



After studying this chapter, you will be able to:

- ◆ Describe the anatomy of factor markets
- ◆ Explain how the value of marginal product determines the demand for a factor of production
- ◆ Explain how wage rates and employment are determined and how labor unions influence labor markets
- ◆ Explain how capital and land rental rates and natural resource prices are determined

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MARKETS FOR FACTORS OF PRODUCTION

You know that wage rates vary a lot. A worker at McDonald's earns \$8 an hour. Demetrio Luna, who spends his days in a small container suspended from the top of Houston's high-rise buildings cleaning windows, makes \$12 an hour. Richard Seymour, who plays for the New England Patriots, collects a cool \$25 million a year. Some differences in earnings might seem surprising. For example, your college football coach earns much more than your economics professor. What determines the wages that people earn?

Wages are important, but just finding a job is even more important, especially in today's tough labor markets. Factory jobs are vanishing as technological change and foreign competition shrink manufacturing production in the United States. But new job opportunities are opening in service industries, and especially in health care where, in the next 10 years, jobs for more than 500,000 nurses will be created.

In this chapter, we study labor markets as well as markets for capital and natural resources. You will learn how the prices and quantities of factors of production are determined. *In Reading Between the Lines* at the end of the chapter we look at the ever-changing labor markets and how they constantly reallocate labor resources.

The Anatomy of Factor Markets

The four factors of production are

- Labor
- Capital
- Land (natural resources)
- Entrepreneurship

Let's take a brief look at the anatomy of the markets in which these factors of production are traded.

Markets for Labor Services

Labor services are the physical and mental work effort that people supply to produce goods and services. A labor market is a collection of people and firms who trade labor services. The price of labor services is the wage rate.

Some labor services are traded day by day. These services are called *casual labor*. People who pick fruit and vegetables often just show up at a farm and take whatever work is available that day. But most labor services are traded on a contract, called a **job**.

Most labor markets have many buyers and many sellers and are competitive. In these labor markets, the wage rate is determined by supply and demand, just like the price is determined in any other competitive market.

In some labor markets, a labor union organizes labor, which introduces an element of monopoly on the supply-side of the labor market. In this type of labor market, a bargaining process between the union and the employer determines the wage rate.

We'll study both competitive labor markets and labor unions in this chapter.

Markets for Capital Services

Capital consists of the tools, instruments, machines, buildings, and other constructions that have been produced in the past and that businesses now use to produce goods and services. These physical objects are themselves goods—capital goods. Capital goods are traded in goods markets, just as bottled water and toothpaste are. The price of a dump truck, a capital good, is determined by supply and demand in the market for dump trucks. This market is not a market for capital services.

A market for *capital services* is a *rental market*—a market in which the services of capital are hired.

An example of a market for capital services is the vehicle rental market in which Avis, Budget, Hertz, U-Haul, and many other firms offer automobiles and trucks for hire. The price in a capital services market is a *rental rate*.

Most capital services are not traded in a market. Instead, a firm buys capital and uses it itself. The services of the capital that a firm owns and operates have an implicit price that arises from depreciation and interest costs (see Chapter 10, pp. 228–229). You can think of this price as the implicit rental rate of capital. Firms that buy capital and use it themselves are *implicitly* renting the capital to themselves.

Markets for Land Services and Natural Resources

Land consists of all the gifts of nature—natural resources. The market for land as a factor of production is the market for the *services of land*—the use of land. The price of the services of land is a rental rate.

Most natural resources, such as farm land, can be used repeatedly. But a few natural resources are nonrenewable. **Nonrenewable natural resources** are resources that can be used only once. Examples are oil, natural gas, and coal. The prices of nonrenewable natural resources are determined in global *commodity markets* and are called *commodity prices*.

Entrepreneurship

Entrepreneurial services are not traded in markets. Entrepreneurs receive the profit or bear the loss that results from their business decisions.

REVIEW QUIZ

- 1 What are the factors of production and their prices?
- 2 What is the distinction between capital and the services of capital?
- 3 What is the distinction between the price of capital equipment and the rental rate of capital?

You can work these questions in Study Plan 18.1 and get instant feedback.



The rest of this chapter explores the influences on the demand and supply of factors of production. We begin by studying the demand for a factor of production.

◆ The Demand for a Factor of Production

The demand for a factor of production is a **derived demand**—it is derived from the demand for the goods and services that the labor produces. You’ve seen, in Chapters 10 through 15, how a firm determines its profit-maximizing output. The quantities of factors of production demanded are a consequence of the firm’s output decision. A firm hires the quantities of factors of production that produce the firm’s profit-maximizing output.

