how long it takes. We also look at the effect of price shocks on the economy.

After we cover these general applications, we demonstrate the usefulness, and power, of the economic fluctuations model by applying it to understand the most recent recession experienced by the United States. Economists can provide invaluable contributions to society if they can use models like the economic fluctuations model to better understand economic developments and to formulate policies that can help the economy recover from a crisis or prevent such a serious crisis from occurring in the first place.

Changes in Government Purchases

We first use the economic fluctuations model to examine the forces leading to the return of real GDP to potential GDP. To do so, we focus on a particular example, a change in government purchases. In Chapter 23, we showed how a change in government purchases could push real GDP away from potential GDP in the short run. Now let’s see the complete story.

Real GDP and Inflation over Time

Suppose the government cuts military purchases permanently. We want to examine the effects of this decrease in government purchases on the economy in the short run (about one year), the medium run (two to three years), and the long run (four to five years and beyond). The three lengths of time given in the parentheses are approximations; in reality, the times will not be exactly these lengths, but rather they will be somewhat longer or shorter. We use the term short run to refer to the initial departure of real GDP from potential GDP, medium run to refer to the recovery period, and long run to refer to the time at which real GDP is nearly back to potential GDP.

Figure 25-1 shows the aggregate demand curve and the inflation adjustment line on the same diagram. The intersection of the aggregate demand curve and the inflation adjustment line determines a level of inflation and real GDP. Let us assume that we began with real GDP equal to potential GDP. Thus, the initial intersection of the aggregate demand curve and the inflation adjustment line occurs at a level of real GDP equal to potential GDP.

Now, recall from Chapter 24 that a change in government purchases shifts the aggregate demand curve; in particular, a decline in government purchases shifts the aggregate demand curve to the left. Because the inflation adjustment line is flat, and because it does not move in the short run, a change in government purchases—shown by the shift from the “old” to the “new” aggregate demand curve in Figure 25-1—leads to a change in real GDP of the same amount as the shift in the aggregate demand curve. This is the short-run effect. The decrease in government purchases initially moves the aggregate demand curve to the left, and real GDP falls to the point indicated by the intersection of the inflation adjustment line and the new aggregate demand curve. At the new intersection, real GDP is below potential GDP.

As real GDP falls below potential GDP, employment falls because the decline in demand forces firms to cut back on production and lay off workers. The model predicts that unemployment rises, just as it does during actual declines in real GDP.

Now consider what happens over time. The tendency for inflation to adjust over time is represented by upward or downward shifts of the inflation adjustment line. Only in the short run does the inflation adjustment line stay put. What is likely to happen over time when real GDP is below potential GDP? Inflation should begin to decline, because firms will increase their prices by smaller amounts. We represent a decline in inflation by
shifting the inflation adjustment line down, as shown in Figure 25-2. The initial impact of the change in government spending took us to the point we label SR, for short run, in Figure 25-2. At that point, real GDP is lower than potential GDP. Hence, inflation will fall and the inflation adjustment line shifts down, as shown in the diagram. Now we have a new point of intersection; we label that point MR, for medium run.

Note that real GDP has started to recover. At the point labeled MR in the diagram, real GDP is still below potential GDP, but it is higher than at the low (SR) point in the downturn. The reason real GDP starts to rise is that the lower inflation rate causes the central bank to lower the real interest rate. The lower real interest rate increases investment spending and causes net exports to rise. As a result, real GDP rises, and as it does, firms start to call back workers who were laid off. As more workers are employed, unemployment begins to fall.

Because real GDP is still below potential GDP, the tendency is for inflation to fall. Thus, the inflation adjustment line continues to shift downward until real GDP returns to potential GDP. Figure 25-2 shows a third intersection at
the point marked $LR$, for long run, the point at which production has increased all the way back to potential GDP. At this point, real GDP has reached long-run equilibrium in the sense that real GDP equals potential GDP. With real GDP equal to potential GDP, the inflation adjustment line stops shifting down. Inflation is at a new lower level than before the decline in government purchases, but at the final point of intersection in the diagram, it is no longer falling. Thus, real GDP remains equal to potential GDP.

