Both Mr. Osborne and Mr. Bernanke seem to be predicting that, over time, increases in government spending and higher budget deficits would result in less investment and less accumulation of capital in the economy. In this section, we develop an economic model that will help you better understand how lower budget deficits and decreasing the share of government purchases in gross domestic product (GDP) would result in lower interest rates, and, in turn, how lower interest rates would raise the share of investment in GDP.

The model we develop is called the spending allocation model because of its use in determining how GDP is allocated among the major components of spending: consumption, investment, government purchases, and net exports. Because each share of spending must compete for the scarce resources in GDP, an increase in the share of one of the components will lead to a reduction in the share of another component. Our model shows that real interest rates are a key factor that both influences and is influenced by spending. By explaining how real interest rates are determined in the long run, our model helps us predict how much of GDP in the long run goes to each of the four components.

The spending allocation model has some useful applications. You can use it to understand why the aging of the population of the United States, coupled with the increases in spending that will be required for programs like Medicare and social security, poses a threat to U.S. citizens. The increased costs of these programs makes it difficult to invest and grow in the decades ahead, and also difficult to understand how a reduction in government purchases in the early 1990s could have led to a boom in investment in the United States.

As you study the spending allocation model, it is imperative that you keep in mind that this model applies more to the long run than to the short run. Therefore, it is most useful in thinking about economic developments that occur over a period of years instead of months. For example, Mr. Bernanke was careful to talk about implications that were decades into the future instead of implications for the state of the economy in 2011.

The Spending Shares

We know that GDP is divided into four components: consumption, investment, government purchases, and net exports. Symbolically,

\[ Y = C + I + G + X \]

where \( Y \) equals GDP, \( C \) equals consumption, \( I \) equals investment, \( G \) equals government purchases, and \( X \) equals net exports. This equation is the starting point for determining how large a share of GDP is allocated to each spending component.

Defining the Spending Shares

We define the spending shares by looking at how GDP is allocated among its various components. The consumption share of GDP is the proportion of GDP that is used.
The consumption share of GDP is defined as consumption ($C$) divided by GDP, or $C/Y$. For example, if $C = $6 trillion and $Y = $10 trillion, then the consumption share is $C/Y = 0.6$, or 60 percent. We can define the other shares of GDP analogously: $I/Y$ is the investment share, $X/Y$ is the net exports share, and $G/Y$ is the government purchases share. Sometimes the investment share is called the investment rate.

We can establish a simple relationship between the shares of spending in GDP by taking the equation $Y = C + I + G + X$ and dividing both sides by $Y$. This simple division gives us a relationship that says that the sum of the shares of spending in GDP must equal one. Writing that algebraically yields the following:

$$1 = \frac{C}{Y} + \frac{I}{Y} + \frac{G}{Y} + \frac{X}{Y}$$

If we use the shares that existed in 2010 (see Table 18-2 in Chapter 18), we get

$$1 = \frac{10,352}{14,660} + \frac{1,821}{14,660} + \frac{3,002}{14,660} + \frac{-515}{14,660} = .706 + .124 + .205 + (-0.035)$$

In other words, consumption accounted for around 70.6 percent of GDP, investment for 12.4 percent of GDP, government purchases for 20.5 percent of GDP, and net exports, in deficit at negative $515 billion, for negative 3.5 percent of GDP. The negative share for net exports occurs because Americans imported more than they exported in 2010. In this example, the sum of the four shares on the right equals one, or, in percentage terms, 100 percent. And, of course, this must be true for any year.

Figure 19-1 shows the four shares of spending in GDP for the last 75 or so years in the United States. A huge temporary fluctuation in the shares of spending in GDP occurred in World War II, when government spending on the military rose sharply. Government purchases reached almost 50 percent of GDP, and the other three shares declined. Since World War II, the shares have been much steadier, but the movements

**Figure 19-1**

**History of Spending Shares in GDP**

The government purchases share rose sharply during World War II, and the other three shares declined. The government purchases share fell in the late 1990s before rising again in recent years.
in government spending as a share of GDP seem to be related to the movements in the investment share of GDP. Between 1990 and 2000, the government purchases share decreased from about 20 percent to 17.5 percent, while the investment share increased from 14.8 percent to 17.7 percent. Between 2000 and 2010, however, the government purchases share of GDP increased from 17.5 percent to 20.5 percent, while the investment share decreased from 17.7 percent to 12.4 percent. The other two shares have shown more sustained patterns: The consumption share generally has been rising during the 30-year period 1980–2010, while the net exports share has been negative over that period, as the United States ran trade deficits that got progressively larger in the period leading up to the 2009 recession. (Recall that when net exports are negative, there is a trade deficit.)

