This and the next four chapters will focus on issues of worker behavior. That is, chapters 6–10 will discuss and analyze various aspects of labor supply behavior. Labor supply decisions can be roughly divided into two categories. The first, which is addressed in this chapter and the next, includes decisions about whether to work at all and, if so, how long to work. Questions that must be answered include whether to participate in the labor force, whether to seek part-time or full-time work, and how long to work both at home and for pay. The second category of decisions, which is addressed in chapters 8–10, deals with the questions that must be faced by a person who has decided to seek work for pay: the occupation or general class of occupations in which to seek offers (chapters 8 and 9) and the geographical area in which offers should be sought (chapter 10).

This chapter begins with some basic facts concerning labor force participation rates and hours of work. We then develop a theoretical framework that can be used in the analysis of decisions to work for pay. This framework is also useful for analyzing the structure of various income maintenance programs.

**Trends in Labor Force Participation and Hours of Work**

When a person actively seeks work, he or she is, by definition, in the labor force. As pointed out in chapter 2, the labor force participation rate is the percentage of a given population that either has a job or is looking for one. Thus, one clear-cut
Chapter 6  Supply of Labor to the Economy: The Decision to Work

statistic important in measuring people’s willingness to work outside the home is the labor force participation rate.

**Labor Force Participation Rates**

One of the most dramatic changes in the labor market over the past six decades has been the increased labor force participation of women, especially married women. Table 6.1 shows the dimensions of this change. As recently as 1950, less than 25 percent of married women were in the labor force, but by 1980, this percentage had doubled. Recently, the labor force participation rate of married women has reached over 60 percent, although since 2000, the growth for married women seems to have stopped and the rates for single women have fallen.¹ One interest of this chapter is in understanding the forces underlying these changes.

<table>
<thead>
<tr>
<th>Year</th>
<th>All Females</th>
<th>Single</th>
<th>Widowed, Divorced</th>
<th>Married</th>
</tr>
</thead>
<tbody>
<tr>
<td>1900</td>
<td>20.6</td>
<td>45.9</td>
<td>32.5</td>
<td>5.6</td>
</tr>
<tr>
<td>1910</td>
<td>25.5</td>
<td>54.0</td>
<td>34.1</td>
<td>10.7</td>
</tr>
<tr>
<td>1920</td>
<td>24.0</td>
<td></td>
<td></td>
<td>9.0</td>
</tr>
<tr>
<td>1930</td>
<td>25.3</td>
<td>55.2</td>
<td>34.4</td>
<td>11.7</td>
</tr>
<tr>
<td>1940</td>
<td>26.7</td>
<td>53.1</td>
<td>33.7</td>
<td>13.8</td>
</tr>
<tr>
<td>1950</td>
<td>29.7</td>
<td>53.6</td>
<td>35.5</td>
<td>21.6</td>
</tr>
<tr>
<td>1960</td>
<td>37.7</td>
<td>58.6</td>
<td>41.6</td>
<td>31.9</td>
</tr>
<tr>
<td>1970</td>
<td>43.3</td>
<td>56.8</td>
<td>40.3</td>
<td>40.5</td>
</tr>
<tr>
<td>1980</td>
<td>51.5</td>
<td>64.4</td>
<td>43.6</td>
<td>49.8</td>
</tr>
<tr>
<td>1990</td>
<td>57.5</td>
<td>66.7</td>
<td>47.2</td>
<td>58.4</td>
</tr>
<tr>
<td>2000</td>
<td>59.9</td>
<td>68.9</td>
<td>49.0</td>
<td>61.1</td>
</tr>
<tr>
<td>2008</td>
<td>59.5</td>
<td>65.3</td>
<td>49.2</td>
<td>61.4</td>
</tr>
</tbody>
</table>


As can be seen in Table 6.2, a second set of changes in labor force participation is the decrease in the participation rates of men, especially among the young and the old. The most substantial decreases in the United States have been among those 65 and older, from about 42 percent in 1950 to about half that currently—although since 1990 rates have been climbing a bit. Participation rates for men of "prime age" have declined only slightly since 1950, although among 45- to 64-year-olds, there were sharp decreases in the 1930s and 1970s. Clearly, men are starting their work lives later and ending them earlier than they were in 1950.

The trends in American labor force participation rates have also been observed in other industrialized countries. In Table 6.3, we display, for countries with comparable data, the trends in participation rates for women in the 25–54 age group and for men near the age of early retirement (55 to 64 years old). Typically, the fraction of women in the labor force rose from half or less in 1965 to three-quarters or more roughly 40 years later. Among men between the ages of 55 and 64, participation fell markedly in each country except Japan, although the declines were much larger in some countries (France, for example) than others.

### Table 6.2

<table>
<thead>
<tr>
<th>Year</th>
<th>14–19</th>
<th>16–19</th>
<th>20–24</th>
<th>25–44</th>
<th>45–64</th>
<th>Over 65</th>
</tr>
</thead>
<tbody>
<tr>
<td>1900</td>
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<td>91.7</td>
<td>96.3</td>
<td>93.3</td>
<td>68.3</td>
<td></td>
</tr>
<tr>
<td>1910</td>
<td>56.2</td>
<td>91.1</td>
<td>96.6</td>
<td>93.6</td>
<td>58.1</td>
<td></td>
</tr>
<tr>
<td>1920</td>
<td>52.6</td>
<td>90.9</td>
<td>97.1</td>
<td>93.8</td>
<td>60.1</td>
<td></td>
</tr>
<tr>
<td>1930</td>
<td>41.1</td>
<td>89.9</td>
<td>97.5</td>
<td>94.1</td>
<td>58.3</td>
<td></td>
</tr>
<tr>
<td>1940</td>
<td>34.4</td>
<td>88.0</td>
<td>95.0</td>
<td>88.7</td>
<td>41.5</td>
<td></td>
</tr>
<tr>
<td>1950</td>
<td>39.9</td>
<td>63.2</td>
<td>82.8</td>
<td>92.8</td>
<td>87.9</td>
<td>41.6</td>
</tr>
<tr>
<td>1960</td>
<td>38.1</td>
<td>56.1</td>
<td>86.1</td>
<td>95.2</td>
<td>89.0</td>
<td>30.6</td>
</tr>
<tr>
<td>1970</td>
<td>35.8</td>
<td>56.1</td>
<td>80.9</td>
<td>94.4</td>
<td>87.3</td>
<td>25.0</td>
</tr>
<tr>
<td>1980</td>
<td>60.5</td>
<td>85.9</td>
<td>95.4</td>
<td>82.2</td>
<td>19.0</td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>55.7</td>
<td>84.4</td>
<td>94.8</td>
<td>80.5</td>
<td>16.3</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>52.8</td>
<td>82.6</td>
<td>93.0</td>
<td>80.4</td>
<td>17.7</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>40.1</td>
<td>78.7</td>
<td>91.9</td>
<td>81.4</td>
<td>21.5</td>
<td></td>
</tr>
</tbody>
</table>

**Table 6.3**

<table>
<thead>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Women, Age 25 to 54</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td>33.9</td>
<td>44.0</td>
<td>65.1</td>
<td>75.6</td>
<td>82.0</td>
</tr>
<tr>
<td>France</td>
<td>42.8</td>
<td>54.1</td>
<td>67.0</td>
<td>76.1</td>
<td>83.2</td>
</tr>
<tr>
<td>Germany</td>
<td>46.1</td>
<td>50.5</td>
<td>58.3</td>
<td>72.5</td>
<td>80.5</td>
</tr>
<tr>
<td>Japan</td>
<td>–</td>
<td>53.0</td>
<td>59.5</td>
<td>65.2</td>
<td>70.3</td>
</tr>
<tr>
<td>Sweden</td>
<td>56.0</td>
<td>68.9</td>
<td>87.1</td>
<td>88.2</td>
<td>87.5</td>
</tr>
<tr>
<td>United States</td>
<td>45.1</td>
<td>52.0</td>
<td>67.1</td>
<td>74.6</td>
<td>75.8</td>
</tr>
<tr>
<td><strong>Men, Age 55 to 64</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td>86.4</td>
<td>81.3</td>
<td>72.3</td>
<td>60.4</td>
<td>67.2</td>
</tr>
<tr>
<td>France</td>
<td>76.0</td>
<td>72.1</td>
<td>53.6</td>
<td>43.5</td>
<td>42.6</td>
</tr>
<tr>
<td>Germany</td>
<td>84.6</td>
<td>73.4</td>
<td>63.1</td>
<td>53.0</td>
<td>67.2</td>
</tr>
<tr>
<td>Japan</td>
<td>–</td>
<td>86.3</td>
<td>84.7</td>
<td>85.4</td>
<td>85.1</td>
</tr>
<tr>
<td>Sweden</td>
<td>88.3</td>
<td>82.7</td>
<td>77.0</td>
<td>70.9</td>
<td>76.7</td>
</tr>
<tr>
<td>United States</td>
<td>82.9</td>
<td>76.9</td>
<td>69.4</td>
<td>66.5</td>
<td>70.4</td>
</tr>
</tbody>
</table>

aData are for 1974 (earlier data not comparable).


