of economic fluctuations, we will consider the other components and the other influences. Let us begin by examining why consumption may be affected by income.

The Consumption Function

The consumption function describes how consumption depends on income. The notion of a consumption function originated with John Maynard Keynes, who wrote about it during the 1930s. Research on the consumption function has been intense ever since. For each individual, the consumption function says that the more income one has, the more one consumes. For the national economy as a whole, it says that the more income Americans have, the more Americans consume. For the world economy as a whole, it says that the more income the world has, the more the people in the world consume. Table 23-1 gives a simple example of how consumption depends on income in the U.S. economy.

As you can see from the table, as income increases from $1,000 billion to $2,000 billion, consumption increases as well, from $2,000 billion to $2,600 billion, and as income increases from $3,000 billion to $4,000 billion, consumption increases from $3,200 billion to $3,800 billion. More income means more consumption, but the consumption function also tells us how much consumption increases when income increases. Each change in income of $1,000 billion causes an increase in consumption of $600...
billion. The changes in consumption are smaller than the changes in income. Notice that, in this example, at very low levels of income, consumption is greater than income. If consumption were greater than income for a particular individual, that individual would have to borrow. At higher levels of income, when consumption is less than income, the individual would be able to save.

The consumption function is supposed to describe the behavior of individuals because the economy is made up of individuals. Consequently, it summarizes the behavior of all people in the economy with respect to consumption. The simple consumption function is not meant to be the complete explanation of consumption. Recall that it is based on a simplifying assumption.

The Marginal Propensity to Consume A concept related to the consumption function is the marginal propensity to consume (MPC). The MPC measures how much consumption changes for a given change in income. The term marginal refers to the additional amount of consumption that is due to a change in income. The term propensity refers to the inclination to consume. By definition,

\[
\text{Marginal Propensity to Consume (MPC)} = \frac{\text{change in consumption}}{\text{change in income}}
\]

What is the MPC for the consumption function in Table 23-1? Observe that the change in consumption from row to row is 600. The change in income from row to row is 1,000; thus, the MPC = 600/1,000 = 0.6. Although this is only a simple example, the MPC for the U.S. economy is around that magnitude.

Figure 23-3 graphs the consumption function by putting income on the horizontal axis and consumption on the vertical axis. We get the upward-sloping line by plotting the pairs of observations on consumption and income in Table 23-1 and connecting them with a line. This line, which demonstrates that consumption rises with income, is the consumption function. Its slope is equal to the MPC. For this example, the

### Table 23-1

<table>
<thead>
<tr>
<th>Consumption (billions of dollars)</th>
<th>Income (billions of dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,000</td>
<td>1,000</td>
</tr>
<tr>
<td>2,600</td>
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</tr>
<tr>
<td>9,800</td>
<td>14,000</td>
</tr>
</tbody>
</table>

marginal propensity to consume (MPC) the slope of the consumption function, showing the change in consumption that is due to a given change in income.

### Figure 23-3

The Consumption Function For the economy as a whole, more income leads to more consumption, as shown by the example of an upward-sloping consumption function in the figure. This represents the sum of all the individuals in the economy, many of whom consume more when their income rises. The graph is based on the numbers in Table 23-1.
MPC = 0.6. The graph shows that at low levels of income, consumption is greater than income, but at high levels of income, consumption is less than income.

**Which Measure of Income?** The consumption function is a straight-line relationship between consumption and income. Income in the relationship is sometimes measured by *aggregate income* ($Y$), which also is equal to real GDP, and sometimes by disposable income. *Disposable income* is the income that households receive in wages, dividends, and interest payments plus transfers they may receive from the government minus any taxes they pay to the government. Disposable income is the preferred measure of income when one is interested in household consumption because this is what households have available to spend. But the consumption function for the whole economy for aggregate income and that for disposable income look similar because aggregate income and disposable income fluctuate and grow together. In the United States and most other countries, taxes and transfers are nearly proportional to aggregate income.

