Figure 3.6 illustrates and summarizes these distinctions. If the price of the good changes and other things remain the same, there is a *change in the quantity supplied* of that good. If the price of the good falls, the quantity supplied decreases and there is a movement down along the supply curve S_0. If the price of the good rises, the quantity supplied increases and there is a movement up along the supply curve S_0. When any other influence on selling plans changes, the supply curve shifts and there is a *change in supply*. If supply increases, the supply curve shifts rightward to S_1. If supply decreases, the supply curve shifts leftward to S_2.

TABLE 3.2 The Supply of Energy Bars

The Law of Supply

The quantity of energy bars supplied

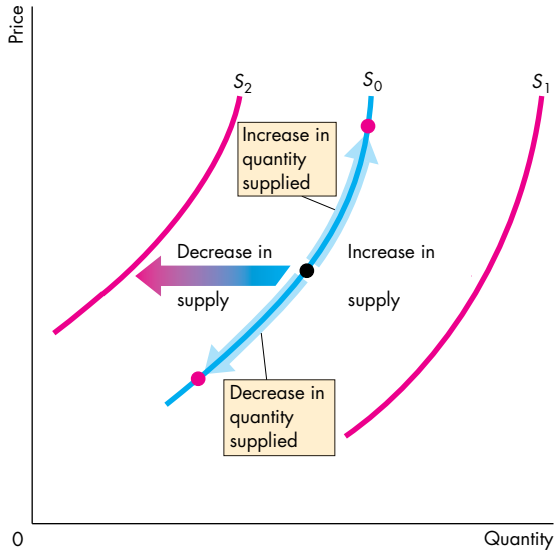
Decreases if:	*Increases if:*
■ The price of an energy bar falls	■ The price of an energy bar rises

Changes in Supply

The supply of energy bars

Decreases if:	*Increases if:*
■ The price of a factor of production used to produce energy bars rises	■ The price of a factor of production used to produce energy bars falls
■ The price of a substitute in production rises	■ The price of a substitute in production falls
■ The price of a complement in production falls	■ The price of a complement in production rises
■ The expected future price of an energy bar rises	■ The expected future price of an energy bar falls
■ The number of suppliers of bars decreases	■ The number of suppliers of bars increases
■ A technology change decreases energy bar production	■ A technology change increases energy bar production
■ A natural event decreases energy bar production	■ A natural event increases energy bar production

FIGURE 3.6 A Change in the Quantity Supplied Versus a Change in Supply



When the price of the good changes, there is a movement along the supply curve and *a change in the quantity supplied,* shown by the blue arrows on supply curve S_0. When any other influence on selling plans changes, there is a shift of the supply curve and a *change in supply*. An increase in supply shifts the supply curve rightward (from S_0 *to* S_1), and a decrease in supply shifts the supply curve leftward (from S_0 *to* S_2).

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REVIEW QUIZ

1. Define the quantity supplied of a good or service.
2. What is the law of supply and how do we illustrate it?
3. What does the supply curve tell us about the producer's minimum supply price?
4. List all the influences on selling plans, and for each influence, say whether it changes supply.
5. What happens to the quantity of cell phones supplied and the supply of cell phones if the price of a cell phone falls?

You can work these questions in Study Plan 3.3 and get instant feedback. myeconlab

Now we're going to combine demand and supply and see how prices and quantities are determined.

Market Equilibrium

We have seen that when the price of a good rises, the quantity demanded *decreases* and the quantity supplied *increases*. We are now going to see how the price adjusts to coordinate buying plans and selling plans and achieve an equilibrium in the market.

An *equilibrium* is a situation in which opposing forces balance each other. Equilibrium in a market occurs when the price balances buying plans and selling plans. The **equilibrium price** is the price at which the quantity demanded equals the quantity supplied. The **equilibrium quantity** is the quantity bought and sold at the equilibrium price. A market moves toward its equilibrium because

- Price regulates buying and selling plans.
- Price adjusts when plans don't match.

