to who has the more tenable position. This evaluation requires that you have a framework for understanding the fascinating, dynamic process through which a recession ends and a new expansion begins, and for deciding which government actions, if any, can cut the length of a recession or speed up the expansion. This chapter presents just such a framework in the form of a model of economic fluctuations—a simplified description of how the economy adjusts over time when it moves away from potential GDP, as in a recession.

Economic fluctuations models are used to make decisions about monetary policy at the Fed and at other central banks around the world. Private business analysts use the ideas to track the economy and predict central bank decisions. This model is much newer than the supply and demand model, which has been around for more than 100 years. It combines Keynes’s idea, developed 75 years ago, that aggregate demand causes the departure of real GDP from potential GDP, with newer ideas, developed in the 1980s and 1990s, about how expectations and inflation adjust over time. Although newer, the economic fluctuations model is analogous to the supply and demand model (Chapter 3). Just as we presented the supply and demand model in a graph consisting of three elements:

- a demand curve,
- a supply curve, and
- an equilibrium at the intersection of the two curves.

We present the economic fluctuations model in a graph consisting of three elements:

- an aggregate demand (AD) curve,
- an inflation adjustment (IA) line, and
- an equilibrium at the intersection of the curve and the line.

We use the economic fluctuations model to explain fluctuations in real GDP and inflation in much the same way that we used supply and demand curves to explain quantity and price in the market for peanuts or other microeconomic markets. In the microeconomic supply and demand model, the intersection of the demand curve and the supply curve gives us a prediction of price and quantity. In the economic fluctuations model, the intersection of the aggregate demand (AD) curve and the inflation adjustment (IA) line gives us a prediction of real GDP and inflation.

We start our construction of the economic fluctuations model by deriving the aggregate demand curve and then the inflation adjustment line. We then will show how their intersection determines real GDP and inflation.

The Aggregate Demand Curve

The aggregate demand (AD) curve is a relationship between two economic variables: real GDP and the inflation rate. The inflation rate usually is measured as the annual percentage change in the overall price level from year to year. Figure 24-1 shows an aggregate demand curve for the United States. Observe that inflation is measured on the vertical axis, that real GDP is measured on the horizontal axis, and that we have drawn a vertical dashed line to mark the point at which real GDP equals potential GDP. The aggregate demand curve shows different combinations of real GDP and inflation. It is downward sloping from left to right because real GDP is related negatively to inflation.

aggregate demand (AD) curve
a line showing a negative relationship between inflation and the aggregate quantity of goods and services demanded at that inflation rate.
along the curve. The term *aggregate demand* is used because the movements of real GDP away from potential GDP are due to fluctuations in the sum (aggregate) of the demand for consumption, investment, net exports, and government purchases.

Why does the aggregate demand curve slope downward? We will answer this question and derive the curve in three stages. First, we show that a negative relationship exists between the real interest rate and real GDP. Second, we show that a positive relationship exists between inflation and the real interest rate. Third, we show that these two relationships imply a negative relationship between real GDP and inflation, and that that relationship is the aggregate demand curve. The following schematic chart shows how the three stages fit together.
Interest Rates and Real GDP

Consumption, investment, and net exports each are related negatively to the interest rate. Combining these components provides an explanation of the negative relationship between real GDP and the interest rate. Keep in mind that the real interest rate is a better measure of the effects of interest rates on investment, consumption, and net exports because it corrects for inflation. Recall from Chapter 17 that the real interest rate equals the stated, or nominal, interest rate minus the inflation rate. The negative effect of the real interest rate on consumption, investment, and net exports is no different from that discussed in Chapter 19. If you already have studied that chapter, the next few pages will review that information.

Investment

Investment is the component of expenditure that is probably most sensitive to the real interest rate. Recall that part of investment is the purchase of new equipment or a new factory by a business firm. Many firms must borrow funds to pay for such investments. Higher real interest rates make such borrowing more costly. The additional profits the firm might expect to earn from purchasing a photocopier or a truck are more likely to be lower than the interest costs on the loan if the real interest rate is high. Hence, businesses that are thinking about buying a new machine and need to borrow funds will be less inclined to purchase such an investment good if real interest rates are higher, and so higher real interest rates reduce investment spending by businesses. Also, remember that part of investment is the purchase of new houses. Most people need to take out a mortgage to buy a house. Like any loan, the mortgage has an interest rate, and higher interest rates make mortgages more costly. Hence, with higher real interest rates, fewer people take out mortgages and buy new houses. Spending for new housing declines.

The same reasoning works to show why lower real interest rates will increase investment spending: Lower real interest rates reduce the cost of borrowing and make investment more attractive to firms and households.

