Inflation and Unemployment: The Phillips Curve

What you will learn in this Module:

- What the Phillips curve is and the nature of the short-run trade-off between inflation and unemployment
- Why there is no long-run trade-off between inflation and unemployment
- Why expansionary policies are limited due to the effects of expected inflation
- Why even moderate levels of inflation can be hard to end
- Why deflation is a problem for economic policy and leads policy makers to prefer a low but positive inflation rate
The Short-Run Phillips Curve

We’ve just seen that expansionary policies lead to a lower unemployment rate. Our next step in understanding the temptations and dilemmas facing governments is to show that there is a short-run trade-off between unemployment and inflation—lower unemployment tends to lead to higher inflation, and vice versa. The key concept is that of the Phillips curve.

The origins of this concept lie in a famous 1958 paper by the New Zealand-born economist Alban W. H. Phillips. Looking at historical data for Britain, he found that when the unemployment rate was high, the wage rate tended to fall, and when the unemployment rate was low, the wage rate tended to rise. Using data from Britain, the United States, and elsewhere, other economists soon found a similar apparent relationship between the unemployment rate and the rate of inflation—that is, the rate of change in the aggregate price level. For example, Figure 34.1 shows the U.S. unemployment rate and the rate of consumer price inflation over each subsequent year from 1955 to 1968, with each dot representing one year’s data.

Looking at evidence like Figure 34.1, many economists concluded that there is a negative short-run relationship between the unemployment rate and the inflation rate, represented by the short-run Phillips curve, or SRPC. (We’ll explain the difference between the short-run and the long-run Phillips curve soon.) Figure 34.2 shows a hypothetical short-run Phillips curve.

Early estimates of the short-run Phillips curve for the United States were very simple: they showed a negative relationship between the unemployment rate and the inflation rate, without taking account of any other variables. During the 1950s and 1960s this simple approach seemed, for a while, to be adequate. And this simple relationship is clear in the data in Figure 34.1.

Even at the time, however, some economists argued that a more accurate short-run Phillips curve would include other factors. Previously, we discussed the effect of supply shocks, such as sudden changes in the price of oil, that shift the short-run aggregate supply curve. Such shocks also shift the short-run Phillips curve: surging oil prices were an important factor in the inflation of the 1970s and also played an important role in the acceleration of inflation in 2007–2008. In general, a negative supply shock shifts SRPC up, as the inflation rate increases for every level of the unemployment rate, and
The Short-Run Phillips Curve

a positive supply shock shifts it down as the inflation rate falls for every level of the unemployment rate. Both outcomes are shown in Figure 34.3.

But supply shocks are not the only factors that can change the inflation rate. In the early 1960s, Americans had little experience with inflation as inflation rates had been low for decades. But by the late 1960s, after inflation had been steadily increasing for a number of years, Americans had come to expect future inflation. In 1968 two economists—Milton Friedman of the University of Chicago and Edmund Phelps of Columbia University—indisputably set forth a crucial hypothesis: that expectations about future inflation directly affect the present inflation rate. Today most economists accept that the expected inflation rate—the rate of inflation that employers and workers expect in the near future—is the most important factor, other than the unemployment rate, affecting inflation.

**Figure 34.2**

The Short-Run Phillips Curve

The short-run Phillips curve, SRPC, slopes downward because the relationship between the unemployment rate and the inflation rate is negative.

**Figure 34.3**

The Short-Run Phillips Curve and Supply Shocks

A negative supply shock shifts the SRPC up, and a positive supply shock shifts the SRPC down.
Inflation Expectations and the Short-Run Phillips Curve

The expected rate of inflation is the rate that employers and workers expect in the near future. One of the crucial discoveries of modern macroeconomics is that changes in the expected rate of inflation affect the short-run trade-off between unemployment and inflation and shift the short-run Phillips curve.

Why do changes in expected inflation affect the short-run Phillips curve? Put yourself in the position of a worker or employer about to sign a contract setting the worker’s wages over the next year. For a number of reasons, the wage rate they agree to will be higher if everyone expects high inflation (including rising wages) than if everyone expects prices to be stable. The worker will want a wage rate that takes into account future declines in the purchasing power of earnings. He or she will also want a wage rate that won’t fall behind the wages of other workers. And the employer will be more willing to agree to a wage increase now if hiring workers later will be even more expensive. Also, rising prices will make paying a higher wage rate more affordable for the employer because the employer’s output will sell for more.