Price as a Regulator

The price of a good regulates the quantities demanded and supplied. If the price is too high, the quantity supplied exceeds the quantity demanded. If the price is too low, the quantity demanded exceeds the quantity supplied. There is one price at which the quantity demanded equals the quantity supplied. Let's work out what that price is.

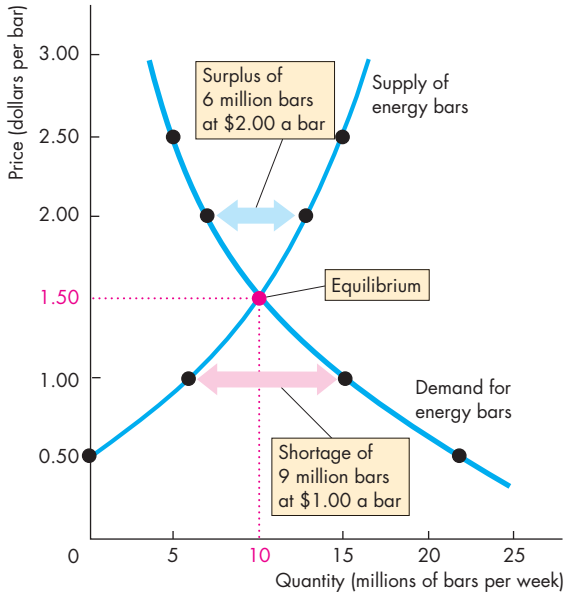
Figure 3.7 shows the market for energy bars. The table shows the demand schedule (from Fig. 3.1) and the supply schedule (from Fig. 3.4). If the price is 50¢ a bar, the quantity demanded is 22 million bars a week but no bars are supplied. There is a shortage of 22 million bars a week. The final column of the table shows this shortage. At a price of $1.00 a bar, there is still a shortage but only of 9 million bars a week.

If the price is $2.50 a bar, the quantity supplied is 15 million bars a week but the quantity demanded is only 5 million. There is a surplus of 10 million bars a week.

The one price at which there is neither a shortage nor a surplus is $1.50 a bar. At that price, the quantity demanded equals the quantity supplied: 10 million bars a week. The equilibrium price is $1.50 a bar, and the equilibrium quantity is 10 million bars a week.

Figure 3.7 shows that the demand curve and the supply curve intersect at the equilibrium price of $1.50 a bar. At each price *above* $1.50 a bar, there is a surplus of bars. For example, at $2.00 a bar, the surplus is 6

FIGURE 3.7 Equilibrium



Price (dollars per bar)	Quantity demanded	Quantity supplied	Shortage (–) or surplus (+)
	(millions of bars per week)		
0.50	22	0	–22
1.00	15	6	–9
1.50	**10**	**10**	**0**
2.00	7	13	+6
2.50	5	15	+10

The table lists the quantity demanded and the quantity supplied as well as the shortage or surplus of bars at each price. If the price is $1.00 a bar, 15 million bars a week are demanded and 6 million bars are supplied. There is a shortage of 9 million bars a week, and the price rises.

If the price is $2.00 a bar, 7 million bars a week are demanded and 13 million bars are supplied. There is a surplus of 6 million bars a week, and the price falls.

If the price is $1.50 a bar, 10 million bars a week are demanded and 10 million bars are supplied. There is neither a shortage nor a surplus, and the price does not change. The price at which the quantity demanded equals the quantity supplied is the equilibrium price, and 10 million bars a week is the equilibrium quantity.

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million bars a week, as shown by the blue arrow. At each price *below* $1.50 a bar, there is a shortage of bars. For example, at $1.00 a bar, the shortage is 9 million bars a week, as shown by the red arrow.

Price Adjustments

You've seen that if the price is below equilibrium, there is a shortage and that if the price is above equilibrium, there is a surplus. But can we count on the price to change and eliminate a shortage or a surplus? We can, because such price changes are beneficial to both buyers and sellers. Let's see why the price changes when there is a shortage or a surplus.