To summarize, both business investment and housing investment decline when the real interest rate rises, and they increase when the real interest rate falls. At any given time some firms or households are deciding whether to buy a new machine or a new house, and they are going to be less inclined to buy such things when the interest rate is higher.

Net Exports

The negative relationship between net exports and the real interest rate requires a somewhat more involved explanation than the relationship between the real interest rate and investment. The relationship exists because higher real interest rates in the United States tend to lead to a higher dollar exchange rate and, in turn, a higher exchange rate reduces net exports.

A higher real interest rate in the United States compared with other countries increases the demand for U.S. dollar bank accounts and other assets that pay interest. That increased demand bids up the price of dollars; hence, the exchange rate—the price of dollars—rises. Now, with a higher exchange rate, net exports will be lower because U.S.-produced exports become more expensive to foreigners, who must pay a higher price for dollars, and imported foreign goods become cheaper for Americans, who can get more foreign goods for higher-priced dollars. With exports falling and imports rising, net exports—exports less imports—must fall. In sum, higher real interest rates reduce net exports.

The same reasoning works for lower real interest rates as well. If the real interest rate falls in the United States, then U.S. dollar bank accounts are less attractive compared with bank accounts in other currencies, such as those of Germany or Japan. This falling interest rate bids down the price of dollars, and the exchange rate falls. Now, with a lower exchange rate, net exports will be higher because U.S.-produced exports are less expensive to foreigners and imported foreign goods are more expensive for Americans. With exports rising and imports falling, net exports must rise. Thus, lower
real interest rates increase net exports. To summarize, a negative relationship exists between the interest rate and the net exports that works through the exchange rate, as shown below.

<table>
<thead>
<tr>
<th>Interest Rate</th>
<th>Value of the Domestic Currency</th>
<th>Net Exports</th>
</tr>
</thead>
<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 the value of the domestic currency goes up, causing net exports to go down. If the interest rate goes down, then the value of the domestic currency goes down, causing net exports to go up.

Consumption  We have shown that two of the components of expenditure—investment and net exports—are sensitive to the real interest rate. What about consumption?

Although consumption probably is less sensitive to the real interest rate than the other components, some evidence indicates that higher real interest rates encourage people to save a larger fraction of their income. Higher real interest rates encourage people to save because they earn more on their savings. Because more saving means less consumption, this implies that consumption is related negatively to the interest rate. Most economists, however, feel that the effect of interest rates on consumption is much less than on investment and net exports.

The Overall Effect  To summarize the discussion thus far, investment, net exports, and consumption all are related negatively to the real interest rate. The overall effect of a change in real interest rates on real GDP now can be assessed.

Figure 24-2 shows the 45-degree line and two different expenditure lines corresponding to two different interest rates. Higher interest rates shift the expenditure line...
down because a higher interest rate lowers investment, net exports, and consumption, which all are part of expenditure.

Observe how the downward shift of the expenditure line leads to a new point of spending balance. The intersection of the expenditure line with the 45-degree line occurs at a lower level of real GDP. Note that real GDP is lower not only because the higher real interest rate lowers investment, net exports, and consumption, but also because a decline in income will lower consumption further. Real GDP declines by the amount shown on the horizontal axis, which is larger than the downward shift in the expenditure line. Thus, an increase in the real interest rate lowers real GDP.

What about a decline in the real interest rate? A lower real interest rate will raise the expenditure line. In that case, when the expenditure line shifts up, the point of spending balance at the intersection with the 45-degree line will be at a higher level of real GDP. Thus, a decrease in the real interest rate raises real GDP. In sum, we have shown that a negative relationship exists between the real interest rate and real GDP.

**Interest Rates and Inflation**

Now that we have seen why interest rates affect real GDP, let us proceed to the second stage in our analysis. We want to show why a rise in inflation will increase the real interest rate and thereby lower real GDP, or why a decline in inflation will decrease the real interest rate and thereby raise real GDP.

**Central Bank Interest Rate Policy** The easiest way to see why the real interest rate rises when the inflation rate increases is to examine the behavior of the Fed. The Fed and central banks in other countries typically follow policies in which they respond to an increase in the inflation rate by raising the nominal interest rate. By far the most widely followed and analyzed decision by the Fed is its nominal interest rate decision.

Why do central banks raise the nominal interest rate when they think the inflation rate is rising? The inflation rate is ultimately the responsibility of the Fed, and the goal of controlling inflation requires that the central bank raise the nominal interest rate so that the real interest rate rises when the inflation rate rises. If the central bank raises the real interest rate successfully, then the higher real interest rate will reduce investment, consumption, and net exports. The reduced demand will then reduce inflationary pressures and bring inflation back down again.

