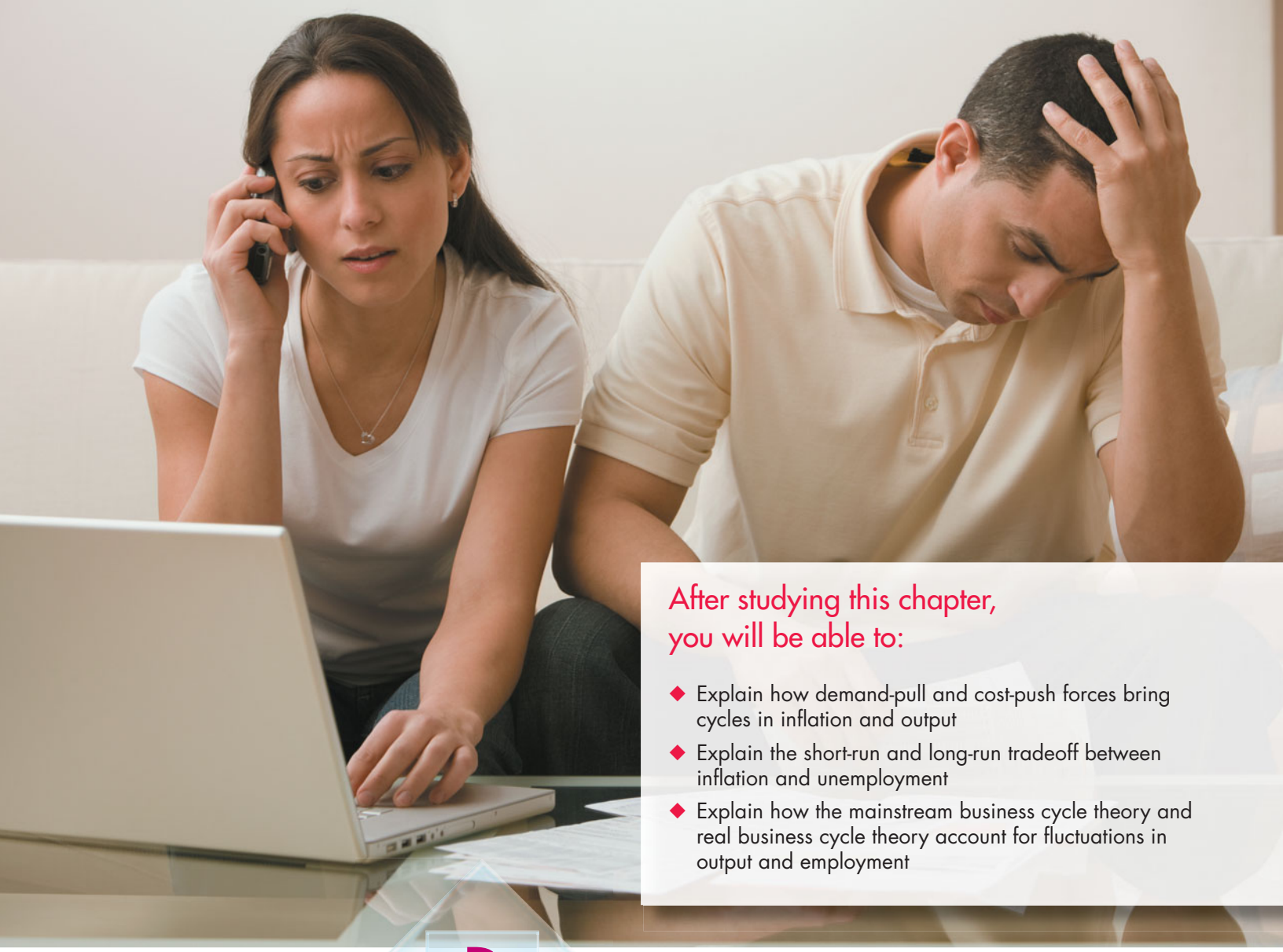


After studying this chapter, you will be able to:

- Explain how demand-pull and cost-push forces bring cycles in inflation and output
- Explain the short-run and long-run tradeoff between inflation and unemployment
- Explain how the mainstream business cycle theory and real business cycle theory account for fluctuations in output and employment

12

U.S. INFLATION, UNEMPLOYMENT, AND BUSINESS CYCLE

Back in the 1970s, when inflation was raging at a double-digit rate, economist Arthur M. Okun proposed what he called the "misery index." Misery, he suggested, could be measured as the sum of the inflation rate and the unemployment rate. At its peak, in 1980, the misery index hit 22. At its lowest, in 1953, the misery index was 3.

Inflation and unemployment make us miserable for good reasons. We care about inflation because it raises our cost of living. And we care about unemployment because either it hits us directly and takes our jobs or it scares us into thinking that we might lose our jobs.

We want rapid income growth, low unemployment, and low inflation. But can we have all these things at the same time? Or do we face a tradeoff among them? As this chapter explains, we face a tradeoff in the short run but not in the long run.

At the end of the chapter, in *Reading Between the Lines*, we examine the state of unemployment and inflation and the "misery index" in 2010 compared with some earlier episodes.

Inflation Cycles

In the long run, inflation is a monetary phenomenon. It occurs if the quantity of money grows faster than potential GDP. But in the short run, many factors can start an inflation, and real GDP and the price level interact. To study these interactions, we distinguish between two sources of inflation:

- Demand-pull inflation
- Cost-push inflation

Demand-Pull Inflation

An inflation that starts because aggregate demand increases is called **demand-pull inflation**. Demand-pull inflation can be kicked off by *any* of the factors that change aggregate demand. Examples are a cut in the interest rate, an increase in the quantity of money, an increase in government expenditure, a tax cut, an increase in exports, or an increase in investment stimulated by an increase in expected future profits.

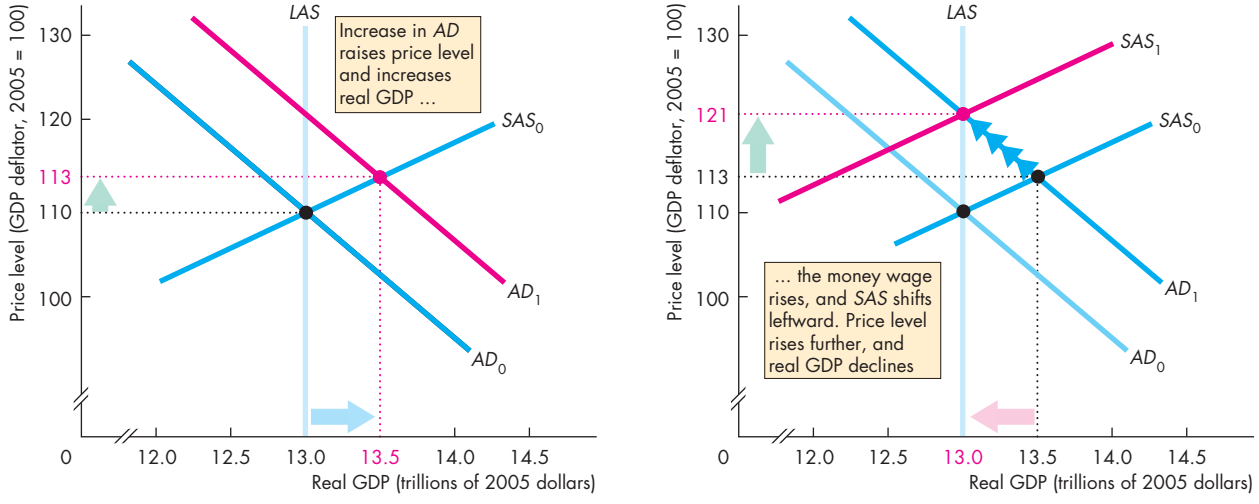
Initial Effect of an Increase in Aggregate Demand

Suppose that last year the price level was 110 and real GDP was $13 trillion. Potential GDP was also $13 trillion. Figure 12.1(a) illustrates this situation. The aggregate demand curve is AD_0, the short-run aggregate supply curve is SAS_0, and the long-run aggregate supply curve is *LAS*.