A Shortage Forces the Price Up Suppose the price of an energy bar is $1. Consumers plan to buy 15 million bars a week, and producers plan to sell 6 million bars a week. Consumers can't force producers to sell more than they plan, so the quantity that is actually offered for sale is 6 million bars a week. In this situation, powerful forces operate to increase the price and move it toward the equilibrium price. Some producers, noticing lines of unsatisfied consumers, raise the price. Some producers increase their output. As producers push the price up, the price rises toward its equilibrium. The rising price reduces the shortage because it decreases the quantity demanded and increases the quantity supplied. When the price has increased to the point at which there is no longer a shortage, the forces moving the price stop operating and the price comes to rest at its equilibrium.

A Surplus Forces the Price Down Suppose the price of a bar is $2. Producers plan to sell 13 million bars a week, and consumers plan to buy 7 million bars a week. Producers cannot force consumers to buy more than they plan, so the quantity that is actually bought is 7 million bars a week. In this situation, powerful forces operate to lower the price and move it toward the equilibrium price. Some producers, unable to sell the quantities of energy bars they planned to sell, cut their prices. In addition, some producers scale back production. As producers cut the price, the price falls toward its equilibrium. The falling price decreases the surplus because it increases the quantity demanded and decreases the quantity supplied. When the price has fallen to the point at which there is no longer a surplus, the forces moving the price stop operating and the price comes to rest at its equilibrium.

The Best Deal Available for Buyers and Sellers When the price is below equilibrium, it is forced upward. Why don't buyers resist the increase and refuse to buy at the higher price? The answer is because they value the good more highly than its current price and they can't satisfy their demand at the current price. In some markets—for example, the markets that operate on eBay—the buyers might even be the ones who force the price up by offering to pay a higher price.

When the price is above equilibrium, it is bid downward. Why don't sellers resist this decrease and refuse to sell at the lower price? The answer is because their minimum supply price is below the current price and they cannot sell all they would like to at the current price. Sellers willingly lower the price to gain market share.

At the price at which the quantity demanded and the quantity supplied are equal, neither buyers nor sellers can do business at a better price. Buyers pay the highest price they are willing to pay for the last unit bought, and sellers receive the lowest price at which they are willing to supply the last unit sold.

When people freely make offers to buy and sell and when demanders try to buy at the lowest possible price and suppliers try to sell at the highest possible price, the price at which trade takes place is the equilibrium price—the price at which the quantity demanded equals the quantity supplied. The price coordinates the plans of buyers and sellers, and no one has an incentive to change it.

REVIEW QUIZ

1. What is the equilibrium price of a good or service?
2. Over what range of prices does a shortage arise? What happens to the price when there is a shortage?
3. Over what range of prices does a surplus arise? What happens to the price when there is a surplus?
4. Why is the price at which the quantity demanded equals the quantity supplied the equilibrium price?
5. Why is the equilibrium price the best deal available for both buyers and sellers?

You can work these questions in Study Plan 3.4 and get instant feedback. myeconlab

Predicting Changes in Price and Quantity

The demand and supply model that we have just studied provides us with a powerful way of analyzing influences on prices and the quantities bought and sold. According to the model, a change in price stems from a change in demand, a change in supply, or a change in both demand and supply. Let's look first at the effects of a change in demand.

An Increase in Demand

If more people join health clubs, the demand for energy bars increases. The table in Fig. 3.8 shows the original and new demand schedules for energy bars as well as the supply schedule of energy bars.

The increase in demand creates a shortage at the original price and to eliminate the shortage, the price must rise.

Figure 3.8 shows what happens. The figure shows the original demand for and supply of energy bars. The original equilibrium price is $1.50 an energy bar, and the equilibrium quantity is 10 million energy bars a week. When demand increases, the demand curve shifts rightward. The equilibrium price rises to $2.50 an energy bar, and the quantity supplied increases to 15 million energy bars a week, as highlighted in the figure. There is an *increase in the quantity supplied* but *no change in supply*—a movement along, but no shift of, the supply curve.