The goal of controlling inflation also requires that the central bank lower the real interest rate when inflation falls. Suppose that the inflation rate starts to fall. If the central bank lowers the nominal interest rate so that the real interest rate falls, then the lower real interest rate will increase investment, consumption, and net exports. The increase in demand will put upward pressure on inflation.

Table 24-1 illustrates these actions of the Fed using a hypothetical example. For each inflation rate, a nominal interest rate decision by the Fed is shown. For example, when inflation is 2 percent, the nominal interest rate decision is 4 percent. When inflation rises to 4 percent, the nominal interest rate decision by the Fed is 7 percent. Thus, when inflation rises, the central bank raises the nominal interest rate, and when inflation falls, the central bank lowers the nominal interest rate.

Note that the nominal interest rate rises more than inflation rises in Table 24-1. The reason is that for an increase in the nominal interest rate to reduce demand, the real interest rate must rise because investment, consumption, and net exports depend negatively on the real interest rate, as described in the previous section. The nominal interest
rate has to rise by more than the inflation rate for the real interest rate to rise and demand to decline. If, instead, the nominal interest rate rose by less than the increase in the inflation rate, then the real interest rate would not rise; rather, it would fall. The behavior of the central bank illustrated in the third column of Table 24-1 is called a monetary policy rule because it describes the systematic response of the real interest rate to inflation as decided by the central bank.

How the Fed Changes the Interest Rate  
Keep in mind that the central bank does not set interest rates by decree or by direct control. Governments sometimes do control the price of goods; for example, some city governments control the rents on apartments. The central bank does not apply such controls to the interest rate. Rather, it enters the market in which short-term interest rates are determined by the usual forces of supply and demand. In the United States, the short-term interest rate the Fed focuses on is the interest rate on overnight loans between banks. This is called the federal funds rate, and the overnight loan market is called the federal funds market because reserves at the Fed are what are loaned or borrowed in this market. When the Fed wants to lower this interest rate, it supplies more reserves to this market. When it wants to raise the interest rate, it reduces reserves. Recall from Chapter 22 that the Fed can change the amount of reserves in the banking system through open market operations—that is, by buying and selling government bonds. If the Fed wants to increase reserves and thereby lower the federal funds rate, it buys government bonds. If the Fed wants to decrease reserves and thereby increase the federal funds rate, it sells government bonds.

**Table 24-1**

<table>
<thead>
<tr>
<th>(a) Inflation Rate</th>
<th>(b) Nominal Interest Rate Decision (made by the central bank)</th>
<th>Resulting Real Interest Rate (b) – (a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>1.0</td>
<td>2.5</td>
<td>1.5</td>
</tr>
<tr>
<td>2.0</td>
<td>4.0</td>
<td>2.0</td>
</tr>
<tr>
<td>3.0</td>
<td>5.5</td>
<td>2.5</td>
</tr>
<tr>
<td>4.0</td>
<td>7.0</td>
<td>3.0</td>
</tr>
<tr>
<td>5.0</td>
<td>8.5</td>
<td>3.5</td>
</tr>
<tr>
<td>6.0</td>
<td>10.0</td>
<td>4.0</td>
</tr>
<tr>
<td>7.0</td>
<td>11.5</td>
<td>4.5</td>
</tr>
<tr>
<td>8.0</td>
<td>13.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

The buying and selling of bonds are called open market operations.

REMINDER

**Actions the Fed takes:**
- To reduce the federal funds rate, the Fed increases the supply of reserves by buying bonds.
- To raise the federal funds rate, the Fed decreases the supply of reserves by selling bonds.

The federal funds rate is the interest rate on overnight loans between banks that the Federal Reserve influences by changing the supply of funds (bank reserves) in the market.

**REMINDER**

**A Graph of the Response of the Interest Rate to Inflation**  
Figure 24-3 represents the monetary policy rule graphically, using the information in Table 24-1. When the inflation rate rises, the nominal interest rate rises along the blue upward-sloping line. When the inflation rate declines, the nominal interest rate declines. The nominal interest rate must rise by more than the inflation rate if the real interest rate is to rise when inflation rises; this requires that the slope of the monetary policy rule in Figure 24-3 be greater than 1. For example, if the slope is 1.5, then when the inflation rate increases by 1 percentage point, the interest rate rises by 1.5 percentage points, as in Table 24-1. In other words, the nominal interest rate rises by 0.5 percentage point *more* than the inflation rate rises, causing the real interest rate to rise by...
0.5 percentage point. The resulting real interest rate decision of the Fed is indicated by the orange line: The real interest rate changes by 0.5 percentage point when the inflation rate changes by 1 percentage point. The real interest rate policy rule is shown in Figure 24-4.

