falls short of the preferred amount. The bottom line is that suppliers behave just like anyone else. They try to maximize the net benefit they get from the scarce resources under their control. In this chapter, we explore the choices and constraints that producers face in deciding how to allocate these scarce resources.

7.1 The Behavior of Individual Suppliers

All of us are suppliers of some sort. Most of us supply our time to the labor market in the form of work, and many of us supply money to banks and other lenders through our savings. Therefore, from an economic perspective, all of us are "suppliers." This means you shouldn't think of suppliers as only retailers or corporations that produce "things" for sale in the market. The economic model of supplier behavior that we will develop applies to all types of supply activity, including your own.

Every potential supplier in every market must decide whether it makes sense to use scarce resources to produce a particular good or service. A farmer has to decide whether to grow corn, soybeans, or nothing at all. A worker has to decide whether to work in his mother's local business, take a job in another city, or go back to school. Sometimes suppliers take a risk in choosing what to produce—it may turn out after the fact that there are no buyers for the product. Even successful companies such as McDonald's can occasionally get it wrong when it comes to consumer demand for new products. Its hula burger—a cheeseburger with a slice of pineapple in place of the burger—was a resounding flop when McDonald's founder Ray Croc introduced it in the early 1960s. In later years, McDonald's McSpaghetti, McLobster, and McPizza were rolled out with great fanfare, only to be withdrawn within months of their debut.

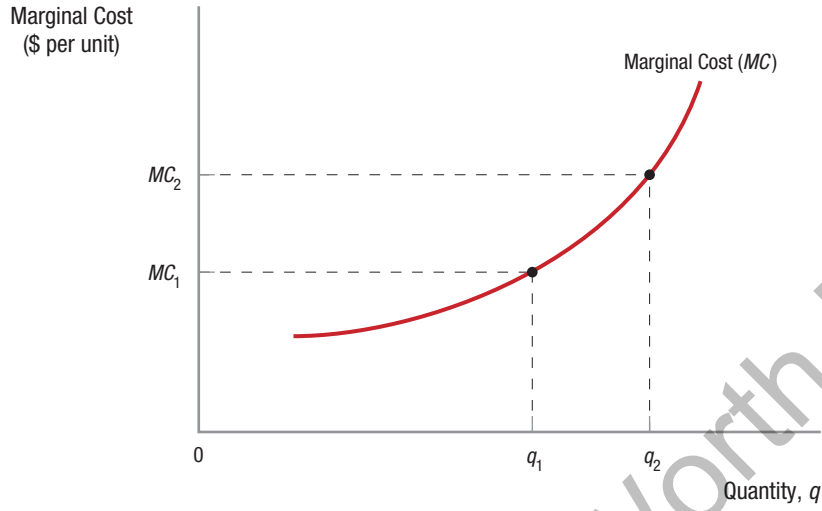
Suppliers not only create new products but also enter existing markets when they expect there is a net benefit to be had from augmenting the scarce resources already committed to these markets. In other words, they anticipate that the economic benefit of supplying additional units of an existing good or service outweighs the opportunity cost. Recall that opportunity cost reflects the forgone net benefit that would have been enjoyed from putting resources to their next-best use. This means that suppliers must consider the net benefit they would receive from a wide variety of supply activities before choosing which market to participate in. A salesperson, for example, must choose which line of products to sell, that is, which product markets to participate in as a supplier. A restaurant owner must decide whether he wants to be a supplier of take-out food, focus on the dine-in crowd, or serve both markets. And an education major must decide whether she wants to teach at the preschool, elementary, middle-school, or high-school level.

The Opportunity Cost of Production: Increasing Marginal Cost

We have already introduced the principle of increasing marginal cost, which tells us that the cost of producing additional units of a good rises at some point. This phenomenon can occur from the very first unit onward or kick in at some higher level of production. **Figure 7.1** illustrates this principle. You can see that as additional units of the good are produced, the marginal cost of each of these units is higher than for the unit before.

Why does the assumption of increasing marginal cost make sense? Recall that in the case of water, the first gallons of water can be supplied at low cost simply by catching rainwater in a bucket or reservoir. To increase the supply further, groundwater sources could be tapped and pumped up from under the earth's surface, a more

FIGURE 7.1 An Illustration of the Principle of Increasing Marginal Cost



The principle of increasing marginal cost tells us that the cost of producing additional units of a good rises at some point. Here, the cost of producing the q_1 unit is MC_1, whereas the cost of producing the q_2 unit is MC_2.

expensive process than simply collecting rainwater. As more water is supplied, the cost of supplying additional gallons rises.

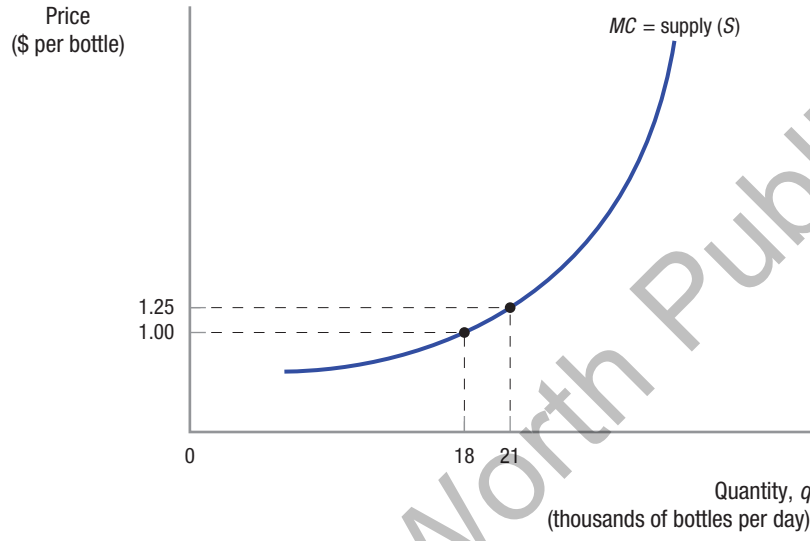
The concept of increasing marginal cost applies to virtually everything that is produced. Think about starting a home-based business that provides catering services for your friends. Your existing kitchen setup—your oven, refrigerator, pots and pans—is perfectly adequate to meet your friends' demands for catering their special events. However, as word of mouth spreads and your client list expands, you will likely outgrow this low-cost production setting and have to move to a larger facility. Quite likely, you will have to hire more staff and lease or purchase more cooking equipment. As a result, the cost of servicing additional clients and events is likely to rise. Each additional catered event (assuming the same menu and number of guests) costs more to produce than the one before.

Closer to home, we observe that the "production" of household services—cleaning, cooking, mowing the lawn, and so forth—also exhibits increasing marginal cost. This happens because we tend to get tired and bored the more chores we do, thereby increasing the cost of performing additional services around the house.

You have already learned that a person will maximize the net benefit obtained from an activity if she engages in it to the point where its marginal benefit equals its marginal cost. There is no reason to believe that this would be any different for suppliers. After all, each supplier is trying to maximize the return she gets from the scarce resources that she owns. In the case of price-taking suppliers, the "benefit" they get when they sell each unit of a good is equal to the price (P) they receive for the unit. This means that the quantity supplied that will maximize a producer's net benefit is where the good's price just covers the marginal cost of the very last unit produced.

Figure 7.2 shows a typical marginal cost (MC) curve, which exhibits increasing marginal cost, for the production of bottled water. As we can see, if the price of

FIGURE 7.2 The Law of Supply: The Case of Bottled Water



If the price of bottled water is $1, a producer would be willing to supply 18,000 bottles per day, which is the point at which the marginal cost of production is just equal to the price ($1). If, for some reason, the price of bottled water rises to $1.25, then the producer will increase her production to 21,000 bottles per day.

bottled water is $1 per bottle, the producer would be willing to supply 18,000 bottles per day, which is the point at which the marginal cost of producing the very last bottle is just equal to the price ($1) she receives for it.

Why is 18,000 bottles per day the "best" output level to choose? Suppose that the bottler chose instead to produce more than 18,000 bottles a day. At this higher output level, the marginal cost of each of the additional bottles is greater than $1, the price she receives for each bottle. This means that she is losing money on all of the bottles produced beyond 18,000 bottles a day; that is, the net benefit received from these additional bottles is *negative.* Rational economic decision makers will never engage in an activity that generates negative net benefits. They will stop at the point where the marginal benefit is just equal to the marginal cost.

Suppose instead that the supplier decides to produce only 12,000 bottles of water a day. The marginal cost of producing the 12,001th bottle of water is less than $1, meaning that if she expanded her output, she could capture additional net benefit. This will be the case up to the 18,000th bottle of water. As you have already learned, she won't receive any additional net benefit from the 18,000th bottle supplied because the price she receives for it ($1) is just equal to the marginal cost of producing it ($1). Unless her marginal cost of production goes down, or the price goes up, she won't be inclined to supply any more units.

The Law of Supply

Suppose that the price that the bottler receives rises to $1.25. How will she respond to this change in her economic environment? She will choose a new output level, where the marginal cost of producing the last unit is now just equal to $1.25. Figure 7.2

shows that the supplier is willing to increase her output level to 21,000 bottles per day when the price is $1.25 because the higher price will cover the higher marginal cost of producing additional bottles. As the price rises, the producer is "enticed" to move up her marginal cost curve and increase the quantity of bottled water supplied.