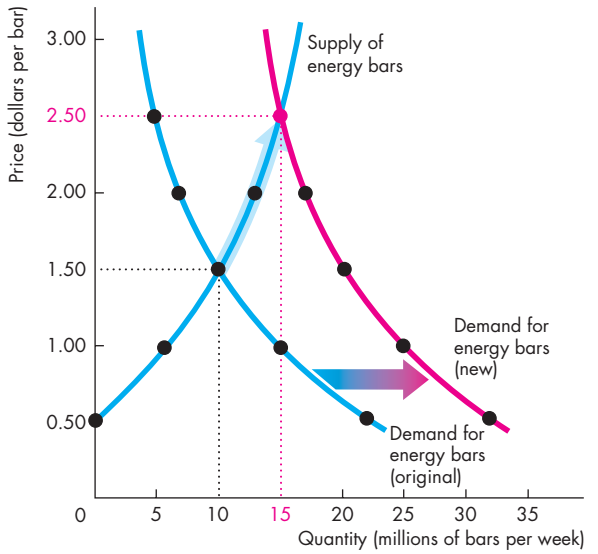
A Decrease in Demand

We can reverse this change in demand. Start at a price of $2.50 a bar with 15 million energy bars a week being bought and sold, and then work out what happens if demand decreases to its original level. Such a decrease in demand might arise if people switch to energy gel (a substitute for energy bars). The decrease in demand shifts the demand curve leftward. The equilibrium price falls to $1.50 a bar, the quantity supplied decreases, and the equilibrium quantity decreases to 10 million bars a week.

We can now make our first two predictions:

1. When demand increases, the price rises and the quantity increases.
2. When demand decreases, the price falls and the quantity decreases.

FIGURE 3.8 The Effects of a Change in Demand



Price (dollars per bar)	Quantity demanded (millions of bars per week)		Quantity supplied (millions of bars per week)
	Original	New	
0.50	22	32	0
1.00	15	25	6
1.50	**10**	20	**10**
2.00	7	17	13
2.50	5	**15**	**15**

Initially, the demand for energy bars is the blue demand curve. The equilibrium price is $1.50 a bar, and the equilibrium quantity is 10 million bars a week. When more health-conscious people do more exercise, the demand for energy bars increases and the demand curve shifts rightward to become the red curve.

At $1.50 a bar, there is now a shortage of 10 million bars a week. The price of a bar rises to a new equilibrium of $2.50. As the price rises to $2.50, the quantity supplied increases—shown by the blue arrow on the supply curve—to the new equilibrium quantity of 15 million bars a week. Following an increase in demand, the quantity supplied increases but supply does not change—the supply curve does not shift.

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Economics in Action

The Global Market for Crude Oil

The demand and supply model provides insights into all competitive markets. Here, we'll apply what you've learned about the effects of an increase in demand to the global market for crude oil.

Crude oil is like the life-blood of the global economy. It is used to fuel our cars, airplanes, trains, and buses, to generate electricity, and to produce a wide range of plastics. When the price of crude oil rises, the cost of transportation, power, and materials all increase.

In 2001, the price of a barrel of oil was $20 (using the value of money in 2010). In 2008, before the global financial crisis ended a long period of economic expansion, the price peaked at $127 a barrel.

While the price of oil was rising, the quantity of oil produced and consumed also increased. In 2001, the world produced 65 million barrels of oil a day. By 2008, that quantity was 72 million barrels.

Who or what has been raising the price of oil? Is it the action of greedy oil producers? Oil producers might be greedy, and some of them might be big enough to withhold supply and raise the price, but it wouldn't be in their self-interest to do so. The higher price would bring forth a greater quantity supplied from other producers and the profit of the producer limiting supply would fall.

Oil producers could try to cooperate and jointly withhold supply. The Organization of Petroleum Exporting Countries, OPEC, is such a group of producers. But OPEC doesn't control the *world* supply and its members' self-interest is to produce the quantities that give them the maximum attainable profit.