For the rest of this chapter, we will use aggregate income, or real GDP, as the measure of income in the consumption function. We put real GDP, or income (we drop the word *aggregate* in *aggregate income*), on the horizontal axis of the consumption function diagram, because real GDP and income always are equal. Figure 23-4 shows the actual relationship between consumption and income, or real GDP. Note, however, that when we consider an explicit change in taxes, we must take into account the difference between disposable income and income.

**What about Interest Rates and Other Influences on Consumption?**

Other factors besides income affect consumption. For example, you may recall from Chapter 19 that people’s consumption is affected by the interest rate. Also, people’s wealth—including their savings in a bank and their house—may affect their consumption. A person with a large amount of savings in a bank might consume a considerable amount even if the person’s income in any one year is very low. Why have we not brought the interest rate or wealth into the picture here?

The answer is simple. To keep the analysis manageable at the start, we are putting the interest rate and other influences aside. We eventually return to consider the effects of interest rates and other factors on consumption. But during economic fluctuations, the effects of changes in income on consumption are most important, and we focus on these now.
Making *Time*'s Top 100

John Maynard Keynes was chosen by *Time* magazine as one of the 100 most influential people in the twentieth century. Keynes was the inventor of the marginal propensity to consume and of the broader idea emphasized in this chapter that a decline in aggregate demand could bring the economy below its potential.

Keynes was always active in bringing economics into practice. He gained notoriety in his thirties for a best-selling book called *The Economic Consequences of the Peace*, written in only two months during the summer of 1919. Keynes was an economic adviser to the British government, and he accompanied the prime minister to the Versailles peace conference in 1919 at the end of World War I. At that peace conference, the victors demanded heavy reparations from Germany, harming the German economy and thereby helping Hitler in his rise to power. In his 1919 book, Keynes predicted serious harm from the stiff reparations and ridiculed the heads of government at the conference, including his own prime minister, David Lloyd George, and the American president, Woodrow Wilson.

Keynes’s most influential book, however, was *The General Theory of Employment, Interest and Money*. He wrote it in the midst of the Great Depression, providing an explanation for a worldwide tragedy that prevailing economic theory—with its microeconomic emphasis—hardly addressed. Much of the *General Theory* is difficult to read unless you are an economist, because as Keynes put it, his book is chiefly addressed to “my fellow economists.” But Keynes’s well-developed writing skills emerge in some of the less technical passages, especially those on speculation and expectations in financial markets. Keynes’s ideas, such as the marginal propensity to consume and the importance of aggregate demand, spread rapidly and had a lasting influence: Referring to these ideas as the “Keynesian revolution” is no exaggeration.

Keynes’s *Tract on Monetary Reform*, written in 1923, focused more on inflation than did the *General Theory*. His earlier writings suggest that if he had lived longer, he might have explained the high inflation of the 1970s as effectively as he explained the Great Depression of the 1930s.

Keynes appeared on the cover of *Time* magazine in 1965, when the influence of his economics was at its peak in Washington. However, in the 1970s, when inflation was rising and economic growth was slowing, Keynes’s theory was criticized because it did not deal with inflation and with long-run economic growth. Moreover, by emphasizing aggregate demand so much, Keynes’s theory suggested to some policy makers that increases in government spending could increase real GDP almost without limit, regardless of supply constraints. Any thoughts that Keynes had waned in influence after the 1970s disappeared during the current recession. As economists and policy makers worried about whether the 2008–2009 recession would turn into another economic depression, Keynesian ideas and policies once again began to play a major role in policy circles and the news. Debates about the appropriate size of a fiscal stimulus program and the effectiveness of that stimulus program revolved around the concept of the Keynesian multiplier, an idea that you will learn about later in this chapter.