Figure 24-3

A Monetary Policy Rule
The monetary policy rule shows that the Fed raises the real interest rate when inflation rises and lowers the real interest rate when inflation falls. To accomplish this, the Fed has to move the nominal interest rate by more than 1 percentage point when the rate of inflation changes by 1 percentage point.

Figure 24-4

The Real Interest Rate is Positively Related to Inflation
From now on, the monetary policy rule of the Fed will be presented as a relationship between the inflation rate and the real interest rate. When inflation rises, the Fed raises the real interest rate (through a more than proportional increase in the nominal interest rate), whereas when inflation falls, the Fed lowers the real interest rate (by decreasing the nominal rate in a more than proportional manner).
Most central banks have a **target inflation rate**, the inflation rate that the central bank tries to maintain on average over the long run. Because of various shocks to the economy, the central bank cannot control the inflation rate perfectly; sometimes the inflation rate will rise above the target inflation rate, and sometimes the inflation rate will fall below the target inflation rate. By reacting to these movements in inflation according to a monetary policy rule—that is, by increasing the interest rate when inflation rises and cutting the interest rate when inflation falls—the central bank will cause the actual inflation rate to move back toward the target inflation rate over time. Some central banks, such as the Bank of England and the Reserve Bank of New Zealand, have explicit inflation targets. Other central banks, like the Fed, have implicit inflation targets that are not announced explicitly, but that can be assessed by observing central bank decisions over time. The target inflation rate for many central banks is about 2 percent. For the economy described in Figure 24-3, at the target inflation rate of 2 percent, the central bank sets real interest rates at 2 percent by choosing a nominal rate of 4 percent.

**A Good Simplifying Assumption** The behavior of the central bank described in this section provides the easiest explanation of the response of interest rates to inflation, but it is not the only possible explanation. Economists have found that the general upward-sloping relationship in Figure 24-4, which we call the monetary policy rule, is common to many different types of monetary policies, including policies in which the central bank focuses on money growth. Although the position and shape of the monetary policy rule will differ for these different types of policies, the overall response of interest rates to inflation will be similar. We use this particular derivation because it is the easiest to explain and describes the actual behavior of the Fed and other central banks.

**Derivation of the Aggregate Demand Curve**

Thus far, we have shown that the level of real GDP is related negatively to the real interest rate and that the real interest rate is related positively to the inflation rate through the central bank’s policy rule. We now combine these two concepts to derive the aggregate demand curve—the inverse relationship between the inflation rate and real GDP.

The chain of reasoning that brings about the aggregate demand curve can be explained by considering what would happen if the inflation rate rose. First, the interest rate would rise because the Fed would raise the real interest rate in response to the higher inflation rate. Next, the higher real interest rate would mean less investment spending, a decline in net exports, and a decline in consumption. Lower investment spending would occur because investment would be made more costly by the high real interest rate. U.S. goods would become more expensive, and foreign goods would become cheaper. Thus, net exports—exports minus imports—would decline.

The opposite chain of events would occur if inflation fell. First, the Fed would lower the real interest rate according to the monetary policy rule. The lower real interest rate, in turn, would cause investment, net exports, and consumption to rise. Hence, real GDP would rise.

Thus, we see that when the inflation rate rises, real GDP decreases, and when the inflation rate falls, real GDP increases. In other words, a negative relationship exists between inflation and real GDP. When we graph this relationship in a diagram with real GDP on the horizontal axis and inflation on the vertical axis, we get a downward-sloping curve like the one shown in Figure 24-1; this curve is the aggregate demand curve, which we have thus derived.

If you want to review the derivation, seeing all the paragraphs together on the same page, a self-guided graphic overview is provided in Figure 24-5. If you read the explanatory boxes in numerical order, you will be able to trace the sequence of events following an increase in inflation, including the Fed’s real interest rate increase according to its policy rule and the decline in real GDP.
Follow the numbers to see an overview of the derivation of the aggregate demand curve. The black dots represent the situation before we increase the inflation rate. The pink dots represent the situation after we increase the inflation rate. When inflation rises, the central bank raises the real interest rate, and this lowers real GDP. Hence, we have the aggregate demand curve.

