

# Additional Examples of Supply and Demand

Our discussion has clearly demonstrated that supply and demand analysis is a powerful tool for understanding equilibrium prices and quantities. The information provided is fully sufficient for moving forward in the book, but you may find that additional examples of supply and demand are helpful. This optional appendix provides several concrete illustrations of changes in supply and demand.

Your instructor may assign all, some, or none of this appendix, depending on time availability and personal preferences.

## Changes in Supply and Demand

As Figure 3.6 of this chapter demonstrates, changes in supply and demand cause changes in price, quantity, or both. The following applications illustrate this fact in several real-world markets. The simplest situations are those in which either supply changes while demand remains constant or demand changes while supply remains constant. Let's consider two such simple cases first, before looking at more complex applications.

### Lettuce

Every now and then we hear on the news that extreme weather has severely reduced the size of some crop such as lettuce, oranges, or cherries. Suppose, for example, that a severe freeze destroys a sizable portion of the lettuce crop. This unfortunate situation implies a significant decline in supply, which we represent as a leftward shift of the supply curve from  $S_1$  to  $S_2$  in Figure 1. At each price, consumers desire as much lettuce as before, so the freeze does not affect the demand for lettuce. That is, demand curve  $D_1$  does not shift.

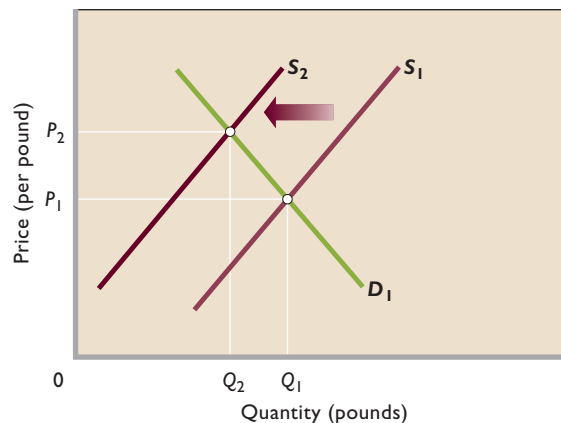
What are the consequences of the reduced supply of lettuce for equilibrium price and quantity? As shown in Figure 1, the leftward shift of the supply curve disrupts the previous equilibrium in the market for lettuce and drives the equilibrium price upward from  $P_1$  to  $P_2$ . Consumers respond to that price hike by reducing the quantity of lettuce demanded from  $Q_1$  to  $Q_2$ . Equilibrium in the market is restored, now at  $P_2$  and  $Q_2$ .

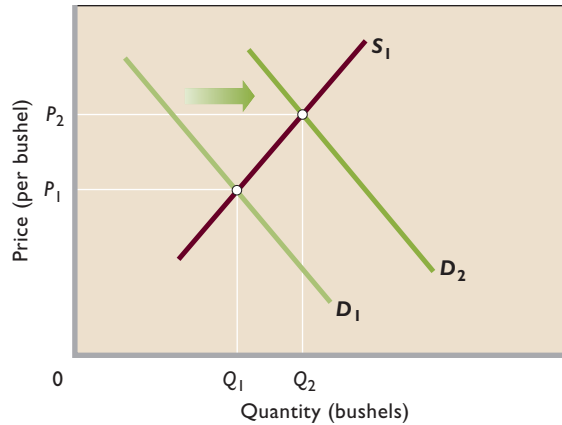
Consumers who are willing and able to pay price  $P_2$  obtain lettuce; consumers unwilling or unable to pay that price do not. Some consumers continue to buy as much lettuce as before, even at the higher price. Others buy some lettuce but not as much as before, and still others opt out of the market completely. The latter two groups use the money they would have spent on lettuce to obtain other products, say, carrots, whose price has not gone up.

