
U.S. Inflation Developments in 1995

By Todd E. Clark

In setting monetary policy in 1995, the Federal Reserve sought to promote sustainable economic growth and continued progress toward price stability. Toward those ends, the Federal Reserve adjusted the stance of monetary policy three times in 1995. In February, amid signs of increasing inflationary pressures, policy was tightened. In July and December, in response to signals of a slowing economy and abating inflationary pressures, policy was eased.

This article reviews inflation developments in the United States during 1995. The first section examines the actual behavior of inflation over the past year. The second section examines developments in inflation expectations in 1995. The third section describes the contents and rationale of legislation introduced in Congress in 1995 that would make price stability the primary long-run goal of Federal Reserve monetary policy.

The article concludes that inflation developments of the past year were mixed. Most inflation measures rose relative to the previous year, but inflation remained moderate. Moreover, expectations of inflation declined in 1995, so that future inflation is generally expected to remain near the

current level. The Federal Reserve, therefore, appeared to be successful in maintaining moderate inflation during the year and in convincing the public that inflation will remain moderate in the period ahead.

INFLATION IN 1995

During 1995, the behavior of inflation was affected by the state of the economy and by some special factors. The continued U.S. economic expansion, which began in the second quarter of 1991, tended to place upward pressure on prices as the economy operated at or close to capacity constraints. Specific factors, such as movements in energy and food prices, also affected various inflation indicators.

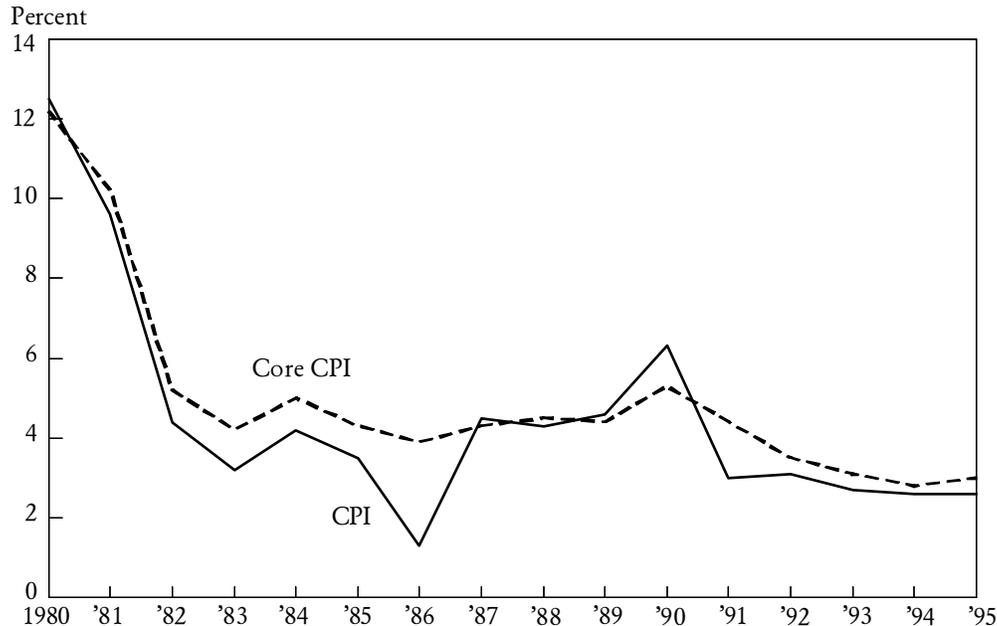
Inflation over the year

For the year as a whole, inflation remained moderate in 1995. Inflation in the consumer price index (CPI) for all items was 2.6 percent, the same as in 1994.¹ Inflation in the so-called *core* CPI, which excludes food and energy prices, was 3.0 percent, up from 2.8 percent in 1994. Although consumer inflation remained moderate, progress toward price stability stalled in 1995. In recent years, the Federal Reserve has sought and achieved a gradual reduction in consumer inflation (Chart 1). In 1995, however, CPI inflation was unchanged, and core CPI inflation edged up.

Todd E. Clark is a senior economist at the Federal Reserve Bank of Kansas City. Mangal Goswami, a research associate at the bank, helped prepare the article.

Chart 1

CPI INFLATION SINCE 1980



Note: Data are Q4/Q4 percent changes.

Other measures of inflation in final goods and services prices increased somewhat (Chart 2). See the accompanying box which describes alternative inflation measures. Specifically, inflation in the chain-weighted price index for gross domestic product (GDP) rose from 2.3 percent in 1994 to 2.7 percent in 1995.² Inflation in the producer price index (PPI) for finished goods increased from 1.4 percent in 1994 to 2.1 percent in 1995.³ Inflation in the core PPI for finished goods, which excludes food and energy prices, rose from 1.7 percent in 1994 to 2.5 percent in 1995.

Over the course of 1995, inflation measures tended to increase early in the year and then decrease later in the year. Inflation in consumer and producer prices rose from January to April but slowed from May to December (Table 1).⁴

Inflation in the chain-weighted price index for GDP rose in the first quarter of 1995, but then slowed in the second and third quarters (Table 2).

Inflation and the state of the economy

In keeping with historical patterns, the behavior of inflation in 1995 as a whole was strongly influenced by the state of the economy. In the past, business cycle expansions have typically been accompanied by rising consumer price inflation (Chart 3).⁵ The economic boom of the late 1980s, for example, was accompanied by a rise in inflation. Moreover, statistical procedures identify a strong relationship between inflation and unemployment over the business cycle (King and Watson).⁶ When a business cycle boom generates a reduction in unemployment, inflation often rises.