For these reasons, an increase in expected inflation shifts the short-run Phillips curve upward: the actual rate of inflation at any given unemployment rate is higher when the expected inflation rate is higher. In fact, macroeconomists believe that the relationship between changes in expected inflation and changes in actual inflation is one-to-one. That is, when the expected inflation rate increases, the actual inflation rate at any given unemployment rate will increase by the same amount. When the expected inflation rate falls, the actual inflation rate at any given level of unemployment will fall by the same amount.

Figure 34.4 shows how the expected rate of inflation affects the short-run Phillips curve. First, suppose that the expected rate of inflation is 0%. \( SRPC_0 \) is the short-run Phillips curve when the public expects 0% inflation. According to \( SRPC_0 \), the actual inflation rate will be 0% if the unemployment rate is 6%; it will be 2% if the unemployment rate is 4%.

Alternatively, suppose the expected rate of inflation is 2%. In that case, employers and workers will build this expectation into wages and prices: at any given unemployment rate, the actual inflation rate will be 2 percentage points higher than in the no-inflation case.
points higher than it would be if people expected 0% inflation. $SRPC_2$, which shows the Phillips curve when the expected inflation rate is 2%, is $SRPC_0$ shifted upward by 2 percentage points at every level of unemployment. According to $SRPC_2$, the actual inflation rate will be 2% if the unemployment rate is 6%; it will be 4% if the unemployment rate is 4%.

**From the Scary Seventies to the Nifty Nineties**

Figure 34.1 showed that the American experience during the 1950s and 1960s supported the belief in the existence of a short-run Phillips curve for the U.S. economy, with a short-run trade-off between unemployment and inflation.

After 1969, however, that relationship appeared to fall apart according to the data. The figure here plots the course of U.S. unemployment and inflation rates from 1961 to 1990. As you can see, the course looks more like a tangled piece of yarn than like a smooth curve.

Through much of the 1970s and early 1980s, the economy suffered from a combination of above-average unemployment rates coupled with inflation rates unprecedented in modern American history. This condition came to be known as stagflation—for stagnation combined with high inflation. In the late 1990s, by contrast, the economy was experiencing a blissful combination of low unemployment and low inflation. What explains these developments?

Part of the answer can be attributed to a series of negative supply shocks that the U.S. economy suffered during the 1970s. The price of oil, in particular, soared as wars and revolutions in the Middle East led to a reduction in oil supplies and as oil-exporting countries deliberately curbed production to drive up prices. Compounding the oil price shocks, there was also a slowdown in labor productivity growth. Both of these factors shifted the short-run Phillips curve upward. During the 1990s, by contrast, supply shocks were positive. Prices of oil and other raw materials were generally falling, and productivity growth accelerated. As a result, the short-run Phillips curve shifted downward.

Equally important, however, was the role of expected inflation. As mentioned earlier, inflation accelerated during the 1960s. During the 1970s, the public came to expect high inflation, and this also shifted the short-run Phillips curve up. It took a sustained and costly effort during the 1980s to get inflation back down. The result, however, was that expected inflation was very low by the late 1990s, allowing actual inflation to be low even with low rates of unemployment.

What determines the expected rate of inflation? In general, people base their expectations about inflation on experience. If the inflation rate has hovered around 0% in the last few years, people will expect it to be around 0% in the near future. But if the inflation rate has averaged around 5% lately, people will expect inflation to be around 5% in the near future.

Since expected inflation is an important part of the modern discussion about the short-run Phillips curve, you might wonder why it was not in the original formulation of the Phillips curve. The answer lies in history. Think back to what we said about the early 1960s: at that time, people were accustomed to low inflation rates and reasonably expected that future inflation rates would also be low. It was only after 1965 that persistent inflation became a fact of life. So only then did it become clear that expected inflation would play an important role in price-setting.
Inflation and Unemployment in the Long Run

The short-run Phillips curve says that at any given point in time there is a trade-off between unemployment and inflation. According to this view, policy makers have a choice: they can choose to accept the price of high inflation in order to achieve low unemployment, or they can reject high inflation and pay the price of high unemployment. In fact, during the 1960s many economists believed that this trade-off represented a real choice.