Now suppose that the Fed cuts the interest rate. The quantity of money increases and the aggregate demand curve shifts from AD_0 to AD_1. With no change in potential GDP and no change in the money wage rate, the long-run aggregate supply curve and the short-run aggregate supply curve remain at *LAS* and SAS_0, respectively.

The price level and real GDP are determined at the point where the aggregate demand curve AD_1 intersects the short-run aggregate supply curve. The price level rises to 113, and real GDP increases above potential GDP to $13.5 trillion. Unemployment falls below its natural rate. The economy is at an above full-employment equilibrium and there is an inflationary gap. The next step in the unfolding story is a rise in the money wage rate.

FIGURE 12.1 A Demand-Pull Rise in the Price Level



(a) Initial effect

In part (a), the aggregate demand curve is AD_0, the short-run aggregate supply curve is SAS_0, and the long-run aggregate supply curve is *LAS*. The price level is 110, and real GDP is $13 trillion, which equals potential GDP. Aggregate demand increases to AD_1. The price level rises to 113, and real GDP increases to $13.5 trillion.

(b) The money wage adjusts

In part (b), starting from the above full-employment equilibrium, the money wage rate begins to rise and the short-run aggregate supply curve shifts leftward toward SAS_1. The price level rises further, and real GDP returns to potential GDP.

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Money Wage Rate Response Real GDP cannot remain above potential GDP forever. With unemployment below its natural rate, there is a shortage of labor. In this situation, the money wage rate begins to rise. As it does so, short-run aggregate supply decreases and the *SAS* curve starts to shift leftward. The price level rises further, and real GDP begins to decrease.

With no further change in aggregate demand—that is, the aggregate demand curve remains at AD_1—this process ends when the short-run aggregate supply curve has shifted to SAS_1 in Fig. 12.1(b). At this time, the price level has increased to 121 and real GDP has returned to potential GDP of $13 trillion, the level at which it started.

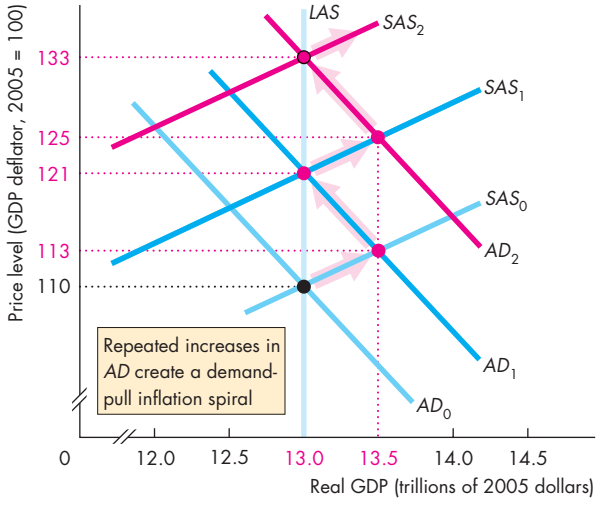
A Demand-Pull Inflation Process The events that we've just described bring a *one-time rise in the price level*, not an inflation. For inflation to proceed, aggregate demand must *persistently* increase.

The only way in which aggregate demand can persistently increase is if the quantity of money persistently increases. Suppose the government has a budget deficit that it finances by selling bonds. Also suppose that the Fed buys some of these bonds. When the Fed buys bonds, it creates more money. In this situation, aggregate demand increases year after year. The aggregate demand curve keeps shifting rightward. This persistent increase in aggregate demand puts continual upward pressure on the price level. The economy now experiences demand-pull inflation.

Figure 12.2 illustrates the process of demand-pull inflation. The starting point is the same as that shown in Fig. 12.1. The aggregate demand curve is AD_0, the short-run aggregate supply curve is SAS_0, and the long-run aggregate supply curve is *LAS*. Real GDP is $13 trillion, and the price level is 110. Aggregate demand increases, shifting the aggregate demand curve to AD_1. Real GDP increases to $13.5 trillion, and the price level rises to 113. The economy is at an above full-employment equilibrium. There is a shortage of labor, and the money wage rate rises. The short-run aggregate supply curve shifts to SAS_1. The price level rises to 121, and real GDP returns to potential GDP.

But the Fed increases the quantity of money again, and aggregate demand continues to increase. The aggregate demand curve shifts rightward to AD_2. The price level rises further to 125, and real GDP again exceeds potential GDP at $13.5 trillion. Yet again,

FIGURE 12.2 A Demand-Pull Inflation Spiral



Each time the quantity of money increases, aggregate demand increases and the aggregate demand curve shifts rightward from AD_0 to AD_1 to AD_2, and so on. Each time real GDP increases above potential GDP, the money wage rate rises and the short-run aggregate supply curve shifts leftward from SAS_0 to SAS_1 to SAS_2, and so on. The price level rises from 110 to 113, 121, 125, 133, and so on. There is a demand-pull inflation spiral. Real GDP fluctuates between $13 trillion and $13.5 trillion.

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the money wage rate rises and decreases short-run aggregate supply. The *SAS* curve shifts to SAS_2, and the price level rises further, to 133. As the quantity of money continues to grow, aggregate demand increases and the price level rises in an ongoing demand-pull inflation process.

The process you have just studied generates inflation—an ongoing process of a rising price level.

Demand-Pull Inflation in Kalamazoo You may better understand the inflation process that we've just described by considering what is going on in an individual part of the economy, such as a Kalamazoo soda-bottling plant. Initially, when aggregate demand increases, the demand for soda increases and the price of soda rises. Faced with a higher price, the soda plant works overtime and increases production. Conditions

are good for workers in Kalamazoo, and the soda factory finds it hard to hang on to its best people. To do so, it offers a higher money wage rate. As the wage rate rises, so do the soda factory's costs.

What happens next depends on aggregate demand. If aggregate demand remains constant, the firm's costs increase but the price of soda does not increase as quickly as its costs. In this case, the firm cuts production. Eventually, the money wage rate and costs increase by the same percentage as the rise in the price of soda. In real terms, the soda factory is in the same situation as it was initially. It produces the same amount of soda and employs the same amount of labor as before the increase in demand.

But if aggregate demand continues to increase, so does the demand for soda and the price of soda rises at the same rate as wages. The soda factory continues to operate at above full employment and there is a persistent shortage of labor. Prices and wages chase each other upward in a demand-pull inflation spiral.

Demand-Pull Inflation in the United States A demand-pull inflation like the one you've just studied occurred in the United States during the late 1960s. In 1960, inflation was a moderate 2 percent a year, but its rate increased slowly to 3 percent by 1966. Then, in 1967, a large increase in government expenditure on the Vietnam War and an increase in spending on social programs, together with an increase in the growth rate of the quantity of money, increased aggregate demand more quickly. Consequently, the rightward shift of the aggregate demand curve accelerated and the price level increased more quickly. Real GDP moved above potential GDP, and the unemployment rate fell below its natural rate.

With unemployment below its natural rate, the money wage rate started to rise more quickly and the short-run aggregate supply curve shifted leftward. The Fed responded with a further increase in the money growth rate, and a demand-pull inflation spiral unfolded. By 1970, the inflation rate had reached 5 percent a year.

For the next few years, aggregate demand grew even more quickly and the inflation rate kept rising. By 1974, the inflation rate had reached 11 percent a year.

Next, let's see how shocks to aggregate supply can create cost-push inflation.