To decide the quantity of a factor of production to hire, a firm compares the cost of hiring an additional unit of the factor with its value to the firm. The cost of hiring an additional unit of a factor of production is the factor price. The value to the firm of hiring one more unit of a factor of production is called the factor’s **value of marginal product**. We calculate the value of marginal product as the price of a unit of output multiplied by the marginal product of the factor of production.

To study the demand for a factor of production, we’ll use labor as the example. But what you learn here about the demand for labor applies to the demand for all factors of production.

Value of Marginal Product

Table 18.1 shows you how to calculate the value of the marginal product of labor at Angelo’s Bakery. The

first two columns show Angelo’s total product schedule—the number of loaves per hour that each quantity of labor can produce. The third column shows the marginal product of labor—the change in total product that results from a one-unit increase in the quantity of labor employed. (See Chapter 11, pp. 253–256 for a refresher on product schedules.)

Angelo can sell bread at the going market price of \$2 a loaf. Given this information, we can calculate the value of marginal product (fourth column). It equals price multiplied by marginal product. For example, the marginal product of hiring the second worker is 6 loaves. Each loaf sold brings in \$2, so the value of the marginal product of the second worker is \$12 (6 loaves at \$2 each).

A Firm’s Demand for Labor

The value of the marginal product of labor tells us what an additional worker is worth to a firm. It tells us the revenue that the firm earns by hiring one more worker. The wage rate tells us what an additional worker costs a firm.

The value of the marginal product of labor and the wage rate together determine the quantity of labor demanded by a firm. Because the value of marginal product decreases as the quantity of labor employed increases, there is a simple rule for maximizing profit: Hire the quantity of labor at which the value of marginal product equals the wage rate.

If the value of marginal product of labor exceeds the wage rate, a firm can increase its profit by hiring

TABLE 18.1 Value of Marginal Product at Angelo’s Bakery

	Quantity of labor (L) (workers)	Total product (TP) (loaves per hour)	Marginal product (MP = $\Delta TP / \Delta L$) (loaves per worker)	Value of marginal product (VMP = $MP \times P$) (dollars per worker)
A	0	0	.....7	14
B	1	7	.....6	12
C	2	13	.....5	10
D	3	18	.....4	8
E	4	22	.....3	6
F	5	25		

The value of the marginal product of labor equals the price of the product multiplied by marginal product of labor. If Angelo’s hires 2 workers, the marginal product of the second worker is 6 loaves (in the third column). The price of a loaf is \$2, so the value of the marginal product of the second worker is \$2 a loaf multiplied by 6 loaves, which is \$12 (in fourth column).

one more worker. If the wage rate exceeds the value of marginal product of labor, a firm can increase its profit by firing one worker. But if the wage rate equals the value of the marginal product of labor, the firm cannot increase its profit by changing the number of workers it employs. The firm is making the maximum possible profit. So

The quantity of labor demanded by a firm is the quantity at which the value of the marginal product of labor equals the wage rate.

A Firm's Demand for Labor Curve

A firm's demand for labor curve is derived from its value of marginal product curve. Figure 18.1 shows these two curves. Figure 18.1(a) shows the value of marginal product curve at Angelo's Bakery. The blue bars graph the numbers in Table 18.1. The curve labeled *VMP* is Angelo's value of marginal product curve.

If the wage rate falls and other things remain the same, a firm hires more workers. Figure 18.1(b) shows Angelo's demand for labor curve.

Suppose the wage rate is \$10 an hour. You can see in Fig. 18.1(a) that if Angelo hires 2 workers, the value of the marginal product of labor is \$12 an hour. At a wage rate of \$10 an hour, Angelo makes a profit of \$2 an hour on the second worker. If Angelo hires a third worker, the value of the marginal product of that worker is \$10 an hour. So on this third worker, Angelo breaks even.