However, this view was greatly altered by the later recognition that expected inflation affects the short-run Phillips curve. In the short run, expectations often diverge from reality. In the long run, however, any consistent rate of inflation will be reflected in expectations. If inflation is consistently high, as it was in the 1970s, people will come to expect more of the same; if inflation is consistently low, as it has been in recent years, that, too, will become part of expectations. So what does the trade-off between inflation and unemployment look like in the long run, when actual inflation is incorporated into expectations? Most macroeconomists believe that there is, in fact, no long-run trade-off. That is, it is not possible to achieve lower unemployment in the long run by accepting higher inflation. To see why, we need to introduce another concept: the long-run Phillips curve.
The Long-Run Phillips Curve

Figure 34.5 reproduces the two short-run Phillips curves from Figure 34.4, SRPC₀ and SRPC₂. It also adds an additional short-run Phillips curve, SRPC₄, representing a 4% expected rate of inflation. In a moment, we’ll explain the significance of the vertical long-run Phillips curve, LRPC.

Suppose that the economy has, in the past, had a 0% inflation rate. In that case, the current short-run Phillips curve will be SRPC₀, reflecting a 0% expected inflation rate. If the unemployment rate is 6%, the actual inflation rate will be 0%.

Also suppose that policy makers decide to trade off lower unemployment for a higher rate of inflation. They use monetary policy, fiscal policy, or both to drive the unemployment rate down to 4%. This puts the economy at point A on SRPC₀, leading to an actual inflation rate of 2%.

Over time, the public will come to expect a 2% inflation rate. This increase in inflationary expectations will shift the short-run Phillips curve upward to SRPC₂. Now, when the unemployment rate is 6%, the actual inflation rate will be 2%. Given this new short-run Phillips curve, policies adopted to keep the unemployment rate at 4% will lead to a 4% actual inflation rate—point B on SRPC₂—rather than point A with a 2% actual inflation rate.

Eventually, the 4% actual inflation rate gets built into expectations about the future inflation rate, and the short-run Phillips curve shifts upward yet again to SRPC₄. To keep the unemployment rate at 4% would now require accepting a 6% actual inflation rate, point C on SRPC₄, and so on. In short, a persistent attempt to trade off lower unemployment for higher inflation leads to accelerating inflation over time.

To avoid accelerating inflation over time, the unemployment rate must be high enough that the actual rate of inflation matches the expected rate of inflation. This is the situation at E₀ on SRPC₀: when the expected inflation rate is 0% and the unemployment rate is 6%, the actual inflation rate is 0%. It is also the situation at E₂ on SRPC₂: when the expected inflation rate is 2% and the unemployment rate is 6%, the actual inflation rate is 2%. And it

The nonaccelerating inflation rate of unemployment, or NAIRU, is the unemployment rate at which inflation does not change over time.

The long-run Phillips curve shows the relationship between unemployment and inflation after expectations of inflation have had time to adjust to experience.
is the situation at $E_4$ on $SRPC_4$: when the expected inflation rate is 4\% and the unemployment rate is 6\%, the actual inflation rate is 4\%. As we’ll learn shortly, this relationship between accelerating inflation and the unemployment rate is known as the *natural rate hypothesis*.

The unemployment rate at which inflation does not change over time—6\% in Figure 34.5—is known as the **nonaccelerating inflation rate of unemployment**, or **NAIRU** for short. Keeping the unemployment rate below the NAIRU leads to ever-accelerating inflation and cannot be maintained. Most macroeconomists believe that there is a NAIRU and that there is no long-run trade-off between unemployment and inflation.

We can now explain the significance of the vertical line $LRPC$. It is the **long-run Phillips curve**, the relationship between unemployment and inflation in the long run, after expectations of inflation have had time to adjust to experience. It is vertical because any unemployment rate below the NAIRU leads to ever-accelerating inflation. In other words, the long-run Phillips curve shows that there are limits to expansionary policies because an unemployment rate below the NAIRU cannot be maintained in the long run. Moreover there is a corresponding point we have not yet emphasized: any unemployment rate above the NAIRU leads to decelerating inflation.
The Natural Rate of Unemployment, Revisited

Recall the concept of the natural rate of unemployment, the portion of the unemployment rate unaffected by the swings of the business cycle. Now we have introduced the concept of the NAIRU. How do these two concepts relate to each other?