Cost-Push Inflation

An inflation that is kicked off by an increase in costs is called **cost-push inflation**. The two main sources of cost increases are

1. An increase in the money wage rate
2. An increase in the money prices of raw materials

At a given price level, the higher the cost of production, the smaller is the amount that firms are willing to produce. So if the money wage rate rises or if the prices of raw materials (for example, oil) rise, firms decrease their supply of goods and services. Aggregate supply decreases, and the short-run aggregate supply curve shifts leftward.[1] Let's trace the effects of such a decrease in short-run aggregate supply on the price level and real GDP.

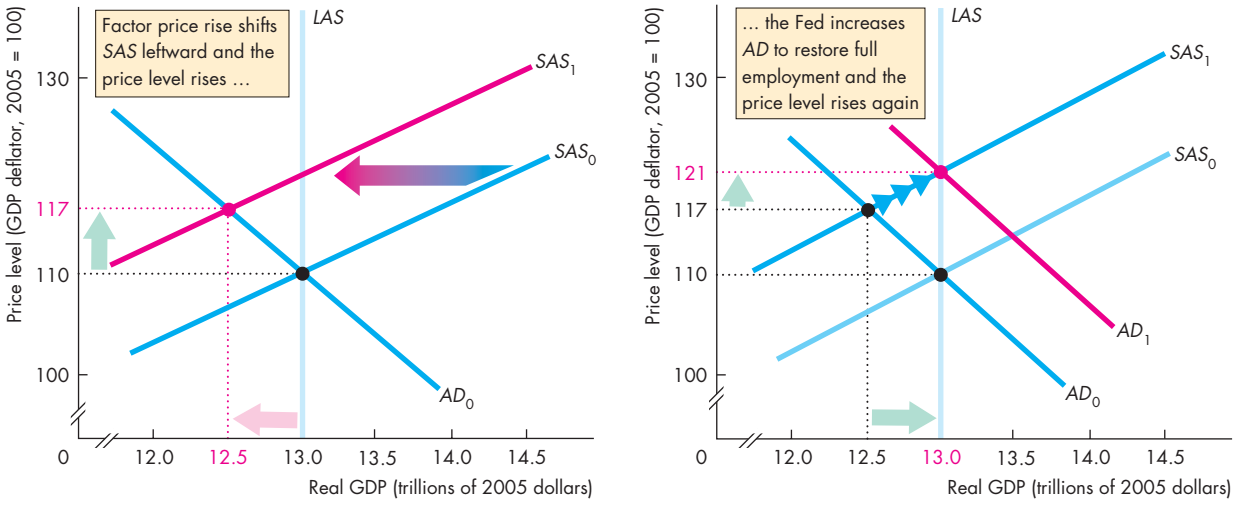
Initial Effect of a Decrease in Aggregate Supply

Suppose that last year the price level was 110 and real GDP was $13 trillion. Potential real GDP was also $13 trillion. Figure 12.3(a) illustrates this situation. The aggregate demand curve was AD_0, the short-run aggregate supply curve was SAS_0, and the long-run aggregate supply curve was *LAS*. In the current year, the world's oil producers form a price-fixing organization that strengthens their market power and increases the relative price of oil. They raise the price of oil, and this action decreases short-run aggregate supply. The short-run aggregate supply curve shifts leftward to SAS_1. The price level rises to 117, and real GDP decreases to $12.5 trillion. The economy is at a below full-employment equilibrium and there is a recessionary gap.

This event is a *one-time rise in the price level*. It is not inflation. In fact, a supply shock on its own cannot cause inflation. Something more must happen to enable a one-time supply shock, which causes a one-time rise in the price level, to be converted into a process of ongoing inflation. The quantity of money must persistently increase. Sometimes it does increase, as you will now see.

[1] Some cost-push forces, such as an increase in the price of oil accompanied by a decrease in the availability of oil, can also decrease long-run aggregate supply. We'll ignore such effects here and examine cost-push factors that change only short-run aggregate supply. Later in the chapter, we study the effects of shocks to long-run aggregate supply.

FIGURE 12.3 A Cost-Push Rise in the Price Level



(a) Initial cost push

Initially, the aggregate demand curve is AD_0, the short-run aggregate supply curve is SAS_0, and the long-run aggregate supply curve is *LAS*. A decrease in aggregate supply (for example, resulting from a rise in the world price of oil) shifts the short-run aggregate supply curve to SAS_1. The economy moves to the point where the short-run aggregate supply curve SAS_1 intersects the aggregate demand curve AD_0. The price level rises to 117, and real GDP decreases to $12.5 trillion.

(b) The Fed responds

In part (b), if the Fed responds by increasing aggregate demand to restore full employment, the aggregate demand curve shifts rightward to AD_1. The economy returns to full employment, but the price level rises further to 121.

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Aggregate Demand Response When real GDP decreases, unemployment rises above its natural rate. In such a situation, there is often an outcry of concern and a call for action to restore full employment. Suppose that the Fed cuts the interest rate and increases the quantity of money. Aggregate demand increases. In Fig. 12.3(b), the aggregate demand curve shifts rightward to AD_1 and full employment is restored. But the price level rises further to 121.

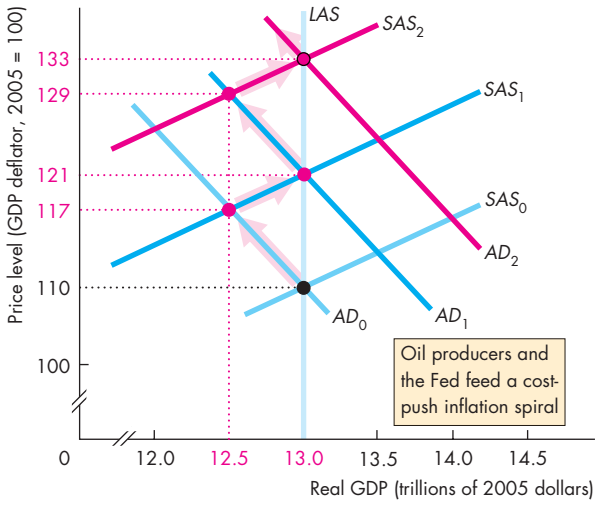
A Cost-Push Inflation Process The oil producers now see the prices of everything they buy increasing, so oil producers increase the price of oil again to restore its new high relative price. Figure 12.4 continues the story. The short-run aggregate supply curve now shifts to SAS_2. The price level rises and real GDP decreases.

The price level rises further, to 129, and real GDP decreases to $12.5 trillion. Unemployment increases above its natural rate. If the Fed responds yet again with an increase in the quantity of money, aggregate demand increases and the aggregate demand curve shifts to AD_2. The price level rises even higher—to 133—and full employment is again restored. A cost-push inflation spiral results. The combination of a rising price level and decreasing real GDP is called **stagflation.**

You can see that the Fed has a dilemma. If it does not respond when producers raise the oil price, the economy remains below full employment. If the Fed increases the quantity of money to restore full employment, it invites another oil price hike that will call forth yet a further increase in the quantity of money.

If the Fed responds to each oil price hike by increasing the quantity of money, inflation will rage along at a rate decided by oil producers. But if the Fed keeps the lid on money growth, the economy remains below full employment.

FIGURE 12.4 A Cost-Push Inflation Spiral



Each time a cost increase occurs, the short-run aggregate supply curve shifts leftward from SAS_0 to SAS_1 to SAS_2, and so on. Each time real GDP decreases below potential GDP, the Fed increases the quantity of money and the aggregate demand curve shifts rightward from AD_0 to AD_1 to AD_2, and so on. The price level rises from 110 to 117, 121, 129, 133, and so on. There is a cost-push inflation spiral. Real GDP fluctuates between $13 trillion and $12.5 trillion.

