reveals that the inflation-unemployment points for recent years are closer to the points associated with the Phillips Curve of the 1960s than to the points in the late 1970s and early 1980s. The points for 1997–2007, in fact, are very close to points on the 1960s curve. (The very low inflation and unemployment rates in this latter period produced an exceptionally low value of the so-called *misery index*, as shown in Global Perspective 35.1.)

The Long-Run Phillips Curve

The overall set of data points in Figure 35.10 supports our third generalization relating to the inflation-unemployment relationship: There is no apparent *long-run* trade-off between inflation and unemployment. Economists point out that when decades as opposed to a few years are considered, any rate of inflation is consistent with the natural rate of unemployment prevailing at that time. We know from Chapter 26 that the natural rate of unemployment is the unemployment rate that occurs when cyclical unemployment is zero; it is the full-employment rate of unemployment, or the rate of unemployment when the economy achieves its potential output.

How can there be a short-run inflation-unemployment trade-off but not a long-run trade-off? Figure 35.11 provides the answer.

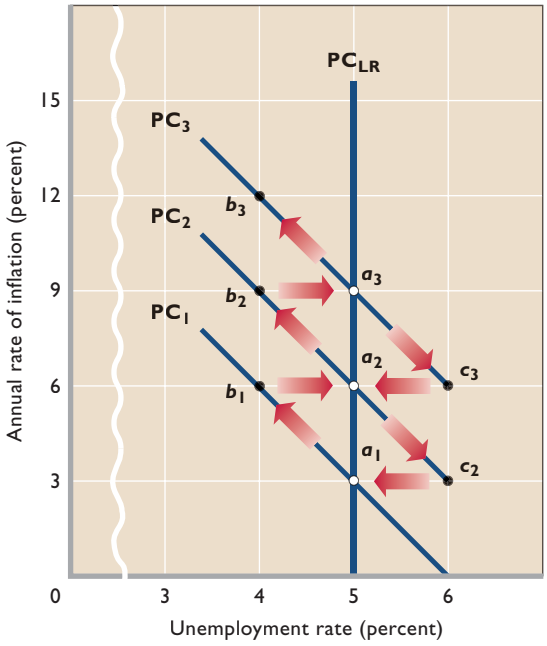
Short-Run Phillips Curve

Consider Phillips Curve PC_1 in Figure 35.11. Suppose the economy initially is experiencing a 3 percent rate of inflation and a 5 percent natural rate of unemployment. Such short-term curves as PC_1, PC_2, and PC_3 (drawn as straight lines for simplicity) exist because the actual rate of inflation is not always the same as the expected rate.

Establishing an additional point on Phillips Curve PC_1 will clarify this. We begin at a_1, where we assume nominal wages are set on the assumption that the 3 percent rate of inflation will continue. That is, because workers expect output prices to rise by 3 percent per year, they negotiate wage contracts that feature 3 percent per year increases in nominal wages so that these nominal wage increases will exactly offset the expected rise in prices and thereby keep their real wages the same.

But suppose that the rate of inflation rises to 6 percent, perhaps because the Fed has decided to move the AD curve to the right even faster than it had been before. With a nominal wage rate set on the expectation that the 3 percent rate of inflation will continue, the higher product prices raise business profits. Firms respond to the higher profits by hiring more workers and increasing output. In the short run, the economy moves to b_1, which, in contrast to a_1, involves

FIGURE 35.11 The long-run vertical Phillips Curve. Increases in aggregate demand beyond those consistent with full-employment output may temporarily boost profits, output, and employment (as from a_1 to b_1). But nominal wages eventually will catch up so as to sustain real wages. When they do, profits will fall, negating the previous short-run stimulus to production and employment (the economy now moves from b_1 to a_2). Consequently, there is no trade-off between the rates of inflation and unemployment in the long run; that is, the long-run Phillips Curve is roughly a vertical line at the economy's natural rate of unemployment.



a lower rate of unemployment (4 percent) and a higher rate of inflation (6 percent). The move from a_1 to b_1 is consistent both with an upward-sloping aggregate supply curve and with the inflation-unemployment trade-off implied by the Phillips Curve analysis. But this short-run Phillips Curve simply is a manifestation of the following principle: *When the actual rate of inflation is higher than expected, profits temporarily rise and the unemployment rate temporarily falls.*

Long-Run Vertical Phillips Curve

But point b_1 is not a stable equilibrium. Workers will recognize that their nominal wages have not increased as fast as inflation and will therefore renegotiate their labor contracts so that they feature faster increases in nominal wages. These faster increases in nominal wages make up for the higher rate of inflation and restore the workers' lost purchasing power. As these new labor contracts kick in, business profits will fall to their prior level. The reduction in profits means that the original motivation to employ more workers and increase output has disappeared.