Furthermore, the downward trends in four of the six countries shown appear to have reversed since the mid-1990s. Thus, while there are some differences in trends across the countries, it is likely that common forces are influencing labor supply trends in the industrialized world.

**Hours of Work**

Because data on labor force participation include both the employed and those who want a job but do not have one, they are a relatively pure measure of labor supply. In contrast, the weekly or yearly hours of work put in by the typical employee are often thought to be determined only by the demand side of the market. After all, don’t employers, in responding to the factors discussed in chapter 5, set the hours of work expected of their employees? They do, of course, but hours worked are also influenced by employee preferences on the supply side of the market, especially in the long run.

Even though employers set work schedules, employees can exercise their preferences regarding hours of work through their choice of part-time or full-time work, their decisions to work at more than one job, or their selection of (Sweden).
occupations and employers. For example, women managers who work full-time average more hours of work per week than full-time clerical workers, and male sales workers work more hours per week than their full-time counterparts in skilled craft jobs. Moreover, different employers offer different mixes of full-time and part-time work, require different weekly work schedules, and have different policies regarding vacations and paid holidays.

Employer offers regarding both hours and pay are intended to enhance their profits, but they must also satisfy the preferences of current and prospective employees. For example, if employees receiving an hourly wage of $X for 40 hours per week really wanted to work only 30 hours at $X per hour, some enterprising employer (presumably one with relatively lower quasi-fixed costs) would eventually seize on their dissatisfaction and offer jobs with a 30-hour workweek, ending up with a more satisfied, productive workforce in the process.

While the labor supply preferences of employees must be satisfied in the long run, most of the short-run changes in hours of work seem to emanate from the demand side of the market. Workweeks typically vary over the course of a business cycle, for example, with longer hours worked in periods of robust demand. In analyzing trends in hours of work, then, we must carefully distinguish between the forces of supply and demand.

In the first part of the twentieth century, workers in U.S. manufacturing plants typically worked 55 hours per week in years with strong economic activity; in the last two decades, American manufacturing workers have worked, on average, less than 40 hours per week during similar periods. For example, in the years 1988, 1995, and 2004—when the unemployment rate was roughly 5.5 percent and falling—manufacturing production workers averaged 38.4, 39.3, and 38.6 hours per week, respectively. In general, the decline in weekly hours of

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manufacturing work in the United States occurred prior to 1950, and since then, hours of work have shown little tendency to decline.\(^4\)

### A Theory of the Decision to Work

Can labor supply theory help us to understand the long-run trends in labor force participation and hours of work noted above? Because labor is the most abundant factor of production, it is fair to say that any country’s well-being in the long run depends heavily on the willingness of its people to work. Leisure and other ways of spending time that do not involve work for pay are also important in generating well-being; however, any economy relies heavily on goods and services produced for market transactions. Therefore, it is important to understand the work-incentive effects of higher wages and incomes, different kinds of taxes, and various forms of income maintenance programs.

The decision to work is ultimately a decision about how to spend time. One way to use our available time is to spend it in pleasurable leisure activities. The other major way in which people use time is to work. We can work around the home, performing such household production as raising children, sewing, building, or even growing food. Alternatively, we can work for pay and use our earnings to purchase food, shelter, clothing, and child care.

Because working for pay and engaging in household production are two ways of getting the same jobs done, we shall initially ignore the distinction between them and treat work activities as working for pay. We shall therefore be characterizing the decision to work as a choice between leisure and working for pay. Most of the crucial factors affecting work incentives can be understood in this context, but insight into labor supply behavior can also be enriched by a consideration of household production; this we do in chapter 7.

If we regard the time spent eating, sleeping, and otherwise maintaining ourselves as more or less fixed by natural laws, then the discretionary time we have (16 hours a day, say) can be allocated to either work or leisure. It is most convenient for us to begin our analysis of the work/leisure choice by analyzing the demand for leisure hours.

### Some Basic Concepts

Basically, the demand for a good is a function of three factors:

1. The opportunity cost of the good (which is often equal to market price).

\(^4\)The averages cited in this paragraph refer to actual hours of work (obtained from the Census of Manufactures), not the more commonly available “hours paid for,” which include paid time off for illness, holidays, and vacations. A recent study found an unexpected expansion of work hours among highly educated men during the last two decades of the twentieth century; see Peter Kuhn and Fernando Lozano, “The Expanding Workweek? Understanding Trends in Long Work Hours among U.S. Men, 1979–2006,” Journal of Labor Economics 26 (April 2008): 311–343.
2. One’s level of wealth.
3. One’s set of preferences.

For example, consumption of heating oil will vary with the cost of such oil; as that cost rises, consumption tends to fall unless one of the other two factors intervenes. As wealth rises, people generally want larger and warmer houses that obviously require more oil to heat. Even if the price of energy and the level of personal wealth were to remain constant, the demand for energy could rise if a falling birthrate and lengthened life span resulted in a higher proportion of the population being aged and therefore wanting warmer houses. This change in the composition of the population amounts to a shift in the overall preferences for warmer houses and thus leads to a change in the demand for heating oil. (Economists usually assume that preferences are given and not subject to immediate change. For policy purposes, changes in prices and wealth are of paramount importance in explaining changes in demand because these variables are more susceptible to change by government or market forces.)

**Opportunity Cost of Leisure** To apply this general analysis of demand to the demand for leisure, we must first ask, “What is the opportunity cost of leisure?” The cost of spending an hour watching television is basically what one could earn if one had spent that hour working. Thus, the opportunity cost of an hour of leisure is equal to one’s wage rate—the extra earnings a worker can take home from an extra hour of work.

**Wealth and Income** Next, we must understand and be able to measure wealth. Naturally, wealth includes a family’s holdings of bank accounts, financial investments, and physical property. Workers’ skills can also be considered assets, since these skills can be, in effect, rented out to employers for a price. The more one can get in wages, the larger the value of one’s human assets. Unfortunately, it is not usually possible to directly measure people’s wealth. It is much easier to measure the returns from that wealth, because data on total income are readily available from government surveys. Economists often use total income as an indicator of total wealth, since the two are conceptually so closely related.

**Defining the Income Effect** Theory suggests that if income increases while wages and preferences are held constant, the number of leisure hours demanded will rise. Put differently, if income increases, holding wages constant, desired hours of

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5When the demand for a good rises with wealth, economists say the good is a normal good. If demand falls as wealth rises, the good is said to be an inferior good (traveling or commuting by bus is sometimes cited as an example of an inferior good).

6This assumes that individuals can work as many hours as they want at a fixed wage rate. While this assumption may seem overly simplistic, it will not lead to wrong conclusions with respect to the issues analyzed in this chapter. More rigorously, it should be said that leisure’s marginal opportunity cost is the marginal wage rate (the wage one could receive for an extra hour of work).

7The best indicator of wealth is permanent, or long-run potential, income. Current income may differ from permanent income for a variety of reasons (unemployment, illness, unusually large amounts of overtime work, etc.). For our purposes here, however, the distinction between current income and permanent income is not too important.
work will go down. (Conversely, if income is reduced while the wage rate is held constant, desired hours of work will go up.) Economists call the response of desired hours of leisure to changes in income, with wages held constant, the income effect. The income effect is based on the simple notion that as incomes rise, holding leisure’s opportunity cost constant, people will want to consume more leisure (which means working less).

Because we have assumed that time is spent either in leisure or in working for pay, the income effect can be expressed in terms of the supply of working hours as well as the demand for leisure hours. Because the ultimate focus of this chapter is labor supply, we choose to express this effect in the context of supply.

Using algebraic notation, we define the income effect as the change in hours of work (\( \Delta H \)) produced by a change in income (\( \Delta Y \)), holding wages constant (\( \bar{W} \)):

\[
\text{Income Effect} = \frac{\Delta H}{\Delta Y} | \bar{W} < 0
\]  

We say the income effect is negative because the sign of the fraction in equation (6.1) is negative. If income goes up (wages held constant), hours of work fall. If income goes down, hours of work increase. The numerator (\( \Delta H \)) and denominator (\( \Delta Y \)) in equation (6.1) move in opposite directions, giving a negative sign to the income effect.

**Defining the Substitution Effect** Theory also suggests that if income is held constant, an increase in the wage rate will raise the price and reduce the demand for leisure, thereby increasing work incentives. (Likewise, a decrease in the wage rate will reduce leisure’s opportunity cost and the incentives to work, holding income constant.) This substitution effect occurs because as the cost of leisure changes, income held constant, leisure and work hours are substituted for each other.

In contrast to the income effect, the substitution effect is positive. Because this effect is the change in hours of work (\( \Delta H \)) induced by a change in the wage (\( \Delta W \)), holding income constant (\( \bar{Y} \)), the substitution effect can be written as

\[
\text{Substitution Effect} = \frac{\Delta H}{\Delta W} | \bar{Y} > 0
\]  

Because the numerator (\( \Delta H \)) and denominator (\( \Delta W \)) always move in the same direction, at least in theory, the substitution effect has a positive sign.

