

Has the Cost of Disinflation Declined?

By George A. Kahn and Stuart E. Weiner

With inflation showing few signs of ebbing after its sharp drop in the early 1980s, some policymakers are now calling for further disinflation. For example, a resolution before Congress (H.J. Res. 409) would direct the Federal Reserve to eliminate inflation in five years. Moreover, some Federal Open Market Committee members have argued that, with or without explicit legislation, merely capping inflation at its current rate is not enough and that the Federal Reserve needs to make further progress in eliminating inflation.

Calls for further disinflation have not generated unanimous support, however, because of disagreement over the relative costs and benefits of disinflation. A program of eliminating inflation would enhance the economy's long-run growth potential, but also likely cause unemployment to rise temporarily. While camps on both sides of the disinflation issue acknowledge dif-

ficulties in estimating the costs and benefits, proponents of further disinflation nevertheless believe the benefits exceed the costs. Opponents are not convinced.

Disinflation would clearly be more popular if it could be achieved with less cost. Whatever the benefits of disinflation, any reduction in its cost strengthens the case for further disinflation. Some proponents of further disinflation believe the sharp increase in unemployment accompanying the disinflation of the early 1980s might not accompany further disinflation today. Because of enhanced monetary policy credibility and increased wage and price flexibility, these proponents believe the Federal Reserve can lower inflation without imposing as large a cost as in the past.

This article examines evidence on the current cost of reducing inflation. The first section explains why past disinflations have been costly, showing how reductions in inflation have required substantial increases in unemployment. The second section finds little evidence that the relationship between inflation and unemployment has changed in recent years. The third section

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finds only limited evidence that monetary policy credibility and wage and price flexibility have increased in recent years. Thus, taken together, the available evidence provides little support for the view that the cost of disinflation is substantially lower today than in the past.

I. Disinflation in the Past

Inflation is indisputably costly. It discourages saving and investment by creating uncertainty about future prices. It forces businesses and individuals to spend time and money predicting future prices. And, through its interaction with the tax system, it can increase tax burdens by artificially raising incomes and profits. All of these factors cause the economy to operate less efficiently, hampering economic growth and ultimately reducing standards of living (Fischer 1984b).

But reducing inflation is also costly. History suggests that when an economy is operating at full employment, as it is today, the only way to reduce inflation is to temporarily generate slack in the economy. That is, growth of aggregate spending must be reduced so as to temporarily underutilize labor and capital resources. This underutilization of resources lowers output, lowers employment, and increases unemployment.

The historical record

The cost of disinflation has historically been quite high in the United States. One way of measuring the cost is to express it in terms of *point years of unemployment*, defined as the cumulative excess of the actual unemployment rate over the full-employment unemployment rate. For example, if the full-employment unemployment rate were 5½ percent, but the actual unemployment rate were 6½ percent one year and 6 percent the following year, then the number of point years of unemployment would be 1½—calculated as $(6\frac{1}{2} - 5\frac{1}{2}) + (6 - 5\frac{1}{2})$.

Estimates based on post-World War II data show that a permanent one-percentage-point reduction in inflation has required roughly two point years of unemployment. Thus, disinflation has come at a considerable cost.¹

While this estimate of a point-year ratio of 2 is a convenient rule of thumb, specific estimates vary depending on the particular inflation measure used and the underlying assumption about the value of the full-employment unemployment rate. Nevertheless, virtually all estimates show that disinflations have inevitably required substantial increases in unemployment. This has been true of both sharp disinflations over short time periods (cold turkey disinflations) and smooth disinflations over longer time periods (gradual disinflations).² The disinflations of the late 1950s and the early 1980s illustrate this point.

The disinflation of the late 1950s began from an inflation level that was already quite low by today's standards. In 1957, inflation, as measured by the consumer price index, was running at 3 percent. Reflecting a combination of more restrictive fiscal and monetary policies, as well as some weakening of private demand, growth of total spending started to slow (Chandler and Goldfeld 1977). As a result, slack developed in the economy and inflation began to fall as unemployment began to rise.

The adjustment process took several years. Inflation declined gradually, falling to 2 percent in 1958 and to an average of 1 percent in 1961 and 1962. Unemployment, meanwhile, rose from 4.3 percent in 1957 to 6.8 percent in 1958, and then slowly declined, not returning to its full-employment level until 1964. By the end of the process, inflation had been reduced two percentage points at a cost of 4.5 point years of unemployment, implying a point-year ratio of slightly over 2.³ Thus, the disinflation of the late 1950s—an example of a gradual disinflation—required a significant increase in unemployment.

The disinflation of the early 1980s occurred

in a much different environment. Inflation had escalated throughout the late 1970s until consumer price inflation had reached 12½ percent by 1979. The Federal Reserve responded in October 1979 by changing its operating procedure from interest rate targeting to reserve targeting and by adopting a restrictive disinflationary policy.

The restrictive policy had a strong impact. Within three years, inflation had fallen to 4½ percent, while unemployment had climbed from 5½ to 9¾ percent. In following years, inflation remained near 4½ percent, while unemployment only slowly returned to its full-employment level. Unlike the late 1950s disinflation, the early 1980s disinflation was administered cold turkey—growth of total spending was sharply curtailed, leading to sharp movements in inflation and unemployment. But the ultimate cost in terms of unemployment was similar. Inflation was reduced eight percentage points at a cost of 18 point years of unemployment, implying a point-year ratio, again, of slightly over 2.⁴

The disinflation process

Why is disinflation so costly? Why must so much slack be generated in the economy in order to achieve lower inflation?

In a perfectly flexible economy, an economy with perfect wage and price flexibility and complete monetary policy credibility, disinflation would be costless. The disinflation process would begin with monetary authorities announcing a disinflationary policy—that is, announcing their intention to lower inflation by tightening monetary policy. Workers and businesses would immediately and fully revise their expectations about the future course of monetary policy because announcements by the monetary authorities would be seen as fully credible. Workers and businesses would also know from experience that wage and price inflation, having no built-in inertia, would immediately moderate under such

circumstances. As a result, workers and businesses would immediately lower their inflation expectations.

Lower inflation expectations would in turn speed the adjustment of prices and wages. Given lower expectations of inflation, businesses would immediately reduce the rate of price increases on their products to stay competitive. Businesses could take such action because, not only would the prices on all their input materials be moderating, but their labor costs would be moderating as well. Labor costs would be moderating because workers would have lowered their wage demands in light of lower expected inflation. Workers would realize that in an environment of lower inflation, they could maintain their real wage growth with lower nominal wage growth. They would also realize that if they did not lower their wage demands, they would become more costly to employers in terms of product prices and thus face possible layoffs.

