Chapter 14 INFLATION*

Key Concepts

Inflation and the Price Level

Inflation is an ongoing process in which the price level is rising and money is losing value. Inflation is different than a rise in the price of one good or a one-time increase in the price level. The inflation rate equals $\frac{P_1 - P_0}{P_0} \times 100$, where P_1 is the current price level and P_0 is last year's price level.

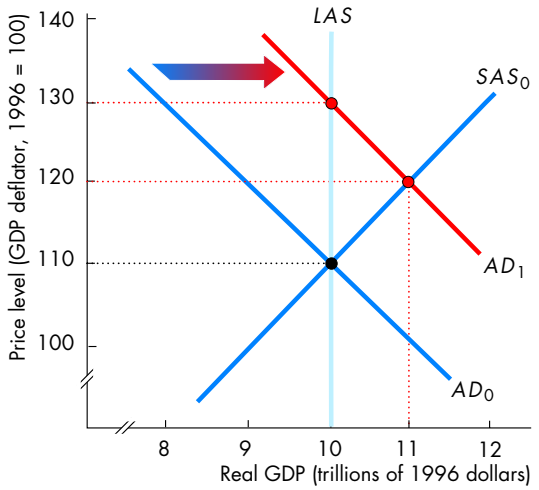
Demand-Pull Inflation

An inflation that starts from an initial increase in aggregate demand is a **demand-pull inflation.**

- Figure 14.1 illustrates the start of a demand-pull inflation. The increase in aggregate demand raises the price level from 110 to 120.
- With no further increase in aggregate demand, in the long run the price level rises to 130 and then stops. This process is a one-time change in the price level.
- For the inflation to become established, the rightward shift in the *AD* curve needs to continue. Persistent increases in the quantity of money result in persistent rightward shifts in the *AD* curve, so monetary growth is necessary for a demand-pull inflation.

The U.S. experienced demand-pull inflation through the middle of the 1970s, by which time the inflation rate was almost 10 percent per year.

FIGURE **14.1**
Start of a Demand-Pull Inflation



Cost-Push Inflation

A **cost-push inflation** starts as the result of an increase in costs. Money wage rates and the cost of raw materials are the main sources of cost-push inflation.

- The cost hike decreases short-run aggregate supply, raising the price level and decreasing GDP. The combination of a rising price level and decreasing GDP is called **stagflation**.
- If nothing else changes, in the long run the money wage rate adjusts and the price level stops rising. There is a one-time increase in the price level.
- If in response to the short-run decline in GDP, the Fed increases the quantity of money, aggregate demand increases and the price level rises still higher.
- The rise in the price level created by the increase in aggregate demand invites another cost hike. If it oc-

* This is Chapter 29 in *Economics*.

curs and aggregate demand increases again, a cost-push inflation results.

The United States experienced cost-push inflation in the late 1970s when OPEC hiked the price of oil higher and the Fed initially responded with an expansionary monetary policy.

Effects of Inflation

In the labor market, unanticipated inflation redistributes income between workers and employers. In addition, unanticipated inflation can hurt *both* workers and employers:

- Higher than expected inflation leads workers to quit their jobs to search for better paying positions. These workers have a period of unemployment and firms incur costs to hire new workers.
- Lower than expected inflation lowers firms' profits, and they respond by laying off workers.

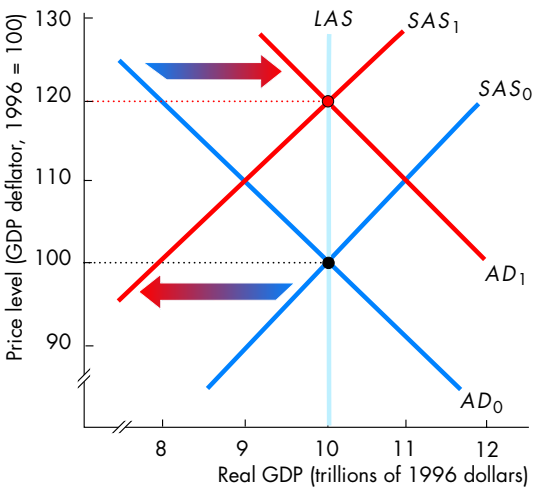
In the asset market, unanticipated inflation redistributes income between borrowers and lenders. When inflation is higher than expected, borrowers gain and lenders lose and vice versa when inflation is lower than expected. Additionally, unanticipated inflation means *both* borrowers and lenders are dissatisfied:

- Higher than expected inflation makes borrowers want to have borrowed more and lenders want to have loaned less.
- Lower than expected inflation makes borrowers want to have borrowed less and lenders want to have loaned more.

A **rational expectation** is a forecast based on all relevant information and it is the most accurate forecast possible. If people correctly anticipate the change that causes inflation, money wage rates adjust to reflect the higher price level. Figure 14.2 illustrates this case. The increase in aggregate demand to AD_1 is matched by higher wage rates that decrease short-run aggregate supply to SAS_1. So GDP remains equal to potential GDP and the anticipated inflation does not affect real GDP.

If aggregate demand increases more than people expect, unanticipated inflation occurs and real GDP exceeds potential GDP. If aggregate demand increases less than expected, the decrease in short-run aggregate supply exceeds the increase in aggregate demand. As a result, real GDP is less than potential GDP.

