

Inflation and Disinflation: a Comparison Across Countries

By George A. Kahn

The major industrial countries have made impressive progress in reducing inflation. In the United States, statistics on inflation have repeatedly surprised economic forecasters, who have generally predicted steady or increasing rates of inflation. In Europe and Japan, inflation has fallen despite an appreciating dollar and accompanying increases in commodity prices. These experiences with inflation raise the question of whether a fundamental change has occurred in the inflation process. Can the same factors that explained the generally rising inflation rates of the 1960s and 1970s explain the decline in inflation after 1980?

After reviewing the inflation experience of six countries since 1965, this article uses a simple economic model to break changes in inflation into inertia, supply, and demand components. Estimates from the model show generally that the same factors that explained the cross-country rise in inflation in the 1960s

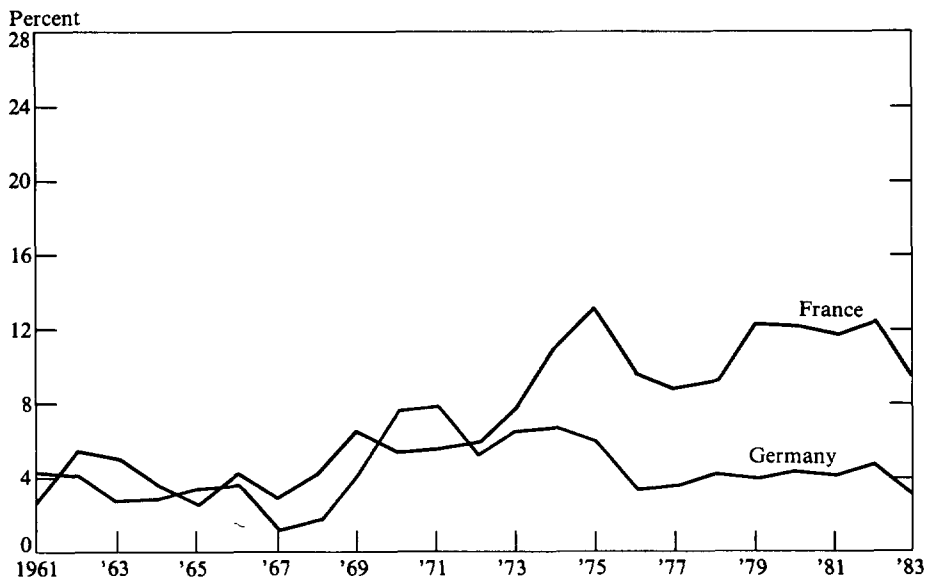
and 1970s also explain the decline in inflation after 1980. While exchange rate movements are relatively more important in explaining disinflation in the United States, recession is relatively more important in Europe and Japan.

Inflation and disinflation experiences: an overview

In describing cross-country patterns of inflation since 1965 in France, Germany, Italy, Japan, the United Kingdom, and the United States, it is useful to break the analysis into three periods—the late 1960s, which brought slowly rising rates of inflation to most countries; the 1970s, which brought two dramatic oil price rises and sharp increases in inflation; and the early 1980s, which brought almost universal disinflation. As Charts 1 through 3 show, almost all of these countries share common inflationary behavior in each of the three periods. Because episodes of rising or falling inflation seem to transcend national boundaries, it may be possible to trace inflation in different countries to common sources.

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CHART 1
Inflation in France and Germany
 (Change in annual GNP or GDP deflators)



This section takes an anecdotal approach to comparing the inflation experiences of many countries. By correlating episodes of inflation and disinflation with economic and social events, important variables can be identified for use in the more formal analysis that follows. A shortcoming of this approach is that it cannot establish causal relationships or weigh the relative importance of alternative explanations of inflation. These tasks are taken up in later sections that present a theory and empirical analysis of inflation in the large industrial countries.

Creeping inflation in the 1960s

Because the empirical analysis starts in 1965, the discussion of inflation in the 1960s concentrates on the period from 1965 to 1970.¹ During these six years, inflation increased in all six countries after a period of

relative stability in the early 1960s. The increase, however, was moderate in all of the countries. It ranged from 1.7 percentage points in the United Kingdom to 4.7 percentage points in Japan.² The level of inflation was also moderate, especially when compared with the inflation rates experienced in the 1970s. Average inflation for the period from 1965 to 1970, as measured by the implicit GNP (or GDP) deflator, ranged from 3.7 percent in West Germany to 4.9 percent in Japan and the United Kingdom.

The two explanations that are often given for slowly increasing inflation in the late 1960s are based largely on noneconomic events. One focuses on the strength of labor in

¹ The starting date reflects data availability and the lag structure imposed in the empirical model.

² Inflation statistics in this section are based on changes in annual implicit GNP (or GDP) deflators.

CHART 2
Inflation in Italy and Japan
 (Change in annual GNP or GDP deflators)

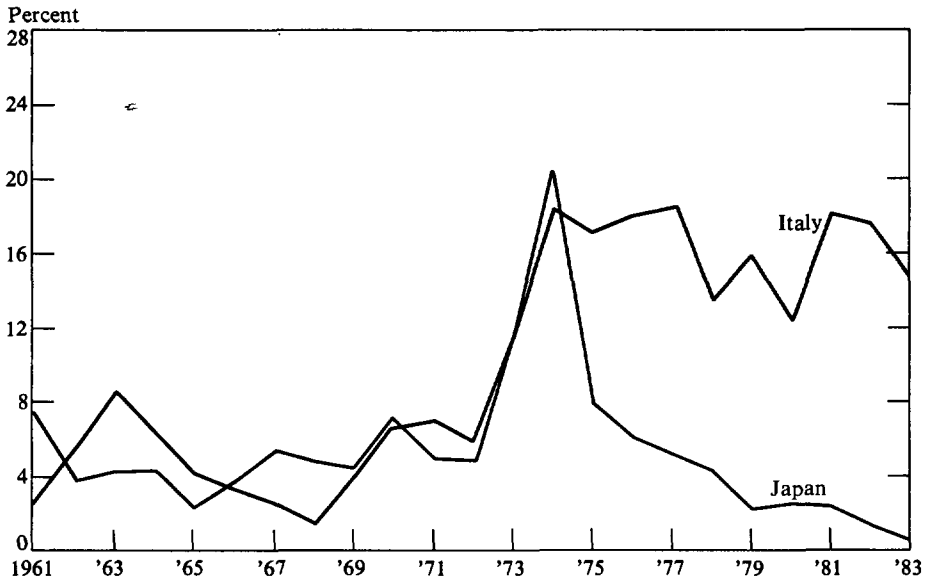
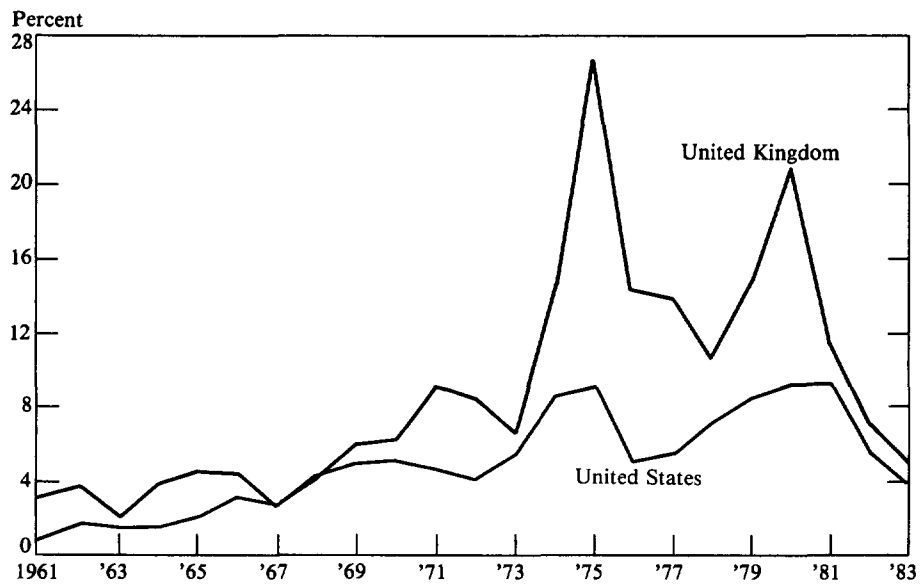