**John Maynard Keynes, 1883–1946**

*Born:* Cambridge, England, 1883  
*Education:* Cambridge University, graduated 1906  
*Major Publications:* *The Economic Consequences of the Peace*, 1919; *A Tract on Monetary Reform*, 1923; *A Treatise on Money*, 1930; *The General Theory of Employment, Interest and Money*, 1936
Finding Real GDP When Consumption and Income Move Together

Now let us use the consumption function to get a better prediction of what happens to real GDP in the short run when government purchases change. In other words, we want to improve the conditional forecast of real GDP when government purchases change by taking the consumption function into account. Again, as in the earlier example of forecasting, let us assume that government spending will increase by $500 billion next year. Our goal is to find out what happens to real GDP in the short run.

Our first attempt at forecasting proposed that an increase in government spending would increase real GDP. But now we see that something else must happen, because consumption depends on income, and real GDP is equal to income. An increase in government spending will increase income. The consumption function tells us that an increase in income must increase consumption, which further increases GDP.

Here is the chain of logic in brief:

1. An increase in government spending increases real GDP.
2. Real GDP equals income; thus income increases.
3. Consumption depends on income; thus consumption increases.
4. An increase in consumption further increases real GDP.

In sum, consumption will increase when we raise government spending.

For example, when the government increases spending on new highway construction, the firms that produce materials and services for highway construction find demand rising and produce more. Existing workers work more hours and new workers find jobs working on highway construction. Therefore, they will receive a higher income than before. In addition, the profits at the construction firms will increase; thus, the income of the owners of the firms will rise as well. With more income, the workers and the owners will spend more; that is, their consumption will rise. This is the connection between government spending and consumption about which we are concerned: The increase in government purchases raises construction workers’ income, which results in more consumption.

The process can work in reverse as well. This type of logic was applied by economists to estimate the impact of closing Fort Ord, the military base near Monterey Bay in California, on the Monterey economy. When the estimates were made, the base employed 3,000 civilians and 14,000 military personnel. Payroll was $558 million. Thus, closing the base would reduce incomes by as much as $558 million as these workers were laid off or retired. Although some workers might quickly find jobs elsewhere, the decline in income would result in a reduction in consumption by those workers. Using an MPC of 0.6, consumption would decline by $335 million (0.6 times 558) if income was reduced by $558 million. This reduced income would tend to throw others in the Monterey area

REVIEW

- The consumption function describes the response of consumption to changes in income. The elementary consumption function ignores the effects of interest rates and wealth on consumption.
- The MPC tells us how much consumption changes in response to a change in income.
- For the economy as a whole, the consumption function can be expressed in terms of aggregate income or disposable income. Aggregate income is always equal to real GDP.
out of work as spending in retail and service stores declined. This would further reduce consumption, and so on. Although this case study refers to a small region of the entire country, the same logic applies to the economy as a whole.

**The 45-Degree Line**

We can use a convenient graph to calculate how much income and consumption change in the whole economy and thereby project what will happen to real GDP. A line in Figure 23-5 shows graphically that income in the economy is equal to spending. In Figure 23-5, income is on the horizontal axis and spending is on the vertical axis. All the points at which spending equals income are on the upward-sloping line in Figure 23-5. The line has a slope of 1, or an angle of 45 degrees with the horizontal axis, because the distances from any point on the line to the horizontal axis and the vertical axis are equal. Along that line—which is called the **45-degree line**—spending and income are equal.

**The Expenditure Line**

Figure 23-6 shows another relationship called the **expenditure line**. As in Figure 23-5, income, or real GDP, is on the horizontal axis, and spending is on the vertical axis. The top line in Figure 23-6 is the expenditure line. It is called the expenditure line because it shows how expenditure, or spending, depends on income. The four components that make up the expenditure line are consumption, investment, government purchases, and net exports. The expenditure line, however, shows how these four components depend on income. It is this dependency of spending on income that is the defining characteristic of the expenditure line. The next paragraph explains how the expenditure line is derived.

