Factor Markets and the Distribution of Income

THE VALUE OF A DEGREE

If you have doubts about completing college, consider this: factory workers with high school degrees earn much less than college grads. The present discounted value of the difference in lifetime earnings is as much as $500,000.

Does Higher Education Pay?
Yes, it does: in the modern economy, employers are willing to pay a premium for workers with more education. And the size of that premium has increased a lot over the last few decades. Back in 1973 workers with advanced degrees, such as law degrees or MBAs, earned only 76% more than those who had only graduated from high school. By 2011, the premium for an advanced degree had risen to over 225%.

Who decided that the wages of workers with advanced degrees would rise so much compared with those of high school grads? The answer, of course, is that nobody decided it. Wage rates are prices, the prices of different kinds of labor, and they are decided, like other prices, by supply and demand.

Still, there is a qualitative difference between the wage rate of high school grads and the price of used textbooks: the wage rate isn’t the price of a good, it’s the price of a factor of production. And although markets for factors of production are in many ways similar to those for goods, there are also some important differences.

In this chapter, we examine factor markets, the markets in which the factors of production such as labor, land, and capital are traded. Factor markets, like goods markets, play a crucial role in the economy: they allocate productive resources to producers and help ensure that those resources are used efficiently.

This chapter begins by describing the major factors of production. Then we consider the demand for factors of production, which leads us to a crucial insight: the marginal productivity theory of income distribution. We then consider some challenges to the marginal productivity theory. Next, we examine the markets for capital and for land. The chapter concludes with a discussion of the supply of the most important factor, labor.
The Economy's Factors of Production

You may recall that we defined a factor of production in Chapter 2 in the context of the circular-flow diagram; it is any resource that is used by firms to produce goods and services, items that are consumed by households. Factors of production are bought and sold in factor markets, and the prices in factor markets are known as factor prices.

What are these factors of production, and why do factor prices matter?

The Factors of Production

As we learned in Chapter 2, economists divide factors of production into four principal classes: land, labor, physical capital, and human capital. Land is a resource provided by nature; labor is the work done by human beings.

In Chapter 9 we defined capital; it is the value of the assets that are used by a firm in producing its output. There are two broad types of capital. Physical capital—often referred to simply as “capital”—consists of manufactured resources such as equipment, buildings, tools, and machines.

In the modern economy, human capital, the improvement in labor created by education and knowledge, and embodied in the workforce, is at least equally significant. The importance of human capital has been greatly increased by the progress of technology, which has made a high level of technical sophistication essential to many jobs—one cause of the increased premium paid for workers with advanced degrees.

Why Factor Prices Matter: The Allocation of Resources

Factor markets and factor prices play a key role in one of the most important processes that must take place in any economy: the allocation of resources among producers.

Consider the example of Mississippi and Louisiana in the aftermath of Hurricane Katrina, which was the costliest hurricane to hit the U.S. mainland to date. The states had an urgent need for workers in the building trades—carpenters, plumbers, and so on—to repair or replace damaged homes and businesses.

What ensured that those needed workers actually came? The factor market: the high demand for workers drove up wages. During 2005, the average U.S. weekly wage grew at a rate of around 6%. But in areas heavily affected by Katrina, the average wage during the fall of 2005 grew by 30% more than the national rate, and some areas saw a rate of increase twice as high. Over time, these higher wages led large numbers of workers with the right skills to move temporarily to these states to do the work. In other words, the market for a factor of production—construction workers—allocated that factor of production to where it was needed.

In this sense factor markets are similar to goods markets, which allocate goods among consumers. But there are two features that make factor markets special. Unlike in a goods market, demand in a factor market is what we call derived demand. That is, demand for the factor is derived from the firm's output choice. The second feature is that factor markets are where most of us get the largest shares of our income (government transfers being the next largest source of income in the economy).

PITFALLS

WHAT IS A FACTOR, ANYWAY?

Imagine a business that produces shirts. The business will make use of workers and machines—that is, of labor and capital. But it will also use other inputs, such as electricity and cloth. Are all of these inputs factors of production? No: labor and capital are factors of production, but cloth and electricity are not.

The key distinction is that a factor of production earns income from the selling of its services over and over again but an input cannot. For example, a worker earns income over time from repeatedly selling his or her efforts; the owner of a machine earns income over time from repeatedly selling the use of that machine.

So a factor of production, such as labor and capital, represents an enduring source of income. An input like electricity or cloth, however, is used up in the production process. Once exhausted, it cannot be a source of future income for its owner.
Factor Incomes and the Distribution of Income

Most American families get most of their income in the form of wages and salaries—that is, they get their income by selling labor. Some people, however, get most of their income from physical capital: when you own stock in a company, what you really own is a share of that company’s physical capital. And some people get much of their income from rents earned on land they own.

Obviously, then, the prices of factors of production have a major impact on how the economic “pie” is sliced among different groups. For example, a higher wage rate, other things equal, means that a larger proportion of the total income in the economy goes to people who derive their income from labor, and less goes to those who derive their income from capital or land. Economists refer to how the economic pie is sliced as the “distribution of income.” Specifically, factor prices determine the factor distribution of income—how the total income of the economy is divided among labor, land, and capital.

As the following Economics in Action explains, the factor distribution of income in the United States has been quite stable over the past few decades. In other times and places, however, large changes have taken place in the factor distribution. One notable example: during the Industrial Revolution, the share of total income earned by landowners fell sharply, while the share earned by capital owners rose. As explained in the following For Inquiring Minds, this shift had a profound effect on society.

FOR INQUIRING MINDS

THE FACTOR DISTRIBUTION OF INCOME AND SOCIAL CHANGE IN THE INDUSTRIAL REVOLUTION

Have you read any novels by Jane Austen? How about Charles Dickens? If you’ve read both, you probably noticed that they seem to be describing quite different societies. Austen’s novels, set around 1800, describe a world in which the leaders of society are land-owning aristocrats. Dickens, writing about 50 years later, describes a world in which businessmen, especially factory owners, are in control.

This literary shift reflects a dramatic transformation in the factor distribution of income. The Industrial Revolution, which took place between the late eighteenth century and the middle of the nineteenth century, changed England from a mainly agricultural country, in which land earned a fairly substantial share of income, to an urbanized and industrial one, in which land rents were dwarfed by capital income. Recent estimates by the economist Nancy Stokey show that between 1780 and 1850 the share of national income represented by land fell from 20% to 9%, but the share represented by capital rose from 35% to 44%. That shift changed everything—even literature.

ECONOMICS IN ACTION

THE FACTOR DISTRIBUTION OF INCOME IN THE UNITED STATES

When we talk about the factor distribution of income, what are we talking about in practice?

In the United States, as in all advanced economies, payments to labor account for most of the economy’s total income. Figure 19-1 shows the factor distribution of income in the United States in 2010: in that year, 68% of total income in the economy took the form of “compensation of employees”—a
number that includes both wages and benefits such as health insurance. This number is somewhat low by historical standards (it was 72.2% in 1972 and 70.4% in 2007). It reflects the depressed state of the economy in 2010, which resulted in high unemployment and reduced wages for many American employees.

However, measured wages and benefits don’t capture the full income of “labor” because a significant fraction of total income in the United States (usually 7 to 10%) is “proprietors’ income”—the earnings of people who own their own businesses. Part of that income should be considered wages these business owners pay themselves. So the true share of labor in the economy is probably a few percentage points higher than the reported “compensation of employees” share.

But much of what we call compensation of employees is really a return on human capital. A surgeon isn’t just supplying the services of a pair of ordinary hands (at least the patient hopes not!): that individual is also supplying the result of many years and hundreds of thousands of dollars invested in training and experience. We can’t directly measure what fraction of wages is really a payment for education and training, but many economists believe that human capital has become the most important factor of production in modern economies.

**CHECK YOUR UNDERSTANDING 19-1**

1. Suppose that the government places price controls on the market for college professors, imposing a wage that is lower than the market wage. Describe the effect of this policy on the production of college degrees. What sectors of the economy do you think will be adversely affected by this policy? What sectors of the economy might benefit?

Solutions appear at back of book.

**Marginal Productivity and Factor Demand**

All economic decisions are about comparing costs and benefits—and usually about comparing marginal costs and marginal benefits. This goes both for a consumer, deciding whether to buy another pound of fried clams, and for a producer, deciding whether to hire an additional worker.

Although there are some important exceptions, most factor markets in the modern American economy are perfectly competitive, meaning that buyers and sellers of a given factor are price-takers. And in a competitive labor market, it’s clear how to define an employer’s marginal cost of a worker: it is simply the worker’s wage rate. But what is the marginal benefit of that worker? To answer that question, we return to a concept first introduced in Chapter 11: the production function, which relates inputs to output. And as in Chapter 12, we will assume throughout this chapter that all producers are price-takers in their output markets—that is, they operate in a perfectly competitive industry.