**Observing Income and Substitution Effects Separately** At times, it is possible to observe situations or programs that create only one effect or the other. (Laboratory experiments can also create separate income and substitution effects; an experiment with pigeons, discussed in Example 6.1, suggests that labor supply theory can even be generalized beyond humans!) Usually, however, both effects are simultaneously present, often working against each other.
Receiving an inheritance offers an example of the income effect by itself. The bequest enhances wealth (income) independent of the hours of work. Thus, income is increased without a change in the compensation received from an hour of work. In this case, the income effect induces the person to consume more leisure, thereby reducing the willingness to work. (Some support for this theoretical prediction can be seen later in Example 6.3.)

Observing the substitution effect by itself is rare, but one example comes from the 1980 presidential campaign, when candidate John Anderson proposed a program aimed at conserving gasoline. His plan consisted of raising the gasoline tax but offsetting this increase by a reduced Social Security tax payable by individuals on their earnings. The idea was to raise the price of gasoline without reducing people’s overall spendable income.

For our purposes, this plan is interesting because, for the typical worker, it would have created only a substitution effect on labor supply. Social Security revenues are collected by a tax on earnings, so reductions in the tax are, in effect, increases in the wage rate for most workers. For the average person, however, the increased wealth associated with this wage increase would have been exactly

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**Example 6.1**

The Labor Supply of Pigeons

Economics has been defined as “the study of the allocation of scarce resources among unlimited and competing uses.” Stated this way, the tools of economics can be used to analyze the behavior of animals as well as humans. In a classic study, Raymond Battalio, Leonard Green, and John Kagel describe an experiment in which they estimated income and substitution effects (and thus the shape of the labor supply curve) for animals.

The subjects were male White Carneaux pigeons. The job task consisted of pecking at a response key. If the pigeons pecked the lever enough times, their payoff was access to a food hopper containing mixed grains. “Wages” were changed by altering the average number of pecks per payoff. Pecking requirements varied from as much as 400 pecks per payoff (a very low wage) to as few as 12.5 pecks. In addition, “unearned income” could be changed by giving the pigeons free access to the food hopper without the need for pecking. The environment was meant to observe the trade-off between key pecking (“work”) and the pigeons’ primary alternative activities of preening themselves and walking around (“leisure”). The job task was not awkward or difficult for pigeons to perform, but it did require effort.

Battalio, Green, and Kagel found that pigeons’ actions were perfectly consistent with economic theory. In the first stage of the experiment, they cut the wage rate (payoff per peck) but added enough free food to isolate the substitution effect. In almost every case, the birds reduced their labor supply and spent more time on leisure activities. In the second stage of the experiment, they took away the free food to isolate the income effect. They found that every pigeon increased its pecking (cutting its leisure) as its income was cut. Thus, leisure is a normal good for pigeons.

offset by increases in the gasoline tax. Hence, wages would have been increased while income was held more or less constant. This program would have created a substitution effect that induced people to work more hours.

**Both Effects Occur When Wages Rise** While the above examples illustrate situations in which the income or the substitution effect is present by itself, *normally both effects are present, often working in opposite directions*. The presence of both effects working in opposite directions creates ambiguity in predicting the overall labor supply response in many cases. Consider the case of a person who receives a wage increase.

The labor supply response to a simple wage increase will involve *both* an income effect and a substitution effect. The *income effect* is the result of the worker’s enhanced wealth (or potential income) after the increase. For a given level of work effort, he or she now has a greater command over resources than before (because more income is received for any given number of hours of work). The *substitution effect* results from the fact that the wage increase raises the opportunity costs of leisure. Because the actual labor supply response is the *sum* of the income and substitution effects, we cannot predict the response in advance; theory simply does not tell us which effect is stronger.

If the income effect is stronger, the person will respond to a wage increase by decreasing his or her labor supply. This decrease will be *smaller* than if the same change in wealth were due to an increase in nonlabor wealth, because the substitution effect is present and acts as a moderating influence. However, as seen in Example 6.2, when the income effect dominates, the substitution effect is not large enough to prevent labor supply from *declining*. It is entirely plausible, of course, that the substitution effect will dominate. If so, the actual response to wage increases will be to *increase* labor supply.

Should the substitution effect dominate, the person’s labor supply curve—relating, say, his or her desired hours of work to wages—will be *positively sloped*. That is, labor supplied will increase with the wage rate. If, on the other hand, the income effect dominates, the person’s labor supply curve will be *negatively sloped*. Economic theory cannot say which effect will dominate, and in fact, individual labor supply curves could be positively sloped in some ranges of the wage and negatively sloped in others. In Figure 6.1, for example, the person’s desired hours of work increase (substitution effect dominates) when wages go up as long as wages are low (below $W^*$). At higher wages, however, further increases result in

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8An increase in the price of gasoline will reduce the income people have left for expenditures on non-gasoline consumption only if the demand for gasoline is inelastic. In this case, the percentage reduction in gasoline consumption is smaller than the percentage increase in price; total expenditures on gasoline would thus rise. Our analysis assumes this to be the case. For a study of how gasoline taxes affect labor supply, see Sarah West and Roberton Williams, “Empirical Estimates for Environmental Policy Making in a Second-Best Setting,” National Bureau of Economic Research, Working Paper No. 10330 (March 2004).
reduced hours of work (the income effect dominates); economists refer to such a curve as *backward-bending*.

**Analysis of the Labor/Leisure Choice**

This section introduces indifference curves and budget constraints—visual aids that make the theory of labor supply easier to understand and to apply to complex policy issues. These graphical aids visually depict the basic factors underlying the demand for leisure (supply of labor) discussed earlier.

**Preferences**  Let us assume that there are two major categories of goods that make people happy—leisure time and the goods people can buy with money. If we take the prices of goods as fixed, then they can be compressed into one index that is measured by money income (with prices fixed, more money income means
it is possible to consume more goods). Using two categories, leisure and money income, allows our graphs to be drawn in two-dimensional space.

Since both leisure and money can be used to generate satisfaction (or utility), these two goods are to some extent substitutes for each other. If forced to give up some money income—by cutting back on hours of work, for example—some increase in leisure time could be substituted for this lost income to keep a person as happy as before.

To understand how preferences can be graphed, suppose a thoughtful consumer/worker were asked to decide how happy he or she would be with a daily income of $64 combined with 8 hours of leisure (point a in Figure 6.2). This level of happiness could be called utility level A. Our consumer/worker could name other combinations of money income and leisure hours that would also yield utility level A. Assume that our respondent named five other combinations. All six combinations of money income and leisure hours that yield utility level A are represented by heavy dots in Figure 6.2. The curve connecting these dots is called an indifference curve, which connects the various combinations of money income and leisure that yield equal utility. (The term indifference curve is derived from the fact that since each point on the curve yields equal utility, a person is truly indifferent about where on the curve he or she will be.)

Our worker/consumer could no doubt achieve a higher level of happiness if he or she could combine the 8 hours of leisure with an income of $100 per day.
instead of just $64 a day. This higher satisfaction level could be called utility level $B$. The consumer could name other combinations of money income and leisure that would also yield this higher level of utility. These combinations are denoted by the Xs in Figure 6.2 that are connected by a second indifference curve.

Indifference curves have certain specific characteristics that are reflected in the way they are drawn:

1. Utility level $B$ represents more happiness than level $A$. Every level of leisure consumption is combined with a higher income on $B$ than on $A$. Hence, our respondent prefers all points on indifference curve $B$ to any point on curve $A$. A whole set of indifference curves could be drawn for this one person, each representing a different utility level. Any such curve that lies to the northeast of another one is preferred to any curve to the southwest because the northeastern curve represents a higher level of utility.

2. Indifference curves do not intersect. If they did, the point of intersection would represent one combination of money income and leisure that yielded two different levels of satisfaction. We assume our worker/consumer is not so inconsistent in stating his or her preferences that this could happen.

3. Indifference curves are negatively sloped because if either income or leisure hours are increased, the other is reduced in order to preserve the same level of utility. If the slope is steep, as at segment $LK$ in Figure 6.3, a given loss of income need not be accompanied by a large increase in leisure hours to keep utility constant.9 When the curve is relatively flat, however, as at segment $MN$ in Figure 6.3, a given decrease in income must be accompanied by a large increase in the consumption of leisure to hold utility constant. Thus, when indifference curves are relatively steep, people do not value money income as highly as when such curves are relatively flat; when they are flat, a loss of income can only be compensated for by a large increase in leisure to maintain equal utility.

4. Indifference curves are convex—steeper at the left than at the right. This shape reflects the assumption that when money income is relatively high and leisure hours are relatively few, leisure is more highly valued (and income less valued) than when leisure is abundant and income relatively scarce. At segment $LK$ in Figure 6.3, a great loss of income (from $Y_4$ to $Y_3$, for example) can be compensated for by just a little increase in leisure, whereas a little loss of leisure time (from $H_3$ to $H_4$, for example) would require a relatively large increase in income to maintain equal utility. What is relatively scarce is more highly valued.

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9Economists call the change in money income needed to hold utility constant when leisure hours are changed by one unit the marginal rate of substitution between leisure and money income. This marginal rate of substitution can be graphically understood as the slope of the indifference curve at any point. At point $L$, for example, the slope is relatively steep, so economists would say that the marginal rate of substitution at point $L$ is relatively high.
5. Conversely, when income is low and leisure is abundant (segment $MN$ in Figure 6.3), income is more highly valued. Losing income (by moving from $Y_2$ to $Y_1$, for example) would require a huge increase in leisure for utility to remain constant. To repeat, what is relatively scarce is assumed to be more highly valued.