### Corn and Ethanol

Between the beginning of 2006 and the middle of 2007, the price of corn doubled. Did people suddenly demand more corn flakes? Not hardly! The demand for cereals, beef, and other food products that use corn as inputs was relatively stable. Instead, the driving force was a rapid increase in the price of oil and gasoline (one of our following examples). This increase boosted the demand for ethanol, an alcohol-like substance that is blended with conventional gasoline. In the United States, producers refine ethanol

**FIGURE 1** The market for lettuce. The decrease in the supply of lettuce, shown here by the shift from  $S_1$  to  $S_2$ , increases the equilibrium price of lettuce from  $P_1$  to  $P_2$  and reduces the equilibrium quantity from  $Q_1$  to  $Q_2$ .





**FIGURE 2 The market for corn.** The increase in the demand for corn, shown here by the shift from  $D_1$  to  $D_2$ , increases the equilibrium price of corn from  $P_1$  to  $P_2$  and expands the equilibrium quantity from  $Q_1$  to  $Q_2$ .

mainly from corn, although ethanol can also be refined from sugar and other agricultural commodities. So the increase in the demand for ethanol drove up the demand for corn and raised its equilibrium price.

We depict this situation in Figure 2 as the rightward shift of the demand curve from  $D_1$  to  $D_2$ . This demand increase upped the equilibrium price of corn, in this case from  $P_1$  to  $P_2$ . Producers responded accordingly by increasing the quantity of corn supplied, as from  $Q_1$  to  $Q_2$ . At the higher price and quantity, the market achieved a new equilibrium.

Notice that the demand for corn, the price of corn, and the quantity of corn demanded and supplied all increased. But in the period depicted, the supply of corn—the entire curve  $S_1$ —remained securely fixed in place. Eventually, of course, the potential for high profits will encourage farmers to plant more corn and therefore shift the supply curve rightward. Depending on what happens to demand, the price of corn may drop closer to  $P_1$ .

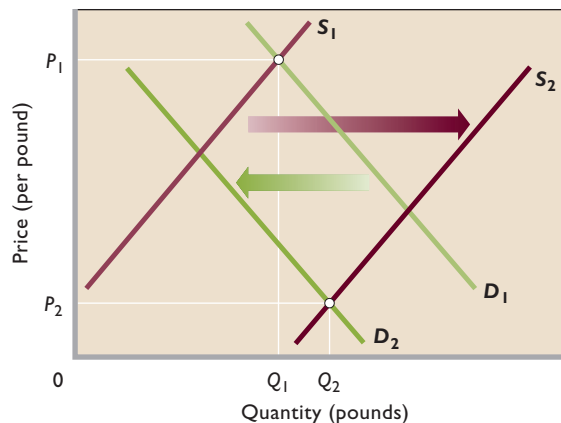
The rapid rise in the price of corn had a host of other effects that are easily understood through demand and supply analysis. The costs of producing corn-fed beef went up, which reduced the supply of beef and upped the price of hamburger and steak. The higher corn price caused a jump in the price of farm land in the Corn Belt. Further, the price of corn syrup (fructose) used in soft drinks rocketed and led some soft-drink makers to use cane sugar instead of corn syrup in the production process. In Mexico, large numbers of angry people gathered in cities to protest the higher price of tortillas, which are made from corn and consumed in large quantities by many Mexicans.

## PinkSalmon

Now let's see what happens when both supply and demand change at the same time. Several decades ago, people who caught salmon earned as much as \$1 for each pound of pink salmon—the type used mainly for canning—brought to the buyer. In Figure 3 that price is represented as  $P_1$ , at the intersection of supply curve  $S_1$  and demand curve  $D_1$ . The corresponding quantity of pink salmon is shown as  $Q_1$  pounds.

As time passed, supply and demand changed in the market for pink salmon. On the supply side, improved technology in the form of larger, more efficient fishing boats greatly increased the catch and lowered the cost of obtaining it. Also, high profits at price  $P_1$  encouraged many new fishers to enter the industry. As a result of these changes, the supply of pink salmon greatly increased and the supply curve shifted to the right, as from  $S_1$  to  $S_2$  in Figure 3.