**Value of the Marginal Product**

Figure 19-2 reproduces Figures 11-1 and 11-2, which showed the production function for wheat on George and Martha’s farm. Panel (a) uses the total product curve to show how total wheat production depends on the number of workers.
employed on the farm; panel (b) shows how the marginal product of labor, the increase in output from employing one more worker, depends on the number of workers employed.

Table 19-1, which reproduces the table in Figure 11-1, shows the numbers behind the figure.

Assume that George and Martha want to maximize their profit, that workers must be paid $200 each, and that wheat sells for $20 per bushel. What is their optimal number of workers? That is, how many workers should they employ to maximize profit?

In Chapters 11 and 12 we showed how to answer this question in several steps. In Chapter 11 we used information from the producer’s production function to derive the firm’s total cost and its marginal cost. And in Chapter 12 we derived the price-taking firm’s optimal output rule: a price-taking firm’s profit is maximized by producing the quantity of output at which the marginal cost of the last unit produced is equal to the market price. Having determined the optimal quantity of output, we can go back to the production function and find the optimal number of workers—it is simply the number of workers needed to produce the optimal quantity of output.

There is, however, another way to use marginal analysis to find the number of workers that maximizes a producer’s profit. We can go directly to the question of what level of employment maximizes profit. This alternative approach is equivalent to the approach we outlined in the preceding paragraph—it’s just a different way of looking at the same thing. But it gives us more insight into the demand for factors as opposed to the supply of goods.

To see how this alternative approach works, let’s suppose that George and Martha are considering whether or not to employ an additional worker. The increase in cost from employing that additional worker is the wage rate, W. The benefit to George and Martha from employing that extra worker is the value of the
The value of the marginal product of a factor is the value of the additional output generated by employing one more unit of that factor.

The value of the marginal product curve of a factor shows how the value of the marginal product of that factor depends on the quantity of the factor employed.

extra output that worker can produce. What is this value? It is the marginal product of labor, \( MPL \), multiplied by the price per unit of output, \( P \). This amount—the extra value of output that is generated by employing one more unit of labor—is known as the value of the marginal product of labor, or \( VMPL \):

\[
(19-1) \quad \text{Value of the marginal product of labor} = VMPL = P \times MPL
\]

So should George and Martha hire that extra worker? The answer is yes if the value of the extra output is more than the cost of the worker—that is, if \( VMPL > W \). Otherwise they shouldn’t hire that worker.

So the decision to hire labor is a marginal decision, in which the marginal benefit to the producer from hiring an additional worker (\( VMPL \)) should be compared with the marginal cost to the producer (\( W \)). And as with any marginal decision, the optimal choice is where marginal benefit is just equal to marginal cost. That is, to maximize profit George and Martha will employ workers up to the point at which, for the last worker employed,

\[
(19-2) \quad VMPL = W
\]

This rule doesn’t apply only to labor; it applies to any factor of production. The value of the marginal product of any factor is its marginal product times the price of the good it produces. The general rule is that a profit-maximizing price-taking producer employs each factor of production up to the point at which the value of the marginal product of the last unit of the factor employed is equal to that factor’s price.

It’s important to realize that this rule doesn’t conflict with our analysis in Chapters 11 and 12. There we saw that a profit-maximizing producer of a good chooses the level of output at which the price of that good is equal to the marginal cost of production. It’s just a different way of looking at the same rule. If the level of output is chosen so that price equals marginal cost, then it is also true that at that output level the value of the marginal product of labor will equal the wage rate.

Now let’s look more closely at why choosing the level of employment at which the value of the marginal product of the last worker employed is equal to the wage rate works—and at how it helps us understand factor demand.

### Value of the Marginal Product and Factor Demand

Table 19-2 calculates the value of the marginal product of labor on George and Martha’s farm, on the assumption that the price of wheat is $20 per bushel. In Figure 19-3 the horizontal axis shows the number of workers employed; the vertical axis measures the value of the marginal product of labor and the wage rate. The curve shown is the value of the marginal product curve of labor. This curve, like the marginal product of labor curve, slopes downward because of diminishing returns to labor in production. That is, the value of the marginal product of each worker is less than that of the preceding worker, because the marginal product of each worker is less than that of the preceding worker.

We have just seen that to maximize profit, George and Martha must hire workers up to the point at which the wage rate is equal to the value of the marginal product of the last worker employed. Let’s use the example to see how this principle really works.

<table>
<thead>
<tr>
<th>Quantity of labor</th>
<th>Marginal product of labor</th>
<th>Value of the marginal product of labor</th>
</tr>
</thead>
<tbody>
<tr>
<td>( L ) (workers)</td>
<td>( MPL ) (bushels per worker)</td>
<td>( VMPL = P \times MPL )</td>
</tr>
<tr>
<td>0</td>
<td>19</td>
<td>$380</td>
</tr>
<tr>
<td>1</td>
<td>17</td>
<td>340</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>300</td>
</tr>
<tr>
<td>3</td>
<td>13</td>
<td>260</td>
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<td>4</td>
<td>11</td>
<td>220</td>
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<td>5</td>
<td>9</td>
<td>180</td>
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<tr>
<td>6</td>
<td>7</td>
<td>140</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
<td>100</td>
</tr>
</tbody>
</table>
Assume that George and Martha currently employ 3 workers and that workers must be paid the market wage rate of $200. Should they employ an additional worker?

Looking at Table 19-2, we see that if George and Martha currently employ 3 workers, the value of the marginal product of an additional worker is $260. So if they employ an additional worker, they will increase the value of their production by $260 but increase their cost by only $200, yielding an increased profit of $60. In fact, a producer can always increase profit by employing one more unit of a factor of production as long as the value of the marginal product of that unit exceeds its factor price.

Alternatively, suppose that George and Martha employ 8 workers. By reducing the number of workers to 7, they can save $200 in wages. In addition, the value of the marginal product of the last one, the 8th worker, was only $100. So, by reducing employment by one worker, they can increase profit by $200 – $100 = $100. In other words, a producer can always increase profit by employing one less unit of a factor of production as long as the value of the marginal product produced by that unit exceeds its factor price.

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Using this method, we can see from Table 19-2 that the profit-maximizing employment level is 5 workers given a wage rate of $200. The value of the marginal product of the 5th worker is $220, so adding the 5th worker results in $20 of additional profit. But George and Martha should not hire more than 5 workers: the value of the marginal product of the 6th worker is only $180, $20 less than the cost of that worker. So, to maximize profit, George and Martha should employ workers up to but not beyond the point at which the value of the marginal product of the last worker employed is equal to the wage rate.

Now look again at the value of the marginal product curve in Figure 19-3. To determine the profit-maximizing level of employment, we set the value of the marginal product of labor equal to the price of labor—a wage rate of $200 per worker. This means that the profit-maximizing level of employment is at point A, corresponding to an employment level of 5 workers. If the wage rate were higher...
than $200, we would simply move up the curve and decrease the number of workers employed: if the wage rate were lower than $200, we would move down the curve and increase the number of workers employed.

In this example, George and Martha have a small farm in which the potential employment level varies from 0 to 8 workers, and they hire workers up to the point at which the value of the marginal product of the last worker is not less than the wage rate. Suppose, however, that the firm in question is large and has the potential of hiring many workers. When there are many employees, the value of the marginal product of labor falls only slightly when an additional worker is employed. As a result, there will be some worker whose value of the marginal product almost exactly equals the wage rate. (In keeping with the George and Martha example, this means that some worker generates a value of the marginal product of approximately $200.) In this case, the firm maximizes profit by choosing a level of employment at which the value of the marginal product of the last worker hired equals (to a very good approximation) the wage rate.

In the interest of simplicity, we will assume from now on that firms use this rule to determine the profit-maximizing level of employment. This means that the value of the marginal product of labor curve is the individual producer's labor demand curve. And, in general, a producer's value of the marginal product curve for any factor of production is that producer's individual demand curve for that factor of production.

### Shifts of the Factor Demand Curve

As in the case of ordinary demand curves, it is important to distinguish between movements along the factor demand curve and shifts of the factor demand curve. What causes factor demand curves to shift? There are three main causes:

1. Changes in prices of goods
2. Changes in supply of other factors
3. Changes in technology

#### 1. Changes in Prices of Goods

Remember that factor demand is derived demand: if the price of the good that is produced with a factor changes, so will the value of the marginal product of the factor. That is, in the case of labor demand, if \( P \) changes, \( VMPL = P \times MPL \) will change at any given level of employment.

Figure 19-4 illustrates the effects of changes in the price of wheat, assuming that $200 is the current wage rate. Panel (a) shows the effect of an increase in the price of wheat. This shifts the value of the marginal product of labor curve upward, because \( VMPL \) rises at any given level of employment. If the wage rate remains unchanged at $200, the optimal point moves from point A to point B: the profit-maximizing level of employment rises.

Panel (b) shows the effect of a decrease in the price of wheat. This shifts the value of the marginal product of labor curve downward. If the wage rate remains unchanged at $200, the optimal point moves from point A to point C: the profit-maximizing level of employment falls.