The fact is that higher prices tend to persuade suppliers to supply more output. A higher wage will entice you to work overtime. A higher interest rate will entice you to save more. When a price increases, the marginal benefit of supplying additional units rises. This encourages producers to supply more, even though they incur higher marginal costs of production. This result leads directly to the **law of supply**.

LAW OF SUPPLY When a good's price increases, suppliers are willing to offer more units for sale, all other things held constant. Conversely, when the price falls, suppliers cut back on the number of units they are willing to sell.

EXAMPLE You work an eight-hour shift as a waiter at a local restaurant, after which you are dead on your feet. Your boss offers you double time—twice your regular wage—to cover the next shift for a sick employee. You agree, but only because you will receive twice the money for the second shift.

EXAMPLE When interest rates rise from 1.5 percent to 12 percent, people tend to save more money because the opportunity cost of spending it now has risen.

A Producer's Supply Curve

In the previous chapter, we discussed the relationship between the price of hot dogs in New York City and the number of hot dogs that a tourist will buy during her weekend visit there. Let's now look at how many hot dogs a typical street vendor in New York City is willing and able to supply at different prices. **Table 7.1** shows the hot dog vendor's **supply schedule**.

SUPPLY SCHEDULE A table that shows various prices of a good and the number of units a producer is willing to sell at each price during a specific time period.

As you can see, this supply schedule is consistent with the notion that as the price of hot dogs increases, so does the street vendor's willingness to sell more hot dogs. At a lower price of $1 per hot dog, the vendor is only willing to supply five dozen each day. As the price rises to $1.25, however, he is willing to increase production and

Table 7.1 Supply Schedule of Hot Dogs

p Price per hot dog ($)	*q* No. of hot dogs supplied each day (in dozens)
1	5
1.25	10
1.50	15
1.75	20

supply an additional five dozen hot dogs, for a total of ten dozen each day. The price has to rise to elicit this additional supply because the vendor will incur higher marginal costs of production, say from working later hours in the cold or having to buy a lot more ice to keep a greater number of hot dogs cold all day.

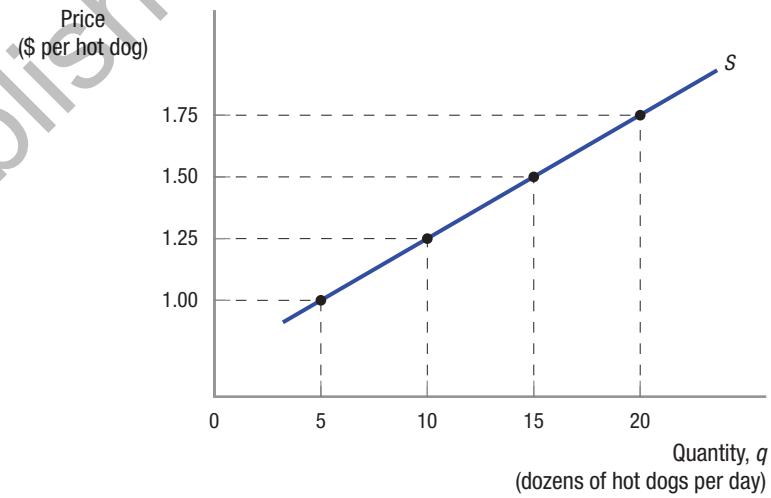
As we did with the demand schedule, we can use the information in the supply schedule to construct a **supply curve**.

SUPPLY CURVE A graphic representation of a supplier's supply schedule. The supply curve plots various price–quantity combinations that an individual producer is willing to accept.

A supply curve, like the one shown in **Figure 7.3** for hot dogs, plots the various price–quantity combinations that the supplier is willing to accept. By convention, the price (P) of the good is on the vertical axis, and the number of units, or quantity (q), of the good that an individual supplier is *willing to supply* is on the horizontal axis. We adopt the convention of using a lowercase "q" to represent the quantity that an individual supplier is willing to supply.

In Figure 7.3, the height of the supply curve at any given output level reflects the opportunity cost of supplying the last, or marginal, unit. For example, the marginal cost of supplying the tenth dozen of hot dogs equals $1.25 per hot dog. Therefore, the supplier must be paid at least $1.25 per hot dog to provide this much output. At $1.25, the vendor is indifferent to whether he supplies the last (tenth) dozen of

FIGURE 7.3 A Hot Dog Vendor's Supply Curve



This supply curve shows the various price–quantity combinations that a hot dog supplier is willing to accept. The height of the supply curve at any given output level reflects the opportunity cost of supplying the last, or marginal, hot dog. At a price of $1 per hot dog, the vendor is willing to supply five dozen hot dogs a day. When the price rises to $1.25, he is willing to supply ten dozen hot dogs, and so on.

hot dogs or not because the marginal benefit (price) received is just equal to marginal cost, resulting in zero net benefit.

It is important to recognize that the supply curve reveals the amount of a good that a producer is willing to sell at different prices. But just because he may be willing to sell different amounts at these different prices doesn't mean that there will be buyers for his output at all of these prices. Our street vendor might be willing to supply 80 dozen hot dogs per day if the price was $25 a hot dog, but at that price, the amount actually sold will likely be little or none. Similarly, you might be willing to supply 90 hours of work each week for $500 an hour. The trouble is you are likely to have a hard time finding an employer who will hire you at that wage. So if the prices that suppliers are willing to sell at are higher than even one buyer's willingness to pay, no voluntary exchanges will take place at all in this market.

The Supply of Labor

To better understand the concept of a supply curve, we turn to an example that is likely to be of particular interest to you—your supply of labor. Because we "own" our time in free societies, we must be paid to supply labor services (unless we are willing to volunteer our time). How much we must be paid depends on the opportunity cost of our time. That is, what is the net benefit we pass up from our next-best activity if, instead, we go to work?

We may be paid by the hour, day, or year. Regardless of how we are paid, there is a price at which we are willing to supply some labor services. When it comes to labor services, we call this price a **wage**.

WAGE The price at which labor services are supplied.

EXAMPLE The going wage for economic tutoring is $9.50 per hour. Ben is willing to work six hours a week at that wage.

EXAMPLE A telecommunications company offered a consultant $100 per hour to testify as an expert witness in a trial. She turned it down, saying that her going consulting rate was $175 an hour.

To maximize your economic well-being, you will weigh the benefits of working against the opportunity cost of working. This decision process will dictate how much time you spend at work and how much you spend on your next-best alternative. As you dedicate more and more of your time to work, there is less and less time left over for other activities that also give you pleasure. The more you work, the less time you have to sleep, go to school, play sports, or pursue other leisure activities.

Sure, the additional wages you earn will increase the amount of goods you can buy in the marketplace. Even so, these goods generate declining contributions to your personal satisfaction if the principle of diminishing marginal benefit holds. And, as the remaining time that is available for other activities declines, it becomes all the more valuable when put to these uses. Working more than 50 hours a week can even jeopardize your health by increasing the risk of high blood pressure and related health problems.[3] Therefore, if you are to be enticed into working extra hours, the wage you get for these additional hours must increase. Conversely, if the wage rate drops, it

[3]"Overtime: Good for Your Wallet but Bad for Your Health." *St. Louis Post Dispatch*, October 1, 2006.

will no longer cover the opportunity cost of working these extra, higher-cost hours. People will move down their labor supply curves, devoting more time to leisure activities and less to work.

This work–leisure trade-off is consistent with the observed behavior of employers and employees. For example, employers have a long history of paying more for "overtime" hours to persuade workers to put in more than a 40-hour workweek. In 1938, during the Great Depression, labor groups successfully lobbied Congress for "time-and-a-half" wages to be paid to hourly employees who worked more than 40 hours a week. Their rationale was that employees should be compensated for sacrificing additional leisure opportunities when they worked overtime. Congress supported the "time-and-a-half" initiative for quite a different reason. It wanted to penalize employers for extending the workweek for existing workers instead of hiring more employees. Whatever the underlying rationale, we know that according to the law of supply, an increase in the wage for overtime hours encourages workers to work more hours per week, all other things remaining the same.

ECONOMIC FALLACY When salaries go up, some people work less, not more. This means that the law of supply must not apply to labor markets.

False. Recall that the law of supply states that when the price of a good or service—in this case, the wage—goes up, more of it will be supplied—in this case, hours worked. You will also recall that this prediction holds *ceteris paribus*, that is, when everything else remains unchanged. In fact, the *ceteris paribus* condition is violated when we talk about a person's responsiveness to wage changes. The reason for this is that when wages change, so does the income of the worker. If we believe that leisure activities are normal goods, then more income would lead to greater consumption of leisure. However, this means that more time will be spent on leisure activities, leaving less time for work. We call this the *income effect* of a change in the wage rate.

It still remains true, however, that an increase in the wage rate increases the opportunity cost of pursuing more leisure activities because more goods can now be purchased for every hour worked. This is referred to as the *substitution effect* between leisure and consumables. In most cases, the substitution effect outweighs the income effect, so that a greater quantity of labor services is supplied when the wage rate rises and a lesser quantity is supplied when the wage rate declines. The income effect usually doesn't outweigh the substitution effect except at very high wage rates, where an individual's labor supply curve actually becomes *backward-bending*.

