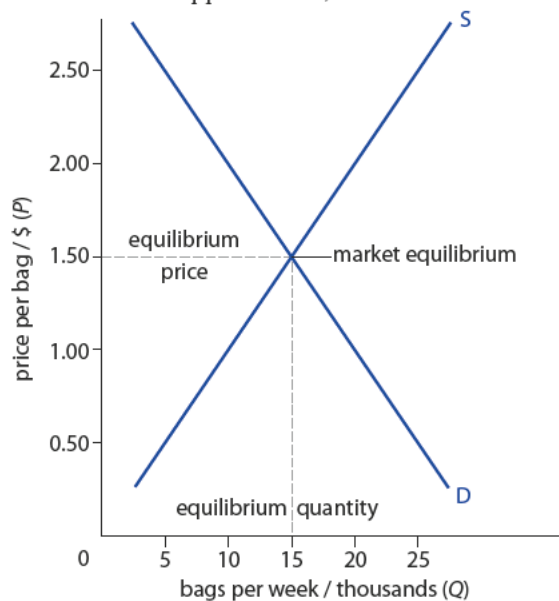
supplied and demanded is 15 000 bags per week. All the chips offered on the market are purchased by consumers. Prices set above or below the market price will result in market disequilibrium, because there will be excess supply or demand.

TABLE 3.1 DEMAND AND SUPPLY SCHEDULE: POTATO CHIPS

Price of potato chips (P) / \$	Quantity of potato chips demanded per week (Q_D) / thousands	Quantity of potato chips supplied per week (Q_S) / thousands
2.50	5	25
2.00	10	20
1.50	15	15
1.00	20	10
0.50	25	5

Figure 3.1 shows market equilibrium, with the equilibrium price of \$1.50. At that price, an equal amount are demanded and supplied. Thus, the market clears all output at that price.

Figure 3.1
Market equilibrium.



Market disequilibrium

Excess supply

A market disequilibrium is any price at which the demand and supply quantities are not equal. Let's look at specific examples of market disequilibria, and analyse the results of attempting to set prices anywhere other than the equilibrium price.

Table 3.1 and Figure 3.1 show the market price to be \$1.50. If the producers of these potato chips had an exaggerated sense of their value, they might set the price too high. Let's say, for example, that they greedily set the price at \$2.50 per bag. At that price, the quantity demanded is much smaller than at the equilibrium price. Quantity demanded drops from 15 000 to 5 000 bags per month. This is equivalent to a movement along the demand curve, as shown in Figure 3.2.

As price increases, the quantity demanded decreases or moves upwards and left along the demand curve. At the same time, setting the price higher induces producers to increase production as they expect higher profits at higher prices. Quantity supplied thus moves in the opposite direction, moving upwards along the curve to a quantity of 25 000.

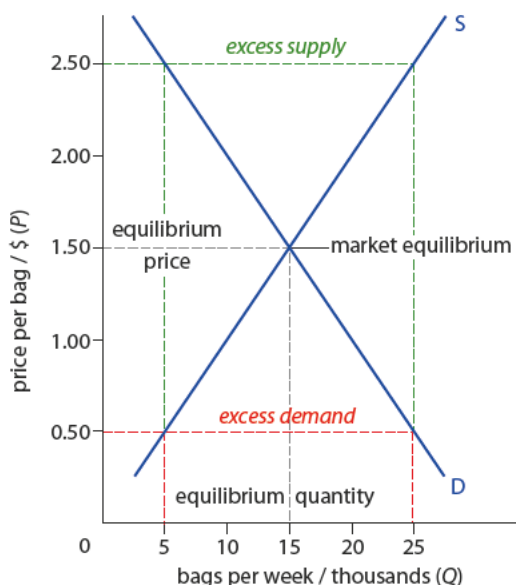


Figure 3.2
Equilibrium with shortages
and surplus.

Thus, we can say at \$2.50, an *excess supply* for chips exists, with more quantity supplied than demanded. What happens to this surplus? Producers can only sell the extra goods if they lower the price. As they do so, more quantity is demanded, and producers reduce production. This narrows the gap continuously until the surplus is reduced to zero at the market-clearing, equilibrium price.

Excess demand

Let's take up the opposite case and assume that firms are not aware of the market value of their chips, and they under-price them at \$0.50. At this price, the quantity demanded is much higher, now 25 000 bags, while the lower price is not well received by producers. They scale back production to only 5000 bags. This gap between relatively higher quantity demanded and lower quantity supplied is called *excess demand*.

When excess demand exists, market forces take over. With relatively scarce amounts of the good on the market at \$0.50 (an excess demand of 20 000 bags) some consumers start to bid the price higher in an attempt to get more of the good. As chips quickly fly off the shelves, producers also realize they can charge a higher price. So, at the higher price of \$1.00, producers make more (10 000 bags) and some consumers drop out of the market, reducing the quantity demanded to 20 000. Now the shortage is smaller (10 000 bags) but there is still a shortage. This prompts producers to raise the price again, with some consumers dropping out again. This process continues until all of the extra demand is satisfied at the market-clearing price of \$1.50.

Therefore, at any price other than the market-clearing price, either excess supply or demand will exist. Furthermore, unless firms are compelled by law to keep their prices at some disequilibrium level (too high or too low), market forces will urge producers and consumers towards a market-clearing price where everything offered is purchased.

Changes in supply and demand

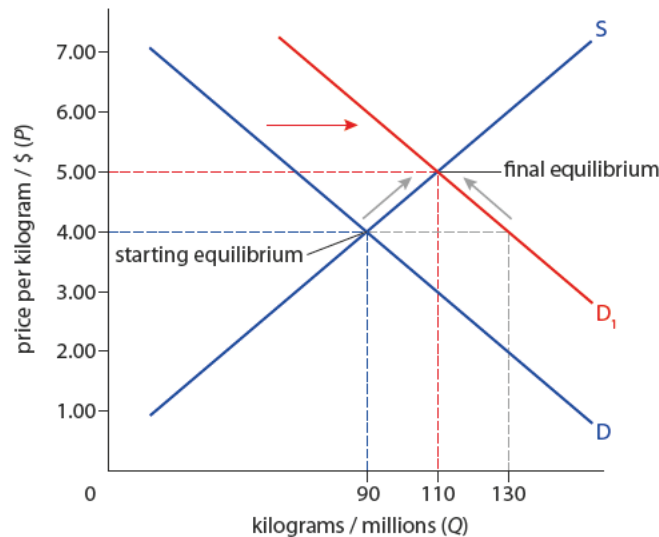
The tendency of a market towards equilibrium is strong. When prices are too high or too low, the market tends to clear eventually. And when markets are in balance, it requires some external force or event to change them. Shifts in either market supply or demand will change the market equilibrium, changing the market-clearing price and quantity as well.