ALTERNATIVE INFLATION MEASURES

Policymakers, businesses, and individuals find a number of inflation measures to be useful. These include the *consumer price index*, the *chain-weighted price index for GDP*, and the *producer price index*. The CPI and the GDP price index track final goods and services, measuring the prices of items sold to the final user. The PPI tracks prices of goods at different stages of production, from the very earliest stage to the finished stage.

More specifically, the consumer price index tracks the average change in the prices of a fixed set of goods and services purchased by the typical consumer. The all-items CPI, known simply as the CPI, measures the average price change of all goods and services. More specialized indexes of consumer prices are also available. The *core* CPI measures the prices of nonfood and nonenergy goods and services. The exclusion of food and energy prices, which tend to be highly volatile, can sometimes help make underlying inflation trends more apparent. The CPI and core CPI are the most commonly cited measures of inflation because they come closest to tracking changes in the cost of living of the average U.S. resident.

The chain-weighted price index for GDP

measures the average price change for all final goods and services produced in the United States. The chain-weighted index, which the Bureau of Economic Analysis began featuring in January 1996, represents something of a hybrid measure.⁷ Inflation in the chain-weighted index is the average of two different fixed-weighted indexes of overall price change. In measuring inflation from the past year to the current year, one fixed-weighted index uses the past year's composition of purchases to weight individual price changes, while the other index uses the current year's composition of purchases to weight individual price changes.

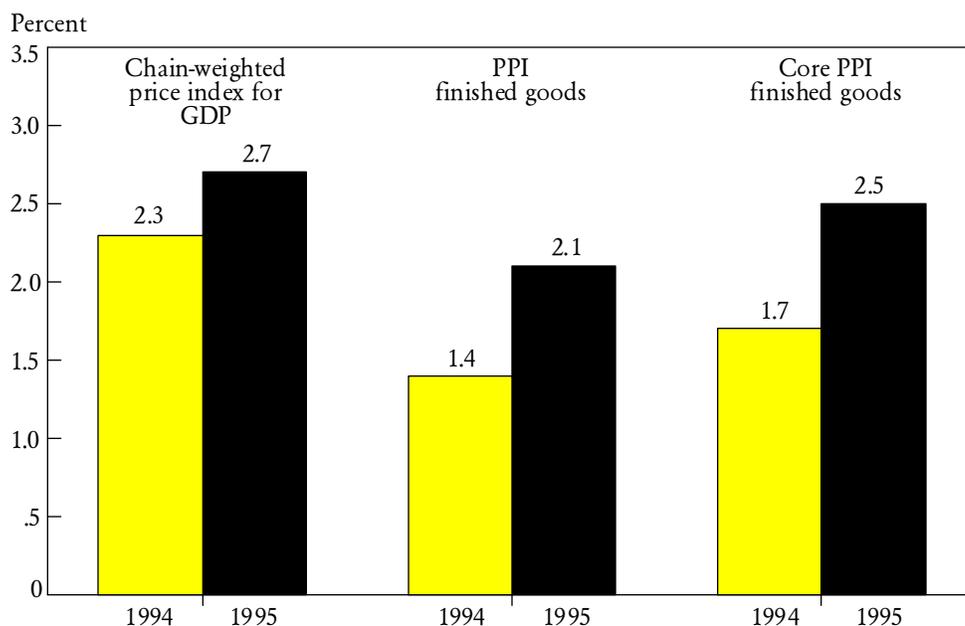
Finally, the producer price index tracks the average change in prices received by domestic producers of a fixed set of goods. The PPI collectively refers to three different indexes corresponding to different stages of production—one for crude materials, one for intermediate goods, and one for finished goods. The indexes for crude materials and intermediate goods are sometimes viewed as indicators of future changes in prices at later stages of production, such as consumer prices.⁸ For each of the producer price indexes, a *core* series—one excluding food and energy prices—is also available.

In late 1994 and early 1995, the economy operated at a high level of resource utilization. Capacity utilization was high and labor markets were tight (Chart 4). From January to March of

1995, the rate of capacity utilization in manufacturing averaged more than 84 percent. Historically, utilization rates above 82 percent have been associated with rising inflation (Garner). More-

Chart 2

GDP PRICE INDEX AND PPI INFLATION, 1995 VS. 1994



Note: The 1994 figure for the GDP price index is the year to year percent change reported by the Bureau of Economic Analysis (BEA). The 1995 figure for the GDP price index is the average of the Q1-Q3 inflation rates reported by the BEA. Data for the PPI and core PPI are Q4/Q4 percent changes.

over, from January to March, the unemployment rate averaged 5.5 percent. This rate is below most estimates of the “natural rate”—the lowest rate associated with stable inflation (Weiner).⁹ Put differently, the natural rate would be observed if the economy were in neither a cyclical expansion nor a recession but instead expanding on trend.

Over the course of 1995, resource pressures eased somewhat. The capacity utilization rate for manufacturing drifted down, from more than 84 percent early in the year to about 82 percent late in the year (Chart 4). Unemployment edged up, from an average of 5.5 percent in the first quarter to an average of slightly more than 5.6 percent over the remainder of the year.

These economic conditions were an important determinant of inflation in the past year. The strains on resources in late 1994 and early 1995 created upward pressure on inflation in 1995. However, the easing of resource strains late in 1995 helped cool the inflationary pressures. On balance, economic conditions caused inflation to edge up but left inflation generally moderate.