6. Finally, different people have different sets of indifference curves. The curves drawn in Figures 6.2 and 6.3 were for one person. Another person would have a completely different set of curves. People who value leisure more highly, for example, would have had indifference curves that were generally steeper (see Figure 6.4a). People who do not value leisure highly would have relatively flat curves (see Figure 6.4b). Thus, individual preferences can be portrayed graphically.

**Income and Wage Constraints**  Everyone would like to maximize his or her utility, which would be ideally done by consuming every available hour of leisure combined with the highest conceivable income. Unfortunately, the resources anyone can command are limited. Thus, all that is possible is to do the best one can, given limited resources. To see these resource limitations graphically requires superimposing constraints on one’s set of indifference curves to see which combinations of income and leisure are available and which are not.

Suppose the person whose indifference curves are graphed in Figure 6.2 had no source of income other than labor earnings. Suppose, further, that he
or she could earn $8 per hour. Figure 6.5 includes the two indifference curves shown in Figure 6.2 as well as a straight line (ED) connecting combinations of leisure and income that are possible for a person with an $8 wage and no outside income. If 16 hours per day are available for work
and leisure, and if this person consumes all 16 in leisure, then money income will be zero (point D in Figure 6.5). If 5 hours a day are devoted to work, income will be $40 per day (point M), and if 16 hours a day are worked, income will be $128 per day (point E). Other points on this line—for example, the point of 15 hours of leisure (1 hour of work) and $8 of income—are also possible. This line, which reflects the combinations of leisure and income that are possible for the individual, is called the budget constraint. Any combination to the right of the budget constraint is not achievable; the person’s command over resources is simply not sufficient to attain these combinations of leisure and money income.

The slope of the budget constraint is a graphical representation of the wage rate. One’s wage rate is properly defined as the increment in income ($\Delta Y$) derived from an increment in hours of work ($\Delta H$):

$$\text{Wage Rate} = \frac{\Delta Y}{\Delta H}$$

Now $\Delta Y/\Delta H$ is exactly the slope of the budget constraint (in absolute value). Figure 6.5 shows how the constraint rises $8 for every 1-hour increase in work: if the person works 0 hours, income per day is zero; if the person works 1 hour, $8 in income is received; if he or she works 5 hours, $40 in income is achieved. The constraint rises $8 because the wage rate is $8 per hour. If the person could earn $16 per hour, the constraint would rise twice as fast and therefore be twice as steep.

It is clear from Figure 6.5 that our consumer/worker cannot achieve utility level B. He or she can achieve some points on the indifference curve representing utility level A—specifically, those points between L and M in Figure 6.5. However, if our consumer/worker is a utility maximizer, he or she will realize that a utility level above A is possible. Remembering that an infinite number of indifference curves can be drawn between curves A and B in Figure 6.5, one representing each possible level of satisfaction between A and B, we can draw a curve (A') that is northeast of curve A and just tangent to the budget constraint at point N. Any movement along the budget constraint away from the tangency point places the person on an indifference curve lying below A'.

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10Our assumption that 8 hours per day are required for sleeping and other “maintenance” activities is purely for ease of exposition. These activities themselves are a matter of economic choice, at least to some extent; see, for example, Jeff E. Biddle and Daniel S. Hamermesh, “Sleep and the Allocation of Time,” *Journal of Political Economy* 98, no. 5, pt. 1 (October 1990): 922–943. Modeling a three-way choice between work, leisure, and maintenance activities would complicate our analysis without changing the essential insights theory can offer about the labor/leisure choice workers must make.

11The vertical change for a one-unit change in horizontal distance is the definition of slope. Absolute value refers to the magnitude of the slope, disregarding whether it is positive or negative. The budget constraint drawn in Figure 6.5 is a straight line (and thus has a constant slope). In economic terms, a straight-line budget constraint reflects the assumption that the wage rate at which one can work is fixed and that it does not change with the hours of work. However, the major theoretical implications derived from using a straight-line constraint would be unchanged by employing a convex one, so we are using the fixed-wage assumption for ease of exposition.
Workers who face the same budget constraint, but who have different preferences for leisure, will make different choices about hours of work. If the person whose preferences were depicted in Figure 6.5 had placed lower values on leisure time—and therefore had indifference curves that were comparatively flatter, such as the one shown in Figure 6.4b—then the point of tangency with constraint $ED$ would have been to the left of point $N$ (indicating more hours of work). Conversely, if he or she had steeper indifference curves, signifying that leisure time was more valuable (see Figure 6.4a), then the point of tangency in Figure 6.5 would have been to the right of point $N$, and fewer hours of work would have been desired. Indeed, some people will have indifference curves so steep (that is, preferences for leisure so strong) that there is no point of tangency with $ED$. For these people, as is illustrated by Figure 6.6, utility is maximized at the “corner” (point $D$); they desire no work at all and therefore are not in the labor force.

**The Income Effect**  
Suppose now that the person depicted in Figure 6.5 receives a source of income independent of work. Suppose further that this *nonlabor* income amounts to about $36 per day. Thus, even if this person worked 0 hours per day, his or her daily income would be $36. Naturally, if the person worked more than 0 hours, his or her daily income would be equal to $36 plus earnings (the wage multiplied by the hours of work).

Our person’s command over resources has clearly increased, as can be shown by drawing a new budget constraint to reflect the nonlabor income. As shown by the darker blue line in Figure 6.7, the endpoints of the new constraint are point $d$ (0 hours of work and $36 of money income) and point $e$ (16 hours of...
work and $164 of income—$36 in nonlabor income plus $128 in earnings). Note that the new constraint is parallel to the old one. Parallel lines have the same slope; since the slope of each constraint reflects the wage rate, we can infer that the increase in nonlabor income has not changed the person’s wage rate.

We have just described a situation in which a pure income effect should be observed. Income (wealth) has been increased, but the wage rate has remained unchanged. The previous section noted that if wealth increased and the opportunity cost of leisure remained constant, the person would consume more leisure and work less. We thus concluded that the income effect was negative, and this negative relationship is illustrated graphically in Figure 6.7.

When the old budget constraint (ED) was in effect, the person’s highest level of utility was reached at point N, working 9 hours a day. With the new constraint (ed), the optimum hours of work are 8 per day (point P). The new source of income, because it does not alter the wage, has caused an income effect that results in one less hour of work per day. Statistical analyses of people who received large inheritances (Example 6.3) or who won large lottery prizes\(^\text{12}\)

support the prediction that labor supply is reduced when unearned income rises.

**Income and Substitution Effects with a Wage Increase**  Suppose that instead of increasing one’s command over resources by receiving a source of nonlabor income, the wage rate were to be increased from $8 to $12 per hour. This increase, as noted earlier, would cause both an income effect and a substitution effect; workers would be wealthier and face a higher opportunity cost of leisure. Theory tells us in this case that the substitution effect pushes them toward more hours of work and the income effect toward fewer, but it cannot tell us which effect will dominate.

Figures 6.8 and 6.9 illustrate the possible effects of the above wage change on a person’s labor supply, which we now assume is initially 8 hours per day. Figure 6.8 illustrates the case in which the observed response by a worker is to increase the hours of work; in this case, the substitution effect is stronger than the income effect. Figure 6.9 illustrates the case in which the income effect is stronger and the response to a wage increase is to reduce the hours of work. The difference between the two figures lies solely in the shape of the indifference curves that might describe a person’s preferences; the budget constraints, which reflect wealth and the wage rate, are exactly the same.

Figures 6.8 and 6.9 both show the old constraint, \( AB \), the slope of which reflects the wage of $8 per hour. They also show the new one, \( AC \), which reflects

![Figure 6.8: Wage Increase with Substitution Effect Dominating](image-url)
the $12 wage. Because we assume workers have no source of nonlabor income, both constraints are anchored at point A, where income is zero if a person does not work. Point C on the new constraint is now at $192 (16 hours of work times $12 per hour).

With the worker whose preferences are depicted in Figure 6.8, the wage increase makes utility level $U_2$ the highest that can be reached. The tangency point at $N_2$ suggests that 11 hours of work is optimum. When the old constraint was in effect, the utility-maximizing hours of work were 8 per day (point $N_1$). Thus, the wage increase would cause this person’s desired hours of work to increase by 3 per day.

With the worker whose preferences are depicted in Figure 6.9, the wage increase would make utility level $U_2'$ the highest one possible (the prime emphasizes that workers’ preferences differ and that utility levels in Figures 6.8 and 6.9 cannot be compared). Utility is maximized at $N_2'$, at 6 hours of work per day. Thus, with preferences like those in Figure 6.9, working hours fall from 8 to 6 as the wage rate increases.

**Isolating Income and Substitution Effects** We have graphically depicted the income effect by itself (Figure 6.7) and the two possible outcomes of an increase in wages (Figures 6.8 and 6.9), which combine the income and substitution effects. Is it possible to graphically isolate the substitution effect? The answer is yes, and
EXAMPLE 6.3

Do Large Inheritances Induce Labor Force Withdrawal?

