Chapter 11
The Labor Market

Chapter Introduction

In this chapter, we learn about the labor market. We start with labor demand. After defining labor demand, we ask, "Why do firms demand labor?" We draw the labor-demand curve in the wage-rate and quantity-of-labor space. Next, we turn to labor supply and ask, "Why do households supply labor?" After drawing the labor-supply curve in the wage-rate and quantity-of-labor space, we combine the labor-demand and labor-supply curves to get the equilibrium wage rate and the equilibrium quantity of labor traded in the labor market. We also look at the factors that may shift the labor-demand curve and/or the labor-supply curve and the impact of these shifts on the equilibrium wage rate.

Before we get started, it is important to note that the model of the labor market presented here is a very simplified version of the actual labor market. We make several assumptions that may or may not prevail in the "real world." This, however, does not detract from the value of this simplified model. Even in this simplified version, the model provides valuable insights.

Labor Demand

As we know, labor is one of the three factors of production. The other two factors of production are land and capital. We learned from the circular flow diagram (Chapter 2, Figure 2.1) that in the factors' market, firms demand labor, and households supply labor. In return, firms pay wages to workers for their service; these wages become the workers' income.

Why Do Firms Demand Labor?

Why do firms demand labor? The answer is that firms demand labor to produce goods and services. Firms do not hire workers just for the sake of hiring workers. Firms hire workers for what they can produce. If the demand for the goods and services that a worker can produce increases, the demand for that worker increases. And when the demand for goods and services that a worker can produce decreases, the demand for that worker decreases.

Put differently, the demand for labor is *derived demand*; it is derived from the demand for goods and services that a worker can produce. Indeed, the demand for any factor of production—land, labor, or capital—is derived demand. Firms demand a factor of production for what that factor of production can produce.

How do firms decide how many workers to hire and what wage rate to pay?

Recall that although the tools that we are learning apply equally well, with some modifications, to firms that do not produce goods and services for profit, we use firms that produce for profit as an example.

To build the model of labor demand, we will make the following assumptions:

- All the workers in the labor market are identical; their skills are the same, their work habits are the same, and so on.
- Firms can hire any number of workers they want at the going wage rate.
- Firms are producing widgets, and they can sell as many widgets as they want to at the going market price.

Those of you who have taken Principles of Microeconomics must have recognized that we are assuming that both the labor market and the output market are perfectly competitive. Admittedly, these are rather strong assumptions; workers differ in skills, their work habits, and so forth, and goods and services differ in all sorts of ways. However, we are presenting a simplified version of reality to get a basic understanding of how the labor market and the economy as a whole work—a more realistic model of the labor market is beyond the scope of this textbook.

The Law of Diminishing Marginal Product

In Chapter 3, we learned the law of diminishing marginal utility. This law states that, holding all else constant, as we keep consuming more units of a product, each additional unit brings us successively lower marginal utility.

The production counterpart of the law of diminishing marginal utility is the law of diminishing marginal product of an input.

The law of diminishing marginal product states that, holding other inputs constant, as we keep using more of an input, beyond a certain point, the marginal product of each additional unit of that input is successively smaller. The case of labor is no different. As we keep using more labor, holding land and capital constant, beyond a certain point, each additional worker's marginal product keeps declining.

Why does the marginal product of an input first increase, then decline?

Let us take the example of a hypothetical car repair shop. Although this shop performs numerous car repairs, we will focus on tire rotations performed per hour in this shop. One tire rotation refers to the practice of rotating all four tires of a car—that is, the tires in the back are moved to the front of the car and crisscrossed, and the tires in the front are moved to the back of the car and crisscrossed. This practice makes all four tires wear evenly. Car manuals usually recommend rotating tires every 10,000 miles. Table 11.1 presents data for this hypothetical repair shop.

Table 11.1: Labor-Demand Curve

1	2	3	4	5	6
L	*TP*	*MP*	*P*	*MRP*	*W*
0	0	—	20	—	40
1	1	1	20	20	40
2	3	2	20	40	40
3	7	4	20	80	40
4	10	3	20	60	40
5	12	2	20	40	40
6	13	1	20	20	40
7	12	–1	20	–20	40

Where: *L*, labor; *TP*, total product; *MP*, marginal product; *P*, price per unit of the product; *MRP*, marginal revenue product; *W*, wage.

In Table 11.1, columns 1 and 2 provide the number of workers (L) used to produce the total output (TP). Column 3 lists the marginal product (MP); column 4 lists the price that this repair shop charges for its tire-rotation services per car (P); column 5 lists the marginal revenue product (MRP), which equals $P \times MP$; and column 6 lists the wage rate (W).

Suppose that the owner of this car repair shop charges $20 for rotating four tires (of one car), and she can hire car mechanics at a wage of $40 per hour. When she hires the first mechanic, he can rotate tires for one car in an hour; the MP of the first mechanic is 1, and the MRP of the first mechanic is $20 (= 1 × $20). Recall that $MRP = P \times MP$. When she hires a second mechanic, both can perform three tire rotations in an hour; the MP of the second worker is 2, and the MRP of the second mechanic is $40 (= 2 × $20). When she hires the third worker, the number of tire rotations increases to seven; the MP of the third worker is 4, and the MRP of the third mechanic is $80 (= 4 × $20).

Now suppose that the repair shop owner hires a fourth mechanic. Although the TP is still higher (10 tire rotations), the MP of the fourth mechanic (3 tire rotations) is lower than that of the third mechanic (4 tire rotations). When she hires the fifth and the sixth mechanics, although the TP is increasing (12 and 13 rotations, respectively), the marginal products of the fifth and the sixth mechanics are lower still (2 and 1, respectively).

Why did the MP, and hence the MRP, increase? The reason is that the mechanics were able to divide the various tasks in the tire-rotation routine. As a result, the MP of each additional mechanic kept increasing until the third mechanic.

Why did the MP, and hence the MRP, decrease after the third mechanic? The reason is that there are only so many tasks that can be divided among mechanics. Indeed, if the owner were to keep hiring more mechanics, given the size of the shop and the equipment, the shop would become crowded, and the mechanics would start running into each other, leading to a decline in TP and a negative MP and MRP. In our example, the TP starts to decline after the sixth mechanic, and the MP and MRP become negative; the MP of the seventh mechanic is –1, and the MRP of the seventh mechanic is –$20 (= –1 × $20).

Decision to Hire Workers: The Labor-Demand Curve (L_d)

How many workers should a firm hire?