In the end, the disinflation would have been achieved costlessly. Inflation expectations would have adjusted immediately. Price and wage inflation would have adjusted immediately. The full impact of the tighter monetary policy would be felt in lower inflation, with no loss of output or employment.

The real world, unfortunately, does not operate this way. Disinflations are costly because the economy is characterized by rigidities in expectations, prices, and wages.

Expectations rigidities arise from two sources. First, monetary authorities may not have full credibility. Rational workers and businesses may suspect the authorities will not keep their promise of a disinflationary policy. In particular, workers and businesses may be suspicious because they realize the monetary authority may have an incentive to renege on its disinflationary promise in order to temporarily generate higher output and employment.⁵ A second reason expectations are rigid is workers and businesses have come to believe wages and prices adjust slowly.

Based on their knowledge of how the economy has functioned in the past, workers and businesses rationally expect inflation not to decline rapidly.⁶

Price rigidities arise because many businesses have an incentive to resist rapid adjustment of their prices when aggregate spending declines. One reason businesses may be slow in restraining their prices is the process of changing prices can be costly. Revising price lists and catalogs, for example, is an expense that businesses would prefer to incur only infrequently.⁷ A second reason businesses may be slow in restraining their prices is the cost of their inputs—materials and labor—may remain high, partly because of long-term contracts. Businesses often enter into price agreements with materials suppliers far in advance of the time of delivery, imparting inertia to materials prices. Likewise, labor agreements between businesses and unions usually extend for several years, imparting inertia to wages. This inertia in the cost of inputs generates inertia in prices.

Wage rigidities arise because of long-term union contracts, incomplete inflation indexation, and productivity concerns. Union contracts in the United States typically last three years, implying that the wage structure for a particular year was largely negotiated in previous years. In theory, such multiyear contracts need not limit wage flexibility, because if wages were indexed to inflation, reductions in aggregate spending and inflation would automatically restrain wages. In practice, however, cost-of-living-adjustment clauses (COLAs) appear in less than half of union contracts, and where COLAs do appear, indexation is usually only partial (Weiner 1986b). Thus, long-term labor contracts, in conjunction with incomplete indexation, introduce rigidities into union wages. Moreover, because union wages sometimes set the pattern for nonunion wages, rigidities in the union sector indirectly introduce rigidities in the nonunion sector as well. Reinforcing rigidities in nonunion wages

are fears that restraining wages will hurt worker productivity and fuel worker discontent. Therefore, businesses may be reluctant to lower wages for fear worker productivity will decline or their best workers will quit.⁸ Consequently, wages are slow to adjust throughout the economy. As with prices, a good deal of wage inertia exists. Thus, in contrast to the perfectly flexible scenario described earlier, the U.S. economy operates in the presence of numerous rigidities, which make the disinflation process lengthy and costly.

A more accurate description of the disinflation process would go as follows. The monetary authority announces a disinflationary policy. Because workers and businesses question the authorities' commitment to the policy, they initially leave their expectations of inflation unchanged. As the monetary authority begins to act on its policy, aggregate spending in the economy starts to decline. With the decline in aggregate spending, production begins to outstrip demand, and inventories begin to rise. To help move these excess inventories, businesses are forced to reduce the rate at which they increase prices. However, workers' wage increases remain unchanged because the inflation expectations on which those wages were based—expectations that have been incorporated in current wage contracts—have not yet changed. So, not only does demand decline and inventories rise, but workers are now more costly relative to the prices businesses can get for their products. As a result, businesses begin to reduce their demand for labor, causing a decrease in employment and an increase in unemployment. Thus, the initial effects of the disinflation are a rise in unemployment and a decline in inflation.

The process is not over, however, because inflation expectations of workers and businesses begin to fall. The actual inflation rate is now somewhat lower than it had been initially. As a result, workers lower their inflation expectations and agree to lower their wage increases as labor contracts expire and new ones are negoti-

ated. After all, with inflation now lower, workers no longer require as large a wage increase to maintain their purchasing power. In turn, as wage increases moderate, businesses are able to further restrain their price increases and, assuming no further declines in aggregate spending, businesses begin to rehire workers. Consequently, the unemployment rate starts to decline. Eventually, the economy returns to its full employment level, with the inflation rate equal to what workers and businesses are expecting. There is no pressure for change. Thus, disinflation has been achieved, albeit at the cost of a temporary increase in unemployment.

Prospects

The disinflation process described above is highly simplified. Nevertheless, it accords well with actual disinflations to date. Are the prospects for future disinflations any different? Specifically, is there reason to believe the cost of disinflation would be lower than the rule-of-thumb estimate suggests?

The rule-of-thumb estimate indicates that eliminating inflation from its current $4\frac{1}{2}$ percent level would require about nine point years of unemployment. For example, assuming a full-employment unemployment rate of $5\frac{1}{2}$ percent, a cold turkey disinflation would require three years of $8\frac{1}{2}$ percent unemployment (9 point years equals 3 years times $(8\frac{1}{2} - 5\frac{1}{2})$ percentage points of unemployment). Alternatively, a gradual disinflation would require six years of 7 percent unemployment (9 point years equals 6 years times $(7 - 5\frac{1}{2})$ percentage points of unemployment).

Proponents of further disinflation correctly point out that estimates such as these are based on past experience and, as such, might not have any relevance for the future. Fundamental relationships in the economy could have changed so that disinflation in the future could be attained at a much lower cost than in the past. In partic-

ular, some or all of the rigidities discussed in the previous subsection could have lessened, moving the economy toward the perfectly flexible economy.

It might be argued, for example, that Federal Reserve credibility has increased in recent years, allowing workers' and businesses' inflation expectations to adjust rapidly to an announced disinflationary policy. Alternatively, it might be argued that wages and prices have become more flexible, so that for a given level of inflation expectations, businesses would now more rapidly restrain their price increases and workers would more rapidly restrain their wage increases in the face of reductions in aggregate spending. Such arguments appear reasonable. The Federal Reserve showed considerable resolve in reducing inflation in the early 1980s, a resolve that might have enhanced its credibility. Similarly, in the face of intense foreign competition and a decline in union power, businesses and workers now appear to have more incentive to rapidly adjust prices and wages.

Two types of evidence can help determine whether the cost of disinflation has declined. One type of evidence comes from empirical studies estimating the relationship between inflation and unemployment. Evidence that the relationship has recently changed could indicate a change in the cost of disinflation. However, the reliance of this evidence on historical relationships, and its inability to separate credibility changes from wage and price flexibility changes, tempers its conclusiveness. The other type of evidence comes from examining the factors affecting credibility and wage and price flexibility. But credibility and wage and price flexibility cannot be observed directly, so this evidence must also be carefully interpreted. Examining both types of evidence together provides a more accurate assessment of any potential changes in the cost of disinflation than examining either type of evidence alone. The next two sections take up this task.