Shifts of demand

A few years ago, consumer demand for pomegranate juice significantly increased following reports that it contained very high levels of antioxidants. As a result, demand for all products using pomegranate increased, shifting demand for pomegranates to the right. As shown in Figure 3.3, demand for pomegranates shifted to the right, causing a temporary shortage at the old equilibrium price of \$4.00. The quantity demanded (Q_D) is thus far greater than the quantity supplied (Q_S). In this case, the excess demand is 40 million kilograms. As producers realize they can raise the price, they produce more, a movement upwards along the supply curve. And as consumers see the higher prices, they decrease the quantity demanded, a movement up and left along the new demand curve. The quantities of supply and demand settle at the new equilibrium price of \$5 and equilibrium quantity of 110 million kilograms. As a result of the increased demand, prices are higher and quantities greater than before.

Figure 3.3

Market equilibrium, increased demand: pomegranates.



Market shocks (sudden increases in supply or demand) can raise serious ethical dilemmas. After the earthquake, tsunami and radiation disaster in Japan (March 2011), thousands of people tried to leave the country. Airlines were reportedly charging four to five times the usual price to fly out of Tokyo (e.g. flights to Los Angeles at \$6000). Is it unethical to charge higher prices for necessity goods during a humanitarian crisis? Or would the law of supply help ensure that more of these goods are offered for sale in the crisis zone?



A decrease in demand can have the opposite effect. A decrease in a country's income might decrease the demand for all normal goods. Automobile sales, in particular, tend to be immediately affected by decreases in income, and a recession causes a decrease in demand for automobiles. In Figure 3.4, a decrease in demand of this type results in a temporary surplus of 6 million cars at the equilibrium price of \$12 500 (fewer new cars being sold); producers cut prices to entice buyers (increasing quantity demanded, moving down along the new demand curve). Eventually, the market settles at a new, lower market price and quantity (\$9000 and 5.5 million cars): fewer cars are being sold at lower prices.

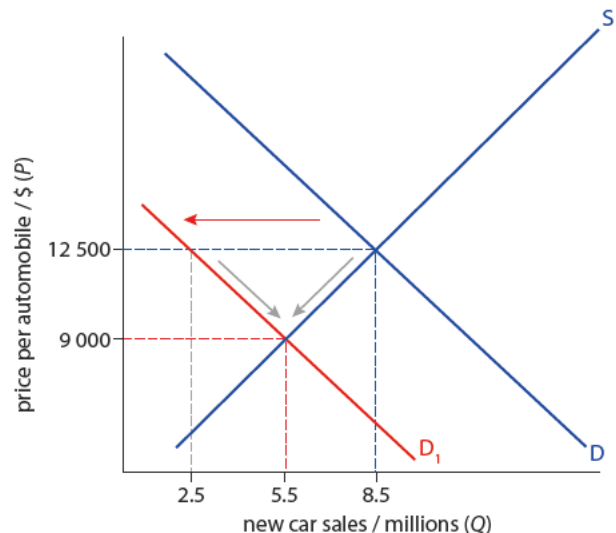


Figure 3.4

Market equilibrium, decreased demand: new cars.

Shifts of supply

Supply shifts can also have important effects on price and quantity. In Figure 3.5, the market for rubber ducks shows the effect of synthetic rubber production. Synthetic rubber is much cheaper than rubber collected from rubber trees, so it becomes much less costly to produce rubber items, including rubber ducks. As a result, the supply of rubber ducks shifts to the right. A temporary surplus of 7 million ducks exists at the old equilibrium price of \$3.75. This surplus is eliminated by cutting prices and selling off the excess supply. Consumers do their part by buying up the residual amounts at successively lower prices, an increase in quantity demanded at each lower price. The increase in supply therefore results in a lower equilibrium price for rubber ducks at \$2.25, and a higher equilibrium quantity of 12 million sold.



How does production of synthetic rubber affect the price of rubber ducks?

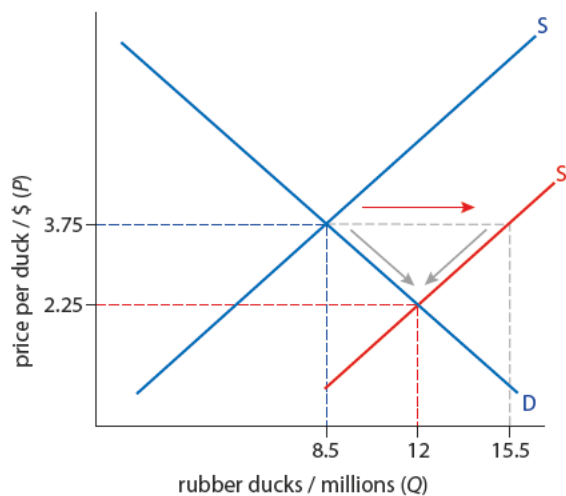


Figure 3.5

Increased supply: rubber ducks.

A decrease in supply will have the inverse result. Figure 3.6 shows the effect of a deep winter freeze across the Mediterranean which damaged orange crops in Greece, Italy, Spain and Cyprus. As a result, the number of oranges available for juice products decreased dramatically. Oranges are an input cost for orange juice, so the supply of orange juice decreases, shifting supply to the left. The reduced supply causes a temporary shortage of 700 million litres at the old equilibrium price of \$1.50

per litre. Producers therefore begin to increase their prices, and consumers respond by decreasing the quantity demanded. The final price and quantity settle at \$2.10 per litre and 550 million litres consumed. Thus, the decrease in supply has caused a decrease in quantity available and increased prices.