The answer is that the NAIRU is another name for the natural rate. The level of unemployment the economy “needs” in order to avoid accelerating inflation is equal to the natural rate of unemployment.

In fact, economists estimate the natural rate of unemployment by looking for evidence about the NAIRU from the behavior of the inflation rate and the unemployment rate over the course of the business cycle. For example, the way major European countries learned, to their dismay, that their natural rates of unemployment were 9% or more was through unpleasant experience. In the late 1980s, and again in the late 1990s, European inflation began to accelerate as European unemployment rates, which had been above 9%, began to fall, approaching 8%.

The Great Disinflation of the 1980s

As we’ve mentioned several times, the United States ended the 1970s with a high rate of inflation, at least by its own peacetime historical standards—13% in 1980. Part of this inflation was the result of one-time events, especially a world oil crisis. But expectations of future inflation at 10% or more per year appeared to be firmly embedded in the economy.

By the mid-1980s, however, inflation was running at about 4% per year. Panel (a) of the figure shows the annual rate of change in the “core” consumer price index (CPI)—also called the core inflation rate. This index, which excludes volatile energy and food prices, is widely regarded as a better indicator of underlying inflation trends than the overall CPI. By this measure, inflation fell from about 12% at the end of the 1970s to about 4% by the mid-1980s.

How was this disinflation achieved? At great cost. Beginning in late 1979, the Federal Reserve imposed strongly contractionary monetary policies, which pushed the economy into its worst recession since the Great Depression. Panel (b) shows the Congressional Budget Office estimate of the U.S. output gap from 1979 to 1989: by 1982, actual output was 7% below potential output, corresponding to an unemployment rate of more than 9%. Aggregate output didn’t get back to potential output until 1987.

Our analysis of the Phillips curve tells us that a temporary rise in unemployment, like that of the 1980s, is needed to break the cycle of inflationary expectations. Once expectations of inflation are reduced, the economy can return to the natural rate of unemployment at a lower inflation rate. And that’s just what happened.
At what cost? If you add up the output gaps over 1980–1987, you find that the economy sacrificed approximately 18% of an average year's output over the period. If we had to do the same thing today, that would mean giving up roughly $2.6 trillion worth of goods and services.

In Figure 33.3 we cited Congressional Budget Office estimates of the U.S. natural rate of unemployment. The CBO has a model that predicts changes in the inflation rate based on the deviation of the actual unemployment rate from the natural rate. Given data on actual unemployment and inflation, this model can be used to deduce estimates of the natural rate—and that's where the CBO numbers come from.
The Costs of Disinflation

Through experience, policy makers have found that bringing inflation down is a much harder task than increasing it. The reason is that once the public has come to expect continuing inflation, bringing inflation down is painful.

A persistent attempt to keep unemployment below the natural rate leads to accelerating inflation that becomes incorporated into expectations. To reduce inflationary expectations, policy makers need to run the process in reverse, adopting contractionary policies that keep the unemployment rate above the natural rate for an extended period of time. The process of bringing down inflation that has become embedded in expectations is known as disinflation.

Disinflation can be very expensive. The U.S. retreat from high inflation at the beginning of the 1980s appears to have cost the equivalent of about 18% of a year’s real GDP, the equivalent of roughly $2.6 trillion today. The justification for paying these costs is that they lead to a permanent gain. Although the economy does not recover the short-term production losses caused by disinflation, it no longer suffers from the costs associated with persistently high inflation. In fact, the United States, Britain, and other wealthy countries that experienced inflation in the 1970s eventually decided that the benefit of bringing inflation down was worth the required suffering—the large reduction in real GDP in the short term.