II. Inflation-Unemployment Evidence

The historical relationship between inflation and unemployment can help determine whether the cost of disinflation has declined. While looking at this relationship over the entire post-World War II period gives a useful picture of the past cost of disinflation, determining whether this relationship has recently changed sheds light on whether the cost of disinflation today might be lower. This section looks for evidence of instability in estimated relationships between inflation and unemployment. Many studies have found these relationships to have remained unchanged through the early 1980s disinflation. Yet few studies have examined the more recent experience.⁹ The relationships estimated in this section confirm earlier findings of stability, suggesting little evidence of a decline in the cost of disinflation.

The relationship between inflation and unemployment

For years, economists have explained the behavior of inflation by exploiting the empirical relationship between inflation and unemployment. This relationship, called the Phillips curve, associates falling inflation with temporary increases in unemployment above the full-employment unemployment rate. The Phillips-curve approach is consistent with the simplified characterization of disinflation described earlier, in which unemployment rises as monetary policy turns disinflationary. The increase in unemployment eventually puts downward pressure on inflation.

Falling inflation, in turn, causes inflation expectations to adjust downward. As pointed out in the last section, inflation expectations must fall during a disinflation to ensure that the economy eventually returns to full employment. This fall in inflation expectations reinforces the

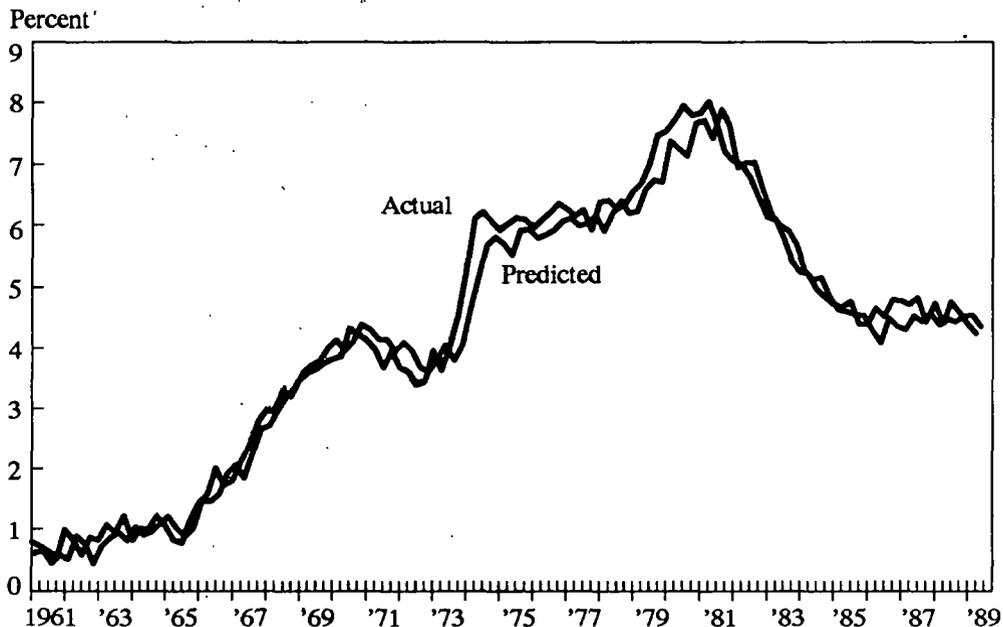
downward pressure on inflation coming from higher unemployment. Because inflation expectations cannot be directly observed, however, they are usually determined indirectly in the Phillips-curve approach. Typically, any variable thought to be used by individuals and businesses in forming their expectation of inflation is included as an additional variable explaining inflation. The most common of these variables is past inflation, but other variables such as past unemployment might also be required.¹⁰ Along with current unemployment, these variables help explain inflation in the Phillips-curve approach.¹¹

Phillips-curve evidence

The Phillips-curve estimation reported here provides little evidence that the cost of disinflation has declined. If the cost of disinflation were now lower because of such structural changes as enhanced monetary policy credibility or increased wage and price flexibility, the performance of estimated Phillips-curve relationships would deteriorate. Estimated Phillips curves do not incorporate credibility as an explanatory variable and assume constant wage and price flexibility over time. Thus, if credibility or wage and price flexibility had increased, estimated Phillips curves would overpredict inflation. Such an overprediction of inflation did not systematically occur during the early 1980s disinflation and has not systematically occurred since then. In fact, estimated Phillips curves remained quite stable throughout the decade. Thus, Phillips-curve evidence points to no significant change in the relationship of inflation to unemployment and hence gives little indication of a change in the cost of disinflation.

To illustrate the stability of the relationship between unemployment and inflation, a simple Phillips-curve equation—fully described in the appendix—was estimated through 1979 and forecast over the 1980s. Following the approach of Blanchard (1984), the equation was then sub-

Chart 1
Actual and Predicted Inflation



Notes: Actual inflation is measured by the fixed-weight deflator for personal consumption expenditures net of food and energy. Predicted inflation is based on the model described in the text. Actual and predicted inflation are smoothed by taking a four-quarter moving average of quarterly rates of change.

Source: Department of Commerce and authors' estimates based on the model described in the text.

jected to a number of tests for stability. The purpose of estimating a highly simplified Phillips curve was not to explain every wiggle in the data on inflation, but rather to test the stability of the inflation-unemployment relationship both over long periods of time as well as in recent years. Clearly, a more complicated specification of the Phillips curve could explain much more of the variation in inflation over time. What is important for the purpose of this article, however, is to examine whether the broad historical relationship that held in the past continues to hold today.