CHART 3
Inflation in the United Kingdom and United States
 (Change in annual GNP or GDP deflators)



demanding wage gains, and the other focuses on U.S. spending on the Vietnam war and the resulting transmission of U.S. inflation abroad.³

The labor militancy view holds that wage gains reflect labor's victory over management in a struggle for income shares. These wage gains increase production costs and lead to higher prices. Several sociological factors

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have been cited as explaining the apparent increase in labor power over this period. They include the development of international ties between labor that allow cross-country comparisons of wage gains, the "rise of the tactics of the New Left, and the decline of authority."⁴ Two episodes of sudden large wage increases in separate countries support this hypothesis. One is the general strike in France in 1968. This strike "brought with it the government-backed Grenelle accords that called for a large, one-time increase in real wages, and obliged employers to negotiate with unions on economic demands."⁵ And another is the Italian "hot autumn of 1969," when unions demanded unusually large wage increases.⁶ These two episodes lend credence

³ For an evaluation of these two views, see Robert J. Gordon, "World Inflation and Monetary Accommodation in Eight Countries," *Brookings Papers on Economic Activity*, 2:1977, pp. 409-468.

⁴ Gordon, "World Inflation and Monetary Accommodation in Eight Countries," p. 415.

⁵ Jeffrey Sachs, "Wages, Profits, and Macroeconomic Adjustment: A Comparative Study," *Brookings Papers on Economic Activity*, 2:1979, p. 279.

⁶ George Perry, "Determinants of Wage Inflation Around the World," *Brookings Papers on Economic Activity*, 2:1975, p. 420.

to the labor militancy view of creeping inflation.⁷

The international transmission view of creeping inflation after 1965 holds that inflation in the United States caused inflation in Europe and possibly Japan. According to this view, the U.S. policy of guns and butter during the Vietnam war led to the transmission of inflation from the United States to other countries through channels of international trade. Specifically, increased U.S. production and inflation was associated with increases in the world money supply, in the trade surpluses of other countries, and in the prices of internationally traded goods.⁸ The result was increased production and inflation abroad. These effects of U.S. inflation also contributed to the breakdown of the Bretton Woods system of fixed exchange rates—a system that fostered the transmission of inflation from the United States to Europe and Japan.

Sharply rising inflation in the 1970s

Inflation rose sharply in most countries in the sample soon after 1972. The sharpest increases were in Japan where inflation rose from 5.1 percent in 1972 to 20.6 percent in 1974, and in the United Kingdom, where inflation rose from 7.0 percent in 1973 to 27.0 percent in 1975. Inflation in the United States rose much more moderately over the period from 1972 to 1975, advancing from 4.1 percent to 9.2 percent. By 1975, inflation had peaked and was beginning to fall in most

⁷ Because sociological factors, such as labor strife, are difficult to measure and incorporate in economic models, their importance is difficult to assess. In the subsequent empirical analysis, which for the most part ignores noneconomic explanations, some of the unexplained variation in inflation might be attributable to such noneconomic factors

⁸ Gordon, "World Inflation and Monetary Accommodation in Eight Countries," pp. 413-415.

countries. However, another round of rising inflation hit after 1978. This time, inflation rates rose less sharply but from much higher levels. Hardest hit were Italy, the United Kingdom, and France.

The two episodes of rising inflation in the 1970s coincided with two large increases in oil prices engineered by the Organization of Petroleum Exporting Countries (OPEC). The first price hike saw the constant-dollar export price of standard-quality oil more than triple in the three months after the outbreak of the Arab-Israeli war in October 1973.⁹ Policy responses to what was ultimately a quadrupling of world oil prices differed from country to country and explain some of the variation in the resulting rates of inflation.

The United States, for example, maintained tight fiscal and monetary policy throughout 1973-74. As a possible result, the U.S. rate of inflation began falling in the first quarter of 1975. But unemployment, which had risen gradually throughout most of 1974, increased sharply to its highest level since World War II. In Japan, more severely restrictive policies quickly pushed inflation down after it had risen higher than in most other countries. "The cost in terms of lost output, however, was large. By mid-1974, production in the Japanese economy was about 12 to 14 percent below even a modest projection of its potential output."¹⁰

Western European policy reactions to the 1973-74 oil shock varied, but were generally less restrictive than Japanese or U.S. policies. As a result of the oil price shock and policy responses, aggregate demand in western Europe fell, as it had in the United States and

Japan, "but on a somewhat smaller scale and with a delay of six months."¹¹ After mid-1974, however, most countries eased policy. Germany eased in 1974, followed by the United States, Japan, France, and Italy in 1975.¹²

The second oil price rise came with the Iranian Revolution in 1979. During that period, the price of Saudi Arabian crude oil more than doubled, rising from \$13.30 to \$28.00 a barrel. As before, inflation and unemployment rose in most countries. This time, with rising inflation—as well as rising internal and external deficits—governments adjusted policies to counter inflationary pressures. The hope was to avoid a resurgence of inflationary expectations and a concomitant rise in wages. The

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OECD estimates that "taking the three years to 1982 together, the cumulative swing towards fiscal restriction of the major seven economies as a whole [our sample plus Canada] amounted to about 1 1/2 percent of their combined GNP."¹³ Also, a significant tightening of monetary policy in the United States in 1979, associated with a change in Federal Reserve operating procedures, further dampened nominal demand growth. Resulting high U.S. interest rates were quickly transmitted abroad, where concern over "depreciation-induced inflation" caused a near-universal tightening of monetary policies.¹⁴ Thus, the

¹¹ Fried and Schultze, *Higher Oil Prices*, p. 26.