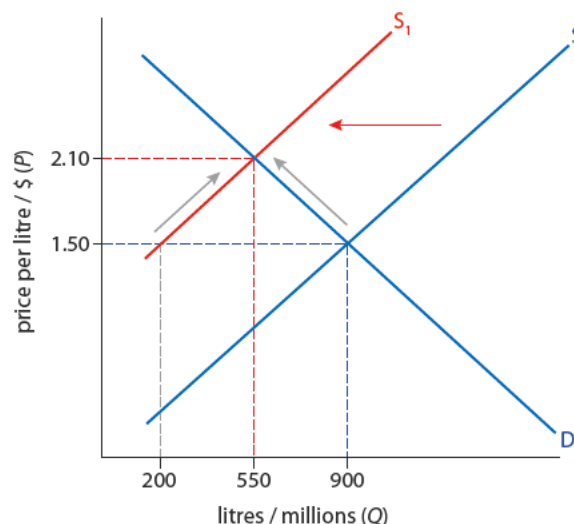


Figure 3.6

Decreased supply: orange juice.

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To access Worksheet 3.1 on linear functions and equilibrium, please visit www.pearsonbacconline.com and follow the onscreen instructions.



EXERCISES

- 1 For each of the headlines i–ix below:
 - a Decide the kind of shift that would occur, and create a diagram to demonstrate the shift. Diagrams should show the relevant shifts and notation that reflect the new equilibrium.
 - b Identify the determinant that caused the shift.
 - i Heavy rainfall affects the market for rubber boots.
 - ii Diplomatic agreements open the market for Chinese cars to several new countries.
 - iii Consumers learn that cars will be much more heavily taxed starting with next year's models.
 - iv House-building companies are gloomy about new business during the recession.
 - v A baby boom 15 years ago influences the market for popular music and cosmetics today.
 - vi The government places more regulations on food preparation after several poisoning scares.
 - vii A maker of MP3 players moves production to a country with significantly lower labour costs.
 - viii A severe winter frost decimates the crop of grapes from which French champagne is made.
 - ix Country X joins the EU and its wheat farmers reap massive subsidies.

3.2

Market equilibrium and linear equations (HL only)

Learning outcomes

- Calculate the equilibrium price and equilibrium quantity from linear demand and supply functions.
- Plot demand and supply curves from linear functions, and identify the equilibrium price and equilibrium quantity.
- State the quantity of excess demand or excess supply in the above diagrams.

You have already learned how linear equations can demonstrate both demand and supply functions. You can use the same type of linear equations to establish the equilibrium market price and quantity.

Using the cappuccino examples from Chapter 2 (pages 36 and 48), the demand and supply functions for cappuccinos were:

$$Q_D = a - bP = 600 - 50P$$

$$Q_S = c + dP = -200 + 150P$$

These functions can be presented as a demand and supply schedule (Table 3.2).

The equilibrium price and quantity are easily spotted as the price at which the quantity demanded equals the quantity supplied. At \$4, cappuccino producers are willing to make 400 drinks, and consumers are willing to buy 400 drinks. The market is in equilibrium at \$4 per drink.



TABLE 3.2 COMBINED SUPPLY AND DEMAND SCHEDULE: CAPPUCCINOS

Price of cappuccinos (P) / \$	Quantity demanded per day (Q_D)	Quantity supplied per day (Q_S)
10	100	1300
9	150	1150
8	200	1000
7	250	850
6	300	700
5	350	550
4	400	400
3	450	250
2	500	100
1	550	-50
0	600	-200

It is possible to determine equilibrium price and quantity without producing a side-by-side supply and demand schedule.

Worked example

Equilibrium is the point at which supply equals demand, so the first step is to set supply equal to demand.

$$(Q_S = -200 + 150P) = (Q_D = 600 - 50P)$$

$$-200 + 150P = 600 - 50P$$

To find the equilibrium price, simply solve for P .

Simplify by adding 200 to both sides.

$$150P = 800 - 50P$$

Simplify again by adding $50P$ to both sides.

$$200P = 800$$

Divide both sides by 200.

$$P = 4$$

The equilibrium price is \$4. Now that we have the equilibrium price, we can determine the equilibrium quantity by substituting the price into the demand and supply functions.

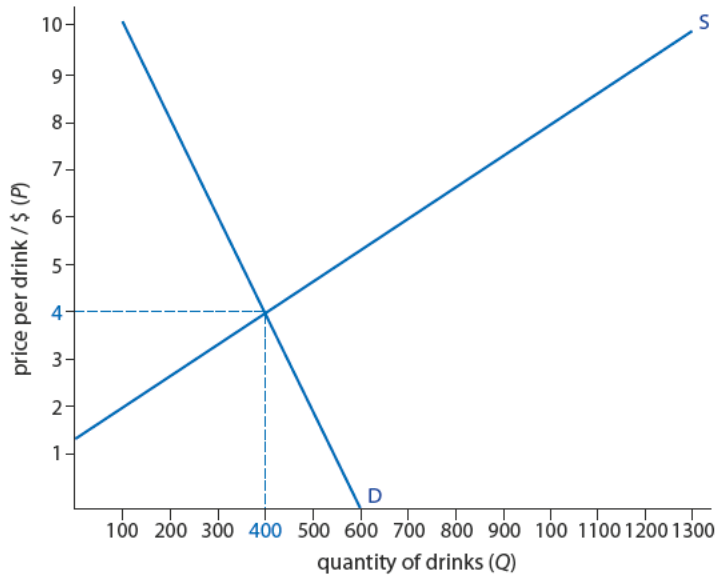
$$Q_S = -200 + 150(4) = -200 + 600 = 400$$

$$Q_D = 600 - 50(4) = 600 - 200 = 400$$

At a price of \$4 per drink, the quantity demanded and supplied is equal. There is neither a shortage nor a surplus of cappuccinos at this price. Therefore, this is the equilibrium or market-clearing price and quantity.

We can also plot the values of the demand and supply schedule to illustrate the market equilibrium, as shown in Figure 3.7 (overleaf). Again, the equilibrium price is evident at the intersection of demand and supply at a price of \$4 and quantity 400 drinks.

Figure 3.7
Market equilibrium, linear
demand and supply:
cappuccinos.