Although the estimated Phillips curve is highly simplified, it predicts both the disinflation of 1980 to 1986 and the stabilization of inflation after 1986. This performance is shown in Chart 1, which plots actual inflation against

the inflation rate predicted by the Phillips-curve equation, estimated from 1961:Q2 to 1979:Q3.¹² While from 1980 to 1985 the equation slightly overpredicts inflation, the equation slightly underpredicts inflation from 1986 to 1988. These prediction errors, however, are too small to attribute to structural changes that would significantly reduce the cost of disinflation.¹³

Parameter estimates of the Phillips-curve equation confirm the impression of stability implied by the equation's forecasting ability. Table 1 reports parameter estimates from the Phillips-curve model that generated the predictions in the chart. The table shows how inflation has been related to unemployment and past inflation during various periods in the recent past. The table shows that, as years are added to a sample beginning in the second quarter of 1961

Table 1
Phillips-Curve Estimates

<u>Period ending¹</u>	<u>Constant</u>	<u>Sum of coefficients on unemployment</u>	<u>Mean lag on inflation</u>	<u>S.E.²</u>	<u>F³</u>
1979:Q3	-2.39 (1.55)	-.70 (1.64)	2.08	1.04	—
1980:Q3	-2.03 (1.34)	-.61 (1.45)	2.05	1.05	1.20
1981:Q3	-1.89 (1.30)	-.59 (1.47)	2.07	1.05	.94
1982:Q3	-2.67 (1.88)	-.79 (1.97)	1.88	1.07	1.64
1983:Q3	-2.63 (1.99)	-.77 (2.06)	1.86	1.04	.16
1984:Q3	-2.80 (2.35)	-.82 (2.41)	1.91	1.02	.28
1985:Q3	-2.79 (2.46)	-.81 (2.49)	1.90	1.00	.09
1986:Q3	-2.63 (2.38)	-.77 (2.44)	1.90	1.00	.95
1987:Q3	-2.53 (2.38)	-.74 (2.42)	1.87	.99	.41
1988:Q3	-2.63 (2.50)	-.77 (2.54)	1.91	.99	1.15
1989:Q3	-2.56 (2.45)	-.77 (2.53)	1.91	.99	.87

Note: Dependent variable is the annualized change in the log of the fixed-weight personal consumption expenditure deflator, net of food and energy. Absolute values of t-statistics are in parentheses. Further details of the model are provided in the appendix.

¹ All periods begin in 1961:2.

² Standard error of the regression.

³ Test statistic for the hypothesis of no change in the last year of the sample. Distributed F(4,x), x = 58, 62, . . . , 94. None of the statistics is significant at the 0.10 level.

and ending initially in the third quarter of 1979, the estimated response of inflation to increases in unemployment does not change much.¹⁴ In particular, reported sums of coefficients on current and past unemployment, which measure the sensitivity of inflation to unemployment over several quarters, change little through 1989 as years are added to the sample. The coefficients range roughly from -0.6 to -0.8 , with most of the variation occurring in the early 1980s and with the coefficients in the last half of the 1980s slightly higher in absolute value than in the first half.

While the coefficients on unemployment have risen slightly in absolute value, the mean lag on inflation has fallen slightly, from 2.1 in 1979 to 1.9 in 1989.¹⁵ The fall in the mean lag on inflation implies that inflation now adjusts slightly faster to changes in unemployment than it did earlier in the decade. Together with the slight increase in inflation's responsiveness to unemployment (and a decline in the size of the constant term), the decline in inflation's mean lag suggests the possibility of a slight decline in the cost of disinflation. However, given the small magnitude of changes in the parameters over time, any overall change in the cost of disinflation would likely be very small and probably insignificant.

Moreover, despite slight variation in parameter estimates, the overall Phillips-curve relationship has remained extremely stable. The statistics reported in the last column of Table 1 test the hypothesis that the overall relationship changed when each extra year of data was added to the sample.¹⁶ In no case was the test statistic significant, indicating that no statistically significant change occurred in the overall relationship in any year since 1979.¹⁷ As a result, the estimated Phillips curves provide little evidence of a change in the cost of disinflation.

Limitations

At least two potential shortcomings in the Phillips-curve approach limit the reliability of the results. First, the approach is based on historical relationships. Consequently, the approach may not reliably predict future behavior under certain circumstances, mainly those outside the realm of historical experience. No matter how well Phillips curves predict past inflation, a major change in the conduct of monetary policy could still lead individuals and businesses to change fundamentally the way they form expectations about price and wage inflation. Even though the 1979 change in monetary policy did not apparently have this effect, future changes in the conduct of monetary policy could nevertheless make historical relationships obsolete.

Second, the Phillips-curve approach cannot identify sources of change in the cost of disinflation. It can only reveal whether a change has occurred. In the Phillips-curve approach, the estimated sensitivity of inflation to unemployment and other variables is a combination of expectations effects and wage and price flexibility effects. If, for example, information about unemployment helps people predict inflation, the coefficient on unemployment in estimated Phillips curves will represent a combination of at least two different effects—the effect of unemployment on expected inflation and the effect of unemployment on price and wage adjustment. The Phillips-curve approach provides no way to disentangle these two effects. Any change in the cost of disinflation must be attributed to an unknown combination of credibility effects and wage and price flexibility effects.¹⁸

III. Credibility-Flexibility Evidence

The evidence presented in the preceding section suggests the inflation-unemployment relationship has remained stable, implying the cost of disinflation has not declined. Indirectly, then,

this evidence suggests monetary policy credibility and wage and price flexibility have not increased. However, if credibility or flexibility had only recently increased, an estimated Phillips curve like that used in the preceding section might not be able to detect the change. Thus, it is imperative to look as well for direct evidence of changes in credibility or wage and price flexibility.

Credibility

Credibility is a nebulous concept. It cannot be observed and thus cannot be measured directly. Even if it could be measured directly, there is no guarantee its value today would be relevant tomorrow. But because credibility is so central to determining the cost of disinflation, one must attempt to infer what one can about it. A starting point is to be precise in defining credibility. For the purposes of this article, credibility means the public believes the Federal Reserve will follow through on its disinflation policy announcements and, as a result, the public is willing to lower its inflation expectations before it actually observes inflation declining. Credibility is said to have "increased" to the extent that the public is now more likely to believe the Fed's policy announcements than it was prior to the early 1980s disinflation. Both theoretical and empirical evidence can be brought to bear on the current state of Federal Reserve credibility.

On theoretical grounds, one may initially be inclined to believe that Federal Reserve credibility has increased substantially in recent years. The Federal Reserve showed considerable resolve in reducing inflation in the early 1980s, tolerating almost 10 percent unemployment in order to drive inflation down from its double-digit levels. Having demonstrated that resolve, the Fed presumably enhanced its reputation as an inflation fighter. And such a reputation is crucial. In the absence of formal rules that pre-commit a central bank to specific actions,

establishing a reputation is paramount if a central bank is to have credibility in its policy announcements.¹⁹

But reputation—and, hence, credibility—does not automatically pass from one central bank regime to another. When a new group of individuals assumes leadership at a central bank, workers and businesses will be uncertain of their policy preferences. As a result, workers and businesses, acting rationally, will want to observe policymakers' actual performance for a while before they are willing to believe the central bank is truly committed to fighting inflation (Backus and Driffill 1985, and Barro 1986). Such a situation appears applicable today. Since the early 1980s disinflation, a completely new group of individuals has been appointed to the Federal Reserve Board, forming a majority on the Federal Open Market Committee. Under this new regime, there has been no further disinflation. The new regime has not yet established a track record in reducing inflation. As a result, workers and businesses may remain skeptical of the new regime's commitment to disinflation until some actual disinflation is observed.