**If One Share Goes Up, Another Must Go Down**

The shares of spending equation demonstrates a simple but important point: A change in one of the shares implies a change in one or more of the other shares. That the shares must sum to one means that an increase in any of the shares must entail a reduction in one of the other shares. For example, an increase in the share of spending going to government purchases must result in a decrease in the share going to one or more of the other components of spending. Similarly, a decrease in the government purchases share must result in an increase in some other share, such as the investment share. One cannot have an increase in government purchases as a share of GDP (going from, say, 20 percent to 25 percent) without a decline in the share of either consumption or investment or net exports.

What determines how the shares of GDP are allocated? What is the mechanism through which a change in one share—such as the government share of GDP—brings about a change in one of the other shares? Is it only the investment share that changes in response to a rise in the government share of GDP? Or do the consumption and net exports shares change as well? Which share would change by more as a result of the increase in the government share? To answer these questions, we develop the spending allocation model. At the heart of the spending model lies the real interest rate, which plays an important role in relating changes in one share to changes in another. We begin the derivation of the spending allocation model by taking a closer look at how real interest rates influence the various shares of GDP.

Before beginning this derivation of the spending allocation model, it is important to remember that the spending allocation model relates changes in one spending share to changes in the other spending shares in the long run. Recall from Chapter 17 that potential GDP is the economy’s long-term trend level of GDP. We will refer to potential GDP as $Y^*$, to distinguish it from GDP. In the short run, actual GDP can (and does) fluctuate around potential GDP, but in the long run, we know that GDP is equal to potential GDP ($Y = Y^*$).

We will modify the equation that relates the shares to one another to represent a long-run relationship among the values of the spending shares. Because $Y = Y^*$ in the long run, this relationship can easily be written as follows:

$$1 = \frac{C}{Y^*} + \frac{I}{Y^*} + \frac{G}{Y^*} + \frac{X}{Y^*}$$

The intuition is unchanged—an increase in the long-run share of one of the components of GDP implies a decrease in the long-run share of one or more of the other components.
The Effect of Interest Rates on Spending Shares

In this section, we show that the interest rate affects the three shares of spending by the private sector: consumption, investment, and net exports. Each private-sector spending component competes for a share of GDP along with government purchases, and the interest rate is a key factor in determining how the spending is allocated.

Consumption

In the long run, the value of the consumption share of GDP \( \frac{C}{Y^*} \) depends on people’s decisions to consume, which are like any other choice with scarce resources, as defined in Chapter 1. If people decide to consume a larger fraction of their income, then the consumption share of GDP will increase. Conversely, if people decide to lower the fraction of income that they consume, then the consumption share of GDP will decrease.

**Consumption and the Real Interest Rate** Keep in mind that people’s decisions to consume more or less of their income today have implications for their consumption decisions tomorrow. Individuals who consume more today save less, and therefore have less to consume tomorrow. On the other hand, individuals who consume less today save more, and therefore have more to consume tomorrow. A person’s choice between consuming today and consuming tomorrow depends on a relative price, just like any other economic decision. The price of consumption today relative to the price of consumption tomorrow is the real interest rate.

Why is the real interest rate the relative price of current consumption? If the real interest rate is high, then any saving you do today will deliver more funds in the future, which then can be used for future consumption (a larger home or more college education, for example). Conversely, when the real interest rate is high, increasing current consumption will reduce your saving and result in your passing up opportunities for future consumption.
We can better illustrate this link between the real interest rate and consumption with a numerical example. Suppose you earned enough to buy $1,000 worth of goods, but you were buying only $900 worth of goods and saving the remainder. If the real interest rate was 2 percent, your saving plus the interest you earned would allow you to consume $102 worth of goods next year. In other words, by consuming $100 less in goods today, you get to consume $102 more in goods tomorrow. But if the real interest rate instead were 6 percent, you would be able to consume $106 worth of goods in a year by consuming $100 less in goods today. The increase in the real interest rate from 2 percent to 6 percent raises the price of consuming $100 worth of goods today by $4 worth of goods in the future.

Even though this may seem like a small amount, keep in mind that small differences in interest rates can add up when you consider saving large sums of money to finance a college education or to save for retirement. So a higher real interest rate gives people more incentive to consume less and save for the future, whereas a lower real interest rate gives people more incentive to consume today instead of saving for the future. We therefore can conclude that consumption is negatively related to the real interest rate.