Do large bequests of unearned income reduce people’s incentives to work? One study divided people who received inheritances in 1982–1983 into two groups: those who received small bequests (averaging $7,700) and those who received larger ones, averaging $346,200. The study then analyzed changes in the labor force participation behavior of the two groups between 1982 and 1985. Not surprisingly, those who received the larger inheritances were more likely to drop out of the labor force. Specifically, in an environment in which other forces were causing the labor force participation rate among the small-bequest group to rise from 76 percent to 81 percent, the rate in the large-bequest group fell from 70 percent to 65 percent. Somewhat more surprising was the fact that perhaps in anticipation of the large bequest, the labor force participation rate among the people in the latter group was lower to begin with!

Chapter 6  Supply of Labor to the Economy: The Decision to Work

day. This shift is graphical verification that the income effect is negative, assuming that leisure is a normal good.

The substitution effect is the effect on labor supply of a change in the wage rate, holding wealth constant. It can be seen in panel (c) of Figure 6.10 as the difference between where the person actually ended up on indifference curve $U_2$ (tangency at $N_2$) and where he or she would have ended up with a pure income effect (tangency at $N_3$). Comparing tangency points on the same indifference curve is a graphical approximation to holding wealth constant. Thus, with the wage change, the person represented in Figure 6.10 ended up at point $N_2$, working 11 hours a day. Without the wage change, the person would have chosen to work 7 hours a day (point $N_3$). The wage change by itself, holding utility (or real wealth) constant, caused work hours to increase by 4 per day. This increase demonstrates that the substitution effect is positive.

To summarize, the observed effect of raising wages from $8 to $12 per hour increased the hours of work in Figure 6.10 from 8 to 11 per day. This observed effect, however, is the sum of two component effects. The income effect, which operates because a higher wage increases one’s real wealth, tended to reduce the hours of work from 8 to 7 per day. The substitution effect, which captures the pure effect of the change in leisure’s opportunity cost, tended to push the person toward 4 more hours of work per day. The end result was an increase of 3 in the hours worked each day.

Which Effect Is Stronger? Suppose that a wage increase changes the budget constraint facing a worker from $CD$ to $CE$ in Figure 6.11. If the worker had a relatively flat set of indifference curves, the initial tangency along $CD$ might be at point $A$, implying a relatively heavy work schedule. If the person had more steeply sloped indifference curves, the initial tangency might be at point $B$, where hours at work are fewer.

One important influence on the size of the income effect is the extent of the northeast movement of the new constraint: the more the constraint shifts outward, the greater the income effect will tend to be. For a person with an initial tangency at point $A$, for example, the northeast movement is larger than that for a person whose initial tangency is at point $B$. Put in words, the increased command over resources made possible by a wage increase is only attainable if one works, and the more work-oriented the person is, the greater will be his or her increase in resources. Other things equal, people who are working longer hours will exhibit greater income effects when wage rates change.

To take this reasoning to the extreme, suppose a person’s indifference curves were so steep that the person was initially out of the labor force (that is, when the

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13In our initial definition of the substitution effect, we held money income constant, while in the graphical analysis, we held utility constant. These slightly different approaches were followed for explanatory convenience, and they represent (respectively) the theoretical analyses suggested by Evgeny Slutsky and John Hicks. For an easy-to-follow explanation of the two approaches, see Heinz Kohler, *Intermediate Microeconomics* (Glenview, Ill.: Scott Foresman, 1986): 76–81.
Figure 6.10
Wage Increase with Substitution Effect
Dominating: Isolating Income and Substitution Effects

(a) The Observed Change

(b) The Income Effect

(c) The Substitution Effect
budget constraint was $CD$ in Figure 6.11, his or her utility was maximized at point $C$). The wage increase and the resultant new constraint, $CE$, can induce only two outcomes: the person will either begin to work for pay or remain out of the labor force. Reducing the hours of paid employment is not possible. For those who are out of the labor force, then, the decision to participate as wage offers rise clearly reflects a dominant substitution effect. Conversely, if someone currently working decides to change his or her participation decision and drop out of the labor force when wages fall, the substitution effect has again dominated. Thus, the labor force participation decisions brought about by wage changes exhibit a dominant substitution effect. We turn now to a more detailed analysis of the decision whether to join the labor force.

**The Reservation Wage** An implication of our labor supply theory is that if people who are not in the labor force place a value of $X$ on the marginal hour of leisure, then they would be unwilling to take a job unless the offered wages were greater than $X$. Because they will “reserve” their labor unless the wage is $X$ or more (see Example 6.4), economists say that they have a reservation wage of $X$. The reservation wage, then, is the wage below which a person will not work, and in the labor/leisure context, it represents the value placed on an hour of lost leisure time.\(^\text{14}\)

Refer back to Figure 6.6, which graphically depicted a person choosing not to work. The reason there was no tangency between an indifference curve and

the budget constraint—and the reason the person remained out of the labor force—was that the wage was everywhere lower than his or her marginal value of leisure time.

Often, people are thought to behave as if they have both a reservation wage and a certain number of work hours that must be offered before they will consider taking a job. The reasons are not difficult to understand and are illustrated in Figure 6.12. Suppose that taking a job entails 2 hours of commuting time (round-trip) per day. These hours, of course, are unpaid, so the worker’s budget constraint must reflect that if a job is accepted, 2 hours of leisure are given up before there is any increase in income. These fixed costs of working are reflected in Figure 6.12 by segment $AB$. Segment $BC$, of course, reflects the earnings that are possible (once at work), and the slope of $BC$ represents the person’s wage rate.

Is the wage underlying $BC$ great enough to induce the person to work? Consider indifference curve $U_1$, which represents the highest level of utility this person can achieve, given budget constraint $ABC$. Utility is maximized at point $A$, and the person chooses not to work. It is clear from this choice that the offered wage (given the 2-hour commute) is below the person’s reservation wage, but can we show the latter wage graphically?

To take work with a 2-hour commute, the person depicted in Figure 6.12 must find a job able to generate a combination of earnings and leisure time that yields a utility level equal to, or greater than, $U_1$. This is possible only if the person’s budget constraint is equal to (or to the right of) $ABD$, which is tangent to $U_1$. 

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**Figure 6.12**

Reservation Wage with Fixed Time Costs of Working

Income

Income

Hours of Leisure

Hours of Leisure

Hours of Paid Work

Hours of Paid Work

0 2 4 6 8 10 12 14 16

0 2 4 6 8 10 12 14 16

$D$

$X$

$C$

$A$

$B$

$U_1$

$X$

$A$

$U_1$

Income

Hours of Leisure

Hours of Paid Work
at point $X$. The person’s reservation wage, then, is equal to the slope of $BD$, and you can readily note that in this case, the slope of $BD$ exceeds the slope of $BC$, which represents the currently offered wage. Moreover, to bring utility up to the level of $U_1$ (the utility associated with not working), the person shown in Figure 6.12 must be able to find a job at the reservation wage that offers 4 hours of work per day. Put differently, at this person’s reservation wage, he or she would want to consume 10 hours of leisure daily, and with a 2-hour commute, this implies 4 hours of work.

**Empirical Findings on the Income and Substitution Effects**

Labor supply theory suggests that the choices workers make concerning their desired hours of work depend on their wealth and the wage rate they can command, in addition to their preferences. In particular, this theory suggests the existence of a negative income effect and a positive substitution effect. Empirical tests of labor supply theory generally attempt to determine if these two effects can be observed, if they operate in the expected directions, and what their relative magnitudes are.
Most recent studies of labor supply have used large samples of individuals to analyze how labor force participation and hours of work are affected by wage rates and income, holding other influences (age, for example) constant. Studies of male and female labor force behavior are done separately because of the different roles men and women typically play in performing household work and child-rearing—activities that clearly affect labor supply decisions but about which information is usually very limited.

The studies of labor supply behavior for men between the ages of 25 and 55 generally conclude that both income and substitution effects are small, perhaps even zero. Probably because the net responses to wage changes are so close to zero, the results of studies that try to separately measure the income and substitution effects—while generally supportive of the theory—are highly dependent on the statistical methods used.\(^{15}\) Studies of older men tend to focus on retirement behavior (a topic we will address in chapter 7) and find, as theory suggests, that the substitution effect dominates the decision whether to withdraw from the labor force. In particular, the sharp rise in early retirements in the last two decades of the twentieth century was concentrated among men with lower levels of education, for whom wages fell during that period.\(^{16}\)

Studies of the labor supply behavior of married women generally have found a greater responsiveness to wage changes than is found among men, and recent work suggests two generalizations. First, changes in the hours of work associated with a wage change for married women are closer to those for men than are changes in labor force participation; that is, as seen in Example 6.5, the labor force participation rate for married women has been more responsive to wage changes than have been the hours of work. Second, in the last two decades, the labor supply behavior of married women has become much more similar to that for men—meaning that the labor supply of women is becoming less responsive to wage changes than it used to be. The reduced responsiveness has been especially noticeable in women’s labor force participation decisions, where the differences between men and women have been greatest.\(^{17}\) This growing similarity in labor supply behavior may well reflect a growing similarity in the expectations held by women and men concerning work and careers.