Special factors

While the behavior of inflation in 1995 was fundamentally related to the state of the economy, a number of special factors also influenced inflation behavior. Such special factors can play an important role over the short term, but their

Table 1
INFLATION IN THE CPI AND PPI

	<u>CPI</u>	<u>Core CPI</u>	<u>PPI finished goods</u>	<u>Core PPI finished goods</u>
1991	3.0	4.4	-.1	3.2
1992	3.1	3.5	1.6	2.0
1993	2.7	3.1	.2	.2
1994	2.6	2.8	1.4	1.7
1995	2.6	3.0	2.1	2.5
January-April	3.6	4.2	3.1	3.0
May-December	2.1	2.3	1.8	2.3

Notes: Annual inflation rates are Q4/Q4 percent changes. Inflation rates for January-April 1995 and May-December 1995 are measured as (annualized) percent changes from December 1994 to April, and from April to December 1995, respectively.

influence dissipates over longer horizons. In 1995, two factors had a special impact on inflation of consumer prices. First, reductions in energy prices over the year as a whole helped keep overall CPI inflation below core CPI inflation, which excludes food and energy prices. The reductions in energy prices were led by falling gasoline prices, the result of previous declines in crude oil prices.

A second special factor, transportation costs, also influenced consumer price inflation—particularly, the pattern of inflation movements over the year. Changes in transportation costs helped push CPI inflation up early in the year and then down later in the year. From January through April, large increases in airfares, auto financing costs, and used car prices pushed up the transportation component of CPI inflation to an annual rate of 6.8 percent. The pickup in airfares stemmed from ongoing strategic pricing efforts by airlines, while the surge in auto financing costs reflected increases in interest rates following the tightening of monetary policy in 1994 and February 1995. Over the remainder of the year, the transportation component of the

CPI declined as airfares, auto financing costs, and used car prices fell.

Some special factors also influenced price inflation for producers. For the year as a whole, reductions in energy prices slowed the PPI for finished goods, keeping overall PPI inflation below the core PPI rate.¹⁰ Over the course of 1995, prices for both energy and food affected producer price inflation. For the first four months of the year, food prices fell, while energy prices rose sharply. Because the food price reductions offset the energy price increases, overall PPI inflation was about the same as the core rate. From May to December, energy prices declined, keeping overall finished goods inflation below the core rate.

INFLATION EXPECTATIONS IN 1995

Examining inflation expectations provides another useful means of gauging progress toward price stability. Expectations are important because they can affect actual inflation and because they provide a signal of the credibility of monetary policy. In 1995, both short-term and long-term

inflation expectations declined. By the end of the year, inflation was generally expected to remain near its current level.

The importance of expectations

Inflation expectations are important for two reasons. First, inflation expectations influence the supply and demand decisions made by individuals and businesses and thereby can affect actual inflation.¹¹ For example, if inflation is expected to fall, workers will tend to moderate their wage demands, and businesses will tend to moderate their price increases in response to both the expected slowing of overall inflation and the deceleration of wages. The reason for this behavior is that, with lower inflation expected, workers and businesses can maintain their real wages and prices even with slower growth in nominal terms. Thus, a fall in inflation expectations can lead to a reduction in actual inflation.

Inflation expectations are also important because they provide a signal of the credibility of a central bank's monetary policy. For instance, a central bank might have a goal of reducing inflation over time. If the public believes the bank will act to achieve the goal, expectations of inflation some years into the future will probably be less than the current rate of inflation. In contrast, if the public doubts the central bank will act to achieve the goal of reducing inflation, expectations of future inflation are likely to be near the current rate of inflation. Thus, inflation expectations provide a useful indicator of monetary policy's credibility.

Short-term expectations

Measures of short-term inflation expectations declined over the course of 1995 (Chart 5). By the end of the year, inflation was expected to remain near the 1995 level. One measure of inflation expectations is the Blue Chip consensus

Table 2

INFLATION IN THE PRICE INDEX FOR GDP

	Chain-weighted price index
1991	3.9
1992	2.8
1993	2.6
1994	2.3
1995	2.7
Q1	3.3
Q2	2.5
Q3	2.4

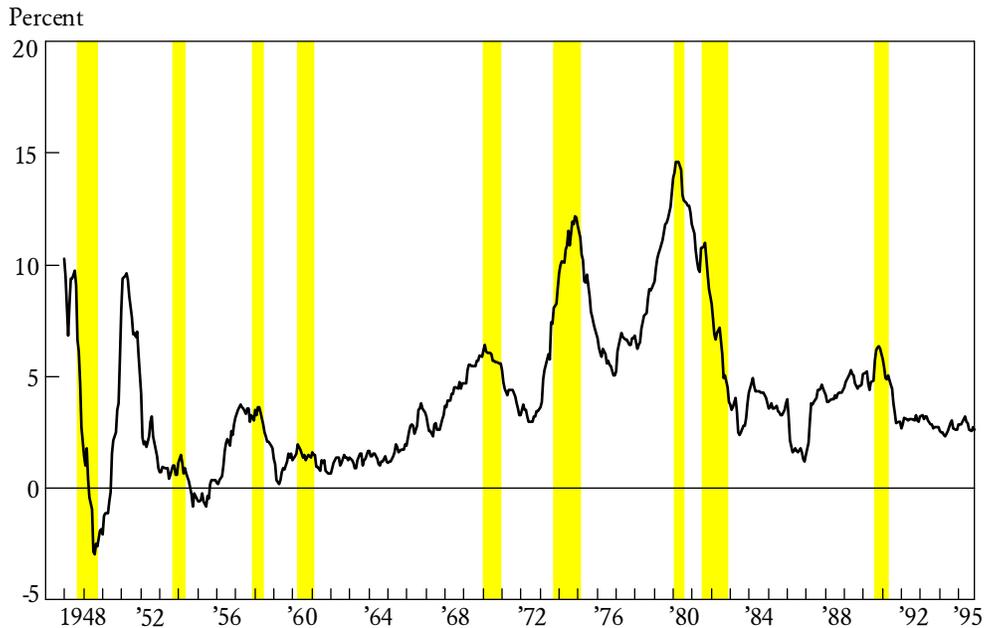
Notes: 1991-94 inflation rates are year to year percent changes, as reported by the Bureau of Economic Analysis (BEA). Inflation rates for Q1-Q3 1995 are (annualized) quarterly percent changes, as reported by the BEA. The 1995 inflation rate is the simple average of the Q1-Q3 rates.