1. Suppose the inflation rate rises by this amount...
2. ...which is also noted in this diagram.
3. Then the Fed raises the real interest rate by this amount...
4. ...causing the expenditure line to shift down by this amount...
5. ...resulting in a decline in real GDP of this amount...
6. ...which is also noted in this diagram.
7. The $AD$ curve is then drawn through the resulting inflation and real GDP points.
The Fed Changes the Interest Rate

These two press statements from the Fed’s Federal Open Market Committee (FOMC) show how changes in the Fed’s target interest rate are determined by changes in the inflation rate, much as assumed by the monetary policy rule in Figure 24-3. In the first statement, issued in June 2008, about six months after the beginning of the most recent recession, the Fed explains that it left the interest rate unchanged because it was not clear whether inflation would rise (in which case the target interest rate would be increased) or fall (in which case the target interest rate would be lowered) in the next few months. In the second statement, which was issued a couple of months later, the Fed explains that it cut interest rates because the deteriorating economy had reduced the likelihood of higher inflation and made it more likely that inflation would move lower and not higher in the next few months. In an extremely unusual move, the policy decision made by the Fed was announced as a joint statement with leading central banks from the Euro area, Canada, Sweden, Switzerland and the United Kingdom, all of whom also were pledging to lower interest rates for similar reasons. With the benefit of hindsight, we now see what motivated the Federal Reserve and these other Central Banks to take such a dramatic step—the possibility that a full-blown financial crisis could trigger an extremely severe recession in the global economy.

**For Immediate Release: June 25, 2008**

The Federal Open Market Committee decided today to keep its target for the federal funds rate at 2 percent. Recent information indicates that overall economic activity continues to expand, partly reflecting some firming in household spending. However, labor markets have softened further and financial markets remain under considerable stress. Tight credit conditions, the ongoing housing contraction, and the rise in energy prices are likely to weigh on economic growth over the next few quarters.

The Committee expects inflation to moderate later this year and next year. However, in light of the continued increases in the prices of energy and some other commodities and the elevated state of some indicators of inflation expectations, uncertainty about the inflation outlook remains high.

The substantial easing of monetary policy to date, combined with ongoing measures to foster market liquidity, should help to promote moderate growth over time. Although downside risks to growth remain, they appear to have diminished somewhat, and the upside risks to inflation and inflation expectations have increased. The Committee will continue to monitor economic and financial developments and will act as needed to promote sustainable economic growth and price stability.

**Release Date: October 8, 2008**

**Joint Statement by Central Banks**

Throughout the current financial crisis, central banks have engaged in continuous close consultation and have cooperated in unprecedented joint actions such as the provision of liquidity to reduce strains in financial markets. Inflationary pressures have started to moderate in a number of countries, partly reflecting a marked decline in energy and other commodity prices. Inflation expectations are diminishing and remain anchored to price stability. The recent intensification of the financial crisis has augmented the downside risks to growth and thus has diminished further the upside risks to price stability.

Some easing of global monetary conditions is therefore warranted. Accordingly, the Bank of Canada, the Bank of England, the European Central Bank, the Federal Reserve, Sveriges Riksbank, and the Swiss National Bank are today announcing reductions in policy interest rates. The Bank of Japan expresses its strong support of these policy actions.

**Federal Reserve Actions**

The Federal Open Market Committee has decided to lower its target for the federal funds rate 50 basis points to 1-1/2 percent. The Committee took this action in light of evidence pointing to a weakening of economic activity and a reduction in inflationary pressures.

Incoming economic data suggest that the pace of economic activity has slowed markedly in recent months. Moreover, the intensification of financial market turmoil is likely to exert additional restraint on spending, partly by further reducing the ability of households and businesses to obtain credit. Inflation has been high, but the Committee believes that the decline in energy and other commodity prices and the weaker prospects for economic activity have reduced the upside risks to inflation. The Committee will monitor economic and financial developments carefully and will act as needed to promote sustainable economic growth and price stability.
**Movements along the Aggregate Demand Curve** Thus far, we have explained why the aggregate demand curve has a negative slope—that is, why higher inflation means a lower real GDP. A change in real GDP due to a change in inflation is thus a movement along the aggregate demand curve. In microeconomics, a similar movement along the demand curve occurs when a change in the price leads to a change in quantity demanded. When inflation rises, causing the Fed to raise the interest rate, and real GDP declines, a movement occurs up and to the left along the aggregate demand curve. When inflation declines and the Fed lowers the interest rate, causing GDP to rise, a movement occurs down and to the right along the aggregate demand curve.

**Shifts of the Aggregate Demand Curve** Now, the inflation rate is not the only thing that affects aggregate demand. Changes in government purchases, shifts in monetary policy, shifts in foreign demand for U.S. exports, changes in taxes, and changes in consumer confidence, among other things, affect aggregate demand. When any one of these factors changes aggregate demand, we call it a shift in the aggregate demand curve. Let us briefly consider some of those sources of shifts in the aggregate demand curve.