#### 2. Changes in Supply of Other Factors

Suppose that George and Martha acquire more land to cultivate—say, by clearing a woodland on their property. Each worker now produces more wheat because each one has more land to work with. As a result, the marginal product of labor on the farm rises at any given level of employment. This has the same effect as an increase in the price of wheat, which is illustrated in panel (a) of Figure 19-4: the value of the marginal product of labor curve shifts upward, and at any given wage rate the profit-maximizing level of employment rises. Similarly, suppose George and Martha cultivate less land. This leads to a fall in the marginal product of labor at any given employment
level. Each worker produces less wheat because each has less land to work with. As a result, the value of the marginal product of labor curve shifts downward—as in panel (b) of Figure 19-4—and the profit-maximizing level of employment falls.

3. Changes in Technology In general, the effect of technological progress on the demand for any given factor can go either way: improved technology can either increase or reduce the demand for a given factor of production.

How can technological progress reduce factor demand? Consider horses, which were once an important factor of production. The development of substitutes for horse power, such as automobiles and tractors, greatly reduced the demand for horses.

The usual effect of technological progress, however, is to increase the demand for a given factor. In particular, although there have been persistent fears that machinery would reduce the demand for labor, over the long run the U.S. economy has seen both large wage increases and large increases in employment, suggesting that technological progress has greatly increased labor demand.

The Marginal Productivity Theory of Income Distribution

We’ve now seen that each perfectly competitive producer in a perfectly competitive factor market maximizes profit by hiring labor up to the point at which its value of the marginal product is equal to its price—in the case of labor, to the point where $\text{VMPL} = W$. What does this tell us about labor’s share in the factor distribution of income? To answer that question, we need to examine equilibrium in the labor market. From that vantage point we will go on to learn about the markets for land and capital and about how they also influence the factor distribution of income.
Let’s start by assuming that the labor market is in equilibrium: at the current market wage rate, the number of workers that producers want to employ is equal to the number of workers willing to work. Thus, all employers pay the same wage rate, and each employer, whatever he or she is producing, employs labor up to the point at which the value of the marginal product of the last workers hired is equal to the market wage rate.

This situation is illustrated in Figure 19-5, which shows the value of the marginal product curves of two producers—Farmer Jones, who produces wheat, and Farmer Smith, who produces corn. Despite the fact that they produce different products, they compete for the same workers and so must pay the same wage rate, $200. When both farmers maximize profit, both hire labor up to the point at which its value of the marginal product is equal to the wage rate. In the figure, this corresponds to employment of 5 workers by Jones and 7 by Smith.

Figure 19-6 illustrates the labor market as a whole. The market labor demand curve, like the market demand curve for a good (shown in Figure 3-5), is the horizontal sum of all the individual labor demand curves of all the producers who hire labor. And recall that each producer’s individual labor demand curve is the same as his or her value of the marginal product of labor curve. For now, let’s simply assume an upward-sloping labor supply curve; we’ll discuss labor supply later in this chapter. Then the equilibrium wage rate is the wage rate at which the quantity of labor supplied is equal to the quantity of labor demanded. In Figure 19-6, this leads to an equilibrium wage rate of $W^*$ and the corresponding equilibrium employment level of $L^*$. (The equilibrium wage rate is also known as the market wage rate.)

And as we showed in the examples of the farms of George and Martha and of Farmer Jones and Farmer Smith (where the equilibrium wage rate is $200), each farm hires labor up to the point at which the value of the marginal product of labor is equal to the equilibrium wage rate. Therefore, in equilibrium, the value of the marginal product of labor is the same for all employers. So the equilibrium
(or market) wage rate is equal to the equilibrium value of the marginal product of labor—\( VMPL \) of labor—the additional value produced by the last unit of labor employed in the labor market as a whole. It doesn't matter where that additional unit is employed, since equilibrium \( VMPL \) is the same for all producers.

What we have just learned, then, is that the market wage rate is equal to the equilibrium value of the marginal product of labor. And the same is true of each factor of production: in a perfectly competitive market economy, the market price of each factor is equal to its equilibrium value of the marginal product. Let's examine the markets for land and (physical) capital now. (From this point on, we'll refer to physical capital as simply "capital."

The Markets for Land and Capital

If we maintain the assumption that the markets for goods and services are perfectly competitive, the result that we derived for the labor market also applies to other factors of production. Suppose, for example, that a farmer is considering whether to rent an additional acre of land for the next year. He or she will compare the cost of renting that acre with the value of the additional output generated by employing an additional acre—the value of the marginal product of an acre of land. To maximize profit, the farmer must employ land up to the point at which the value of the marginal product of an acre of land is equal to the rental rate per acre.

What if the farmer already owns the land? We already saw the answer in Chapter 9, which dealt with economic decisions: even if you own land, there is an implicit cost—the opportunity cost—of using it for a given activity, because it could be used for something else, such as renting it out to other farmers at the market rental rate. So a profit-maximizing producer employs additional acres of land up to the point at which the cost of the last acre employed, explicit or implicit, is equal to the value of the marginal product of that acre.

The same is true for capital. The explicit or implicit cost of using a unit of land or capital for a set period of time is called its rental rate. In general, a unit of land or capital is employed up to the point at which that unit's value of the marginal product is equal to its rental rate. The equilibrium value of the marginal product of labor is the additional value produced by the last unit of labor employed in the labor market as a whole.
product is equal to its rental rate over that time period. How are the rental rates for land and capital determined? By the equilibria in the land market and the capital market, of course. Figure 19-7 illustrates those outcomes.

Panel (a) shows the equilibrium in the market for land. The supply curve for land is relatively steep, reflecting the high cost of increasing the quantity of productive land. The supply curve for capital, in contrast, is relatively flat, due to the relatively high responsiveness of savings to changes in the rental rate for capital. The equilibrium rental rates for land and capital, as well as the equilibrium quantities transacted, are given by the intersections of the demand and supply curves. In a competitive land market, each unit of land will be paid the equilibrium value of the marginal product of land, $R_{Land}^*$. Likewise, in a competitive capital market, each unit of capital will be paid the equilibrium value of the marginal product of capital, $R_{Capital}^*$.

The Marginal Productivity Theory of Income Distribution
So we have learned that when the markets for goods and services and the factor markets are perfectly competitive, a factor of production will be employed up to the point at which its value of the marginal product is equal to its market rental rate.
equilibrium price. That is, it will be paid its equilibrium value of the marginal product. What does this say about the factor distribution of income? It leads us to the marginal productivity theory of income distribution, which says that each factor is paid the value of the output generated by the last unit of that factor employed in the factor market as a whole—its equilibrium value of the marginal product.

To understand why the marginal productivity theory of income distribution is important, look back at Figure 19-1, which shows the factor distribution of income in the United States, and ask yourself this question: who or what decided that labor would get 68% of total U.S. income? Why not 90% or 50%?

The answer, according to the marginal productivity theory of income distribution, is that the division of income among the economy’s factors of production isn’t arbitrary: it is determined by each factor’s marginal productivity at the economy’s equilibrium. The wage rate earned by all workers in the economy is equal to the increase in the value of output generated by the last worker employed in the economy-wide labor market.

Here we have assumed that all workers are of the same ability. (Similarly, we’ve assumed that all units of land and capital are equally productive.) But in reality workers differ considerably in ability.

Rather than thinking of one labor market for all workers in the economy, we can instead think of different markets for different types of workers, where workers are of equivalent ability within each market. For example, the market for computer programmers is different from the market for pastry chefs. And in the market for computer programmers, all participants are assumed to have equal ability; likewise for the market for pastry chefs. In this scenario, the marginal productivity theory of income distribution still holds. That is, when the labor market for computer programmers is in equilibrium, the wage rate earned by all computer programmers is equal to the market’s equilibrium value of the marginal product—the value of the marginal product of the last computer programmer hired in that market.

According to the marginal productivity theory of income distribution, every factor of production is paid its equilibrium value of the marginal product.

**PITFALLS**

**GETTING MARGINAL PRODUCTIVITY THEORY RIGHT**

It’s important to be careful about what the marginal productivity theory of income distribution says: it says that all units of a factor get paid the factor’s equilibrium value of the marginal product—the additional value produced by the last unit of the factor employed.

The most common source of error is to forget that the relevant value of the marginal product is the equilibrium value, not the value of the marginal products you calculate on the way to equilibrium. In looking at Table 19-2, you might be tempted to think that because the first worker has a value of the marginal product of $380, that worker is paid $380 in equilibrium. Not so: if the equilibrium value of the marginal product in the labor market is equal to $200, then all workers receive $200.