What is true for individuals on average also will be true for the economy as a whole. Figure 19-2 describes an economy in which the consumption share is negatively related to the real interest rate. For this example, when the real interest rate is 4 percent, the share of consumption in GDP will be about 65 percent. If the real interest rate increases to 8 percent, then the share declines to 64 percent. Alternatively, if the real interest rate declines, the consumption share increases.

**Movements Along versus Shifts of the Consumption Share Line**

Observe that the relationship between the real interest rate and consumption as a share of GDP in Figure 19-2 looks like a demand curve. Like a demand curve, it is downward sloping. And like a demand curve, it shows the quantity that consumers are willing to consume at each price, where the price is the real interest rate. A higher price—that is, a higher real interest rate—reduces the amount of goods and services that people will consume, and a lower price—that is, a lower real interest rate—increases the amount that they will consume. As with demand curves, when a change in the price (in this case, the real interest rate) leads to a change in the quantity demanded (in this case, the consumption share), we see a movement along the consumption share line, as shown in Figure 19-2.

As with a demand curve, it is also important to distinguish such movements along the consumption share line from shifts of the consumption share line. The real interest rate is not the only thing that affects consumption as a share of GDP. When a factor other than the real interest rate changes the consumption share of GDP, the consumption share line in Figure 19-2 shifts. For example, an increase in taxes on
consumption—such as a national sales tax—would reduce the quantity of goods people would consume relative to their income. In other words, an increase in taxes on consumption would shift the consumption share line in Figure 19-2 to the left: Less would be consumed relative to GDP at every interest rate. Conversely, a decrease in taxes on consumption would shift the consumption share line in Figure 19-2 to the right.

**Investment**

A similar inverse, or negative, relationship exists between investment and the real interest rate. When businesses decide to invest, by buying new machines and equipment or by building a new factory, they need funds. Typically, they acquire these funds by borrowing. Higher real interest rates raise the cost of borrowing—the firm would need to produce enough additional output to pay back the loan plus interest, which implies that it would be willing to borrow only if it were confident about the success of the investment project. Another way of stating this is that investment projects undertaken at lower real interest rates may be postponed or canceled when interest rates rise because of the higher costs of borrowing.

Therefore, when real interest rates rise, firms are less likely to spend on investment, fewer new equipment purchases will be made, and fewer new factories will be built. Conversely, when real interest rates fall, firms are encouraged to spend more on investment, more equipment will be purchased, and more new factories will be built. This relationship holds even if firms use their own funds to finance their investment projects. Higher real interest rates increase the opportunity cost of using their own funds for investment: Firms are tempted to leave their money in the bank earning the higher interest rate, instead of putting those funds into investment projects.

Recall that investment also includes the purchases of new houses by individuals. Most people need to take out loans (mortgages) to purchase houses. When the real interest rate on mortgages rises, people purchase fewer or smaller houses because they would have to give up too much consumption to repay their mortgage plus interest; when the real interest rate falls, people purchase more or larger houses because they are more easily able to repay their mortgage plus interest. The story would be similar even if individuals used their savings to pay for their new home. A higher real interest rate increases the opportunity cost of taking the money out of the bank account and using it to buy a house.

Combining the behavior of firms that borrow or use their own funds to finance investment projects with that of individuals who take out mortgages or use their own funds to buy houses, the negative relationship between investment as a share of GDP and the interest rate that has been observed in the economy for many years makes sense: A higher real interest rate discourages investment, and a lower real interest rate encourages investment. Figure 19-3
shows this negative relationship between the interest rate and the investment share. For this example, when the interest rate rises from 4 percent to 8 percent, the investment share decreases from 15 percent to 12 percent. Economists have observed that investment is more sensitive to interest rates than consumption is. Therefore, the line for \( I/Y^* \) in Figure 19-3 is flatter than the line for \( C/Y^* \) in Figure 19-2. As before, when a change in the real interest rate leads to a change in the investment share, this is reflected as a movement along the consumption share line. An example is shown in Figure 19-3.

Other factors besides the interest rate also affect investment; when these factors change, the investment share line in Figure 19-3 will shift. For example, an investment tax credit, which lowers a firm’s taxes if the firm buys new equipment, would increase the amount that firms would invest at each interest rate. An investment tax credit would shift the investment share line in Figure 19-3 to the right: The investment that firms are willing to do as a share of GDP at a given interest rate would rise. A change in firms’ expectations of the future also could shift the investment share line: If firms feel that new computing or telecommunications equipment will lower their costs in the future, they will purchase the equipment, thereby increasing their investment at a given interest rate; the investment share line will shift to the right. Conversely, pessimism on the part of firms about the benefits of investment could shift the line to the left.