Policy Applications

Many income maintenance programs create budget constraints that increase income while reducing the take-home wage rate (thus causing the income and substitution effects to work in the same direction). Therefore, using labor supply theory to analyze the work-incentive effects of various social programs is both instructive and important. We characterize these programs by the budget constraints they create for their recipients.
Some social insurance programs compensate workers who are unable to work because of a temporary work injury, a permanent disability, or a layoff. Workers’ compensation insurance replaces most of the earnings lost when workers are hurt on the job, and private or public disability programs do the same for workers who become physically or emotionally unable to work for other reasons. Unemployment compensation is paid to those who have lost a job and have not been able to find another. While exceptions can be found in the occasional jurisdiction, it is generally true that these income replacement programs share a common characteristic: they pay benefits only to those who are not working.

To understand the consequences of paying benefits only to those who are not working, let us suppose that a workers’ compensation program is structured so that, after injury, workers receive their pre-injury earnings for as long as they are off work. Once they work even one hour, however, they are no longer considered disabled and cannot receive further benefits. The effects of this program on work incentives are analyzed in Figure 6.13, in which it is assumed that the pre-injury budget constraint was \( AB \) and pre-injury earnings were \( E_0(= AC) \).

\(^{18}\)UI and workers’ compensation programs in the United States are run at the state level and thus vary in their characteristics to some extent.
Furthermore, we assume that the worker’s “market” budget constraint (that is, the constraint in the absence of a workers’ compensation program) is unchanged, so that after recovery, the pre-injury wage can again be earned. Under these conditions, the post-injury budget constraint is \( BAC \), and the person maximizes utility at point \( C \)—a point of no work.

Note that constraint \( BAC \) contains the segment \( AC \), which looks like a spike. It is this spike that creates severe work-incentive problems, for two reasons. First, the returns associated with the first hour of work are negative. That is, a person at point \( C \) who returns to work for 1 hour would find his or her income to be considerably reduced by working. Earnings from this hour of work would be more than offset by the reduction in benefits, which creates a negative “net wage.” The substitution effect associated with this program characteristic clearly discourages work.\(^{19}\)

Second, our assumed no-work benefit of \( AC \) is equal to \( E_0 \), the pre-injury level of earnings. If the worker values leisure at all (as is assumed by the standard downward slope of indifference curves), being able to receive the old level of earnings while also enjoying more leisure clearly enhances utility. The worker is better off at point \( C \) than at point \( f \), the pre-injury combination of earnings and leisure hours, because he or she is on indifference curve \( U_2 \) rather than \( U_1 \). Allowing workers to reach a higher utility level without working generates an income effect that discourages, or at least slows, the return to work.

Indeed, the program we have assumed raises a worker’s reservation wage above his or her pre-injury wage, meaning that a return to work is possible only if the worker qualifies for a higher-paying job. To see this graphically, observe the dashed blue line in Figure 6.13 that begins at point \( A \) and is tangent to indifference curve \( U_2 \) (the level of utility made possible by the social insurance program). The slope of this line is equal to the person’s reservation wage, because if the person can obtain the desired hours of work at this or a greater wage, utility will be at least equal to that associated with point \( C \). Note also that for labor force participation to be induced, the reservation wage must be received for at least \( R^* \) hours of work.

Given that the work-incentive aspects of income replacement programs often quite justifiably take a backseat to the goal of making unfortunate workers “whole” in some economic sense, creating programs that avoid work disincentives is not easy. With the preferences of the worker depicted in Figure 6.13, a benefit of slightly less than \( Ag \) would ensure minimal loss of utility while still

\(^{19}\)In graphical terms, the budget constraint contains a vertical spike, and the slope of this vertical segment is infinitely negative. In economic terms, the implied infinitely negative (net) wage arises from the fact that even 1 minute of work causes a person to lose his or her entire benefit. For empirical evidence, see Susan Chen and Wilbert van der Klaauw, “The Work Disincentive Effects of the Disability Insurance Program in the 1990s,” *Journal of Econometrics* 142 (February 2008): 757–784. For an analysis of disability insurance usage, see David H. Autor and Mark G. Duggan, “The Growth in the Social Security Disability Rolls: A Fiscal Crisis Unfolding,” *Journal of Economic Perspectives* 20 (Summer 2006): 71–96.
providing incentives to return to work as soon as physically possible (work would allow indifference curve $U_1$ to be attained—see point $f$—while not working and receiving a benefit of less than $Ag$ would not). Unfortunately, workers differ in their preferences, so the optimal benefit—one that would provide work incentives yet ensure only minimal loss of utility—differs for each individual.

With programs that create spikes, the best policymakers can do is set a no-work benefit as some fraction of previous earnings and then use administrative means to encourage the return to work among any whose utility is greater than state.

On July 15, 1980, Kentucky raised its maximum weekly benefit by 66 percent. It did not alter benefits in any other way, so this change effectively granted large benefit increases to high-wage workers without awarding them to anyone else. Because those injured before July 15 were ineligible for the increased benefits, even if they remained off work after July 15, this policy change created a nice natural experiment: one group of injured workers was able to obtain higher benefits, while another group was not. Did the group receiving higher benefits show evidence of reduced labor supply, as suggested by theory?

The effects of increased benefits on labor supply were unmistakable. High-wage workers ineligible for the new benefits typically stayed off the job for four weeks, but those injured after July 15 stayed away for five weeks—25 percent longer! No increases in the typical time away from work were recorded among lower-paid injured workers, who were unaffected by the changes in benefits.


Programs with Net Wage Rates of Zero

The programs just discussed were intended to confer benefits on those who are unable to work, and the budget-constraint spike was created by the eligibility requirement that to receive benefits, one must not be working. Other social programs, such as welfare, have different eligibility criteria and calculate benefits differently. These programs factor income needs into their eligibility criteria and then pay benefits based on the difference between one’s actual earnings and one’s needs. We will see that paying people the difference between their earnings and their needs creates a net wage rate of zero; thus, the work-incentive problems associated with these welfare programs result from the fact that they increase the income of program recipients while also drastically reducing the price of leisure.

Nature of Welfare Subsidies  Welfare programs have historically taken the form of a guaranteed annual income, under which the welfare agency determines the income needed by an eligible person ($Y_n$ in Figure 6.14) based on family size, area living costs, and local welfare regulations. Actual earnings are then subtracted from this needed level, and a check is issued to the person each month for the difference. If the person does not work, he or she receives a subsidy of $Y_n$. If the person works, and if earnings cause dollar-for-dollar reductions in welfare benefits, then a budget constraint like $ABCD$ in Figure 6.14 is created. The person’s income
remains \( Y_n \) as long as he or she is subsidized. If receiving the subsidy, then, an extra hour of work yields no net increase in income, because the extra earnings result in an equal reduction in welfare benefits. The net wage of a person on the program—and therefore his or her price of leisure—is zero, which is graphically shown by the segment of the constraint having a slope of zero (BC).

Thus, a welfare program like the one summarized in Figure 6.14 increases the income of the poor by moving the lower end of the budget constraint out from AC to ABC; as indicated by the dashed hypothetical constraint in Figure 6.14, this shift creates an income effect tending to reduce labor supply from the hours associated with point E to those associated with point F. However, it also causes the wage to effectively drop to zero; every dollar earned is matched by a dollar reduction in welfare benefits. This dollar-for-dollar reduction in benefits induces a huge substitution effect, causing those accepting welfare to reduce their hours of work to zero (point B). Of course, if a person’s indifference curves were sufficiently flat so that the curve tangent to segment CD passed above point B (see Figure 6.15), then that person’s utility would be maximized by choosing work instead of welfare.

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21Gary Burtless, “The Economist’s Lament: Public Assistance in America,” *Journal of Economic Perspectives* 4 (Winter 1990): 57–78, summarizes a variety of public assistance programs in the United States prior to 1990. This article suggests that in actual practice, benefits were usually reduced by something less than dollar for dollar (perhaps by 80 or 90 cents per dollar of earnings).

**Welfare Reform**  In light of the disincentives for work built into traditional welfare programs, the United States adopted major changes to its come-subsidy programs in the 1990s. The Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) of 1996 gave states more authority over how they could design their own welfare programs, with the intent of leading to more experimentation in program characteristics aimed at encouraging work, reducing poverty, and moving people off welfare. PRWORA also placed a five-year (lifetime) time limit on the receipt of welfare benefits and required that after two years on welfare, recipients must work at least 30 hours per week. These changes appear to have had the effect of increasing the labor force participation rates of single mothers (the primary beneficiaries of the old welfare system); the participation rate for single mothers jumped from 68 percent in 1994 to roughly 78 percent in 2000—a much larger increase than was observed for other groups of women.

