

Low Inflation: The Surprise of the 1990s

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Over the past six years, inflation has been stable or declining in the United States. But over that period, economic forecasters continually predicted an upturn in inflation that never materialized. Is inflation now behaving differently than it did in prior decades? Or are the forecasters using inadequate models?

The persistent errors in the forecasts of in-

flation are disturbing. Forecasters had done an outstanding job of projecting inflation prior to the 1990s, as I described in my 1996 article, "Inflation Forecasts: How Good Are They?" Statistical tests discussed in that article verify that over a long period, forecasts of inflation were unbiased. So the recent, persistent overprediction of inflation is unusual.

Why should we be concerned about bad inflation forecasts? For one thing, the private sector uses inflation forecasts in a number of ways, from businesses that print catalogs showing their prices, to lenders who set interest rates

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depending on what they think inflation will be in the future. If those inflation forecasts aren't very good, businesses and lenders will set prices incorrectly, and such a mistake may be costly to them and their customers.

In addition, inflation forecasts provide important information to policymakers who are formulating monetary policy today. If forecasts indicate a rise in inflation (if policy doesn't change), policymakers may wish to tighten monetary policy now to keep inflation from rising. Looking at forecasts helps policymakers address the problem that monetary policy actions affect the economy with a lag: actions today affect the inflation rate one to two years from now. So basing policy actions on forecasts would be desirable *if* the forecasts were accurate. Unfortunately, the persistent errors in the forecasts of inflation cast doubt on the value of using those forecasts as a basis for making policy.

Given the potential importance of inflation forecasts for policymakers and the good track record of forecasters prior to the 1990s, what explains the erroneous forecasts of the last six years? Has something changed in the way forecasters make their predictions? Or has the inflation process itself changed?

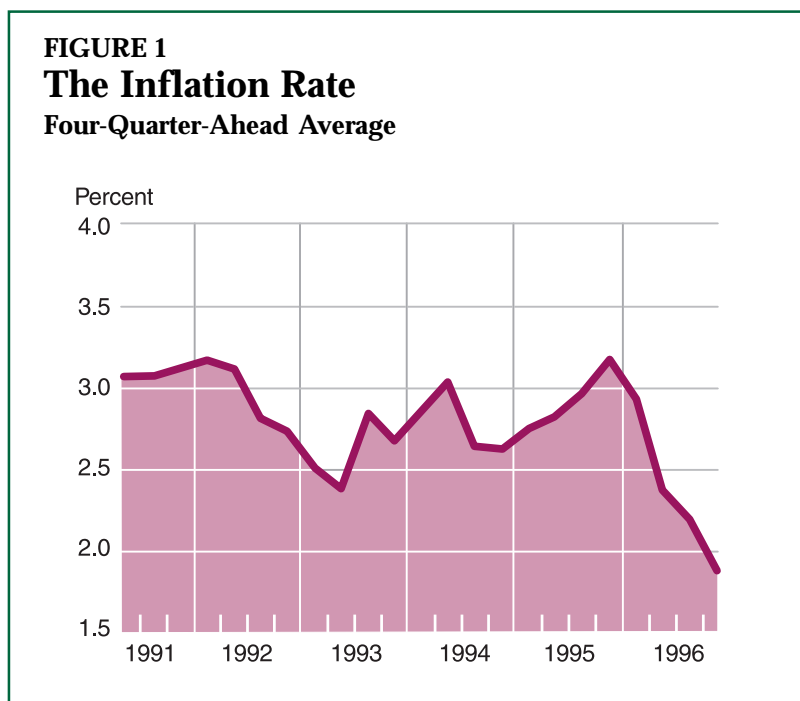
RECENT INFLATION AND FORECASTS

Inflation Has Been Surprisingly Stable . . . Perhaps the most remarkable aspect of the economic expansion that's been going on since 1991 is that the inflation rate held fairly

steady for several years and has been declining recently (Figure 1).¹

The fact that the inflation rate has not risen over the period shown in the figure is unusual, at least when compared to recent experience. Only two other economic expansions since World War II lasted at least six years (1961 to 1969 and 1983 to 1990), and in both, inflation was accelerating significantly by the sixth year. In the 1961-69 expansion, the average annual inflation rate rose from 1 percent in 1961 to about 3 percent in 1967 and to more than 5 per-