Shifts in supply and the effect on equilibrium

Using demand and supply functions, we can also demonstrate the effects on equilibrium of a change in the determinants of supply. Such a change causes a change in the value of the c variable of the supply function. Let's assume, for instance, that the price of coffee beans increases, adding to the costs of production of cappuccinos, and thereby reducing the supply. The new supply function is:

$$Q_S = -400 + 150P$$

The new supply schedule is shown in Table 3.3.

Price of cappuccinos (P) / \$	Quantity supplied per day (Q_S)
10	1100
9	950
8	800
7	650
6	500
5	350
4	200
3	50
2	-100
1	-250
0	-400

With the new supply schedule, we can plot the new supply curve.

Worked example

First solve for the P -intercept by making $Q_S = 0$.

$$0 = -400 + 150P$$

$$400 = 150P$$

$$P = 2.67$$

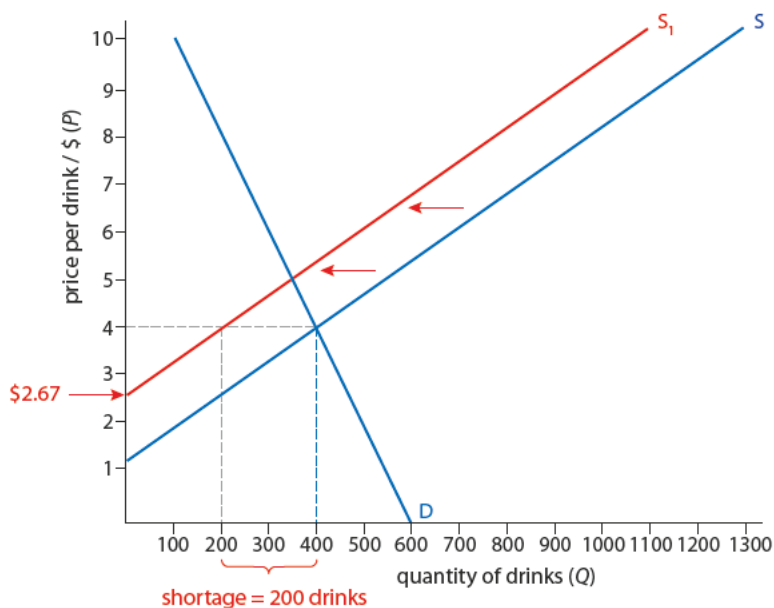


Figure 3.8
Linear functions, supply shift:
cappuccinos.

Our new supply curve starts at a price of \$2.67. As the d value has not changed, it will have the same slope as the original supply curve (Figure 3.8, above).

The c variable has decreased by 200 units. As shown above, the supply curve has shifted to the left, with 200 fewer units being offered for sale at every price.

With the new supply, there is a disequilibrium at the original price of \$4. To determine whether there is a shortage or a surplus of cappuccinos, we must find the quantity supplied at \$4 based on the new supply function:

$$Q_S = -400 + 150(4) = -400 + 600 = 200$$

At \$4, the quantity demanded is 400 drinks but the quantity supplied following the increase in resource costs is only 200 cappuccinos. There is a shortage of 200 drinks in the market. We therefore expect the price to begin to rise in order to eliminate the excess demand in the market.

The price rises until the market is cleared, with all the excess demand eliminated. To determine the new equilibrium price following the decrease in supply, we need to make the new supply and demand functions equal to one another and solve for P .

Worked example

$$-400 + 150P = 600 - 50P$$

$$150P = 1000 - 50P$$

$$200P = 1000$$

$$P = 5$$

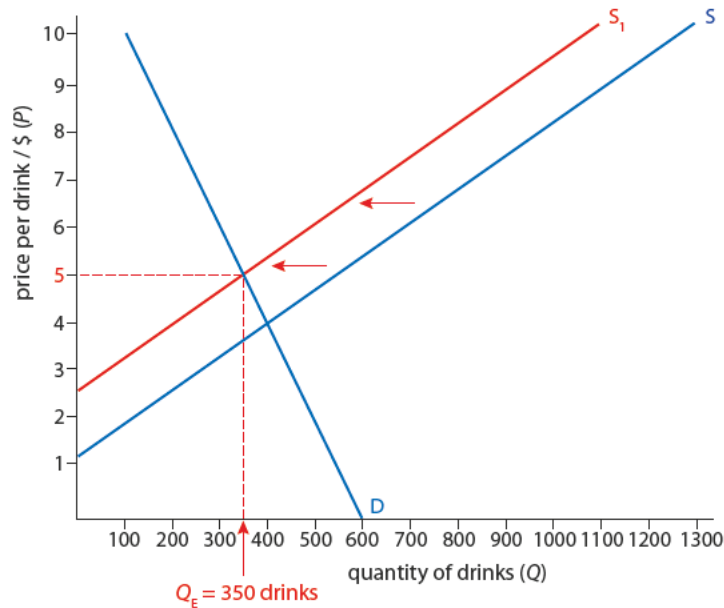
The new equilibrium quantity can be found by putting the price into the supply and demand functions:

$$Q_S = -400 + 150(5) = 350$$

$$Q_D = 600 - 50(5) = 350$$

As the market adjusts to the reduced supply of cappuccinos resulting from higher resource costs, a new equilibrium price and quantity are established (Figure 3.9).

Figure 3.9
New market equilibrium after supply shift: cappuccinos.