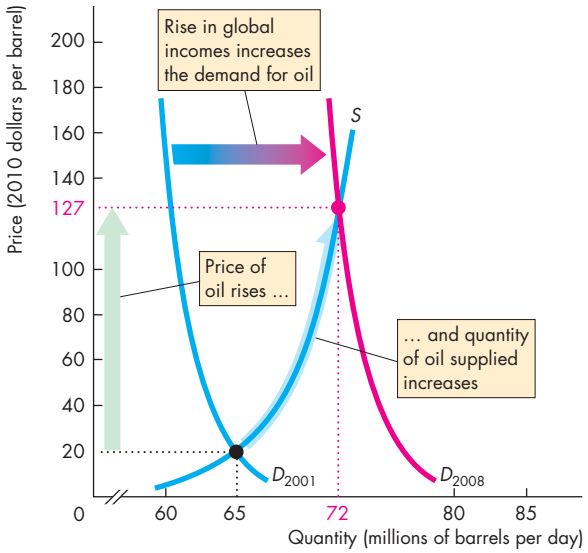
So even though the global oil market has some big players, they don't fix the price. Instead, the actions of thousands of buyers and sellers and the forces of demand and supply determine the price of oil.

So how have demand and supply changed?

Because both the price and the quantity have increased, the demand for oil must have increased. Supply might have changed too, but here we'll suppose that supply has remained the same.

The global demand for oil has increased for one major reason: World income has increased. The increase has been particularly large in the emerging economies of Brazil, China, and India. Increased world income has increased the demand for oil-using goods such as electricity, gasoline, and plastics, which in turn has increased the demand for oil.

The figure illustrates the effects of the increase in demand on the global oil market. The supply of oil remained constant along supply curve *S*. The demand for oil in 2001 was D_{2001}, so in 2001 the price was $20 a barrel and the quantity was 65 million barrels per day. The demand for oil increased and by 2008 it had reached D_{2008}. The price of oil increased to $127 a barrel and the quantity increased to 72 million barrels a day. The increase in the quantity is an *increase in the quantity supplied*, not an increase in supply.



The Global Market for Crude Oil

An Increase in Supply

When Nestlé (the producer of PowerBar) and other energy bar producers switch to a new cost-saving technology, the supply of energy bars increases. Figure 3.9 shows the new supply schedule (the same one that was shown in Fig. 3.5). What are the new equilibrium price and quantity? The price falls to $1.00 a bar, and the quantity increases to 15 million bars a week. You can see why by looking at the quantities demanded and supplied at the old price of $1.50 a bar. The new quantity supplied at that price is 20 million bars a week, and there is a surplus. The price falls. Only when the price is $1.00 a bar does the quantity supplied equal the quantity demanded.

Figure 3.9 illustrates the effect of an increase in supply. It shows the demand curve for energy bars and the original and new supply curves. The initial equilibrium price is $1.50 a bar, and the equilibrium quantity is 10 million bars a week. When supply increases, the supply curve shifts rightward. The equilibrium price falls to $1.00 a bar, and the quantity demanded increases to 15 million bars a week, highlighted in the figure. There is an *increase in the quantity demanded* but *no change in demand*—a movement along, but no shift of, the demand curve.

A Decrease in Supply

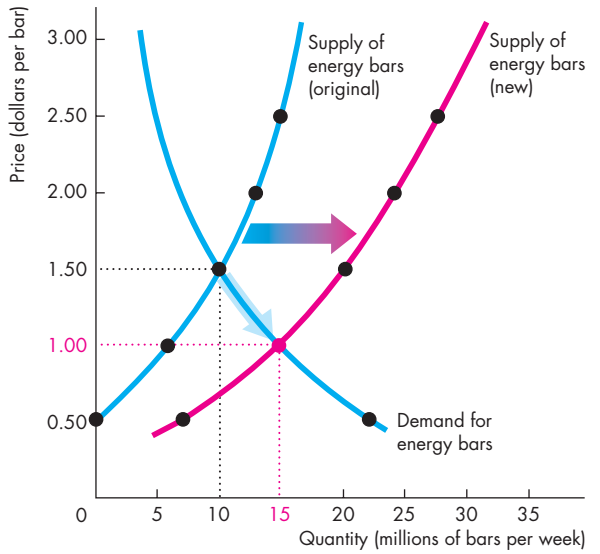
Start out at a price of $1.00 a bar with 15 million bars a week being bought and sold. Then suppose that the cost of labor or raw materials rises and the supply of energy bars decreases. The decrease in supply shifts the supply curve leftward. The equilibrium price rises to $1.50 a bar, the quantity demanded decreases, and the equilibrium quantity decreases to 10 million bars a week.