Recall from Chapter 1 that although totals and averages are important, what matters for decision-making purposes is marginal costs and revenue. This means that when a firm wants to decide whether to hire an additional worker, it should compare the value that the additional worker brings to the firm and compare it with the wage rate. So long as the value that the additional worker brings is at least as high as the wage rate that the firm is paying to the additional worker, it is worth hiring the additional worker; otherwise, it is not. Putting this mathematically, a firm should hire workers up to the point where

$$W = MRP \tag{11.1}$$

Using our example, how many mechanics should our repair shop owner hire? Note that the repair shop owner can hire mechanics at $40 per hour. Using the data in Table 11.1 and the decision

rule in Equation 11.1, we see that the *MRP* of the fifth worker ($40) is equal to *P* ($40). This means that the repair shop owner should hire five mechanics.

Note also that although *W* = *MRP* for the second mechanic as well, it pays to keep hiring more mechanics because the *MP*, and hence the *MRP*, are increasing. The *MR*, and hence the *MRP*, are the highest for the third mechanic—4 and $80, respectively. However, the value that the fourth and fifth mechanics bring is still higher than or equal to the wage rate that the repair shop owner pays (i.e., $40), so it makes economic sense to hire the fourth and fifth mechanics. Figure 11.1 plots these data.

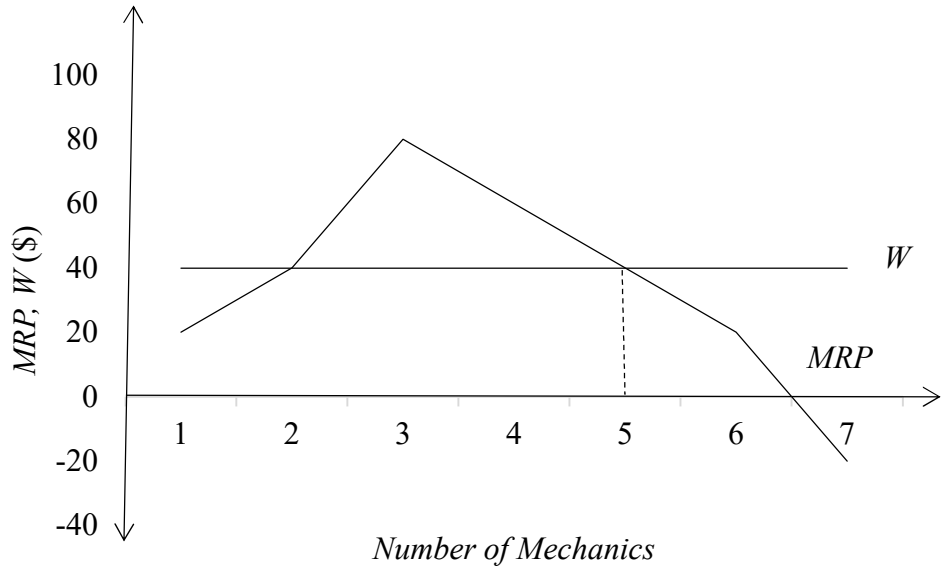

Figure 11.1: Marginal Revenue Product and Wage Rate

Source: M. Ashraf

Figure 11.1: Number of mechanics (*L*), Marginal Revenue Product *(MRP*), Wage Rate (*W*).

In Figure 11.1, we have number of mechanics on the horizontal axis, and Marginal Revenue Product *(MRP*) the wage rate (*W*) on the vertical axis, measured in dollars. The value on the horizontal axis ranges between 0 and 7. The value of the vertical axis ranges between 100 and -40. We have a horizontal curve at 40 which represents the wage rate. This is because the shop owner can hire any number of workers at the going wage rate, which in this case is $40. The *MRP* curve first has a positive slope, and then negative slope. The *MRP* curve reaches at its maximum at 80 when the number of mechanics is 3. When the *MRP* curve has a positive slope, it intersects the wage rate curve when the number of mechanics is 2. It makes sense, however, to keep on hiring more mechanics because the *MPR* is increasing—each additional mechanic's *MRP* is greater than the wage rate. The *MRP* of the third mechanic is the highest—$80. Beyond the third mechanic, the *MRP* starts to decline. *MRP* crosses again the wage rate curve when the number of mechanics is 5. Beyond the fifth mechanic the *MRP* is lower than the wage rate. The *MRP* of the seventh mechanic is negative. <alt text>

Suppose, now, that the wage rate increases to $60. In this case, only the fourth mechanic will be worth hiring. If, on the other hand, the wage rate were to decrease to $20, then even the sixth mechanic will be worth hiring. This understanding gives us a negative relationship between the wage rate and the number of mechanics hired. In fact, the downward-sloping part of the marginal revenue product curve, before it intersects the horizontal axis, represents the labor-demand curve.

In general, we can state that when the wage rate increases, the quantity of labor demanded decreases, and when the wage rate decreases, the quantity of labor demanded increases, all else constant.

We can draw the labor-demand curve (L_d) in the space of the wage rate (W) and the number of workers or worker hours (L). Figure 11.2 shows the labor-demand curve.

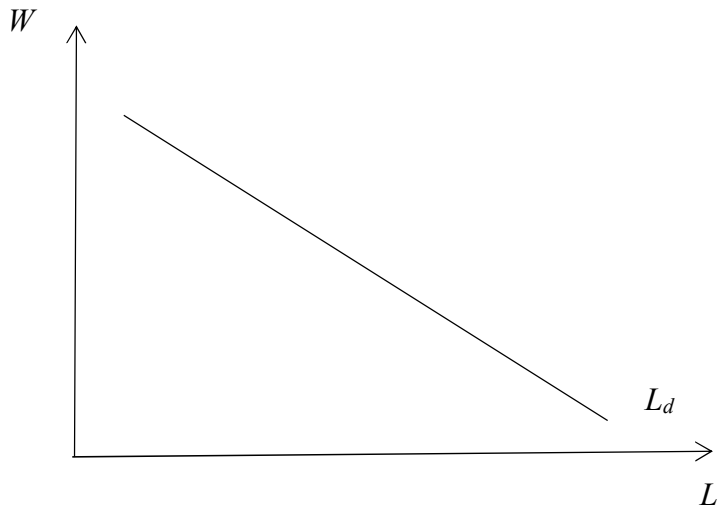

Figure 11.2: The Labor-Demand Curve

Source: M. Ashraf

Figure 11.2: Figure 11.2 plots the labor demand curve. We have the quantity of labor (L) on the horizontal axis, and the wage rate (W) on the vertical axis. The labor demand curve (L_d) has a negative slope. <alt text>

In Figure 11.2, the wage rate (W) is on the vertical axis, and the number of workers (L) is on the horizontal axis. The negative slope of the curve says that as the wage rate increases, the quantity of labor demanded decreases, and vice versa, holding all else constant.

Note also that because all firms in the industry are identical—they are producing identical widgets—we can think of this labor-demand curve as the market labor-demand curve.