**FIGURE 3 The market for pink salmon.** In the last several decades, the supply of pink salmon has increased and the demand for pink salmon has decreased. As a result, the price of pink salmon has declined, as from  $P_1$  to  $P_2$ . Because supply has increased by more than demand has decreased, the equilibrium quantity of pink salmon has increased, as from  $Q_1$  to  $Q_2$ .



Over the same years, the demand for pink salmon declined, as represented by the leftward shift from  $D_1$  to  $D_2$  in Figure 3. That decrease was caused by increases in consumer income and reductions of the price of substitute products. As buyers' incomes rose, consumers shifted demand away from canned fish and toward higher-quality fresh or frozen fish, including more-valued Atlantic, Chinook, Sockeye, and Coho salmon. Moreover, the emergence of fish farming, in which salmon are raised in ocean net pens, lowered the prices of these substitute species. That, too, reduced the demand for pink salmon.

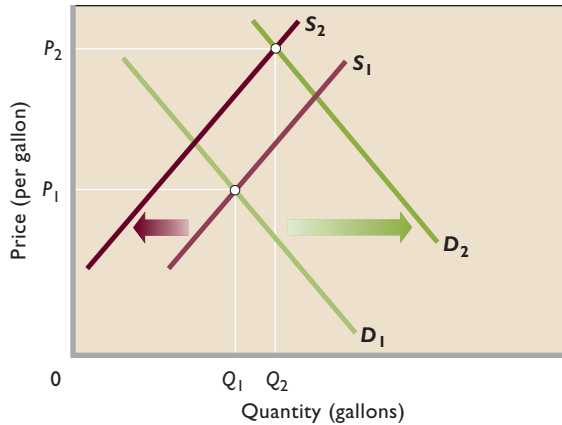
The altered supply and demand reduced the price of pink salmon to as low as \$.10 per pound, as represented by the drop in price from  $P_1$  to  $P_2$  in Figure 3. Both the supply increase and the demand decrease helped reduce the equilibrium price. However, in this particular case the equilibrium quantity of pink salmon increased, as represented by the move from  $Q_1$  to  $Q_2$ . Both shifts of the curves reduced the equilibrium price, but equilibrium quantity increased because the increase in supply exceeded the decrease in demand.

## Gasoline

The price of gasoline has increased rapidly in the United States over the past several years. For example, the average price of a gallon of gasoline rose from around \$2 in 2004 to about \$3 in 2007. What caused this 50 percent rise in the price of gasoline? How would we diagram this increase?

We begin in Figure 4 with the price of a gallon of gasoline at  $P_1$ , representing the \$2 price. Simultaneous supply and demand factors disturbed this equilibrium. Supply uncertainties relating to Middle East politics and warfare and expanded demand for oil by fast-growing countries such as China pushed up the price of a barrel of oil from \$37 in 2004 to \$80 in 2007. Oil is the main input for producing gasoline, so any sustained rise in its price boosts the per-unit cost of producing gasoline. Such cost rises decrease the supply of gasoline, as represented by the leftward shift of the supply curve from  $S_1$  to  $S_2$  in Figure 4. At times refinery breakdowns in the United States also contributed to this reduced supply.

While the supply of gasoline declined between 2004 and 2007, the demand for gasoline increased, as depicted by the rightward shift of the demand curve from  $D_1$  to  $D_2$ . Incomes in general were rising over these years because the U.S. economy was rapidly expanding. Rising incomes raise demand for all normal goods, including gasoline. An increased number of low-gas-mileage SUVs and light trucks on the road also contributed to growing gas demand.



**FIGURE 4 The market for gasoline.** An increase in the demand for gasoline, as shown by the shift from  $D_1$  to  $D_2$ , coupled with a decrease in supply, as shown by the shift from  $S_1$  to  $S_2$ , boosts equilibrium price (here from  $P_1$  to  $P_2$ ). In this case, equilibrium quantity increases from  $Q_1$  to  $Q_2$  because the increase in demand outweighs the decrease in supply.