We can now make two more predictions:

1. When supply increases, the price falls and the quantity increases.
2. When supply decreases, the price rises and the quantity decreases.

You've now seen what happens to the price and the quantity when either demand or supply changes while the other one remains unchanged. In real markets, both demand and supply can change together. When this happens, to predict the changes in price and quantity, we must combine the effects that you've just seen. That is your final task in this chapter.

FIGURE 3.9 The Effects of a Change in Supply



Price (dollars per bar)	Quantity demanded (millions of bars per week)	Quantity supplied (millions of bars per week)	
		Original	New
0.50	22	0	7
1.00	**15**	6	**15**
1.50	**10**	**10**	20
2.00	7	13	25
2.50	5	15	27

Initially, the supply of energy bars is shown by the blue supply curve. The equilibrium price is $1.50 a bar, and the equilibrium quantity is 10 million bars a week. When the new cost-saving technology is adopted, the supply of energy bars increases and the supply curve shifts rightward to become the red curve.

At $1.50 a bar, there is now a surplus of 10 million bars a week. The price of an energy bar falls to a new equilibrium of $1.00 a bar. As the price falls to $1.00, the quantity demanded increases—shown by the blue arrow on the demand curve—to the new equilibrium quantity of 15 million bars a week. Following an increase in supply, the quantity demanded increases but demand does not change—the demand curve does not shift.

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Economics in Action

The Market for Strawberries

California produces 85 percent of the nation's strawberries and its crop, which starts to increase in March, is in top flight by April. During the winter months of January and February, Florida is the main strawberry producer.

In a normal year, the supplies from these two regions don't overlap much. As California's production steps up in March and April, Florida's production falls off. The result is a steady supply of strawberries and not much seasonal fluctuation in the price of strawberries.

But 2010 wasn't a normal year. Florida had exceptionally cold weather, which damaged the strawberry fields, lowered crop yields, and delayed the harvests. The result was unusually high strawberry prices.

With higher than normal prices, Florida farmers planted strawberry varieties that mature later than their normal crop and planned to harvest this fruit during the spring. Their plan worked perfectly and good growing conditions delivered a bumper crop by late March.

On the other side of the nation, while Florida was freezing, Southern California was drowning under unusually heavy rains. This wet weather put the strawberries to sleep and delayed their growth. But when the rains stopped and the temperature began to rise, California joined Florida with a super abundance of fruit.

With an abundance of strawberries, the price tumbled. Strawberry farmers in both regions couldn't hire enough labor to pick the super-sized crop, so some fruit was left in the fields to rot.

The figure explains what was happening in the market for strawberries.

Demand, shown by the demand curve, *D*, didn't change. In January, the failed Florida crop kept supply low and the supply curve was $S_{January}$. The price was high at $3.80 per pound and production was 5.0 million pounds per day.

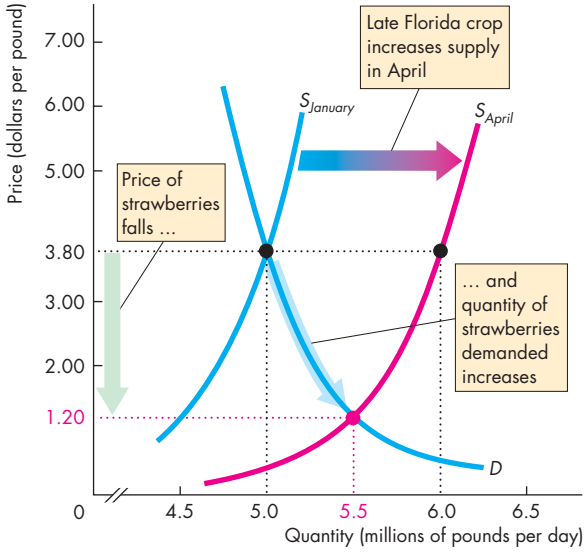
In April, the bumper crops in both regions increased supply to S_{April}. This increase in supply lowered the price to $1.20 per pound and increased the quantity demanded—a movement along the demand curve—to 5.5 million pounds per day.