Shifts in the Labor-Demand Curve

Which factors might shift the labor-demand curve? Recall that labor demand is derived demand; it is derived from the demand for goods and services that labor can produce. When the demand for a good or service increases, the demand for workers who produce that good or service increases at any given wage rate. To show this, we shift the labor-demand curve to the right.

On the other hand, when the demand for a good or service decreases, the demand for workers who produce that good or service decreases at any given wage rate. To show this, we shift the labor-demand curve to the left. Figure 11.3 shows these shifts.

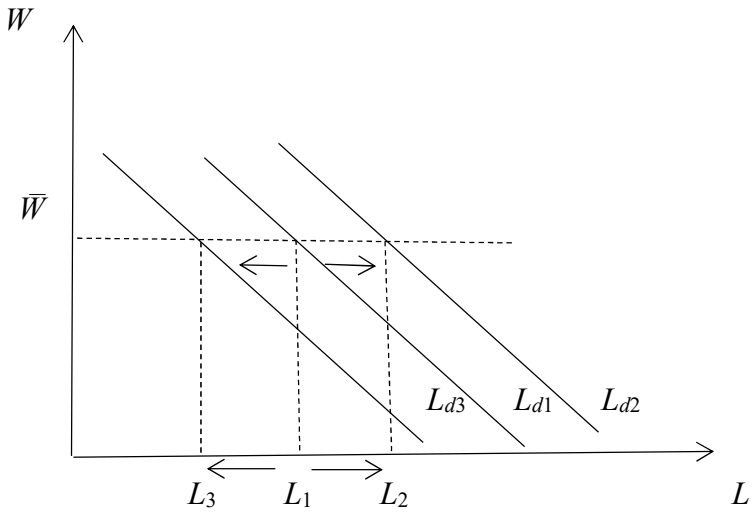

Figure 11.3: Shifts in the Labor-Demand Curve

Source: M. Ashraf

Figure 11.3: The quantity of labor (L) on the horizontal axis and the wage rate (W) on the vertical axis. We start with labor demand curve, L_{d1}. The quantity demanded of labor at some wage, $\bar{W}$ is L_1. When the demand for labor increases, the labor demand curve shifts to the right, from L_{d1} to L_{d2}, and the number of workers demanded at $\bar{W}$ is L_2. When the labor demand decreases, the labor demand curve shifts to the left, from L_{d1} to L_{d3}, and at $\bar{W}$ the number of workers demanded is L_3.

In Figure 11.3, wage rate (W) is on the vertical axis, and quantity of labor (L) is on the horizontal axis. We start from L_{d1}, where at a given wage rate, $\bar{W}$, the quantity demanded of labor is L_1. When the demand for labor with a given set of skills increases, the labor-demand curve shifts to the right, from L_{d1} to L_{d2}. At any given wage rate, $\bar{W}$, the quantity of labor demanded increases accordingly, from L_1 to L_2. The bar (—) over W represents a given wage rate.

The reverse happens when the demand for labor with a certain skill set decreases; the labor-demand curve shifts to the left, from L_{d1} to L_{d3}. The quantity of labor demanded at any given wage rate, $\bar{W}$, decreases accordingly, from L_1 to L_3.

Labor Supply

Now that we understand labor demand, we turn to labor supply.

Recall from the circular flow diagram that households supply labor in the factors' market in return for wages. How is the decision of households to supply labor affected by changes in the wage rate?

Why Do Households Supply Labor?

To build this simple model of labor supply, we assume, as we did in the case of labor demand, the following:

- Workers are identical.
- The only source of a worker's income is wages.
- Workers can supply their labor services for as many hours as they want at the going wage rate. Of course, the number of hours cannot be greater than 24 hours per day.
- Workers can divide their time, in a 24-hour day, between work and not work. For ease of exposition, we call not working "leisure time." When workers are not working, they are not earning any wage income.

Altogether, this means that when workers are not working, they are giving up the wage income they would be earning. That is, the opportunity cost of leisure is the foregone wage income. And as the wage rate increases, so does the opportunity cost of leisure per hour. As we learned in Chapter 3, when the opportunity cost of some product increases (i.e., it becomes expensive), we consume less of that product. In this case, the product is leisure. As the opportunity cost of leisure increases, workers consume less of it. Given that there are only two activities—work and leisure—workers work more.

The reverse happens when the wage rate decreases. As the opportunity cost of leisure decreases and leisure becomes cheaper, workers consume more leisure. In other words, workers supply less labor as the wage rate decreases.

We can state these conclusions as follows:

> When the wage rate increases, the quantity of labor supplied increases, and when the wage rate decreases, the quantity of labor supplied decreases, holding all else constant.

We can draw this positive relationship between the wage rate and the quantity of labor supplied in the form of a diagram. Figure 11.4 plots this relationship.

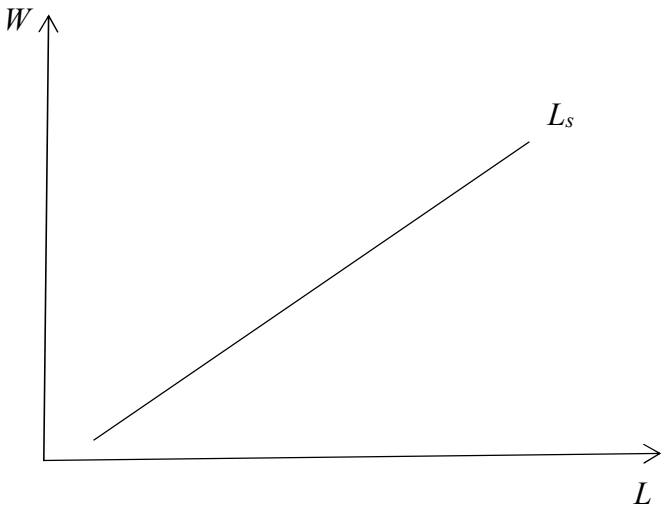

Figure 11.4: The Labor-Supply Curve

Source: M. Ashraf

Figure 11.4: The wage rate (W) is on the vertical axis, and the quantity of labor (L) is on the horizontal axis. The positive relationship between the wage rate and the quantity of labor supplied is represented by the positively slopped curve, L_s.

In Figure 11.4, the wage rate (W) is on the vertical axis, and the quantity of labor (L) is on the horizontal axis. The positive relationship between the wage rate and the quantity of labor supplied is represented by the curve L_s. Note again that because all workers in the industry are identical by assumption, we can think of this labor-supply curve as the market labor-supply curve.

Shift in the Labor-Supply Curve

As we know from Chapter 3, in a two-dimensional diagram, when one variable changes while the other does not, we can show this change in the variables by shifting the curve. When the quantity of labor supplied changes at any given wage rate, to show this, we shift the labor-supply curve.

What are the factors that may shift the labor-supply curve?