Theoretical considerations, therefore, cast some doubt on the view that Federal Reserve credibility has significantly increased. What about empirical evidence? Are there any direct signs that Federal Reserve credibility has substantially risen? The answer here also appears to be no.

Studies of financial markets during the early 1980s disinflation suggest the Fed's reputation as an inflation fighter grew as the 1980s disinflation unfolded.²⁰ Interest rates, foreign exchange rates, and commodity prices all tended to move in a way consistent with a growing conviction that the Fed was serious about fighting inflation. However, part of these movements were reactions to declines in actual inflation, and such "learning" does not constitute credibility. Moreover, as just argued, this evidence is probably irrelevant anyway. It applies to the 1980s regime,

not the 1990s regime.

Evidence that does apply today is not encouraging. Federal Reserve officials in recent years have often claimed that achieving price stability is their long-run goal. Yet, market surveys show inflation expectations for the next five to ten years remain in the 4 to 5 percent range, and long-term interest rates remain at levels consistent with such expectations (Hoey 1990). Moreover, numerous economic forecasts in both the private and public sectors continue to project inflation of 4 to 5 percent over the next five years.²¹ Market participants may question the Fed's ability to adhere to its commitment to price stability.

Some proponents of further disinflation believe Federal Reserve credibility would be greatly enhanced by passage of H.J. Resolution 409. This resolution, introduced in September 1989 and presently in committee, would direct the Federal Reserve to eliminate inflation in five years. Inflation would be deemed eliminated when "the expected rate of change of the general level of prices ceases to be a factor in individual and business decisionmaking."²² Many of the resolution's supporters believe the resolution would give the Fed a mandate to pursue price stability, thereby enhancing the Fed's credibility. But there are reasons to be skeptical. For one thing, the resolution would not be enforceable. For another, several additional policy goals, including full employment, would remain in force under the Humphrey-Hawkins Act and the Federal Reserve Act. Thus, it is not clear that the resolution would provide a mandate for price stability and, as a result, it is not clear that workers and businesses would be any more inclined to believe the Fed was serious about reducing inflation. As in past disinflations, workers and businesses would likely take a wait-and-see attitude.

Wage and price flexibility

While there is little evidence of an increase in Federal Reserve credibility, there may be some evidence of a small increase in wage and price flexibility. Sources of increased flexibility include the greater influence of foreign trade on the U.S. economy, the decline of union power, and the rise of new forms of labor compensation that tie labor costs more closely to economic performance.

Because foreign trade is growing relative to GNP, more domestic businesses now compete directly with foreign businesses for customers. When the foreign exchange value of the dollar increases because of disinflationary monetary policy, inflation of prices for imported goods declines. As a result, domestic industries producing goods that compete with imports may become more cost conscious and more willing to lower profit margins to maintain market share. As more and more foreign goods and services enter the U.S. market, prices may respond more quickly to market signals. And with foreign goods possibly being produced by cheaper foreign labor, U.S. workers may accept greater downward wage flexibility, realizing that they now compete with foreigners for jobs.

What is the evidence that greater international trade has increased wage and price flexibility? Both macro and microeconomic studies find evidence of an increased influence of international trade on prices and wages in the early 1980s but typically do not examine more recent changes in the influence of international trade. Macroeconomic studies have shown, for example, that import prices help explain the early 1980s disinflation. Specifically, one recent study found that while the increasing importance of international trade accounts for less than one-fifth of the slowdown of wage growth in the private nonfarm economy, it accounts for as much as 35 percent of the wage growth slowdown in the manufacturing sector during the 1980s.²³

Such studies, however, say little about recent changes in the cost of disinflation because they do not attempt to uncover structural changes in the late 1980s.

Microeconomic studies of the labor market also support the view that, in the early 1980s at least, growth of international trade had a small effect on wage flexibility. For example, in a study of collective bargaining settlements from 1959 to 1984, Vroman and Vroman (1989) estimate identical models of wage behavior for industries with an average import share above 8 percent and for industries with an average import share below 8 percent. They find that for both types of industries, import competition exerts some downward pressure on wages. Furthermore, the effect is more pronounced in industries with greater import competition. But despite this measured effect of import competition on wages, the authors find that other factors are much more important in explaining the deceleration of wages in the early 1980s. These factors include declining inflation expectations and high unemployment among prime-age men.

Another factor potentially increasing wage flexibility is the decline of union power.²⁴ Union employment has declined both as a share of total employment and as a share of employment in traditional union strongholds. Between the early 1970s and 1987, the share of union employment in full-time, nonexecutive, nonprofessional jobs in many traditionally highly unionized industries fell from 47 to 31 percent. Moreover, strikes have become much less frequent today than in the past—almost one-tenth fewer in 1988 than on average in the 1960s. And recent strikes have been unusually long, in part because employers have resisted wage demands and often hired replacement workers as permanent employees.²⁵

These union-sector developments could lead to increased wage flexibility as wages in the union sector fall closer to competitive levels. In the current economic environment, union power will likely continue to moderate. As a result, the

wage gap between the union and nonunion sectors should fall slowly. But this decline in the union wage premium is unlikely to be large enough to make union wages significantly more responsive to market forces. For this reason, developments in the union sector are unlikely to reduce significantly the cost of disinflation in the 1990s (Wachter and Carter 1989).

A final factor affecting price and wage flexibility is the advent of new forms of labor compensation potentially tied to economic performance. Two types of nonwage compensation have grown in popularity in the 1980s—lump-sum payments and bonus plans. Lump-sum payments exchange base wage increases in union wage settlements for one-time or annual payments to workers that are not directly related to worker or firm performance. Lump-sum payments potentially increase wage flexibility because they are not built into base wages and are therefore more easily denied in adverse economic circumstances. Bonus plans, such as employee stock option plans and profit sharing, differ from lump-sum payments in that they are explicitly tied to firm performance. As a result, they make labor compensation respond automatically to changes in economic circumstances (Bell 1989).

Lump-sum payments and profit sharing plans have become increasingly popular. These innovations were virtually unknown as recently as 1975. By 1987, however, almost 63 percent of all workers negotiating contracts received lump-sum payments, while over 30 percent of workers received some form of profit sharing (Bell 1989, pp. 50-51). Because of their greater popularity, lump-sum payments potentially influence wage behavior more than profit sharing does. But studies at the firm level provide only limited evidence that lump-sum payments increase wage flexibility (Bell and Neumark 1989). Nevertheless, if lump-sum payments become even more pervasive and if firms and workers allow lump sums to be paid or not paid

on the basis of economic circumstances, labor compensations could become more flexible, reducing the unemployment cost of disinflation.