**Government Purchases** Imagine that government purchases rise. We know from our analysis of spending balance in Chapter 23 that an increase in government purchases will increase real GDP in the short run. This increase in real GDP occurs at any inflation rate: at 2 percent, at 4 percent, or at any other level. Now, if real GDP increases at a given inflation rate, the aggregate demand curve will shift to the right. This is shown in Figure 24-6. The new aggregate demand curve will be parallel to the original aggregate demand curve because no matter what the inflation rate is in the economy, the shift in government purchases is going to have the same effect on real GDP. The same reasoning implies that a decline in government spending shifts the aggregate demand curve to the left.

**Changes in the Target Inflation Rate** Suppose the Fed has an inflation target of 2 percent. Consider what happens when the Fed shifts its policy objectives. Suppose, for
instance, that the Fed chair decides that a somewhat higher inflation rate, say, 3 percent, would be tolerable to achieve some other objective. One example of such a change would be if the Fed was concerned about credit market conditions because firms were curtailing investment, or because consumers were cutting back on spending because of the difficulty in obtaining loans at affordable rates—or because the Fed believed that the banking sector was in trouble with more banks needing to borrow money from one another to meet their obligations to depositors. In that case, the Fed immediately will try to increase spending by lowering the real interest rate. This move will enhance access to credit, stimulate greater spending, and affect real GDP regardless of the current inflation rate: The \( AD \) curve will shift to the right, as shown in Figure 24-7.

This type of action also could work in reverse—the Fed could decide that the current inflation target is too high and that it needs to act to lower the targeted rate of inflation. To get inflation to fall, the Fed immediately will try to lower spending by raising the real interest rate: The \( AD \) curve will shift to the left. In practice, such a shift to a lower targeted rate of inflation could happen for a variety of reasons, including changes in the preferences of policymakers. For instance, when Paul Volcker took over as chairman of the Federal Reserve, it was clear that he had a much greater dislike of inflation than his predecessors. Therefore, it was not a surprise when he raised interest rates substantially, shortly after taking office.

**Other Changes** Many other changes in the economy (other than a change in the inflation rate, which is a movement along the \( AD \) curve) will shift the \( AD \) curve. We

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**Figure 24-7**

**A Shift in the Monetary Policy Rule**

A shift in the policy rule to higher inflation implies a decline in the real interest rate. The lower real interest rate increases real GDP in the short run. As a result, at a given inflation rate, the \( AD \) curve shifts to the right.
considered many such possibilities in Chapter 23; their effects on the aggregate demand curve are listed in Figure 24-8. For example, an increase in the foreign demand for U.S. products will increase net exports, raise real GDP, and shift the aggregate demand curve to the right. A drop in consumer confidence that reduces the amount of consumption at every level of income will shift the aggregate demand curve to the left. Finally, an increase in taxes shifts the aggregate demand curve to the left, whereas a decrease in taxes shifts the aggregate demand curve to the right.

**Figure 24-8**

A List of Possible Shifts in the Aggregate Demand Curve

Many things shift the AD curve. An increase in government purchases shifts the AD curve to the right. A change in the monetary policy rule toward a higher inflation target shifts the AD curve to the right. A decline in government purchases and a change in the monetary policy rule toward a lower inflation target shift the curve to the left.

**REVIEW**

- The aggregate demand curve is an inverse relationship between inflation and real GDP.
- Investment, net exports, and consumption are negatively related to the real interest rate. Hence, real GDP falls when the real interest rate rises, and vice versa.
- When inflation increases, the central bank raises the real interest rate, and this lowers real GDP. Conversely, when inflation falls, the central bank lowers the real interest rate, and this raises real GDP. It does so by moving nominal interest rates by more than 1 percentage point when inflation changes by 1 percentage point. These are movements along the aggregate demand curve.
- The aggregate demand curve shifts to the right when the central bank changes its monetary policy rule toward more inflation and shifts to the left when the central bank changes its policy rule toward less inflation.
- Higher government purchases shift the aggregate demand curve to the right. Lower government purchases shift the aggregate demand curve to the left.
Having derived the aggregate demand curve and studied its properties, let us now look at the inflation adjustment line, the second element of the economic fluctuations model. The inflation adjustment (IA) line is a flat line showing the level of inflation in the economy at any point in time. Figure 24-9 shows an example of the inflation adjustment line in a diagram with inflation on the vertical axis and real GDP on the horizontal axis. For example, if the line touches 4 percent on the vertical axis, it tells us that inflation is 4 percent.

The inflation adjustment line describes the economic behavior of firms and workers setting prices and wages in the economy. Next, we discuss several important features about the slope and position of the inflation adjustment line.

The Inflation Adjustment Line Is Flat

That the inflation adjustment line is flat indicates that firms and workers adjust their prices and wages in such a way that the inflation rate remains steady in the short run as real GDP changes. Only over time does inflation change significantly and the line move. In the short run, inflation stays at 4 percent, or wherever the line happens to be when real GDP changes.