**ECONOMICS IN ACTION**

**HELP WANTED!**

Hamill Manufacturing of Pennsylvania makes precision components for military helicopters and nuclear submarines. Their highly skilled senior machinists are well paid compared to other workers in manufacturing, earning nearly $70,000 in 2011, excluding benefits. Like most skilled machinists in the United States, Hamill’s machinists are very productive: according to the U.S. Census Annual Survey of Manufacturer, in 2010 the average skilled machinist generated approximately $137,000 in value added.

But there is a $67,000 difference between the salary paid to Hamill machinists and the value added they generate. Does this mean that the marginal productivity theory of income distribution doesn’t hold? Doesn’t the theory imply that machinists should be paid $137,000, the average value added that each one generates?

The answer is no, for two reasons. First, the $137,000 figure is averaged over all machinists currently employed. The theory says that machinists will be paid the value of the marginal product of the last machinist hired, and due to diminishing returns to labor,

The marginal productivity theory of income distribution holds for skilled machinists at Hamill Manufacturing.
that value will be lower than the average over all machinists currently employed. Second, a worker’s equilibrium wage rate includes other costs, such as employee benefits, that have to be added to the $70,000 salary. The marginal productivity theory of income distribution says that workers are paid a wage rate, including all benefits, equal to the value of the marginal product.

You can see all these costs are present at Hamill. There the machinists have good benefits and job security, which add to their salary. Including these benefits, machinists’ total compensation will be equal to the value of the marginal product of the last machinist employed.

In Hamill’s case, there is yet another factor that explains the $67,000 gap: there are not enough machinists at the current wage rate. Although the company increased the number of employees from 85 in 2004 to 125 in 2011, they would like to hire more. Why doesn’t Hamill raise its wages in order to attract more skilled machinists? The problem is that the work they do is so specialized that it is hard to hire from the outside, even when the company raises wages as an inducement. To address this problem, Hamill has spent a significant amount of money training each new hire, approximately $125,000 plus the cost of benefits per trainee. In the end, it does appear that the marginal productivity theory of income distribution holds.

**CHECK YOUR UNDERSTANDING 19-2**

1. In the following cases, state the direction of the shift of the demand curve for labor and what will happen, other things equal, to the market equilibrium wage rate and quantity of labor employed as a result.
   a. Service industries, such as retailing and banking, experience an increase in demand. These industries use relatively more labor than nonservice industries. 
   b. Due to overfishing, there is a fall in the amount of fish caught per day by commercial fishers; this decrease affects their demand for workers.

2. Explain the following statement: “When firms in different industries all compete for the same workers, then the value of the marginal product of the last worker hired will be equal across all firms regardless of whether they are in different industries.”

Solutions appear at the back of the book.

Is the Marginal Productivity Theory of Income Distribution Really True?

Although the marginal productivity theory of income distribution is a well-established part of economic theory, closely linked to the analysis of markets in general, it is a source of some controversy. There are two main objections to it.

First, in the real world we see large disparities in income between factors of production that, in the eyes of some observers, should receive the same payment. Perhaps the most conspicuous examples in the United States are the large differences in the average wages between women and men and among various racial and ethnic groups. Do these wage differences really reflect differences in marginal productivity, or is something else going on?

Second, many people wrongly believe that the marginal productivity theory of income distribution gives a moral justification for the distribution of income, implying that the existing distribution is fair and appropriate. This misconception sometimes leads other people, who believe that the current distribution of income is unfair, to reject marginal productivity theory.
To address these controversies, we'll start by looking at income disparities across gender and ethnic groups. Then we'll ask what factors might account for these disparities and whether these explanations are consistent with the marginal productivity theory of income distribution.

**Wage Disparities in Practice**

Wage rates in the United States cover a very wide range. In 2011, hundreds of thousands of workers received the legal federal minimum of $7.25 per hour. At the other extreme, the chief executives of several companies were paid more than $100 million, which works out to $20,000 per hour even if they worked 100-hour weeks. Even leaving out these extremes, there is a huge range of wage rates. Are people really that different in their marginal productivities?

A particular source of concern is the existence of systematic wage differences across gender and ethnicity. Figure 19-8 compares annual median earnings in 2010 of workers age 25 or older classified by gender and ethnicity. As a group, White males had the highest earnings. Other data show that women (averaging across all ethnicities) earned only about 65% as much; African-American workers (male and female combined), only 65% as much; Hispanic workers (again, male and female combined), only 54% as much.

**Figure 19-8 Median Earnings by Gender and Ethnicity, 2010**

The U.S. labor market continues to show large differences across workers according to gender and ethnicity. Women are paid substantially less than men; African-American and Hispanic workers are paid substantially less than White male workers.

Source: U.S. Census Bureau.

We are a nation founded on the belief that all men are created equal—and if the Constitution were rewritten today, we would say that all people are created equal. So why do they receive such unequal pay? Let's start with the marginal productivity explanations, then look at other influences.

**Marginal Productivity and Wage Inequality**

A large part of the observed inequality in wages can be explained by considerations that are consistent with the marginal productivity theory of income distribution. In particular, there are three well-understood sources of wage differences across occupations and individuals.
First is the existence of **compensating differentials**: across different types of jobs, wages are often higher or lower depending on how attractive or unattractive the job is. Workers with unpleasant or dangerous jobs demand a higher wage in comparison to workers with jobs that require the same skill and effort but lack the unpleasant or dangerous qualities. For example, truckers who haul hazardous loads are paid more than truckers who haul normal loads. But for any given job, the marginal productivity theory of income distribution generally holds true. For example, hazardous-load truckers are paid a wage equal to the equilibrium value of the marginal product of the last person employed in the market for hazardous-load truckers.

A second reason for wage inequality that is clearly consistent with marginal productivity theory is differences in talent. People differ in their abilities: a high-ability person, by producing a better product that commands a higher price compared to a lower-ability person, generates a higher value of the marginal product. And these differences in the value of the marginal product translate into differences in earning potential. We all know that this is true in sports: practice is important, but 99.99% (at least) of the population just doesn’t have what it takes to throw passes like Tom Brady or hit tennis balls like Roger Federer. The same is true, though less obvious, in other fields of endeavor.

A third and, very important reason for wage differences is differences in the quantity of **human capital**. Recall that human capital—education and training—is at least as important in the modern economy as physical capital in the form of buildings and machines. Different people “embody” quite different quantities of human capital, and a person with a higher quantity of human capital typically generates a higher value of the marginal product by producing a product that commands a higher price. So differences in human capital account for substantial differences in wages. People with high levels of human capital, such as skilled surgeons or engineers, generally receive high wages.

The most direct way to see the effect of human capital on wages is to look at the relationship between educational levels and earnings. Figure 19-9 shows earnings differentials by gender, ethnicity, and three educational levels for people age 25 or older in 2010. As you can see, regardless of gender or ethnicity, higher

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**Compensating differentials** are wage differences across jobs that reflect the fact that some jobs are less pleasant than others.

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**FIGURE 19-9 Earnings Differentials by Education, Gender, and Ethnicity, 2010**

It is clear that, regardless of gender or ethnicity, education pays: those with a high school diploma earn more than those without one, and those with a college degree earn substantially more than those with only a high school diploma. Other patterns are evident as well: for any given education level, White males earn more than every other group, and males earn more than females for any given ethnic group.

*Source: U.S. Census Bureau.*
education is associated with higher median earnings. For example, in 2010 White females with 9 to 12 years of schooling but without a high school diploma had median earnings 32% less than those with a high school diploma and 65% less than those with a college degree—and similar patterns exist for the other five groups. Additional data show that surgeons—an occupation that requires steady hands and many years of formal training—earned an average of $225,390 in 2010.

Because even now men typically have had more years of education than women and Whites more years than non-Whites, differences in level of education are part of the explanation for the earnings differences shown in Figure 19-8.

It's also important to realize that formal education is not the only source of human capital; on-the-job training and experience are also very important. This point was highlighted by a 2003 National Science Foundation report on earnings differences between male and female scientists and engineers. The study was motivated by concerns over the male–female earnings gap: the median salary for women in science and engineering is about 24% less than the median salary for men. The study found that women in these occupations are, on average, younger than men and have considerably less experience than their male counterparts. This difference in age and experience, according to the study, explained most of the earnings differential. Differences in job tenure and experience can partly explain one notable aspect of Figure 19-9: that, across all ethnicities, women's median earnings are less than men's median earnings for any given education level.

But it's also important to emphasize that earnings differences arising from differences in human capital are not necessarily "fair." A society in which non-White children typically receive a poor education because they live in underfunded school districts, then go on to earn low wages because they are poorly educated, may have labor markets that are well described by marginal productivity theory (and would be consistent with the earnings differentials across ethnic groups shown in Figure 19-8). Yet many people would still consider the resulting distribution of income unfair.

Still, many observers think that actual wage differentials cannot be entirely explained by compensating differentials, differences in talent, and differences in human capital. They believe that market power, efficiency wages, and discrimination also play an important role. We will examine these forces next.