FIGURE **14.2**
Expected Inflation



Even though anticipated inflation does not affect real GDP, anticipated inflation still inflicts costs on the economy:

- *Transactions costs* — higher anticipated inflation causes people to use resources (e.g., shoe leather) in order to spend their money more rapidly (by shopping more frequently). At still higher anticipated inflation rates, people incur costs by using alternatives for money to conduct transactions.
- *Tax consequences* — anticipated inflation reduces the after-tax return from saving, which decreases saving and hence the capital stock. Long-run growth in GDP falls.
- *Increased uncertainty* — higher anticipated inflation leads people to spend time and resources avoiding losses from inflation, which reduces long-term economic growth.

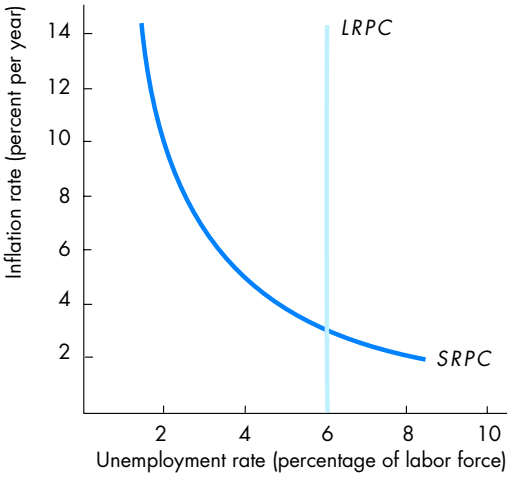
Inflation and Unemployment: The Phillips Curve

A **Phillips curve** shows a relationship between the inflation rate and the unemployment rate. There is a short-run Phillips curve and a long-run Phillips curve.

The **short-run Phillips** curve shows the tradeoff between the inflation rate and the unemployment rate. Moving along the short-run Phillips curve, the expected inflation rate and natural rate of unemployment do not change.

FIGURE **14.3**

Short-Run and Long-Run Phillips Curves



- Figure 14.3 shows a short-run Phillips curve, labeled *SRPC*. Along a short-run Phillips curve, higher inflation is associated with lower unemployment.
- The short-run Phillips curve is related to the short-run aggregate supply curve. A surprise increase in aggregate demand moves the economy upward along the *SAS* curve, leading to a higher price level — hence higher inflation — and an increase in real GDP — hence lower unemployment.
- A decrease in the expected inflation rate shifts the short-run Phillips curve downward by the amount of the decrease in expected inflation.

A **long-run Phillips curve** shows the relationship between the inflation rate and unemployment rate when the inflation rate equals the expected inflation rate.

- Figure 14.3 also shows a long-run Phillips curve, labeled *LRPC*. It is vertical at the natural rate of unemployment (6 percent in the figure).
- Both the short-run and long-run Phillips curves shift if the natural rate of unemployment changes. For instance, if the natural rate of unemployment increases by 1 percentage point, both the short-run and long-run Phillips curves shift rightward by 1 percentage point.

In the United States, changes in both the expected inflation rate and the natural rate of unemployment have shifted the Phillips curves.

Interest Rates and Inflation

The real interest rate is determined by saving supply and investment demand. The nominal interest rate is determined by the demand for money and the quantity of money.

- The nominal interest rate equals the real interest rate plus the expected inflation rate.
- When inflation is anticipated, the nominal interest rate rises by the amount of expected inflation and the real interest rate does not change. The data show that higher inflation tends to be accompanied by higher nominal interest rates.

Helpful Hints

1. **RATIONAL EXPECTATIONS AND THE EFFECTS FROM A CHANGE IN THE QUANTITY OF MONEY:** An important implication of the rational expectations idea is that the consequences of a change in the quantity of money depend on expectations. The position of the short-run aggregate supply curve depends on the expected price level, which in turn depends on the expected change in the quantity of money. Hence an increase in the quantity of money can result in an increase in real GDP, no change in real GDP, or even a decrease in real GDP, depending on what was the expected change. Real GDP increases if the hike in aggregate demand is not anticipated or is underanticipated; real GDP does not change if the increase in aggregate demand is anticipated correctly; and real GDP decreases if the new aggregate demand is less than anticipated.
2. **LINKS BETWEEN AGGREGATE SUPPLY AND THE PHILLIPS CURVE:** The Phillips curve and the *AD/AS* model are closely linked.

   Consider an unexpected increase in aggregate demand. In the short run, a movement occurs along the *SAS* curve. The price level rises, and real GDP increases above potential GDP. The rise in the price level means that inflation occurs, and the increase in GDP means that the unemployment rate falls. Hence the unexpected increase in aggregate demand has resulted in a movement along the short-run Phillips curve, with higher inflation and unemployment falling to below its natural rate.

   GDP, in the long run, cannot remain greater than potential GDP. Tight conditions in the labor mar-

ket (and other resource markets) result in the money wage rate (and other resource prices) rising to reflect the higher price level. So, in the *AD/AS* model, the rise in the money wage rate shifts the *SAS* curve leftward. Real GDP returns to the vertical *LAS* curve and equals potential GDP.