And even though there may be backward-bending supply curves when it comes to an individual's labor supply, after we aggregate all these curves to obtain the market supply curve, we expect that it will still conform to the law of supply and be upward sloping.

7.2 Supply in the Short Run versus the Long Run

Even though supply curves are upward sloping, this does not tell us exactly how much *more* quantity is supplied when the price of a product increases or what the magnitude of the reduction will be if its price drops. We can get a better handle on a supplier's responsiveness to price by looking at the slope of her supply curve. Usually,

suppliers are less responsive to price changes in the short run than in the long run. Given more time to adjust, suppliers have greater freedom (meaning that they face fewer costly constraints) to respond fully to price changes. For example, a manufacturer may be able to expand her production in the long run at low cost because over time, she can train additional employees and avoid paying overtime to existing workers. Or, she can build additional production facilities to accommodate more workers rather than pay employees a premium to work night shifts. Therefore, we expect a supplier's *long-run* supply curve to be flatter than the *short-run* supply curve.

In the very short run, called the **market period**, a supplier is unable to respond at all to a change in the price offered for his product. The quantity he supplies to the market cannot contract if the price falls or expand if the price rises.

MARKET PERIOD The length of time during which a supplier cannot make any adjustment to the quantity he supplies to the market.

EXAMPLE After a farmer has planted his crops for the season, he cannot change the volume or mix of agricultural products he supplies to the market.

EXAMPLE In the fall, clothing retailers submit their orders for spring fashions. These retailers are then locked into the styles and volume of clothing they have on hand to sell in the spring.

Consider the situation where your boss offered you $200 an hour to work 4 more hours after you have already worked an 18-hour shift. You probably wouldn't be inclined to accept his offer because you need some sleep. Similarly, if we look at the supply of residential housing, we know that in the market period, the supply of new houses is unresponsive to changes in price. It takes time to find land, get building permits, and construct a new house. Given more time, builders may be able to convert warehouses into lofts or apartments into condos at a relatively low cost in response to increases in housing prices. We refer to the period in which this type of partial response occurs as the **short run**.

SHORT RUN The length of time during which a supplier is able to only partially adjust the quantity she supplies to the market in response to a change in the good's price.

EXAMPLE A manufacturer of a hit toy can expand her output somewhat in response to an increase in the toy's price by adding a third shift to her firm's current production schedule.

EXAMPLE When the price of plywood rose as a result of Hurricane Katrina, Gulf Coast suppliers of building materials could only modestly increase the quantities they had to sell by buying from suppliers in nearby states.

In the **long run**, a supplier can fully respond to a change in price by expanding or contracting all inputs into production at low cost.

LONG RUN The length of time required for a supplier to be able to fully adjust the quantity she supplies to the market in response to a change in the good's price.

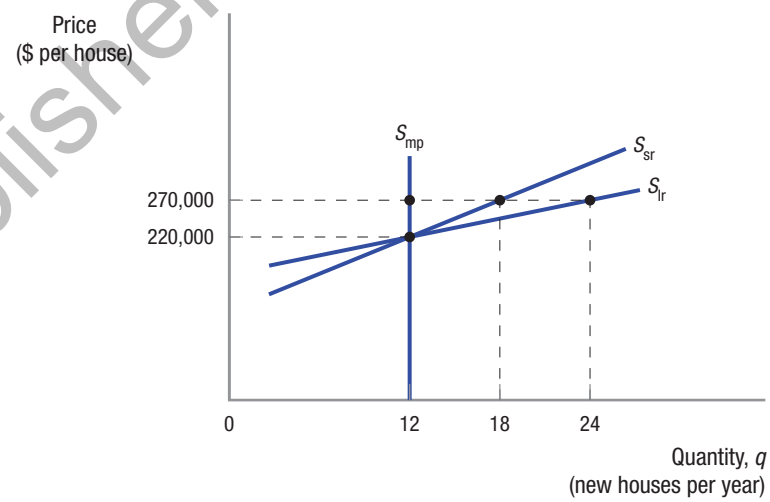
EXAMPLE When tofu and other soybean products became a mainstay of the American diet and led to higher soybean prices, it took farmers several years to fully transition from wheat to soybean production.

EXAMPLE When the world price of oil increases, it can take oil producers years to bring new offshore oil rigs on line.

When it comes to the housing industry, it will take much longer for builders to increase the supply of homes built from the ground up than to retrofit apartment buildings or warehouses in response to higher housing prices.

Figures 7.4 shows how the housing supply curve changes from the market period to the short run, and, finally, to the long run. In the market period, the supply curve (S_{mp}) of a typical builder in Atlanta is vertical at the current quantity of new, vacant houses he has available for sale—say 12 units. In this case, notice that even if housing prices increase from $220,000 to $270,000, there is no increase in the quantity supplied. The other two supply curves represent the short run (S_{sr}) and the long run (S_{lr}). As you can see, over time, the builder is able to respond more fully to price increases. In the short run, a price increase from $220,000 to $270,000 results in an increase in available housing from 12 to 18 units per year. Over a longer period of time, the same price increase elicits even more supply, increasing the available quantity from 18 to 24 units per year.

FIGURE 7.4 The Supply Curve for Houses in the Market Period (mp), Short Run (sr), and Long Run (lr)



In the market period, the supply curve (S_{mp}) of a typical builder in Atlanta is vertical at his current quantity of new, vacant houses—12 units. Even if housing prices increase from $220,000 to $270,000, the quantity supplied remains at 12 units during the market period. The other two supply curves represent the short run (S_{sr}) and the long run (S_{lr}). In the short run, a price increase from $220,000 to $270,000 results in an increase in available housing from 12 to 18 units per year. In the long run, this same price increase elicits an increase in quantity from 18 to 24 units per year.

A frequently asked question is how long—in terms of actual time—it takes for a supplier to "get to" the long run. The answer depends on the good in question and the constraints that the supplier faces. Suppliers with a lot of unused capacity, such as fiber-optic network suppliers, can readily expand their services in a very short period of time. In contrast, an airline running at nearly 100 percent seating capacity requires significantly more time to expand its services, especially if the expansion requires new planes, new airport gates, and the hiring and training of new pilots and crews.

It can also take time for a supplier to downsize operations and reduce the quantity he produces. In 1989, the U.S. government enacted regulations that have since required employers to give employees 60 day advance notice of a plant closure. These new laws have slowed the ability of U.S. producers to respond to dramatic reductions in price. Similarly, car manufacturers that have negotiated multiyear contracts with unionized workers can't quickly scale back production when car prices drop. This is one reason that major U.S. car manufacturers sought bankruptcy protection during the 2007 Great Recession. Under bankruptcy protection, they were able to renegotiate the terms of their labor union contracts before these agreements had expired.

Because different industries respond to price changes on different timetables, it can be difficult to precisely pinpoint the impact that government policies have on various sectors of the economy. For example, when the Federal Reserve reduces interest rates, it's likely that the automobile industry will improve—in terms of sales and employment levels—before the housing industry because the production cycle for housing is 12 to 15 months long compared to just 30 days for cars.

7.3 Movements along a Supply Curve versus Shifts in the Supply Curve

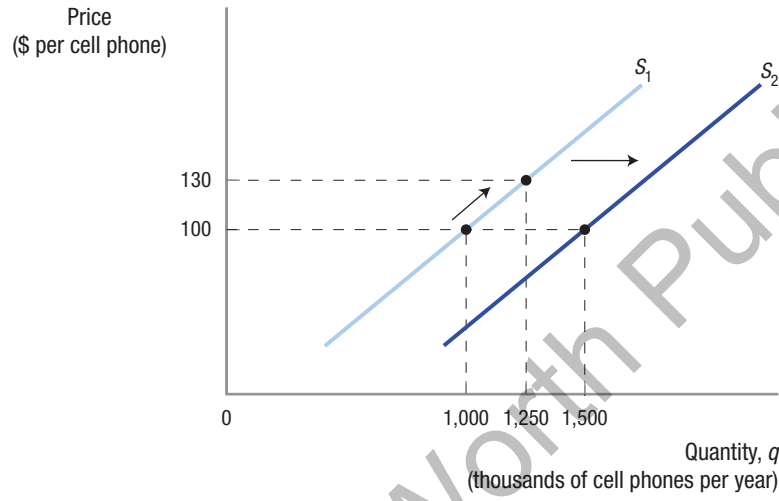
When a good's price changes, a supplier responds by changing the quantity of the good she is willing to produce (as long as we are not in the market period). As you saw in Figure 7.3, an increase in the price of hot dogs leads to an increase in the quantity of hot dogs that a typical street vendor is willing to sell, if he is able. If the price of hot dogs falls, the vendor will reduce the number of hot dogs supplied. Unlike the demand curve, the supply curve exhibits a positive relationship between price and quantity supplied. That is, the quantity supplied moves in the *same* direction as the change in price. A price increase, therefore, moves a supplier up along his supply curve.

What leads to a shift in the supply curve? If you recall, a shift in the demand curve means that there is a change in the quantity demanded *at each and every price*. It turns out that we have an analogous situation for the supply curve. In **Figure 7.5**, we have drawn a supply curve for cell phones that has the now-familiar upward slope. At $100, we see that the quantity of cell phones supplied by Qualcomm, a producer of cell phones, is 1,000,000 units per year.