**Net Exports**

Net exports also are negatively related to the real interest rate. The explanation behind this relationship is somewhat more involved than that for investment or for consumption. The *exchange rate*—the rate at which one country’s currency can be exchanged for another—plays an integral role in this relationship. This explanation has three parts. First, we need to understand the relationship between the real interest rate and the exchange rate. Second, we need to understand the relationship between the exchange rate and exports and imports. Third, we will combine these two parts to obtain a relationship between the real interest rate and net exports.

**The Interest Rate and the Exchange Rate** Let us start with the relationship between the interest rate and the *exchange rate*. We will express the exchange rate in terms of the number of units of foreign currency that are needed to purchase one unit of domestic currency, or, in other words, as the price of a unit of domestic currency in terms of foreign currency. Thus, the exchange rates for the dollar for various international currencies will be expressed in the form of euros per dollar, yen per dollar, pounds per dollar, and so on.

A substantial influence on exchange rates is exerted by international investors, who must decide whether to put their funds in assets denominated in dollars—such as an account at a U.S. bank in New York City—or in assets denominated in foreign currencies—such as an account at a Japanese bank in Tokyo. If real interest rates rise in the United States, but not elsewhere, then international investors will put more funds in dollar-denominated assets because they can earn more by doing so. As international investors shift their funds from London, Frankfurt, Tokyo, and other financial centers to New York to take advantage of the higher interest rate in the United States, the demand for dollars will rise. This increased demand puts upward pressure on the dollar exchange rate, so that more units of foreign currency will be needed to buy $1 in the foreign exchange market. For example, an increase in the interest rate in the United States might cause the U.S. dollar to increase from 100 yen per dollar to 120 yen per dollar. Conversely, a lower interest rate in the United States brings about a lower exchange rate for the dollar. Thus, the interest rate and the exchange rate are positively related.
The Exchange Rate and Net Exports  The next part of the relationship deals with how the exchange rate affects net exports. When the dollar becomes less valuable—that is, the dollar exchange rate becomes lower—foreign goods imported into the United States become less attractive to U.S. consumers because they are more expensive. For example, at the end of 2010, the dollar exchange rate against the euro was 0.75 euro (€) per dollar compared with the exchange rate at the end of 2005, which was €0.80 per dollar. In 2005, an American consumer could have bought a German-made Audi costing €40,000 for $50,000 (40,000/0.8). In 2010, when the exchange rate was €0.75 per dollar, the Audi would be much more expensive; it would cost around $53,333 (40,000/0.75). Thus, a lower exchange rate decreases the quantity demanded of imported goods.

Conversely, the lower exchange rate makes U.S. exports more attractive to foreign consumers. For example, a $20,000 Jeep Grand Cherokee would have cost a German consumer €16,000 in 2005 but would cost only €15,000 in 2010. Thus, a lower exchange rate increases U.S. exports. We have shown that a lower exchange rate will raise exports and lower imports. Because net exports is the difference between exports and imports, a lower exchange rate must mean an increase in net exports. Conversely, a higher exchange rate will mean a decrease in net exports.

Combining the Two Relationships  Finally, we can combine these two relationships—one that relates the real interest rate to the exchange rate, and the other that relates the exchange rate to net exports—to obtain the desired relationship between the real interest rate and net exports:

<table>
<thead>
<tr>
<th>Interest Rate</th>
<th>Exchange Rate</th>
<th>Net Exports</th>
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<tbody>
<tr>
<td>up</td>
<td>up</td>
<td>down</td>
</tr>
<tr>
<td>down</td>
<td>down</td>
<td>up</td>
</tr>
</tbody>
</table>

If the interest rate goes up, then net exports go down. The link is the exchange rate. The dollar increases in value (the exchange rate rises) as a result of the higher interest rate, which, in turn, makes net exports fall. Of course, all of this works in reverse, too. If the interest rate goes down, then the dollar decreases in value (the exchange rate goes down) and net exports go up.

The relationship between net exports as a share of GDP and the interest rate is shown in Figure 19-4. Like the consumption share line and the investment share line, the net exports share line is downward sloping. For this example, when the interest rate goes up from 4 percent to 8 percent, net exports go from zero to about −4 percent of GDP. Remember that when net exports are negative, there is a trade deficit. Changes in the interest rate lead to movements along the net exports line in Figure 19-4. Changes in other factors—such as a shift in foreign demand for U.S. products—may cause the line to shift.
Putting the Three Shares Together

We have shown that the consumption, investment, and net exports shares are all negatively related to the interest rate. The three diagrams—Figures 19-2, 19-3, and 19-4—summarize this key idea. Our next task is to determine the interest rate, which then will enable us to determine the particular value of each share.