In terms of the Phillips curve, the unemployment rate cannot remain below its natural rate. Therefore as inflation continues and people come to expect it, the higher inflation rates are built into money wages (and the prices of other resources). The short-run Phillips curve shifts upward as people revise the amount of inflation they expect. The unemployment rate returns to the vertical long-run Phillips curve and equals the natural rate.

Note the strong links between the *AD/AS* model and the Phillips curve. In the short run, the increase in real GDP is associated with a drop in unemployment. In the long run, as real GDP returns to potential GDP in the *AD/AS* model, unemployment similarly returns to the natural rate in the Phillips curve model.

Questions

True/False and Explain

Inflation and the Price Level

1. If the price level at the beginning of 2002 is 120 and the price level at the beginning of 2003 is 130, the inflation rate is 8.3 percent.

Demand-Pull Inflation

2. Demand-pull inflation starts with an increase in aggregate demand.

Cost-Push Inflation

3. An inflation that starts with an expansionary monetary policy is a cost-push inflation.
4. Cost-push inflation results in stagflation.
5. By itself, a one-time increase in the price of oil creates an ongoing inflation.

Effects of Inflation

6. Inflation that is higher than expected redistributes income to savers.
7. A rational expectation is a forecast that always is correct.
8. If an increase in aggregate demand is anticipated correctly, inflation will not occur.
9. Higher anticipated inflation increases transaction costs.

Inflation and Unemployment: The Phillips Curve

10. The short-run Phillips curve shows that, if the inflation rate rises and the expected inflation rate does not change, the unemployment rate falls.
11. The long-run Phillips curve shows that higher inflation lowers unemployment.
12. An increase in the expected inflation rate shifts the short-run Phillips curve upward and the long-run Phillips curve rightward.
13. Data for the United States show that the short-run Phillips curve has not shifted during the last three decades.

Interest Rates and Inflation

14. During a period with zero expected inflation, the (nominal) interest rate is 5 percent. If the expected inflation rate rises to 6 percent, the nominal interest rate will rise to 11 percent.
15. Data for the United States show that higher inflation lowers the nominal interest rate.

Multiple Choice

Inflation and the Price Level

1. Which of the following is inflation?
   a. A one-time 25 percent rise in the price of a street hockey blade.
   b. A continuing rise of 4 percent per year in the price of a street hockey blade with no other prices changing.
   c. A one-time 25 percent rise in the prices of all goods.
   d. A continuing rise of 4 percent per year in the prices of all goods.

2. Of the following sequences of price levels, which correctly represents a 10 percent inflation rate?
   a. 100, 100, 100, 100
   b. 100, 110, 110, 110
   c. 100, 110, 120, 130
   d. 100, 110, 121, 133.1

Demand-Pull Inflation

3. Demand-pull inflation occurs when
   a. aggregate demand increases persistently.
   b. aggregate supply and aggregate demand decrease persistently.
   c. the government increases its purchases.
   d. oil prices increase substantially.

4. In a demand-pull inflation, the *AD* curve shifts ____ and the *SAS* curve shifts ____.
   a. rightward; rightward
   b. rightward; leftward
   c. leftward; rightward
   d. leftward; leftward

5. Which of the following results in the aggregate demand curve shifting rightward year after year?
   a. A one-time tax cut.
   b. A one-time increase in government purchases of goods and services.
   c. Inflation.
   d. Growth in the quantity of money.

Cost-Push Inflation

6. Cost-push inflation might start with
   a. a rise in money wage rates.
   b. an increase in government purchases.
   c. an increase in the quantity of money.
   d. a fall in the prices of raw materials.

7. A rise in the price level owing to an increase in the price of oil
   a. definitely triggers a cost-push inflation.
   b. definitely triggers a demand-pull inflation.
   c. might trigger a cost-push inflation.
   d. might trigger a demand-pull inflation.

8. Which of the following statements about a cost-push inflation is correct?
   a. Cost-push inflation starts when an increase in aggregate demand "pushes" costs higher.
   b. Cost-push inflation might start with a rise in the price of raw materials, but it requires increases in the quantity of money to persist.
   c. To persist, cost-push inflation needs a continual series of cost hikes with no change in aggregate demand.
   d. The United States has never experienced a cost-push inflation.

Effects of Inflation

9. As far as redistribution is concerned, if the inflation rate is lower than anticipated,
   a. lenders gain at the expense of borrowers and some workers gain at the expense of employers.
   b. borrowers gain at the expense of lenders and some workers gain at the expense of employers.
   c. lenders gain at the expense of borrowers and some employers gain at the expense of workers.
   d. borrowers gain at the expense of lenders and some employers gain at the expense of workers.

10. Which of the following is NOT true of a rational expectation forecast?
    a. It uses all available information.
    b. It is the best forecast possible.
    c. It always is correct.
    d. None of the above because they are all true.

11. A correctly anticipated increase in aggregate demand that causes a correctly anticipated increase in inflation leads to ____ in short-run aggregate supply and ___ in real GDP.
    a. an increase; an increase
    b. a decrease; an increase
    c. a decrease; no change
    d. a decrease; a decrease

12. If the aggregate demand curve shifts rightward less than expected,
    a. expectations could not be rational expectations.
    b. real GDP will be less than potential GDP.
    c. the real interest rate will be lower than expected.
    d. the real wage rate will be lower than expected.