**Market Power**

The marginal productivity theory of income distribution is based on the assumption that factor markets are perfectly competitive. In such markets we can expect workers to be paid the equilibrium value of their marginal product, regardless of who they are. But how valid is this assumption?

We studied markets that are not perfectly competitive in Chapters 13, 14, and 15; now let's touch briefly on the ways in which labor markets may deviate from the competitive assumption.

One undoubted source of differences in wages between otherwise similar workers is the role of unions—organizations that try to raise wages and improve working conditions for their members. Labor unions, when they are successful, replace one-on-one wage deals between workers and employers with collective bargaining, in which the employer must negotiate wages with union representatives. Without question, this leads to higher wages for those workers who are represented by unions. In 2010 the median weekly earnings of union members in the United States were $917, compared with $717 for workers not represented by unions—about a 30% difference.

Just as workers can sometimes organize to extract higher wages than they would otherwise receive, employers can sometimes organize to pay lower wages than would result from competition. For example, health care workers—doctors,
nurses, and so on—sometimes argue that health maintenance organizations (HMOs) are engaged in a collective effort to hold down their wages.

How much does collective action, either by workers or by employers, affect wages in the modern United States? Several decades ago, when around 30% of American workers were union members, unions probably had a significant upward effect on wages. Today, however, most economists think unions exert a fairly minor influence. Union membership in the United States is relatively limited: in 2010, less than 7% of the employees of private businesses were represented by unions. And although there are fields like health care in which a few large firms account for a sizable share of employment in certain geographical areas, the sheer size of the U.S. labor market is enormous and the ease with which most workers can move in search of higher-paying jobs probably means that concerted efforts to hold wages below the unrestrained market equilibrium level rarely occur and even more rarely succeed.

Efficiency Wages

A second source of wage inequality is the phenomenon of efficiency wages—a type of incentive scheme used by employers to motivate workers to work hard and to reduce worker turnover. Suppose a worker performs a job that is extremely important but that the employer can observe how well the job is being performed only at infrequent intervals—say, serving as a caregiver for the employer's child. Then it often makes sense for the employer to pay more than the worker could earn in an alternative job—that is, more than the equilibrium wage. Why? Because earning a premium makes losing this job and having to take the alternative job quite costly for the worker.

So a worker who happens to be observed performing poorly and is therefore fired is now worse off for having to accept a lower-paying job. The threat of losing a job that pays a premium motivates the worker to perform well and avoid being fired. Likewise, paying a premium also reduces worker turnover—the frequency with which an employee leaves a job voluntarily. Despite the fact that it may take no more effort and skill to be a child's caregiver than to be an office worker, efficiency wages show why it often makes economic sense for a parent to pay a caregiver more than the equilibrium wage of an office worker.

The efficiency-wage model explains why we might observe wages offered above their equilibrium level. Like the price floors we studied in Chapter 5—and, in particular, much like the minimum wage—this phenomenon leads to a surplus of labor in labor markets that are characterized by the efficiency-wage model. This surplus of labor translates into unemployment—some workers are actively searching for a high-paying efficiency-wage job but are unable to get one, and other more fortunate but no more deserving workers are able to acquire one.

As a result, two workers with exactly the same profile—the same skills and same job history—may earn unequal wages: the worker who is lucky enough to get an efficiency-wage job earns more than the worker who gets a standard job (or who remains unemployed while searching for a higher-paying job). Efficiency wages are a response to a type of market failure that arises from the fact that some employees don't always perform as well as they should and are able to hide that fact. As a result, employers use nonequilibrium wages in order to motivate their employees, leading to an inefficient outcome.

Discrimination

It is a real and ugly fact that throughout history there has been discrimination against workers who are considered to be of the wrong race, ethnicity, gender, or other characteristics. How does this fit into our economic models?
The main insight economic analysis offers is that discrimination is not a natural consequence of market competition. On the contrary, market forces tend to work against discrimination. To see why, consider the incentives that would exist if social convention dictated that women be paid, say, 30% less than men with equivalent qualifications and experience. A company whose management was itself unbiased would then be able to reduce its costs by hiring women rather than men—and such companies would have an advantage over other companies that hired men despite their higher cost. The result would be to create an excess demand for female workers, which would tend to drive up their wages.

But if market competition works against discrimination, how is it that so much discrimination has taken place? The answer is twofold. First, when labor markets don’t work well, employers may have the ability to discriminate without hurting their profits. For example, market interferences (such as unions or minimum-wage laws) or market failures (such as efficiency wages) can lead to wages that are above their equilibrium levels. In these cases, there are more job applicants than there are jobs, leaving employers free to discriminate among applicants. In 2011, with unemployment over 9%, the Equal Employment Opportunity Commission, the federal agency tasked with investigating employment discrimination charges, reported that the complaints from workers and job-seekers had hit an all-time high, the most logged in the agency’s 46-year history.

In research published in the *American Economic Review*, two economists, Marianne Bertrand and Sendhil Mullainathan, documented discrimination in hiring by sending fictitious résumés to prospective employers on

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**FOR INQUIRING MINDS**

**THE ECONOMICS OF APARTHEID**

The Republic of South Africa is the richest nation in Africa, but it also has a harsh political history. Until the peaceful transition to majority rule in 1994, the country was controlled by its White minority, Afrikaners, the descendants of European (mainly Dutch) immigrants. This minority imposed an economic system known as apartheid, which overwhelmingly favored White interests over those of native Africans and other groups considered “non-White,” such as Asians.

The origins of apartheid go back to the early years of the twentieth century, when large numbers of White farmers began moving into South Africa’s growing cities. There they discovered, to their horror, that they did not automatically earn higher wages than other races. But they had the right to vote—and non-Whites did not. And so the South African government instituted “job-reservation” laws designed to ensure that only Whites got jobs that paid well. The government also set about creating jobs for Whites in government-owned industries. As Allister Sparks notes in *The Mind of South Africa* (1990), in its efforts to provide high-paying jobs for Whites, the country “eventually acquired the largest amount of nationalized industry of any country outside the Communist bloc.”

In other words, racial discrimination was possible because it was backed by the power of the government, which prevented markets from following their natural course.

A postscript: In 1994, in one of the political miracles of modern times, the White regime ceded power and South Africa became a full-fledged democracy. Apartheid was abolished.

Unfortunately, large racial differences in earnings remain. The main reason is that apartheid created huge disparities in human capital, which will persist for many years to come.

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Although abolished, apartheid has left behind a legacy of large racial differences in earnings that will likely persist for many years.
a random basis. Applicants with “White-sounding” names such as Emily Walsh were 50% more likely to be contacted than applicants with “African-American-sounding” names such as Lakisha Washington. Also, applicants with White-sounding names and good credentials were much more likely to be contacted than those without such credentials. By contrast, potential employers seemed to ignore the credentials of applicants with African-American-sounding names.

Second, discrimination has sometimes been institutionalized in government policy. This institutionalization of discrimination has made it easier to maintain it against market pressure, and historically it is the form that discrimination has typically taken. For example, at one time in the United States, African-Americans were barred from attending “Whites-only” public schools and universities in many parts of the country and forced to attend inferior schools. Although market competition tends to work against current discrimination, it is not a remedy for past discrimination, which typically has had an impact on the education and experience of its victims and thereby reduces their income. The following Economics in Action illustrates the way in which government policy enforced discrimination in the world’s most famous racist regime, that of the former government of South Africa.

**So Does Marginal Productivity Theory Work?**

The main conclusion you should draw from this discussion is that the marginal productivity theory of income distribution is not a perfect description of how factor incomes are determined but that it works pretty well. The deviations are important. But, by and large, in a modern economy with well-functioning labor markets, factors of production are paid the equilibrium value of the marginal product—the value of the marginal product of the last unit employed in the market as a whole.

It’s important to emphasize, once again, that this does not mean that the factor distribution of income is morally justified.

**ECONOMICS IN ACTION**

**MARGINAL PRODUCTIVITY AND THE “1%”**

In the fall of 2011, there were widespread public demonstrations, in the United States and in a number of other countries, protesting the growing inequality of personal income. Many of the U.S. protestors adopted the slogan “We are the 99%,” emphasizing the fact that the incomes of the top 1% of the population had grown much faster than those of most Americans.

Indeed, just as the protest movement was gathering strength, the Congressional Budget Office released a study on income inequality. The CBO found that, between 1979 and 2007, the income of the median household, adjusted for inflation, had risen 34.8%—but the average income of the top 1% of households had risen 277.5%.

Why have the richest Americans been pulling away from the rest? The short answer is that the causes are a source of considerable dispute and continuing research. One thing is clear, however: this aspect of growing inequality can’t be explained simply in terms of the growing demand for highly educated labor. In this chapter’s opening story, we pointed out that there has been a growing wage premium...
for workers with advanced degrees. Yet despite this growing premium, as the Figure 19-10 shows, such workers have seen only a fraction of the gains going to the top 1%.

This does not prove that the top 1% aren’t “earning” their incomes. It does show, however, that whatever the explanation for their huge gains, it’s not education.