What if the price of cell phones increases to $130? At this higher price, you can see that Qualcomm is willing to *move up* its supply curve and provide 1,250,000 phones for sale each year. A decrease in the price would have had the opposite effect.

For Qualcomm's supply curve to shift, there must be a change in its economic environment that results in a change in its willingness to supply *at each and every price*. Consider the shift in Qualcomm's supply curve from S_1 to S_2. At S_2, Qualcomm is now willing to supply 1,500,000 phones at $100; that is, the quantity supplied has increased even though the price of the cell phone hasn't. This tells us that something

FIGURE 7.5 Movement along the Supply Curve versus a Shift in the Supply Curve: The Supply of Cell Phones



The initial supply curve for cell phones produced by Qualcomm is S_1. At $100, the quantity of cell phones supplied by Qualcomm is 1,000,000 phones per year. If the price of cell phones increases to $130, Qualcomm is willing to *move up* its supply curve and provide 1,250,000 phones per year. If there is a reduction in Qualcomm's marginal cost of production so that it is willing to supply more at each and every price, its supply curve shifts to S_2. Qualcomm is now willing to increase its supply to 1,500,000 phones at $100 even though the price of the cell phone hasn't increased.

in the economic environment has changed that affected Qualcomm's decision process, and it wasn't the price of the cell phone.

A rightward shift in the supply curve means that there is an increase in the quantity supplied at each and every price. A leftward shift in the supply curve means that there is a decrease in the quantity supplied at each and every price. What can cause the supply curve to shift? We address this question next.

7.4 Factors that Shift a Supply Curve

When we discussed factors that shift an individual's demand curve, we considered changes in income, property rights, the price of alternatives, and preferences. These changes shift the demand curve so that the quantity demanded is now higher or lower at each and every price. When it comes to the supply curve, a change in the opportunity cost of production leads to a shift in the curve. That is, anything that affects the marginal cost of producing an additional unit of output will result in a shift in the supply curve so that the quantity supplied *at each and every price* changes.

Although a number of things can change a supplier's marginal cost of production, perhaps the most obvious is a change in the price of an input used in the production process. We look at this next.

Changes in Input Prices

If the marginal cost of production changes, it changes the net benefit that a supplier receives for each unit produced. Why? The net benefit per unit is simply the difference

between its marginal benefit and marginal cost or, in this case, the difference between the price received for the unit and its marginal cost of production. When there is an increase in the cost of hiring workers, for example, the marginal cost curve will shift upward and, given that there is no change in price, the supplier will cut back on the number of units he is willing to produce.

Whether we are talking about labor, machinery, or other resources used up in the production process, each has a price. Workers are paid wages, and equipment owners are paid a lease payment. We call these **input prices**. An input price tells us the price of a "unit" of an input—the wage per hour, the price per barrel of oil, the monthly lease rate for a scanning machine, and so forth.

INPUT PRICE The price of one unit of an input used in production.

EXAMPLE Animators are employed to produce Disney films such as *The Lion King*. The wage they receive per hour, day, or week is an input price.

EXAMPLE Oil is used to produce rubber, steel, plastics, and other basic manufacturing materials. The price of oil per barrel is an input price.

Let's take a closer look at how a change in the price of an input affects the supply of a good. Consider the impact that an increase in animators' wages has on Disney's supply of animated movies each year. **Figure 7.6** depicts the supply curve, labeled S_1, of animated movies that Disney is willing to supply each year based on its current costs of production.

FIGURE 7.6 How an Input Price Shifts the Supply Curve: A Wage Increase for Movie Animators

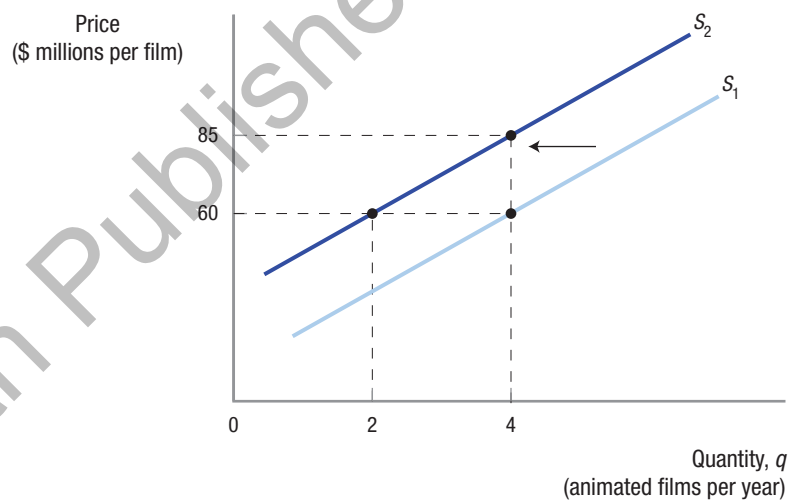


Figure 7.6 shows S_1, the initial supply curve of animated movies produced by Disney. At a price of $60 million, four movies are produced each year. If animators' wages increase, the cost of producing each movie increases, leading to a leftward shift in the supply curve of animated movies to S_2. Disney will make fewer animated films at each and every price. At a price of $60 million, the number of movies it will supply drops to two per year. To make the same number of animated films (four) per year as before the wage increase, Disney must now receive $85 million per movie.

If film distributors are willing to pay $60 million per movie, then Disney will supply four films per year. Now what if animators' wages increase by one-third, perhaps because the opening of a new animation studio (Pixar) increases their opportunities? The cost of producing each movie increases as a result. As the marginal cost of each movie increases, the net benefit from producing each movie declines. Consequently, the supply curve of animated movies shifts to the left, to the supply curve labeled S_2. Disney will make fewer animated films at each and every price. If Disney expects to sell each movie at the same price as before ($60 million), the number of movies it will supply will drop to two per year. To acquire the same number of animated films (four) as before the wage increase, the film distributors must now offer $85 million per movie. This is because the marginal cost of producing the third and fourth movie is now higher than the original price tag of $60 million per movie.

Virtually all goods use labor in either their production or distribution stages. This means that an increase in wage rates will translate directly into an increase in the cost of supplying most goods. As we have just shown, this will result in a leftward shift in the supply curve for these goods. At any given price, a lesser quantity of the good is now supplied. Suppose, for example, that the government required all employers to provide workers with health-insurance coverage or a new paid holiday (e.g., Super Bowl Monday). The employer's cost of labor services would increase, and the supply curve for its product would shift to the left. One way of seeing this is to recognize that after the leftward shift in the supply curve, the *vertical height* of the new supply curve, which reflects the marginal cost of producing each unit, is greater at all levels of output. Of course, if there is a supplier who is not subject to the new law—perhaps because he has a small number of employees or is located outside the country—then his supply curve would not shift at all.

What if the government enacts policies that lower labor costs? Some state and federal initiatives subsidize firms that hire more workers in areas with high-unemployment rates. *Enterprise zones* have been created in central cities, and employers located there have been subsidized to encourage more hiring.[4] Wage subsidies lower a company's payroll costs, thereby reducing its production costs. Consider the Tums factory located in downtown St. Louis. If GlaxoSmithKline, the maker of Tums, receives a wage subsidy from the city of St. Louis, the company's supply curve for Tums will shift to the right from S_1 to S_2: at every price, the factory is now willing to supply a greater amount of output. This is depicted in **Figure 7.7**.

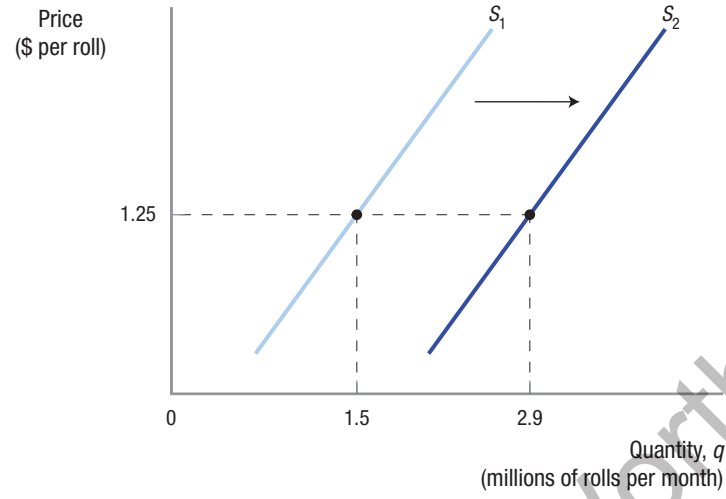
Before the wage subsidy, GlaxoSmithKline was willing to supply 1.5 million rolls of Tums per month at $1.25 per roll. After the wage subsidy, it is willing to increase its output to 2.9 million rolls per month at $1.25 per roll.

A similar result occurs when the government provides child-care subsidies to working parents. In the United States, these subsidies primarily come in the form of tax credits and government-funded Head Start preschool programs. These initiatives reduce the opportunity cost of working, resulting in a rightward shift in a working parent's labor supply curve. This translates into an increase in the number of hours that a working parent is willing to supply at each and every wage, as depicted in **Figure 7.8**.

Prior to the subsidy, we see that a working parent is willing to work 35 hours per week if the going wage is $12 per hour. After the subsidy is introduced, this parent is willing to increase her hours worked to 39 per week at the going wage of $12 per hour.