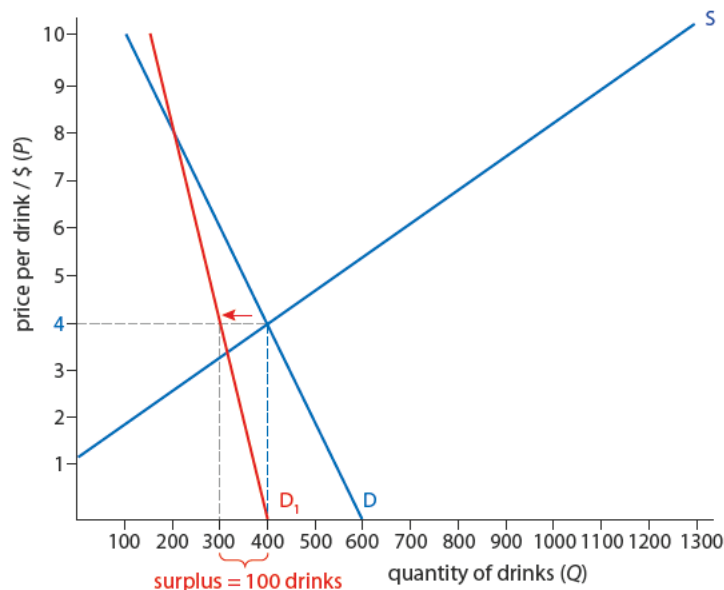
Shifts in demand and the effect on equilibrium

Now let's assume that one of the determinants of demand changes. In addition, demand becomes less elastic. In other words, a and b values change in the demand function. The new demand function is:

$$Q_D = a - bP = 400 - 25P$$

The decrease in demand for cappuccinos shifts the demand curve to the right. The decrease in the value of b means that consumers are less responsive to price changes, so the demand curve becomes steeper (Figure 3.10).

Figure 3.10
Linear functions, demand shift: cappuccinos.





At the original equilibrium price of \$4, there is a surplus of cappuccinos. The amount of excess supply can be found by plugging \$4 into the new demand function and the original supply function.

Worked example

$$Q_D = 400 - 25(4) = 300$$

$$Q_S = -200 + 150(4) = 400$$

There is a surplus of 100 cappuccinos at \$4. Therefore, the price of cappuccinos is likely to fall to a new equilibrium, which reduces the quantity supplied and increases the quantity demanded until the excess supply is eliminated.

To determine the new equilibrium price and quantity, simply make supply and demand equal.

Worked example

$$400 - 25P = -200 + 150P$$

Solve for P .

$$600 - 25P = 150P$$

$$600 = 175P$$

$$P = 3.43$$

Finally, solve for Q .

$$Q_S = -200 + 150(3.43) = 314$$

$$Q_D = 400 - 25(3.43) = 314$$

The decrease in demand causes the price of cappuccinos to fall from \$4 to \$3.43 and the equilibrium quantity to decrease from 400 to 314 drinks. The new market equilibrium is shown in Figure 3.11.

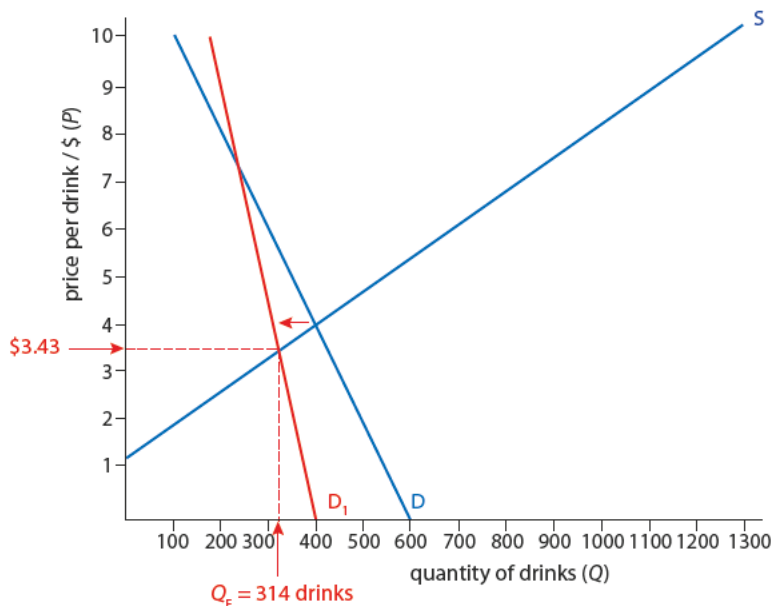


Figure 3.11

New market equilibrium after demand shift: cappuccinos.



To access worksheet 3.1 on linear functions and equilibrium practice, please visit www.pearsonbacconline.com and follow the on-screen instructions.

HL EXERCISES

- 2 Solve for P and Q_D using the following linear supply and demand functions:
 - a $Q_S = -400 + 50P$; $Q_D = 800 - 30P$
 - b $Q_S = -240 + 40P$; $Q_D = 660 - 20P$
 - c $Q_S = -50 + 25P$; $Q_D = 90 - 10P$
- 3 $Q_S = 100 + 10P$; $Q_D = 300 - 30P$
 - a Create a table to show the demand and supply schedule with prices of \$0, \$3, \$5, \$7 and \$9.
 - b Create a demand curve, plotting the points from your demand schedule.
 - c Show the equilibrium quantity bought and sold.
 - d Using the two functions, solve for the equilibrium price and quantity.
- 4 Assume that the above demand function changes to $Q_D = 380 - 30P$
 - a Make a new supply and demand schedule for all the prices in exercise 3a.
 - b Plot the points on this new schedule.
 - c Show the excess demand at the original price.
 - d Calculate the excess demand using the old equilibrium price and the current demand and supply functions.

3.3

Role of price in resource allocation

Learning outcomes

- Explain why scarcity necessitates choices that answer the 'What to produce?' question.
- Explain why choice results in an opportunity cost.
- Explain, using diagrams, that price has a signalling function and an incentive function, which result in a reallocation of resources when prices change as a result of a change in demand or supply conditions.

Signalling and incentive functions of price

In a world of finite resources, human desires run up against the fact of scarcity. Our wants are unlimited compared to the limited resources we have available, which is another way of saying that resources are scarce. With this in mind, we are faced with a choice of how to use those resources.

All such choices involve a cost – specifically, an opportunity cost. To choose one product or activity, we lose out on the opportunity to enjoy the other. This makes the system of resources allocation all the more important.