¹The figure shows the percentage change in the Consumer Price Index for All Urban Consumers (CPI-U), which is the most commonly forecasted measure of consumer prices. It is averaged over a year to give a better picture of the trend in inflation, since inflation data vary a lot from month to month. The data points are four-quarter-ahead moving averages; for example, the data point plotted for 1991Q2 is the inflation rate in the CPI-U from 1991Q2 to 1992Q2.



cent in 1969. In the 1983-90 expansion, inflation rose from 3 percent in 1983 to about 5 percent in 1990. But since the current economic expansion began in 1991, inflation has remained remarkably steady, about 3 percent or less.

...But Forecasters Predicted That Inflation Would Rise. Over the past six years, forecasters have predicted an uptick in inflation, but they've been consistently wrong. The typical forecast during this expansion held that inflation would creep up by about one-half of a percentage point over the coming year, for example, from 3 to 3.5 percent.

Comparing forecasts of inflation since the current expansion began with actual inflation shows how persistently the forecasters have missed the mark (Figure 2). To interpret the figure, look at the values for the second quarter of 1991 (where the "Forecast" and "Actual" lines begin). The value shown (3.8 percent) on the "Forecast" line is the inflation forecast made in the second quarter of 1991 for the average in-

flation rate from that date to the second quarter of 1992.² The value shown (3.1 percent) on the "Actual" line is the actual inflation rate from the second quarter of 1991 to the second quarter of 1992.

The line showing the actual inflation rate is almost always below the line showing the forecast, which means forecasters persistently predicted a rise in the inflation rate that never materialized. The average forecast error (the forecast of the inflation rate minus the actual inflation rate) is about 0.4 percentage points. Actual inflation was 2.9 percent on average, while the forecast of inflation was 3.3 percent on average.³

Examining the quarterly pattern of the forecasts in more detail shows even more clearly that forecasters expected inflation to rise. A typical example can be seen in the forecast that was made in the second quarter of 1992 (Figure 3).

²The forecasts come from the *Survey of Professional Forecasters*, a quarterly survey produced by the Federal Reserve Bank of Philadelphia that covers a wide variety of macroeconomic variables, including consumer price inflation. The participants are forecasters on Wall Street, at banks, at corporations, and in consulting firms. For more details on the survey, see my 1993 article, "Introducing: The Survey of Professional Forecasters," or visit the Philadelphia Fed's Web site at '<http://www.phil.frb.org/econ/spf/spfpage.html>'.

³The only time the forecast was below actual inflation occurred in 1995Q4 and 1996Q1, because unexpectedly high increases in food and energy prices in 1996 caused the actual inflation rate to exceed the forecast. But in every other quarter, the forecast exceeded the actual inflation rate.