Some economists argue that the costs of disinflation can be reduced if policy makers explicitly state their determination to reduce inflation. A clearly announced, credible policy of disinflation, they contend, can reduce expectations of future inflation and so shift the short-run Phillips curve downward. Some economists believe that the clear determination of the Federal Reserve to combat the inflation of the 1970s was credible enough that the costs of disinflation, huge though they were, were lower than they might otherwise have been.
Deflation

Before World War II, deflation—a falling aggregate price level—was almost as common as inflation. In fact, the U.S. consumer price index on the eve of World War II was 30% lower than it had been in 1920. After World War II, inflation became the norm in all countries. But in the 1990s, deflation reappeared in Japan and proved difficult to reverse. Concerns about potential deflation played a crucial role in U.S. monetary policy in the early 2000s and again in late 2008. In fact, in late 2008, the U.S. experienced a brief period of deflation.

Why is deflation a problem? And why is it hard to end?
Debt Deflation

Deflation, like inflation, produces both winners and losers—but in the opposite direction. Due to the falling price level, a dollar in the future has a higher real value than a dollar today. So lenders, who are owed money, gain under deflation because the real value of borrowers’ payments increases. Borrowers lose because the real burden of their debt rises.

In a famous analysis at the beginning of the Great Depression, Irving Fisher claimed that the effects of deflation on borrowers and lenders can worsen an economic slump. Deflation, in effect, takes real resources away from borrowers and redistributes them to lenders. Fisher argued that borrowers, who lose from deflation, are typically short of cash and will be forced to cut their spending sharply when their debt burden rises. Lenders, however, are less likely to increase spending sharply when the values of the loans they own rise. The overall effect, said Fisher, is that deflation reduces aggregate demand, deepening an economic slump, which, in a vicious circle, may lead to further deflation. The effect of deflation in reducing aggregate demand, known as debt deflation, probably played a significant role in the Great Depression.

Debt deflation is the reduction in aggregate demand arising from the increase in the real burden of outstanding debt caused by deflation.
Like expected inflation, expected deflation affects the nominal interest rate.
Consider Figure 29.6 from Section 5 (repeated here as Figure 34.6),
which demonstrates how expected inflation affects the equilibrium interest
rate. As shown, the equilibrium nominal interest rate is 4% if the expected
inflation rate is 0%. Clearly, if the expected inflation rate is –3%—if the
public expects deflation at 3% per year—the equilibrium nominal interest
rate will be 1%.

But what would happen if the expected rate of inflation were –5%? Would the
nominal interest rate fall to –1%, meaning that lenders are paying
borrowers 1% on their debt? No. Nobody would lend money at a negative
nominal rate of interest because they could do better by simply holding
cash. This illustrates what economists call the zero bound on the nominal
interest rate: it cannot go below zero.

This zero bound can limit the effectiveness of monetary policy. Suppose the
economy is depressed, with output below potential output and the
unemployment rate above the natural rate. Normally, the central bank can
respond by cutting interest rates so as to increase aggregate demand. If the
nominal interest rate is already zero, however, the central bank cannot push
it down any further. Banks refuse to lend and consumers and firms refuse to
spend because, with a negative inflation rate and a 0% nominal interest
rate, holding cash yields a positive real rate of return. Any further increases
in the monetary base will either be held in bank vaults or held as cash by
individuals and firms, without being spent.

A situation in which conventional monetary policy to fight a slump—cutting
interest rates—can’t be used because nominal interest rates are up against
the zero bound is known as a liquidity trap. A liquidity trap can occur
whenever there is a sharp reduction in demand for loanable funds—which is
exactly what happened during the Great Depression. Figure 34.7 shows the
interest rate on short-term U.S. government debt from 1920 to January
2010. As you can see, starting in 1933 and ending when World War II
brought a full economic recovery, the U.S. economy was either close to or
up against the zero bound. After World War II, when inflation became the
norm around the world, the zero bound problem largely vanished as the
public came to expect inflation rather than deflation.
However, the recent history of the Japanese economy, shown in Figure 34.8, provides a modern illustration of the problem of deflation and the liquidity trap. Japan experienced a huge boom in the prices of both stocks and real estate in the late 1980s, and then saw both bubbles burst. The result was a prolonged period of economic stagnation, the so-called Lost Decade, which gradually reduced the inflation rate and eventually led to persistent deflation. In an effort to fight the weakness of the economy, the Bank of Japan—the equivalent of the Federal Reserve—repeatedly cut interest rates. Eventually, it arrived at the “ZIRP”: the zero interest rate policy. The “call money rate,” the equivalent of the U.S. federal funds rate, was literally set equal to zero. Because the economy was still depressed, it would have been desirable to cut interest rates even further. But that wasn’t possible: Japan was up against the zero bound.
In 2008 and 2009, the Federal Reserve also found itself up against the zero bound. In the aftermath of the bursting of the housing bubble and the ensuing financial crisis, the interest on short-term U.S. government debt had fallen to virtually zero.
1. The long-run Phillips curve is
   I. the same as the short-run Phillips curve.
   II. vertical.
   III. the short-run Phillips curve plus expected inflation.
   a. I only
   b. II only
   c. III only
   d. I and II only
   e. I, II, and III