In competitive markets, we have seen that buyers and sellers come to a settlement or agreement on the appropriate market price. This is not done through any central command or by the guidance of some overseeing body of government. Instead, the establishment of a market price happens when countless buyers and sellers, each making rational choices about their scarce resources, make the best decision for themselves. Buyers are conscious of their time and income levels, while suppliers watch closely their costs and the selling potential for their goods. This decentralized, seemingly random process produces one of the most

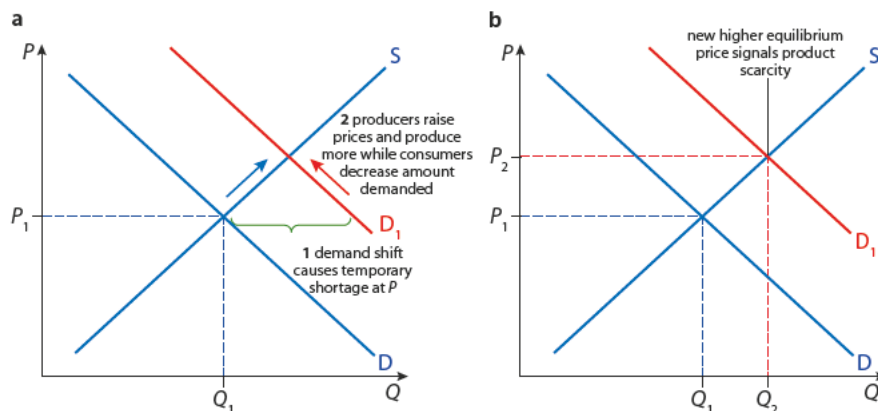
important benefits of competitive markets, an efficient rationing of resources through the price system.

When markets operate freely, the price system is the organizing principle around which all resources are allocated. Resource allocation is the manner by which society selects which resources are used for what purposes. The interaction of supply and demand tells us those goods which are most scarce (lowest supply relative to demand) because they have the highest prices, and least scarce (lowest demand relative to supply) because they have the lowest prices.

When a resource or product rises in price, buyers and producers act accordingly by using it less frequently in the case of a buyer, or trying to produce more of it in the case of the producer. Buyers are rationing their income and use of products to get the most out of all of their consumption choices. Producers may see a price increase and choose to produce more of the good because the price has revealed a scarcity in that market.

Thus, when markets act freely and competitively, the price information they emit acts as a signal to all the market actors. The signalling function of the price system allows this decentralized system of actors to make decisions for themselves and at the same time tell the world what is most important to them, what is worth producing. In this system, consumer desires rule the market. Consumer sovereignty is a term that suggests the enormous power that consumer wishes have in deciding what gets made, even if this power is diffuse and indirect. If you recall, this is the first great question any economic system must answer, 'What is to be produced?'

Figure 3.12 shows how a competitive market uses supply and demand to ration resources in this way. As demand for a good increases, a temporary shortage occurs (Figure 3.12a). Firms see the shortage and begin to raise the price of the good. This acts as incentive to produce more, helping to relieve the shortage. At the same time, consumers reduce the quantity they demand, and there is a movement up and to the left along the demand curve. Eventually, the price settles at a new equilibrium (Figure 3.12b). The rise in prices has told consumers to ration their consumption and producers to make more.



The price system also answers the second question, 'How to produce?' A producer surveys all the resource costs for the product and constantly looks for ways to save on costs. By managing resources effectively, a firm can save money and increase profits. It may also be able to reduce prices so as to sell more competitively on the market. So, in addition to serving consumer wants, this process also helps ration resources more efficiently. In seeking out lower-priced alternatives to current resources, firms use price information to help society get more out of its scarce resources.

Figure 3.13 (overleaf) shows a resource market for capital equipment (i.e. any kind of machinery or service that is used in production). Here, an increase in the supply of this resource sends critical information to the producer, who buys the capital equipment as an

i Resource allocation is the manner by which society manages and rations its resources.

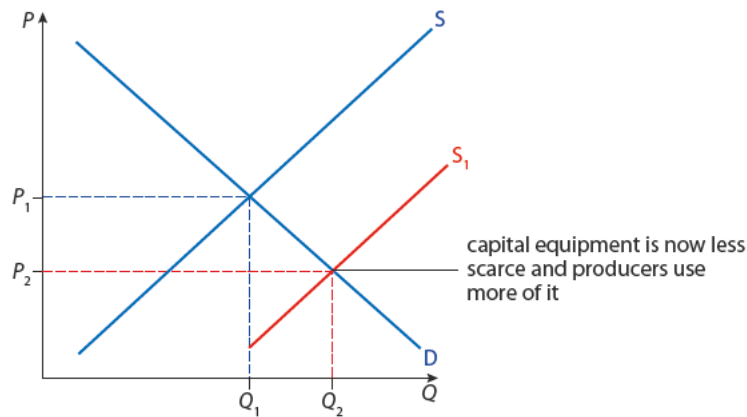
i Because they do a poor job of placing a value on goods, command economies are famous for producing shortages. A noteworthy shortage occurred in 1980 when, in parts of the Soviet Union, milk was in such short supply that it was rationed by medical prescription. Little or poor-quality food often led to work stoppages. A chronic lack of medical supplies and basic necessities had a long-term debilitating effect on the population. Even nurses were scarce because the job was difficult and did not pay.

Figure 3.12
Role of prices, signalling function. **a** Temporary shortage; **b** new equilibrium.

input for the products. The information about lower prices says that this resource is more available and will cost less. A wise producer may look for ways to use this resource more frequently, and for ways to use other, relatively more expensive resources, less frequently. A rational reaction to this information would be for producers to look for ways to hire more capital equipment (which now costs less) and less labour.

Figure 3.13

Role of prices, signalling and rationing: resource market, capital equipment.



To access Worksheet 3.2 on how prices allocate resources, please visit www.pearsonbacconline.com and follow the onscreen instructions.

Thus, the forces of supply and demand work towards an efficient allocation of resources. This is what Adam Smith referred to when he coined the term the 'invisible hand of the market.' Market forces, Smith argued, consistently and accurately guide us to produce and consume to get the best outcomes. Buyers and sellers are rationing resources, based on prices, to get the most from what they have. In the process, consumer wants are satisfied with the least possible cost to society.

EXERCISES

- 5 Cite an example when the price of a good you use increased.
- 6 Speculate as to the reason why it increased. Was it increased demand or decreased supply?
- 7 Discuss how the price sends signals about the scarcity of the good.
- 8 Discuss how the price may cause consumers to ration the good.

3.4

Market efficiency

Learning outcomes

- Explain the concept of consumer surplus.
- Identify consumer surplus on a demand and supply diagram.
- Explain the concept of producer surplus.
- Identify producer surplus on a demand and supply diagram.
- Explain that the best allocation of resources from society's point of view is at competitive market equilibrium, where social (community) surplus (consumer surplus and producer surplus) is maximized (marginal benefit = marginal cost).