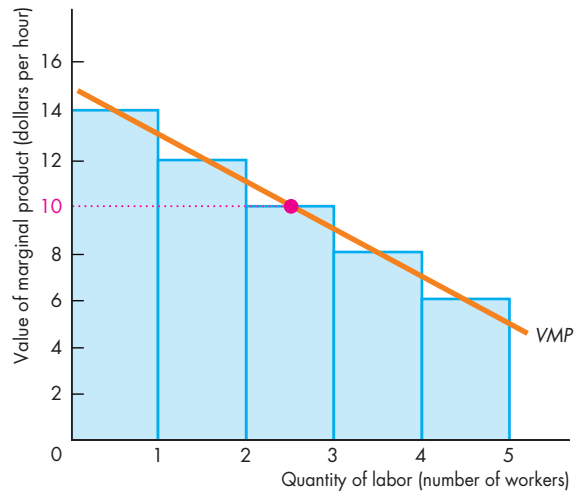
If Angelo hired 4 workers, his profit would fall. The fourth worker generates a value of marginal product of only \$8 an hour but costs \$10 an hour, so Angelo does not hire the fourth worker. When the wage rate is \$10 an hour, the quantity of labor demanded by Angelo is 3 workers.

Figure 18.1(b) shows Angelo's demand for labor curve, *D*. At \$10 an hour, the quantity of labor demanded by Angelo is 3 workers. If the wage rate increased to \$12 an hour, Angelo would decrease the quantity of labor demanded to 2 workers. If the wage rate decreased to \$8 an hour, Angelo would increase the quantity of labor demanded to 4 workers.

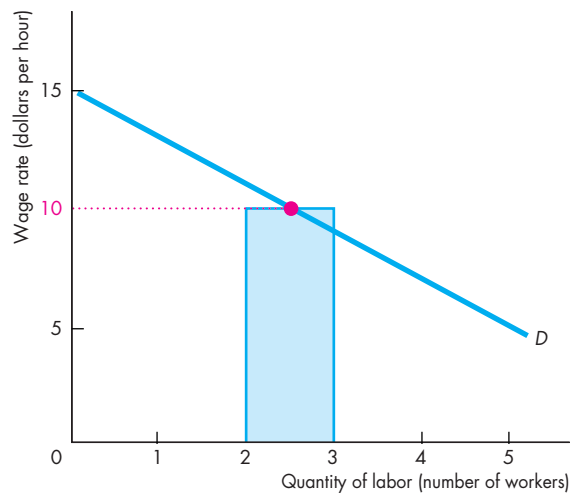
A change in the wage rate brings a change in the quantity of labor demanded and a movement along the demand for labor curve.

A change in any other influence on a firm's labor-hiring plans changes the demand for labor and shifts the demand for labor curve.

FIGURE 18.1 The Demand for Labor at Angelo's Bakery



(a) Value of marginal product



(b) Demand for labor

Angelo's Bakery can sell any quantity of bread at \$2 a loaf. The blue bars in part (a) represent the firm's value of marginal product of labor (based on Table 18.1). The line labeled *VMP* is the firm's value of marginal product curve. Part (b) shows Angelo's demand for labor curve. Angelo hires the quantity of labor that makes the value of marginal product equal to the wage rate. The demand for labor curve slopes downward because the value of marginal product diminishes as the quantity of labor employed increases.

Changes in a Firm's Demand for Labor

A firm's demand for labor depends on

- The price of the firm's output
- The prices of other factors of production
- Technology

The Price of the Firm's Output The higher the price of a firm's output, the greater is the firm's demand for labor. The price of output affects the demand for labor through its influence on the value of marginal product of labor. A higher price for the firm's output increases the value of the marginal product of labor. A change in the price of a firm's output leads to a shift in the firm's demand for labor curve. If the price of the firm's output increases, the demand for labor increases and the demand for labor curve shifts rightward.

For example, if the price of bread increased to \$3 a loaf, the value of the marginal product of Angelo's fourth worker would increase from \$8 an hour to \$12 an hour. At a wage rate of \$10 an hour, Angelo would now hire 4 workers instead of 3.

The Prices of Other Factors of Production If the price of using capital decreases relative to the wage rate, a firm substitutes capital for labor and increases the quantity of capital it uses. Usually, the demand for labor will decrease when the price of using capital falls. For example, if the price of a bread-making machine falls, Angelo might decide to install one machine and lay off a worker. But the demand for labor could increase if the lower price of capital led to a sufficiently large increase in the scale of production. For example, with cheaper machines available, Angelo might install a machine and hire more labor to operate it. This type of factor substitution occurs in the long run when the firm can change the size of its plant.

Technology New technologies decrease the demand for some types of labor and increase the demand for other types. For example, if a new automated bread-making machine becomes available, Angelo might install one of these machines and fire most of his workforce—a decrease in the demand for bakery workers. But the firms that manufacture and service automated bread-making machines hire more labor, so there is an increase in the demand for this type of labor. An event similar to this one occurred during the 1990s when the introduction of electronic

telephone exchanges decreased the demand for telephone operators and increased the demand for computer programmers and electronics engineers.