forecast for CPI inflation in 1996. According to this indicator, expectations improved significantly in 1995. Forecasters expected 1996 inflation of 3.5 percent in January and 3.7 percent in February. But by the end of 1995, the consensus forecast for 1996 had fallen to 2.9 percent.

The same pattern was evident in other indicators of short-term expectations. Another measure of expectations is provided by the average CPI inflation forecast from the Survey of Professional Forecasters, compiled quarterly by the Federal Reserve Bank of Philadelphia.¹² According to this indicator, inflation expectations for 1996 declined from 3.5 percent in the first quarter of 1995 to 3.0 percent in the fourth quarter of 1995. Consumer expectations of inflation were more pessimistic and more volatile, but they too

Chart 3

CPI INFLATION



Note: Data are 12-month rates of change. Shaded areas represent recessions.

declined over 1995. The University of Michigan's consumer survey of inflation expectations for 12 months ahead fell gradually from the March peak of 4.6 percent to 3.3 percent in December.¹³

Long-term expectations

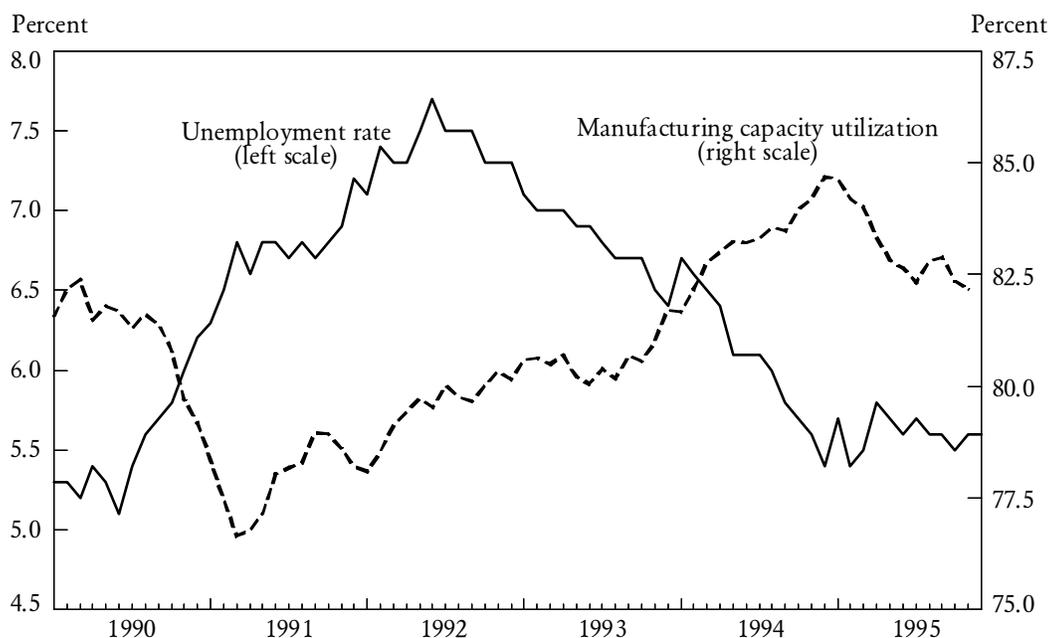
Long-term inflation expectations also improved in 1995. The Survey of Professional Forecasters provides one indicator of long-term inflation expectations—CPI inflation expected over the next ten years. By this measure, expectations declined in 1995 (Chart 6). The ten-year forecast fell from 3.5 percent in the fourth quarter of 1994 to 3.0 percent in the fourth quarter of 1995. The Livingston Survey, also compiled by the Federal

Reserve Bank of Philadelphia, provides another forecast of CPI inflation over the next ten years. In June and December of each year, the Livingston Survey presents an average of the forecasts of economists from business, government, banking, and academia. According to the Livingston survey, expectations declined from 3.4 percent in December 1994 to 3.0 percent in December 1995.

Overall, inflation expectations improved in 1995, as most measures of expectations declined over the course of the year. By the end of the year, inflation was expected to remain near the current level in both the short and the long term. The public, therefore, appears to believe the Federal

Chart 4

UNEMPLOYMENT AND CAPACITY UTILIZATION



Reserve will be able to keep inflation at its current moderate level.