Unemployment then returns to its natural level at point a_2. Note, however, that the economy now faces a higher

actual and expected rate of inflation—6 percent rather than 3 percent. This happens because the new labor contracts feature 6 percent per year increases in wages to make up for the 6 percent per year inflation rate. Because wages are a production cost, this faster increase in wage rates will imply faster future increases in output prices as firms are forced to raise prices more rapidly to make up for the faster future rate of wage growth. Stated a bit differently, the initial increase in inflation will become *persistent* because it leads to renegotiated labor contracts that will perpetuate the higher rate of inflation. In addition, because the new labor contracts are public, it will also be the case that the higher rates of inflation that they will cause will be *expected* by everyone rather than being a surprise.

In view of the higher 6 percent expected rate of inflation, the short-run Phillips Curve shifts upward from PC_1 to PC_2 in Figure 35.11. An "along-the-Phillips-Curve" kind of move from a_1 to b_1 on PC_1 is merely a short-run or transient occurrence. In the long run, after nominal wage contracts catch up with increases in the inflation rate, unemployment returns to its natural rate at a_2, and there is a new short-run Phillips Curve PC_2 at the higher expected rate of inflation.

The scenario repeats if aggregate demand continues to increase. Prices rise momentarily ahead of nominal wages, profits expand, and employment and output increase (as implied by the move from a_2 to b_2). But, in time, nominal wages increase so as to restore real wages. Profits then fall to their original level, pushing employment back to the normal rate at a_3. The economy's "reward" for lowering the unemployment rate below the natural rate is a still higher (9 percent) rate of inflation.

Movements along the short-run Phillips curve (a_1 to b_1 on PC_1) cause the curve to shift to a less favorable position (PC_2, then PC_3, and so on). A stable Phillips Curve with the dependable series of unemployment-rate–inflation-rate trade-offs simply does not exist in the long run. The economy is characterized by a **long-run vertical Phillips Curve.**

The vertical line through a_1, a_2, and a_3 shows the long-run relationship between unemployment and inflation. Any rate of inflation is consistent with the 5 percent natural rate of unemployment. So, in this view, society ought to choose a low rate of inflation rather than a high one.

ORIGIN OF THE IDEA

O 35.2
Long-run vertical Phillips Curve

Disinflation

The distinction between the short-run Phillips Curve and the long-run Phillips Curve also helps explain **disinflation**—reductions in the inflation rate from year to year. Suppose that in Figure 35.11 the economy is at a_3, where the inflation rate is 9 percent. And suppose that a decline in the rate at which aggregate demand shifts to the right faster than aggregate supply (as happened during the 1981–1982 recession) reduces inflation below the 9 percent expected rate, say, to 6 percent. Business profits fall because prices are rising less rapidly than wages. The nominal wage increases, remember, were set on the assumption that the 9 percent rate of inflation would continue. In response to the decline in profits, firms reduce their employment and consequently the unemployment rate rises. The economy temporarily slides downward from point a_3 to c_3 along the short-run Phillips Curve PC_3. *When the actual rate of inflation is lower than the expected rate, profits temporarily fall and the unemployment rate temporarily rises.*

Firms and workers eventually adjust their expectations to the new 6 percent rate of inflation, and thus newly negotiated wage increases decline. Profits are restored, employment rises, and the unemployment rate falls back to its natural rate of 5 percent at a_2. Because the expected rate of inflation is now 6 percent, the short-run Phillips Curve PC_3 shifts leftward to PC_2.