The combined decline in gasoline supply and increase in gasoline demand boosted the price of gasoline from \$2 to \$3, as represented by the rise from  $P_1$  to  $P_2$  in Figure 4. Because the demand increase outweighed the supply decrease, the equilibrium quantity expanded, here from  $Q_1$  to  $Q_2$ .

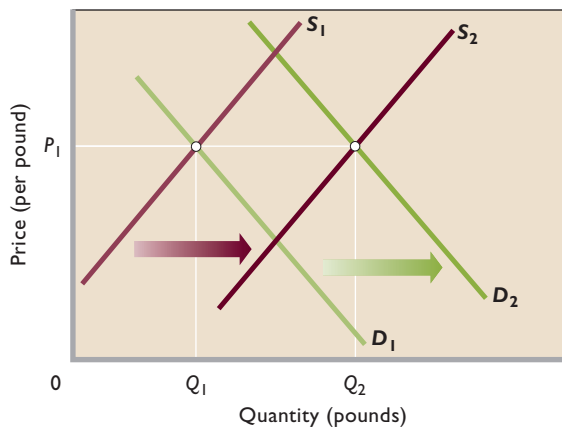
In other periods the price of gasoline has *declined* as the demand for gasoline has increased. Test your understanding of the analysis by explaining how such a price decrease could occur.

## Sushi

Sushi bars are springing up like Starbucks in American cities (well, maybe not that fast!). Consumption of this raw-fish delicacy from Japan has soared in the United States in recent years. Nevertheless, the price of sushi has remained relatively constant.

Supply and demand analysis helps explain this circumstance of increased quantity and constant price. A change in tastes has increased the U.S. demand for sushi. Many consumers of sushi find it highly tasty when they try it. And, as implied by the growing number of sushi bars in the United States, the supply of sushi has also expanded.

We represent these supply and demand changes in Figure 5 as the rightward shift of the demand curve from  $D_1$  to  $D_2$  and the rightward shift of the supply curve from  $S_1$



**FIGURE 5 The market for sushi.** Equal increases in the demand for sushi, as from  $D_1$  to  $D_2$ , and in the supply of sushi, as from  $S_1$  to  $S_2$ , expand the equilibrium quantity of sushi (here from  $Q_1$  to  $Q_2$ ) while leaving the price of sushi unchanged at  $P_1$ .

to  $S_2$ . Observe that the equilibrium quantity of sushi increases from  $Q_1$  to  $Q_2$  and equilibrium price remains constant at  $P_1$ . The increase in supply, which—taken alone would reduce price, has perfectly offset the increase in demand, which taken alone would raise price. The price of sushi does not change, but the equilibrium quantity greatly rises. That happens because both the increase in demand and the increase in supply expand purchases and sales.

Simultaneous increases in demand and supply can cause price to either rise, fall, or remain constant, depending on the relative magnitudes of the supply and demand increases. In this case, price remained constant.

## Preset Prices

In the body of this chapter, we saw that an effective government-imposed price ceiling (legal maximum price) causes quantity demanded to exceed quantity supplied—a shortage. An effective government-imposed price floor (legal minimum price) causes quantity supplied to exceed quantity demanded—a surplus. Put simply: Shortages result when prices are set below, and surpluses result when prices are set above, equilibrium prices.

We now want to establish that shortages and surpluses can occur in markets other than those in which government imposes price floors and ceilings. Such market imbalances happen when the seller or sellers set prices in advance of sales and the prices selected turn out to be below or above equilibrium prices. Consider the following two examples.