¹² John Llewellyn, "Resource Prices and Macroeconomic Policies: Lessons from Two Oil Price Shocks," *OECD Economic Studies*, No. 1, Autumn 1983, p. 200.

¹³ Llewellyn, "Resource Prices and Macroeconomic Policies," p. 204.

¹⁴ Llewellyn, "Resource Prices and Macroeconomic Policies," pp. 204-207.

⁹ Edward R. Fried and Charles L. Schultze, Editors, *Higher Oil Prices and the World Economy: The Adjustment Problem*, The Brookings Institution, Washington, D.C., 1975, p. 3.

¹⁰ Fried and Schultze, *Higher Oil Prices*, pp. 22-24.

major industrial economies entered the 1980s with high inflation and unemployment.

Disinflation in the 1980s

Inflation has declined in the United States, Japan, and the large European countries since 1980. The heights from which inflation has fallen and the extent of the fall vary, however, across countries. From 1980 to 1983, inflation fell 14.7 percentage points in the United Kingdom, 5.3 percentage points in the United States, and somewhat less in the other countries. The smallest drop was in Germany, where inflation fell from 4.5 percent to 3.2 percent.

The decline of inflation in the United States has coincided with the Federal Reserve's adoption of a strong anti-inflationary monetary policy. Associated with this policy, however, were large increases in unemployment and a sharp appreciation of the dollar against most major foreign currencies. These two factors reinforced the downward pressure on prices and kept inflation falling even as economic recovery began in 1983.

Because of the appreciation of the dollar, lower inflation in the European countries was not easy to accomplish. As the exchange value of the dollar rose against other currencies, the price in Europe and Japan of dollar-denominated imports, such as oil, rose. "To limit the damage from both domestic and imported inflation, most European countries...accepted higher real interest rates than they would have accepted otherwise. Indeed, this is the mechanism through which recession was transmitted to Europe in 1981."¹⁵ The depth of the recession varied in Europe, ranging from peak unemployment rates in 1983 of 8.8 percent in France to 12.4 percent in the United King-

¹⁵ *Economic Report of the President*, U.S. Government Printing Office, Washington, D.C., 1984, p. 63.

dom. Compared with other countries, Japan performed extremely well throughout the period. Inflation remained around 3 percent and unemployment remained below 3 percent.

While anecdotal evidence on labor militancy, oil price rises, exchange rate movements, and other economic and social indicators provides useful information for analyzing inflation, the application of an economic

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model potentially can determine the relative importance of alternative factors. Thus, the next two sections turn to the presentation and estimation of a simple model of inflation.

Framework for inflation analysis

One method of studying inflation divides changes in the price level into three causal categories—inertia created by past price changes, shocks affecting aggregate demand, and shocks affecting aggregate supply. These three categories, along with a random error term that arises from mismeasured or omitted variables, such as proxies for labor militancy, explain the variation of inflation across time and place.¹⁶ Because of differences in economic institutions, the relative importance of various causes of inflation is expected to differ across countries. This section examines the

¹⁶ The single equation model combines features of Phillips curve price markup equations with features of atheoretical vector autoregressive (VAR) models. Specifically, the explanatory variables come from the Phillips curve approach, but in accordance with the VAR methodology, each variable is entered with several lags and no current variables are allowed on the right-hand side of the inflation equation. The purpose of this latter restriction is to avoid biasing coefficients as a result of contemporaneous feedback from inflation to the various supply and demand variables on the right-hand side of the equation.

three sources of inflation and describes structural and institutional arrangements that affect the relative importance of the three sources.¹⁷

The influence of inertia on inflation

Inflation inertia represents the influence of past inflation on current inflation. Equivalently, it represents the persistence of current inflation into the future. How far into the future inflation persists—or how important this persistence is—depends on the organization of economic institutions and the way that expectations are formed. Thus, of two explanations given for the dependence of current inflation on past inflation, one focuses on price and wage-setting institutions, and the other focuses on backward-looking price expectations.

One theory of inertia relies on economic institutions calling for long-term nominal contracts.¹⁸ Pre-existing nominal wage or price contracts can fix the prices of some commodities at previously negotiated levels. For example, long-term union wage contracts in the U.S. labor market limit for three or more years the extent to which wages can adjust. If contract wages do not respond to current economic conditions and make up a significant part of the cost of production, wages and prices will adjust slowly. If, on the other

hand, contracts are indexed to the price level or are short in duration, as they are in many European countries, inertia may not be an important characteristic of inflation. Greater centralization of bargaining, shorter contract length, increased indexation, and greater simultaneity of bargaining all tend to reduce inertia.

Another theory of inflation inertia relies on the gradual adjustment of expectations. If inflation depends on expected inflation and expected inflation depends on past inflation, inertia will result. Actual inflation depends on expected inflation when economic agents decide price and wage increases before the economy-wide inflation rate is known.¹⁹ Because they are interested in relative price increases and real wage gains, both workers and firms must deflate the nominal variables they use in decisionmaking by an expected inflation rate. Thus, the price increases a firm charges and the wages it pays depend on its expectations of general inflation. Aggregated across firms, inflation becomes a function of expected inflation.²⁰ As long as inflation expectations are backward looking—relying on a fixed relationship of past inflation to current inflation—inertia results.²¹

¹⁷ For a discussion of alternative theories of price determination, see George A. Kahn, "Theories of Price Determination," *Economic Review*, Federal Reserve Bank of Kansas City, Vol. 69, No. 4, April 1984, pp. 16-27.

¹⁸ For a more formal discussion of this theory and its application to the United States, see George A. Kahn, "Wage Behavior in the United States: 1907-1980," *Economic Review*, Federal Reserve Bank of Kansas City, Vol. 68, No. 4, April 1983, pp. 16-26. For a discussion of wage-setting institutions in the large industrial countries and an international comparison of wage behavior, see George A. Kahn, "International Differences in Wage Behavior: Real, Nominal, or Exaggerated?" *American Economic Review*, Vol. 74, No. 2, May 1984, pp. 155-159, and the references cited there.

¹⁹ This behavior might be the result of short-term or one-period price or wage contracts.

²⁰ Another theory for the dependence of actual inflation on expected inflation hypothesizes that firms may increase production in response to unanticipated increases in the price level. This reaction occurs because firms attribute at least some of the unanticipated price rise to an increase in demand for their product. If firms base expectations of price changes on past price changes, the output they supply becomes a function of current and past prices. Combining this theory of supply with a textbook theory of aggregate demand determines current prices as a function of past prices and, therefore, current inflation as a function of past inflation.