13. Which of the following is NOT a cost of high anticipated inflation?
    a. Higher transactions costs.
    b. An unemployment rate that exceeds the natural rate.
    c. Increased uncertainty.
    d. A decrease in saving and investment.

14. Higher anticipated inflation
    a. increases economic growth.
    b. decreases economic growth.
    c. decreases unemployment.
    d. has no effect on economic growth or unemployment.

Inflation and Unemployment: The Phillips Curve

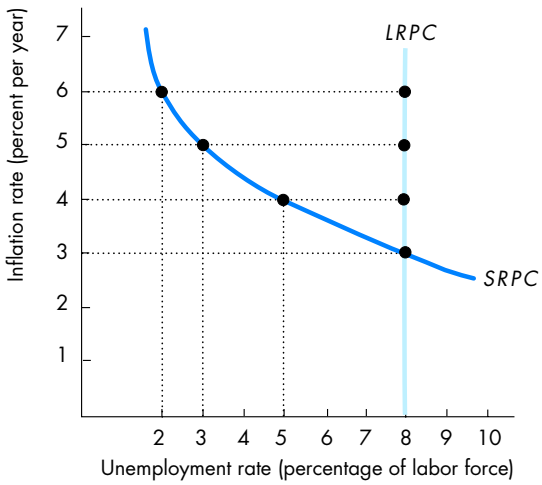
15. The short-run Phillips curve shows the relationship between
    a. the price level and real GDP in the short run.
    b. the price level and unemployment in the short run.
    c. inflation and unemployment when expected inflation equals the actual inflation.
    d. inflation and unemployment when expected inflation does not change.

16. The long-run Phillips curve shows the relationship between
    a. the price level and real GDP in the long run.
    b. the price level and unemployment in the long run.
    c. inflation and unemployment when expected inflation equals the actual inflation.
    d. inflation and unemployment when expected inflation does not change.

Use Figure 14.4 for the next four questions.

FIGURE **14.4**

Multiple Choice Questions 17, 18, 19, 20



17. In the above figure, what is the natural rate of unemployment?
    a. 2 percent.
    b. 3 percent.
    c. 5 percent.
    d. 8 percent.

18. Based on Figure 14.4, what is the expected inflation rate?
    a. 3 percent.
    b. 4 percent.
    c. 5 percent.
    d. 6 percent.

19. If people's expected inflation rate does not change, for an inflation rate of 5 percent, what is the short-run unemployment rate?
    a. 2 percent.
    b. 3 percent.
    c. 5 percent.
    d. 8 percent.

20. After people's expected inflation rate completely adjusts, for an inflation rate of 5 percent, what is the long-run unemployment rate?
    a. 2 percent.
    b. 3 percent.
    c. 5 percent.
    d. 8 percent.

21. A rise in the expected inflation rate leads to ____ in the long-run Phillips curve and ____ in the short-run Phillips curve.
    a. an upward shift; no shift
    b. a leftward shift; an upward shift
    c. no shift; no shift
    d. no shift; an upward shift

22. A rise in the natural rate of unemployment leads to a ____ in the long-run Phillips curve and ____ in the short-run Phillips curve.
    a. rightward shift; no shift
    b. leftward shift; a rightward shift
    c. rightward shift; a rightward shift
    d. leftward shift; a leftward shift

Interest Rates and Inflation

23. Suppose that, initially, the nominal interest rate is 8 percent and the expected inflation rate is 5 percent. If the expected inflation rate increases to 8 percent, what will be the new nominal interest rate?
    a. 8 percent
    b. 3 percent
    c. 13 percent
    d. 11 percent

24. U.S. data show that over the last 30 years, the real interest rate has ____, and that an increase in inflation is usually accompanied by ____ nominal interest rates.
    a. been constant; higher
    b. been constant; lower
    c. fluctuated; lower
    d. fluctuated; higher

Short Answer Problems

1. What will happen to the price level and real GDP if the quantity of money increases and the increase is not anticipated; that is, the price level is not expected to change? Be sure to tell what happens to the aggregate demand curve and short-run aggregate supply curve.
2. Explain how the events in problem 1 could lead to a demand-pull inflation spiral.
3. Explain the differences between the short-run Phillips curve and the long-run Phillips curve.

TABLE **14.1**

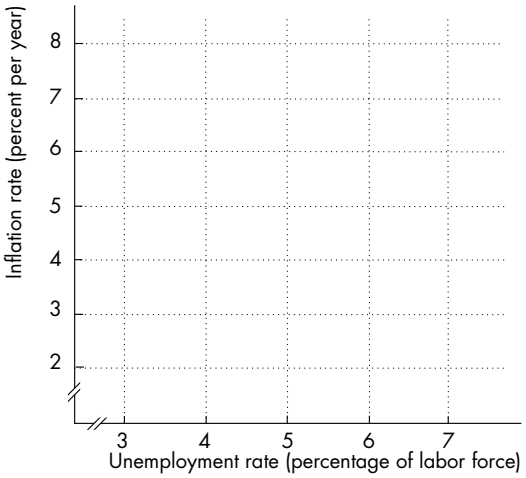
Phillips Curve

Inflation rate (percent per year)	Unemployment rate (percent of labor force)
3	7
4	6
5	5
6	4

4. Table 14.1 shows the Phillips curve when the expected inflation rate is 4 percent. The natural rate of unemployment is 6 percent, and the actual inflation rate is 4 percent.
    a. In Figure 14.5, draw the short-run Phillips curve (label it $SRPC_0$) and the long-run Phillips curve (label it $LRPC$).
    b. Suppose that the inflation rate rises to 6 percent and, immediately after the increase, the expected inflation rate does not change. What is the unemployment rate?