Although there may be numerous factors that lead to a change in the supply of labor, here, we focus on three main factors: migration, demographic changes, and changes in attitudes toward work.

Migration

Workers may leave one country to go to another country. The reasons for migration may include the search for better economic life or escape from war and crime in the home country, among others. The labor supply in the country to which individuals migrate will increase, and the labor supply in the country from which individuals migrate will decrease. Let us call the country to which workers migrate *domestic* and the country from which workers migrate *foreign*. Figure 11.5 shows the shift in the labor-supply curve of the domestic country, and Figure 11.6 shows the shift in the labor-supply curve of the foreign country.

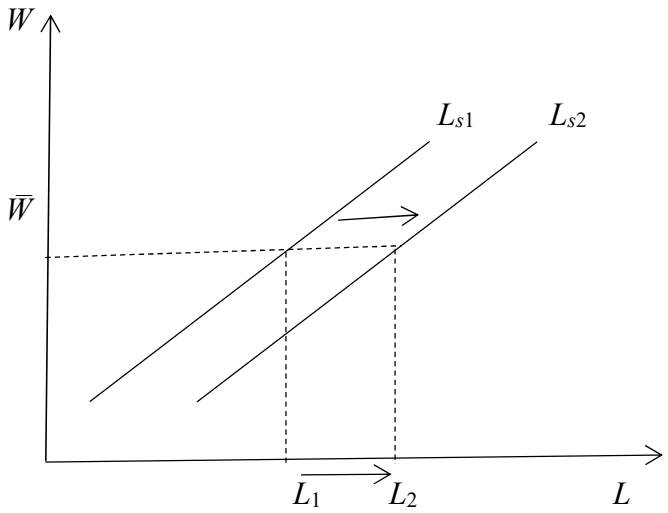

Figure 11.5: Shifts in the Labor-Supply Curve in the Domestic Country

Source: M. Ashraf

Figure 11.5: The quantity of labor is along the horizontal axis and the wage rate is along the vertical axis. Before the migration to the domestic country, the labor supply curve is represented by L_{s1}, and at some wage rate $\bar{W}$ the quantity of labor supplied is L_1. After the migration to the domestic country, the labor supply curve shifts to the right, from L_{s1} to L_{s2}, and at wage $\bar{W}$, the quantity of labor supplied is L_2.

Figure 11.5 plots the market labor-supply curves in the domestic country before and after the migration. The labor-supply curve in the domestic country will shift to the right, from L_{s1} to L_{s2}. As a result, holding all else constant, at any wage rate, $\bar{W}$, the quantity of labor supplied increases from L_1 to L_2. The bar (—) over W represents a given wage rate.

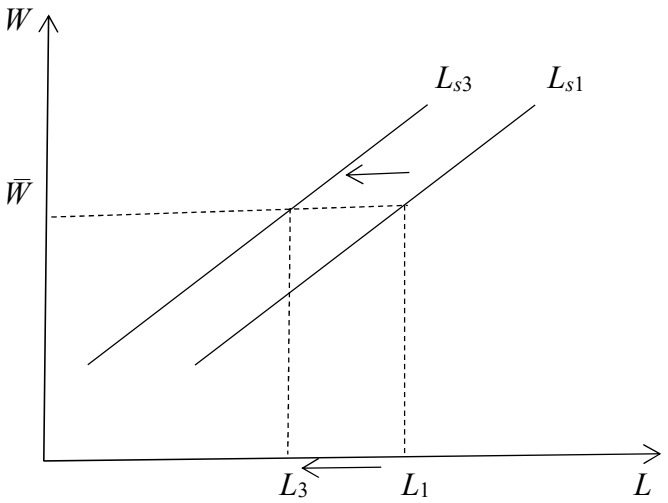

Figure 11.6: Shifts in the Labor-Supply Curve in the Foreign Country

Source: M. Ashraf

Figure 11.6: The quantity of labor is along the horizontal axis and the wage rate is along the vertical axis. Before the migration, the labor supply curve is represented by L_{s1}, and at some wage rate $\bar{W}$ the quantity of labor supplied is L_1. After the migration, the labor supply curve shifts to the left, from L_{s1} to L_{s3}, and at wage $\bar{W}$, the quantity of labor supplied is L_3.

Figure 11.6 plots the market labor-supply curves in the foreign country before and after the migration. The labor-supply curve in the foreign country will shift to the left, from L_{s1} to L_{s3}. As a result, holding all else constant, at any wage rate, $\bar{W}$, the quantity of labor supplied decreases from L_1 to L_3. The bar (—) over W represents a given wage rate.

Demographic Changes

The labor supply may also change due to demographic changes. If the birth rate in a country is higher than the death rate, then over time, holding all else constant, the number of working-age adults will increase, leading to an increase in the labor supply. This will shift the labor-supply curve to the right. As shown in Figure 11.7, the labor-supply curve will shift from L_{s1} to L_{s2}, and at any wage rate, $\bar{W}$, the quantity of labor supplied will increase from L_1 to L_2.

The reverse will happen if the birth rate is lower than the death rate. As the current cohorts of workers retire and die out, because the stock of the labor force is not being replenished or is being replenished at a lower rate by new entrants into the labor market, the labor supply will decrease. Figure 11.7 shows this by shifting the labor-supply curve to the left, from L_{s1} to L_{s3}, and at any wage rate, $\bar{W}$, the quantity of labor supplied will decrease from L_1 to L_3. The bar (—) over W represents a given wage rate.

Changes in Attitudes Toward Work

Suppose that the number of workers who enter the labor market per year and the number of workers who leave the labor market because of retirement are the same. All else constant, the size of the labor force will be constant. Now suppose that some workers want to delay their retirement. Because the number of workers entering the labor market per year has not changed, the total number of workers in the labor market will increase. As shown in Figure 11.7, the labor-

supply curve will shift to the right, from L_{s1} to L_{s2}. As a result, at any wage rate, $\bar{W}$, the quantity of labor supplied will increase from L_1 to L_2.

The reverse will happen if workers start taking early retirement. Because the number of workers entering the labor market per year has not changed, the total number of workers in the labor market will decrease. We show this by shifting the labor-supply curve to the left. As shown in Figure 11.7, the labor-supply curve shifts from L_{s1} to L_{s3}, and at any wage rate, $\bar{W}$, the quantity of labor supplied decreases from L_1 to L_3. The bar (—) over W represents a given wage rate.