**Lifetime Limits**  Both lifetime limits and work requirements can be analyzed using the graphical tools developed in this chapter. Lifetime limits on the receipt of welfare have the effect of ending eligibility for transfer payments, either by forcing recipients off welfare or by inducing them to leave so they can “save” their eligibility in case they need welfare later in life. Thus, in terms of Figure 6.14, the lifetime limit ultimately removes ABC from the potential recipient’s budget constraint, which then reverts to the market constraint of AD. Clearly, the lifetime limit increases work incentives by ultimately eliminating the income subsidy. However, within the limits of their eligible years, potential welfare recipients must choose when to receive the subsidy and when to “save” their eligibility in the event of a future need. Federal law provides for welfare subsidies only to families with children under the age of 18; consequently, the closer one’s youngest child is to 18 (when welfare eligibility ends anyway), the smaller are the incentives of the parent to forgo the welfare subsidy and save eligibility for the future.

**Work Requirements**  As noted earlier, PRWORA introduced a work requirement into the welfare system, although in some cases, unpaid work or enrolling in education or training programs counts toward that requirement. States differ in how the earnings affect welfare benefits, and many have rules that allow welfare recipients to keep most of what they earn (by not reducing, at least by much, their welfare benefits); we analyze such programs in the next section. For now, we can understand the basic effects of a work requirement by maintaining our assumption that earnings reduce welfare benefits dollar for dollar.

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Figure 6.16 illustrates the budget constraint associated with a minimum work requirement of 6 hours a day (30 hours per week). If the person fails to work the required 6 hours a day, no welfare benefits are received, and he or she will be along segment $AB$ of the constraint. If the work requirement is met, but earnings are less than $Y_n$, welfare benefits are received (see segment $BCD$). If the work requirement is exceeded, income (earnings plus benefits) remains at $Y_n$—the person is along $CD$—until earnings rise above needed income and the person is along segment $DE$ of the constraint and no longer eligible for welfare benefits.

The work-incentive effects of this work requirement can be seen from analyzing Figure 6.16 in the context of people whose skills are such that they are potential welfare recipients. At one extreme, some potential recipients may have such steeply sloped indifferences curves (reflecting a strong preference, or a need, to stay at home) that utility is maximized along segment $AB$, where so little market work is performed that they do not qualify for welfare. At the opposite extreme, others may have such flat indifference curves (reflecting a strong preference for income and a weak preference for leisure) that their utility is maximized along segment $DE$; they work so many hours that their earnings disqualify them for welfare benefits.

In the middle of the above extremes will be those whose preferences lead them to work enough to qualify for welfare benefits. Clearly, if their earnings reduce their benefits dollar for dollar—as shown by the horizontal segment $DC$ in Figure 6.16—they will want to work just the minimum hours needed to qualify for welfare, because their utility will be maximized at point $C$ and not along $DC$. (For
labor supply responses to different forms of a work requirement—requisitions of food from farmers during wartime—see Example 6.7 on page 204.)

**Subsidy Programs with Positive Net Wage Rates**

So far, we have analyzed the work-incentive effects of income maintenance programs that create net wage rates for program recipients that are either negative or zero (that is, they create constraints that have either a spike or a horizontal segment). Most current programs, however, including those adopted by states under PRWORA, create positive net wages for recipients. Do these programs offer a solution to the problem of work incentives? We will answer this question by analyzing a relatively recent and rapidly growing program: the Earned Income Tax Credit (EITC).

The EITC program makes income tax credits available to low-income families with at least one worker. A tax credit of $1 reduces a person’s income taxes by $1, and in the case of the EITC, if the tax credit for which workers qualify exceeds their total income tax liability, the government will mail them a check for the difference. Thus, the EITC functions as an earnings subsidy, and because the subsidy goes only to those who work, the EITC is seen by many as an income maintenance program that preserves work incentives. This view led Congress to vastly expand the EITC under President Bill Clinton and it is now the largest cash subsidy program directed at low-income households with children.

The tax credits offered by the EITC program vary with one’s earnings and the number of dependent children. For purposes of our analysis, which is intended to illustrate the work-incentive effects of the EITC, we will focus on the credits in the year 2009 offered to unmarried workers with two children. Figure 6.17 graphs the relevant program characteristics for a worker with two children who could earn a market (unsubsidized) wage reflected by the slope of $AC$. As we will see later, for such a worker, the EITC created a budget constraint of $ABDEC$.

For workers with earnings of $12,570 or less, the tax credit was calculated at 40 percent of earnings. That is, for every dollar earned, a tax credit of 40 cents was also earned; thus, for those with earnings of under $12,570, net wages ($W_n$) were 40 percent higher than market wages ($W$). Note that this tax credit is represented by segment $AB$ on the EITC constraint in Figure 6.17 and that the slope of $AB$ exceeds the slope of the market constraint $AC$.

The maximum tax credit allowed for a single parent with two children was $5,028 in 2009. Workers who earned between $12,570 and $16,420 per year qualified for this maximum tax credit. Because these workers experienced no increases or reductions in tax credits per added dollar of earnings, their net wage is equal to their market wage. The constraint facing workers with earnings in this range is represented by segment $BD$ in Figure 6.17, which has a slope equal to that of segment $AC$.

For earnings above $16,420, the tax credit was gradually phased out, so that when earnings reached $40,295, the tax credit was zero. Because after $16,420 each dollar earned reduced the tax credit by 21 cents, the net wage of EITC recipients was only 79 percent of their market wage (note that the slope of segment $DE$ in Figure 6.17 is flatter than the slope of $AC$).
Figure 6.17
Earned Income Tax Credit (Unmarried, Two Children), 2009

Looking closely at Figure 6.17, we can see that EITC recipients will be in one of three “zones”: along $AB$, along $BD$, or along $DE$. The incomes of workers in all three zones are enhanced, which means that all EITC recipients experience an income effect that pushes them in the direction of less work. However, the program creates quite different net wage rates in the zones, and therefore the substitution effect differs across zones.

For workers with earnings below $12,570, the net wage is greater than the market wage (by 40 percent), so along segment $AB$, workers experience an increase in the price of leisure. Workers with earnings below $12,570, then, experience a substitution effect that pushes them in the direction of more work. With an income effect and a substitution effect that push in opposite directions, it is uncertain which effect will dominate. What we can predict, though, is that some of those who would have been out of the labor force in the absence of the EITC program will now decide to seek work (earlier, we discussed the fact that for non-participants in the labor force, the substitution effect dominates).

Segments $BD$ and $DE$ represent two other zones, in which theory predicts that labor supply will fall. Along $BD$, the net wage is equal to the market wage, so the price of leisure in this zone is unchanged while income is enhanced. Workers in this zone experience a pure income effect. Along segment $DE$, the net wage is actually below the market wage, so in this zone, both the income and the substitution effects push in the direction of reduced labor supply.

Using economic theory to analyze labor supply responses induced by the constraint in Figure 6.17, we can come up with two predictions. First, if an EITC
Regression analysis, described in Appendix 1A, allows us to analyze the effects of one or more independent variables on a dependent variable. This statistical procedure is based on an important assumption: that each independent variable is exogenous (determined by some outside force and not itself influenced by the dependent variable). That is, we assume that the chain of causation runs from the independent variables to the dependent variable, with no feedback from the dependent variable to those that we assume are independent.

The issue of exogeneity arises when estimating the effects on hours of work caused by a change in income (wages held constant). Theory leads us to predict that desired hours of work are a function of wages, wealth, and preferences. Wealth is not usually observed in most data sets, so nonlabor income, such as the returns from financial investments, is used as a proxy for it. Measuring the effect that nonlabor income (an independent, or causal, variable) has on desired hours of work (our dependent variable), holding the wage constant, is intended to capture the income effect predicted by labor supply theory.

The problem is that those who have strong preferences for income and weak preferences for leisure, for example, may tend to accumulate financial assets over time and end up with relatively high levels of nonlabor income later on. Put differently, high levels of work hours (supposedly our dependent variable) may create high levels of nonlabor income (what we hoped would be our independent variable); thus, when we estimate a correlation between work hours and nonlabor income, we cannot be sure whether we are estimating the income effect, some relationship between hard work and savings, or a mix of both (a problem analogous to the one discussed in the empirical study in chapter 4). In estimating the income effect, therefore, researchers must be careful to use measures of nonlabor income that are truly exogenous and not themselves influenced by the desired hours of work.

Are lottery winnings an exogenous source of nonlabor income? Once a person enters a lottery, winning is a completely random event and thus is not affected by work hours; however, entering the lottery may not be so independent. If those who enter the lottery also have the strongest preferences for leisure, for example, then correlating work hours and lottery winnings across different individuals would not necessarily isolate the income effect. Rather, it might just reflect that those with stronger preferences for leisure (and thus lower work hours) were more likely to enter (and thus win) the lottery.

Therefore, if we want to measure the income effect associated with winning the lottery, we need to find a way to hold both...
wages and preferences for leisure constant. One study of how winning the lottery affected labor supply took account of the preferences of lottery players by performing a before-and-after analysis using panel data on winners and nonwinners. That is, for winners—defined as receiving prizes over $20,000, with a median prize of $635,000—the authors compared hours of work for six years before winning to hours of work during the six years after winning. By focusing on each individual's changes in hours and lottery winnings over the two periods, the effects of preferences (which are assumed to be unchanging) drop out of the analysis.