FIGURE **14.5**

Phillips Curves



5. Continuing with the situation in part (b) of problem 4, when the inflation rate rises to 6 percent, suppose that after a year the expected inflation rate rises to 5 percent.
    a. In Figure 14.5, draw the new short-run Phillips curve that results from the change in the expected inflation rate. Label this Phillips curve $SRPC_1$.
    b. If the inflation rate remains at 6 percent, after inflation expectations have increased to 5 percent, what is the unemployment rate?
6. Continuing with the situation in Problem 4, suppose that, two years after the inflation rate increased to 6 percent, expected inflation rises to 6 percent.
    a. In Figure 14.5, draw the new short-run Phillips curve that results from the change in the expected inflation rate to 6 percent. Label this Phillips curve $SRPC_2$.
    b. If the inflation rate remains at 6 percent, after the expected inflation rate has increased to 6 percent, what is the unemployment rate?
7. What is the relationship between the expected inflation rate and the nominal interest rate?

TABLE **14.2**

Interest Rates and Inflation

Real interest rate (percent)	Inflation rate (percent)	Nominal interest rate (percent)
4	0	____
4	2	____
4	4	____
4	–2	____

8. Complete Table 14.2 to show the relationship between interest rates and the inflation rate.
9. When the inflation rate is expected to be zero, Jennifer wants to lend money if the interest rate is at least 4 percent, and Pat wants to borrow money if the interest rate is 4 percent or less. So they enter into a loan agreement at a 4 percent interest rate if they expect zero inflation.
   a. If they both expect an inflation rate of 2 percent over the period of the loan, what interest rate will they agree to?
   b. If they both expect a deflation rate of 2 percent over the period of the loan, what interest rate will they agree to?
   c. Suppose that Jennifer expects the inflation rate will be 4 percent, and Pat expects it will be 6 percent. Will they be able to work out a loan agreement? If so, what interest rate will they agree to?
   d. Suppose that Pat and Jennifer both expect inflation will be 2 percent, have agreed to the interest rate from your answer to part (a), and a loan of $100 for one year has been made. Instead of the expected inflation rate of 2 percent, the actual rate is 6 percent. Who gains, who loses, and how much?

You're the Teacher

1. "You know, I'm really glad that you talked me into taking this economics course because I've always wondered about inflation and, boy, this chapter sure helped me understand it better. One point still bothers me, though. I can see how monetary growth leads to inflation because it makes the aggregate demand curve shift rightward. But what about government spending? Why can't it lead to inflation, too?" Earn even more of your friend's gratitude by answering the question.

Answers

True/False Answers

Inflation and the Price Level

1. **T** The inflation rate is $\frac{130-120}{120} \times 100 = 8.3$ percent.

Demand-Pull Inflation

2. **T** With the initial increase in aggregate demand, the price level starts to rise.

Cost-Push Inflation

3. **F** An increase in the monetary growth rate increases aggregate demand and results in demand-pull inflation.
4. **T** When the short-run aggregate supply decreases, stagflation occurs.
5. **F** Unless the Fed increases the quantity of money, a one-time increase in the price of oil creates a one-time increase in the price level.

Effects of Inflation

6. **F** Higher than expected inflation reduces the real value of loan payments, thereby harming savers by redistributing income to borrowers.
7. **F** Rational expectations are not always correct.
8. **F** If the increase in aggregate demand is anticipated, real GDP does not change but the price level rises so inflation occurs.
9. **T** As anticipated inflation rises, people take actions to hold less money by spending it more rapidly.

Inflation and Unemployment: The Phillips Curve

10. **T** Along the short-run Phillips curve, higher inflation rates lower the unemployment rate.
11. **F** The long-run Phillips curve is vertical, indicating that in the long run higher inflation does not lower unemployment.
12. **F** The increase in expected inflation shifts the short-run Phillips curve upward but does not shift the long-run Phillips curve.
13. **F** Data show several shifts in the Phillips curve because of changes in the expected inflation rate and in the natural rate of unemployment.

Interest Rates and Inflation

14. **T** With zero expected inflation, the nominal interest rate equals the real interest rate. Hence the real interest rate is 5 percent. So when the expected inflation rate is 6 percent, the nominal interest rate, which equals the real rate plus the expected inflation rate, is 5 percent plus 6 percent, or 11 percent.
15. **F** The data show that higher inflation is associated with higher nominal interest rates.