Note how successive downward shifts of the inflation adjustment line with intersections along the aggregate demand curve trace out values for real GDP and inflation as the economy first goes into recession and then recovers. In the short run, a decline in production comes about because of the decrease in government spending; that decline is followed by successive years of reversal as the economy recovers and real GDP returns to

**Figure 25-2**

**Dynamic Adjustment after a Reduction in Government Purchases**

Initially, the reduction in government purchases shifts the $AD$ curve to the left. This reduces real GDP to the point labeled $SR$, or the short run. Then the $IA$ line begins to shift down because real GDP is less than potential GDP. The $IA$ line keeps shifting down until real GDP is back to potential GDP.
potential GDP. This behavior is shown in the sketch in the lower part of Figure 25-2. Thus, we have achieved one of the major goals of this chapter: showing how real GDP returns to potential GDP after an initial departure because of a shift in aggregate demand. In the case in which the shift in aggregate demand is large enough to cause real GDP to decline, as in a recession, we have shown how recessions end and recoveries take the economy back to normal.

Details on the Components of Spending

It is possible to give a more detailed description of what happens to consumption, net exports, and investment during this temporary departure from, and return to, potential GDP.

Let’s focus first on the short run and then on the long run. Figure 25-3 summarizes how each component of real GDP changes in the short run and the long run. The arrows in the table indicate what happens compared with what would have happened in the absence of the change in government purchases. The path of the economy in the absence of the hypothetical change is called the baseline. The term baseline is commonly used in public policy discussions to refer to what would happen if a contemplated policy action were not taken; the arrows in the table tell whether a variable is up or down relative to the baseline. In this case, the baseline for real GDP is potential GDP. Thus, a downward-pointing arrow in the real GDP column means that real GDP is below potential GDP; the sideways arrows indicate that real GDP is equal to the baseline or potential GDP; an upward-pointing arrow would mean that real GDP is above potential GDP.

**Short Run** The decline in government spending gets things started, lowering aggregate demand and the level of real GDP. With lower real GDP, income is down, and so people consume less, as explained by the consumption function in Chapter 23. In the short run, investment does not change because interest rates have not yet changed. Net exports rise, however, because the lower level of income in the United States means that people will import less from abroad. Recall that net exports is defined as exports minus imports. Thus, if imports fall, then net exports must rise.

These short-run effects are shown in the first row in the table. Real GDP and consumption are down relative to the baseline. Net exports are up relative to the baseline.

**Long Run** Now consider the long run, approximately four to five years. By this time, real GDP has returned to potential GDP. Government spending is still lower than it was originally because we have assumed that this is a permanent decline in military spending. Because real GDP is equal to potential GDP, aggregate income in the economy—which equals real GDP—is back to normal. Because income is back to normal, the effects of income on consumption and net exports are just what they would have been in the absence of the change in government purchases.

What about interest rates and their effect on consumption, investment, and net exports? We know that the real interest rate would be lowered by the monetary policy maker when inflation declined. With a lower real interest rate, more real GDP will go to investment, net exports, and consumption to make

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### Figure 25-3

**More Detailed Analysis of a Reduction in Government Purchases**

The arrows in the diagram keep track of the changes in the major variables relative to the baseline.

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up for the decline in the amount of real GDP going to the government. The diagram in Figure 25-3 shows that consumption, investment, and net exports are higher in the long run. We would expect the consumption effects to be small, however, because consumption is not sensitive to interest rates. Most of the long-run impact of the decline in government purchases is to raise investment and net exports.

**A Higher Growth Path after a Recession** To summarize, a decrease in government purchases has negative effects on the economy in the short run. Real GDP declines. Workers are laid off. Unemployment rises. In the long run, the economy is back to potential GDP, and consumption, investment, and net exports have gone up. Workers are called back, and unemployment declines to the point at which it was before the recession. In the long run, the decrease in government purchases permits greater private investment and more net exports. The increase in investment benefits long-run economic growth, as we know from Chapter 19; hence, the path of potential GDP over time has risen, and now real GDP is growing more quickly, as shown in Figure 25-4.

Observe also that the rate of inflation is lower in the long run than it was before the temporary decline in real GDP. Inflation declined during the period when real GDP was lower than potential GDP, and it did not increase again. This lower inflation rate means that the Fed implicitly has allowed the target rate of inflation—the average level of inflation over the long run—to drift down. If the Fed had wanted to keep the target rate of inflation from falling, it would have had to lower interest rates before the inflation rate started to fall. This decline in the interest rate would have pushed the aggregate demand curve back to the right and thereby kept the inflation rate from falling.

A good example occurred in the mid-1990s when government purchases were cut in an effort to reduce the federal budget deficit. Economists argued that the Fed should cut interest rates by an extra amount. They recognized that such action would cause the aggregate demand curve to shift to the right and prevent real GDP from declining in the short run while at the same time keeping the inflation rate from falling in the long run.