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Cost-Push Inflation in Kalamazoo What is going on in the Kalamazoo soda-bottling plant when the economy is experiencing cost-push inflation?

When the oil price increases, so do the costs of bottling soda. These higher costs decrease the supply of soda, increasing its price and decreasing the quantity produced. The soda plant lays off some workers.

This situation persists until either the Fed increases aggregate demand or the price of oil falls. If the Fed increases aggregate demand, the demand for soda increases and so does its price. The higher price of soda brings higher profits, and the bottling plant increases its production. The soda factory rehires the laid-off workers.

Cost-Push Inflation in the United States A cost-push inflation like the one you've just studied occurred in the United States during the 1970s. It began in 1974 when the Organization of the Petroleum Exporting Countries (OPEC) raised the price of oil fourfold. The higher oil price decreased aggregate supply, which caused the price level to rise more quickly and real GDP to shrink. The Fed then faced a dilemma: Would it increase the quantity of money and accommodate the cost-push forces, or would it keep aggregate demand growth in check by limiting money growth? In 1975, 1976, and 1977, the Fed repeatedly allowed the quantity of money to grow quickly and inflation proceeded at a rapid rate. In 1979 and 1980, OPEC was again able to push oil prices higher. On that occasion, the Fed decided not to respond to the oil price hike with an increase in the quantity of money. The result was a recession but also, eventually, a fall in inflation.

Expected Inflation

If inflation is expected, the fluctuations in real GDP that accompany demand-pull and cost-push inflation that you've just studied don't occur. Instead, inflation proceeds as it does in the long run, with real GDP equal to potential GDP and unemployment at its natural rate. Figure 12.5 explains why.

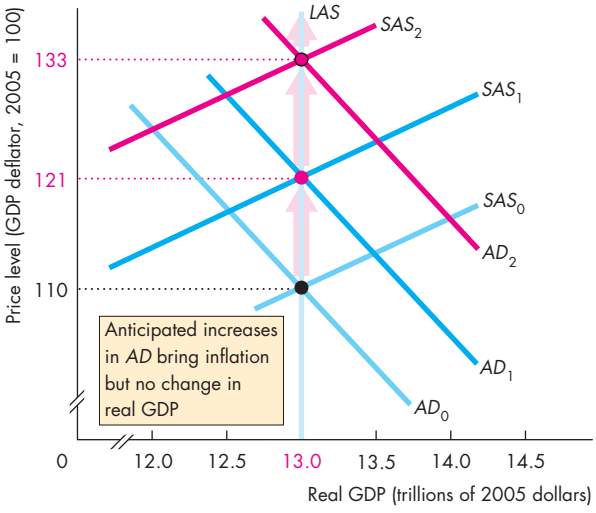
Suppose that last year the aggregate demand curve was AD_0, the aggregate supply curve was SAS_0, and the long-run aggregate supply curve was *LAS*. The price level was 110, and real GDP was $13 trillion, which is also potential GDP.

To keep things as simple as possible, suppose that potential GDP does not change, so the *LAS* curve doesn't shift. Also suppose that aggregate demand is *expected to increase* to AD_1.

In anticipation of this increase in aggregate demand, the money wage rate rises and the short-run aggregate supply curve shifts leftward. If the money wage rate rises by the same percentage as the price level is expected to rise, the short-run aggregate supply curve for next year is SAS_1.

If aggregate demand turns out to be the same as expected, the aggregate demand curve is AD_1. The short-run aggregate supply curve, SAS_1, and AD_1 determine the actual price level at 121. Between last year and this year, the price level increased from 110 to 121 and the economy experienced an inflation rate equal to that expected. If this inflation is ongoing, aggregate demand increases (as expected) in the following year and the aggregate demand curve shifts to AD_2. The money wage rate rises to reflect the expected inflation, and the short-run aggregate sup-

FIGURE 12.5 Expected Inflation



Potential real GDP is $13 trillion. Last year, aggregate demand was AD_0 and the short-run aggregate supply curve was SAS_0. The actual price level was the same as the expected price level: 110. This year, aggregate demand is expected to increase to AD_1 and the price level is expected to rise from 110 to 121. As a result, the money wage rate rises and the short-run aggregate supply curve shifts to SAS_1. If aggregate demand actually increases as expected, the actual aggregate demand curve AD_1 is the same as the expected aggregate demand curve. Real GDP is $13 trillion, and the actual price level rises to 121. The inflation is expected. Next year, the process continues with aggregate demand increasing as expected to AD_2 and the money wage rate rising to shift the short-run aggregate supply curve to SAS_2. Again, real GDP remains at $13 trillion, and the price level rises, as expected, to 133.

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ply curve shifts to SAS_2. The price level rises, as expected, to 133.

What caused this inflation? The immediate answer is that because people expected inflation, the money wage rate increased and the price level increased. But the expectation was correct. Aggregate demand was expected to increase, and it did increase. It is the actual and expected increase in aggregate demand that caused the inflation.

An expected inflation at full employment is exactly the process that the quantity theory of money predicts. To review the quantity theory of money, see Chapter 8, pp. 200–201.

This broader account of the inflation process and its short-run effects show why the quantity theory of money doesn't explain the *fluctuations* in inflation. The economy follows the course described in Fig. 12.5, but as predicted by the quantity theory, only if aggregate demand growth is forecasted correctly.

Forecasting Inflation

To anticipate inflation, people must forecast it. Some economists who work for macroeconomic forecasting agencies, banks, insurance companies, labor unions, and large corporations specialize in inflation forecasting. The best forecast available is one that is based on all the relevant information and is called a **rational expectation**. A rational expectation is not necessarily a correct forecast. It is simply the best forecast with the information available. It will often turn out to be wrong, but no other forecast that could have been made with the information available could do better.

Inflation and the Business Cycle

When the inflation forecast is correct, the economy operates at full employment. If aggregate demand grows faster than expected, real GDP rises above potential GDP, the inflation rate exceeds its expected rate, and the economy behaves like it does in a demand-pull inflation. If aggregate demand grows more slowly than expected, real GDP falls below potential GDP and the inflation rate slows.

REVIEW QUIZ

1. How does demand-pull inflation begin?
2. What must happen to create a demand-pull inflation spiral?
3. How does cost-push inflation begin?
4. What must happen to create a cost-push inflation spiral?
5. What is stagflation and why does cost-push inflation cause stagflation?
6. How does expected inflation occur?
7. How do real GDP and the price level change if the forecast of inflation is incorrect?

You can work these questions in Study Plan 12.1 and get instant feedback. myeconlab

Inflation and Unemployment: The Phillips Curve

Another way of studying inflation cycles focuses on the relationship and the short-run tradeoff between inflation and unemployment, a relationship called the **Phillips curve**—so named because it was first suggested by New Zealand economist A.W. Phillips.

Why do we need another way of studying inflation? What is wrong with the *AS-AD* explanation of the fluctuations in inflation and real GDP? The first answer to both questions is that we often want to study changes in both the expected and actual inflation rates and for this purpose, the Phillips curve provides a simpler tool and clearer insights than the *AS-AD* model provides. The second answer to both questions is that we often want to study changes in the short-run tradeoff between inflation and real economic activity (real GDP and unemployment) and again, the Phillips curve serves this purpose well.