You can also see in the figure why farmers left fruit in the field to rot. At the January price of $3.80 a pound, farmers would have been paying top wages to hire the workers needed to pick fruit at the rate of 6.0 million pounds per day. This is the quantity on supply curve S_{April} at $3.80 a pound.

But with the fall in price to $1.20 a pound, growers were not able to earn a profit by picking more than 5.5 million pounds.

For some growers the price wasn't high enough to cover the cost of hiring labor, so they opened their fields to anyone who wanted to pick their own strawberries for free.

The events we've described here in the market for strawberries illustrate the effects of a change in supply with no change in demand.



The Market for Strawberries

All the Possible Changes in Demand and Supply

Figure 3.10 brings together and summarizes the effects of all the possible changes in demand and supply. With what you've learned about the effects of a change in *either* demand or supply, you can predict what happens if *both* demand and supply change together. Let's begin by reviewing what you already know.

Change in Demand with No Change in Supply The first row of Fig. 3.10, parts (a), (b), and (c), summarizes the effects of a change in demand with no change in supply. In part (a), with no change in either demand or supply, neither the price nor the quantity changes. With an *increase* in demand and no change in supply in part (b), both the price and quantity increase. And with a *decrease* in demand and no change in supply in part (c), both the price and the quantity decrease.

Change in Supply with No Change in Demand The first column of Fig. 3.10, parts (a), (d), and (g), summarizes the effects of a change in supply with no change in demand. With an *increase* in supply and no change in demand in part (d), the price falls and quantity increases. And with a *decrease* in supply and no change in demand in part (g), the price rises and the quantity decreases.

Increase in Both Demand and Supply You've seen that an increase in demand raises the price and increases the quantity. And you've seen that an increase in supply lowers the price and increases the quantity. Fig. 3.10(e) combines these two changes. Because either an increase in demand or an increase in supply increases the quantity, the quantity also increases when both demand and supply increase. But the effect on the price is uncertain. An increase in demand raises the price and an increase in supply lowers the price, so we can't say whether the price will rise or fall when both demand and supply increase. We need to know the magnitudes of the changes in demand and supply to predict the effects on price. In the example in Fig. 3.10(e), the price does not change. But notice that if demand increases by slightly more than the amount shown in the figure, the price will rise. And if supply increases by slightly more than the amount shown in the figure, the price will fall.

Decrease in Both Demand and Supply Figure 3.10(i) shows the case in which demand and supply *both decrease*. For the same reasons as those we've just reviewed, when both demand and supply decrease, the quantity decreases, and again the direction of the price change is uncertain.

Decrease in Demand and Increase in Supply You've seen that a decrease in demand lowers the price and decreases the quantity. And you've seen that an increase in supply lowers the price and increases the quantity. Fig. 3.10(f) combines these two changes. Both the decrease in demand and the increase in supply lower the price, so the price falls. But a decrease in demand decreases the quantity and an increase in supply increases the quantity, so we can't predict the direction in which the quantity will change unless we know the magnitudes of the changes in demand and supply. In the example in Fig. 3.10(f), the quantity does not change. But notice that if demand decreases by slightly more than the amount shown in the figure, the quantity will decrease; if supply increases by slightly more than the amount shown in the figure, the quantity will increase.

Increase in Demand and Decrease in Supply Figure 3.10(h) shows the case in which demand increases and supply decreases. Now, the price rises, and again the direction of the quantity change is uncertain.