THE MACK BILL

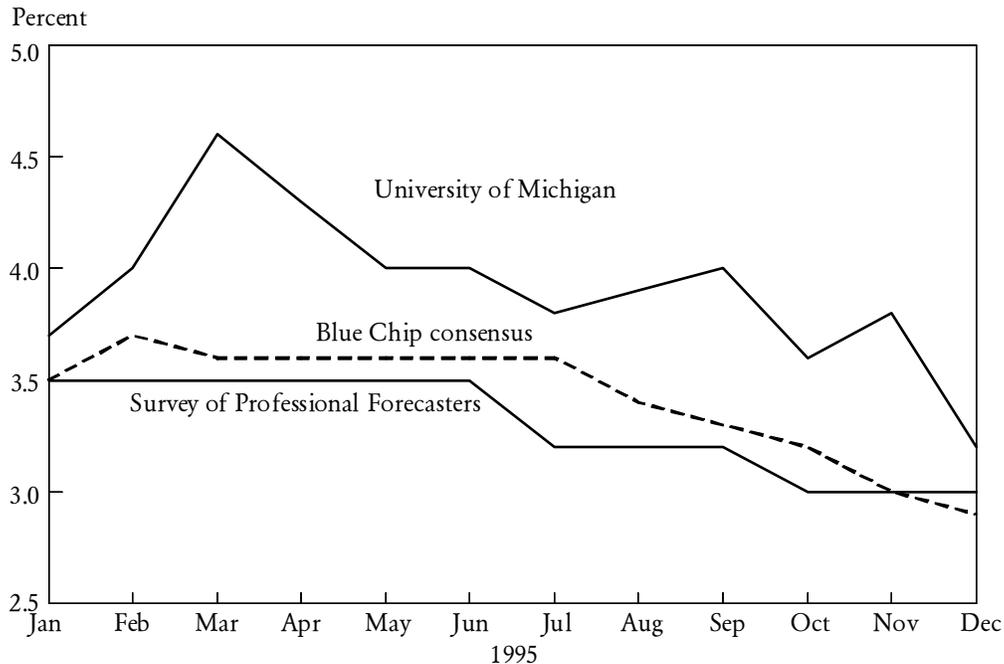
While the public expects inflation to remain near its current level, legislation introduced in Congress in 1995 might enhance the prospects of further reductions in inflation. The legislation would make price stability the primary goal of monetary policy, thereby underscoring the Federal Reserve's objective of reducing inflation until price stability is achieved. Known informally as the Mack bill, the legislation was introduced into the U.S. Senate by Connie Mack and into the U.S. House of Representatives by Jim Saxton in September, but no action has been taken yet. This section reviews the contents and rationale of the bill.

The contents of the Mack bill

Price stability would be made the primary goal of monetary policy if the Mack bill is passed by Congress and signed into law. The legislation, known formally as the *Economic Growth and Price Stability Act of 1995*, would supplant existing legislation. Current law—in particular the Federal Reserve Act, the Employment Act of 1946, and the Full Employment and Balanced Growth Act of 1978 (more commonly known as the Humphrey-Hawkins Act)—commits monetary policy to a variety of goals. These goals include not only price stability but also full employment, economic growth, and balance in international accounts. The Mack bill would modify the Federal Reserve and Employment Acts and repeal the Humphrey-Hawkins Act. The bill states that the Federal Reserve must

Chart 5

SHORT-TERM INFLATION EXPECTATIONS



Notes: The Blue Chip consensus data are forecasts of CPI inflation from 1995:Q4 to 1996:Q4. The Survey of Professional Forecasters data are forecasts of average annual inflation for 1996. The University of Michigan data are expected CPI inflation over the next 12 months.

maintain a monetary policy that effectively promotes the primary objective of long-term price stability.

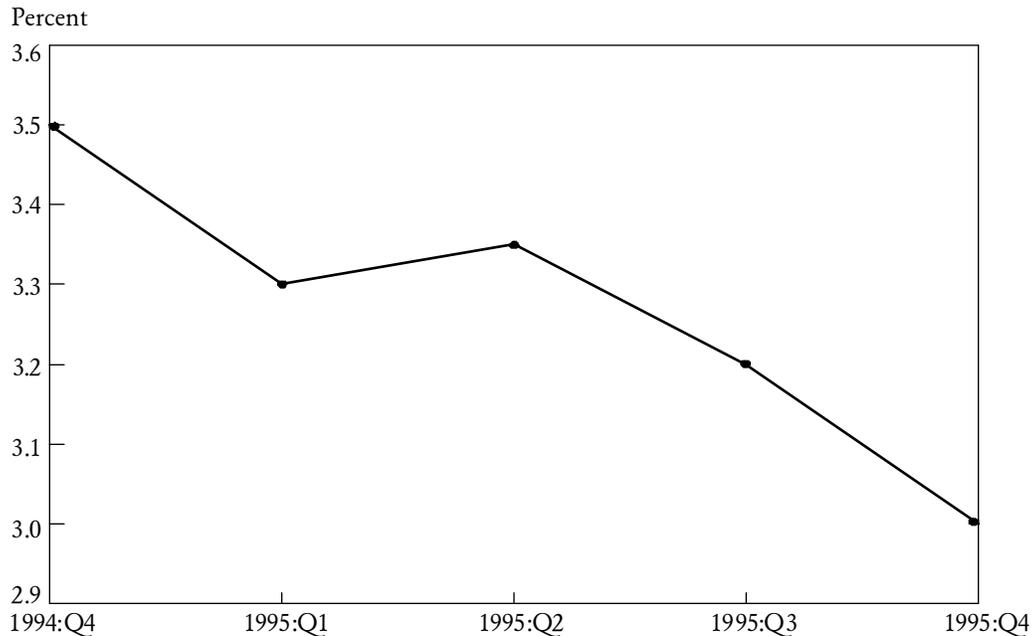
In addition, the Mack bill would require three specific actions by the Federal Reserve. First, the Federal Reserve would need to establish an explicit *numerical* definition of price stability. A variety of inflation indicators—for example, the CPI and the chain-weighted price index for GDP—are available. Moreover, as detailed in the accompanying box, price indexes such as the CPI are widely believed to overstate true inflation. Some argue the CPI overstates inflation by as much as 2 percent per year. Such overstatement implies that *low* inflation, rather than *zero* inflation, is consistent with price stability. Given the availabil-