**The Return to Potential GDP after an Increase in Government Spending**

What if real GDP rises above potential GDP? Surprisingly, the adjustment of real GDP back to potential GDP can be explained using the same theory. For example, suppose an increase in real GDP above potential GDP is caused by an increase in government purchases for new highway construction. Starting from potential GDP, the aggregate demand curve would shift to the right. Real GDP would increase above potential GDP in the short run.

With real GDP above potential GDP, however, firms start to raise their prices more rapidly; inflation begins to rise. We would represent that as an upward shift in the inflation adjustment line. In the medium run, real GDP still would be...
above potential GDP, and inflation would continue to rise. Eventually, real GDP would go back to potential GDP. Thus, we predict that real GDP goes back to potential GDP. In this case, however, because government purchases have risen, the new long-run equilibrium will have a higher interest rate, and the sum of consumption, investment, and net exports will be lower.

**Changes in Monetary Policy**

A large change in government spending, of course, is not the only thing that temporarily can push real GDP away from potential GDP. Changes in taxes, consumer confidence, or foreign demand also can cause recessions. But a particularly important factor is a change in monetary policy.

Consider, for example, a change in monetary policy that aims to lower the rate of inflation. Suppose that the inflation rate is too high, say 10 percent, as it was in the late 1970s, and the Fed decides to reduce the inflation rate to 3 percent. In effect, the central bank changes the target inflation rate from 10 percent to 3 percent. A reduction in the inflation rate is called **disinflation**. Declining prices, or a negative inflation rate is **deflation**, which is different from a declining inflation rate. The aim of the policy in this example is disinflation, not deflation.

Figure 25-5 shows the short-run, medium-run, and long-run impact of such a shift in monetary policy. Recall from Chapter 24 (see Figures 24-7 and 24-8) that a change in monetary policy will shift the aggregate demand curve. A change in monetary policy toward higher inflation will shift the \( AD \) curve to the right, and a change in monetary policy toward lower inflation will shift the \( AD \) curve to the left. In this case, we are examining a change in monetary policy that aims to lower the inflation rate, so the change shifts the aggregate demand curve to the left. This shift occurs because the Fed raises interest rates to curtail demand and thereby lower inflationary pressures.

One effect of the increase in the interest rate is to lower investment. In addition, the higher interest rate causes the dollar to appreciate, and this tends to reduce net exports. Because inflation is slow to adjust, we do not move the inflation adjustment line yet. Thus, inflation remains at 10 percent in the short run. At this time, things seem grim. The short-run effect of the change to a new monetary policy is to cause real GDP to fall below potential GDP. If the disinflation is large enough, this might mean a decline in real GDP, or a recession. If the disinflation is small and gradual, then the decline in real GDP could result in a **temporary growth slowdown**. In a temporary growth slowdown, real GDP growth does not turn negative, as it does in a recession.

In any case, with real GDP below potential GDP, inflation will begin to decline. We show this in the diagram in Figure 25-5 by moving the inflation adjustment line down.
The lower inflation adjustment line, labeled $MR$ for medium run, intersects the aggregate demand curve at a higher level of real GDP. Thus, the economy has begun to recover. The recovery starts because as inflation comes down, the Fed begins to lower the interest rate. As the interest rate declines, investment and net exports begin to rise again, and we move back along the aggregate demand curve.

At this medium-run situation, however, real GDP is still below potential GDP, so the inflation rate continues to decline. We show this in the diagram by shifting the inflation adjustment line down again. To make a long story short, we show the inflation adjustment line shifting all the way down to where it intersects the aggregate demand curve at potential GDP. Thus, in the long-run equilibrium, the economy has fully recovered, and the inflation rate is at its new lower target. The long-run equilibrium has consumption, investment, and net exports back to normal.

The overall dynamic impacts of this change in monetary policy are important. The initial impact of a monetary policy change is on real GDP. It is only later that the change shows up in inflation. Thus, the effect of monetary policy on inflation has a long lag.