The consumption function is shown as the lowest line in Figure 23-6. It is the consumption function from Figure 23-3, which says that the higher income is, the more people want to consume. The next line above the consumption function in Figure 23-6 is parallel to the consumption function. This line represents the addition of investment to consumption at each level of income. It says that investment is so many billions of

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**Figure 23-5**

**The 45-Degree Line**

This simple line is a graphical representation of the income equals spending identity. The pairs of points on the 45-degree line have the same level of spending and income. For example, the level of spending at $A$ is the same dollar amount as the level of income at $A$. Moreover, because income equals real GDP, we can put either income or real GDP on the horizontal axis.
dollars in the U.S. economy, and the distance between the lines is this amount of investment. For example, if investment equals $800 billion, the distance between the consumption function and this line is $800 billion.

The reason the line is parallel to the consumption line is that we are starting our explanation by saying that investment does not depend on income. This simplifying assumption means that investment is a constant number, and the distance between the lines is the same regardless of income. We just add the same amount at each point.

The next line in Figure 23-6 adds in a constant level of government purchases. This line is also parallel to the other lines because the increase at every level of income is the same. The distance between the lines represents a fixed level of government purchases, say, $2,500 billion, at every level of income.

Finally, to get the top line in Figure 23-6, we add in net exports. For simplicity, we assume that net exports do not depend on income, an assumption that we will change soon. Thus, the top line is parallel to all the other lines. The top line is the sum of $C + I + G + X$. It is the expenditure line. The most important thing to remember about the expenditure line is that it shows how the sum of the four components depends on income. Before we can use the expenditure line, we must know what determines its slope and what causes it to shift.

The Slope of the Expenditure Line Observe in Figure 23-6 that the expenditure line is parallel to the consumption function. Therefore, the slope of the expenditure line is the same as the slope of the consumption function. We already know that the slope of the consumption function is the MPC. Hence, the slope of the expenditure line also is equal to the MPC.

Because the MPC is less than 1, the aggregate expenditure line is flatter (the slope is smaller) than the 45-degree line, which has a slope of exactly 1. This fact will soon be used to find real GDP.

Shifts in the Expenditure Line The expenditure line can shift for several reasons. Consider first what happens to the expenditure line if government purchases fall
because of a cut in defense spending. As shown in Figure 23-7, the expenditure line shifts downward in a parallel fashion. The expenditure line is simply the sum \( C + I + G + X \). Because \( G \) is less at all income levels, the line shifts down. The expenditure line is lowered because the distance between the consumption function and the other lines declines (see Figure 23-6). The reverse of this, an increase in government purchases, will cause the expenditure line to shift up.

What happens to the expenditure line if investment falls? Investment, remember, is the gap between the first and second lines in Figure 23-6. If investment declines (as might happen if businesses become pessimistic about the future and invest less), then the expenditure line shifts downward. With less investment, the gap between the lines shrinks. The reverse of this, an increase in investment, will cause the expenditure line to shift up, as shown in Figure 23-7.

A change in net exports, perhaps because of a change in the demand for U.S. exports to other countries, also will shift the expenditure line. A downward shift in net exports lowers the expenditure line, and an upward shift in net exports raises the expenditure line.

Finally, the expenditure line also can be shifted by changes in taxes. At any given level of income, an increase in taxes means that people have less to spend, and this will cause people to consume less. Hence, the expenditure line shifts down when taxes rise. The reverse of this, a cut in taxes, causes the expenditure line to shift up. We will use the symbol \( T \) to refer to taxes. For example, if \( T = $1,500 \) billion, then people pay and the government receives $1,500 billion in taxes.

**Determining Real GDP through Spending Balance**

Having derived the expenditure line and the 45-degree line, we can combine the two to find real GDP. Figure 23-8 shows the expenditure line and the 45-degree line combined in one diagram. Observe that the two lines intersect. They must intersect because they have different slopes. Real GDP is found at the point of intersection of these two lines. Why?

Income and spending always are equal, and the 45-degree line is drawn to represent this equality. Therefore, at any point on the 45-degree line, income equals spending.
Moreover, income and spending must be on the expenditure line, because only at points on that line do people consume according to the consumption function.