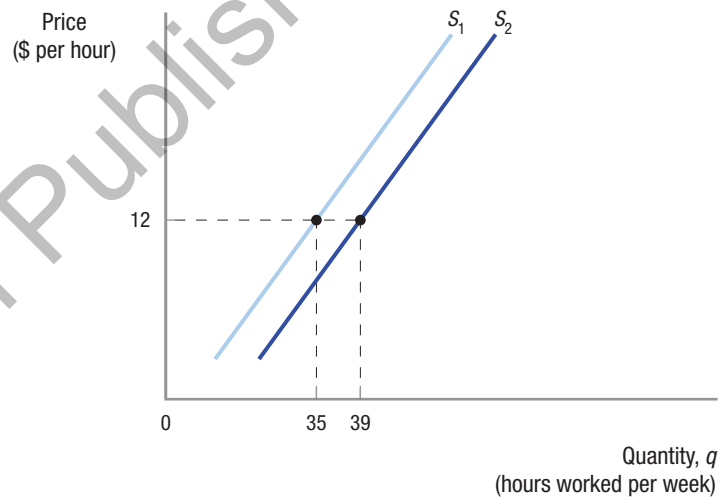
[4]Robert Pear, "Congress Revives Bill on Investment in Poor Areas." *New York Times,* December 14, 2000.

FIGURE 7.7 How a Wage Subsidy Shifts a Supply Curve: The Supply of Tums



At $1.25 per roll, GlaxoSmithKline is willing to produce 1.5 million rolls of Tums each month. Wage subsidies reduce the marginal cost of producing each roll of Tums. As a result, the supply curve shifts to the right, from S_1 to S_2, leading the company to increase its supply to 2.9 million rolls per month.

FIGURE 7.8 The Impact of Subsidized Child Care on a Working Parent's Supply of Labor Services



Child-care subsidies reduce the opportunity cost of working, leading to a rightward shift in a working parent's labor supply curve from S_1 to S_2. Prior to the subsidy, a working parent was willing to work 35 hours per week for $12 an hour. After the subsidy is introduced, the parent is willing to increase her work hours to 39 per week at the same wage rate.

This response is precisely the reason why, in 1996, then-President Clinton incorporated child-care subsidies into the U.S. government's new welfare-to-work program. The idea was to encourage single mothers on welfare to return to the labor force. And it seems to have worked: on average, women who received these child-care subsidies worked more months and had double the earnings of those who did not receive the subsidy.[5]

SOLVED PROBLEM

Q Suppose that the U.S. dollar becomes "weaker" relative to other currencies. This means that each dollar is able to purchase less in the world market, including foreign-produced oil. How would this affect the supply curve of a producer such as U.S. Steel, which is heavily dependent on oil imports.

A The dollar price of each barrel of imported oil rises when the dollar weakens, even though there is no change in the actual resources—labor, equipment, and so forth—that foreign suppliers use to produce this oil. As a result, the supply curve of U.S. Steel will shift to the left: its marginal cost of producing each and every ton of rolled steel rises. Generally speaking, when the dollar weakens, it leads to an increase in the production costs of any domestic supplier whose production process is dependent on imported inputs. This results in a leftward shift in the producer's supply curve.

Technology (Knowledge) and Production Costs

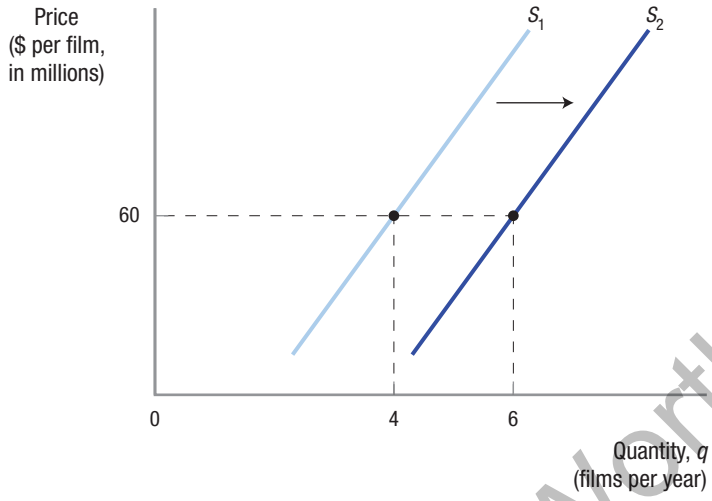
Technological breakthroughs often lead to new, cost-saving production processes. As we noted in Chapter 6, grocery stores introduced labor-saving price-scanning registers to reduce their costs; fast-food restaurants turned to automatic and self-serve drink-filling machines; and banks began to offer a wide range of services through automatic teller machines (ATMs) and online banking. These cost-reducing technologies have increased the quantity of services supplied at each and every price. Banks, for example, are now able to offer 24-hour access to your money without additional service fees.

An important example of how cost-saving technology can increase supply in the absence of any change in a good's price was the invention of the printing press in 1440. The press replaced the costly process of using scribes to handwrite each copy of a manuscript. The end result was an explosive growth in the supply of books and, as a by-product, an increase in knowledge and its dissemination. Think of it: that knowledge, which had been largely locked away in the cloisters of the monks, infused the world at large at a relatively low cost. You are living through a similar kind of transformation: advances in computer technology have led to a dramatic increase in the supply of low-cost information. More and more people can access a wide variety of information through the Web—daily stock prices, weather forecasts, musical scores, and so on—at a very low or zero price. Prior to these advances, people had to pay a much higher price for the same access: there was a charge to access the 24-hour telephone weather line, closing stock prices, and printed musical scores.

Technological innovations that reduce the cost of production lead to a rightward shift in the supply curve of the affected goods and services. More quantity is supplied *at each and every price* because the marginal cost of production has fallen. Computer-generated animation technologies, for example, have substantially reduced the cost

[5]Sandra Danziger, et al., "Childcare Subsidies and the Transition from Welfare to Work." *Family Relations,* November 2003.

FIGURE 7.9 How Technology Can Shift a Supply Curve: Computer Animation and the Supply of Disney Movies



S_1 reflects Disney's marginal cost of producing animated movies precomputerization. At a price of $60 million, four movies are produced each year. Computer-generated animation reduces the marginal cost of producing each movie, translating into a rightward shift in the supply curve to S_2. At the original ($60 million) price, Disney is now willing to supply six movies instead of four per year.

of producing animated features because animators are no longer needed to draw each individual film cel by hand. In fact, Disney produced its first fully computer-animated movie, *Chicken Little,* in 2005.

To see how technological change might impact the supply of animated movies, **Figure 7.9** shows the supply curve, labeled S_1, of animated movies precomputerization. At a price of $60 million, four movies are produced each year. Computer-generated animation reduces the marginal cost of producing each movie, translating into a rightward shift in the supply curve to the new supply curve labeled S_2. At the original ($60 million) price, Disney is now willing to supply six movies instead of four per year. Now, the marginal cost of producing the fourth and fifth movies is less than $60 million, and the marginal cost of producing the sixth movie is just equal to $60 million. The vertical distance of the supply curve at each and every unit of output is lower than before because the marginal cost of producing each film has fallen.

There are many other examples of how advances in technology have lowered the cost of production and increased supply without any increase in the price of the good. E-mail and the Internet have both reduced the cost of working because they permit people to work at home rather than commuting to an office. Many work costs—a professional wardrobe, transportation, and even child care—can be substantially reduced when telecommuting is introduced into the workplace. Your professor, for example, can now hold "virtual" office hours from her home via e-mail, after the kids have been put to bed. When this happens, there is a rightward shift in her supply of office hours; she is willing to offer more virtual hours without an increase in her pay.

In most instances, advances in technology reduce the cost of production, causing the supply curve to shift to the right. There is one glaring exception, however. In the case of medical care, we sometimes find that technological innovations—new diagnostic tests, drugs, recordkeeping systems, and surgical procedures—*increase* the cost of treating a particular disease or medical condition. For example, the introduction of electronic medical-records systems, which the federal government is promoting to improve coordination of patient care across health-care providers, has reduced the number of patients a physician can see in an hour.

Advanced medical technologies typically lead to "better" patient outcomes—where better is defined as a higher probability of survival, an improved quality of life, a shorter recuperation period, fewer side effects, less pain, and so on. The question we leave unanswered is whether these new technologies cause the supply curve for medical care to shift to the left because they increase the cost of care, or whether these new technologies actually create new outputs with their own supply curves.

ECONOMIC FALLACY The supply of digital cameras has increased at the same time as their prices have declined. This is surely a violation of the law of supply.

False. This is a situation where there has been a *shift* in the supply curve that has been mistakenly interpreted as a *movement* along the supply curve. Technological improvements in the production of high-end optics and media storage have resulted in cost savings in the production of digital cameras. This has led to a rightward shift in the supply curve of cameras because the opportunity cost of supplying these cameras has declined. More cameras will now be supplied at all prices. As we will see in the next chapter, this shift right in the supply curve will cause the market price for cameras to decline.

As this example shows, when the *ceteris paribus* assumption is violated (i.e., something other than a good's own price changes), the supply curve will shift, and the law of supply will mistakenly appear to be contradicted.