²¹ The length of the lag relationship depends on how far into the past people look to form their expectations of current inflation. If people use additional information to determine expected inflation, that information becomes an additional determinant of inflation. If, for example, past output helps people predict infla-

The influence of aggregate demand on inflation

Excess demand growth places upward pressure on inflation, while inadequate demand growth contributes to disinflation. Principal demand factors are growth in private autonomous spending and changes in the stance of monetary and fiscal policy. Thus, for example, increased consumer or business confidence or more stimulative policy actions may lead to demand pressures that raise the inflation rate.²²

One frequently used measure of demand pressure is the GNP gap. The GNP gap measures the ratio of the natural or potential rate of output to actual real GNP. The natural rate is the amount of real GNP produced when the economy is operating at an unemployment rate consistent with stable inflation and no supply shocks. Thus, when actual real GNP equals the natural rate of GNP, there is no tendency for inflation either to accelerate or decelerate.

As demand pressures increase, nominal GNP growth rises. The rise in nominal GNP

tion, then past output becomes an additional factor in explaining inflation.

An important distinction between theories of inertia based on long-term contracts and theories based on backward-looking expectations is that inertia emerges in models of long-term contracts even if expectations are "rational." Economic agents forming rational expectations are assumed to combine an accurate understanding of the underlying economic model with all available information. The result is expectations that are forward-looking and are not necessarily bound by the recent history of inflation. "While there are of course expectational errors in these models, the expectations mechanism is endogenous and generally consistent with the economic events described by the models. But the most essential feature of these models is that the [inertia-bound] prices are forward-looking; price and wage setting is anticipatory and expectations of future events matter for current wage and price decisions." (John Taylor, "The Role of Expectations in the Choice of Monetary Policy," *Monetary Policy Issues in the 1980s*, Federal Reserve Bank of Kansas City, 1982, p. 56.)

²² Changes in the income multiplier also affect nominal demand growth.

growth is typically divided between an increase in real GNP growth and an increase in inflation. As real GNP growth rises, the gap between actual output and potential output is reduced. Thus, a negative or inverse relationship between the GNP gap and the rate of inflation is generally expected.²³

The GNP gap can also affect inflation indirectly through contract wages and expectations. If workers accept lower wages in new contracts when unemployment is high, wage growth will moderate when the GNP gap is large. This result follows from the close association between unemployment and the GNP gap. High unemployment rates imply large GNP gaps. The magnitude of the effect of economic slack on average wage growth depends on the proportion of contracts that are renegotiated each period. The greater the proportion, or the shorter the contract length, the greater the effect of the gap on average wage behavior. Thus, in countries with long-term nominal wage contracting, the GNP gap might have less of an effect on current inflation than in countries with short-term or indexed wage contracts.²⁴

The influence of aggregate supply on inflation

Besides inertia and excess aggregate demand, supply shocks influence the behavior of inflation. Beneficial supply shocks decrease inflation and increase real output, given expectations and nominal demand growth. These effects are the result of decreasing

²³ Another approach to studying the influence of excess demand on inflation uses the money supply and possibly a fiscal policy variable as substitutes for the GNP gap. This would determine a more monetarist inflation equation but would suffer from the instability of velocity during the sample period.

²⁴ If economic agents use the output gap to help predict future inflation, the gap will become a determinant of actual inflation. As in the case of inertia, this result follows from the dependence of actual inflation on expected inflation

materials, labor, energy, or capital costs. Adverse supply shocks increase inflation and decrease real output as a result of rising costs of production. The previous section pointed to two types of adverse supply shocks. One was the increase in oil prices in 1973-74 and 1979-80, and the other was the spontaneous demand by some European workers for higher wages in the late 1960s. Adverse oil price shocks increase energy prices and reduce the marginal productivity of labor. Labor militancy raises labor costs. Both types of shocks lead to increases in inflation and reductions in real

Adverse supply shocks increase inflation and decrease real output as a result of rising costs of production.

output. Other types of supply shocks include changes in the terms of international trade and government intervention in price and wage-setting institutions.

The effect of the terms of trade on inflation has become particularly important since the advent of floating exchange rates. A worsening in the terms of trade tends to increase inflation. It results from a depreciation of the foreign exchange rate or from an increase in the price of imports relative to the price of exports. The inflationary effect of a worsening in the terms of trade depends on the importance of imports to the domestic economy. If production costs rise, inflation will increase and real output will fall. To the extent that aggregate spending shifts from foreign to domestic goods, a worsening in the terms of trade may also increase inflation by stimulating aggregate demand. An appreciation of the foreign exchange rate improves the terms of trade and reduces inflationary pressure. By raising the price of exports relative to the price of imports and causing aggregate spending to

shift from domestic goods to less expensive imported goods, appreciation of the exchange rate reduces production costs and causes inflation to fall.

Because changes in exchange rates can affect the terms of trade, an avenue of influence may be opened for monetary policy and the fiscal-monetary policy mix. Tight monetary policy combined with a loose fiscal policy, for example, tends to raise interest rates which, in turn, causes an appreciation of the exchange rate. As shown, the exchange rate appreciation may then lead to a reduction in inflation.

Another category of supply shocks is price and wage controls. Examples include the Nixon price controls program in the United States and various episodes of incomes policies in the United Kingdom. Although these programs potentially reduce inflation while they are in place, they have only a temporary effect. Once lifted, they tend to increase inflation.

The determination of the relative importance of inertia, demand, and supply on inflation requires an empirical model. Only by incorporating all the various causes of inflation into a model can their relative importance be broken out from the data. The next section, therefore, presents an empirical model and the results from its estimation.

Empirical model of inflation

The statistical model used to quantify the relationships described in the previous section relies on a single regression equation.²⁵ The equation is summarized in the accompanying

²⁵ Rather than experiment with different specifications for each country to discover the best fitting set of equations, a single specification (with, of course, the exception of country-specific dummy variables) is used for all countries. This facilitates international comparisons of estimated coefficients and predicted inflation.

The Inflation Equation

$$P_t = a + b(L)P_{t-1} + c_1(L)GAP_{t-1} + c_2(L)POIL_{t-1} + c_3(L)X_{t-1} + dZ_t + e_t$$

Definitions:

P_t = rate of change of implicit GNP (or GDP) deflator

$GAP_t = Q_t^N/Q_t^A$ = GNP gap = ratio of natural rate of output to actual real GNP (or GDP)

$POIL_t$ = change in the relative price of oil in domestic currency

X_t = change in effective nominal exchange rate

Z_t = dummy variables for episodes of price and wage guidelines or controls, and autonomous wage push

e_t = zero mean, finite variance error

a = constant

$b(L)$ = 5th degree polynomial in the lag operator L , with a lag length of 24 quarters and far endpoint constrained to zero

$c_i(L)$ = 3rd degree polynomial in the lag operator L , with a lag length of 4 quarters and no endpoint constraints

d = a vector of coefficients on dummy variables

Note: All variables except dummies are defined in logs or differences in logs.

box. Variables on the right-hand side of the equation represent the influence on inflation of either inertia, demand, or supply. Past rates of inflation measure inertia. Past levels of the GNP gap measure demand pressure. And past changes in oil prices, exchange rates, and various dummy variables measure supply shocks. Specific variable definitions are given in the box. The sample period for estimating the equation runs from 1966:Q2 to 1983:Q4.