If the rate at which aggregate demand shifts to the right faster than aggregate supply declines even more, the scenario will continue. Inflation declines from 6 percent to, say, 3 percent, moving the economy from a_2 to c_2 along PC_2. The lower-than-expected rate of inflation (lower prices) squeezes profits and reduces employment. But, in the long run, firms respond to the lower profits by reducing their nominal wage increases. Profits are restored and unemployment returns to its natural rate at a_1 as the short-run Phillips Curve moves from PC_2 to PC_1. Once again, the long-run Phillips Curve is vertical at the 5 percent natural rate of unemployment. **(Key Question 7)**

QUICK REVIEW 35.3

- As implied by the upward-sloping short-run aggregate supply curve, there may be a short-run trade-off between the rate of inflation and the rate of unemployment. This trade-off is reflected in the Phillips Curve, which shows that lower rates of inflation are associated with higher rates of unemployment.
- Aggregate supply shocks that produce severe cost-push inflation can cause stagflation—simultaneous increases in the inflation rate and the unemployment rate. Such stagflation occurred from 1973 to 1975 and recurred from 1978 to 1980, producing Phillips Curve data points above and to the right of the Phillips Curve for the 1960s.
- After all nominal wage adjustments to increases and decreases in the rate of inflation have occurred, the economy ends up back at its full-employment level of output and its natural rate of unemployment. The long-run Phillips Curve therefore is vertical at the natural rate of unemployment.

Taxation and Aggregate Supply

A final topic in our discussion of aggregate supply is taxation, a key aspect of **supply-side economics**. "Supply-side economists" or "supply-siders" stress that changes in aggregate supply are an active force in determining the levels of inflation, unemployment, and economic growth. Government policies can either impede or promote rightward shifts of the short-run and long-run aggregate supply curves shown in Figure 35.2. One such policy is taxation.

These economists say that the enlargement of the U.S. tax system has impaired incentives to work, save, and invest. In this view, high tax rates impede productivity growth and hence slow the expansion of long-run aggregate supply. By reducing the after-tax rewards of workers and producers, high tax rates reduce the financial attractiveness of working, saving, and investing.

Supply-siders focus their attention on *marginal tax rates*—the rates on extra dollars of income—because those rates affect the benefits from working, saving, or investing more. In 2008 the marginal tax rates varied from 10 to 35 percent in the United States. (See Table 4.1 for details.)

Taxes and Incentives to Work

Supply-siders believe that how long and how hard people work depends on the amounts of additional after-tax earnings they derive from their efforts. They say that lower marginal tax rates on earned incomes induce more work, and therefore increase aggregate inputs of labor. Lower marginal tax rates increase the after-tax wage rate and make leisure more expensive and work more attractive. The higher opportunity cost of leisure encourages people to substitute work for leisure. This increase in productive effort is achieved in many ways: by increasing the number of hours worked per day or week, by encouraging workers to postpone retirement, by inducing more people to enter the labor force, by motivating people to work harder, and by avoiding long periods of unemployment.

Incentives to Save and Invest

High marginal tax rates also reduce the rewards for saving and investing. For example, suppose that Tony saves $10,000 at 8 percent interest, bringing him $800 of interest per year. If his marginal tax rate is 40 percent, his after-tax interest earnings will be $480, not $800, and his after-tax interest rate will fall to 4.8 percent. While Tony might be willing to save (forgo current consumption) for an 8 percent return on his saving, he might rather consume when the return is only 4.8 percent.

Saving, remember, is the prerequisite of investment. Thus, supply-side economists recommend lower marginal tax rates on interest earned from saving. They also call for lower taxes on income from capital to ensure that there are ready investment outlets for the economy's enhanced pool of saving. A critical determinant of investment spending is the expected *after-tax* return on that spending.

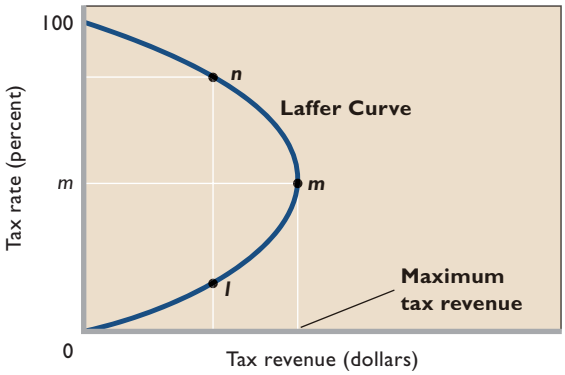
To summarize: Lower marginal tax rates encourage saving and investing. Workers therefore find themselves equipped with more and technologically superior machinery and equipment. Labor productivity rises, and that expands long-run aggregate supply and economic growth, which in turn keeps unemployment rates and inflation low.