ity of different price indexes and the possibility that price stability might be consistent with low measured inflation, the Mack legislation would require the Federal Reserve to define price stability numerically.

The Mack bill would also require the Federal Reserve to continue to report to Congress on a semiannual basis. As under existing law, the Federal Reserve would provide a written report and make an appearance at Congressional hearings twice each year. The written report would include several specific elements. The written report would have to include numerical measures to help assess the Federal Reserve's success in achieving and maintaining price stability. If

Chart 6

LONG-TERM INFLATION EXPECTATIONS



Notes: Data are forecasts of CPI inflation over the next ten years, from the Survey of Professional Forecasters.

the Federal Reserve had a stated objective of, say, 0 to 2 percent inflation in the core CPI, the report to Congress would need to include recent statistics on core CPI inflation. The report would also have to describe the intermediate variables used to gauge the prospects for achieving price stability. This element of the Mack bill would require the Federal Reserve's report to look forward and explain the consistency of the stance of monetary policy with the objective of price stability. And, the Federal Reserve's written report must include its definition of price stability and any changes made in the definition. While the Mack bill would allow monetary policymakers to define price stability, this component of the legislation would require policymakers to report any changes in the definition.

Finally, if the Mack legislation is enacted, the Federal Reserve's first report to Congress after the law takes effect would include an estimate of the time needed to achieve price stability, taking into account any output and employment effects associated with the move to price stability. This element of the legislation would require the Federal Reserve to specify a timetable for achieving price stability. The bill leaves the details of the path to price stability to Federal Reserve policymakers. For example, the bill would allow the Federal Reserve to decide on a gradual path of disinflation as a means of minimizing any output and employment effects that might result from the tightening of monetary policy needed to reduce inflation.

The reasoning behind the Mack bill

The Mack legislation cites several reasons for making price stability the sole objective of monetary policy. The first reason is the one that underlies the Federal Reserve's stated goal of achieving price stability over time—price stability is essential to maximum long-term economic growth. Fundamentally, inflation distorts the price mechanism, interrupting efficient allocation of resources and thereby diminishing growth and living standards.¹⁴ Reducing inflation to the point that it ceases to be a factor affecting decisions made by businesses and individuals—achieving price stability—would eliminate such distortions and thereby foster economic growth.

The second reason is that charging the Federal Reserve with the single objective of price stability would reduce uncertainty about monetary policy. The multiple objectives to which the Federal Reserve is committed under current law can create uncertainty about monetary policy. That uncertainty may have important real consequences. The profitability of a firm's investment project, for example, may depend on next year's short-term interest rates. Uncertainty about the objectives of monetary policy may exacerbate uncertainty about next year's interest rates and thereby affect the firm's investment decision. Committing the Federal Reserve to a single objective would eliminate uncertainty about monetary policy's goals and therefore reduce the uncertainty surrounding the firm's investment.

Finally, the Mack legislation argues that making price stability the primary objective of the Federal Reserve would lead to a more stable economy. In the view of the bill's authors, the attempts of monetary policy to stabilize the economy in the short run are often in fact destabilizing. Historically, monetary policy has sought not only to contain inflation but also to

reduce fluctuations in the economy. For example, the Federal Reserve has in the past eased monetary policy to try to prevent or mitigate economic slowdowns. The Mack bill argues that these attempts to affect the real economy rarely have the desired outcome and often have undesired consequences. In the bill's view, policy changes affect the economy with long, variable, and highly unpredictable lags. As a result, monetary policy changes made in an attempt to stabilize the economy may ultimately prove destabilizing. If a change in policy designed to stabilize the economy takes longer than expected to affect the economy, the change in policy may be unwarranted by the time it has an effect.

CONCLUSIONS

To minimize inflation's costs and thereby foster sustainable economic growth, the Federal Reserve seeks to contain and reduce inflation until price stability is achieved. Accordingly, the stance of monetary policy was adjusted three times in 1995. To contain rising inflationary pressures, the Federal Reserve increased short-term interest rates early in the year. Amid signs of abating inflationary pressures, the Federal Reserve eased monetary policy twice later in the year.

Given the goal of containing and ultimately reducing inflation, the developments of the past year were mixed. Inflation rose but remained moderate. Moreover, inflation expectations declined in 1995, so that inflation is expected to remain near the current level in both the short and the long term. The Federal Reserve, therefore, succeeded in maintaining moderate inflation and in convincing the public that inflation will remain moderate. While the past year did not yield a reduction in inflation, supporters of the Mack bill believe the legislation would help ensure future reductions by making price stability the primary goal of monetary policy.

IS INFLATION OVERSTATED?