REVIEW

- Consumption, investment, and net exports are all negatively related to the real interest rate.
- The real interest rate is the price of consumption this year relative to next year. When the real interest rate rises, consumers will be more inclined to forgo current consumption and save so that they can consume more in the future. Accordingly, the share of consumption will rise when the real interest rate falls and will fall when the real interest rate rises.
- Changes in the real interest rate affect investment because they change the borrowing costs (and also the opportunity cost of using one’s own money) for firms looking to invest in machines and factories and for individuals looking to buy and build homes. Business firms and individuals will spend less on investment when the real interest rate rises. Accordingly, the share of investment will rise when the real interest rate falls and will fall when the real interest rate rises.
- Changes in the real interest rate affect net exports through their effects on the exchange rate. A higher real interest rate raises the value of the domestic currency (a higher exchange rate) and thereby discourages exports and encourages imports, while a lower real interest rate results in a fall in the value of the domestic currency (a lower exchange rate), which encourages exports and discourages imports. Accordingly, the share of net exports will rise when the real interest rate falls and fall when the real interest rate rises.
- A downward-sloping relationship exists between the real interest rate and each of these three shares. Changes in the real interest rate are reflected as movements along these curves. Other factors besides the interest rate may also affect consumption, investment, and net exports. When one of these factors changes, the relationship between the interest rate and consumption, investment, or net exports shifts.

Determining the Equilibrium Interest Rate

Because the interest rate affects each of the three shares (consumption, investment, and net exports), it also affects the sum of the three shares. We will refer to the sum of the three shares as the nongovernment share of GDP, or NG/Y, because the fourth component of GDP is the government share. The collective impact is shown by the downward-sloping line in diagram (d) of Figure 19-5. As before, we are focusing on the shares in the long run, so the diagram shows the sum of consumption, investment, and net exports as a share of potential output (NG/Y*).

The Nongovernment Share of GDP

Note carefully how Figure 19-5 is put together and how the downward-sloping line in diagram (d) is derived. We have taken the graphs from Figures 19-2, 19-3, and 19-4 and assembled them horizontally in diagrams (a), (b), and (c) of Figure 19-5. The downward-sloping blue line in diagram (d) is the sum of the three downward-sloping lines in
diagrams (a), (b), and (c). For example, when the interest rate is 4 percent, the line in diagram (d) shows that the nongovernment share—the sum of investment, consumption, and net exports as a share of GDP—is 80 percent; this is the sum of 65 percent for the consumption share, 15 percent for the investment share, and 0 percent for the net exports share. Similarly, the other points in diagram (d) are obtained by adding up the three shares at other interest rate levels. For example, at an interest rate of 5 percent, we see that the sum of the shares of consumption, investment, and net exports is down to about 78 percent.

The Government’s Share of GDP and the Share of GDP Available for Nongovernment Use

We have determined that the real interest rate has a negative effect on the consumption, investment, and net exports shares of GDP. What about the impact of real interest rates on government purchases? We will assume that government purchases do not depend on the real interest rate; instead, they likely will be affected by the decisions made by elected representatives on behalf of the voters who elected them to office. So the share of government purchases (\(G/Y\)) will not be affected by fluctuations in interest rates. For example, if the decisions made by elected officials result in a government purchases share that is 22 percent of GDP, then that share will not be affected by changes in the real interest rate. This is shown by the vertical line in diagram (a) of Figure 19-6.

The government share determines how much is available for nongovernment use, that is, for either consumption, investment, or net exports. The share available for nongovernment use is easily defined as follows:

\[
\text{Share available for nongovernment use} = 1 - \frac{G}{Y}
\]
If the government share is not affected by changes in the real interest rate, the share that is available for nongovernment use also will not be affected. For the case shown in diagram (a) of Figure 19-6, with a share of government purchases of 22 percent, the share available for nongovernment use must equal 78 percent. The share of GDP available for nongovernment use is shown in diagram (b) of Figure 19-6. As always, we are looking at the long run, so the diagram shows the share of potential output available for nongovernment use.