Multiple Choice Answers

Inflation and the Price Level

1. **d** Inflation is an on-going rise in the prices of all (or most) goods.
2. **d** The inflation rate is $\frac{P_1 - P_0}{P_0} \times 100$, where P_1 is the current price level and P_0 is last year's price level. Of the price level sequences, only part (d) gives a persisting inflation rate of 10 percent.

Demand-Pull Inflation

3. **a** Demand-pull inflation results when the demand for goods increases, thereby "pulling up" the price level.
4. **b** Aggregate demand increases, which raises the price level. Hence money wages rise and aggregate supply decreases.
5. **d** Growth in the quantity of money means that the quantity of money in the economy continually increases, which persistently shifts the *AD* curve rightward.

Cost-Push Inflation

6. **a** Cost-push inflation starts with a factor that decreases aggregate supply.
7. **c** The oil price increase might trigger a cost-push inflation if the Fed responds by increasing the growth rate of the quantity of money.
8. **b** A rise in the price of a resource can kick off a cost-push inflation, but to persist the inflation needs ratification by persistent increases in the quantity of money.

Effects of Inflation

9. **a** Lenders gain because the real repayments on loans are higher than expected; some workers gain because real wages are higher than expected. (Not all workers gain because some workers are laid off and those workers are harmed.)

10. **c** Rational expectations are not always correct, but they are the best possible forecasts.
11. **c** The higher inflation leads to higher money wages, which decrease short-run aggregate supply and results in no change in real GDP.
12. **b** If the *AD* curve shifts rightward less than expected, the price level is lower than expected, which means that real wages are higher than expected. Firms respond by cutting production so that real GDP is less than potential GDP.
13. **b** The other answers are all costs of anticipated inflation, which all increase dramatically when anticipated inflation rises to high levels.
14. **b** By lowering the nation's economic growth, anticipated inflation imposes a significant cost on a country.

Inflation and Unemployment: The Phillips Curve

15. **d** Answer (d) is the definition of the short-run Phillips curve.
16. **c** Answer (c) is the definition of the long-run Phillips curve. Comparing this question with question 15 shows the important role played by inflation expectations.
17. **d** The *LRPC* is vertical at the natural rate of unemployment, 8 percent.
18. **a** The *SRPC* crosses the *LRPC* at the level of expected inflation.
19. **b** In the short run, the economy moves along its *SRPC* so that the increase in the inflation rate reduces the unemployment rate to 3 percent.
20. **d** In the long run, the economy returns to the *LRPC* and unemployment returns to its natural rate, or 8 percent here.
21. **d** The long-run Phillips curve shifts only when the natural rate of unemployment changes; the short-run Phillips curve shifts when the natural rate of unemployment changes and when the expected inflation rate changes.
22. **c** Both Phillips curves shift rightward by the amount of the increase in the natural rate of unemployment.

Interest Rates and Inflation

23. **d** Initially, the real interest rate is 3 percent, the 8 percent nominal interest rate minus the 5 percent expected inflation rate. Then, after the increase in expected inflation, the nominal interest rate equals the 3 percent real interest rate plus the 8 percent expected inflation rate.
24. **d** The real interest rate has averaged about 2.1 percent, but has fluctuated from one year to the next. And, a higher inflation rate is typically associated with higher nominal interest rates.

Answers to Short Answer Problems

1. An increase in the quantity of money shifts the aggregate demand curve rightward. If the price level is not expected to change, the short-run aggregate supply curve remains unchanged and the increase in aggregate demand leads to a rise in the price level and an increase in real GDP.
2. The higher price level leads to demands for higher money wages, which push up the costs of production and shift the *SAS* curve leftward, leading to a further rise in the price level and a drop in real GDP. A demand-pull inflation spiral could result if the Federal Reserve again increases the quantity of money. In this case, the *AD* curve continues to shift rightward, triggering leftward shifts in the *SAS* curve and leading to an ongoing inflation.
3. The short-run Phillips curve applies when the expected inflation rate is constant. Therefore the short-run Phillips curve slopes downward so that if the inflation rate rises (and hence real wages fall) unemployment falls.

   The long-run Phillips curve applies when the expected inflation rate has fully adjusted to reflect changes in the actual inflation rate. In other words, along the long-run Phillips curve, the expected inflation rate equals the actual inflation rate. The long-run Phillips curve, therefore, is vertical at the natural rate of unemployment. Along the long-run Phillips curve, a rise in the actual inflation rate is matched by an equivalent rise in the expected inflation rate (so that the real wage rate is constant) and thus the unemployment rate remains constant at the natural rate.
4. a. Figure 14.6 (on the next page) shows the short-run and long-run Phillips curves.

   b. If the inflation rate rises to 6 percent and the expected inflation rate remains at 4 percent, the economy moves along the Phillips curve $SRPC_0$ to point *a* and the unemployment rate falls to 4 percent.