As highlighted in Congressional hearings last year, price indexes such as the CPI may overstate true inflation (U.S. Congress).¹⁵ Analysts generally agree the government agencies responsible for computing the price indexes do a good job but that some bias problems are inevitable.¹⁶ In particular, the CPI, chain-weighted price index for GDP, and PPI may all suffer from a *quality bias*.¹⁷ The CPI and PPI might also have a *substitution bias*. Recent research on the CPI indicates the index may suffer two additional problems, a *sample rotation bias* and an *outlet substitution bias*.¹⁸ All of these biases may cause the price indexes to exaggerate true inflation. However, estimates of the size of the overall bias vary widely.

Quality bias. The prices and qualities of many goods change over time. The price and quality of the typical car, for example, have increased significantly. Some of an observed price increase will reflect quality improvement, while some of it will represent true inflation. A variety of methods are used to measure quality and in turn separate the change in a good's price due to quality from the change that truly represents inflation. Price indexes such as the CPI are intended to track changes in prices measured to be truly inflationary, rather than due to quality.

Mismeasurement of quality improvement may lead to a quality bias in the CPI, GDP price index, and PPI. Many analysts believe the methods for measuring quality under-

state improvements in quality. Such understatement means that too little of an observed price change is attributed to quality and too much is treated as a truly inflationary price change. As individual price changes are overstated because some component of a measured price change actually reflects quality improvement, the price indexes overstate inflation.

Substitution bias. Inflation is generally intended to refer to increases in a consumer's overall cost of living or a firm's total cost of doing business. Accordingly, an increase in the price of just one item purchased by a consumer or used by a firm may not generate much inflation. Consumers and firms can generally substitute another good for the good whose price has risen. Such substitution will mitigate the increase in expenditure needed for consumers or producers to maintain a desired standard of living or level of production. Therefore, substitution will mitigate the inflationary effects of a change in a particular good's price.

The CPI and PPI may overstate inflation because they do not allow for substitution among goods. These indexes each measure the average price change in a *fixed* set of goods. The indexes may then exaggerate inflation because they track the cost of the same set of goods, when in fact the set of goods changes as consumers and producers substitute among goods as individual prices change by different amounts. Recognizing this bias,

the Bureau of Labor Statistics (BLS) stresses that the CPI is not a true cost of living measure and may exaggerate increases in the true cost of living (U.S. Department of Labor 1992). In contrast to the CPI and PPI, the chain-weighted price index for GDP is free from the substitution bias, as it allows the set of goods to change over time.¹⁹

Sample rotation bias in the CPI. Because it is practically impossible to collect prices on all consumer items sold in the United States, the CPI is based on a large, representative sample of prices (U.S. Department of Labor 1992). Specifically, the CPI is a weighted average of sampled price changes, with weights that reflect the importance of each item in overall consumer expenditures. Each year, in an effort to keep up with changes in consumer purchasing patterns, the BLS rotates the sample of items and retail outlets from which prices are taken. For example, in any given year, the BLS may rotate from measuring the price of bananas at one supermarket to measuring the price at another supermarket in the same area.

The sample rotation bias arises from the way prices for newly sampled items are weighted in computing the CPI. When a new item or outlet is introduced to the CPI sample, its price may temporarily differ from normal. For instance, bananas may be on sale at a supermarket newly introduced into the sample. Over time, a price will move back toward normal—an initially low price will rise relatively rapidly, until reaching its normal level. BLS procedures create a sample rotation

bias by giving too much weight to prices that are initially low and too little weight to prices that are initially high. As low prices tend to rise relatively rapidly and high prices rise slowly, the CPI gives excessive weight to rapidly rising prices and insufficient weight to slowly rising prices. Consequently, the CPI overstates inflation somewhat. This sample rotation problem appears chiefly to affect food prices, as they tend to be more volatile. However, the BLS implemented procedures to correct the problem in the food component of the CPI in January 1995 (Stewart).

Outlet substitution bias in the CPI. Over time, consumers change the retail outlets from which they make purchases, substituting one store for another. Particularly, in recent years, consumers have shifted from making purchases at smaller, more specialized stores toward making purchases at larger discount stores. Typically, a discount store sells an item for considerably less than a smaller specialty store sells the same item.

The outlet substitution bias arises because current CPI procedures essentially ignore the decline in price that occurs as consumers shift from a traditional store to a discount store. In many cases, discount store prices are lower because the store provides less service than a smaller specialty store. In this sense, the item purchased at the discount outlet has lower quality. Based on this view, the BLS attributes the reduction in price that occurs with outlet substitution entirely to a decline in quality and records no true price change. In fact, some of the discount outlet's price

advantage may not be entirely due to lower quality and may therefore represent a truly lower price. For example, discount stores might have lower costs because they have more efficient inventory systems and are able to buy larger quantities of goods at lower wholesale prices. To the extent not all of the gap in price between a discount store and a more specialized store is due to a difference in service provided, the CPI will fail to pick up a true price reduction when outlet substitution occurs. As a result, the CPI may overstate inflation.

The size of the overall bias. Research has generally focused on measuring the overall bias in the CPI, paying less attention to the bias in other indexes. Estimates of the overall

bias in CPI inflation vary widely, even though the different estimates are generally drawn from the same, relatively small set of original studies. There is great disagreement about the magnitude of the quality bias, except that most analysts believe quality bias is probably the single largest source of overstatement. Researchers generally agree the substitution bias in CPI inflation amounts to about 0.2 percent per year. Finally, there is little agreement about the sizes of the sample rotation and outlet substitution biases. Reflecting the differences of opinions on the magnitudes of particular biases, estimates of the overall bias in CPI inflation range from about 0.2 to 2.0 percent per year. Estimates tend to concentrate around 1.0 percent.