Lower inflation, for example, 3 percent rather than 10 percent in this case, is likely to make potential GDP grow faster, perhaps because uncertainty is lower and productivity rises faster. If this is so, the return of real GDP to potential GDP will mean that real GDP is higher, and the long-run benefits of the disinflation to people in the economy may be great over the years. But such changes in the growth of real GDP will appear small in the span of years during which a disinflation takes place and will not change the basic story that a reduction in the rate of inflation, unless it is gradual, usually results in a recession.
The Volcker Disinflation

The scenario we just described is similar to the disinflation in the United States in the early 1980s under Paul Volcker, the head of the Fed from 1979 to 1987. First, interest rates skyrocketed as the disinflation began. The federal funds rate went to more than 20 percent. By any measure, real GDP fell well below potential GDP in the early 1980s. Workers were laid off, the unemployment rate rose to 10.8 percent, investment declined, and net exports fell. Eventually, pricing decisions began to adjust and inflation began to come down. As inflation came down, the Fed began to lower the interest rate. The economy eventually recovered: In 1982, the recovery was under way, and by 1985, the economy had returned to near its potential. The good news was that inflation was down from over 10 percent to about 4 percent.

Reinflation and the Great Inflation

The opposite of disinflation might be called reinflation, an increase in the inflation rate caused by a change in monetary policy. This could be analyzed with our theory simply by reversing the preceding process, starting with a change in monetary policy to a higher inflation rate target. This higher target would cause the aggregate demand curve to shift right. Real GDP would rise above potential GDP, and unemployment would decline. But eventually inflation would rise and real GDP would return to potential.

Although it would be unusual for central bankers to explicitly admit they were raising the target inflation rate, there could be political pressures that would lead to less concern about inflation. In such a case, the target for inflation would rise implicitly.

Reinflation is one way to interpret the Great Inflation in the United States and other countries in the 1970s. In the late 1960s and 1970s, the Fed and other central banks around the world let the inflation rate increase. Other things were going on at that time, including a quadrupling of oil prices, but without the inflationary monetary policy, the decade-long inflation would not have been sustained for so long.

REVIEW

- Disinflation is a reduction in inflation. It occurs when the central bank shifts monetary policy in the direction of a lower inflation target.
- According to the theory of economic fluctuations, disinflation has either a temporary slowing of real GDP growth or a recession as a by-product. A higher interest rate at the start of a disinflation lowers investment spending and net exports. This lower spending causes real GDP to fall below potential GDP. Eventually the economy recovers. Inflation comes down, and so does the interest rate.
- The large disinflation in the early 1980s in the United States was accompanied by a recession, as predicted by the theory.

Price Shocks

Shifts in the aggregate demand curve are called demand shocks. The change in government purchases and the shift in monetary policy described in the previous two sections of this chapter are examples of demand shocks. However, shifts in the aggregate demand curve are not the only things that can push real GDP away from potential GDP. In particular, the inflation adjustment line can shift.
What Is a Price Shock?

Shifts in the inflation adjustment line are called **price shocks**. A price shock usually occurs when a temporary shortage of a key commodity, or group of commodities, drives up prices by such a large amount that it has a noticeable effect on the rate of inflation. Oil price shocks have been common in the last 35 years. For example, oil prices rose sharply in 1974, in 1979, in 1990, in 2005, in 2007–2008 and then again in early 2011. After many of these shocks, but not all, real GDP usually has declined and unemployment has increased. Hence, such shocks appear to move real GDP significantly, though temporarily, away from potential GDP.

**Explaining the Recovery from the Great Depression**

The Great Depression was the biggest economic downturn in American history. Simply no event in history has paralleled it either before or since. As shown in the figure, from 1929 to 1933, real GDP declined 35 percent. Between 1933 and 1937, real GDP rose 33 percent; it then declined 5 percent in a recession in 1938. Real GDP increased by a spectacular 49 percent between 1938 and 1942. By 1942, real GDP had caught up with potential GDP, as estimated in the figure.

Economists still disagree about what caused the Great Depression—that is, what caused the initial departure of real GDP from potential GDP. In their monetary history of the United States, Milton Friedman and Anna Schwartz argue that it was caused by an error in monetary policy that produced a massive leftward shift in the aggregate demand curve. Unfortunately, it took several years of continually declining real GDP, declining inflation, and even deflation before the errors in monetary policy were corrected.

Another explanation is that a downward shift in consumption and investment spending lowered total expenditures. Peter Temin of MIT has argued that such a spending shift was a cause of the Great Depression.

But whatever the initial cause, more consensus is shared that monetary policy eventually was responsible for the recovery from the Great Depression. Interest rates (in real terms) fell precipitously in 1933 and remained low or negative throughout most of the second half of the 1930s. These low interest rates led to an increase in investment and net exports. Christina Romer, head of President Obama’s Council of Economic Advisers until recently, and professor of economics at University of California at Berkeley, estimated that without the monetary response, “the U.S. economy in 1942 would have been 50 percent below its pre-Depression trend path, rather than back to its normal level.” Could the recovery from the Great Depression have been associated with an increase in government purchases or a reduction in taxes? Evidently not. Romer shows that government purchases and tax policy basically were unchanged until 1941, when government spending increased sharply during World War II. By that time, the economy had already made up most of the Depression decline in real GDP relative to potential GDP.