Property Rights and Production Costs

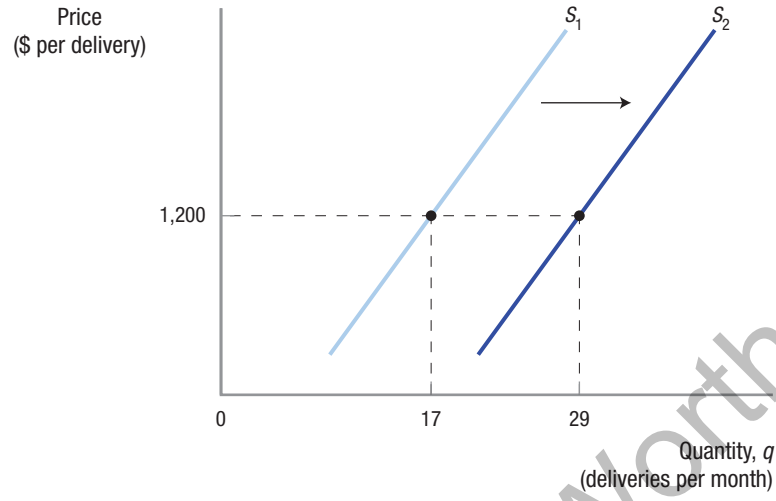
Changes in property rights can have a substantial impact on the decisions that suppliers make. Some of these changes reduce the marginal cost of production, while others increase the cost.

Consider, for example, the impact of court rulings which have established that victims of drunk drivers have the right to sue bars that serve the drivers. This new property right increases the cost of operating a bar and selling drinks because bar owners now have to pay higher insurance premiums to cover their additional liability. As a result, there is a leftward shift in the supply curve for bar drinks.

In contrast, some state legislatures have limited the liability of physicians by placing caps on the size of medical malpractice awards. We would expect this change to reduce the malpractice insurance premiums doctors pay. **Figure 7.10** shows the supply curve for a doctor who provides obstetrical services (the care of pregnant women and delivery of their babies). We define output in this case as the number of babies delivered each month.

At the price of $1,200 per delivery, we can see that this doctor is willing to "supply" 17 deliveries per month. Her cost of doing business includes her malpractice insurance premium, which increases with the number of deliveries she does each month. That is, it is part of her marginal cost curve. The cap that is now placed on medical malpractice

FIGURE 7.10 How a Change in Property Rights Can Shift a Supply Curve: The Supply of Obstetrical Services



At a price of $1,200 per delivery, this doctor is willing to "supply" 17 deliveries a month. A malpractice-award cap will decrease her malpractice insurance premium and, therefore, the marginal cost of each delivery, resulting in a rightward shift in the supply curve from S_1 to S_2. The quantity of deliveries that the doctor is now willing to supply increases to 29 per month at a price of $1,200 per delivery.

awards will decrease malpractice insurance premiums and, therefore, the marginal cost of each delivery. This leads to a rightward shift in the supply curve to the new supply curve labeled S_2. The doctor is now willing to supply 29 deliveries each month. The 18th through 28th deliveries now have a marginal cost that is less than $1,200, and the marginal cost of providing the 29th delivery is exactly equal to $1,200. As it turns out, after passage of these malpractice caps, the supply curves for obstetrics, neurosurgery, and other medical services that result in frequent malpractice lawsuits did, in fact, shift to the right.[6] However, not all states have passed laws to cap malpractice awards, so this rightward shift in supply has not occurred everywhere.

There are many examples of government regulations that affect the cost of supplying a good. Examples include workplace standards, reporting requirements, restrictions on how certain inputs can be handled or used in the production process, and waste-disposal rules. Regulations have the same impact on supply curves as government taxation. For example, whether the government requires all employers to offer health insurance to their workers or taxes them to fund a public health-care plan for all employees, the result will be qualitatively the same: labor costs will rise, leading to an increase in the marginal cost of production and a leftward shift in the employer's supply curve. Of course, the actual monetary impact of the two policies on an employer's payroll costs may be different if the tax does not equal the cost of directly providing employees with insurance.

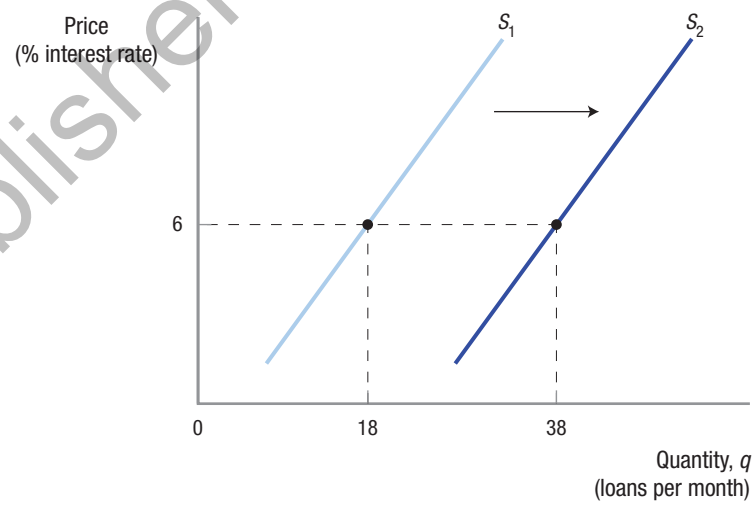
[6]William E. Encinosa and Fred J. Hellinger, "Have State Caps on Malpractice Awards Increased the Supply of Physicians?" *Health Affairs*, May 2005.

Before leaving this discussion, recall from Chapter 5 that the government sometimes deliberately tries to change the choices people make when they create externalities. This is done through taxes, subsidies, or regulations. Consider the negative externalities generated by drinking, including drunk driving, alcohol-related illnesses, and so on. How can the government get liquor suppliers to internalize these externalities? The U.S. government imposes a tax on liquor producers, requiring them to buy a tax "stamp" to place on the cap of each bottle sold. In effect, this tax stamp is an additional "input" into production. It increases the marginal cost of liquor production, thereby shifting the producer's supply curve to the left, leading to a lower level of output at each and every price.

When a good generates positive externalities, governments often offer subsidies to encourage producers to increase the quantity supplied. Recall our example about the child-care subsidies implemented by President Clinton. Another example is government loan guarantees that reduce the cost that banks bear when they lend money to college students. These guarantees eliminate the risk of loan defaults that banks shouldered in the past. As a result, the number of student loans that banks are willing to make at any given interest rate increases. So, a typical bank's supply curve for student loans shifts to the right, as illustrated in **Figure 7.11**.

You can see that at a 6 percent interest rate, a typical bank was willing to make 18 student loans each semester. After the federal guarantee kicks in, the bank is willing to offer 38 student loans each semester at the same 6 percent interest rate.

FIGURE 7.11 How Government Subsidies Can Shift the Supply Curve: The Supply of Student Loans



The introduction of government loan guarantees reduces the risk that a bank bears when it lends money to college students. Because there is no longer a risk of loan default, the bank's supply curve for student loans will shift to the right: at each and every interest rate, it is willing to supply a greater number of loans. At a 6 percent interest rate, the bank was willing to make 18 student loans each semester in the absence of government guarantees. After the federal guarantee kicks in, the bank is willing to offer 38 student loans each semester at the same 6 percent interest rate.

7.5 From Individual to Market Supply Curves

Recall that the market demand curve was derived by summing up the quantity demanded by each person at each and every price. In a parallel fashion, we can derive the **market supply curve** by adding up the quantity supplied by each producer at each and every price.

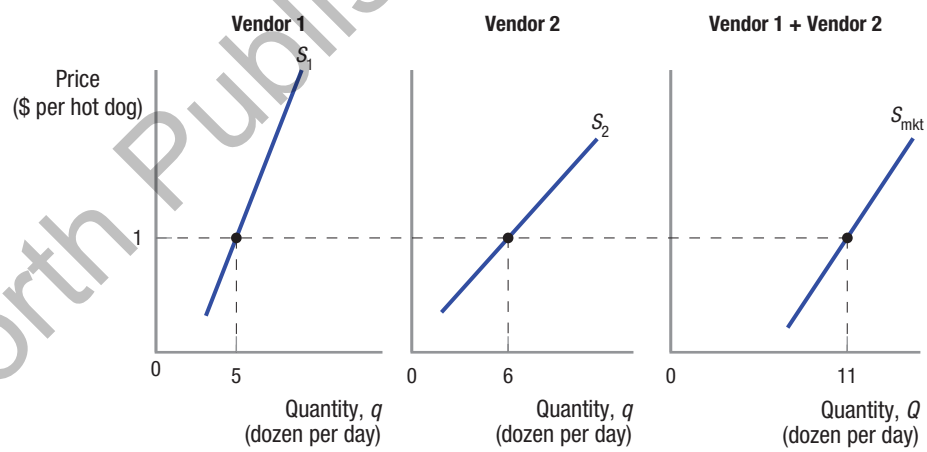
MARKET SUPPLY CURVE A graphical representation of the total number of units of a good supplied at each and every price by all producers in a market during a specific period of time.

Note that while we represent an individual producer's quantity supplied by a lowercase q, we denote the total amount of output supplied in the market at each and every price by Q.

Our ability to derive a market supply curve is subject to the same challenges that arose in the derivation of a market demand curve. Defining the market and identifying suppliers who trade in the same market may, in reality, be quite difficult. Assuming that we can resolve these issues, how do we derive a market supply curve?