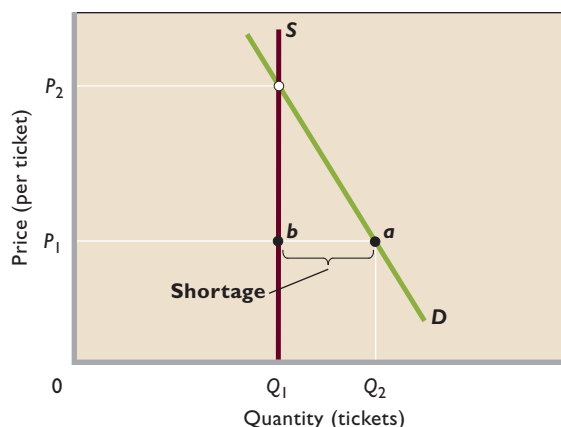
## Olympic Figure Skating Finals

Tickets for the women's figure skating championship at the Olympics are among the world's "hottest tickets." The popularity of this event and the high incomes of buyers translate into tremendous ticket demand. The Olympic officials set the price for the tickets in advance. Invariably, the price, although high, is considerably below the equilibrium price that would equate quantity demanded and quantity supplied. A severe shortage of tickets therefore occurs in this *primary market*—the market involving the official ticket office.

The shortage, in turn, creates a *secondary market* in which buyers bid for tickets held by initial purchasers rather than the original seller. Scalping tickets—selling them above the ticket price—may be legal or illegal, depending on local laws.

Figure 6 shows how the shortage in the primary ticket market looks in terms of supply and demand analysis. Demand curve  $D$  represents the strong demand for tickets

**FIGURE 6** The market for tickets to the Olympic women's figure skating finals. The demand curve  $D$  and supply curve  $S$  for the Olympic women's figure skating finals produce an equilibrium price that is above the  $P_1$  price printed on the ticket. At price  $P_1$  the quantity of tickets demanded,  $Q_2$ , greatly exceeds the quantity of tickets available ( $Q_1$ ). The resulting shortage of  $ab$  ( $= Q_2 - Q_1$ ) gives rise to a legal or illegal secondary market.



and supply curve  $S$  represents the supply of tickets. The supply curve is vertical because a fixed number of tickets are printed to match the capacity of the arena. At the printed ticket price of  $P_1$ , the quantity of tickets demanded,  $Q_2$ , exceeds the quantity supplied,  $Q_1$ . The result is a shortage of  $ab$ —the horizontal distance between  $Q_2$  and  $Q_1$  in the primary market.

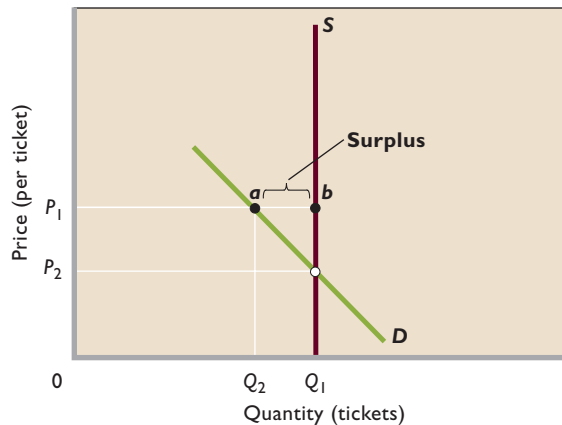
If the printed ticket price had been the higher equilibrium price  $P_2$ , no shortage of tickets would have occurred. But at the lower price  $P_1$ , a shortage and secondary ticket market will emerge among those buyers willing to pay more than the printed ticket price and those sellers willing to sell their purchased tickets for more than the printed price. Wherever there are shortages and secondary markets, it is safe to assume that price was set below the equilibrium price.

### Olympic Curling Preliminaries

Contrast the shortage of tickets for the women’s figure skating finals at the Olympics to the surplus of tickets for one of the preliminary curling matches. For the uninitiated, curling is a sport in which participants slide a heavy round object called a “stone” down the ice toward a target while teammates called “sweepers” use brooms to alter the course of the stone when desired.

Curling is a popular spectator sport in a few nations such as Canada, but it does not draw many fans in most countries. So the demand for tickets to most of the preliminary curling events is not very strong. We demonstrate this weak demand as  $D$  in Figure 7. As in our previous example, the supply of tickets is fixed by the size of the arena and is shown as vertical line  $S$ .