To begin our explanation of the Phillips curve, we distinguish between two time frames (similar to the two aggregate supply time frames). We study

- The short-run Phillips curve
- The long-run Phillips curve

The Short-Run Phillips Curve

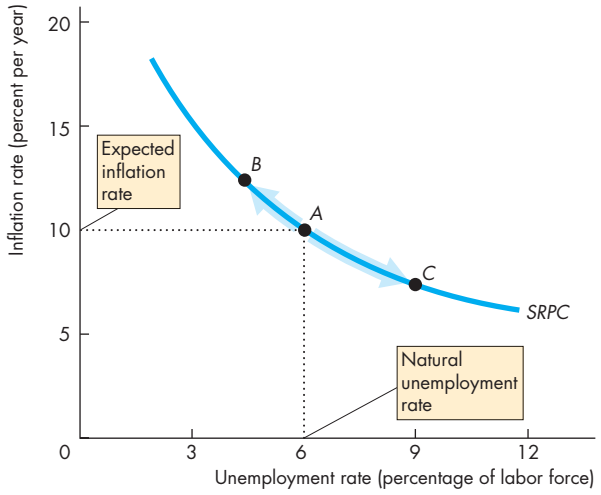
The **short-run Phillips curve** shows the relationship between inflation and unemployment, holding constant:

1. The expected inflation rate
2. The natural unemployment rate

You've just seen what determines the expected inflation rate. The natural unemployment rate and the factors that influence it are explained in Chapter 5, pp. 113–114.

Figure 12.6 shows a short-run Phillips curve, *SRPC*. Suppose that the expected inflation rate is 10 percent a year and the natural unemployment rate is 6 percent, point *A* in the figure. A short-run Phillips curve passes through this point. If inflation rises above its expected rate, unemployment falls below its natural rate. This joint movement in the inflation rate and the unemployment rate is illustrated as a movement up along the short-run Phillips curve from point *A* to point *B*. Similarly, if inflation falls below its expected rate, unemployment rises above its natural rate. In this case, there is movement down along the short-run Phillips curve from point *A* to point *C*.

FIGURE 12.6 A Short-Run Phillips Curve



The short-run Phillips curve (*SRPC*) shows the relationship between inflation and unemployment at a given expected inflation rate and a given natural unemployment rate. With an expected inflation rate of 10 percent a year and a natural unemployment rate of 6 percent, the short-run Phillips curve passes through point *A*.

An unexpected increase in aggregate demand lowers unemployment and increases the inflation rate—a movement up along the short-run Phillips curve to point *B*. An unexpected decrease in aggregate demand increases unemployment and lowers the inflation rate—a movement down along the short-run Phillips curve to point *C*.

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The short-run Phillips curve is like the short-run aggregate supply curve. A movement along the *SAS* curve that brings a higher price level and an increase in real GDP is equivalent to a movement along the short-run Phillips curve from *A* to *B* that brings an increase in the inflation rate and a decrease in the unemployment rate.

Similarly, a movement along the *SAS* curve that brings a lower price level and a decrease in real GDP is equivalent to a movement along the short-run Phillips curve from *A* to *C* that brings a decrease in the inflation rate and an increase in the unemployment rate.

The Long-Run Phillips Curve

The **long-run Phillips curve** shows the relationship between inflation and unemployment when the actual inflation rate equals the expected inflation rate. The long-run Phillips curve is vertical at the natural unemployment rate. In Fig. 12.7, it is the vertical line *LRPC*.

The long-run Phillips curve tells us that any expected inflation rate is possible at the natural unemployment rate. This proposition is consistent with the *AS-AD* model, which predicts (and which Fig. 12.5 illustrates) that when inflation is expected, real GDP equals potential GDP and unemployment is at its natural rate.

The short-run Phillips curve intersects the long-run Phillips curve at the expected inflation rate. A change in the expected inflation rate shifts the short-run Phillips curve but it does not shift the long-run Phillips curve.

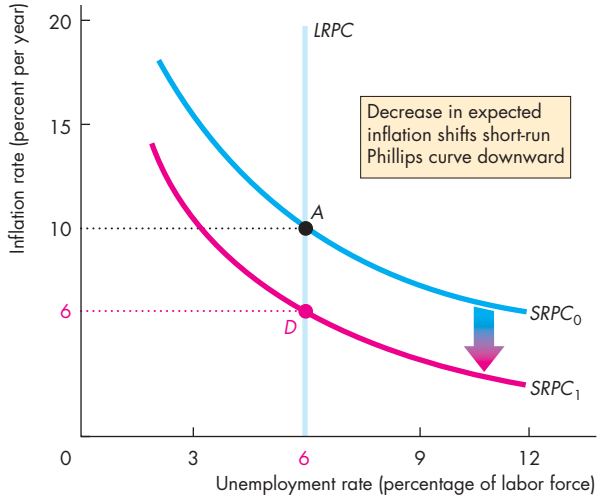
In Fig. 12.7, if the expected inflation rate is 10 percent a year, the short-run Phillips curve is $SRPC_0$. If the expected inflation rate falls to 6 percent a year, the short-run Phillips curve shifts downward to $SRPC_1$. The vertical distance by which the short-run Phillips curve shifts from point *A* to point *D* is equal to the change in the expected inflation rate. If the actual inflation rate also falls from 10 percent to 6 percent, there is a movement down the long-run Phillips curve from *A* to *D*. An increase in the expected inflation rate has the opposite effect to that shown in Fig. 12.7.

The other source of a shift in the Phillips curve is a change in the natural unemployment rate.

Changes in the Natural Unemployment Rate

The natural unemployment rate changes for many reasons (see Chapter 5, pp. 113–114). A change in the natural unemployment rate shifts both the short-run and long-run Phillips curves. Figure 12.8 illustrates such shifts.

FIGURE 12.7 Short-Run and Long-Run Phillips Curves



The long-run Phillips curve is *LRPC*. A fall in expected inflation from 10 percent a year to 6 percent a year shifts the short-run Phillips curve downward from $SRPC_0$ to $SRPC_1$. The long-run Phillips curve does not shift. The new short-run Phillips curve intersects the long-run Phillips curve at the new expected inflation rate—point *D*.

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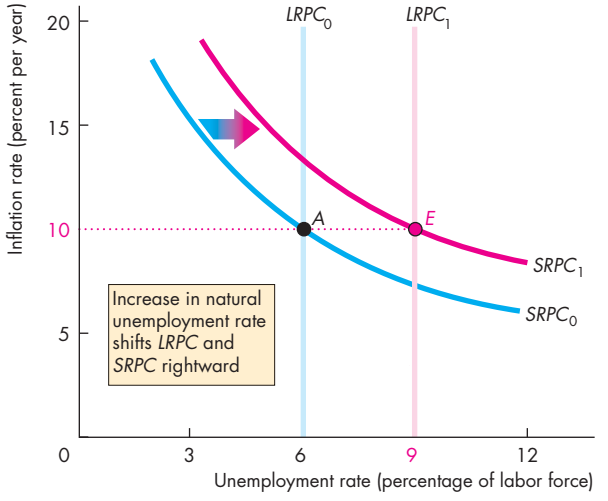
FIGURE 12.8 A Change in the Natural Unemployment Rate



A change in the natural unemployment rate shifts both the short-run and long-run Phillips curves. An increase in the natural unemployment rate from 6 percent to 9 percent shifts the Phillips curves rightward to $SRPC_1$ and $LRPC_1$. The new long-run Phillips curve intersects the new short-run Phillips curve at the expected inflation rate—point *E*.

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Economics in Action

The Shifting Short-Run Tradeoff

Figure 1 is a scatter diagram of the U.S. inflation rate (measured by the GDP deflator) and the unemployment rate since 1961. We can interpret the data in terms of the shifting short-run Phillips curve in Fig. 2.

During the 1960s, the short-run Phillips curve was $SRPC_0$, with a natural unemployment rate of 4.5 percent and an expected inflation rate of 2 percent a year (point *A*).

During the early 1970s, the short-run Phillips curve was $SRPC_1$, with a natural unemployment rate of 5 percent and an expected inflation rate of 6 percent a year (point *B*).

During the late 1970s, the natural unemployment rate increased to 8 percent (point *C*) and the short-run Phillips curve shifted to $SRPC_2$. Briefly in 1975 and again in 1981, the expected inflation rate surged to 9 percent a year (point *D*) and the short-run Phillips curve shifted to $SRPC_3$.