Let's revisit our earlier example of the hot dog vendor. In the first panel of **Figure 7.12** we show his supply curve. At a price of $1 per hot dog, this vendor is willing to sell 5 dozen hot dogs a day. The second panel shows the supply curve of the vendor on the next street corner. Notice that the two vendors' supply curves are not identical, which tells us that there are differences in the vendors' costs of production. Perhaps the second vendor has a lower cost of production because he

FIGURE 7.12 Deriving the Market Supply Curve for Hot Dogs



At $1 per hot dog, vendor 1 is willing to sell 5 dozen hot dogs per day, and vendor 2 is willing to sell 6 dozen hot dogs per day. If these two vendors are the only ones in the market, there will be a total of 11 (5 + 6) dozen hot dogs supplied each day. We repeat this calculation at every price to get the market supply curve. We call this a *horizontal summation* of individual supply curves.

doesn't have to pay for napkins—the theater down the street has given them to him to hand out to promote a new play. Because his marginal cost of production is lower, the second vendor is willing to supply 6 dozen hot dogs a day if the price is $1. If these are the only vendors in the market, then the market supply curve, as shown in the third panel of Figure 7.12, reveals the total market supply at each and every price. As indicated, at a price of $1, the combined quantity supplied is equal to 11 dozen hot dogs per day. We call this a *horizontal summation* of the individual supply curves. It directly parallels what we did with individual demand curves to obtain a market demand curve.

To derive a market supply curve when there are more than two suppliers, we follow the same approach, only adding in many more suppliers. By adding up the quantities (q) supplied at each and every price, we arrive at a market supply curve.

Because the height of the individual supply curves reflects the cost of producing each incremental unit, the height of the market supply curve will likewise represent the cost of supplying the marginal unit to the market. It is the lowest marginal cost possible given the cost considerations that each supplier faces. If one supplier enjoys lower costs than another, perhaps because he is exempt from paying a tax, this lower-cost supplier will be the only supplier in the market until the point where his cost of supplying one more unit just equals the marginal cost of the first unit supplied by the next-lowest cost supplier.

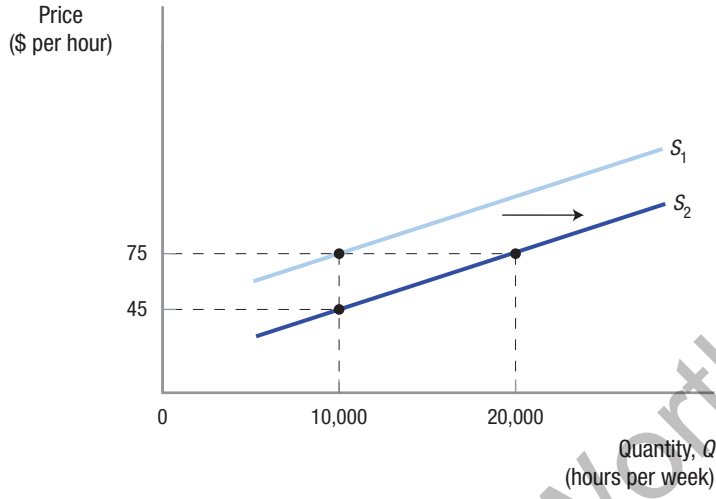
All of the factors that shift individual supply curves will likewise shift the market supply curve because the market supply curve is simply the summation of these individual curves. An increase in an input price that causes each producer's supply curve to shift left also causes the market supply curve to shift left. If only a few suppliers are affected by this increase, however, and there are many suppliers in the market, then the market supply curve may not shift very much at all. Imagine if a small city imposed a per drink tax on all of the bars located within its city limits. If this happened, the supply curves for drinks offered by local bars would shift to the left, but the supply curves of all the other bars in the greater metropolitan area would not change. As a result, the market supply curve for bar drinks in the entire metropolitan area would hardly budge as long as there are a large number of bars that lie outside the taxing city.

Whenever the number of suppliers increases, there will be additional individual supply curves to "add into" the market supply curve. This means that the quantity supplied at each and every price increases, resulting in a rightward shift in the market supply curve. Conversely, if the number of suppliers decreases, the market supply curve will shift to the left. For example, those states that have enacted medical-malpractice caps have seen an influx of "high-risk" specialists, which has resulted in a rightward shift in the market supply curves for these medical services. At the same time, the supply curves in states that have not enacted malpractice caps have shifted to the left due to this exodus.

As markets become more global, the number of suppliers in many markets has increased dramatically. For example, low-cost access to the Internet has promoted global e-commerce, thereby expanding the number of retailers who are willing to supply U.S. consumers with DVDs, art, books, and electronics at low cost. This shifts the market supply curve for each of these products to the right.

Or, consider the impact that technology has had on the labor supply curves facing U.S. employers. The Internet and secure, high-speed telecommunication services have enabled skilled workers living in India and elsewhere to supply accounting, software-development, and customer-support services to U.S. employers. "Offshoring"

FIGURE 7.13 The Impact of Foreign Suppliers: The Supply of Accounting Services in the United States



The supply curve labeled S_1 is the supply of accounting services provided to U.S. companies each week before suppliers located overseas enter the market. At a price of $75 per hour, accountants in the United States are willing to offer a total of 10,000 hours in services per week. After accountants located in India enter the market from their remote location, the amount of accounting services supplied to U.S. companies at each and every wage rate increases. There is a rightward shift in the supply curve to S_2. At $75 an hour, the total number of hours of accounting services supplied increases sharply, to 20,000 per week. The original number of accounting hours supplied at $75 an hour (10,000 hours) will now be supplied at $45 an hour.

these kinds of jobs to workers located outside the United States shifts the supply curve of labor services available to U.S. employers to the right. Foreign workers augment the number of workers actually living in the United States who are willing to work at each and every wage. We show this effect in **Figure 7.13**.

The supply curve labeled S_1 is the supply of accounting services provided to U.S. companies pre-Internet. At a price of $75 per hour, accountants in the United States are willing to offer a total of 10,000 hours of services per week.

Now let accountants living in India "enter" the market, providing accounting services to U.S. clients from their foreign locale. The supply curve of accounting services available to U.S. employers shifts right to S_2, reflecting the greater number of suppliers of accounting services. Also, because these foreign accountants often incur lower opportunity costs of working, they tend to supply more services at each and every wage. This means that the market supply curve for accounting services shifts to the right not only because there are more suppliers of these services but also because the marginal cost of these new suppliers is lower. At the initial price of $75, the total number of hours of accounting services supplied increases sharply, to 20,000 per week. The original number of accounting hours supplied at $75 (10,000 hours) will now be supplied at a price of $45 an hour. These hours will be supplied by the lowest-cost suppliers in the market—primarily by the foreign accountants.

The vertical distance between the old (S_1 and new supply curves (S_2) at 10,000 hours tells us that the marginal cost of supplying the 10,000th hour is now lower than before—$45 instead of $75. Employers—who are consumers of accounting services—benefit from using the lower-cost services provided by accountants living overseas.

Not everyone views this trend toward globalization favorably. What if, for example, the American Accounting Association (AAA) believes that its members will suffer economically from the increased reliance on foreign accounting services? After all, as we just saw, this is likely to reduce the wages of accountants working in the United States. We would expect the AAA to lobby the government to intervene to "protect" U.S. accountants from any loss of income. In many markets, the entry of foreign suppliers and the resulting growth in the quantity of imported goods and services purchased by U.S. consumers has led to an angry "push back" in the form of new tariffs and trade sanctions, along with subsidies for American producers. In one example, high tariffs on imported steel once effectively blocked foreign steel suppliers from entering the U.S. market. When they were repealed in 2003, the supply curve for steel in the United States shifted to the right.[7] In 2002, the United States imposed steep tariffs on Canadian lumber imports to protect U.S. jobs in the lumber industry. Because Canada had been a major supplier of wood to U.S. markets, these tariffs caused the supply curve of lumber available in the United States to shift to the left.[8]

The United States is not the only country that imposes these types of trade barriers on imports and exports. Following a drought in 2006, India banned the export of lentils for fear there would be domestic shortages of the product.[9] Because of this export ban, the quantity of lentils available at each and every price to U.S. consumers, including Indian restaurants, declined dramatically. The absence of Indian lentil suppliers translated into a leftward shift in the supply curve of lentils in the United States.

SOLVED PROBLEM

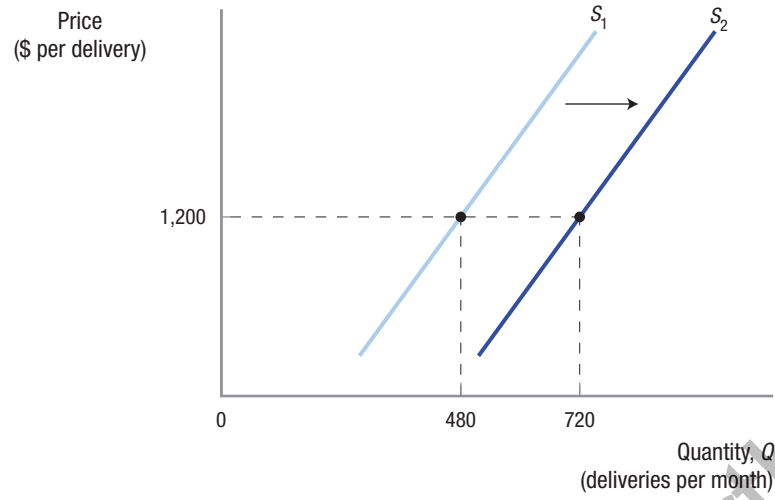
Q Suppose the state of Oregon passes a law that nurse-midwives can deliver babies in lieu of obstetricians. (1) What is the impact on the supply curve for delivery services? (2) Why do you think the state would pass this law? (3) Do you think that obstetricians would support enactment of this law or not?