Table 18.2 summarizes the influences on a firm's demand for labor.

TABLE 18.2 A Firm's Demand for Labor

The Law of Demand

(Movements along the demand curve for labor)

The quantity of labor demanded by a firm

Decreases if:

Increases if:

- The wage rate increases

- The wage rate decreases

Changes in Demand

(Shifts in the demand curve for labor)

A firm's demand for labor

Decreases if:

Increases if:

- The price of the firm's output decreases
- The price of a substitute for labor falls
- The price of a complement of labor rises
- A new technology or new capital decreases the marginal product of labor

- The price of the firm's output increases
- The price of a substitute for labor rises
- The price of a complement of labor falls
- A new technology or new capital increases the marginal product of labor

REVIEW QUIZ

- 1 What is the value of marginal product of labor?
- 2 What is the relationship between the value of marginal product of labor and the marginal product of labor?
- 3 How is the demand for labor derived from the value of marginal product of labor?
- 4 What are the influences on the demand for labor?

You can work these questions in Study Plan 18.2 and get instant feedback.



Labor Markets

Labor services are traded in many different labor markets. Examples are markets for bakery workers, van drivers, crane operators, computer support specialists, air traffic controllers, surgeons, and economists. Some of these markets, such as the market for bakery workers, are local. They operate in a given urban area. Some labor markets, such as the market for air traffic controllers, are national. Firms and workers search across the nation for the right match of worker and job. And some labor markets are global, such as the market for superstar hockey, basketball, and soccer players.

We'll look at a local market for bakery workers as an example. First, we'll look at a *competitive* labor market. Then, we'll see how monopoly elements can influence a labor market.

A Competitive Labor Market

A competitive labor market is one in which many firms demand labor and many households supply labor.

Market Demand for Labor Earlier in the chapter, you saw how an individual firm decides how much labor to hire. The market demand for labor is derived from the demand for labor by individual firms. We determine the market demand for labor by adding together the quantities of labor demanded by all the firms in the market at each wage rate. (The market demand for a good or service is derived in a similar way—see Chapter 5, p. 109.)

Because each firm's demand for labor curve slopes downward, the market demand for labor curve also slopes downward.

The Market Supply of Labor The market supply of labor is derived from the supply of labor decisions made by individual households.

Individual's Labor Supply Decision People can allocate their time to two broad activities: labor supply and leisure. (Leisure is a catch-all term. It includes all activities other than supplying labor.) For most people, leisure is more fun than work so to induce them to work they must be offered a wage.

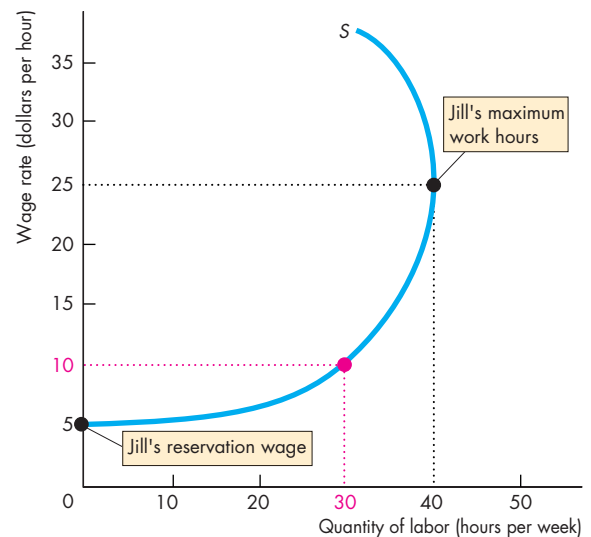
Think about the labor supply decision of Jill, one of the workers at Angelo's Bakery. Let's see how the wage rate influences the quantity of labor she is willing to supply.

Reservation Wage Rate Jill enjoys her leisure time, and she would be pleased if she didn't have to spend her time working at Angelo's Bakery. But Jill wants to earn an income, and as long as she can earn a wage rate of at least \$5 an hour, she's willing to work. This wage is called her *reservation wage*. At any wage rate above her reservation wage, Jill supplies some labor.

The wage rate at Angelo's is \$10 an hour, and at that wage rate, Jill chooses to work 30 hours a week. At a wage rate of \$10 an hour, Jill regards this use of her time as the best available. Figure 18.2 illustrates.