CHECK YOUR UNDERSTANDING 19-3

1. Assess each of the following statements. Do you think they are true, false, or ambiguous? Explain.
   a. The marginal productivity theory of income distribution is inconsistent with the presence of income disparities associated with gender, race, or ethnicity.
   b. Companies that engage in workplace discrimination but whose competitors do not are likely to have lower profits as a result of their actions.
   c. Workers who are paid less because they have less experience are not the victims of discrimination.

Solutions appear at back of book.

The Supply of Labor

Up to this point we have focused on the demand for factors, which determines the quantities demanded of labor, capital, or land by producers as a function of their factor prices. What about the supply of factors?

In this section we focus exclusively on the supply of labor. We do this for two reasons. First, in the modern U.S. economy, labor is the most important factor of production, accounting for most of factor income. Second, as we’ll see, labor supply is the area in which factor markets look most different from markets for goods and services.

Work versus Leisure

In the labor market, the roles of firms and households are the reverse of what they are in markets for goods and services. A good such as wheat is supplied by firms and demanded by households; labor, though, is demanded by firms and supplied by households. How do people decide how much labor to supply?

As a practical matter, most people have limited control over their work hours: either you take a job that involves working a set number of hours per week, or you don’t get the job at all. To understand the logic of labor supply, however, it helps to put realism to one side for a bit and imagine an individual who can choose to work as many or as few hours as he or she likes.

Why wouldn’t such an individual work as many hours as possible? Because workers are human beings, too, and have other uses for their time. An hour spent on the job is an hour not spent on other, presumably more pleasant, activities. So the decision about how much labor to supply involves making a decision about time allocation—how many hours to spend on different activities.

By working, people earn income that they can use to buy goods. The more hours an individual works, the more goods he or she can afford to buy. But this increased purchasing power comes at the expense of a reduction in leisure, the time spent not working. (Leisure doesn’t necessarily mean time spent goofing off. It could mean time spent with one’s family, pursuing hobbies, exercising, and so on.) And though purchased goods yield utility, so does leisure. Indeed, we can think of leisure itself as a normal good, which most people would like to consume more of as their incomes increase.

Decisions about labor supply result from decisions about time allocation: how many hours to spend on different activities.

Leisure is time available for purposes other than earning money to buy marketed goods.
The individual labor supply curve shows how the quantity of labor supplied by an individual depends on that individual’s wage rate.

How does a rational individual decide how much leisure to consume? By making a marginal comparison, of course. In analyzing consumer choice, we asked how a utility-maximizing consumer uses a marginal dollar. In analyzing labor supply, we ask how an individual uses a marginal hour.

Consider Clive, an individual who likes both leisure and the goods money can buy. Suppose that his wage rate is $10 per hour. In deciding how many hours he wants to work, he must compare the marginal utility of an additional hour of leisure with the additional utility he gets from $10 worth of goods. If $10 worth of goods adds more to his total utility than an additional hour of leisure, he can increase his total utility by giving up an hour of leisure in order to work an additional hour. If an extra hour of leisure adds more to his total utility than $10 worth of goods, he can increase his total utility by working one fewer hour in order to gain an hour of leisure.

At Clive’s optimal labor supply choice, then, his marginal utility of one hour of leisure is equal to the marginal utility he gets from the goods that his hourly wage can purchase. This is very similar to the optimal consumption rule we encountered in Chapter 10, except that it is a rule about time rather than money.

Our next step is to ask how Clive’s decision about time allocation is affected when his wage rate changes.

Wages and Labor Supply

Suppose that Clive’s wage rate doubles, from $10 to $20 per hour. How will he change his time allocation?

You could argue that Clive will work longer hours, because his incentive to work has increased: by giving up an hour of leisure, he can now gain twice as much money as before. But you could equally well argue that he will work less, because he doesn’t need to work as many hours to generate the income to pay for the goods he wants.

As these opposing arguments suggest, the quantity of labor Clive supplies can either rise or fall when his wage rate rises. To understand why, let’s recall the distinction between substitution effects and income effects that we learned in Chapter 10 and its appendix. We saw there that a price change affects consumer choice in two ways: by changing the opportunity cost of a good in terms of other goods (the substitution effect) and by making the consumer richer or poorer (the income effect).

Now think about how a rise in Clive’s wage rate affects his demand for leisure. The opportunity cost of leisure—the amount of money he gives up by taking an hour off instead of working—rises. That substitution effect gives him an incentive, other things equal, to consume less leisure and work longer hours. Conversely, a higher wage rate makes Clive richer—and this income effect leads him, other things equal, to want to consume more leisure and supply less labor, because leisure is a normal good.

So in the case of labor supply, the substitution effect and the income effect work in opposite directions. If the substitution effect is so powerful that it dominates the income effect, an increase in Clive’s wage rate leads him to supply more hours of labor. If the income effect is so powerful that it dominates the substitution effect, an increase in the wage rate leads him to supply fewer hours of labor.

We see, then, that the individual labor supply curve—the relationship between the wage rate and the number of hours of labor supplied by an individual worker—does not necessarily slope upward. If the income effect dominates, a higher wage rate will reduce the quantity of labor supplied.

Figure 19-11 illustrates the two possibilities for labor supply. If the substitution effect dominates the income effect, the individual labor supply curve slopes upward; panel (a) shows an increase in the wage rate from $10 to $20 per hour...
leading to a rise in the number of hours worked from 40 to 50. However, if the income effect dominates, the quantity of labor supplied goes down when the wage rate increases. Panel (b) shows the same rise in the wage rate leading to a fall in the number of hours worked from 40 to 30. (Economists refer to an individual labor supply curve that contains both upward-sloping and downward-sloping segments as a “backward-bending labor supply curve”—a concept that we analyze in detail in this chapter’s appendix.)

Is a negative response of the quantity of labor supplied to the wage rate a real possibility? Yes: many labor economists believe that income effects on the supply

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**FOR INQUIRING MINDS**

**WHY YOU CAN’T FIND A CAB WHEN IT’S RAINING**

Everyone says that you can’t find a taxi in New York when you really need one—say, when it’s raining. That could be because everyone else is trying to get a taxi at the same time. But according to a study published in the *Quarterly Journal of Economics,* it’s more than that: cab drivers actually go home early when it’s raining.

The reason is that the hourly wage rate of a taxi driver depends on the weather: when it’s raining, drivers get more fares and therefore earn more per hour. But it seems that the income effect of this higher wage rate outweighs the substitution effect.

This behavior leads the authors of the study to question drivers’ rationality. They point out that if taxi drivers thought in terms of the long run, they would realize that rainy days and nice days tend to average out and that their high earnings on a rainy day don’t really affect their long-run income very much. Indeed, experienced drivers (who have probably figured this out) are less likely than inexperienced drivers to go home early on a rainy day. But leaving such issues to one side, the study does seem to show clear evidence of a labor supply curve that slopes downward instead of upward, thanks to income effects.

(See source note on copyright page.)
of labor may be somewhat stronger than substitution effects. The most compelling piece of evidence for this belief comes from Americans’ increasing consumption of leisure over the past century. At the end of the nineteenth century, wages adjusted for inflation were only about one-eighth what they are today; the typical workweek was 70 hours, and very few workers retired at age 65. Today the typical workweek is less than 40 hours, and most people retire at age 65 or earlier. So it seems that Americans have chosen to take advantage of higher wages in part by consuming more leisure.

**Shifts of the Labor Supply Curve**

Now that we have examined how income and substitution effects shape the individual labor supply curve, we can turn to the market labor supply curve. In any labor market, the market supply curve is the horizontal sum of the individual labor supply curves of all workers in that market. A change in any factor other than the wage that alters workers’ willingness to supply labor causes a shift of the labor supply curve. A variety of factors can lead to such shifts, including changes in preferences and social norms, changes in population, changes in opportunities, and changes in wealth.

**Changes in Preferences and Social Norms** Changes in preferences and social norms can lead workers to increase or decrease their willingness to work at any given wage. A striking example of this phenomenon is the large increase in the number of employed women—particularly married employed women—that has occurred in the United States since the 1960s. Until that time, women who could afford to largely avoided working outside the home. Changes in preferences and norms in post–World War II America (helped along by the invention of labor-saving home appliances such as washing machines, increasing urbanization of the population, and higher female education levels) have induced large numbers of American women to join the workforce—a phenomenon often repeated in other countries that experience similar social and technological forces.

**Changes in Population** Changes in the population size generally lead to shifts of the labor supply curve. A larger population tends to shift the labor supply curve rightward as more workers are available at any given wage; a smaller population tends to shift the labor supply curve leftward. Currently the size of the U.S. labor force grows by approximately 1% per year, a result of immigration from other countries and, in comparison to other developed countries, a relatively high birth rate. As a result, many labor markets in the United States are experiencing rightward shifts of their labor supply curves.