The Laffer Curve

In the supply-side view, reductions in marginal tax rates increase the nation's aggregate supply and can leave the nation's tax revenues unchanged or even enlarge them. Thus, supply-side tax cuts need not produce Federal budget deficits.

This idea is based on the **Laffer Curve,** named after Arthur Laffer, who popularized it. As Figure 35.12 shows, the Laffer Curve depicts the relationship between tax rates and tax revenues. As tax rates increase from 0 to 100 percent, tax revenues increase from zero to some maximum level (at *m*) and then fall to zero. Tax revenues decline beyond some point because higher tax rates discourage economic activity, thereby shrinking the tax base (domestic output and income). This is easiest to see at the extreme, where the tax rate is 100 percent. Tax revenues here are, in theory, reduced to zero because the 100 percent confiscatory tax rate has halted production. A 100 percent tax rate applied to a tax base of zero yields no revenue.

FIGURE 35.12 The Laffer Curve. The Laffer Curve suggests that up to point *m* higher tax rates will result in larger tax revenues. But tax rates higher than *m* will adversely affect incentives to work and produce, reducing the size of the tax base (output and income) to the extent that tax revenues will decline. It follows that if tax rates are above *m*, reductions in tax rates will produce increases in tax revenues.



In the early 1980s, Laffer suggested that the United States was at a point such as *n* on the curve in Figure 35.12. There, tax rates are so high that production is discouraged to the extent that tax revenues are below the maximum at *m*. If the economy is at *n*, then lower tax rates can either increase tax revenues or leave them unchanged. For example, lowering the tax rate from point *n* to point *l* would bolster the economy such that the government would bring in the same total amount of tax revenue as before.

Laffer's reasoning was that lower tax rates stimulate incentives to work, save and invest, innovate, and accept business risks, thus triggering an expansion of real output and income. That enlarged tax base sustains tax revenues even though tax rates are lowered. Indeed, between *n* and *m* lower tax rates result in *increased* tax revenue.

Also, when taxes are lowered, tax avoidance (which is legal) and tax evasion (which is not) decline. High marginal tax rates prompt taxpayers to avoid taxes through various tax shelters, such as buying municipal bonds, on which the interest earned is tax-free. High rates also encourage some taxpayers to conceal income from the Internal Revenue Service. Lower tax rates reduce the inclination to engage in either tax avoidance or tax evasion. **(Key Question 9)**

Criticisms of the Laffer Curve

The Laffer Curve and its supply-side implications have been subject to severe criticism.

Taxes, Incentives, and Time A fundamental criticism relates to the degree to which economic incentives are sensitive to changes in tax rates. Skeptics say ample empirical evidence shows that the impact of a tax cut on incentives is small, of uncertain direction, and relatively slow to emerge. For example, with respect to work incentives, studies indicate that decreases in tax rates lead some people to work more but lead others to work less. Those who work more are enticed by the higher after-tax pay; they substitute work for leisure because the opportunity cost of leisure has increased. But other people work less because the higher after-tax pay enables them to "buy more leisure." With the tax cut, they can earn the same level of after-tax income as before with fewer work hours.

Inflation or Higher Real Interest Rates Most economists think that the demand-side effects of a tax cut are more immediate and certain than longer-term supply-side effects. Thus, tax cuts undertaken when the economy is at or near full employment may produce increases in aggregate demand that overwhelm any increase in aggregate supply. The likely result is inflation or restrictive monetary policy to prevent it. If the latter, real interest rates will rise and investment will decline. This will defeat the purpose of the supply-side tax cuts.

Position on the Curve Skeptics say that the Laffer Curve is merely a logical proposition and assert that there must be some level of tax rates between 0 and 100 percent at which tax revenues will be at their maximum. Economists of all persuasions can agree with this. But the issue of where a particular economy is located on its Laffer Curve is an empirical question. If we assume that we are at point *n* in Figure 35.12, then tax cuts will increase tax revenues. But if the economy is at any point below *m* on the curve, tax-rate reductions will reduce tax revenues.

CONSIDER THIS . . .