2. The short-run Phillips curve shows a __________ relationship between __________.
   a. negative the aggregate price level and aggregate output
   b. positive the aggregate price level and aggregate output
   c. negative unemployment and inflation
   d. positive unemployment and aggregate output
   e. positive unemployment and the aggregate price level

3. An increase in expected inflation will shift
   a. the short-run Phillips curve downward.
   b. the short-run Phillips curve upward.
   c. the long-run Phillips curve upward.
   d. the long-run Phillips curve downward.
   e. neither the short-run nor the long-run Phillips curve.

4. Bringing down inflation that has become embedded in expectations is called
   a. deflation.
   b. negative inflation.
   c. anti-inflation.
   d. unexpected inflation.
   e. disinflation.

5. Debt deflation is
   a. the effect of deflation in decreasing aggregate demand.
   b. an idea proposed by Irving Fisher.
   c. a contributing factor in causing the Great Depression.
   d. due to differences in how borrowers/lenders respond to inflation losses/gains.
   e. all of the above.
1. Draw a correctly labeled graph showing a short-run Phillips curve with an expected inflation rate of 0% and the corresponding long-run Phillips curve.

[Answer Field]

b. On your graph, label the nonaccelerating inflation rate of unemployment.

[Answer Field]

c. On your graph, show what happens in the long run if the government decides to decrease the unemployment rate below the nonaccelerating inflation rate of unemployment. Explain.

[Answer Field]

Answer (8 points)

1 point: Vertical axis labeled “Inflation rate”

1 point: Horizontal axis labeled “Unemployment rate”

1 point: Downward sloping curve labeled “SRPC\textsubscript{0}”

1 point: Vertical curve labeled “LRPC”

1 point: \(\text{SRPC}_0\) crosses horizontal axis where it crosses \(LRPC\)

1 point: \(\text{NAIRU}\) is labeled where \(\text{SRPC}_0\) crosses \(LRPC\) and horizontal axis

1 point: New \(SRPC\) is labeled, for example as “SRAS’”, and shown above the original \(\text{SRPC}_0\)

1 point: When the unemployment rate moves below the \(\text{NAIRU}\), it creates inflation and moves the economy to a point such as A. This leads to positive inflationary expectations, which shift the \(SRPC\) up as shown by \(SRPC\).

2. Consider the accompanying diagram.
a. What is the nominal interest rate if expected inflation is 0%?
[Answer Field]

b. What would the nominal interest rate be if the expected inflation rate were —2%? Explain.
[Answer Field]

c. What would the nominal interest rate be if the expected inflation rate were —6%? Explain.
[Answer Field]

d. What would a negative nominal interest rate mean for lenders? How much lending would take place at a negative nominal interest rate? Explain.
[Answer Field]

e. What effect does a nominal interest rate of zero have on monetary policy? What is this situation called?
[Answer Field]
Check Your Understanding

1. Explain how the short-run Phillips curve illustrates the negative relationship between cyclical unemployment and the actual inflation rate for a given level of the expected inflation rate.

[Answer Field]

2. Why is there no long-run trade-off between unemployment and inflation?

[Answer Field]

3. Why is disinflation so costly for an economy? Are there ways to reduce these costs?

[Answer Field]

4. Why won’t anyone lend money at a negative nominal rate of interest? How can this pose problems for monetary policy?

[Answer Field]