Table 1 reports estimates of the inflation equation. The equation determines inflation

with similar accuracy for all six countries from 1966 to 1983. The best fit is for the United States, while the poorest is for West Germany.²⁶ The relatively poor performance of the German equation may indicate that sociological or other noneconomic factors may play a somewhat greater role in determining inflation in Germany than in the other countries. To say more about international differences in inflation behavior requires an examination of

²⁶ As measured by R^2 statistics.

the various coefficients explaining the effects of inertia, demand, and supply. The role of each is discussed in turn.

Inertia

Inertia has a large and significant effect on inflation in all of the countries, except possibly West Germany.²⁷ The presence of inertia in all equations indicates that past inflation is important in determining current inflation in all countries. This means that, at least in the short run, any increase in nominal aggregate demand growth will go partly into inflation and partly into real GNP growth.

The underlying lag structures on inflation reveal little about the characteristics of labor-

Inertia has a large and significant effect on inflation in all of the countries, except possibly West Germany.

market institutions. The United States, with its three-year staggered wage contracts, has a lag structure similar to that of France, Italy, and the United Kingdom, all of which have shorter contracts and more centralized bargaining. Japan is unique, however, in the speed with which the influence of past inflation dies out. Inflation more than three quarters into the past has virtually no effect on current inflation. Thus, any increase in nominal demand growth goes completely into inflation within a year. This could be the result of Japan's one-year wage cycle, which recurs during the "spring wage offensive," and its flexible system of semi-annual bonuses for labor. Aside from Japan, West Germany is the only country with a strikingly different lag structure on past

²⁷ Although summing to zero, the lag structure on German inflation contains individual coefficients that are significantly positive and negative

inflation. Its repeating string of significant positive coefficients followed by significant negative coefficients defies simple explanation.

Aggregate demand

A narrowing of the GNP gap increases inflation in all six countries, as theory would predict.²⁸ This effect of demand on inflation is statistically significant in Japan and the United States. In France, Germany, and the United Kingdom, individual coefficients on the lagged GNP gap are significant. In Italy, the effect is statistically insignificant but in the theoretically predicted direction. Thus, in all the countries except possibly Italy, a narrowing of the GNP gap increases inflation. Put another way, disinflationary policies that increase the size of the GNP gap reduce inflation everywhere except in Italy. The disinflationary effect of enlarging the gap in Germany, however, diminishes to insignificance after four quarters. The strongest effect of the gap on inflation comes in the United Kingdom, which suggests that the output cost of disinflation may be less there than elsewhere.

Aggregate supply

Three types of supply variables are considered in the empirical model—oil price changes, exchange rate movements, and discrete price changes brought on by the actions of government or labor. Rising oil prices significantly increase inflation in France, Italy,

²⁸ To avoid calculating the natural rate of unemployment and the corresponding natural rate of output, the GNP gap is measured as the deviation of actual GNP from trend, where the trend is adjusted for a secular shift in productivity growth. This adjustment is carried out by using a segmented regression model that joins two quadratic trends at a point that minimizes the sum of square residuals.

TABLE 1
The Estimated Inflation Equation*
Sums of Lag Coefficients
 (absolute value of t-statistics in parentheses)
 1966:Q2 - 1983:Q4

<u>Variable</u>	<u>France</u>	<u>Germany</u>	<u>Italy</u>	<u>Japan</u>	<u>United Kingdom</u>	<u>United States</u>
P	0.931 (4.290)	0.131 +, (0.421)	0.793 (3.945)	1.024 (4.763)	0.467 +, (1.946)	0.736 (3.573)
GAP	-0.751 + (1.747)	-0.127 + (0.676)	-0.364 (0.680)	-0.324 (1.906)	-1.006 + (1.870)	-0.374 (2.968)
POIL	0.047 (3.133)	0.019 + (1.727)	0.086 (3.071)	-0.003 (0.150)	0.082 (4.316)	0.022 (2.875)
X	0.032 (0.492)	0.028 (0.424)	0.0021 (0.145)	-0.019 (0.288)	0.298 (2.525)	-0.121 (2.574)
GRENELLE†	8.980 (4.342)					
CHART‡			2.583 (0.959)			
POL 67§					-2.899 (1.776)	
POL 72					-5.336 (2.197)	
POL 77					-11.059 (3.181)	
NIXON						-1.484 (1.965)
S.E.	2.586	2.242	4.530	3.084	3.953	1.325
R ²	0.674	0.465	0.718	0.691	0.743	0.767

* Regressions also include a constant and three quarterly dummies.

TABLE 1
Notes

+ Lag distribution includes one or more significant positive coefficients even though the sum of coefficients is insignificant at .05 level.

- Lag distribution includes one or more significant negative coefficients even though the sum of coefficients is insignificant at .05 level.

† GRENELLE is a dummy variable for the general strike in France in 1968.

$$\text{GRENELLE} = \begin{cases} 1.0 & \text{in 1968:Q3 to 1969:Q2} \\ 0 & \text{otherwise} \end{cases}$$

‡ CHART is a dummy variable for the Italian "hot autumn".

$$\text{CHART} = \begin{cases} 1.0 & \text{in 1970:Q1 to 1970:Q4} \\ 0 & \text{otherwise} \end{cases}$$

§ POL 67, POL 72, POL 77 are dummy variables for incomes policies in the United Kingdom and the "social contract" of 1977.

$$\text{POL 67} = \begin{cases} 1.0 & \text{in 1967:Q2 to 1968:Q1} \\ -1.0 & \text{in 1968:Q2 to 1969:Q1} \\ 0 & \text{otherwise} \end{cases}$$

$$\text{POL 72} = \begin{cases} 0.571 & \text{in 1972:Q1 to 1973:Q3} \\ -1.0 & \text{in 1975:Q2 to 1976:Q1} \\ 0 & \text{otherwise} \end{cases}$$

$$\text{POL 77} = \begin{cases} 0.8 & \text{in 1977:Q4 to 1978:Q4} \\ -0.8 & \text{in 1979:Q3 to 1980:Q3} \\ 0 & \text{otherwise} \end{cases}$$

|| NIXON is a dummy variable for the Nixon wage and price controls.

$$\text{NIXON} = \begin{cases} 0.8 & \text{for 1971:Q3 to 1972:Q3} \\ -0.4 & \text{for 1974:Q2 and 1975:Q1} \\ -1.6 & \text{for 1974:Q3 and 1974:Q4} \\ 0 & \text{otherwise} \end{cases}$$

the United Kingdom, and the United States.²⁹ The effect is marginal in Germany. Surprisingly, the change in the relative price of oil does not influence Japanese inflation when other influences are held constant. This result might be attributable to the Japanese government's quick and highly restrictive policy reaction, which caused real output to fall

²⁹ The effect of oil-related supply shocks on inflation is measured by the change in the relative domestic price of Saudi-Arabian crude oil. That is, the dollar price of Saudi oil is converted to domestic prices by bilateral exchange rates and then deflated by the domestic price level. The result is the real domestic price of oil. Lagged changes in this variable serve as a proxy for oil shocks.

sharply in 1974 and brought inflation down sharply in 1975. Of the countries with highly significant oil shock effects, Italy and the United Kingdom come under the greatest inflationary pressure. The United States comes under the least. This result supports the hypothesis that smaller, more open economies are more vulnerable to supply shocks that affect imported commodities.