**Changes in Opportunities** At one time, teaching was the only occupation considered suitable for well-educated women. However, as opportunities in other professions opened up to women starting in the 1960s, many women left teaching and potential female teachers chose other careers. This generated a leftward shift of the supply curve for teachers, reflecting a fall in the willingness to work at any given wage and forcing school districts to pay more to maintain an adequate teaching staff. These events illustrate a general result: when superior alternatives arise for workers in another labor market, the supply curve in the original labor market shifts leftward as workers move to the new opportunities. Similarly, when opportunities diminish in one labor market—say, layoffs in the manufacturing industry due to increased foreign competition—the supply in alternative labor markets increases as workers move to these other markets.
Changes in Wealth

A person whose wealth increases will buy more normal goods, including leisure. So when a class of workers experiences a general rise in their wealth levels—say, due to a stock market boom—the income effect from the wealth increase will shift the labor supply curve associated with those workers leftward as workers consume more leisure and work less. Note that the income effect caused by a change in wealth shifts the labor supply curve, but the income effect from a wage rate increase—as we discussed in the case of the individual labor supply curve—is a movement along the labor supply curve. The following Economics in Action illustrates how such a change in the wealth levels of many families during the late 1990s led to a shift of the market labor supply curve associated with their employable children.

THE OVERWORKED AMERICAN?

Americans today may work less than they did a hundred years ago, but they still work more than workers in any other industrialized country. This figure compares average annual hours worked in the United States with those worked in other industrialized countries. The differences result from a combination of Americans’ longer workweeks and shorter vacations. For example, the great majority of full-time American workers put in at least 40 hours per week. Until recently, however, a government mandate limited most French workers to a 35-hour workweek; collective bargaining has achieved a similar reduction in the workweek for many German workers.

In 2011, American workers got, on average, eight paid vacation days, but 23% of American workers got none at all. In contrast, German workers are guaranteed six weeks of paid vacation a year. Also, American workers use fewer of the vacation days they are entitled to than do workers in other industrialized countries. A 2011 survey found that only 57% of American workers use all the vacation days they are entitled to, compared to 89% in France.

Why do Americans work so much more than others? Unlike their counterparts in other industrialized countries, Americans are not legally entitled to paid vacation days; as a result, the average American worker gets fewer of them. Moreover, anecdotal evidence suggests that during the recent recession, with its high rates of unemployment, American workers became more reluctant to use the vacation days they were entitled to.

THE DECLINE OF THE SUMMER JOB

Come summertime, resort towns along the New Jersey shore find themselves facing a recurring annual problem: a serious shortage of lifeguards. Traditionally, lifeguard positions, together with many other seasonal jobs, had been filled mainly by high school and college students. But in recent years a combination of adverse shifts in supply and demand have severely diminished summer employment for young workers. In 1979, 71% of Americans between the ages of 16 and 19 were in the summer workforce. By 2007, that number was 42%, and by 2011 it had taken another sharp fall to around 25%.
A fall in supply is one explanation for the change. More students now feel that they should devote their summer to additional study rather than to work. An increase in household affluence over the past 20 years has also contributed to fewer teens taking jobs because they no longer feel pressured to contribute to household finances. In other words, the income effect has led to a reduced labor supply.

Another explanation is the substitution effect: increased competition from immigrants, who are now doing the jobs typically done by teens (like mowing lawns and delivering pizzas), has led to a decline in wages. So many teenagers have forgone summer work to consume leisure instead.

But it was the deep recession of 2007–2009 that contributed most to the severe fall in youth summer employment in the ensuing years. By 2010 and 2011, cutbacks in employment by private employers, as well in local and state government programs that hired teens during the summer, had led to the lowest number of teens employed during the summer in decades. Thus a steep fall in demand, along with a long-run trend of falling supply, has led to the decline of what was once a summer tradition.

**CHECK YOUR UNDERSTANDING**

1. Formerly, Clive was free to work as many or as few hours per week as he wanted. But a new law limits the maximum number of hours he can work per week to 35. Explain under what circumstances, if at all, he is made:
   a. Worse off
   b. Equally as well off
   c. Better off

2. Explain in terms of the income and substitution effects how a fall in Clive’s wage rate can induce him to work more hours than before.

Solutions appear at back of book.
Check out a T-shirt or sweatshirt emblazoned with your school’s logo at your campus bookstore, and the odds are very good that it was made by Alta Gracia, the leading supplier of college-logo apparel to American universities. Alta Gracia is owned by Knights Apparel, a company based in Spartanburg, South Carolina, that manufactures apparel in 30 factories around the world. The Alta Gracia factory is located in the Dominican Republic, where 120 employees turn out T-shirts and sweats.

Workers at Alta Gracia consider themselves lucky because the company pays what it considers a “living wage”—sufficient to feed and shelter a family of four—and allows workers to join a union. Seamstress Santa Castillo, for example, earns $500 a month, three times the average monthly pay of $147 earned by apparel workers in the Dominican Republic, where a loaf of bread costs $1.

Workers at the factory have not always been so fortunate. When the factory was owned by another company, BJ&B, which made baseball caps for Nike and Reebok, workers were paid the prevailing wage and were fired if they complained about working conditions or tried to form a union. Eventually, BJ&B moved its operations to lower-wage Bangladesh, where the minimum wage is 15 cents an hour, compared to 85 cents an hour in the Dominican Republic. In contrast, Alta Gracia pays $2.83 an hour.

Joe Bozich started Knights Apparel in 2000; through scores of deals he has made with universities, his company has surpassed Nike as the number-one college supplier. He works closely with the Worker Rights Consortium, a group of 186 universities that press college-logo apparel manufacturers to improve workers’ welfare. The consortium is part of the “Fair Trade Movement,” an organization dedicated to improving the welfare of workers in developing countries, principally by raising wages. In 2010, $6 billion of Fair Trade–approved goods were sold globally, up 27% from 2009.

Alta Gracia was conceived by Bozich as a model factory to show that an apparel manufacturer could pay its workers a living wage and still succeed when competitors are paying their workers much less. Its production cost for a T-shirt is $4.80—80 cents, or 20%, higher than if it paid minimum wage. Knights Apparel accepts a lower profit margin so it doesn’t have to ask retailers to pay a higher wholesale price for its merchandise.

Some observers, though, are skeptical because Alta Gracia merchandise is sold alongside products made by Nike and Adidas, at approximately the same premium price these well-known brands command. “It’s a noble effort, but it is an experiment,” says Andrew Jassin, an industry analyst. “There are consumers who really care and will buy this apparel at a premium price, and there are those who say they care, but just want value.”

Kellie McElhaney, a professor of corporate social responsibility at the University of California at Berkeley, disagrees: “A lot of college students would much rather pay for a brand that shows workers are treated well.”

**QUESTIONS FOR THOUGHT**

1. Use the marginal productivity theory of labor to explain how the prevailing wage for apparel workers can fall below a living wage in the Dominican Republican.

2. From the point of view of Knights Apparel, what are the pros and cons of paying the Alta Gracia workers a living wage? What are the pros and cons from the point of view of workers generally?

3. What factors does the success or failure of Alta Gracia depend on? What should Knights Apparel do to improve its chances of success?
SUMMARY

1. Just as there are markets for goods and services, there are markets for factors of production, including labor, land, and both physical capital and human capital. These markets determine the factor distribution of income.

2. Profit-maximizing price-taking producers will employ a factor up to the point at which its price is equal to its value of the marginal product—the marginal product of the factor multiplied by the price of the output it produces. The value of the marginal product curve is therefore the individual price-taking producer's demand curve for a factor.

3. The market demand curve for labor is the horizontal sum of the individual demand curves of producers in that market. It shifts for three main reasons: changes in output price, changes in the supply of other factors, and technological changes.

4. When a competitive labor market is in equilibrium, the market wage is equal to the equilibrium value of the marginal product of labor, the additional value produced by the last worker hired in the labor market as a whole. The same principle applies to other factors of production: the rental rate of land or capital is equal to the equilibrium value of the marginal products. This insight leads to the marginal productivity theory of income distribution, according to which each factor is paid the value of the marginal product of the last unit of that factor employed in the factor market as a whole.

5. Large disparities in wages raise questions about the validity of the marginal productivity theory of income distribution. Many disparities can be explained by compensating differentials and by differences in talent, job experience, and human capital across workers. Market interference in the forms of unions and collective action by employers also creates wage disparities. The efficiency-wage model, which arises from a type of market failure, shows how wage disparities can result from employers' attempts to increase worker performance. Free markets tend to diminish disparities, but discrimination remains a real source of wage disparity. Discrimination is typically maintained either through problems in labor markets or (historically) through institutionalization in government policies.

6. Labor supply is the result of decisions about time allocation, where each worker faces a trade-off between leisure and work. An increase in the hourly wage rate tends to increase work hours via the substitution effect but to reduce work hours via the income effect. If the net result is that a worker increases the quantity of labor supplied in response to a higher wage, the individual labor supply curve slopes upward. If the net result is that a worker reduces work hours, the individual labor supply curve—unlike supply curves for goods and services—slopes downward.