REVIEW QUIZ

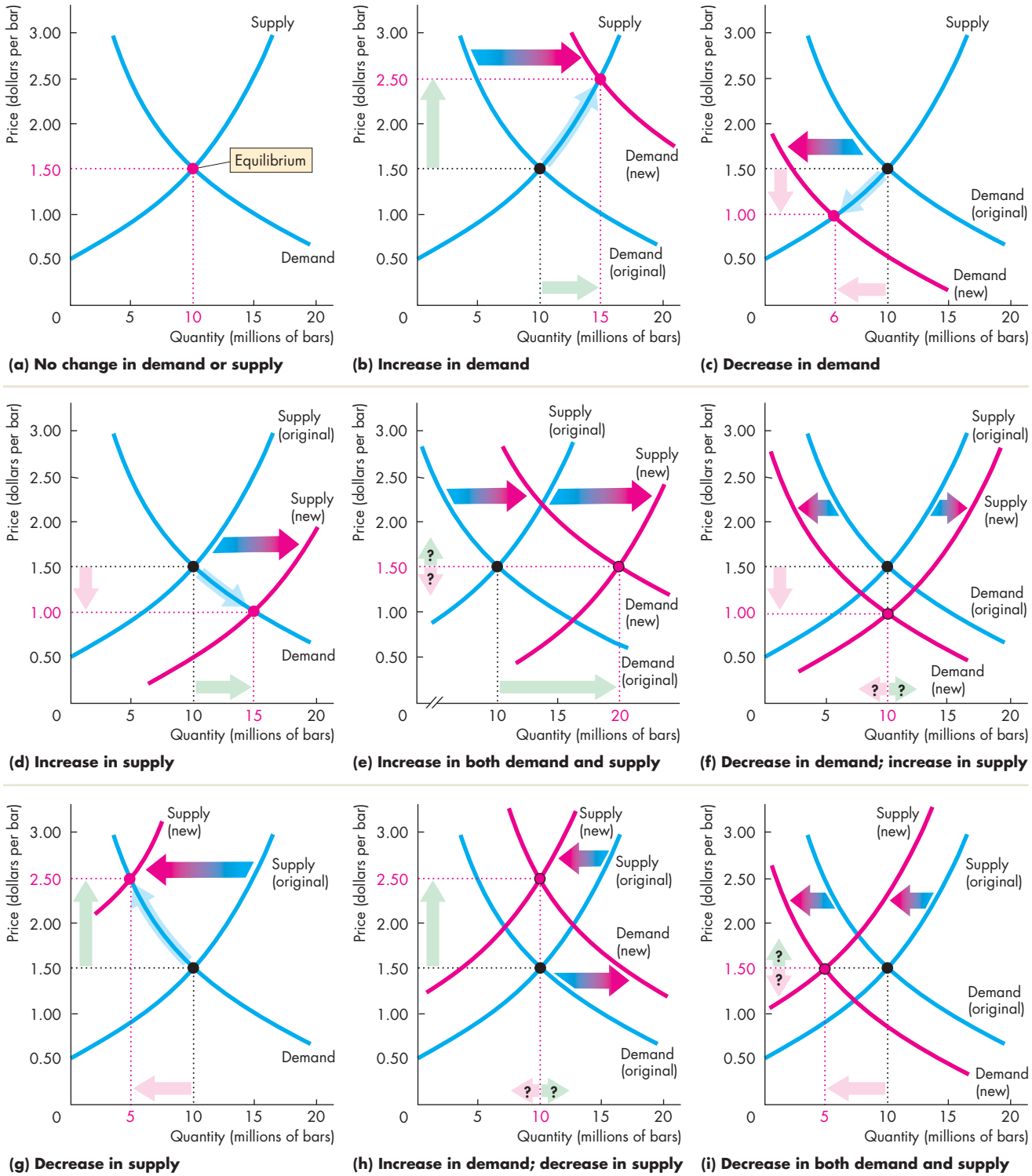
What is the effect on the price and quantity of MP3 players (such as the iPod) if

1. The price of a PC falls or the price of an MP3 download rises? (Draw the diagrams!)
2. More firms produce MP3 players or electronics workers' wages rise? (Draw the diagrams!)
3. Any two of the events in questions 1 and 2 occur together? (Draw the diagrams!)

You can work these questions in Study Plan 3.5 and get instant feedback. myeconlab

To complete your study of demand and supply, take a look at *Reading Between the Lines* on pp. 74–75, which explains why the price of coffee increased in 2010. Try to get into the habit of using the demand and supply model to understand the movements in prices in your everyday life.

FIGURE 3.10 The Effects of All the Possible Changes in Demand and Supply



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