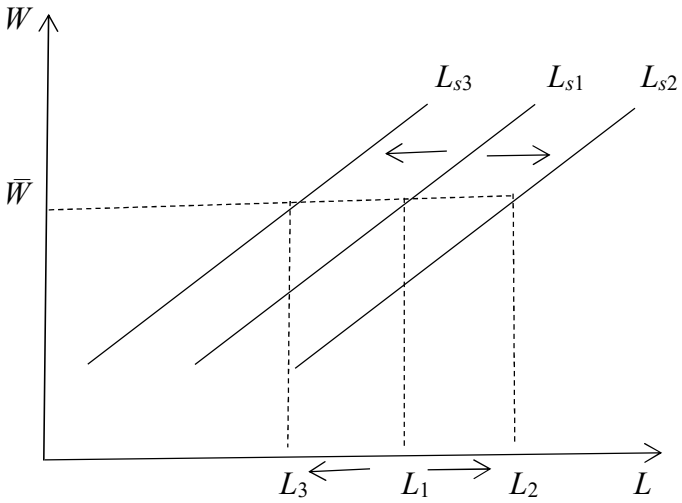

Figure 11.7: Shifts in the Labor-Supply Curve

Source: M. Ashraf

Figure 11.7: The quantity of labor is along the horizontal axis and the wage rate is along the vertical axis. As labor supply increases due to demographic changes or attitudes towards work, the labor supply curve shifts to the right, from L_{s1} to L_{s2}. At any wage rate, $\bar{W}$, the quantity of labor supplied increases from L_1 to L_2. As labor supply decreases due to demographic changes or attitudes towards work, the labor supply curve shifts to the left, from L_{s1} to L_{s3}. At any wage rate, $\bar{W}$, the quantity of labor supplied decreases from L_1 to L_3.

Figure 11.7 shows shifts in the labor-supply curve. In Figure 11.7, we have wage rate, W, on the vertical axis, and labor, L, on the horizontal axis.

Equilibrium in the Labor Market

Now that we understand labor demand and labor supply, we turn to the concept of equilibrium in the labor market.

Equilibrium in the labor market takes place when the quantity of labor demanded is equal to the quantity of labor supplied. Equation 11.2 represents this condition:

$$L^* : L_d = L_s. \tag{11.2}$$

In Equation 11.2, L_d is the quantity of labor demanded, L_s is the quantity of labor supplied, and L^* is the equilibrium quantity of labor in the labor market.

We can show this equilibrium graphically by plotting both the labor-demand curve (L_d) and the labor-supply curve (L_s) on the same set of axes. This will also help us find the equilibrium wage rate. Figure 11.8 plots these two curves and shows the equilibrium quantity of labor and equilibrium wage rate.

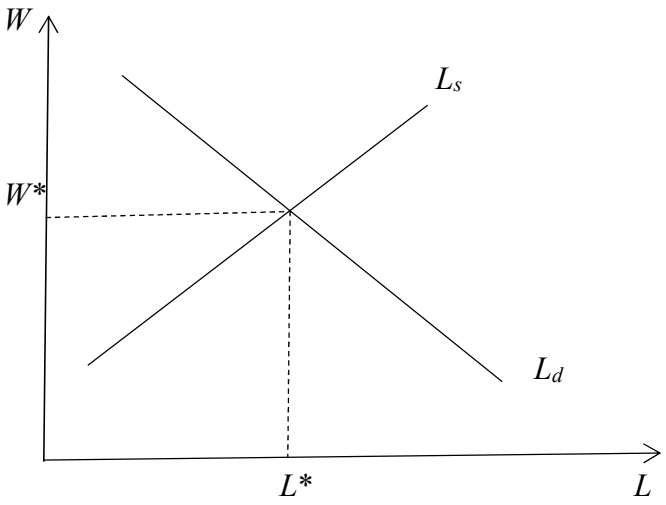

Figure 11.8: Equilibrium in the Labor Market

Source: M. Ashraf

Figure 11.8: The quantity of labor is along the horizontal axis and the wage rate is along the vertical axis. The labor demand curve, L_d, is negatively slopped and the labor supply curve, L_s, is positively slopped. The equilibrium quantity of labor is represented by L^* on the horizontal axis, and the equilibrium wage rate is represented by W^* on the vertical axis.

In Figure 11.8, we have labor (L) on the horizontal axis and wage rate (W) on the vertical axis. L^* and W^* represent the equilibrium quantity of labor and the equilibrium wage rate, respectively.

An excess supply of labor—$L_s > L_d$—results in unemployment. In contrast, a labor shortage is a situation where the quantity of labor demanded is greater than the quantity of labor supplied—$L_d > L_s$. How will the economy return to an equilibrium in the labor market? Before we address this question, we need formal definitions of labor force, unemployment, unemployment rate, employment, labor-force participation rate, and other labor-force-related concepts. We take up this task in the next section.

Employed, Unemployed, and Labor Force

Some of the most closely watched indicators of the health of the economy are related to the labor market. What is the labor force? Who is considered unemployed, and who is considered employed? To answer these questions, we turn to the definitions provided by the U.S. Bureau of Labor Statistics (BLS).

Employed

According to the BLS classification,[1]

> Employed persons consist of: persons who did any work for pay or profit during the survey reference week; persons who did at least 15 hours of unpaid work in a family-operated enterprise; and persons who were temporarily absent from their regular jobs because of illness, vacation, bad weather, industrial dispute, or various personal reasons.

Unemployed

According to the BLS classification,[2]

> Persons are classified as unemployed if they do not have a job, have actively looked for work in the prior 4 weeks, and are currently available for work. Persons who were not working and were waiting to be recalled to a job from which they had been temporarily laid off are also included as unemployed. Receiving benefits from the Unemployment Insurance (UI) program has no bearing on whether a person is classified as unemployed. (

Labor Force

The labor force is the sum of employed persons and unemployed persons.[3] We can express the labor force as follows:

$$LF = E + U, \tag{11.3}$$

where LF represents the labor force, E represents the number of employed persons, and U represents the number of unemployed persons.

Not in the Labor Force

The BLS categorizes persons who are neither employed nor unemployed as not in the labor force. These include the following:[4]

> [R]etired persons, students, those taking care of children or other family members, and others who are neither working nor seeking work. Information is collected on their desire for and availability for work,

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[1] U.S. Bureau of Labor Statistics, "Labor Force Statistics from the Current Population Survey: Labor Force Characteristics (CPS)," https://www.bls.gov/cps/lfcharacteristics.htm#emp, accessed February 21, 2023.
[2] Ibid.
[3] Ibid. (under "Labor force").
[4] Ibid.

job search activity in the prior year, and reasons for not currently searching.

Employment-to-Population Ratio

Now we look at the employment-to-population ratio. One can calculate the employment-to-population ratio by dividing the number of persons employed by the civilian noninstitutionalized population of 16 years of age or older. According to the BLS, the following categories of individuals are excluded from the civilian noninstitutionalized population:[5]

- Active-duty members of the U.S. Armed Forces.
- People confined to, or living in, institutions or facilities such as
  - Prisons, jails, and other correctional institutions and detention centers.
  - Residential care facilities such as skilled nursing homes. (under "Civilian noninstitutionalized population")

Note that the noninstitutionalized population includes "citizens of foreign countries who reside in the United States but do not live on the premises of an embassy."[6]

We can express the employment-to-population ratio as follows:

$$EPR = \left(\frac{E}{Pop}\right) \times 100, \tag{11.4}$$

where *EPR* is the employment-to-population ratio, *E* is the number of persons employed, and *Pop* is the civilian noninstitutionalized population of 16 years of age or older.