“Nonwinners” in the study were defined as lottery players who won only small prizes, ranging from $100 to $5,000. Labor supply changes for them before and after their small winnings were then calculated and compared to the changes observed among the winners. The study found that for every $100,000 in prizes, winners reduced their hours of work such that their earnings went down by roughly $11,000 (that is, winners spent about 11 percent of their prize on “buying” leisure). These findings, of course, are consistent with the predictions concerning the income effect of nonlabor income on labor supply.


program is started or expanded, we should observe that the labor force participation rate of low-wage workers will increase. Second, a new or expanded EITC program should lead to a reduction in working hours among those along BD and DE (the effect on hours along AB is ambiguous).

Several studies have found evidence consistent with prediction that the EITC should increase labor force participation, with one study finding that over half of the increase in labor force participation among single mothers from 1984 to 1996 was caused by expansions in the EITC during that period. The evidence so far, however, does not indicate a measurable drop in hours of work by those receiving the tax credit.26 Thus, the labor supply responses to the EITC are very similar to those found in labor supply studies cited earlier (see footnote 17 and Example 6.5), in that labor force participation rates seem to be more responsive to wage changes than are the hours of work.

Countries at war often adopt “work requirement” policies to obtain needed food supplies involuntarily from their farming populations. Not surprisingly, the way in which these requisitions are carried out can have enormous effects on the work incentives of farmers. Two alternative methods are contrasted in this example: one was used by the Bolshevik government during the civil war that followed the Russian revolution and the other by Japan during World War II.

From 1917 to 1921, the Bolsheviks requisitioned from farmers all food in excess of the amounts needed for the farmers’ own subsistence; in effect, the surplus was confiscated and given to soldiers and urban dwellers. Graphically, this policy created a budget constraint for farmers like \( ACY_s \) in the following diagram (a). Because farmers could keep their output until they reached the subsistence level of income \( Y_s \), the market wage prevailed until income of \( Y_s \) was reached. After that, their net wage was zero (on segment \( CY_s \)), because any extra output went to the government. Thus, a prewar market constraint of \( AB \) was converted to \( ACY_s \) with the consequence that most farmers maximized utility near point C. Acreage planted dropped by 27 percent from 1917 to 1921, while harvested output fell by 50 percent!

Japan during World War II handled its food requisitioning policy completely differently. It required a quota to be delivered by each farmer to the government at very low prices, paying farmers the lump sum of \( EF \) in diagram (b). Japan, however, allowed farmers to sell any produce above the quota at higher (market) prices. This policy converted the prewar constraint of \( AB \) to one much like \( EFG \) in diagram (b). In effect, farmers had to work \( AE \) hours for the government, for which they were paid \( EF \), but they were then allowed to earn the market wage after that. This policy preserved farmers’ work incentives and apparently created an income effect that increased the total hours of work by Japanese farmers, for despite war-induced shortages of capital and labor, rice production was greater in 1944 than in 1941!

1. Referring to the definitions in footnote 5, is the following statement true, false, or uncertain? “Leisure must be an inferior good for an individual’s labor supply curve to be backward-bending.” Explain your answer.

2. Evaluate the following quote: “Higher take-home wages for any group should increase the labor force participation rate for that group.”

3. Suppose a government is considering several options to ensure that legal services are provided to the poor:
   - Option A: All lawyers would be required to devote 5 percent of their work time to the poor, free of charge.
   - Option B: Lawyers would be required to provide 100 hours of work, free of charge, to the poor.
   - Option C: Lawyers who earn over $50,000 in a given year would have to donate $5,000 to a fund that the government would use to help the poor.
Discuss the likely effects of each option on the hours of work among lawyers. (It would help to draw the constraints created by each option.)

4. The way the workers’ compensation system works now, employees permanently injured on the job receive a payment of $X each year, whether they work or not. Suppose the government were to implement a new program in which those who did not work at all got $0.5X, but those who did work got $0.5X plus workers’ compensation of 50 cents for every hour worked (of course, this subsidy would be in addition to the wages paid by their employers). What would be the change in work incentives associated with this change in the way workers’ compensation payments were calculated?

5. A firm wants to offer paid sick leave to its workers, but it wants to encourage them not to abuse it by being unnecessarily absent. The firm is considering two options:
   - a. Ten days of paid sick leave per year; any unused leave days at the end of the year are converted to cash at the worker’s daily wage rate.
   - b. Ten days of paid sick leave per year; if no sick days are used for two consecutive years, the company agrees to buy the worker a $100,000 life insurance policy.
Compare the work-incentive effects of the two options, both immediately and in the long run.

6. In 2002, a French law went into effect that cut the standard workweek from 39 to 35 hours (workers got paid for 39 hours even though they worked 35) while at the same time prohibiting overtime hours from being worked. (Overtime in France is paid at 25 percent above the normal wage rate).
   - a. Draw the old budget constraint, showing the overtime premium after 39 hours of work.
   - b. Draw the new budget constraint.
   - c. Analyze which workers in France are better off under the 2002 law. Are any worse off? Explain.

7. Suppose there is a proposal to provide poor people with housing subsidies that are tied to their income levels. These subsidies will be in the form of vouchers the poor can turn over to their landlords in full or partial payment of their housing expenses. The yearly subsidy will equal $2,400 as long as earnings do not exceed $8,000 per year. The subsidy is to be reduced 60 cents for every dollar earned in excess of $8,000; that is, when earnings

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Review Questions

1. Referring to the definitions in footnote 5, is the following statement true, false, or uncertain? “Leisure must be an inferior good for an individual’s labor supply curve to be backward-bending.” Explain your answer.

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reach $12,000, the person is no longer eligible for rent subsidies.
Draw an arbitrary budget constraint for a person, assuming that he or she receives no government subsidies. Then draw in the budget constraint that arises from the above housing subsidy proposal. After drawing in the budget constraint associated with the proposal, analyze the effects of this proposed housing subsidy program on the labor supply behavior of various groups in the population.

8. The Tax Reform Act of 1986 was designed to reduce the marginal tax rate (the tax rate on the last dollars earned) while eliminating enough deductions and loopholes so that total revenues collected by the government could remain constant. Analyze the work-incentive effects of tax reforms that lower marginal tax rates while keeping total tax revenues constant.

9. The current UI program in the United States gives workers $X per day if they are unemployed but zero if they take a job for even 1 hour per day. Suppose that the law is changed so that UI beneficiaries can keep getting benefits of $X per day if they work 2 or fewer hours per day, but if they work more than 2 hours per day, their UI benefits end. Draw the old and new budget constraints (clearly labeled) associated with the UI program, and analyze the work incentives of this proposed change.

10. Assume that the current Disability Insurance (DI) benefit for those who are unable to work is $X per day and that DI benefits go to zero if a worker accepts a job for even 1 hour per week. Suppose that the benefit rules are changed so those disabled workers who take jobs that pay less than $X per day receive a benefit that brings their total daily income (earnings plus the DI benefit) up to $X. As soon as their labor market earnings rise above $X per day, their disability benefits end. Draw the old and new budget constraints (label each clearly) associated with the DI program, and analyze the work-incentive effects of the change in benefits.

Problems

1. When the Fair Labor Standards Act began to mandate paying 50 percent more for overtime work, many employers tried to avoid it by cutting hourly pay so that total pay and hours remained the same.
   a. Assuming that this 50 percent overtime pay premium is newly required for all work beyond eight hours per day, draw a budget constraint that pictures a strategy of cutting hourly pay so that at the original hours of work, total earnings remain the same.
   b. Suppose that an employer initially paid $11 per hour and had a 10-hour workday. What hourly base wage will the employer offer so that the total pay for a 10-hour workday will stay the same?
   c. Will employees who used to work 10 hours per day want to work more or fewer than 10 hours in the new environment (which includes the new wage rate and the mandated overtime premium)?

2. Nina is able to select her weekly work hours. When a new bridge opens up, it cuts one hour off Nina’s total daily commute to work. If both leisure and income are normal goods, what is the effect of the shorter commute on Nina’s work time?

3. Suppose you win a lottery, and your after-tax gain is $50,000 per year until
you retire. As a result, you decide to work part time at 30 hours per week in your old job instead of the usual 40 hours per week.

a. Calculate the annual income effect from this lottery gain based on a 50-week year. Interpret the results in light of the theory presented in this chapter.

b. What is the substitution effect associated with this lottery win? Explain.

4. The federal minimum wage was increased on July 24, 2007, to $5.85 from $5.15. If 16 hours per day are available for work and leisure, draw the daily budget constraint for a worker who was earning the minimum wage rate of $5.15 and the new budget constraint after the increase.

5. Suppose Michael receives $50 per day as interest on an inheritance. His wage rate is $20 per hour, and he can work a maximum of 16 hours per day at his job. Draw his daily budget constraint.

6. Stella can work up to 16 hours per day at her job. Her wage rate is $8.00 per hour for the first 8 hours. If she works more than 8 hours, her employer pays “time and a half.” Draw Stella’s daily budget constraint.

7. Teddy’s daily budget constraint is shown in the following chart. Teddy’s employer pays him a base wage rate plus overtime if he works more than the standard hours. What is Teddy’s daily nonlabor income? What is Teddy’s base wage rate? What is Teddy’s overtime wage rate? How many hours does Teddy need to work to receive overtime?

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**Selected Readings**