FIGURE **14.6**
Phillips Curves

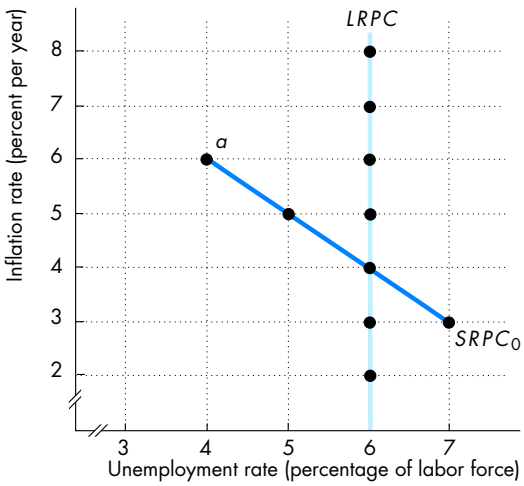
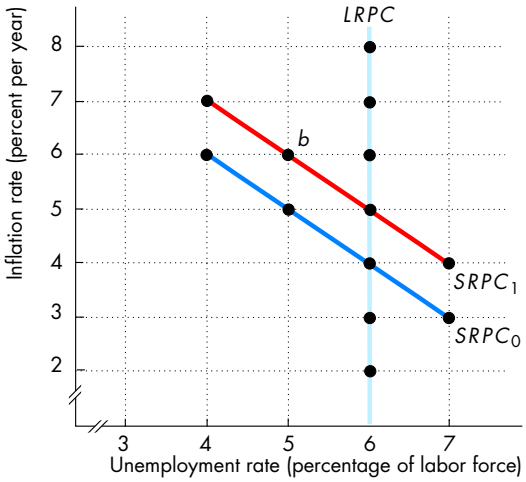


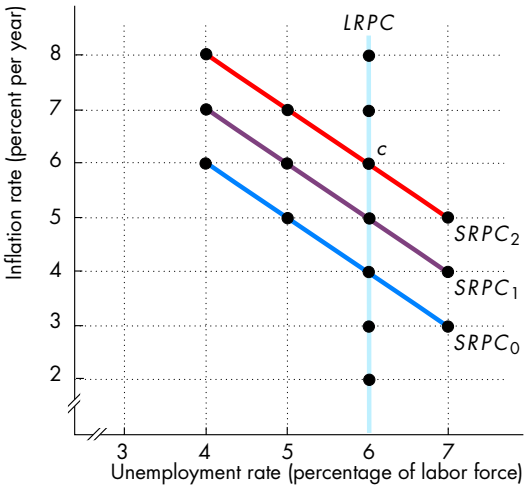
FIGURE **14.7**
Phillips Curves



5. a. When the expected inflation rate increases by 1 percentage point, the *SRPC* shifts vertically upward by 1 percentage point. This shift is illustrated in Figure 14.7, where the short-run Phillips curve shifts from $SRPC_0$ to $SRPC_1$.

   b. When the expected inflation rate is 5 percent, the relevant Phillips curve is $SRPC_1$. So with the inflation rate (still) at 6 percent, the economy is at point *b* on $SRPC_1$, so the unemployment rate becomes 5 percent. Note that, compared to the answer to part (b) of problem 4, when the inflation rate does not change, an increase in the expected inflation rate raises the unemployment rate.

FIGURE **14.8**
Phillips Curves



6. a. The new *SRPC* (when expected inflation is 6 percent) is in Figure 14.8 as $SRPC_2$.

   b. When the expected inflation rate rises to 6 percent, the unemployment rate is 6 percent. You can arrive at this answer in one of two ways. First, when the expected inflation rate is 6 percent, $SRPC_2$ is the relevant short-run Phillips curve. Hence when the inflation rate is 6 percent, the economy is at point *c* on $SRPC_2$. Alternatively, when the expected inflation rate is 6 percent *and* the actual inflation rate is 6 percent, the economy is on its long-run Phillips curve, *LRPC*, because the actual and expected inflation rates are equal. So with the inflation rate at 6 percent, the economy is at point *c* on *LRPC*.

7. When the expected inflation rate rises, the nominal interest rate rises to compensate for the increased rate at which the purchasing power of money is expected to erode. The point is that lenders and borrowers are interested in the quantity of goods and services that a unit of money will buy. With higher inflation, lenders insist on the higher interest rate, to compensate for the loss of purchasing power of money. Borrowers agree because they realize that repaying the loan will be easier when all prices, including their wages, have increased.

TABLE **14.3**

Interest Rates and Inflation

Real interest rate (percent)	Inflation rate (percent)	Nominal interest rate (percent)
4	0	4
4	2	6
4	4	8
4	–2	2

8. The nominal interest rate equals the real interest rate plus the inflation rate. So in the first row in Table 14.3, when the inflation rate is 0 percent, the nominal interest rate is 4 percent plus 0 percent, or 4 percent. Similarly, in the second row, when the inflation rate is 2 percent, the nominal interest rate is 4 percent plus 2 percent, or 6 percent.

   Note that when inflation is zero, then (and only then) the real interest rate equals the nominal interest rate. Also note that for any real interest rate, the higher the inflation rate, the higher is the nominal interest rate.