As an example, in October 2022, the BLS reported that the number of individuals who were 16 years of age or older in the noninstitutionalized population was 264,535,000, and the number of individuals employed was 158,608,000. Using Equation 11.4, the employment-to-population ratio is (approximately) 60.0%:[7]

$$\text{Employment-to-population ratio} = \left(\frac{158{,}608{,}000}{264{,}535{,}000}\right) \times 100 \approx 60.0\%.$$

Note that employment status differs by education, gender, race, geography, and marital status, among other factors. See Table 11.2 later in the chapter.

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[5] U.S. Bureau of Labor Statistics, "Labor Force Statistics from the Current Population Survey: Concepts and Definitions (CPS)," (https://www.bls.gov/cps/definitions.htm#population/, accessed November 20, 2022)

[6] Ibid. (under "Foreign nationals included in the noninstitutionalized population").

[7] U.S. Bureau of Labor Statistics, "Table A-1. Employment Status of the Civilian Population by Sex and Age," (https://www.bls.gov/news.release/empsit.t01.htm/, accessed November 20, 2022)

Unemployment Rate

One can calculate the unemployment rate by dividing the number of persons who are unemployed by the number of persons in the labor force. That is,

$$UR = \left(\frac{U}{LF}\right) \times 100, \tag{11.5}$$

where *UR* is the unemployment rate, *U* is the number of unemployed persons, and *LF* is the number of people in the labor force.

By using Equation 11.5 and plugging in data for the number of unemployed persons and the number of people in the labor force, we can calculate the unemployment rate. Recall that the labor force is the sum of employed and unemployed persons (see Equation 11.3). For instance, using the data for October 2022, the number of unemployed persons was 6,059,000, and the number of people in the labor force was 164,667,000. This translates into an unemployment rate of approximately 3.7%:[8]

$$\text{Unemployment rate} = \left(\frac{6{,}059{,}000}{164{,}667{,}000}\right) \times 100 \approx 3.7\%.$$

The symbol "≈" states that the value is approximate. The reason for the approximation is rounding. For instance, a more accurate result of $\left(\frac{6{,}059{,}000}{164{,}667{,}000}\right) \times 100$ is 3.679547207394317%. Although interesting and even necessary in some other contexts, these extra digits do not add much to understanding the topic at hand.

Figure 11.9 provides an overall picture of these calculations using data from October 2022.

[8] Ibid.

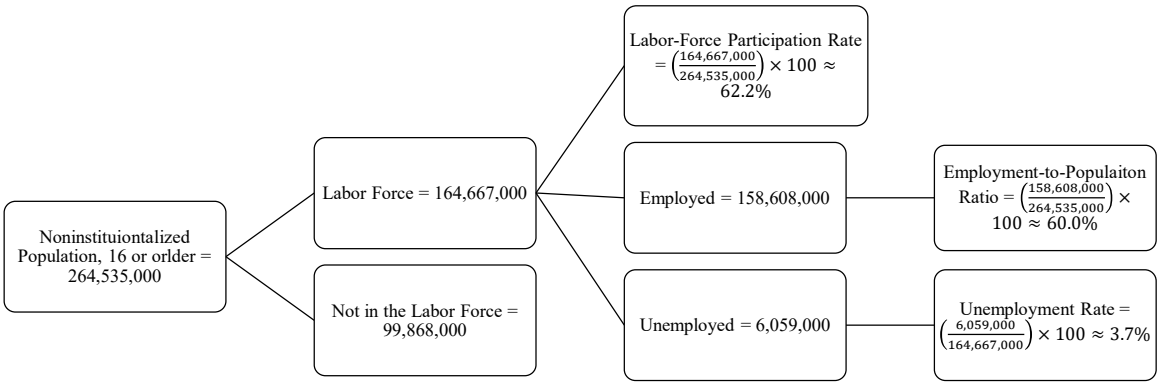

Figure 11.9: Example Labor-Market Calculations

Source: M. Ashraf

Data Source: U.S. Bureau of Labor Statistics, "Employment Situation Summary Table A. Household Data, Seasonally Adjusted," https://www.bls.gov/news.release/empsit.a.htm/, accessed November 20, 2022.

Figure 11.9: Starting from the left most box. The Noninstitutionalized Population is 264,535, 000. It is divided into Labor Force (= 164,667,000), and Not in the Labor Force (= 99,868,000). Labor force is divided into Employed (= 158,608,000) and Unemployed (= 6,059,000). The Labor Force Participation Rate is the ratio of Labor Force to Noninstitutionalized Population. Employment to Population ratio is the ratio of Employed and Noninstitutionalized Population. Unemployment Rate is the ratio of Unemployed to Labor Force.

Where do these data come from? The U.S. Census Bureau conducts a monthly survey for the BLS. This survey is called the *Current Population Survey* (CPS). It is a comprehensive survey of 60,000 U.S. households that represent the U.S. population. The data include, but are not limited to, "information about employment, unemployment, hours of work, earnings, and people not in the labor force."[9]

Unemployment Rates Differ

It is important to note that the overall unemployment rates usually reported in the news are averages; the unemployment rate differs by race, gender, education level, and geography, among

[9] U.S. Bureau of Labor Statistics, "Labor Force Statistics from the Current Population Survey," https://www.bls.gov/cps/cps_over.htm, accessed February 21, 2023.

other factors. Table 11.2 presents the unemployment rate and other labor-force data by gender and race.

Table 11.2: Labor-Force Data by Gender and Race

Gender and Race	Year: 2022 (Numbers in Thousands)							
	Civilian non-institutional Population	Civilian Labor Force						Not in Labor Force
		Total	Percentage of Population	Employed		Unemployed		
				Total	Percentage of Population	Total	Percentage of Labor Force	
TOTAL (men and women, all races)	263,973	164,287	62.2	158,291	60.0	5,996	3.6	99,686
Men	128,617	87,421	68.0	84,203	65.5	3,218	3.7	41,197
Women	135,356	76,866	56.8	74,089	54.7	2,778	3.6	58,490
White (men and women)	203,214	125,957	62.0	121,908	60.0	4,049	3.2	77,257
Men (white)	100,122	68,162	68.1	65,924	65.8	2,238	3.3	31,959
Women (white)	103,093	57,794	56.1	55,984	54.3	1,811	3.1	45,298
Black or African American (men and women)	34,131	21,236	62.2	19,937	58.4	1,300	6.1	12,895
Men (Black or African American)	15,740	10,259	65.2	9,617	61.1	642	6.3	5,480
Women (Black or African American)	18,392	10,977	59.7	10,319	56.1	658	6.0	7,415
Asian (men and women)	16,933	10,921	64.5	10,615	62.7	306	2.8	6,012
Men (Asian)	8,013	5,775	72.1	5,610	70.0	165	2.9	2,238
Women (Asian)	8,920	5,146	57.7	5,006	56.1	140	2.7	3,774

Data Source: Compiled by the author using data from the U.S. Bureau of Labor Statistics (www.bls.gov), accessed February 24, 2023.