**Finding the Equilibrium Interest Rate**

In equilibrium, the nongovernment share of GDP should equal the share of GDP available for nongovernment use. In mathematical terms, we can describe this equilibrium relationship in the long run as follows:

\[
\frac{NG}{Y^*} = 1 - \frac{G}{Y^*}
\]

What brings this equality about is the real interest rate, which is the key to the spending allocation model. Figure 19-7 illustrates how the interest rate brings about this equality. Look first at diagram (d). In diagram (d), the share available for nongovernment use \((1 - G/Y^*)\) is indicated by the vertical line at 78 percent. The nongovernment share of GDP \((NG/Y^*)\), which is the sum of the consumption, investment, and net export shares, is shown by the downward-sloping line in Figure 19-7(d). This is the same line we derived in Figure 19-5(d). The equilibrium is the point at which the nongovernment share equals the share available for nongovernment use. Graphically, this is the intersection of the downward-sloping line and the vertical line. We see in diagram (d) of Figure 19-7 that the point of intersection for that economy occurs when the interest rate is 5 percent. This is the equilibrium interest rate, that is, the interest rate that makes the nongovernment share equal to the share available for nongovernment use.
Once we determine the equilibrium interest rate, we can find the investment, consumption, and net exports shares. Each of these shares depends on the interest rate, as shown in diagrams (a), (b), and (c) of Figure 19-7. To determine each of the shares, simply draw a line across the three diagrams at the equilibrium interest rate. Then in diagram (a) we find the consumption share, in diagram (b) the investment share, and in diagram (c) the net exports share.

What happens if consumption, investment, or net exports increases? Then the non-government share will begin to rise above the share of GDP available after the government takes its share. This rise in spending will be reflected as a rightward shift of the downward-sloping nongovernment share line, which causes the equilibrium interest rate in the economy to increase. Conversely, if consumption, investment, or net exports decreases, then the nongovernment share will begin to fall below the share of GDP available after the government takes its share. This will be reflected as a leftward shift of the downward-sloping nongovernment share line, which causes the equilibrium interest rate in the economy to decrease.

What happens if the share of government purchases increases? Then the share available for nongovernment use will fall, which will be reflected in a leftward shift of the vertical line indicating the share available for nongovernment use. This causes the equilibrium interest rate in the economy to increase. Conversely, if the share of government purchases decreases, then the share available for nongovernment use will rise, which will be reflected in a rightward shift of the vertical line that indicates the share available for nongovernment use. This causes the equilibrium interest rate in the economy to decrease.

The following Economics in Action box traces through this analogy in more detail, showing you how you can find the impact of a change in one of these shares on the other shares and working through the change in the real interest rate.
Using the Spending Allocation Model to Analyze the Long-Run Implications of a Shift in Government Purchases

In this case study, you will see how the spending allocation model can be used to predict the effects of actual changes in the economy. We focus on a shift in government purchases to understand how we can use this model to examine what happens to the other components of GDP. We know as a matter of arithmetic that some other share must move in a direction opposite to that of the government share.

Suppose that the government share of GDP decreases by 2 percent, as happened in the 1990s as a result of a decrease in defense spending and other budget cuts. The effects of this change are shown in Figure 19-8. If government purchases as a share of GDP decrease by 2 percent, then we know that the share available for nongovernment use must increase by 2 percent. Thus, in diagram (d) of Figure 19-8, we shift the vertical line marking the available nongovernment share to the right by 2 percentage points. As Figure 19-8(d) shows, there is now a new intersection of the two lines and a new, lower equilibrium real interest rate. The new real interest rate is 4 percent rather than 5 percent, a decrease of 1 percentage point.

The decrease in the real interest rate is the market mechanism that brings about an increase in the shares of consumption plus investment plus net exports. To see the effect on the consumption, investment, and net exports shares, we draw a horizontal line at a real interest rate of 4 percent, as shown in Figure 19-8, and read off the implied shares. According to the diagram, the share of consumption increases, the share of investment increases, and the share of net exports increases.

A Decrease in the Share of Government Purchases

If the government purchases share of GDP falls, then the share available for nongovernment use must rise by the same amount. This causes a fall in real interest rates, which increases the consumption, investment, and net exports share.
The lessons from this case study can also help you understand the statements made by the chancellor of the exchequer and the chairman of the Federal Reserve that were described in this chapter’s introduction.

**Analogy with Supply and Demand** Observe that the intersection of the two lines in diagram (d) of Figure 19-7 is much like the intersection of a demand curve and a supply curve. The green downward-sloping line—showing how the sum of investment, consumption, and net exports is negatively related to the interest rate—looks just like a demand curve. The orange vertical line—showing the share of GDP available for consumption, investment, and net exports—looks like a vertical supply curve. The intersection of the two curves determines the equilibrium price—in this case, the equilibrium interest rate in the economy as a whole.

**The Real Interest Rate in the Long Run** Having determined the equilibrium interest rate, it is important to mention once more two key features of this model. First, this analysis applies to the long run—perhaps three years or more—rather than to short-run economic fluctuations. Moreover, the interest rate in the analysis is the real interest rate, which, as defined in Chapter 17, is the nominal

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Table 19-1 allows us to compare the predictions of the model with what really happened when the government purchases share was reduced by 2.2 percent between 1989 and 1997. During that period, all of the other shares increased as a result of the decline in the real interest rate. Although the precise magnitudes may not be exactly the same, the model explains the direction of movement well.