Consumer surplus

Competitive markets can also yield benefits beyond the efficiencies just discussed. Consumer surplus is the benefit consumers receive when they pay a price below what they

are willing to pay. Let's take a sample case of a fictitious movie, *Action Hero 2*, released on DVD and for direct digital distribution (via iTunes, for example). The market schedule for this product is shown in Table 3.4.

Price / \$	Quantity demanded (Q_D) / millions	Quantity supplied (Q_S) / millions
25	5	30
20	15	25
15	20	20
10	25	15
5	30	5

In Table 3.6, it is evident that the equilibrium price is \$15, where 20 million copies are sold. However, a closer look at the demand schedule tells us right away that there are many fans of *Action Hero 2* who are willing to pay considerably more than the market price. At a price of \$25, nearly 5 million copies are demanded. And yet, because this is a market where all consumers pay only one price (\$15), these fans will get an extra benefit worth \$10 to each of them. We call this extra benefit received by consumers (here, the fans who are willing to pay \$25) the consumer surplus. In this case, the consumer surplus = \$25 (price willing to pay) – \$15 (actual market price) = \$10. The demand schedule reveals that this consumer surplus can be calculated as the difference between what consumers are willing to pay and the market price they ultimately pay (Table 3.5).

Price / \$	Quantity demanded (Q_D) / millions	Market price / \$	Specific consumer surplus (demand price – market price) / \$
25	5	15	10
20	10	15	5
15	15	15	0

The equilibrium or market price for this movie is, as with all other markets, the intersection of supply and demand. Here it is \$15, where 20 million copies are expected to be sold. The consumer surplus can also be shown on a diagram, as the area between the demand curve and the market price (Figure 3.14).

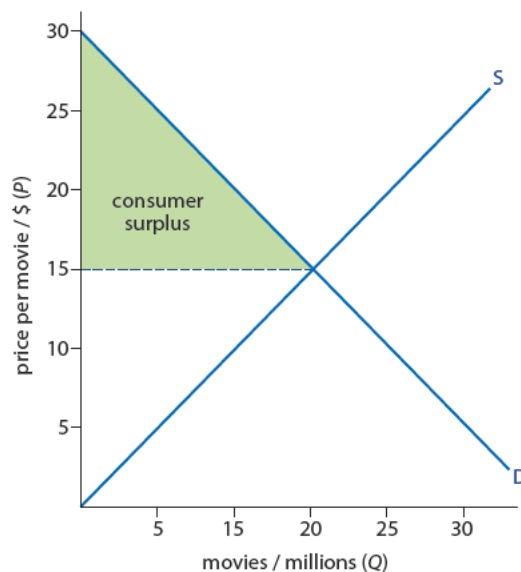


Figure 3.14
Consumer surplus: *Action Hero 2*.

i Consumer surplus is the benefit consumers receive when they pay a price below what they are willing to pay.

It can be inferred (from the schedule or the diagram) that any decrease in price will have the effect of increasing consumer surplus, *ceteris paribus*. Any increase in the market price will shrink that difference, causing a decrease in consumer surplus.

Producer surplus

Producer surplus is the benefit producers receive when they receive a price above the one at which they were willing to supply the good.

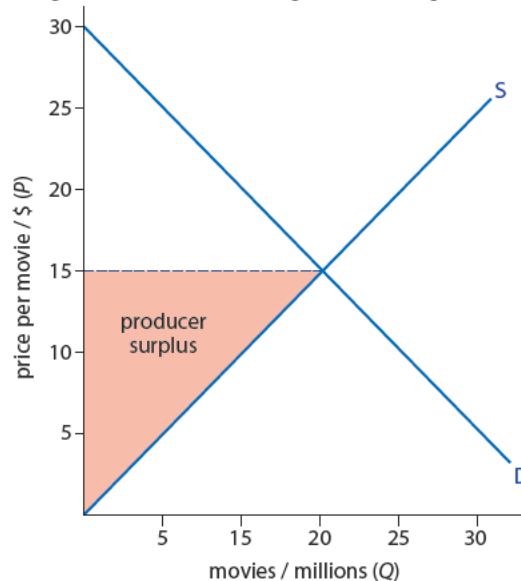


It is also possible to see the same type of benefit accruing to producers. Producer surplus is the benefit producers receive when they receive a price above the one at which they were willing to supply the good. A close look at the supply schedule in Table 3.8 should reveal this phenomenon. Even at the lowest price listed, some producers are willing to produce. Perhaps they are very efficient. They would produce 5 million copies at a price of just \$5. However, because the prevailing market price is \$15, \$15 is what they receive for every unit sold. Therefore, they enjoy a producer surplus of \$10 per unit. Table 3.6 shows the producer surplus at each price.

TABLE 3.6 CALCULATING PRODUCER SURPLUS			
Price / \$	Quantity supplied (Q_s) / millions	Market price / \$	Per-unit producer surplus (market price - supply price) / \$
15	20	15	0
10	15	15	5
5	5	15	10

These extra producer benefits can also be seen on the same supply and demand diagram. Figure 3.15 shows the producer surplus for *Action Hero 2* as the distance between the supply curve up until the market price. We can infer from this diagram, as well as from the data above, that any increase in the market price of *Action Hero 2*, *ceteris paribus*, would yield extra producer surplus at each price and increase the producer surplus area on the diagram.

Figure 3.15
Producer surplus: *Action Hero 2*.



To calculate the *total amount* of consumer or producer surplus, you need the formula for calculating the area of a triangle:

$$A = \frac{1}{2} b \times h$$

Where:

A is the area

b is the length of the base

h is the height

Consumer surplus = $0.5(20 \times (30 - 15)) = 0.5(20 \times 15) = 0.5(300) = 150$

Producer surplus = $0.5(20 \times (15 - 0)) = 0.5(300) = 150$

Consumer surplus + producer surplus = community surplus. Therefore, in this example, the community surplus is \$300 million. It is shown in Figure 3.16 as the area of both the green and red triangles.