In interpreting the inflation adjustment line, it is helpful to remember that it is part of a model of the overall economy and thus is an approximation of reality. In fact, inflation does not remain perfectly steady, and the inflation adjustment line can have a small upward slope. But it is a good approximation to assume that the inflation adjustment line is flat.

Inflation does not change very much in the short run even if real GDP and the demand for firms’ products changes for two good reasons: (1) expectations of continuing inflation and (2) staggered wage and price setting at different firms throughout the economy.

Expectations of Continuing Inflation

Expectations about the price and wage decisions of other firms throughout the economy influence a firm’s price and wage decisions. For example, if the overall inflation rate in the economy has been hovering around 4 percent year after year, then a firm can expect that its competitors’ prices probably will increase by about 4 percent per year, unless circumstances change. To keep prices near those of the competition, this firm will need to increase its price by about 4 percent each year. Thus, the inflation rate stays steady at 4 percent per year.

Wage adjustments also are influenced by expectations. If firms and workers expect that wages at other firms will be getting large wage increases, then meeting the competition will require similar large wage increases. A smaller wage increase would reduce the wage of the firm’s workers relative to that received by other workers. Many firms base their wage decisions on the wages paid by other firms. If they see the wages at other firms rising, they will be more willing to increase wages.

Firms and workers also look to expectations of inflation when deciding on wage increases. In an economy with 4 percent inflation, wages will have to increase by 4 percent for workers just to keep up with the cost of living. Lower wage increases would result in a decline in workers’ real wages.

Staggered Price and Wage Setting

Not all wages and prices are changed at the same time throughout the economy. Rather, price setting and wage setting are staggered over months and even years. For example, autoworkers might negotiate three-year...
wage contracts in 1996, 1999, 2002, and so on. Dockworkers might negotiate three-year contracts in 1997, 2000, 2003, and so on. Bus companies and train companies do not adjust their prices at the same time, even though they may be competing for the same riders. On any given day, we can be sure that a wage or price is adjusting somewhere in the economy, but the vast majority of wages and prices do not change.

Staggered price and wage setting slows down the adjustment of prices in the economy. When considering what wage increases are likely in the next year, firms and workers know about the most recent wage increases. For example, an agreement made by another firm to increase wages by 4 percent per year for three years into the future will affect the expectations of wages paid to competing workers in the future. This wage agreement will not change unless the firm is on the edge of bankruptcy, and perhaps not even then. Hence, workers and firms deciding on wage increases tend to match the wage increases recently made at other firms. Thus, price and wage decisions made today are directly influenced by price and wage decisions made yesterday.

As with many things in life, when today’s decisions are influenced by yesterday’s decisions, inertia sets in. The staggering of the decisions makes it difficult to break the inertia. Unless policy makers have a reason to make a change—such as a persistent decline in demand or a change in expectations of inflation—the price increases or wage increases continue from year to year. The flat inflation adjustment line describes this inertia.

The Inflation Adjustment Line Shifts Gradually When Real GDP Departs from Potential GDP

The inflation adjustment line does not always stay put; rather, it may shift up or down from year to year. If real GDP stays above potential GDP, then inflation starts to rise. Firms see that the demand for their products is remaining high, and they begin adjusting their prices. If the inflation rate is 4 percent, then the firms will have to raise their prices by more than 4 percent if they want their relative prices to increase. Hence, inflation starts to rise. The inflation adjustment line is shifted upward to illustrate this rise in inflation; it will keep shifting upward as long as real GDP is above potential GDP.

If real GDP is below potential GDP, however, then firms will see that the demand for their products is falling off, and they will adjust their prices. If inflation is 4 percent, the firms will raise their prices by less than 4 percent—perhaps by 2 percent—if they want the relative price of their goods to fall. Hence, inflation will fall. The inflation adjustment line is shifted down to illustrate this fall in inflation. Figure 24-9 shows the direction of these shifts.

If real GDP stays at potential GDP, neither to the left nor to the right of the vertical potential GDP line in Figure 24-9, then inflation remains unchanged. This steady inflation is represented by an unmoving inflation adjustment line year after year.

Changes in Expectations or Commodity Prices Shift the Inflation Adjustment Line

Even if real GDP is at potential GDP, some special events in the economy can cause the inflation adjustment line to shift up or down. One important example is shifts in expectations of inflation. If firms and workers expect inflation to rise, they are likely to raise wages and prices by a large amount to keep pace with the expected inflation. Thus, an increase in expectations of inflation will cause the inflation adjustment line to shift up to a higher inflation rate. And a decrease in expectations of inflation will cause the inflation adjustment line to shift down.
Another example is a change in commodity prices that affects firms’ costs of production. For example, we will examine the effects on inflation of an oil price increase in Chapter 25. By raising firms’ costs, such an oil price increase would lead firms to charge higher prices, and the inflation adjustment line would rise, at least temporarily.