The same process would work in reverse if we increased the share of government purchases. In Figure 19-8, the real interest rate would have to rise. To find out the effect on the other components of spending, we would draw a horizontal line at a higher real interest rate. That would show us that the shares of investment, net exports, and consumption would fall.

Sometimes a decline in the investment share due to an increase in government purchases is called crowding out because investment is “crowded out” by the government purchases. Thus, we have shown that an increase in the share of government purchases causes a crowding out of investment in the long run. However, because the shares of net exports and consumption also fall, the crowding out of investment is not as large as it otherwise would be.

**Table 19-1**

<table>
<thead>
<tr>
<th>Change in Spending Shares: 1989–1997 (percent)</th>
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</thead>
<tbody>
<tr>
<td>Consumption share</td>
</tr>
<tr>
<td>Investment share</td>
</tr>
<tr>
<td>Net exports share</td>
</tr>
<tr>
<td>Government purchases share</td>
</tr>
</tbody>
</table>

A big shift in the government purchases share is assumed to cause changes in the other shares in this case study.

*crowding out* the decline in private investment owing to an increase in government purchases.
interest rate less the expected inflation rate. If the inflation rate is low, there is little
difference between the real interest rate and the nominal interest rate; but if inflation
is high, there is a big difference, and the real interest rate is a much better measure of
the incentives affecting consumers and firms. An interest rate of 50 percent would
seem high but actually would be quite low—2 percent in real terms—if people
expected inflation to be 48 percent.

**REVIEW**

- The sum of the consumption, investment, and net exports shares of GDP is called the nongovernment share of GDP. It is negatively related to the interest rate because each of the individual components is negatively related to the interest rate.
- The government share of GDP is assumed to be unaffected by the real interest rate, being determined by the preferences of voters expressed through their elected representatives. The share of GDP available for nongovernment use then can be defined as one minus the government share of GDP. This, too, is unaffected by the real interest rate.
- The equilibrium interest rate is determined by the condition that the nongovernment share equals the share available for nongovernment use. Graphically, this is the interest rate at the intersection of the downward-sloping nongovernment share of GDP line and the vertical share of GDP available for nongovernment use line.
- Once we find the equilibrium interest rate, we then can find the shares of consumption, investment, and net exports by looking at the graphs of those relationships.
- We also can use the model to analyze what would happen to the equilibrium interest rate when there is a change in the government share or in one of the three nongovernment shares.
- Once we know the equilibrium interest rate, we also can find out how exactly the other shares in the economy respond to a change in one of the shares. This is helpful in understanding how a change in government purchases affects investment, for example.

The Relationship between Saving and Investment

By now you should be able to use the spending allocation model to illustrate how changes in the share of spending in one component of GDP affect the other components. In particular, we were able to use it to show how an increase in the consumption share of GDP or an increase in the government purchases share of GDP leads to a decrease in the investment share of GDP. In this section, we derive a similar relationship between the changes in the shares of GDP that are being saved and the share that is being invested. This alternative viewpoint is important to complete your understanding of how one sector of the economy can affect the others. For instance, we will show that the investment share of GDP will decrease when the government’s budget deficit as a percentage of GDP rises, all else equal. The rise in the government budget deficit can be caused either by an increase in government spending or by a decrease in tax revenue. The latter effect is much better understood by looking at the economy from the saving side rather than the spending side.
In Chapter 18, we defined national saving \((S)\) as GDP minus consumption minus government purchases, or

\[
S = Y - C - G
\]

The ratio of national saving to GDP, or \(S/Y\), is the **national saving rate**. For example, in 2010, national saving was $1,306 billion and GDP was $14,660 billion, so the national saving rate was \(1,306/14,660 = 0.089\) or 8.9 percent. If we divide each term in the definition of national saving by \(Y\), we can write the national saving rate as one minus the shares of consumption and government purchases in GDP. That is,

\[
\text{National saving rate} = 1 - \text{consumption share} - \text{government purchases share},
\]

or

\[
\frac{S}{Y} = 1 - \frac{C}{Y} - \frac{G}{Y}
\]

This equation tells us that a change in the economy will affect the national saving rate through its effect on the consumption share and the government purchases share. We once again will express everything in the long run, so the national saving rate in the long run is

\[
\frac{S}{Y^*} = 1 - \frac{C}{Y^*} - \frac{G}{Y^*}
\]

Note also that the equations tell us that the national saving rate depends on the interest rate. Because the consumption share of GDP is negatively related to the real interest rate and the government share of GDP is unrelated to the real interest rate, you easily can show that the national saving rate is positively related to the real interest rate. When the real interest rate rises, the consumption share of GDP falls, implying that the national saving rate rises. On the other hand, when the real interest rate falls, the consumption share of GDP rises, implying that the national saving rate falls.