The change in the effective nominal exchange rate significantly affects inflation only in the United States and the United Kingdom. Of the two countries, however, the sign on this variable is "correct" (negative) only

in the United States.³⁰ Thus, an appreciation of the exchange value of the dollar causes the theoretically predicted decline in U.S. inflation. The positive and significant coefficient in the U.K. equation may be related to the United Kingdom's discovery of oil in the North Sea. Because of its oil exports, the United Kingdom's exchange rate has appreciated against many major currencies. At the same time, oil exports may have increased current and expected income and led to an inflationary increase in aggregate demand.³¹ Under these circumstances, an appreciation of the exchange rate might be associated with a rise in inflation.

Finally, of the government intervention and autonomous wage push variables, the French general strike in 1968 caused a significant, large spike in inflation, while incomes policies in the United Kingdom and the Nixon price and wage controls in the United States temporarily reduced inflation.³²

³⁰ The change in the real effective exchange rate would more accurately capture the terms of trade effect, but these data are not available. The relatively poor performance of the exchange rate variable in some countries may be partly the result of its misspecification.

³¹ This assumes that the increase in domestic spending more than offsets an exchange rate-induced decline in the tradable goods sector. Thus, the finding of a direct relationship between changes in the nominal effective exchange rate and inflation—which is robust to changes in lag length and sample period—may indicate that the United Kingdom does not, in fact, suffer from the “Dutch Disease.” North Sea oil exports and concomitant exchange rate movements have been diagnosed as the “disease” causing such symptoms as rising unemployment and falling demand. Results reported in Table 1, however, suggest that perhaps the export of North Sea oil may have tended to increase total demand in the United Kingdom and, therefore, to increase inflation rather than the reverse.

³² Unfortunately, the use of dummy variables does not guarantee that they really represent the exogenous events they were designed to capture. Anything unique about the years in question could result in significant dummies but incorrect conclusions. Nevertheless, most of the dummy variables significantly improved the fit of their respective estimated inflation equation.

Disinflation experiences

With the estimated model, it is possible to investigate whether the factors that explained rising inflation in the 1960s and 1970s work in reverse to predict falling inflation in the 1980s. It is also possible to examine differences in the way countries achieved disinflation.

Predicting disinflation

In order to examine the disinflationary experience, the basic inflation equation for each country was simulated in-sample over the period from 1981:Q1 to 1983:Q4. The simulations are dynamic in the sense that, in generating the results, predicted inflation rates rather than actual inflation rates are substituted back into the equations.³³ If the relationship between inflation and its various causes changed in the 1980s, it would be doubtful that the estimated equation could predict inflation after 1980. Because the fit of the equation does not deteriorate as inflation slowed after 1980, it can be concluded that the same factors that explained rising inflation in the United States and abroad also explain falling inflation.

Charts 4 through 9 plot actual and predicted inflation from a simulation of the inflation equation between 1981:Q1 and 1983:Q4. The charts show that the estimated equation does a fairly good job of predicting inflation. In all countries where inflation declined significantly over the 1981-83 period, predicted inflation also fell. Furthermore, the direction of quarterly changes in the rate of inflation corre-

³³ Actual values of the GNP gap, the relative price of oil, and the change in the effective exchange rate, however, are used as observations of the other independent variables. A more complete model would include equations that explain and predict these other variables, but that is beyond the scope of this article.