FIGURE 2
The Inflation Rate
Four-Quarter-Ahead Average

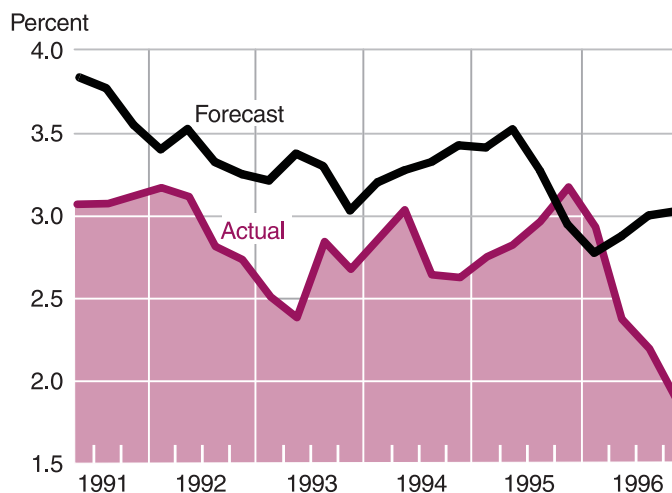
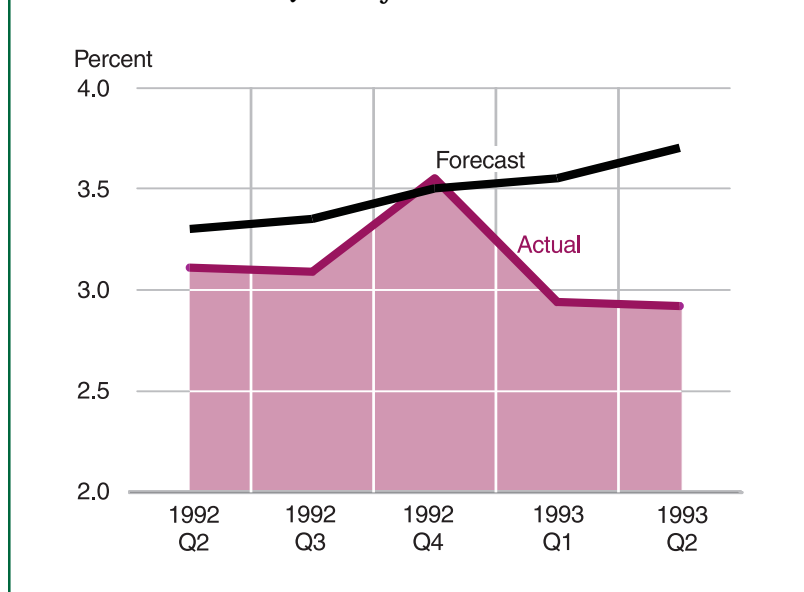


FIGURE 3
The Inflation Rate
 Actual vs. Forecast/Quarterly



In this diagram, the points plotted are the median forecasts for the inflation rate for the current quarter (1992Q2) and each of the next four quarters, compared with the actual inflation rate in each quarter. The figure shows that inflation, which had been 2.7 percent in the first quarter of 1992, was expected to rise gradually over time. The forecasters thought inflation would be 3.3 percent in 1992Q2, 3.35 percent in 1992Q3, 3.5 percent in 1992Q4, 3.55 percent in 1993Q1, and 3.7 percent in 1993Q2. In fact, inflation turned out to be lower than forecast in every quarter except 1992Q4.

WHY WERE THE FORECASTS SO HIGH?

We can't know for sure why forecasts for inflation have been consistently too high in the 1990s. To determine possible reasons, let's look at four different methods for forecasting inflation to see what forecasters might have missed: (1) the cost model, in which increases in the

costs of producing goods translate into higher prices; (2) historical correlations, in which forecasters look at how inflation typically moves over the course of the business cycle; (3) demand-side and supply-side models, in which forecasters examine changes in aggregate demand and supply to determine their impact on inflation; and (4) the monetary model, in which inflation is directly affected by the degree of tightness of monetary policy.

The Cost Model. One method of forecasting inflation is to examine the cost of producing

goods. According to this theory, if production costs begin to grow at a faster rate, firms pass on the higher costs in the form of higher prices of goods, and the inflation rate increases. The question then is, what causes production costs to rise faster? One explanation is based on an economic construct called the Phillips curve, which relates inflation to unemployment. When labor markets get tight—that is, there aren't many qualified workers available—firms increase wages more rapidly, and the cost of producing goods rises faster. This theory leads to the notion that the economy has a natural rate of unemployment, or a non-accelerating-inflation rate of unemployment (NAIRU). The Phillips curve model suggests that when the nation's unemployment rate is less than the natural rate, inflation will rise. Similarly, if unemployment rises above the natural rate, inflation will decline.