Because we know that

\[
1 = \frac{C}{Y^*} + \frac{I}{Y^*} + \frac{G}{Y^*} + \frac{X}{Y^*}
\]

we can use the above definition of the national saving rate in the long run to write

\[
\frac{S}{Y^*} = \frac{I}{Y^*} + \frac{X}{Y^*}
\]

or, in other words, the national saving rate equals the investment share plus the net exports share. Both sides of this equation depend on the interest rate, as shown in Figure 19-9. The upward-sloping line in Figure 19-9 shows the national saving rate. An increase in the real interest rate causes the saving rate to rise. The downward-sloping line shows the sum of the investment and net exports shares; this sum is negatively related to the real interest rate because both the investment share and the net exports share are negatively related to the real interest rate.

The intersection of the two lines in Figure 19-9 determines the equilibrium interest rate. The interest rate is exactly the same as that in Figure 19-7. The only difference is that we are looking at the economy from a government and individual saving perspective rather than from a spending perspective.

Consider the same increase in the consumption share considered in the case study. An upward shift in the consumption share is equivalent to a downward shift in the saving

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**national saving rate**

the proportion of GDP that is saved, neither consumed nor spent on government purchases; equals national saving \((S)\) divided by GDP, or \(S/Y\).
rate. Thus, we shift the interest rate–saving rate relationship to the left in Figure 19-10, representing a downshift in the national saving rate. As shown in the figure, this leads to a higher interest rate and lower shares for investment and net exports. Similarly, an increase in the government expenditure share is also equivalent to a downward shift in the saving rate. This will lead to a shift in the interest rate–saving rate relationship to the left in Figure 19-10, resulting in a higher interest rate and lower shares for investment and net exports.

Obviously, we would not want to derive this alternative way of looking at the economy merely to replicate predictions that we were already able to make. We can make this model adaptable to more situations if we go back to another relationship we derived in Chapter 18, namely, that

\[ S = (Y - C - T) + (T - G) \]
where \( T \) denotes taxes. This relationship states that national saving is equal to the sum of private and government saving. Therefore, the national saving rate will be the sum of the private saving rate and the government saving rate. The government saving rate is simply the budget balance as a percentage of GDP; when there is a budget deficit, this will be negative. We can express the relationship between saving, investment, and net exports in the economy in more detail then as

\[
\text{Private saving rate} + \text{government saving rate} = \frac{I}{Y} + \frac{X}{Y}
\]

This equation has powerful implications for the economy. If the government budget deficit increases (the government saving rate decreases), then the investment share of GDP will fall, assuming that the private saving rate or the net exports share of GDP does not change. If the economy is to keep its investment share unchanged in the face of rising budget deficits, then either private saving will have to increase to offset the fall in government saving, or the share of net exports will have to decrease. Practically speaking, if the rising demands of an aging society cause budget deficits as a percentage of GDP in the United States to increase (thus reducing the government saving rate), then one or more of the following outcomes will occur:

1. The private saving rate will have to increase, meaning that consumers most likely will have to cut back on spending.
2. The investment rate will decrease, which means less capital accumulation and the likelihood for slower economic growth in the future.
3. The trade balance will worsen, and we will buy more foreign goods while foreigners will buy fewer U.S. goods.

**REVIEW**

- We can apply the concepts used to derive the spending allocation model to examine how changes in saving behavior by consumers and the government affect other sectors of the economy.
- Because national saving is defined as \( Y - C - G \), we can show that national saving is equal to the sum of investment and net exports. Expressing this relationship as shares of GDP in the long run, we can show that the national saving rate equals the sum of the investment share and the net exports share of GDP.
- The national saving rate is positively related to the interest rate, whereas the sum of the investment share and the net exports share of GDP is negatively related to the interest rate. The equilibrium real interest rate can be found as the rate that equates the national saving rate and the sum of the investment and net exports shares.
- An increase in the consumption share or the government share is equivalent to a downward shift in the national saving rate. This will result in a higher interest rate and will lower the shares of investment and net exports.
- We can disaggregate the national saving rate into the sum of the private saving rate and the government saving rate. This allows us to illustrate that the impact of rising budget deficits will be to create some combination of a lower investment share of GDP, a higher private saving rate, or a worsening of the trade balance.