Sherwood Forest

The popularization of the idea that tax-rate reductions will increase tax revenues owed much to Arthur Laffer's ability to present his ideas simply. In explaining his thoughts to a *Wall Street Journal* editor over lunch, Laffer reportedly took out his pen and drew the curve on a napkin. The editor retained the napkin and later reproduced the curve in an editorial in *The Wall Street Journal*. The Laffer Curve was born. The idea it portrayed became the centerpiece of economic policy under the Reagan administration (1981–1989), which cut tax rates on personal income by 25 percent over a 3-year period.

Laffer illustrated his supply-side views with a story relating to Robin Hood, who, you may recall, stole from the rich to give to the poor. Laffer likened people traveling through Sherwood Forest to taxpayers, whereas Robin Hood and his band of merry men were government. As taxpayers passed through the forest, Robin Hood and his men intercepted them and forced them to hand over their money. Laffer asked audiences, "Do you think that travelers continued to go through Sherwood Forest?"

The answer he sought and got, of course, was "no." Taxpayers will avoid Sherwood Forest to the greatest extent possible. They will lower their taxable income by reducing work hours, retiring earlier, saving less, and engaging in tax avoidance and tax evasion activities. Robin Hood and his men may end up with less revenue than if they collected a relatively small "tax" from each traveler for passage through the forest.

Do Tax Increases Reduce Real GDP?*

Determining the Relationship Between Changes in Taxes and Permanent Changes in Real GDP is Fraught with Complexities and Difficulties. University of California-Berkeley Economists Christina Romer and David Romer have Recently Devised a Novel New Way to Approach the Topic. Their Findings Suggest That Tax Increases Reduce Real GDP.†

How do changes in the level of taxation affect the level of economic activity? The simple correlation between taxation and economic activity shows that, on average, when economic activity rises more rapidly, tax revenues also are rising more rapidly. But this correlation almost surely does not reflect a positive effect of tax increases on output. Rather, under our tax system, any positive shock to output raises tax revenues by increasing income.

In "The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks," authors Cristina Romer and David Romer observe that this difficulty is just one of many manifestations of a more general problem. Changes in taxes occur for many reasons. And, because the factors that give rise to tax changes often are correlated with other developments in the economy, disentangling the effects of the tax changes from the other effects of these underlying factors is inherently difficult.

To address this problem, Romer and Romer use the narrative record—Presidential speeches, executive branch documents, Congressional reports, and so on—to identify the size, timing, and principal motivation for all major tax policy actions in the post-World War II United States. This narrative analysis allows them to separate revenue changes resulting from legislation from changes occurring for other reasons. It also allows them to classify legislated changes according to their primary motivation.

Romer and Romer find that despite the complexity of the legislative process, most significant tax changes have been motivated by one of four factors: counteracting other influences in the economy; paying for increases in government spending (or lowering taxes in conjunction with reductions in spending); addressing an inherited budget deficit; and promoting long-run growth. They observe that legislated tax changes taken to counteract other influences on the economy, or to pay for increases in government spending, are very likely to be correlated with other factors affecting the economy. As a result these observations are likely to lead to unreliable estimates of the effect of tax changes.

Tax changes that are made to promote long-run growth, or to reduce an inherited budget deficit, in contrast, are undertaken for reasons essentially unrelated to other factors influencing output. Thus, examining the behavior of output following these tax changes is likely to provide more reliable estimates of the output effects of tax changes. *The results of this more reliable test indicate that tax changes have very large effects: a tax increase of 1 percent of GDP lowers real GDP by roughly 2 to 3 percent.*

These output effects are highly persistent. The behavior of inflation and unemployment suggests that this persistence reflects long-lasting departures of output from previous levels. Romer and Romer also find that output effects of tax changes are much more closely tied to the actual changes in taxes than news about future changes, and that investment falls sharply in response to tax changes. Indeed, the strong response of investment helps to explain why the output consequences of tax increases are so large.

Romer and Romer find suggestive evidence that tax increases to reduce an inherited budget deficit have much smaller output costs than other tax increases. This is consistent with the idea that deficit-driven tax increases may have important expansionary effects through [improved] expectations and [lower] longterm interest rates, or through [enhanced] confidence.

*Abridged from Les Picker, "Tax Increases Reduce GDP," *The NBER Digest*, February/March 2008. The *Digest* provides synopses of research papers in progress by economists affiliated with the National Bureau of Economic Research (NBER).