IV. Conclusions

Few would deny that reducing inflation from current levels would bring benefits to the U.S. economy. By permitting the economy to operate more efficiently, lower inflation would enhance economic growth and ultimately raise standards of living. Thus, few would deny that further disinflation warrants serious consideration.

In the past, however, disinflation has been costly, requiring large, albeit temporary, increases in unemployment. Is there reason to believe the costs would be less severe today?

Many proponents of further disinflation believe the answer is yes. They point to enhanced Federal Reserve credibility and increased wage and price flexibility as potential factors lowering the cost of disinflation.

This article has examined evidence on the current cost of reducing inflation. The article concludes that available evidence provides little support for the view that the cost of disinflation has substantially declined. To be sure, predicting the cost of future disinflation is inherently problematic because fundamental changes in people's behavior could make the next disinflation different. Nevertheless, in considering further disinflation, policymakers should recognize that the cost of disinflation has probably not declined substantially.

Appendix

The Phillips-Curve Equation

This appendix describes the Phillips-curve equation used in the text to predict inflation and identify periods of instability. After providing technical details of the approach, the appendix shows that the implied cost of disinflation in the estimated model is similar to the costs cited in the first section of the text.

The Phillips-curve model consisted of a single equation explaining inflation, estimated by ordinary least squares. Inflation was measured by growth in the fixed-weight personal consumption expenditure (PCE) deflator net of food and energy. The personal consumption expenditure deflator was chosen rather than the more familiar consumer price index (CPI) because of measurement errors in the CPI,

which tended to exaggerate inflation, especially from 1978 to 1981.²⁶ The fixed-weight PCE deflator net of food and energy price inflation which, over the short run, is little influenced by slack in the economy. Explanatory variables included a constant term, three quarterly dummy variables, eight lagged values of inflation, and current and four lagged values of (the log of) the married male unemployment rate. Unemployment of married men was used as the measure of labor market slack because it is less sensitive than total unemployment to demographic factors that have tended to change the natural rate of unemployment.

Formally, the Phillips-curve equation that

was estimated is:

$$P_t = a_0 + \sum_{i=1}^3 a_i QTR_i + \sum_{i=1}^8 b_i P_{t-i} + \sum_{i=0}^4 c_i U_{t-i} + e_t$$

where P_t represents inflation, the QTR_i terms represent quarterly dummy variables, U_t represents unemployment, e_t represents a zero mean, finite variance error term, and the a_i , b_i , and c_i terms represent parameters to be estimated.

Data were quarterly, beginning in 1961:Q2 and ending at various dates from 1979:Q3 to 1989:Q3. As suggested by the natural rate theory of inflation, which argues there is no long-run inflation-unemployment tradeoff, the sum of lagged coefficients on inflation was calculated and found to be insignificantly different from one in all sample periods. The sum of these coefficients ranged from 0.97 to 0.999, for samples ending in 1979:Q3 and every subsequent year until 1989:Q3. Because the data did not reject the restriction that the sum of coefficients was one, the restriction was imposed in all regressions.

For the base period from 1961:Q2 to 1979:Q3, estimated residuals were examined for serial correlation. The hypothesis of serial correlation of order 1, 2, 4, 8, 10, and 12 was rejected by a Lagrange multiplier test at standard confidence levels. Also, residuals from both the base period and the 1979:Q4 to 1989:Q3 forecast period were compared with residuals from a naive model that forecast no change in inflation each period. The estimated Phillips-curve equation performed only slightly better than the naive model in the base period and slightly worse than the naive model in the

forecast period. However, in forecasting several steps ahead, the estimated equation clearly outperformed the naive model. This longer term forecasting ability is more important for studying disinflation, which occurs over many quarters, than the ability to forecast high-frequency movements in inflation.

One potentially important omitted variable is import prices. Although the use of the PCE deflator less food and energy was designed to avoid considering supply shocks, it did not eliminate the influence of import prices and the foreign exchange value of the dollar on domestic inflation. When four lagged values of the difference between growth in nonpetroleum import prices and growth in the PCE deflator are added to the right-hand side of the inflation equation, in-sample performance improves, but out-of-sample forecasts deteriorate.

In the equation including import prices estimated from 1961:Q2 to 1979:Q3, the sum of coefficients on relative import price inflation was statistically significant. However, this sum declined over time as years of data were added, one at a time, to the sample. Furthermore, including relative import price inflation caused the constant term to rise in absolute value and the sum of coefficients on unemployment to fall in absolute value as years were added. Despite these movements in coefficients, the hypothesis of no structural change as years were added to the sample could not be rejected except, at the 0.10 significance level, in the sample ending in 1986:Q3. This suggests a possible structural shift in the data after 1985 that might invalidate tests of stability as years of data are added to the sample ending in 1986:Q3.

Although including relative import prices improved in-sample performance, out-of-sample forecasts from 1979:Q4 to 1989:Q3