ENDNOTES

¹ The annual CPI inflation rates are computed as Q4/Q4 percent changes.

² Inflation in the chain-weighted price index for the *consumption* component of GDP was essentially unchanged in 1995.

³ Inflation in the PPI for intermediate goods was unchanged in 1995, while inflation in the PPI for crude materials rose. Excluding food and energy, inflation declined for both the intermediate goods and crude materials indexes.

⁴ Inflation in the PPIs for crude materials and intermediate goods was rapid early in 1995—more rapid than in 1994 as a whole but comparable to inflation in the latter part of 1994—and then slowed. For example, inflation in the core

PPI for intermediate goods rose from 4.7 percent in 1994 (and a monthly average of 7.4 percent in the second half of 1994) to 9.4 percent in January-April and then declined to 0 percent over the rest of 1995.

⁵ Much of the movement in inflation shown in the chart can be attributed to long-term trends rather than the business cycle. Inflation still rises during the typical business cycle expansion even when the trend is removed from inflation using the procedure of King and Watson. However, estimates of the cyclical behavior of prices do show some sensitivity to the definition of business cycle movements (Chadha and Prasad; Rotemberg). For example, when business cycle movements are identified using the procedure of Hodrick and Prescott, the price level declines as the economy expands (Kydland and Prescott; Cooley and

Ohanian). Rotemberg provides an interpretation of such results and examines more specific elements of the behavior of inflation over the business cycle.

⁶ The King and Watson procedure, developed by Baxter and King, isolates business cycle movements by filtering out variation in unemployment and inflation that is attributable to long-term trends and short-term noise factors (such as one-month food price disturbances).

⁷ Traditionally, the Bureau of Economic Analysis (BEA) reported two other price indexes for GDP—the implicit price deflator and the fixed-weighted price index. The BEA still reports an implicit price deflator, but the deflator is now conceptually equivalent to the chain-weighted price index. The BEA has discontinued the fixed-weighted price index.

⁸ Clark, however, finds that movements in the PPI do not in and of themselves presage movements in the CPI.

⁹ Admittedly, however, the statistical uncertainty surrounding estimates of the natural rate is large. A conservative—perhaps too narrow—confidence interval is 5 to 7 percent (Staiger, Stock, and Watson).

¹⁰ On a Q4/Q4 basis, energy prices declined 0.8 percent in 1995. On a December/December basis, however, energy prices increased 0.9 percent. Accordingly, PPI inflation was slower than core PPI inflation on a Q4/Q4 basis because energy prices declined, while PPI inflation was slower than core inflation on a December/December basis because energy price increases were small.

¹¹ In more technical terms, expected inflation affects both aggregate supply and aggregate demand. The example here focuses on the aggregate supply channel. Expected inflation also matters for aggregate demand through its effects on real interest rates and, in turn, consumption and investment.

¹² The Livingston Survey of economists, another indicator compiled by the Federal Reserve Bank of Philadelphia, also showed a reduction in inflation expectations. As of December 1994, the survey reported expected CPI inflation over the next 12 months of 3.5 percent. As of December 1995, the survey reported expected inflation for the next 12 months of 2.9 percent.

¹³ Over much of 1995, expectations as measured by the Survey of Professional Forecasters and the Blue Chip consensus differed importantly from the University of Michigan's consumer survey in the forecast horizon. The professional surveys track forecasts for 1996, while the

Michigan survey tracks inflation expectations for 12 months into the future. Thus, early in 1995, the professional forecasts represented expectations for 1996 inflation, while the Michigan survey essentially represented expectations for 1995. By the end of 1995, the distinction was eliminated.

¹⁴ Inflation imposes a number of other costs on society (Fischer and Modigliani; Fischer). For example, inflation's interaction with the tax system can reduce after-tax returns on investment and thereby reduce investment and, in turn, GDP.

¹⁵ While most analysts agree the CPI overstates inflation, some experts on price measurement disagree (Triplett 1975, 1988). The potential biases in the CPI are surveyed in Advisory Commission to Study the Consumer Price Index; U.S. Congress; U.S. Department of Labor (1995); and Wynne and Sigalla (1993, 1994).

¹⁶ The Bureau of Labor Statistics (BLS) produces the CPI and PPI. The Bureau of Economic Analysis (BEA) produces the GDP price index. In computing the GDP price index, the BEA relies heavily on detailed price indexes used by the BLS in constructing the CPI and PPI, but the BEA does independently compute price indexes for certain goods and services.

¹⁷ The general quality bias encompasses a more specific problem, known as the *new goods bias*. The new goods bias stems from problems with pricing new goods, such as video cassette recorders, which have no well-defined antecedent and which have historically been introduced into the CPI well after they first were available to the typical consumer.

¹⁸ The sample rotation bias is an important part of a more general *functional form effect* problem, sometimes identified as the *elementary index* or *formula* bias. Essentially, the general problem lies in linking into the CPI prices for newly sampled items. An item may be newly sampled either because of sample rotation or because a replacement is needed for an item no longer available. Contrary to the assertion of some analysts, the CPI does not suffer the so-called *logarithms* problem: it is not the case that, if a price declines from 100 to 80 but then rises back to 100, the BLS would measure a positive average percent change in price.

¹⁹ However, the chain-weighted price index for GDP only captures substitution across fairly broad categories of goods and services. To the extent substitution occurs across very narrowly defined categories, such as from one brand of toothpaste to another, the index may still suffer some small bias.

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