With this type of model, it's clear why fore-

casters were predicting that inflation would rise from 1994 on (though not before that). Most estimates in the early 1990s set the natural rate of unemployment at about 6 percent. The unemployment rate fell below that level in 1994. Consequently, many forecasters became alarmed about the prospects of a rise in inflation at that time. But the unemployment rate continued to decline. After averaging 6.1 percent in 1994, it fell to an average of 5.6 percent in 1995, then to 5.4 percent in 1996, and it was below 5.0 percent through most of 1997. Those forecasters who used a Phillips curve model thus produced forecasts of an increasing inflation rate.

However, as inflation continued to be benign, forecasters began to rethink their views on the natural rate of unemployment. They observed both low inflation and significant changes in the labor force, which made them realize that the natural rate of unemployment was probably less than 6 percent. So, over time, a number of forecasters have lowered their estimate of the natural rate of unemployment, and they are no longer predicting as large a rise in inflation.⁴

The fact that forecasters began to change their views about the level of the natural rate

of unemployment led economists Doug Staiger, Jim Stock, and Mark Watson to investigate how the natural rate should be estimated. In their paper "The NAIRU, Unemployment, and Monetary Policy," they found that estimates of the natural rate are quite imprecise. A forecaster has no more basis for using an estimate of the natural rate of unemployment of 6 percent than one of 5.5 percent. The natural rate may be somewhere in that neighborhood, but those estimates could easily be off by a percentage point or more.

How does uncertainty about the natural rate of unemployment affect the models of the Phillips curve that forecasters use? If something happens in the economy that reduces the natural rate, but the forecasters are unaware of this event, their models will use too high a value for the natural rate. As the unemployment rate drops below their estimate of the natural rate, forecasters may think inflation will rise, but they would be wrong.

What factors might have caused the natural rate of unemployment to decline? One notable feature of the 1990s is an increased willingness by corporations to lay off workers, especially at the managerial level (for evidence, see the article by Rob Valletta). This change, in turn, has affected workers' attitudes toward their jobs and led them to reduce demands for higher wages for fear of being "downsized." Such a change in attitude is likely to have reduced the natural rate of unemployment, since workers won't demand higher wages even when the unemployment rate is very low.

Thus, one explanation of the errors in forecasting inflation, at least since 1994, may be the failure of forecasters to modify their Phillips curve models of inflation to reflect a lower natural rate of unemployment.

One other major influence on firms' production costs that may also have played a role in the 1990s in keeping production costs down is the effort to control the cost of health benefits. While benefit costs rose much more rapidly

⁴The natural rate of unemployment represents the unemployment rate when the economy is operating at full capacity. Two groups of people would still be unemployed in such a situation: (1) those who may not have the skills needed for employment (for example, people who have worked in an industry that's shrinking and who need additional training to get another job); and (2) those who are simply between jobs but unlikely to be unemployed for long. Both structural (the first case) and frictional (the second case) unemployment are necessary consequences of a growing economy in which there's always change and technical progress. The natural rate of unemployment can change whenever either structural or frictional unemployment changes. For example, the natural rate of unemployment rose in the late 1970s because the oil price shocks to the economy reduced the need for workers in industries, such as the auto industry, that depend on low oil prices.

than wages and salaries from 1988 to 1994, the situation has been reversed over the past three years, mostly because of changes in health benefits. So firms' costs haven't been rising as rapidly on the health-benefits front, thus putting less pressure on firms to raise prices. To the extent that forecasters haven't accounted for the decline in health costs, their inflation forecasts may be off the mark.

Historical Correlations. Some forecasting models are based on what many people assume to be a fact—that inflation tends to rise as expansions get longer. As we've already seen, in the long expansions of the 1960s and 1980s, inflation accelerated as time passed. As a result, many economists take it on faith that inflation rises as an economic expansion continues.