CHART 4
Actual and Predicted Inflation in France

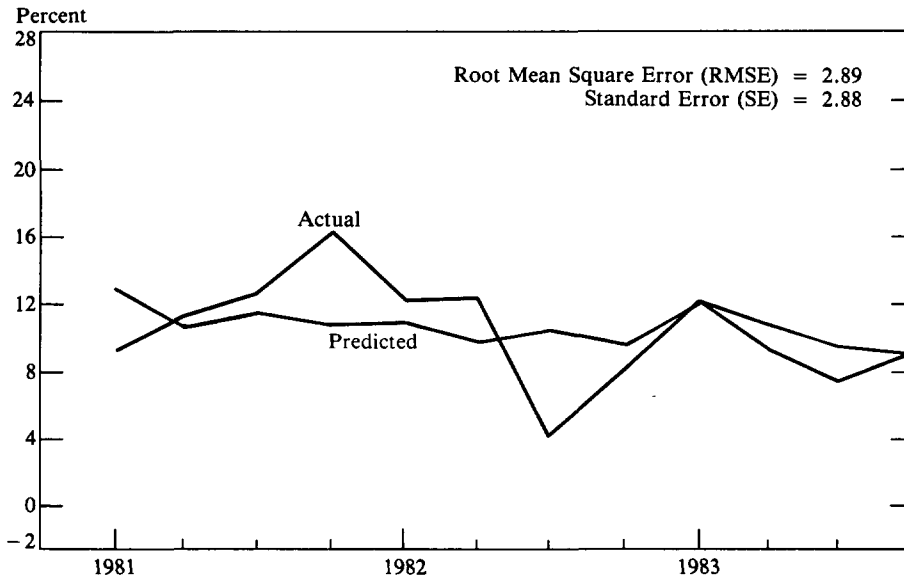


CHART 5
Actual and Predicted Inflation in Germany

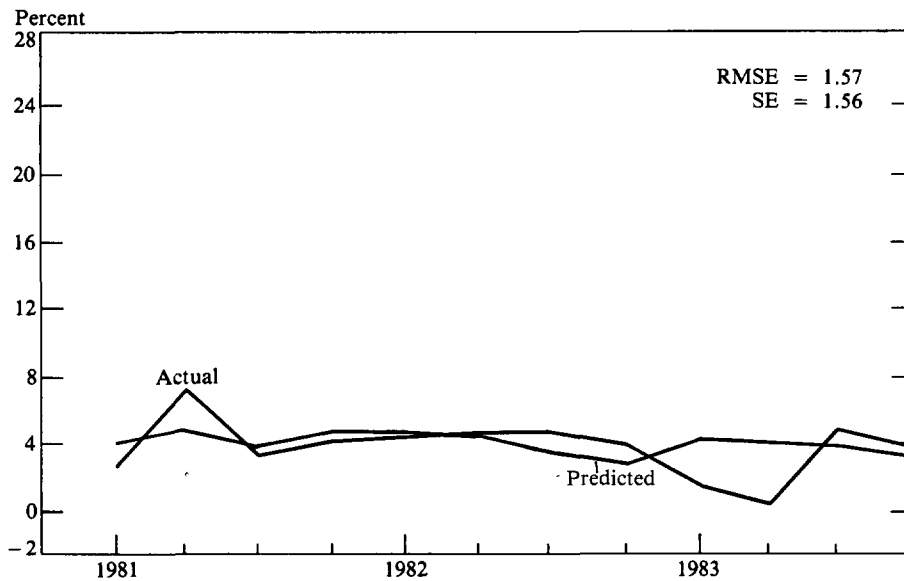


CHART 6
Actual and Predicted Inflation in Italy

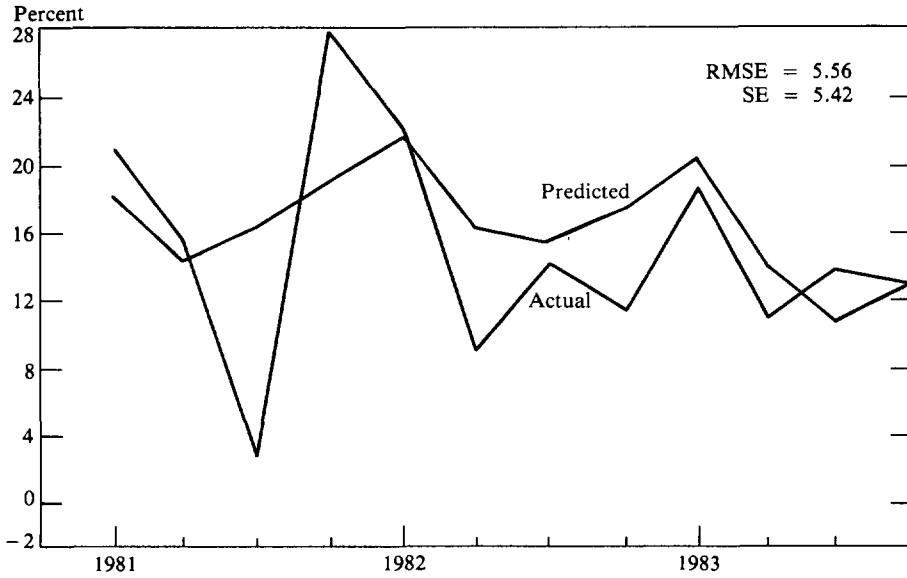


CHART 7
Actual and Predicted Inflation in Japan

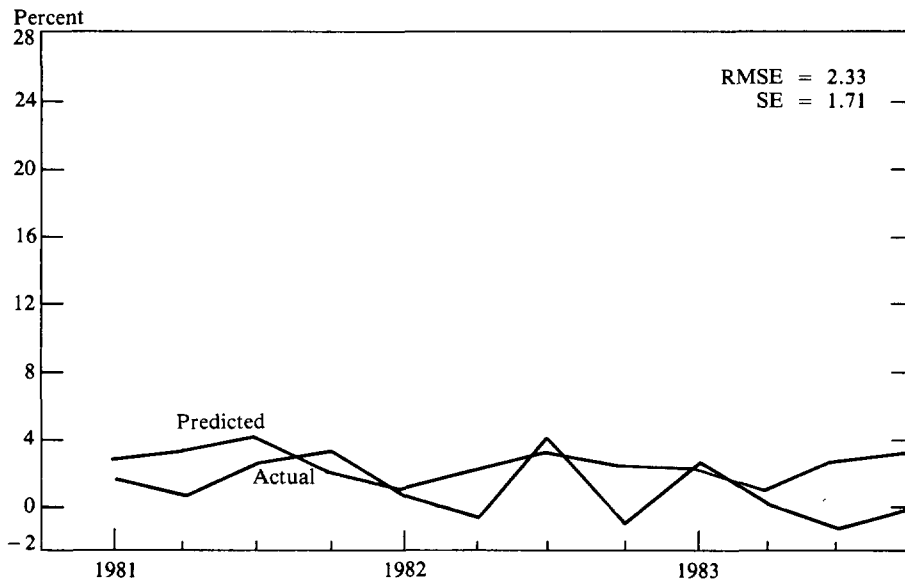


CHART 8
Actual and Predicted Inflation in the United Kingdom

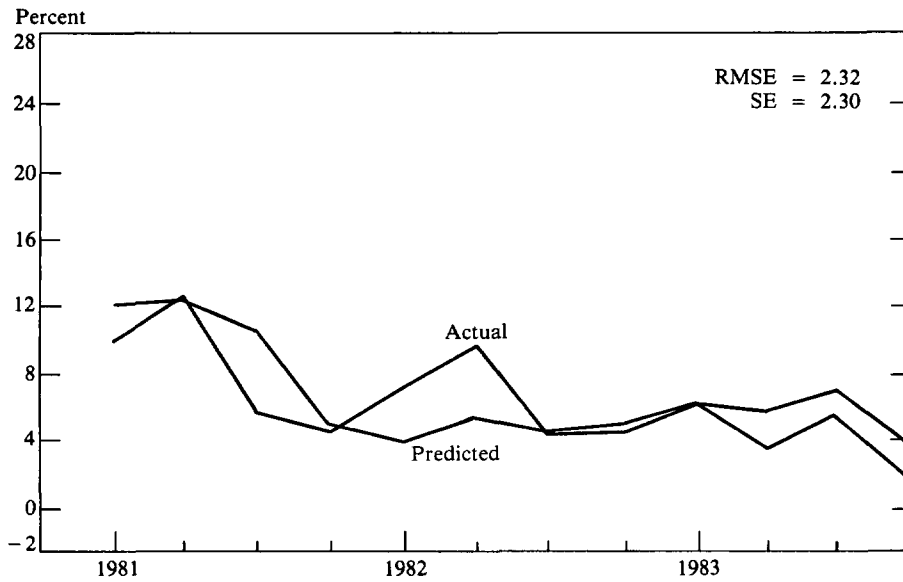
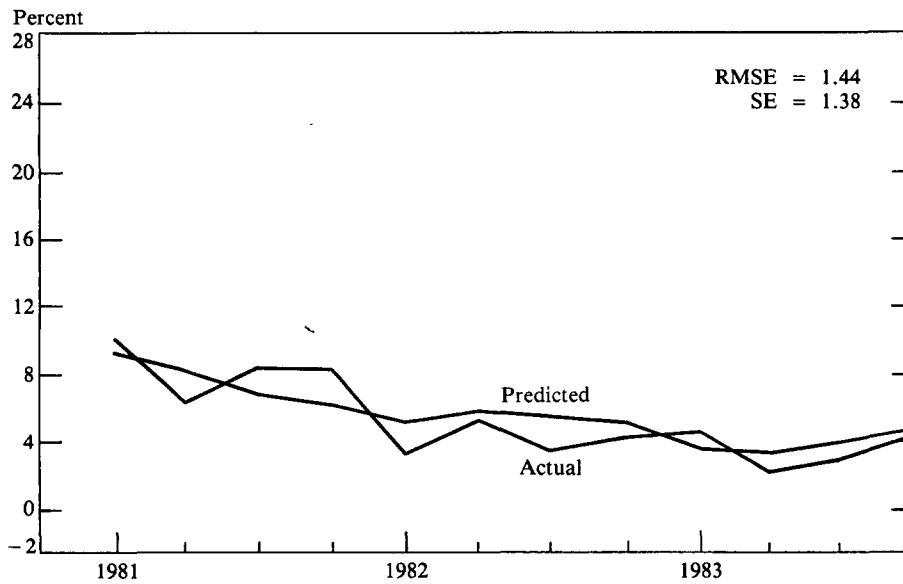