During the 1980s and 1990s, the expected inflation rate and the natural unemployment rate decreased and the short-run Phillips curve shifted leftward back to $SRPC_1$ and, by the mid-1990s, back to $SRPC_0$, where it remained into the 2000s.

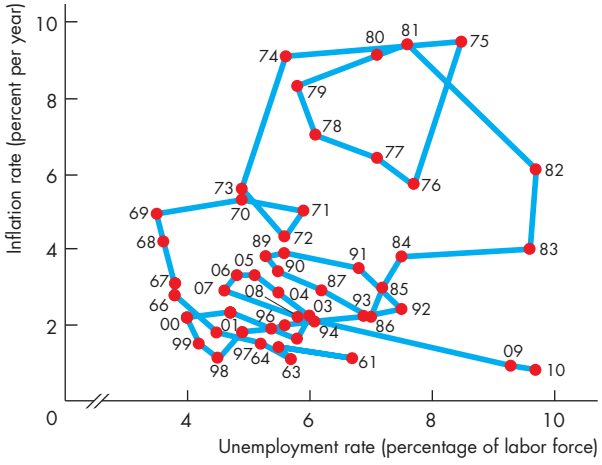

Figure 1 Phillips Curve Data in the United States: The Time Sequence

Source of data: Bureau of Labor Statistics.

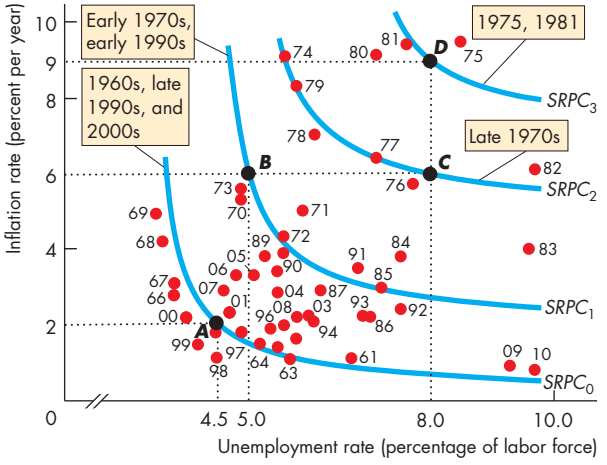

Figure 2 The Shifting Phillips Curves

If the natural unemployment rate increases from 6 percent to 9 percent, the long-run Phillips curve shifts from $LRPC_0$ to $LRPC_1$, and if expected inflation is constant at 10 percent a year, the short-run Phillips curve shifts from $SRPC_0$ to $SRPC_1$. Because the expected inflation rate is constant, the short-run Phillips curve $SRPC_1$ intersects the long-run curve $LRPC_1$ (point *E*) at the same inflation rate at which the short-run Phillips curve $SRPC_0$ intersects the long-run curve $LRPC_0$ (point *A*).

Changes in both the expected inflation rate and the natural unemployment rate have shifted the U.S. Phillips curve but the expected inflation rate has had the greater effect.

REVIEW QUIZ

1. How would you use the Phillips curve to illustrate an unexpected change in inflation?
2. If the expected inflation rate increases by 10 percentage points, how do the short-run Phillips curve and the long-run Phillips curve change?
3. If the natural unemployment rate increases, what happens to the short-run Phillips curve and the long-run Phillips curve?
4. Does the United States have a stable short-run Phillips curve? Explain why or why not.

You can work these questions in Study Plan 12.2 and get instant feedback.

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The Business Cycle

The business cycle is easy to describe but hard to explain and business cycle theory remains unsettled and a source of controversy. We'll look at two approaches to understanding the business cycle:

- Mainstream business cycle theory
- Real business cycle theory

Mainstream Business Cycle Theory

The mainstream business cycle theory is that potential GDP grows at a steady rate while aggregate demand grows at a fluctuating rate. Because the money wage rate is sticky, if aggregate demand grows faster than potential GDP, real GDP moves above potential GDP and an inflationary gap emerges. And if aggregate demand grows slower than potential GDP, real GDP moves below potential GDP and a recessionary gap emerges. If aggregate demand decreases, real GDP also decreases in a recession.

Figure 12.9 illustrates this business cycle theory. Initially, actual and potential GDP are $10 trillion. The long-run aggregate supply curve is LAS_0, the aggregate demand curve is AD_0, and the price level is 100. The economy is at full employment at point *A*.

An expansion occurs when potential GDP increases and the *LAS* curve shifts rightward to LAS_1. During an expansion, aggregate demand also increases, and usually by more than potential GDP, so the price level rises. Assume that in the current expansion, the price level is expected to rise to 110 and the money wage rate has been set based on that expectation. The short-run aggregate supply curve is SAS_1.

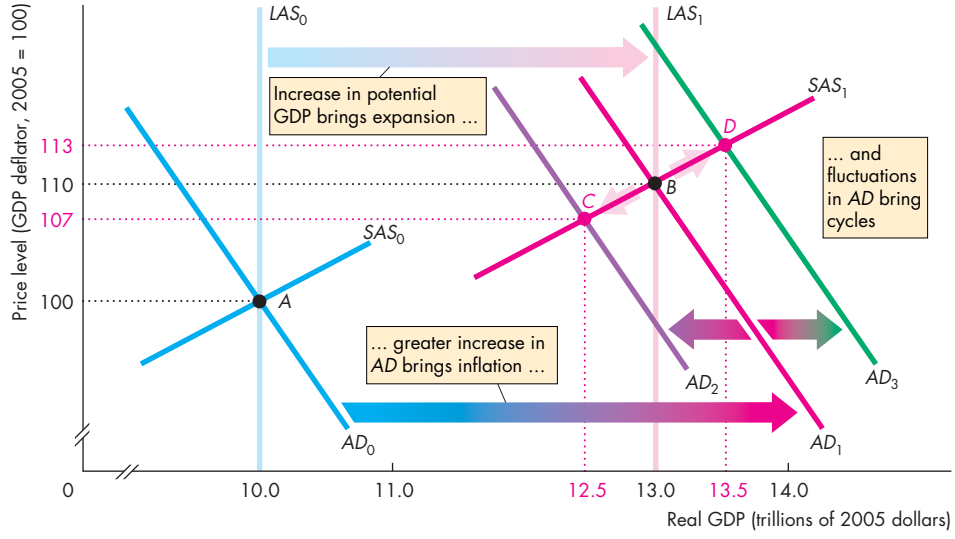
If aggregate demand increases to AD_1, real GDP increases to $13 trillion, the new level of potential GDP, and the price level rises, as expected, to 110. The economy remains at full employment but now at point *B*.

If aggregate demand increases more slowly to AD_2, real GDP grows by less than potential GDP and the economy moves to point *C*, with real GDP at $12.5 trillion and the price level at 107. Real GDP growth is slower and inflation is lower than expected.

If aggregate demand increases more quickly to AD_3, real GDP grows by more than potential GDP and the economy moves to point *D*, with real GDP at $13.5 trillion and the price level at 113. Real GDP growth is faster and inflation is higher than expected.

Growth, inflation, and the business cycle arise from the relentless increases in potential GDP, faster (on average) increases in aggregate demand, and fluctuations in the pace of aggregate demand growth.

FIGURE 12.9 The Mainstream Business Cycle Theory



In a business cycle expansion, potential GDP increases and the *LAS* curve shifts rightward from LAS_0 to LAS_1. A greater than expected increase in aggregate demand brings inflation.

If the aggregate demand curve shifts to AD_1, the economy remains at full employment. If the aggregate demand curve shifts to AD_2, a recessionary gap arises. If the aggregate demand curve shifts to AD_3, an inflationary gap arises.