But just because our history contains two episodes in which inflation rose as the economic expansion continued doesn't mean it must always be so. Indeed, some recent empirical research challenges this notion. In a 1991 article, "The Cyclical Behavior of Prices," Tom Cooley and Lee Ohanian found many periods in U.S. history in which inflation didn't rise during expansions.⁵ In fact, they found that it isn't clear whether the best forecast is for inflation to rise or to fall during expansions. This research surprised many economists who had taken the rise of inflation during expansions as fact.⁶

This line of research makes it clear that if forecasters assume that inflation will rise as an eco-

nomical expansion goes on, they are ignoring important evidence to the contrary. They need to look deeper and investigate the roles of supply and demand in the overall economy.

Demand- and Supply-Side Factors. The issue of whether an expansion is primarily driven by increases in demand or supply is crucial in determining what happens to inflation. Many inflation models suggest that inflation (or the increase in the inflation rate) depends on how fast the economy is growing relative to potential growth. So if the economy's potential growth rate changes, the economy can grow faster without higher inflation. What may have happened in the 1990s is that the potential growth rate of the economy increased, but forecasters didn't recognize it. As a result, they thought the economy was growing faster than it should have, so they thought inflation would rise.

One view of the economy holds that when demand outstrips supply at existing prices, prices are bid up to a higher level until demand equals supply. Thus, if supply is stable and some factor increases demand, we'd expect inflation to rise; if some factor reduces demand, we'd expect inflation to decline. Thus, it isn't really supply or demand alone that determines inflation, but a combination of the two.

In the 1990s, as the economy has grown faster than expected, forecasters may have thought that demand for goods was outstripping sup-

⁵Examining the movement of inflation during expansions involves identifying cycles in inflation relative to its trend, which can be a tricky business. The idea is that if prices are growing 3 percent, on average, over time, we want to see if they're above or below their trend line in expansions. If the trend isn't stable over time, a number of alternative methods can be used to estimate the trend, but it isn't clear which method is best.

⁶Not all economists believe that Cooley and Ohanian's research is the final word. First, Bankim Chadha and Eswar Prasad found evidence that inflation did rise, on average, during expansions. But their results depend on this tricky

business of taking out the trend, as discussed in footnote 5. John Judd and Bharat Trehan suggested that looking at simple correlations between inflation and output (as Cooley and Ohanian, as well as Chadha and Prasad, had done) is misleading. Using a simple example, they showed that such a correlation can't answer the question of whether inflation rises in expansions, because that correlation depends on the timing of the movements in output and prices, not their overall direction. Instead, a more detailed statistical analysis is needed, focusing on whether supply-side factors (what people produce) or demand-side factors (what people buy) are the dominant force in the expansion.

ply, and thus they would expect an increase in the inflation rate. For example, many forecasters thought the economy would grow at a rate of 2 to 2.5 percent in 1995, 1996, and 1997. They were about right in 1995, when the economy grew 2 percent. But in 1996, the economy grew nearly 3 percent, and it grew nearly 4 percent in 1997. So forecasters may have thought that inflation was likely to increase over the past two years, since demand was outstripping supply. In fact, inflation declined between 1995 and 1997, so supply-side factors must have come into play.

The three most important supply-side factors are growth of the labor force, productivity, and foreign competition. All have changed in ways that increased supply in the mid-1990s.

As an example of a surprising change in the growth of the labor force, consider the welfare reform bill of 1996. This bill led to an increase in the labor force that carried over into 1997: people at the lower end of the income scale entered the workforce in increased numbers. An estimate by Mary Daly suggests that the welfare reform bill caused the labor force to increase by 300,000 within the first year.

Economists had been predicting that growth in the labor force would slow down beginning in 1996; some economists even predicted that the labor force would grow by less than 1 million people in 1996 and again in 1997. In fact, the rise in the number of people in the labor force exceeded 2 million and employment grew even more—over 2.5 million—in both years. This surprising growth in the number of people working was a major factor behind the fast pace of the economy in 1996 and 1997.