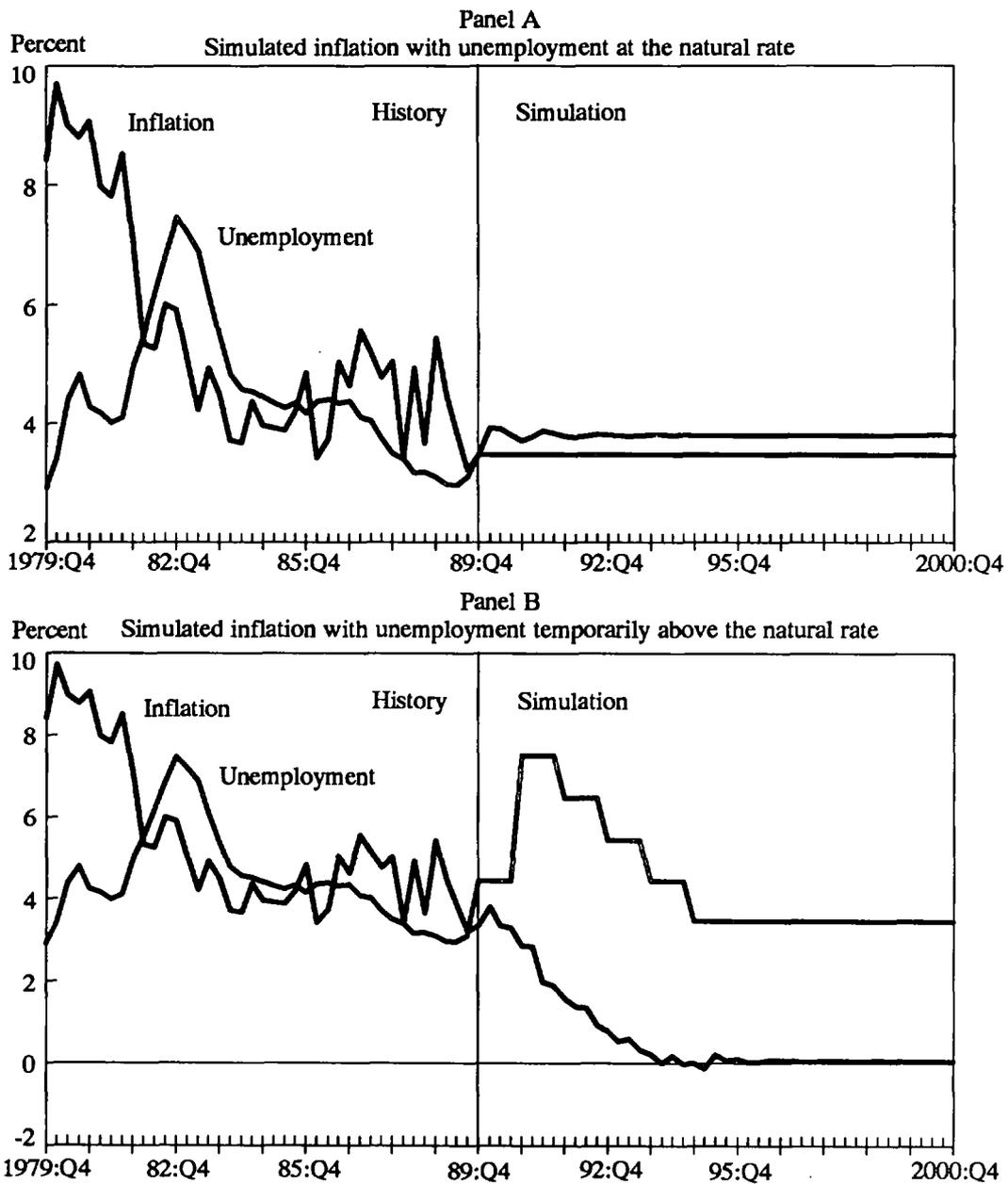
deteriorated. In particular, inflation was consistently underpredicted from 1983 to 1986. This underprediction would imply, if anything, an increase in the cost of disinflation, not a decrease. More likely, however, the underprediction, along with steady changes in the size of coefficients as years of data were added to the sample, indicates instability in the relationship of relative import price inflation to overall inflation. Because of these problems, relative import prices were left out of the analysis in the text.

In generating the forecasts shown in Chart 1, the model without import prices was estimated through 1979:Q3 and forecast out-of-sample from 1979:Q4 to 1989:Q3. The forecasts were static in the sense that actual values of the right-hand-side variables were used in generating predicted inflation. Static forecasts were presented to avoid confusing accumulated past errors with current errors. However, a dynamic simulation of the inflation equation was well able to predict the disinflation of the early 1980s and the subsequent stabilization of inflation. Thus, in both dynamic and static forecasts, the results indicated no systematic tendency to overpredict inflation and therefore gave no sign of a decline in the cost of disinflation.

The implied cost of disinflation in the model is broadly consistent with the cost implied in other Phillips-curve-type models. Chart A-1 shows some of the properties of the model estimated over the entire sample period from 1961:Q2 to 1989:Q3. In particular, Panel A shows a simulation of the model based on a return of the unemployment rate in 1989:Q4 to its natural rate. The model estimates the natural unemployment rate for married men to be 3.5 percent, which is slightly higher than the average unemployment rate for married men from 1961 to 1989. The simulation shows inflation eventually stabilizing at a rate close to its 1989:Q3 rate of just under 4 percent.

Panel B, in contrast, shows the effect of a disinflationary policy that pushes married male unemployment quickly up to 7.5 percent, then allows it to fall gradually back down to the natural rate. The experiment assumes heroically that monetary policy has direct short-run control over unemployment and, therefore, that unemployment is an exogenous variable. The effect of the disinflationary policy is the virtual elimination of inflation by 1993. The cost of this disinflation is 11 point years of unemployment. With inflation falling by roughly four percentage points, the point-year ratio is slightly below three.

**Chart A-1
Simulated Inflation**



Note: Unemployment is the rate for married men. Inflation is measured by the fixed-weight deflator for personal consumption expenditures net of food and energy.

Source: Department of Commerce and authors' estimates based on the model described in the text.

Endnotes

¹ The full-employment unemployment rate used in the point-year approach actually refers to the "natural rate of unemployment;" for discussion, see Weiner 1986a. For further discussion of the point-year approach to measuring the cost of disinflation, see Blinder 1987, Friedman 1988, Congressional Budget Office 1989, and Okun 1978.

² For a theoretical explanation of why the cost of disinflation may be independent of the time horizon, see Dornbusch and Fischer 1987, pp. 528-29. Gordon (1989, pp. 266-68) presents empirical simulations supporting this view. Alternative projections by Data Resources, Inc. (Brinner and Probyn 1989, Wyss and Aguais 1989) also support this view.

³ More precisely, the point-year ratio equals 2.3. The full-employment unemployment rate estimates underlying this calculation are taken from Gordon 1989, pp. A2. Inflation, measured by the consumer price index, is calculated December over December.

⁴ More precisely, the point-year ratio equals 2.2. The full-employment unemployment rate underlying this calculation is assumed to be 5.5 percent; inflation, measured by the consumer price index, is calculated December over December. Using a full-employment unemployment rate estimate of 6.0 percent lowers the ratio to 1.7. Using an alternative inflation measure, the fixed-weight GNP deflator (fourth quarter to fourth quarter)—a measure less distorted by the early 1980s dollar appreciation—raises the ratio to 3.0.

⁵ The monetary authorities' temptation to inflate stems from the "time-inconsistency problem." For discussion, see Sibert and Weiner 1988.

⁶ Note it is in their interest to take account of these rigidities. For example, if a business were to naively assume perfect wage and price flexibility in the economy and, acting on that assumption, cut its prices, it would eventually be forced out of business as materials prices and labor costs did not fall accordingly.

Wage and price rigidities, and resulting expectations of those rigidities, are a particularly onerous source of costly disinflation. Fischer (1984a) presents simulations of a hypothetical economy showing that even with full monetary policy credibility, the cost of disinflation would be reduced by only half in the presence of wage and price rigidities.