7. The market labor supply curve is the horizontal sum of the individual labor supply curves of all workers in that market. It shifts for four main reasons: changes in preferences and social norms, changes in population, changes in opportunities, and changes in wealth.

KEY TERMS

- Physical capital, p. 530
- Human capital, p. 530
- Factor distribution of income, p. 531
- Value of the marginal product, p. 534
- Value of the marginal product curve, p. 534
- Equilibrium value of the marginal product, p. 539
- Rental rate, p. 539
- Marginal productivity theory of income distribution, p. 541
- Compensating differentials, p. 544
- Unions, p. 545
- Efficiency-wage model, p. 546
- Time allocation, p. 549
- Leisure, p. 549
- Individual labor supply curve, p. 550

PROBLEMS

1. In 2007, national income in the United States was $11,186.9 billion. In the same year, 137 million workers were employed, at an average wage of $57,526 per worker per year.
   a. How much compensation of employees was paid in the United States in 2007?
   b. Analyze the factor distribution of income. What percentage of national income was received in the form of compensation to employees in 2007?
   c. Suppose that a huge wave of corporate downsizing leads many terminated employees to open their own businesses. What is the effect on the factor distribution of income?
   d. Suppose the supply of labor rises due to an increase in the retirement age. What happens to the percentage of national income received in the form of compensation to employees?
2. Marty’s Frozen Yogurt has the production function per day shown in the accompanying table. The equilibrium wage rate for a worker is $80 per day. Each cup of frozen yogurt sells for $2.

<table>
<thead>
<tr>
<th>Quantity of labor (workers)</th>
<th>Quantity of frozen yogurt (cups)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>110</td>
</tr>
<tr>
<td>2</td>
<td>200</td>
</tr>
<tr>
<td>3</td>
<td>270</td>
</tr>
<tr>
<td>4</td>
<td>300</td>
</tr>
<tr>
<td>5</td>
<td>320</td>
</tr>
<tr>
<td>6</td>
<td>330</td>
</tr>
</tbody>
</table>

a. Calculate the marginal product of labor for each worker and the value of the marginal product of labor per worker.
b. How many workers should Marty employ?

3. Patty’s Pizza Parlor has the production function per hour shown in the accompanying table. The hourly wage rate for each worker is $10. Each pizza sells for $2.

<table>
<thead>
<tr>
<th>Quantity of labor (workers)</th>
<th>Quantity of pizza</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>19</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>5</td>
<td>24</td>
</tr>
</tbody>
</table>

a. Calculate the marginal product of labor for each worker and the value of the marginal product of labor per worker.
b. Draw the value of the marginal product of labor curve. Use your diagram to determine how many workers Patty should employ.
c. Now the price of pizza increases to $4. Calculate the value of the marginal product of labor per worker, and draw the new value of the marginal product of labor curve in your diagram. Use your diagram to determine how many workers Patty should employ now.

4. The production function for Patty’s Pizza Parlor is given in the table in Problem 3. The price of pizza is $2, but the hourly wage rate rises from $10 to $15. Use a diagram to determine how Patty’s demand for workers responds as a result of this wage rate increase.

5. Patty’s Pizza Parlor initially had the production function given in the table in Problem 3. A worker’s hourly wage rate was $10, and pizza sold for $2. Now Patty buys a new high-tech pizza oven that allows her workers to become twice as productive as before. That is, the first worker now produces 18 pizzas per hour instead of 9, and so on.

a. Calculate the new marginal product of labor and the new value of the marginal product of labor.
b. Use a diagram to determine how Patty’s hiring decision responds to this increase in the productivity of her workforce.

6. Jameel runs a driver education school. The more driving instructors he hires, the more driving lessons he can sell. But because he owns a limited number of training automobiles, each additional driving instructor adds less to Jameel’s output of driving lessons. The accompanying table shows Jameel’s production function per day. Each driving lesson can be sold at $35 per hour.

<table>
<thead>
<tr>
<th>Quantity of labor (driving instructors)</th>
<th>Quantity of driving lessons (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>21</td>
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<td>26</td>
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<tr>
<td>5</td>
<td>30</td>
</tr>
<tr>
<td>6</td>
<td>33</td>
</tr>
</tbody>
</table>

Determine Jameel’s labor demand schedule (his demand schedule for driving instructors) for each of the following daily wage rates for driving instructors: $160, $180, $200, $220, $240, and $260.

7. Dale and Dana work at a self-service gas station and convenience store. Dale opens up every day, and Dana arrives later to help stock the store. They are both paid the current market wage of $9.50 per hour. But Dale feels he should be paid much more because the revenue generated from the gas pumps he turns on every morning is much higher than the revenue generated by the items that Dana stocks. Assess this argument.

8. A New York Times article published in 2007 observed that the wage of farmworkers in Mexico was $11 an hour but the wage of immigrant Mexican farmworkers in California was $9 an hour.

a. Assume that the output sells for the same price in the two countries. Does this imply that the marginal product of labor of farmworkers is higher in Mexico or in California? Explain your answer, and illustrate with a diagram that shows the demand and supply curves for labor in the respective markets. In your diagram, assume that the quantity supplied of labor for any given wage rate is the same for Mexican farmworkers as it is for immigrant Mexican farmworkers in California.

b. Now suppose that farmwork in Mexico is more arduous and more dangerous than farmwork in California. As a result, the quantity supplied of labor
9. Kendra is the owner of Wholesome Farms, a commercial dairy. Kendra employs labor, land, and capital. In her operations, Kendra can substitute between the amount of labor she employs and the amount of capital she employs. That is, to produce the same quantity of output she can use more labor and less land; similarly, to produce the same quantity of output she can use less labor and more land. However, if she uses more land, she must use more of both labor and capital; if she uses less land, she can use less of both labor and capital. Let \( w \) represent the annual cost of labor in the market, let \( r_L \) represent the annual cost of a unit of labor in the market, and let \( r_K \) represent the annual cost of a unit of capital in the market.

a. Suppose that Kendra can maximize her profits by employing less labor and more capital than she is currently using but the same amount of land. What three conditions must now hold for Kendra’s operations (involving her value of the marginal product of labor, land and capital) for this to be true?

b. Kendra believes that she can increase her profits by renting and using more land. What three conditions must hold (involving her value of the marginal product of labor, land, and capital) for this to be true?

c. Illustrate your answer to part b with a diagram.

In this diagram, assume that the quantity of labor demanded for any given wage rate is the same for Mexican employers as it is for Californian employers.

10. For each of the following situations in which similar workers are paid different wages, give the most likely explanation for these wage differences.

a. Test pilots for new jet aircraft earn higher wages than airline pilots.

b. College graduates usually have higher earnings in their first year on the job than workers without college degrees have in their first year on the job.

c. Full professors command higher salaries than assistant professors for teaching the same class.

d. Unionized workers are generally better paid than non-unionized workers.

11. Research consistently finds that despite nondiscrimination policies, African-American workers on average receive lower wages than White workers do. What are the possible reasons for this? Are these reasons consistent with marginal productivity theory?

12. Greta is an enthusiastic amateur gardener and spends a lot of her free time working in her yard. She also has a demanding and well-paid job as a freelance advertising consultant. Because the advertising business is going through a difficult time, the hourly consulting fee Greta can charge falls. Greta decides to spend more time gardening and less time consulting. Explain her decision in terms of income and substitution effects.

13. Wendy works at a fast-food restaurant. When her wage rate was $5 per hour, she worked 30 hours per week. When her wage rate rose to $6 per hour, she decided to work 40 hours. But when her wage rate rose further to $7, she decided to work only 35 hours.

a. Draw Wendy’s individual labor supply curve.

b. Is Wendy’s behavior irrational, or can you find a rational explanation? Explain your answer.

14. You are the governor’s economic policy adviser. The governor wants to put in place policies that encourage employed people to work more hours at their jobs and that encourage unemployed people to find and take jobs. Assess each of the following policies in terms of income and substitution effects; and indicate when the impact of the policy may be ambiguous.

a. The state income tax rate is lowered, which has the effect of increasing workers’ after-tax wage rate.

b. The state income tax rate is increased, which has the effect of decreasing workers’ after-tax wage rate.

c. The state property tax rate is increased, which reduces workers’ after-tax income.

15. A study by economists at the Federal Reserve Bank of Boston found that between 1965 and 2003 the average American’s leisure time increased by between 4 and 8 hours a week. The study claims that this increase is primarily driven by a rise in wage rates.

a. Use the income and substitution effects to describe the labor supply for the average American. Which effect dominates?

b. The study also finds an increase in female labor force participation—more women are choosing to hold jobs rather than exclusively perform household tasks. For the average woman who has newly entered the labor force, which effect dominates?

c. Draw typical individual labor supply curves that illustrate your answers to part a and part b above.