CHART 9
Actual and Predicted Inflation in the United States



spond more often than not with the direction of quarterly changes in predicted inflation. Finally, the standard errors of the forecasts reported in the charts approximate the standard errors of the regressions reported in the table. In France, Italy, and the United States, the standard error of predicted inflation slightly exceeds the standard error of the regression. In Germany, Japan, and the United Kingdom, the standard error of predicted inflation is actually less than the standard error of the regression. In no country does the fit of the equation deteriorate significantly between 1981 and 1983, and in some countries the fit actually improves.

Although the model is generally successful in predicting worldwide disinflation after 1980, there are some specific failures. First, the estimated inflation equation fails to predict quarterly spikes in inflation rates. Not surprisingly, the equation does not identify a sharp decline followed by a sharp rise in inflation in Italy in the second half of 1981. Nor does it predict sharp quarter-to-quarter changes in Japanese inflation in 1982 and French inflation in 1981 and 1982. These failures may simply be the result of poor data. Second, the inflation equation overpredicts inflation in Japan and the United Kingdom in 1983. The overprediction of inflation in the United Kingdom could be the result of an increase in the credibility of the government's disinflationary policies after 1982. If so, inflation might fall further for a given level of the GNP gap after 1982 than before 1982.³⁴

Regardless of some failures in prediction, the inflation equation does correctly forecast disinflation after 1980. Indeed, the equation

³⁴ The equation overpredicts inflation in the United States by a less amount. As in the United Kingdom, this could result from an increased credibility of monetary policy. It might also result from an increased sensitivity of U.S. inflation to exchange rate movements.

performs admirably, considering the variety of institutional arrangements represented by the six countries in the sample.

Explaining disinflation

While the analysis suggests there was no significant structural change in the behavior of inflation after 1980, there were differences across countries in the way disinflation was achieved. To isolate the dominant factors in each country, underlying data movements are examined with respect to their estimated relationship with inflation. Also, the inflation equation is resimulated in-sample using esti-

While the analysis suggests there was no significant structural change in the behavior of inflation after 1980, there were differences across countries in the way disinflation was achieved.

mated coefficients for individual variables in simple combinations. For example, the U.S. inflation equation was resimulated using estimated coefficients on lagged inflation and one other variable at a time. Other coefficients were set equal to zero. Examination of these results suggests that exchange rate movements were relatively more important in the United States and the United Kingdom than in the other countries, while recession was more important in France, Germany, Italy, and Japan.

Exchange rates have been volatile since 1980, but they have contributed to disinflation only in the United States and the United Kingdom. In the United States, the nominal effective exchange rate climbed 33 percent between 1980 and 1983. Because of the statistically significant inverse relationship between changes in the effective nominal exchange

value of the dollar and U.S. inflation, the appreciation of the dollar has contributed importantly to the decline of inflation. In fact, in a resimulation of the inflation equation that includes only the effects of inertia and exchange rate movements, estimated U.S. inflation falls from 9.0 percent in 1980 to 5.1 percent in 1983. In the United Kingdom, the nominal effective exchange rate declined 13 percent between 1980 and 1983. But because of the significant—and theoretically unexpected—direct relationship between changes in the U.K. exchange rate and inflation, the falling value of the British pound has contributed to the decline of inflation in the United Kingdom.

In all the other countries except Japan exchange rates declined between 1980 and 1983. In Japan, the nominal effective exchange rate rose 17 percent. Despite these sometimes sharp movements, however, exchange rates did not affect inflation significantly in any of the other countries, even though they generally increased dollar-denominated commodity prices. This may have been because raw materials make up less of total imports and total consumption in most European countries than in the United States. Also, large profits have allowed foreign corporations to absorb some of the higher commodity prices.³⁵

Large GNP gaps helped drive inflation down in all countries except Japan, where slow economic growth helped keep an already low inflation rate low. While economic slack was important in the disinflation of the 1980s in most countries, it was the most important factor in France, Germany, and possibly Italy. In a resimulation of the inflation equation where only inertia and the GNP gap are allowed to influence inflation, estimated

French inflation fell 1.4 percentage points between 1980 and 1983, compared with an actual decline of 2.0 percentage points. Similarly, inflation in Germany fell 0.7 percentage points, compared with an actual decline of 1.2 percentage points. While the GNP gaps reached much larger levels in the United Kingdom and the United States, actual and estimated inflation also fell much further. The

Large GNP gaps helped drive inflation down in all countries except Japan, where slow economic growth helped keep an already low inflation rate low.

GNP gap thus contributed significantly to the decline of inflation in the United Kingdom and the United States. But, in these countries, exchange rate movements greatly augmented the downward pressure on inflation.

Finally, a slowing in the rise of dollar-denominated oil prices helped reduce inflation in the United States. In the other countries, the rising exchange value of the dollar caused the domestic price of oil to rise relatively more sharply. Thus, movements in oil prices since 1980 have helped the United States achieve lower inflation but they have hindered the European countries and Japan in achieving the same goal.

Summary and conclusions

Inflation has generally declined in the United States and most major industrial countries since 1980. The decline has been particularly sharp in the United Kingdom and the United States, but more moderate in France, Germany, Italy, and Japan. Underlying the decline in inflation are the same forces, operating in reverse, that caused inflation to rise in the 1960s and 1970s. They are the inertia of

³⁵ "Europe's Escape from Inflation," *Business Week*, August 27, 1984, p. 25.

inflation itself, the gap between actual and natural real GNP, changes in oil prices, and movements in exchange rates. Together, these factors explain rising inflation in the 1960s and 1970s and falling inflation in the 1980s.

The prospect for inflation in the future depends critically on what happens to various supply and demand factors. Inertia will tend to keep inflation rates close to the rates of the recent past. The GNP gap will be determined

partly by private spending patterns but also by monetary and fiscal policy. Oil prices should continue to moderate as OPEC loses market power. And finally, exchange rate movements will continue to help reduce the inflation rates of some countries, perhaps at the expense of other countries. Proper anti-inflationary monetary and fiscal policy will be crucial, therefore, in sustaining cross-country reductions in inflation.