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This mainstream theory comes in a number of special forms that differ regarding the source of fluctuations in aggregate demand growth and the source of money wage stickiness.

Keynesian Cycle Theory In **Keynesian cycle theory**, fluctuations in investment driven by fluctuations in business confidence—summarized by the phrase "animal spirits"—are the main source of fluctuations in aggregate demand.

Monetarist Cycle Theory In **monetarist cycle theory**, fluctuations in both investment and consumption expenditure, driven by fluctuations in the growth rate of the quantity of money, are the main source of fluctuations in aggregate demand.

Both the Keynesian and monetarist cycle theories simply assume that the money wage rate is rigid and don't explain that rigidity.

Two newer theories seek to explain money wage rate rigidity and to be more careful about working out its consequences.

New Classical Cycle Theory In **new classical cycle theory**, the rational expectation of the price level, which is determined by potential GDP and *expected* aggregate demand, determines the money wage rate and the position of the *SAS* curve. In this theory, only *unexpected* fluctuations in aggregate demand bring fluctuations in real GDP around potential GDP.

New Keynesian Cycle Theory The **new Keynesian cycle theory** emphasizes the fact that today's money wage rates were negotiated at many past dates, which means that *past* rational expectations of the current price level influence the money wage rate and the position of the *SAS* curve. In this theory, both unexpected and currently expected fluctuations in aggregate demand bring fluctuations in real GDP around potential GDP.

The mainstream cycle theories don't rule out the possibility that occasionally an aggregate supply shock might occur. An oil price rise, a widespread drought, a major hurricane, or another natural disaster, could, for example, bring a recession. But supply shocks are not the normal source of fluctuations in the mainstream theories. In contrast, real business cycle theory puts supply shocks at center stage.

Real Business Cycle Theory

The newest theory of the business cycle, known as **real business cycle theory** (or RBC theory), regards random fluctuations in productivity as the main source of economic fluctuations. These productivity fluctuations are assumed to result mainly from fluctuations in the pace of technological change, but they might also have other sources, such as international disturbances, climate fluctuations, or natural disasters. The origins of RBC theory can be traced to the rational expectations revolution set off by Robert E. Lucas, Jr., but the first demonstrations of the power of this theory were given by Edward Prescott and Finn Kydland and by John Long and Charles Plosser. Today, RBC theory is part of a broad research agenda called dynamic general equilibrium analysis, and hundreds of young macroeconomists do research on this topic.

We'll explore RBC theory by looking first at its impulse and then at the mechanism that converts that impulse into a cycle in real GDP.

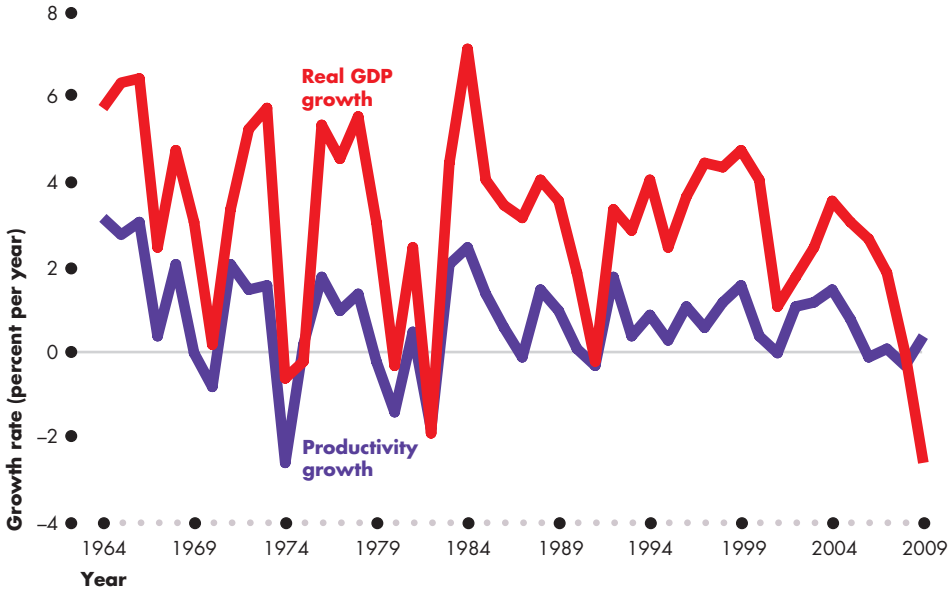
The RBC Impulse The impulse in RBC theory is the growth rate of productivity that results from technological change. RBC theorists believe this impulse to be generated mainly by the process of research and development that leads to the creation and use of new technologies.

To isolate the RBC theory impulse, economists measure the change in the combined productivity of capital and labor. Figure 12.10 shows the RBC impulse for the United States from 1964 through 2009. You can see that fluctuations in productivity growth are correlated with real GDP fluctuations.

The pace of technological change and productivity growth is not constant. Sometimes productivity growth speeds up, sometimes it slows, and occasionally it even *falls*—labor and capital become less productive, on average. A period of rapid productivity growth brings a business cycle expansion, and a slowdown or fall in productivity triggers a recession.

It is easy to understand why technological change brings productivity growth. But how does it *decrease* productivity? All technological change eventually increases productivity. But if initially, technological change makes a sufficient amount of existing capital—especially human capital—obsolete, productivity can temporarily fall. At such a time, more jobs are destroyed than created and more businesses fail than start up.

FIGURE 12.10 The Real Business Cycle Impulse



The real business cycle is caused by changes in technology that bring fluctuations in the growth rate of productivity*. Productivity fluctuations are correlated with real GDP fluctuations and most recessions are associated with a slowdown in productivity growth. The 2008-2009 recession is an exception and occurred at a time when productivity growth increased.

*Productivity growth calculations are based on assumptions about the aggregate production function.

Source of data: Bureau of Economic Analysis.

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The RBC Mechanism Two effects follow from a change in productivity that sparks an expansion or a contraction:

1. Investment demand changes.
2. The demand for labor changes.

We'll study these effects and their consequences during a recession. In an expansion, they work in the direction opposite to what is described here.

Technological change makes some existing capital obsolete and temporarily decreases productivity. Firms expect the future profits to fall and see their labor productivity falling. With lower profit expectations, they cut back their purchases of new capital, and with lower labor productivity, they plan to lay off some workers. So the initial effect of a temporary fall in productivity is a decrease in investment demand and a decrease in the demand for labor.