Backward-Bending Labor Supply Curve If Jill were offered a wage rate between \$5 and \$10 an hour, she would want to work fewer hours. If she were offered a wage rate above \$10 an hour, she would want to work more hours, but only up to a point. If Jill could

FIGURE 18.2 Jill's Labor Supply Curve



Jill's labor supply curve is *S*. Jill supplies no labor at wage rates below her reservation wage of \$5 an hour. As the wage rate rises above \$5 an hour, the quantity of labor that Jill supplies increases to a maximum of 40 hours a week at a wage rate of \$25 an hour. As the wage rate rises above \$25 an hour, Jill supplies a decreasing quantity of labor: her labor supply curve bends backward. The income effect on the demand for leisure dominates the substitution effect.

earn \$25 an hour, she would be willing to work 40 hours a week (and earn \$1,000 a week). But at a wage rate above \$25 an hour, with the goods and services that Jill can buy for \$1,000, her priority would be a bit more leisure time. So if the wage rate increased above \$25 an hour, Jill would cut back on her work hours and take more leisure. Jill's labor supply curve eventually bends backward.

Jill's labor supply decisions are influenced by a substitution effect and an income effect.

Substitution Effect At wage rates below \$25 an hour, the higher the wage rate Jill is offered, the greater is the quantity of labor that she supplies. Jill's wage rate is her *opportunity cost of leisure*. If she quits work an hour early to catch a movie, the cost of that extra hour of leisure is the wage rate that Jill forgoes. The higher the wage rate, the less willing Jill is to forgo the income and take the extra leisure time. This tendency for a higher wage rate to induce Jill to work longer hours is a *substitution effect*.

Income Effect The higher Jill's wage rate, the higher is her income. A higher income, other things remaining the same, induces Jill to increase her demand for most goods and services. Leisure is one of those goods. Because an increase in income creates an increase in the demand for leisure, it also creates a decrease in the quantity of labor supplied.

Market Supply Curve Jill's supply curve shows the quantity of labor supplied by Jill as her wage rate changes. Most people behave like Jill and have a backward bending labor supply curve, but they have different reservation wage rates and wage rates at which their labor supply curves bend backward.

A market supply curve shows the quantity of labor supplied by all households in a particular job market. It is found by adding together the quantities of labor supplied by all households to a given job market at each wage rate.

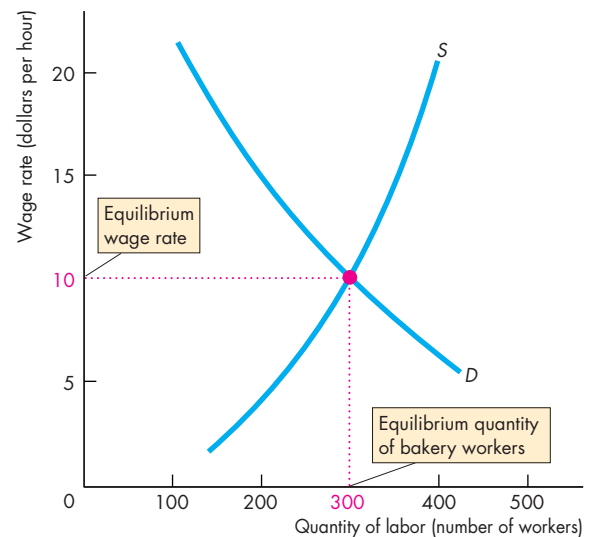
Also, along a supply curve in a particular job market, the wage rates available in other job markets remain the same. For example, along the supply curve of car-wash workers, the wage rates of car salespeople, mechanics, and all other labor are constant.

Despite the fact that an individual's labor supply curve eventually bends backward, the market supply curve of labor slopes upward. The higher the wage rate for car-wash workers, the greater is the quantity of labor supplied in that labor market.

Let's now look at labor market equilibrium.

Competitive Labor Market Equilibrium Labor market equilibrium determines the wage rate and employment. In Fig. 18.3, the market demand curve for bakery workers is D and the market supply curve of bakery workers is S . The equilibrium wage rate is \$10 an hour, and the equilibrium quantity is 300 bakery workers. If the wage rate exceeded \$10 an hour, there would be a surplus of bakery workers. More people would be looking for jobs in bakeries than firms were willing to hire. In such a situation, the wage rate would fall as firms found it easy to hire people at a lower wage rate. If the wage rate were less than \$10 an hour, there would be a shortage of bakery workers. Firms would not be able to fill all the positions they had available. In this situation, the wage rate would rise as firms found it necessary to offer higher wages to attract labor. Only at a wage rate of \$10 an hour are there no forces operating to change the wage rate.