†Cristina Romer and David Romer, "The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks," National Bureau of Economic Research Working Paper No. 13264, 2007.

Rebuttal and Evaluation

Supply-side advocates respond to the skeptics by contending that the Reagan tax cuts in the 1980s worked as Laffer predicted. Although the top marginal income tax rates on earned income were cut from 50 to 28 percent in that decade, real GDP and tax revenues were substantially higher at the end of the 1990s than at the beginning.

But the general view among economists is that the Reagan tax cuts, coming at a time of severe recession, helped boost aggregate demand and return real GDP to its full-employment output and normal growth path. As the economy expanded, so did tax revenues despite the lower tax rates. The rise in tax revenues caused by economic growth swamped the declines in revenues from lower tax rates. In essence, the Laffer Curve shown in Figure 35.12 stretched rightward, increasing net tax revenues. But the tax-rate cuts did not produce extraordinary rightward shifts of the long-run aggregate supply curve. Indeed, saving fell as a percentage of personal income during the period, productivity growth was sluggish, and real GDP growth was not extraordinarily strong.

Because government expenditures rose more rapidly than tax revenues in the 1980s, large budget deficits occurred. In 1993 the Clinton administration increased the top marginal tax rates from 31 to 39.6 percent to address these deficits. The economy boomed in the last half of the 1990s, and by the end of the decade tax revenues were so high relative to government expenditures that budget surpluses emerged. In 2001, the Bush administration reduced marginal tax rates over a series of years partially "to return excess revenues to taxpayers." In 2003 the top marginal tax rate fell to 35 percent. Also, the income tax rates on capital gains and dividends were reduced to 15 percent. Economists generally agree that the Bush tax cuts, along with a highly expansionary monetary policy, helped revive and expand the economy following the recession of 2001. Strong growth of output and income in 2004 and 2005 produced large increases in tax revenues, although large budget deficits remained because spending also increased rapidly. The 2004 deficit was $413 billion and the 2005 deficit was $318 billion. The deficit fell over the next two years, to $162 billion in 2007, but with the economy slowing in late 2007 and threatening to slip into recession in 2008, official forecasts predicted budget deficits of over $400 billion for both 2008 and 2009.

Today, there is general agreement that the U.S. economy is operating at a point below *m*—rather than above *m*—on the Laffer Curve in Figure 35.12. In this zone, the overall effect is that personal tax-rate increases raise tax revenues while personal tax-rate decreases reduce tax revenues. But, at the same time, economists recognize that, other things equal, cuts in tax rates reduce tax revenues in percentage terms by less than the tax-rate reductions. Similarly, tax-rate increases do not raise tax revenues by as much in percentage terms as the tax-rate increases. This is true because changes in marginal tax rates alter taxpayer behavior and thus affect taxable income. Although these effects seem to be relatively modest, they need to be considered in designing tax policy—and, in fact, the Federal government's Office of Tax Policy created a special division in 2007 devoted to estimating the magnitude of such effects when it comes to proposed changes in U.S. tax laws. Thus, supply-side economics has contributed to how economists and policymakers design and implement fiscal policy.

Summary

1. In macroeconomics, the short run is a period in which nominal wages do not respond to changes in the price level. In contrast, the long run is a period in which nominal wages fully respond to changes in the price level.
2. The short-run aggregate supply curve is upsloping. Because nominal wages are unresponsive to price-level changes, increases in the price level (prices received by firms) increase profits and real output. Conversely, decreases in the price level reduce profits and real output. However, the long-run aggregate supply curve is vertical. With sufficient time for adjustment, nominal wages rise and fall with the price level, moving the economy along a vertical aggregate supply curve at the economy's full-employment output.
3. In the short run, demand-pull inflation raises the price level and real output. Once nominal wages rise to match the increase in the price level, the temporary increase in real output is reversed.
4. In the short run, cost-push inflation raises the price level and lowers real output. Unless the government expands aggregate demand, nominal wages eventually will decline under conditions of recession and the short-run aggregate supply curve will shift back to its initial location. Prices and real output will eventually return to their original levels.
5. If prices and wages are flexible downward, a decline in aggregate demand will lower output and the price level. The decline in the price level will eventually lower nominal