If both relationships hold—that is, income and spending are the same (we are on the 45-degree line) and people’s consumption is described by the consumption function (we are on the expenditure line)—then, logically, we must be at the intersection of these two lines. We call that point of intersection spending balance. The level of income determined by that point is just the right level to cause people to purchase an amount of consumption that—when added to investment, government purchases, and net exports—gives exactly the same level of income. We would not have spending balance at either a higher or a lower level of income. The diagram in Figure 23-8 showing that the 45-degree line and the expenditure line cross is sometimes called the “Keynesian Cross” after John Maynard Keynes.

Table 23-2 provides an alternative way to determine spending balance. It uses a numerical tabulation of the consumption function rather than graphs. Total expenditure is obtained by adding the four columns on the right of Table 23-2. Consumption is shown to depend on income according to the same consumption function as in Table 23-1. Observe that income equals total expenditure in only one row. That row is where spending balance occurs. The row is shaded and corresponds to the point of intersection of the 45-degree line and the expenditure line in Figure 23-8.

Because the point of spending balance is at the intersection of two lines, we can think of it as an equilibrium, much as the intersection of a demand curve and a supply curve for wheat is an equilibrium. Because real GDP is not necessarily equal to potential GDP at this intersection, however, in a sense, the equilibrium is temporary; real GDP eventually will move back to potential GDP, as we will show in later chapters.

The point of spending balance is also an equilibrium in the sense that economic forces cause real GDP to be at that intersection. To see this, consider Table 23-2. As we noted, the shaded row corresponds to the intersection of the 45-degree line and the expenditure line: Income or real GDP equals expenditure. Suppose that income or real GDP were less than expenditure, as in one of the rows above the shaded row in Table 23-2. This would
not be an equilibrium because firms would not be producing enough goods and services (real GDP) to satisfy people’s expenditure on goods and services. Firms would increase their production, and real GDP would rise until it equaled expenditure. Similarly, if real GDP were greater than expenditure, as in one of the rows below the shaded row in Table 23-2, firms would be producing more than people would be buying. Hence, firms would reduce their production, and real GDP would fall until it equaled expenditure.

A Better Forecast of Real GDP

Now let us return to forecasting real GDP using these new tools. Recall the example of making a forecast of real GDP for the year 2011 (from the vantage point of December 2010), conditional on a proposed increase in government purchases of $500 billion. Our new tools will enable us to take into account the effect of this increase on consumption, which we ignored in the simple forecast.

Figure 23-9 shows two expenditure lines. The bottom expenditure line is without the change in government purchases. In this case, \( G = \$2,500 \) billion, \( C = \$9,600 \) billion, \( I = \$1,900 \) billion, and \( X = –\$500 \) billion, yielding income, or real GDP, of \$13,500 billion. For the conditional forecast, we assume that \( G \) is increased by \$500 billion, to \$3,000 billion. In Figure 23-9, that causes the expenditure line to shift up to the “new” line. Observe that the expenditure line shifts up by \$500 billion—a parallel shift. This new expenditure line cuts the 45-degree line at a lower point.

Logic tells us that the economy will now operate at a different point of spending balance, the point at which the expenditure line and the 45-degree line now intersect. Thus, we move from one intersection to a new intersection as a result of the increase in the expenditure line. The new point of spending balance is at a higher level of GDP.

We now have a prediction that real GDP will rise if government spending increases. Observe in Figure 23-9 that the increase in real GDP is larger than the \$500 billion increase in government purchases and, therefore, larger than the \$500 billion decline in real GDP in the simple forecast. In addition to the increase in government purchases, consumption has risen because income has increased. The initial \$500 billion is multiplied to create a larger than \$500 billion change in real GDP because of the induced change in consumption. This multiplier phenomenon, which makes the change in real GDP larger than the change in government purchases, is called the Keynesian multiplier and applies to increases as well as to decreases in government purchases. In Figure 23-9, the multiplier looks quite large; the horizontal arrow is at least twice as large as the

### Table 23-2

<table>
<thead>
<tr>
<th>Income or Real GDP</th>
<th>Total Expenditure</th>
<th>Consumption</th>
<th>Investment</th>
<th>Government Purchases</th>
<th>Net Exports</th>
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