FIGURE 18.3 The Market for Bakery Workers



A competitive labor market coordinates firms' and households' plans. The market is in equilibrium—the quantity of labor demanded equals the quantity supplied at a wage rate of \$10 an hour when 300 workers are employed. If the wage rate exceeds \$10 an hour, the quantity supplied exceeds the quantity demanded and the wage rate will fall. If the wage rate is below \$10 an hour, the quantity demanded exceeds the quantity supplied and the wage rate will rise.

A Labor Market with a Union

A **labor union** is an organized group of workers that aims to increase the wage rate and influence other job conditions. Let's see what happens when a union enters a competitive labor market.

Influences on Labor Supply One way of raising the wage rate is to decrease the supply of labor. In some labor markets, a union can restrict supply by controlling entry into apprenticeship programs or by influencing job qualification standards. Markets for skilled workers, doctors, dentists, and lawyers are the easiest ones to control in this way.

If there is an abundant supply of nonunion labor, a union can't decrease supply. For example, in the market for farm labor in southern California, the flow of nonunion labor from Mexico makes it difficult for a union to control the supply.

On the demand side of the labor market, the union faces a tradeoff: The demand for labor curve slopes downward, so restricting supply to raise the wage rate costs jobs. For this reason, unions also try to influence the demand for union labor.

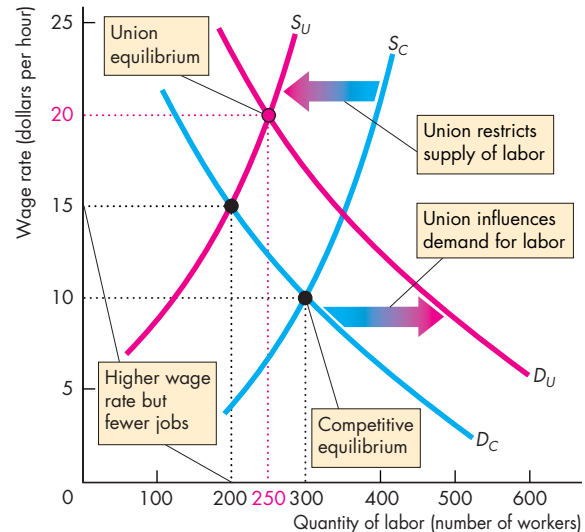
Influences on Labor Demand A union tries to increase the demand for the labor of its members in four main ways:

1. Increasing the value of marginal product of its members by organizing and sponsoring training schemes and apprenticeship programs, and by professional certification.
2. Lobbying for import restrictions and encouraging people to buy goods made by unionized workers.
3. Supporting minimum wage laws, which increase the cost of employing low-skilled labor and lead firms to substitute high-skilled union labor for low-skilled nonunion labor.
4. Lobbying for restrictive immigration laws to decrease the supply of foreign workers.

Labor Market Equilibrium with a Union Figure 18.4 illustrates what happens to the wage rate and employment when a union successfully enters a competitive labor market. With no union, the demand curve is D_C , the supply curve is S_C , the wage rate is \$10 an hour, and 300 workers have jobs.

Now a union enters this labor market. First, look at what happens if the union has sufficient control over the supply of labor to be able to restrict supply

FIGURE 18.4 A Union Enters a Competitive Labor Market



In a competitive labor market, the demand curve is D_C and the supply curve is S_C . The wage rate is \$10 an hour and 300 workers are employed. If a union decreases the supply of labor and the supply of labor curve shifts to S_U , the wage rate rises to \$15 an hour and employment decreases to 200 workers. If the union can also increase the demand for labor and shift the demand for labor curve to D_U , the wage rate rises to \$20 an hour and 250 workers are employed.

 animation

below its competitive level—to S_U . If that is all the union is able to do, employment falls to 200 workers and the wage rate rises to \$15 an hour.

Suppose now that the union is also able to increase the demand for labor to D_U . The union can get an even bigger increase in the wage rate and with a smaller fall in employment. By maintaining the restricted labor supply at S_U , the union increases the wage rate to \$20 an hour and achieves an employment level of 250 workers.

Because a union restricts the supply of labor in the market in which it operates, the union's actions spill over into nonunion markets. Workers who can't get union jobs must look elsewhere for work. This action increases the supply of labor in nonunion markets and lowers the wage rate in those markets. This spillover effect further widens the gap between union and nonunion wages.