We represent the printed ticket price as  $P_1$  in Figure 7. In this case the printed price is much higher than the equilibrium price of  $P_2$ . At the printed ticket price, quantity supplied is  $Q_1$  and quantity demanded is  $Q_2$ . So a surplus of tickets of  $ba$  ( $= Q_1 - Q_2$ ) occurs. No ticket scalping occurs and there are numerous empty seats. Only if the Olympic officials had priced the tickets at the lower price  $P_2$  would the event have been a sellout. (Actually, the Olympic officials try to adjust to demand realities for curling contests by holding them in smaller ice arenas than used for figure skating and by charging less for tickets. Nevertheless, the stands are rarely full for the preliminary contests, which compete against final events in other winter Olympic sports.)



**FIGURE 7** The market for tickets to the Olympic curling preliminaries. The demand curve  $D$  and supply curve  $S$  for the Olympic curling preliminaries produce an equilibrium price below the  $P_1$  price printed on the ticket. At price  $P_1$  the quantity of tickets demanded is less than the quantity of tickets available. The resulting surplus of  $ba$  ( $= Q_1 - Q_2$ ) means the event is not sold out.

## Appendix Summary

1. A decrease in the supply of a product increases its equilibrium price and reduces its equilibrium quantity. In contrast, an increase in the demand for a product boosts both its equilibrium price and its equilibrium quantity.
2. Simultaneous changes in supply and demand affect equilibrium price and quantity in various ways, depending on the relative magnitudes of the changes in supply and demand. Equal increases in supply and demand, for example, leave equilibrium price unchanged.
3. Sellers set prices of some items such as tickets in advance of the event. These items are sold in the primary market that involves the original seller and buyers. If preset prices turn out to be below the equilibrium prices, shortages occur and scalping in legal or illegal secondary markets arises. The prices in the secondary market then rise above the preset prices. In contrast, surpluses occur when the preset prices happen to exceed the equilibrium prices.

## Appendix Study Questions

1. Suppose the supply of apples sharply increases because of perfect weather conditions throughout the growing season. Assuming no change in demand, explain the effect on the equilibrium price and quantity of apples. Explain why quantity demanded increases even though demand does not change. **LO4**
2. Assume the demand for lumber suddenly rises because of a rapid growth of demand for new housing. Assume no change in supply. Why does the equilibrium price of lumber rise? What would happen if the price did not rise under the demand and supply circumstances described? **LO4**
3. Suppose both the demand for olives and the supply of olives decline by equal amounts over some time period. Use graphical analysis to show the effect on equilibrium price and quantity. **LO4**
4. Assume that both the supply of bottled water and the demand for bottled water rise during the summer but that supply increases more rapidly than demand. What can you conclude about the directions of the impacts on equilibrium price and equilibrium quantity? **LO4**
5. Why are shortages or surpluses more likely with preset prices, such as those on tickets, than flexible prices, such as those on gasoline? **LO5**
6. Use the table below to answer the questions that follow: **LO5**
  - a. If this table reflects the supply of and demand for tickets to a particular World Cup soccer game, what is the stadium capacity?
  - b. If the preset ticket price is \$45, would we expect to see a secondary market for tickets? Explain why or why not.

Quantity Demanded, Thousands	Price	Quantity Supplied, Thousands
80	\$25	60
75	35	60
70	45	60
65	55	60
60	65	60
55	75	60
50	85	60

Would the price of a ticket in the secondary market be higher than, the same as, or lower than the price in the primary (original) market?

- c. Suppose for some other World Cup game the quantities of tickets demanded are 20,000 lower at each ticket price than shown in the table. If the ticket price remains \$45, would the event be a sellout? Explain why or why not.
7. Most scalping laws make it illegal to sell—but not to buy—tickets at prices above those printed on the tickets. Assuming that is the case, use supply and demand analysis to explain why the equilibrium ticket price in an illegal secondary market tends to be higher than in a legal secondary market. **LO5**
  8. Go to the Web site of the Energy Information Administration, [www.eia.doe.gov](http://www.eia.doe.gov), and follow the links to find the current retail price of gasoline. How does the current price of regular gasoline compare with the price a year ago? What must have happened to either supply, demand, or both to explain the observed price change? **LO4**