**Does the Inflation Adjustment Line Fit the Facts?**

Are these assumptions about the inflation adjustment line accurate? Does inflation rise when real GDP is above potential GDP and fall when real GDP is below potential GDP?
Although there are exceptions, the answer is generally yes. Look back at Figure 17-8 in Chapter 17 for evidence.

One of the biggest declines in inflation occurred in the recession of 1982, when real GDP was far below potential GDP. Inflation also fell during the recessions of 1990–1991, 2001, and 2008 when real GDP fell below potential GDP. In 1998 and 1999, real GDP rose above potential GDP, but inflation did not immediately start to rise. This delay led some commentators to think that the inflation adjustment relationship was changing, but by late 1999 and 2000, inflation rose as predicted by the theory.

**REVIEW**

- The inflation adjustment (IA) line, the second element of the economic fluctuations model, is a flat line showing the level of inflation in the economy at any point in time. The inflation adjustment line describes the economic behavior of firms and workers setting prices and wages in the economy.
- Firms do not change their prices instantaneously when the demand for their product changes. Thus, when aggregate demand changes and real GDP departs from potential GDP, the inflation rate does not change immediately; the inflation adjustment line does not shift in response to such changes in the short run.
- Staggered wage and price setting tends to slow down the adjustment of inflation in the economy as a whole.
- Over time, inflation does respond to departures of real GDP from potential GDP. This response can be described by upward and downward shifts in the inflation adjustment line over time.

**Combining the Aggregate Demand Curve and the Inflation Adjustment Line**

We have now derived two relationships—the aggregate demand curve and the inflation adjustment line—that describe real GDP and inflation in the economy as a whole. The two relationships can be combined to make predictions about real GDP and inflation.

Along the aggregate demand curve in Figure 24-1, real GDP and inflation are negatively related. This curve describes the behavior of firms and consumers as they respond to a higher real interest rate caused by the Fed’s response to higher inflation. They respond by lowering consumption, investment, and net exports. This line presents a range of possible values of real GDP and inflation.

The inflation adjustment line in Figure 24-9, on the other hand, tells us what the inflation rate is at any point in time. Thus, we can use the inflation adjustment line to determine exactly what inflation rate applies to the aggregate demand curve. For example, if the inflation adjustment line tells us that the inflation rate for 2007 is 3 percent, then we can go right to the aggregate demand curve to determine what the level of real GDP will be at that 3 percent inflation rate. The inflation adjustment line tells us the current location of inflation—and therefore real GDP—on the aggregate demand curve.

Figure 24-10 illustrates the determination of real GDP and inflation graphically. It combines the aggregate demand curve from Figure 24-1 with the inflation adjustment line from Figure 24-9. At any point in time, the inflation adjustment line is given, as shown in Figure 24-10. The inflation adjustment line intersects the aggregate demand curve at a single point. It is at this point of intersection that inflation and real GDP are determined. The intersection gives an *equilibrium* level of real
GDP and inflation. At that point, we can look down to the horizontal axis of the diagram to determine the level of real GDP corresponding to that level of inflation. For example, the point of intersection in the left panel of Figure 24-10 might be when inflation is 5 percent and real GDP is 2 percent below potential GDP. The point of intersection in the right panel is at a lower inflation rate when real GDP is above potential GDP. The point of intersection in the middle panel of Figure 24-10 has real GDP equal to potential GDP.

As Figure 24-10 makes clear, the intersection of the inflation adjustment line and the aggregate demand curve may give values of real GDP that are either above or below potential GDP. But if real GDP is not equal to potential GDP, then the economy has not fully recovered from a recession, as on the left of Figure 24-10, or returned to potential GDP after being above it, as on the right. To describe dynamic movements of inflation and real GDP, we must consider how the inflation adjustment line and the aggregate demand curve shift over time. That is the subject of Chapter 25.

**Determining Real GDP and Inflation**

Real GDP is determined at the intersection of the \( AD \) curve and the \( IA \) line. All three panels have the same \( AD \) curve and the same vertical line marking potential GDP. Three different levels of the \( IA \) line give three different levels of real GDP: less than, equal to, and greater than potential GDP.

**REVIEW**

- In any year, the inflation adjustment line tells what the inflation rate is. Using the aggregate demand curve, we then can make a prediction about what real GDP is.
- The intersection of the aggregate demand curve and the inflation adjustment line gives a pair of observations on real GDP and inflation at any point in time.