A (1) The supply curve for delivery services will shift to the right from S_1 to S_2: there are now a greater number of suppliers of the service. These additional suppliers are likely to also face lower costs for each delivery, which also causes the supply curve to shift right. This means that at any price, more services will be provided. At $1,200 per delivery, for example, the total number of deliveries that will be supplied by obstetricians in Oregon before the new law was 480 a month. After the law passes, obstetricians and midwives are willing to perform 720 deliveries a month. (2) By allowing midwives to deliver babies, the state is supplementing the local supply of doctors available to deliver babies. (3) It is likely that obstetricians would oppose the law, arguing that it could compromise the health of the mother and baby. As we will see in the next chapter, the law is also likely to reduce the price that doctors receive for each delivery.

[7]Dan Ackman, "Bush Cuts Steel Tariffs, Declares Victory." *Forbes Magazine*, December 5, 2003.

[8]Major Garrett, "Bush Imposes Canadian Lumber Tariffs." *Money.cnn.com*, March 22, 2002.

[9]Corey Kilgannon, "Little India Hoards Lentils as Prices Rise." *New York Times*, September 29, 2006.



7.6 Summarizing the Factors that Shift Supply

Now that we have identified all of the factors that affect the supply of goods and services, we can summarize our findings. First, a change in the sales price of a product leads to a change in quantity supplied: each producer moves up or down his supply curve. The individual supply curves—and, consequently, the market supply curve—*will not shift* when the price of the good changes, assuming all else remains unchanged.

Second, a supplier will increase the quantity he is willing to supply at each and every price when his marginal cost of production falls. This will happen if (1) the price of one or more inputs falls; (2) cost-saving technology becomes available; (3) a change in property rights reduces the cost of supply; or (4) a government policy is enacted that provides a subsidy for each unit of the good produced or in some other way reduces a supplier's marginal cost of production. In each of these cases, the supply curve shifts to the right: more is supplied *at each and every price*. And, the vertical height of the supply curve at any level of output, which reflects the cost of producing the marginal unit, is lower than before.

Conversely, a supplier will reduce the quantity he supplies at each and every price when his costs of production increase. This will happen if (1) the price of one or more inputs increases; (2) cost-increasing technology is introduced; (3) a change in property rights increases the cost of supply; or (4) a government policy is enacted that increases the marginal cost of producing each unit. In each of these cases, the supply curve shifts to the left: less is supplied *at each and every price*. The vertical height of the supply curve at any level of output is now higher than before.

Table 7.2 provides a summary of the impact that each of these factors has on individual supply curves and the market supply curve. It also reminds us that when the number of suppliers grows, the total quantity supplied in the market at each and every price also increases, and the market supply curve shifts to the right. On the other hand, if the number of suppliers falls, the total quantity supplied to the market at each and every price also falls, and the market supply curve shifts to the left.

To summarize, demanders are willing to pay a certain amount for each unit of a specific good. Likewise, suppliers are willing to supply units of a specific good if their costs of production are covered. If we assume that a free market economy exists—in

Table 7.2 Factors that Shift a Supply Curve

▶ A producer's supply curve shifts to the right when:

1. The price of one or more inputs falls.
2. Technology reduces the marginal cost of production.
3. A change in property rights reduces the marginal cost of production.
4. A new government policy reduces the marginal cost of production.

◀ A producer's supply curve shifts to the left when:

1. The price of one or more inputs increases.
2. Technology increases the marginal cost of production.
3. A change in property rights increases the marginal cost of production.
4. A new government policy increases the marginal cost of production.

The market supply curve responds to the same factors and shifts in the same direction as individual supply curves. In addition, it will:

▶ Shift to the right as the number of suppliers in the market increases.

◀ Shift to the left as the number of suppliers in the market decreases.

which voluntary trade can occur without interference—under what conditions will demanders and suppliers actually buy and sell goods? To explore this key question, we put the two "sides" of the market together in the next chapter.

WHAT YOU SHOULD HAVE LEARNED FROM CHAPTER 7

- That a supplier is just like every other economic decision maker—he is seeking to maximize the net benefit derived from his scarce resources.
- That the net benefit a supplier gets from selling a good or service in a market is equal to the price she receives for each unit minus the marginal cost of producing that unit.
- That the law of supply states that when a good's price increases, a supplier is willing to increase the quantity supplied of that good, all else remaining the same. Conversely, when a good's price falls, a supplier is willing to supply less of the good.
- That a supplier's supply schedule shows the amount of output that he is willing to provide at each and every market price.
- That the supply curve is a graphical representation of the supply schedule; its height at any level of output reflects the marginal cost of supplying the last unit.
- That long-run supply curves are usually flatter than short-run supply curves; that is, suppliers are more responsive to price changes in the long run.
- That input prices, technology, and property rights all have an impact on the amount a supplier is willing to supply at each and every price; therefore, changes in any of these factors usually lead to a shift in the individual supply curve.
- That the market supply curve is the horizontal summation of individual supply curves.
- That the same factors that shift individual supply curves will also shift the market supply curve in the same direction.
- That the market supply curve will shift to the right when the number of suppliers increases and shift to the left when the number of suppliers declines.

KEY TERMS

Law of supply, p. 177
Supply schedule, p. 177
Supply curve, p. 178
Wage, p. 179
Market period, p. 181
Short run (supply), p. 181
Long run (supply), p. 181
Input price, p. 185
Market supply curve, p. 193

QUESTIONS AND PROBLEMS

1. Maura goes to school full-time and moonlights as a security guard nights and weekends. When her hourly wage increased from $10 per hour to $12 per hour, she requested a cut in her scheduled hours. How would you explain the observed negative slope of her supply curve for labor? Does this tell you anything about whether nonwork activities are inferior or normal goods for Maura?
2. a) Draw the supply curves for two individual suppliers of lettuce, one who produces lettuce in California and the other who produces lettuce in Mexico. Assume that the suppliers are identical; that is, they both face the same opportunity cost of production.
   b) Select a price *P*, and show that both suppliers will supply the same quantity to the marketplace at this price.
   c) Using these same supply curves, now show what happens to the quantity supplied by each producer when the U.S. government requires that suppliers located in the United States pay a tax on every head of lettuce harvested. Assume that the price remains at *P*.
   d) If the U.S. government and the Mexican government permit free trade between their countries, who do you think will supply lettuce to U.S. consumers? Explain your answer.
3. Suppose the government imposes a quota on each fisherman to prevent overharvesting of fish. Show what the fisherman's supply curve looks like after the quota is imposed. What does the market supply curve look like?
4. Opponents to free-trade agreements such as NAFTA argue that they don't lower the true costs of supply because many countries—including the United States—heavily subsidize many of their domestic industries. Explain how subsidies "undermine" the ability of free-trade agreements to promote suppliers with the lowest economic costs of production.
5. Suppose that accounting firms can now either send accounting work to accountants in India via data-transmission technologies or import accountants from India to do the work. Explain carefully what factors might impact their decision. More specifically, under what conditions would it make more sense to send the work overseas?
6. Medical technology has advanced to the point where organs such as the liver can be split, with pieces transplanted into two patients rather than one. Show the impact of this technological change on the market supply curve for transplantable livers.
7. A California court ruled that a dentist was liable for a car accident involving a patient who was given "laughing gas" (nitrous oxide) earlier in the day. Show how the market supply curve for dental treatments using gas as a pain reliever/relaxant changed as a result of this change in property rights.
8. Several states are considering legislation that would give children with sperm donor "daddies" the right to contact these fathers when they reach the age of 21. If these new laws pass, what, if anything, do you think will happen to the market supply curve of sperm for infertility procedures?
9. The federal government has passed a number of regulations in recent years that impact the way in which medical practices operate. Among these regulations are

requirements that (1) medical records are now kept in special cabinets in locked rooms to protect patient privacy; and (2) electronic medical-records systems are introduced into the practice. Show how the market supply curve for LASIK surgeries is affected by these new regulations. Suppose the amount that each LASIK surgeon receives for each procedure remains unchanged. Can you predict what will happen to the number of procedures each surgeon will perform each month after these regulations are put into place?

10. In the long run, how do owners of commercial property reduce the market supply of properties in response to a decline in lease rates? Explain your answer.
11. Environmental-protection groups are delighted that plastic-bag manufacturers have become more attuned to environmental concerns and are now producing bags containing 40 percent recycled materials. Can you think of another reason that these producers have moved in this direction, independent of any environmental concerns? (Hint: plastics contain relatively large amounts of oil.)
12. At what wage rate would you consider working *fewer* hours each week? What types of considerations would factor into your answer? Explain.
13. When the United States eliminates tariffs on steel and chemical imports, more of the steel and chemicals that U.S. customers use are produced overseas. This means that the amount of pollution generated by these industries in the United States is lessened. How, if at all, do you think that pollution should factor into decisions about imposing or eliminating tariffs? Explain your answer.