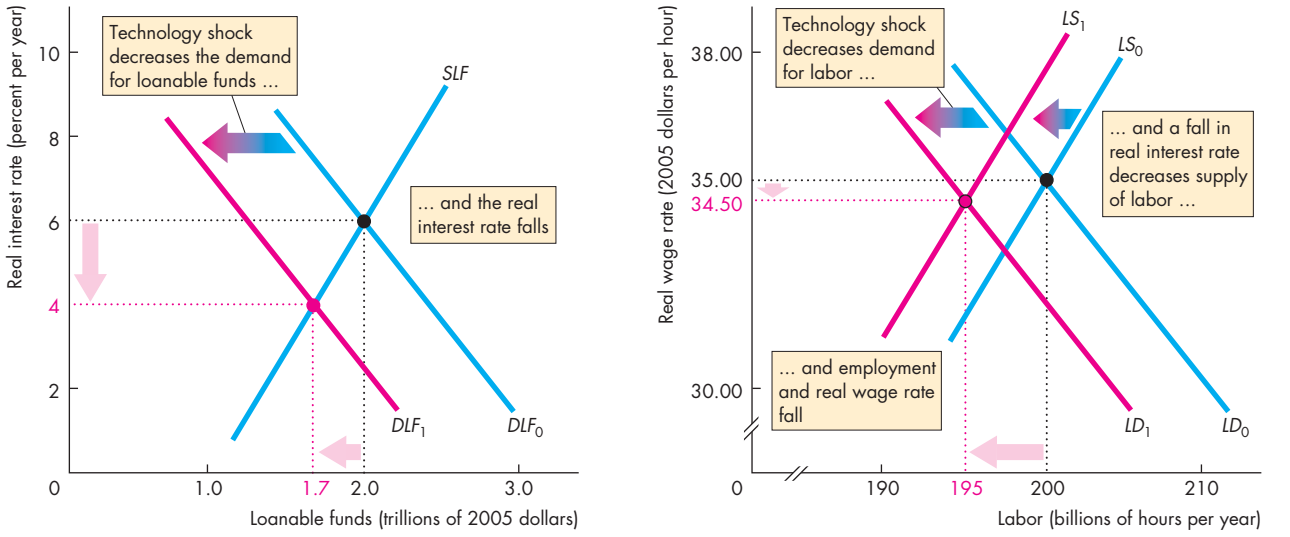
Figure 12.11 illustrates these two initial effects of a decrease in productivity. Part (a) shows the effects of a decrease in investment demand in the loanable funds market. The demand for loanable funds curve is *DLF* and the supply of loanable funds curve is *SLF* (both of which are explained in Chapter 7, pp. 166–168). Initially, the demand for loanable funds curve is DLF_0 and the equilibrium quantity of funds is $2 trillion at a real interest rate of 6 percent a year. A decrease in productivity decreases investment demand, and the demand for loanable funds curve shifts leftward from *DLF* to DLF_1. The real interest rate falls to 4 percent a year, and the equilibrium quantity of loanable funds decreases to $1.7 trillion.

Figure 12.11(b) shows the demand for labor and supply of labor (which are explained in Chapter 6, pp. 139–140). Initially, the demand for labor curve is LD_0, the supply of labor curve LS_0, and equilibrium employment is 200 billion hours a year at a real wage rate of $35 an hour. The decrease in productivity decreases the demand for labor, and the demand for labor curve shifts leftward from LD_0 to LD_1.

Before we can determine the new level of employment and real wage rate, we need to take a ripple effect into account—the key effect in RBC theory.

The Key Decision: When to Work? According to RBC theory, people decide *when* to work by doing a cost-benefit calculation. They compare the return

FIGURE 12.11 Loanable Funds and Labor Markets in a Real Business Cycle



(a) Loanable funds and interest rate

(b) Labor and wage rate

In part (a), the supply of loanable funds *SLF* and initial demand for loanable funds DLF_0 determine the real interest rate at 6 percent a year. In part (b), the initial demand for labor LD_0 and supply of labor, LS_0, determine the real wage rate at $35 an hour and employment at 200 billion hours. A technological change temporarily decreases productivity, and both the demand for loanable funds and the demand for labor decrease. The two demand curves shift leftward to DLF_1 and LD_1. In part (a), the real interest rate falls to 4 percent a year. In part (b), the fall in the real interest rate decreases the supply of labor (the when-to-work decision) and the supply of labor curve shifts leftward to LS_1. Employment decreases to 195 billion hours, and the real wage rate falls to $34.50 an hour. A recession is under way.

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from working in the current period with the *expected* return from working in a later period. You make such a comparison every day in school. Suppose your goal in this course is to get an A. To achieve this goal, you work hard most of the time. But during the few days before the midterm and final exams, you work especially hard. Why? Because you believe that the return from studying close to the exam is greater than the return from studying when the exam is a long time away. So during the term, you take time off for the movies and other leisure pursuits, but at exam time, you study every evening and weekend.

RBC theory says that workers behave like you. They work fewer hours, sometimes zero hours, when the real wage rate is temporarily low, and they work more hours when the real wage rate is temporarily high. But to properly compare the current wage rate with the expected future wage rate, workers must use the real interest rate. If the real interest rate is 6 percent a year, a real wage of $1 an hour earned this week will become $1.06 a year from now. If the real wage rate is expected to be $1.05 an hour next year, today's real wage of $1 looks good. By working longer hours now and shorter hours a year from now, a person can get a 1 percent higher real wage. But suppose the real interest rate is 4 percent a year. In this case, $1 earned now is worth $1.04 next year. Working fewer hours now and more next year is the way to get a 1 percent higher real wage.

So the when-to-work decision depends on the real interest rate. The lower the real interest rate, other things remaining the same, the smaller is the supply of labor today. Many economists believe this *intertemporal substitution* effect to be of negligible size. RBC theorists believe that the effect is large, and it is the key feature of the RBC mechanism.

You saw in Fig. 12.11(a) that the decrease in the demand for loanable funds lowers the real interest rate. This fall in the real interest rate lowers the return to current work and decreases the supply of labor.

In Fig. 12.11(b), the labor supply curve shifts leftward to LS_1. The effect of the decrease in productivity on the demand for labor is larger than the effect of the fall in the real interest rate on the supply of labor. That is, the demand curve shifts farther leftward than does the supply curve. As a result, the real wage rate falls to $34.50 an hour and employment decreases to 195 billion hours. A recession has begun and is intensifying.

What Happened to Money? The name *real* business cycle theory is no accident. It reflects the central prediction of the theory. Real things, not nominal or monetary things, cause the business cycle. If the quantity of money changes, aggregate demand changes. But if there is no real change—with no change in the use of resources and no change in potential GDP—the change in the quantity of money changes only the price level. In RBC theory, this outcome occurs because the aggregate supply curve is the *LAS* curve, which pins real GDP down at potential GDP, so when aggregate demand changes, only the price level changes.

Cycles and Growth The shock that drives the business cycle of RBC theory is the same as the force that generates economic growth: technological change. On average, as technology advances, productivity grows; but as you saw in Fig. 12.10, it grows at an uneven pace. Economic growth arises from the upward trend in productivity growth and, according to RBC theory, the mostly positive but occasionally negative higher frequency shocks to productivity bring the business cycle.

Criticisms and Defenses of RBC Theory The three main criticisms of RBC theory are that (1) the money wage rate *is* sticky, and to assume otherwise is at odds with a clear fact; (2) intertemporal substitution is too weak a force to account for large fluctuations in labor supply and employment with small real wage rate changes; and (3) productivity shocks are as likely to be caused by *changes in aggregate demand* as by technological change.

If aggregate demand fluctuations cause the fluctuations in productivity, then the traditional aggregate demand theories are needed to explain them. Fluctuations in productivity do not cause the business cycle but are caused by it!

Building on this theme, the critics point out that the so-called productivity fluctuations that growth accounting measures are correlated with changes in the growth rate of money and other indicators of changes in aggregate demand.

The defenders of RBC theory claim that the theory explains the macroeconomic facts about the business cycle and is consistent with the facts about economic growth. In effect, a single theory explains *both growth and the business cycle*. The growth accounting exercise that explains slowly changing trends also explains the more frequent business cycle swings. Its defenders also claim that RBC theory is consistent with a wide range of *micro*economic evidence about labor supply decisions, labor demand and investment demand decisions, and information on the distribution of income between labor and capital.

REVIEW QUIZ

1. Explain the mainstream theory of the business cycle.
2. What are the four special forms of the mainstream theory of the business cycle and how do they differ?
3. According to RBC theory, what is the source of the business cycle? What is the role of fluctuations in the rate of technological change?
4. According to RBC theory, how does a fall in productivity growth influence investment demand, the market for loanable funds, the real interest rate, the demand for labor, the supply of labor, employment, and the real wage rate?
5. What are the main criticisms of RBC theory and how do its supporters defend it?

You can work these questions in Study Plan 12.3 and get instant feedback. myeconlab

You can complete your study of economic fluctuations in *Reading Between the Lines* on pp. 310–311, which looks at the shifting inflation–unemployment tradeoff and misery index in the United States.