The second column from the right in Table 11.2 presents the unemployment rate. Note that there are gender and racial differences in the unemployment rate. For instance, men (of all races) have a slightly higher unemployment rate than women, 3.7% versus 3.6%, respectively. African American men and women have a higher unemployment rate (6.1%) than white men and women (3.2%) and Asian men and women (2.8%). Women have a lower unemployment rate than men in all three racial categories presented here.

Discouraged and Marginally Attached Workers

Recall that for persons to be counted as unemployed, they must look for a job. What about those who want to work but are not looking for jobs? The BLS categorizes them as *discouraged and marginally attached workers*. According to the BLS,[10]

> Discouraged workers are a subset of persons marginally attached to the labor force. The marginally attached are those persons not in the labor force who want and are available for work, and who have looked for a job sometime in the prior 12 months, but were not counted as unemployed because they had not searched for work in the 4 weeks preceding the survey. Among the marginally attached, discouraged workers were not currently looking for work specifically because they believed no jobs were available for them or there were none for which they would qualify.

How do discouraged workers affect the unemployment rate? Let us consider an example. Suppose that there are 90 employed workers and 10 workers looking for jobs. In this case, the labor force, which is the sum of employed and unemployed persons, is 100 workers. That is,

$E = 90$, $U = 10$, and $LF = 100$. Using Equation 11.5, we can calculate the unemployment rate:

$$UR = \left(\frac{U}{LF}\right) \times 100 = \left(\frac{10}{100}\right) \times 100 = 10\%.$$

Suppose now that two workers who are looking for jobs become discouraged and stop searching for jobs. Because there are only eight workers looking for jobs, the number of unemployed persons is now is 8. That is, $E = 90$, $U = 8$, and $LF = 98$. Now the unemployment rate is calculated as follows:

$$UR = \left(\frac{U}{LF}\right) \times 100 = \left(\frac{8}{98}\right) \times 100 \approx 8.16\%.$$

Note that because two workers became discouraged and dropped out of the labor market, the unemployment rate decreased from 10% to 8.16%. This decrease in the unemployment rate is not attributable to more workers finding jobs—the number of employed workers is still 90—but results from two workers dropping out of the labor market. This decrease is the unemployment rate is called the *discouraged-worker effect.*

The reverse may happen if some workers who are not looking for jobs start looking for jobs. Suppose that five more workers start looking for jobs. Now that five more workers have started looking for jobs, the number of unemployed workers and the total labor force both increase. That

[10] U.S. Bureau of Labor Statistics, "Labor Force Statistics from the Current Population Survey: Labor Force Characteristics (CPS)," https://www.bls.gov/cps/lfcharacteristics.htm#emp, accessed February 21, 2023.

is, $E = 90$, $U = 15$, and $LF = 105$. Again using Equation 11.5, we can calculate the unemployment rate as follows:

$$UR = \left(\frac{U}{LF}\right) \times 100 = \left(\frac{15}{105}\right) \times 100 \approx 14.29\%.$$

Note that the unemployment rate increased from 10% to 14.29%. This increase is attributable to more workers starting (or restarting) the job search.

The lesson is that one must look at detailed data before drawing any conclusions about the health of the economy.

Types of Unemployment

We can divide unemployment into three categories: frictional unemployment, structural unemployment, and cyclical unemployment.

Frictional Unemployment

In any healthy economy, some workers are entering the labor force and some workers are leaving the labor force. Furthermore, it often takes time to complete the job- and skill-matching process. Consider the example of a new college graduate. She applies for several jobs and goes on some interviews. She is trying to see which firm suits her best, and firms are trying to gauge her compatibility with their needs. This process may take some time. Because she is looking for a job, she will be considered unemployed during this period.

Workers also change jobs. Unless those workers who are changing jobs find new jobs before they quit their previous jobs, they will be considered unemployed while they are looking for a job.

Structural Unemployment

A dynamic economy is always evolving. New types of jobs require new types of skills, and other types of jobs disappear, along with the demand for workers who perform the disappearing jobs. Consider the example of a car mechanic who was trained to work on cars that were built during the 1980s and 1990s. Nowadays, cars are "computers on wheels." Unless the mechanic has updated his skills and knows how to fix hybrid and electric cars, his skills will be obsolete in the current labor market of car mechanics. As a result, he will be out of a job; he will be structurally unemployed, so long as he is looking for a job.

Cyclical Unemployment

When the economy is in a recession, the demand for various goods and services declines. Because labor demand, like any other input demand, is derived demand, the demand for workers who produce these goods and services also declines. This type of unemployment is called *cyclical unemployment.*

Take another look at the business cycle shown in Figure 10.2, reproduced here as Figure 11.10. Note that when the economy is in a recession—headed toward point *a*—output declines, and so does labor demand. In a recession, some workers lose their jobs. Workers who lose their jobs because of a recession are called *cyclically unemployed.*