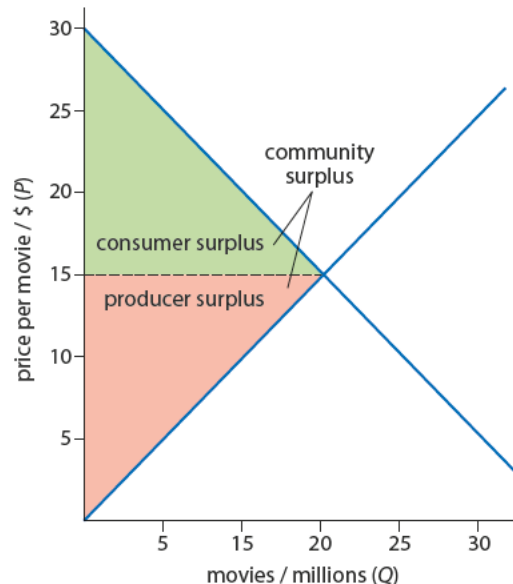


Figure 3.16
Community surplus: *Action Hero 2*.

Allocative efficiency and competitive markets

Allocative efficiency is one of the measures of economic efficiency used by economists. Allocative efficiency is generally considered to be in effect if society is getting the goods and services it wants most. More specifically, allocative efficiency is achieved if society produces enough of a good so that marginal benefit (MB) is equal to marginal cost (MC). This most directly relates to the 'What should be produced?' question of economics. Through the price system, free and competitive markets should bring consumers what they desire. But a look back at marginal cost and benefit theory makes the case clearer.

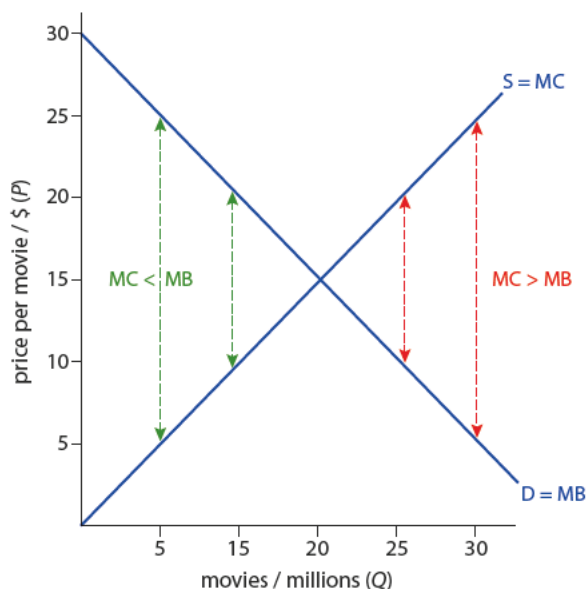
You will recall from Chapter 2 (page 28) that the marginal benefit derived from any good tends to drop as more is consumed. In other words, satisfaction tends to decline with extra consumption, and the demand curve's downward slope reflects this principle. Also, recall that the additional cost of producing more and more units tends to increase. In other words, the marginal costs tend to rise as more is made. This explains why marginal cost (supply) tends to slope upwards, and marginal benefit (demand) tends to slope downwards.

Allocative efficiency asks whether a market produces what consumers want, and part of the answer comes from the demand/marginal benefit curve. Figure 3.17 (overleaf) reproduces the demand curve showing that what consumers are willing to pay for a good is our best guess at the value (or benefit) society places on it. A price of \$15 for a copy of *Action Hero 2* tells us that a certain number of consumers value the movie at least that much (and possibly more).

i Allocative efficiency is achieved if society produces enough of a good so that the marginal benefit is equal to the marginal cost.

★ In theory, markets give us what we want at the least possible costs. How would market theory explain acts of giving or charity? Is the exchange of gifts at holidays and family occasions like weddings efficient? Does it matter? Which ways of knowing (sense perception, emotion, reason, language) does your response draw on?

Figure 3.17
Allocative efficiency in
competitive markets.



The question of whether society is producing enough of that good is further answered by the use of marginal analysis. In the example above, if society produced only 5 million copies, there would be a gap between the marginal benefit and the marginal cost. At this output level, potential consumer and producer surplus is lost. Society would clearly be better off, in terms of consumer satisfaction and producer profit, if the market level of output at the market price of \$15 were produced and sold (i.e. 20 million copies).

In fact, rational decision making by both the producer (to produce more) and consumers (to consume more) is precisely what should happen to bring the market to equilibrium. Market equilibrium is best achieved whenever marginal benefit and marginal cost are equal ($MB = MC$). Any more production, to perhaps 25 million units for example, will bring the marginal costs beyond the marginal benefits. In short, society would be producing too much of the good, and would be paying more than marginal benefit curve shows society to value the good.

In this context, it is possible to say that competitive markets achieve allocative efficiency in this very important sense. Consumers get what they want most, as revealed by their demand and marginal benefit curves, and they get as much as they want, with the market calibrated naturally to prevent them from overpaying or overproducing as marginal costs rise.

To learn more about efficiency, visit www.pearsonhotlinks.com, enter the title or ISBN of this book and select weblink 3.3.



EXERCISES

- 9 Identify a common product you use or consume.
- 10 What is the maximum price you would pay for that good?
- 11 What is the consumer surplus for that good?
- 12 Draw an equilibrium diagram of the market for the good, indicating consumer and producer surplus.
- 13 Identify the consumer, producer, and community surplus for this market.

PRACTICE QUESTIONS

- 1 Identify three reasons why the supply of oranges, for example, might increase and explain how this change will result in a new equilibrium. (10 marks) [AO2], [AO4]
- 2 List three possible reasons why the supply for automobiles, for example, would increase and explain how this change will result in a new equilibrium. (10 marks) [AO2], [AO4]
- 3 The basic economic problem is one of scarcity of productive resources. Explain how resources are allocated between competing uses in a market economy.
(10 marks) [AO2], [AO4]
- 4 © International Baccalaureate Organization 2006
- 5 Using a diagram, explain the concept of community surplus. (10 marks) [AO2], [AO4]
Describe the concept of allocative efficiency and explain why it is achieved at the competitive market equilibrium. (10 marks) [AO2], [AO4]



To access Quiz 3, an interactive, multiple-choice quiz on this chapter, please visit www.pearsonbacconline.com and follow the onscreen instructions.