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**Price Shock**

A change in the price of a key commodity, such as oil, usually because of a shortage, that causes a shift in the inflation adjustment line; also sometimes called a supply shock.
Price shocks sometimes are called *supply shocks* to distinguish them from demand shocks resulting from changes in government spending or monetary policy. However, a shift in potential GDP—rather than a shift in the inflation adjustment line—is more appropriately called a supply shock. Shifts in potential GDP—such as a sudden spurt in productivity growth because of new inventions—can, of course, cause real GDP to fluctuate. Recall that *real business cycle theory* places great emphasis on shifts in potential GDP. Although a price shock might be accompanied by a shift in potential GDP, it need not be. In this case, we are looking at departures of real GDP from potential GDP and thus focusing on price shocks.

**The Effect of Price Shocks**

How does our theory of economic fluctuations allow us to predict the effect of price shocks? The impact of a price shock can be illustrated graphically, as shown in Figure 25-6. In the case of a large increase in oil prices, for example, the inflation adjustment line will shift up to a higher level of inflation. A large increase in oil prices at first will lead to an increase in the price of everything that uses oil in production: heating homes, gasoline, airplane fuel, airfares, plastic toys, and many other things. The overall inflation rate is affected. When the inflation rate rises, the inflation adjustment line must shift up.

The immediate impact of the shock is to lower real GDP, as the intersection of the inflation adjustment line with the aggregate demand curve moves to the left. This result occurs because the higher inflation rate causes the central bank to raise interest rates, reducing investment spending and net exports.

With real GDP below potential GDP, however, the reduction in spending will put pressure on firms to adjust their prices. The lower price increases bring about a lower
rate of inflation. Thus, in the period following the rise of inflation, we begin to see a re-
versal. Inflation starts to decline. As inflation falls, interest rates begin to decline, and the
economy starts to recover again. The rate of inflation will return to where it was before
the price shock.

**Temporary Shifts in the Inflation Adjustment Line** In this analysis of the
price shock, the central bank raises interest rates, and the resulting decline in real GDP
exerts a countervailing force to reduce inflation. It is possible for some price shocks to have
only a temporary effect on inflation. Such a temporary effect can be shown graphically as a
rise followed by a quick fall in the inflation adjustment line. In such a situation—in which
case the price shock would be expected to automatically reverse itself—it would be wise
for the central bank to delay raising the interest rate. Then if the price shock has only a
temporary effect on inflation, the decline in real GDP can be avoided. In reality, whenever
a price shock occurs, a great debate results about whether it will have a temporary or a
permanent effect on inflation. The debate is rarely settled until after the fact.

Price shocks also can occur when commodity prices fall. In this case, the inflation
adjustment line would shift downward—just the opposite of the case of an increase in
commodity prices—and this would cause real GDP to rise as the Fed lowered interest
rates. For example, in the later part of 2008, oil prices declined. This resulted in a
temporary decrease in inflation and a rise in real GDP—exactly what would be predicted
by the theory of economic fluctuations.

**Stagflation** An important difference between price shocks and demand shocks is
that, in the case of a price shock, output declines while inflation rises. With demand
shocks, inflation and output are positively related over the period of recession and recov-
cery. The situation in which inflation is up and real GDP is down is called **stagflation**.
As we have shown, price shocks can lead to stagflation.

**REVIEW**

- A price shock is a large change in the price of some key commodity like oil. Such shocks can push real GDP below potential GDP.
- In the aftermath of a price shock, the interest rate rises. Eventually, with real GDP below potential GDP, inflation begins to come down, and the economy recovers.

**Using the Economic Fluctuations Model to Understand the Recent Recession**

By now you should be comfortable with using the economic fluctuations model in a
general setting to examine the impact of particular economic events—changes in fiscal
policy, monetary policy, consumer behavior, or price shocks—in isolation. What the eco-
nomic fluctuations model is most useful for, however, is to understand actual economic
developments in which many things change, often simultaneously, in the economy. In
this section, we show how the model can explain what brought about the recession that
began in late 2007. We also can show how the model could be used to understand the
policies that were implemented to help the recovery phase that began when the recession
ended in June 2009.