Another supply-side source of economic growth is productivity. As workers become more productive, the economy's output rises. A look at the statistics is discouraging, since our national income accounts show productivity growing at a rather slow rate over the past 20 years. But is it really growing that slowly? To the casual observer, productivity appears to be

exploding, especially since computer technologies are making rapid advances. So why are the statistics on productivity so bleak?

One theory is that our official statistics mismeasure productivity growth. It's hard to calculate how valuable new computers are, and it's difficult to evaluate the improvement in productivity that a new, but expensive, piece of medical equipment generates. And it's nearly impossible to evaluate productivity gains in the service sector. How much more does a lawyer do now than she did 10 years ago? How much has her ability to investigate legal questions improved in the on-line age? Does her constant availability by pager and cell phone make her more productive for her clients?

Economists like Leonard Nakamura think that these measurement issues are of primary importance. In his 1997 article, "Is the U.S. Economy Really Growing Too Slowly? Maybe We're Measuring Growth Wrong," he argues that, in fact, the U.S. economy has been doing much better than the official statistics show. According to Nakamura, the government data overstate inflation and understate productivity and economic growth. Over the last 20 years, U.S. output and productivity growth may have been as much as two percentage points higher per year than the official statistics indicate. And the mismeasurement has been increasing in the last few years. If that's right, the economy should be able to grow rapidly without causing inflation.

A final supply-side factor comes from foreign competition. In the 1990s, U.S. firms, especially in the manufacturing sector, have competed in increasingly global markets. Increased competition from foreign firms may have caused firms to set their prices lower and reduced profit margins (compared with what they would have been in the absence of that competition).

In addition, since early 1995 the dollar has been rising, on average, against other currencies. The rise in the dollar reduces the price of

imports into the United States, so U.S. firms that compete in the same markets as foreign firms must cut their prices to remain competitive. Again, the effect is likely to help reduce inflation.

All of these supply-side factors have been pushing inflation down in the 1990s, especially over the last few years. To the extent that forecasters didn't anticipate these factors, their inflation forecasts were too high.

The Monetary and Financial Model. One final method used to forecast inflation is the monetary model, which is best described by Milton Friedman's famous maxim, "Inflation is always and everywhere a monetary phenomenon." According to Friedman and other monetarists, what matters for inflation is not the growth rate of the economy but the growth rate of the money supply. Forecasters from the monetarist school look at the growth rate of the money supply as an indicator of future inflation.

These days, financial innovation has made it difficult to interpret the growth rate of the money supply itself, but other economic variables provide some indication of whether monetary policy is easy or tight.⁷ One indicator of the stance of monetary

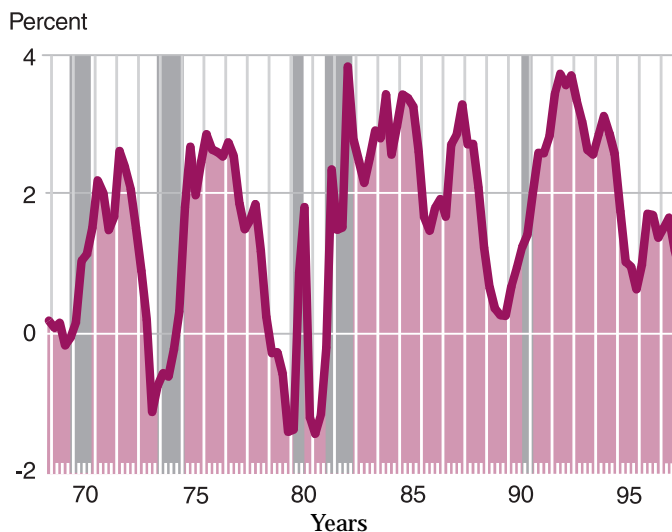
⁷For example, in 1996, the M1 measure of the money supply (which includes currency and deposits in checking accounts) fell 4.6 percent while the M2 measure of the money supply (which includes M1, savings accounts, and small savings deposits) grew 4.3 percent.

policy is the difference between the interest rate on the 10-year U.S. government bond and the interest rate on three-month Treasury bills. The bigger this difference, the easier the stance of monetary policy. Since 1994 this difference has been lower than it usually is in expansions (Figure 4).