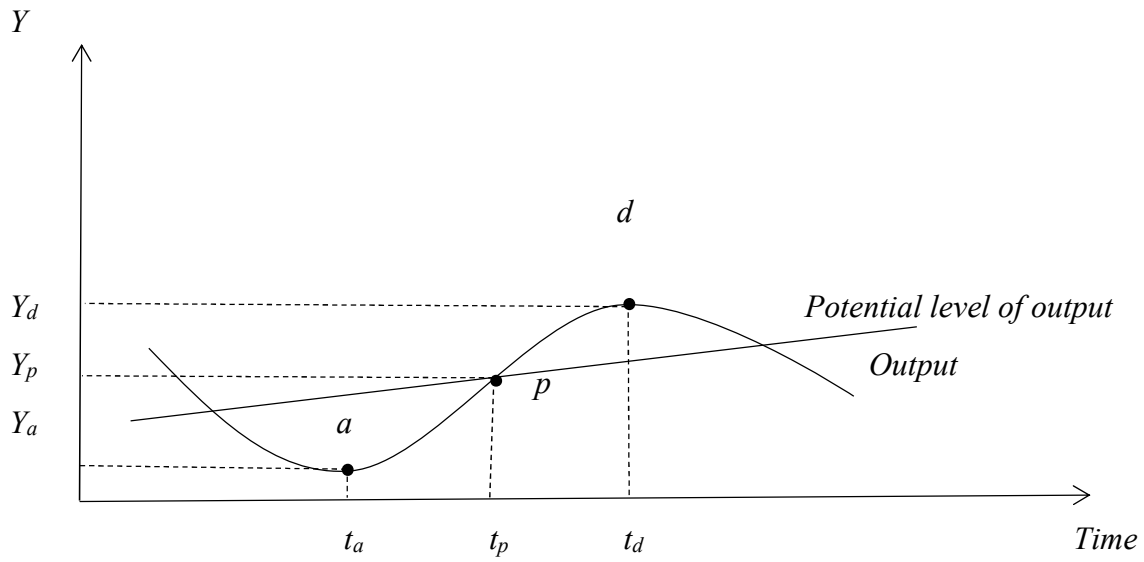

Figure 11.10: Business Cycle Diagram

Source: M. Ashraf

Figure 11.10: A measure of aggregate output on the vertical axis, and time is on the horizontal axis. The curve show ups and downs in the aggregate output over time. Potential level of output is represented by the linear curve. At time t_a, aggregate output is below potential. It is represented by Y_a along the vertical axis. At time t_p, output is equal to the potential level of output. It is represented by Y_p along the vertical axis. And at time t_d aggregate output is above the potential level of output. It is represented by Y_d along the vertical axis.

Natural Rate of Unemployment

As we have seen, in a dynamic economy, there are always some workers who are frictionally unemployed and some workers who are structurally unemployed. This means that the unemployment rate is never zero, even in a healthy economy. The unemployment rate that prevails even in a healthy economy is called the *natural rate of unemployment*. More formally, the natural rate of unemployment is the unemployment rate that prevails when the economy is producing at the potential level of output.

A measure of the natural rate of unemployment is the sum of the frictional rate of unemployment and the structural rate of unemployment. As an example, suppose that the frictional rate of unemployment is 2%, and the structural rate of unemployment is 2.5%. This means that the natural rate of unemployment is 4.5% (= 2% + 2.5%).

Refer to Figure 11.10. Depending on which point the economy is at in the business cycle, the observed unemployment rate may be higher than the natural rate of unemployment (a point represented by point *a*), or it may be lower than the natural rate of unemployment (a point represented by point *d*). Point *p* represents the state where the economy is producing at its potential level of output and the natural rate of unemployment is equal to the observed rate of unemployment; there is no cyclical unemployment.

Note that there is an inverse relationship between the level of output and the unemployment rate. Holding all else constant, the higher the level of output that the economy is producing, the lower

is the unemployment rate, and the lower the level of output the economy is producing, the higher is the unemployment rate.

Deviations from the Equilibrium: The Classical View

Look at Figure 11.8 again. Suppose that the wage rate is above the equilibrium wage rate, W^*. In this simple model, we see that there will be an excess supply of labor. The classical economists thought that wages and prices were flexible. Given this assumption, when there is unemployment (i.e., $L_d < L_s$), wages will adjust downward, the quantity of labor demanded will increase, the quantity of labor supplied will decrease, and the labor market will be in equilibrium again.

On the other hand, when there is labor shortage (i.e., wage rate is below W^*), wages will increase, the quantity of labor supplied will increase, the quantity of labor demanded will decrease, and the labor market will be in equilibrium yet again. An implication of the classical model of the economy is that there is no need for policy interventions when the economy is going through business cycles. Business cycles are self-correcting, according to the classical economists' approach.

The reality, however, did not match the classical model's predictions during the Great Depression of the 1920s and 1930s. Economies across the world saw extended periods of high unemployment. Empirical evidence showed that the wages and prices were not flexible; wage and prices were especially not downward flexible. In other words, recessions were not self-correcting. Policy makers and the academic economists needed new ways of thinking about the economy and needed to develop new tools. Indeed, the lessons learned from that episode in history led to the birth of macroeconomics as a distinct discipline.

Deviations from Equilibrium: The Roles of Fiscal Policy and Monetary Policy

As we saw in Chapter 10, fiscal policy and monetary policy can affect output. Suppose that the economy is in a recession, and the output level is below the potential level of output. Expansionary fiscal policy and/or monetary policy can shift the aggregate demand curve to the right, bringing output back to the potential level of output. On the other hand, when the economy is producing at above the potential level of output, contractionary fiscal policy and/or monetary policy can guide the economy back to the potential level of output. This, in turn, means that when the unemployment rate is moving away from the natural rate of unemployment, fiscal and/or monetary policies can nudge the unemployment rate to the natural rate of unemployment. Which policy mix is optimal—fiscal policy and/or monetary policy—depends on the conditions of the economy.

Chapter Conclusion

We started this chapter by learning why firms demand labor and why households supply labor. We derived the labor-demand curve and the labor-supply curve. We plotted both curves in the wage-rate and quantity-of-labor space, and we found the equilibrium wage rate and equilibrium quantity of labor. We also learned which factors may shift each curve. We also learned how to calculate the unemployment rate. We learned the roles that fiscal and monetary policies might play when the economy is moving away from the potential level of output.

A Review of Terms

- The total product (*TP*) is the total output.
- The marginal product (*MP*) is the change in total product attributable to a change in labor (*L*). That is, $MP = \frac{\Delta T}{\Delta L}$.
- The marginal revenue product (*MRP*) is equal to the marginal product times the price of the product. That is, $MRP = MP \times P$.
- Labor force: The number of employed individuals plus the number of unemployed individuals.
- Labor-force participation rate: The number of individuals in the labor force divided by the population of noninstitutionalized individuals who are at least 16 years old. When we multiply this quantity by 100, it represents the labor-force participation rate in percentage terms.
- Employment-to-population ratio: The number of individuals employed divided by the number of noninstitutionalized individuals who are at least 16 years old. When we multiply this quantity by 100, it represents the employment-to-population ratio in percentage terms.
- Unemployment rate: Number of unemployed individuals divided by the number of individuals in the labor force. When we multiply this quantity by 100, it represents the unemployment rate in percentage terms.
- Frictional unemployment: The unemployment that occurs as a result of the job- and skill-matching process.
- Structural unemployment: The unemployment that occurs as a result of skills becoming obsolete.
- Natural rate of unemployment: The unemployment rate that prevails in the economy when the output level is at the potential level of output. A measure of the natural rate of unemployment is the sum of frictional unemployment and structural unemployment.
- Cyclical unemployment: The unemployment that takes place when the economy is in a recession.
- The law of diminishing marginal product: Holding other inputs constant, as we keep using more of an input, beyond a certain point, the marginal product of each additional unit of that input becomes successively smaller.