⁷ These costs are often referred to as "menu costs." For a full discussion of menu costs and other sources of price and wage rigidities, see Gordon 1989, pp. 212-42.

⁸ This source of wage rigidities is formally developed in "wage efficiency" models. See Gordon 1989, pp. 229-31.

⁹ Examples of studies finding stability in the inflation-unemployment relationship through the early 1980s are Blanchard 1984; Englander and Los 1983a, 1983b; and Gordon 1985. A recent study implying stability in the behavior of inflation through 1987 is Gordon 1988.

¹⁰ The approach is consistent with rational expectations if agents base their inflation expectations on all available information and have full knowledge of the economy and if the Phillips curve accurately captures aggregate supply behavior in the economy.

¹¹ In addition to inflation expectations, supply shocks also affect inflation. Supply shocks can cause inflation to fluctuate even when inflation expectations and monetary policy are unchanged. For example, if import prices fall relative to the overall price level, firms will enjoy lower costs for imported inputs and may, as a result, lower prices. Such a beneficial supply shock could reinforce a disinflationary monetary policy by putting added downward pressure on inflation. Besides relative import prices, other supply variables that are sometimes included in the Phillips-curve approach are food and energy prices and the exchange rate. See Kahn 1984 for a more detailed discussion of aggregate supply.

¹² The starting date for the estimation was determined by data availability and the lag structure of the estimated equation. The ending date was designed to coincide with the Federal Reserve's switch to new operating procedures and a disinflationary monetary policy. Thus, data from the early 1980s disinflation are excluded from the estimation period.

¹³ Moreover, despite frequent statements by Federal Reserve officials that further progress against inflation continues to be an important goal of monetary policy and anecdotal evidence of increased wage and price flexibility, predicted and actual inflation stopped falling in the post-1986 period. If credibility or wage and price flexibility had increased, these statements would have reduced expected inflation below what it otherwise would have been. As a result, inflation would have fallen more than otherwise. Yet a Phillips curve equation, estimated without benefit of data after 1980, closely predicts the recent behavior of inflation. Whatever information was contained in the policy statements apparently was not translated into a reduction in inflation expectations and a lowering of inflation. If it had been, the Phillips curve would have overpredicted inflation after 1986. This overprediction would have resulted because the equation would have been estimated without post-1979 data and, therefore, without taking into account post-1986 policy statements and the possibility of a post-1979 increase in wage and price flexibility.

14 Blanchard (1984) used the same approach to examine the stability of a Phillips-type wage equation. In particular, Blanchard estimated a wage-inflation equation based on the DRI model as specified in 1978—an equation that is similar to the price equation used in this article and described in the appendix. Although Blanchard found signs of instability in the third quarter of 1982, he attributed them to unusually high unemployment rather than credibility effects stemming from the 1979 shift to a disinflationary monetary policy. Blanchard's results showed an increase in the constant term and an increase (in the absolute value) of the coefficient on unemployment. Moreover, Blanchard found evidence of a decrease in the mean lag of price inflation in the wage equation. His overall results, however, imply "no evidence of a major shift in the Phillips curve" (p. 213). Thus, they are consistent with those presented in Table 1.

15 As indicated in the appendix, the sums of coefficients of lagged inflation were constrained to equal one. As a result, the mean lag of inflation is presented instead of coefficient estimates.

16 This is the same test used by Blanchard (1984). Results obtained are similar to Blanchard's.

17 Other stability tests were also conducted. Specifically, when years are added two at a time to a sample that begins in 1961:Q2 and ends initially in 1979:Q3 (that is, 1961:Q2-1979:Q3 vs. 1961:Q2-1981:Q3, 1961:Q2-1981:Q3 vs. 1961:Q2-1983:Q3, and so forth), no sign of instability is detected. Similarly, when years are added cumulatively to the same initial sample (that is, 1961:Q2-1979:Q3 vs. 1961:Q2-1980:Q3, 1961:Q2-1979:Q3 vs. 1961:Q2-1981:Q3, 1961:Q2-1979:Q3 vs. 1961:Q2-1982:Q3, and so forth), no sign of instability is detected. Finally, a test for stability of the sample from 1961:Q2 to 1979:Q3 against separate subsamples split at 1973:Q1 cannot be rejected, and a test for stability of the sample from 1961:Q2 to 1989:Q3 against subsamples split at 1979:Q3 cannot be rejected.

18 Another potential shortcoming is that data from 1960 provide only two periods of steadily falling inflation on which to base predictions about future disinflations. Although inflation fell sharply in 1974, only in the early 1970s and early 1980s did inflation fall steadily over several quarters. More importantly, since 1986, inflation has

remained steady. With no further disinflationary monetary policy—gradual or cold turkey—since the early 1980s, the current cost of disinflation as measured in the Phillips-curve approach cannot differ much from the estimated cost of the last disinflation. On the other hand, even though there has been no further disinflation, there have been policy announcements and product and labor market developments that might have had an effect on expected and actual inflation. These developments were not detected, however, in forecasting the Phillips-curve equation and examining its stability.

19 The role of reputation in establishing credibility is formally examined by Barro and Gordon (1983a, 1983b). For a general discussion of reputation and credibility, see Sibert and Weiner 1988, Blackburn and Christensen 1989, and Alesina 1989.

20 Blanchard 1984, Frankel and Hardouvelis 1985, and Barnhart and Hardouvelis 1989.

21 Caton 1989-90, *Blue Chip Economic Indicators* 1990, Congressional Budget Office 1990.

22 The resolution and testimony by Alan Greenspan are contained in *Zero Inflation* 1989. More recent testimony includes Feldstein 1990, Christ 1990, Friedman 1990, Hoskins 1990, Parry 1990, Black 1990, Corrigan 1990, Keran 1990, Straszheim 1990, and Almon 1990.

23 Vroman and Vroman 1989. See also Gordon 1982, Gordon and King 1982, and Kahn 1985.

24 This discussion draws heavily on Wachter and Carter 1989.

25 Brainard and Perry 1989. For anecdotal evidence, see Kilborn 1990.

26 The most important measurement problem with the CPI is its treatment of homeownership and mortgage interest costs before 1983. For further information on this issue, see Blinder 1980. When growth in the CPI less food and energy is substituted for growth in the fixed-weight PCE deflator less food and energy in the Phillips-curve equation, both in-sample and out-of-sample performance deteriorates. Estimated residuals show signs of serial correlation and inflation is systematically underpredicted after 1979. This underprediction implies, if anything, an increase in the cost of disinflation, not a decrease.

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