9. a. Because both Jennifer and Pat expect the inflation rate to be 2 percent, they expect the value of money to decline by 2 percent. So they will agree to a 6 percent interest rate, with 2 percent offsetting the drop in the value of money, leaving a 4 percent real interest rate paid after accounting for inflation. (Note that this answer is the same as that shown in the second row in Table 14.3, for problem 8.)

   b. If both Jennifer and Pat expect a deflation rate of 2 percent, they expect the value of money to increase by 2 percent. By the same logic as in part (a), they will agree to a 2 percent interest rate. (Again, note that this answer is the same result as in the fourth row in Table 14.3 in problem 8.)

   c. If Jennifer expects a 4 percent inflation rate, she will want to lend only if the interest rate is at least 8 percent. Pat expects a 6 percent inflation rate and will borrow if the interest rate is 10 percent or less. As a result, Jennifer and Pat could agree on any interest rate between 8 and 10 percent.

   d. From part (a), we know that in this situation they will agree to an interest rate of 6 percent, meaning that Pat repays $106. Jennifer expects a real gain of $4 (she can buy 4 percent more goods), after accounting for the 2 percent inflation. However, the actual 6 percent inflation raises the price of goods by 6 percent, so her $106 after 1 year buys only the same amount of goods as the $100 did originally. She therefore has effectively lost $4, and Pat has gained the $4, owing to the real interest rate of zero. Therefore the higher-than-expected inflation rate has helped the borrower (Pat) and harmed the lender (Jennifer).

You're the Teacher

1. "This is a good question. The reason that monetary growth is the only factor that results in inflation involves two things: first, the difference between a one-time change in the price level and ongoing changes and second, what happens in reality.

   "Let's start with the first point, the difference between a one-time change in the price level and ongoing changes. We both know by now that an increase in government purchases increases aggregate demand and that the increase in aggregate demand raises the price level. But to have an ongoing inflation, the price level must continue to rise. For government spending to be the source of inflation, then, it would need to expand year in and year out.

   "Now let's get to the second point — what happens in the real world. In the real world, we know that GDP tends to grow by about 2 percent per year. So for government spending to contribute an extra increase to aggregate demand, it would need to grow more rapidly than everything else. I mean, if consumption expenditure, investment, net exports, and potential GDP all grow at the rate of, say, 2 percent, in order for aggregate demand to increase more rapidly than 2 percent — and consequently for government spending to cause the price level to rise more than otherwise — government spending would need to increase by more than 2 percent. But that hasn't happened. Indeed, as a fraction of GDP, government spending has been near 20 percent for about the last 40 years! So government spending has been increasing at about the same rate as everything else: It sure hasn't been increasing more rapidly and causing inflation!

   "But the quantity of money has been growing more rapidly than everything else. Real GDP per person has grown by about 2 percent per year for the past

half century, but the quantity of money has grown a lot more rapidly, by about 5 to 6 percent per year! As a result, year in and year out, the quantity of money grows so rapidly that aggregate demand increases faster than aggregate supply. So excessively rapid monetary growth is the source of inflation!"

Chapter Quiz

1. If this year's price level exceeds last year's price level,
   a. inflation occurred.
   b. inflation accelerated.
   c. deflation occurred.
   d. deflation accelerated.

2. A demand-pull inflation can be *started* by ____; a cost-push inflation can be *started* by ____.
   a. an increase in the price of oil; an increase in the price of oil
   b. a decrease in money wages; an increase in government spending
   c. an increase in the quantity of money; an increase in the price of oil
   d. an increase in the quantity of money; an increase in the quantity of money

3. To *continue*, a demand-pull inflation needs ____; to *continue*, a cost-push inflation needs ____.
   a. a continuing increase in the price of oil; a continuing increase in the price of oil
   b. a continuing decrease in money wages; a continuing decrease in money wages
   c. a continuing increase in the quantity of money; a continuing increase in the quantity of money
   d. a continuing increase in government spending; a continuing decrease in government spending

4. The relationship between unemployment and inflation is illustrated by
   a. the *AD* curve.
   b. the *LAS* curve.
   c. the *SAS* curve.
   d. the Phillips curves.

5. For a cost-push inflation to occur, higher oil prices must be accompanied by
   a. lower investment.
   b. higher tax rates.
   c. low government purchases.
   d. higher monetary growth.

6. If the inflation rate turns out to be lower than anticipated
   a. lenders can gain and borrowers can lose.
   b. lenders can lose and borrowers can gain.
   c. some workers can lose and some firms can gain.
   d. no one is harmed.

7. In a demand-pull inflation, money wages rise because a(n) ____ in aggregate demand creates a labor ____.
   a. increase; shortage
   b. increase; surplus
   c. decrease; shortage
   d. decrease; surplus

8. The short-run Philips curve crosses the long-run Phillips curve at the
   a. natural interest rate.
   b. nominal interest rate.
   c. actual inflation rate.
   d. expected inflation rate.

9. What influence shifts *both* the short-run and long-run Phillips curve rightward?
   a. An increase in the expected inflation rate equal to the increase in the actual inflation rate shifts both curves.
   b. A decrease in the expected inflation rate equal to the decrease in the actual inflation rate shifts both curves.
   c. An increase in the natural rate of unemployment shifts both curves.
   d. A decrease in the natural rate of unemployment shifts both curves.

10. Data show that higher inflation rates tend to be associated with
    a. higher real interest rates.
    b. lower real interest rates.
    c. higher nominal interest rates.
    d. lower nominal interest rates.

The answers for this Chapter Quiz are on page 310