Another important indicator of monetary policy is the real federal funds rate—the nominal interest rate on overnight loans between banks minus the expected inflation rate. The higher the real federal funds rate is, the tighter monetary policy is. Again, the data show that the real federal funds rate has been a bit higher over the past few years than its average in the 1970s (Figure 5).⁸ That's good, because the

⁸The figure shows the federal funds rate minus the one-year-ahead expected inflation rate from the *Survey of Professional Forecasters*.

FIGURE 4
Interest Rate Spread
Interest Rate on 10-Year Treasury Bond Minus Interest Rate on 3-Month Treasury Bill



Source: Federal Reserve series of constant maturities, secondary markets.

1970s were a time when inflation accelerated. But the real federal funds rate in the 1990s isn't quite as high as it was in the 1980s. In the early 1980s, when the real federal funds rate was very high, inflation declined significantly. Later in the 1980s, when the real federal funds rate was about as high as it is now, inflation was fairly stable.

All these indicators point to tighter monetary policy in the 1990s than is usual in expansions. Thus monetary policy itself may be at least partly responsible for keeping inflation from rising. To the extent that forecasters misread the stance of monetary policy or relied too much on historical correlations or the Phillips curve, their forecasts called for higher inflation.

CONCLUSION

We've seen that inflation has been much lower in the 1990s than forecasters expected.

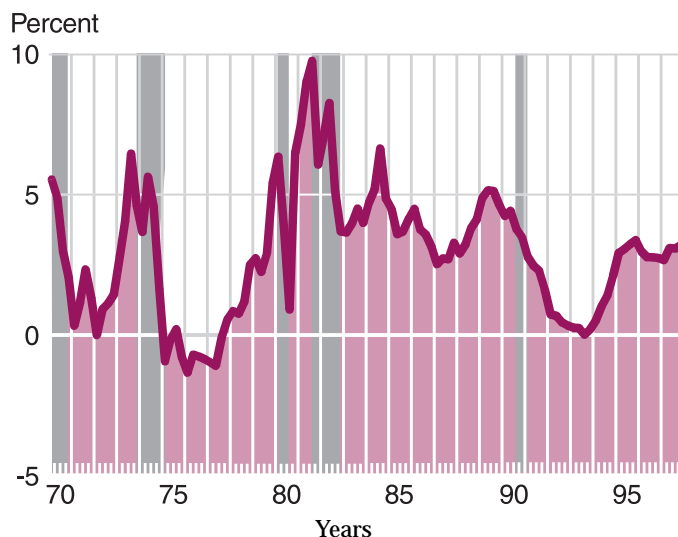
Over the last six years, forecasters have continually predicted that inflation would rise, but it hasn't. It's difficult to figure out the exact source of their forecasting errors, but it's likely to be a combination of many factors. They may have based their forecasts on a cost view of inflation, using a Phillips curve, but not realized that the natural rate of unemployment was declining. They may have looked at historical correlations and assumed (incorrectly) that inflation always rises in expansions. They may have failed to take supply-side factors, such as increased growth in the labor supply, increased productivity, and foreign competition, sufficiently into account. And they may have failed to account completely for the degree of tightness of monetary policy.

With all of these considerations affecting inflation and forecasts of inflation, how should monetary policymakers react? The fact that inflation forecasts have

been too high makes policymakers wary of basing decisions solely on such forecasts.

But if policymakers don't use forecasts, what do they do? They monitor the tightness of monetary policy, using a variety of financial indicators. They keep an eye on both supply and demand factors and do not assume that a rise in demand will necessarily bring higher inflation. Finally, policymakers realize that while Phillips curves and other methods of examining production costs have proven useful historically, they are difficult to use for forecasting inflation.

FIGURE 5
Real Federal Funds Rate



Source: Federal funds rate adjusted by one-year-ahead expectations of GDP price index from the *Survey of Professional Forecasters*.

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