Economic Review

FEDERAL RESERVE BANK OF KANSAS CITY

February 1985

The Federal Reserve's Role in Promoting Economic Growth

Commodity Prices and Monetary Policy Reform

Inflation and Disinflation: a Comparison Across Countries

February 1985, Vol. 70, No. 2

The *Economic Review* (ISSN0161-2387) is published ten times a year by the Federal Reserve Bank of Kansas City. Subscriptions and additional copies are available without charge. Send requests to the address below. If any material is reproduced from this publication, please credit the source. Second class postage paid at Kansas City, Missouri. Postmaster: send address changes to *Economic Review,* Research Division, Federal Reserve Bank of Kansas City, 925 Grand, Kansas City, Missouri, 64198.

Economic Review

FEDERAL RESERVE BANK OF KANSAS CITY

February 1985

The Federal Reserve's Role in Promoting Economic Growth

By Roger Guffey

Each policy directive of the FOMC contains a statement of the goals of Federal Reserve monetary policy. One of those goals is to "promote growth in output on a sustainable basis." It has long been recognized that only through sustained economic growth can we improve living standards, increase job opportunities, and help to achieve other national economic priorities. In addition, several of our current economic problems—such as the international debt situation, the federal budget deficit, and the financial stress in agriculture and other important sectors—can best be managed in an environment of economic growth. For all these reasons, therefore, I believe sustained economic growth should be the preeminent long-run goal of economic policy.

What can the Federal Reserve contribute to achieving this goal? It should be recognized that the Federal Reserve's role in promoting economic growth is a limited but important one. It is limited because many factors outside the control of monetary policy influence economic growth. It is nonetheless important because the economy cannot realize its growth potential without reasonable price stability,

Sustained economic growth should be the preeminent long-run goal of economic policy.

which is largely within the control of monetary policy. In my view, therefore, the major contribution that monetary policy can make to sustained economic growth is to ensure reasonable price stability.

Not all would agree with this assessment. Some have argued, for example, that monetary policy can and should promote growth by keeping interest rates low. They reason that low interest rates encourage capital investment, thus raising productivity and economic growth.

The flaw in this argument is that capital investment depends on real interest rates,

Roger Guffey is president of the Federal Reserve Bank of Kansas City. This article was written for The Conference Board and published in its *Economic Policy Issues* series in February 1985

which are affected by monetary policy only in the very short run. It is true that easy money and credit can temporarily depress market interest rates. However, as soon as the inflationary consequences are realized, the inflation premium in nominal rates rises, pushing market rates up enough to restore real rates to their previous levels. As a result, holding market rates down by inflationary growth of money and credit will not stimulate investment. Indeed, past experience suggests that by increasing uncertainty, inflation leads ultimately to higher interest rates and lower stock prices. Therefore, keeping market interest rates artificially low is at best ineffectual and at worst counterproductive in achieving sustainable economic growth.

Bringing down the budget deficit is the most important fiscal policy action that could be taken to improve prospects for balanced and sustained economic growth.

The need to focus on real rather than nominal interest rates demonstrates a more general principle—that economic growth is determined primarily by real factors rather than by credit conditions. The savings rate determines how much output can be devoted to investment; changes in technology and consumer preferences create profitable opportunities for capital investment; and investment increases productivity growth, which is the driving force behind sustained expansion in output. These real factors, not nominal interest rates, are the fundamental determinants of economic growth in the long run.

Economic policy, nevertheless, has a role to play in promoting economic growth. Fiscal policy—the government's taxing and spending decisions—affects incentives for saving and investment. In this regard, I welcome the national debate stimulated by the Treasury Department's recent tax proposal. If a "flat tax" or some other tax system would enhance incentives for economic growth, such a system should be given serious consideration. It would be unfortunate, however, if discussion of tax reform diverts attention from the most pressing fiscal issue—the budget deficit. With the federal government absorbing up to one-third of private sector savings, too little is left over for the productive investment necessary to sustain economic growth. Moreover, the high interest rates and strong dollar that have accompanied large budget deficits threaten to damage irreparably some domestic industries that could otherwise contribute to economic growth. In short, bringing down the budget deficit is the most important fiscal policy action that could be taken to improve prospects for balanced and sustained economic growth.

Monetary policy has a role, too. That role is to provide a stable financial environment for economic decisionmaking. Such an environment requires stability not only of the financial system but also of the aggregate price level. Reasonable price stability is necessary to ensure that the market system efficiently allocates real resources to the productive sectors of the economy that drive economic growth.

It used to be thought that money was neutral in the long run because growth in productive capacity was independent of the inflation rate. But experience indicates otherwise. While economic growth is determined fundamentally by real factors, experience shows that inflation can depress real growth. In the 1950s and 1960s when inflation was low, output grew at a rate of about 4 percent a year. Since inflation began to accelerate in the early 1970s, though, real growth has slowed to less than 3

percent. To be sure, oil shocks and other real factors were partially responsible for this slowdown. But high and volatile inflation also contributed. Inflation created uncertainty, depressed capital investment, diverted resources from the real to the monetary sector, and impaired the efficiency of the market system. That experience taught us that the economy does not function well with high and volatile inflation. The experience also taught us that the Federal Reserve can best contribute to sustainable economic growth by fostering the expectation and the reality of a stable price level.

The long-run goal of achieving price stability has been the guiding force of monetary policy in recent years. The FOMC has sought to bring inflation down by gradually reducing the annual growth ranges for money and credit aggregates. Although regulatory changes and financial innovation have altered money demand relationships and thus required occasional adjustments in these ranges, the basic strategy has remained intact. This strategy of monetary restraint has led to substantial progress in reducing inflation from the double-digit rates recorded in the late 1970s.

Progress toward price stability achieved in recent years has already improved the nation's economic performance. Lower inflation and the associated improvement in inflation expectations have boosted consumer and business confidence. This improved business confidence has been particularly important because it has created an environment conducive to a capital investment boom, which not only has added to the strength of the current expansion but also has raised future productive capacity. As a consequence, the Federal Reserve's policy of monetary restraint has already borne fruit in promoting long-run economic growth.

Experience in 1984 typifies the Federal Reserve's attitude toward money growth and inflation. When monetary growth ranges were established in February last year, FOMC members expected that growth within those ranges would be consistent with nominal GNP growth of 9 to 10 percent, divided about evenly between inflation and real growth. In the first half of the year, extremely rapid growth in nominal GNP threatened to intensify inflationary pressures and produce monetary growth above the announced targets. In response, increased pressure was applied on reserve positions of depository institutions, and the discount rate was increased. Some critics described these restrictive actions as being "anti-growth." To the contrary, such actions were designed to support sustainable real growth by preventing reacceleration of inflation. Indeed, as growth of money and spending slowed after midyear and it became apparent that inflationary pressures were being contained, the FOMC responded by reducing pressure on reserve positions and lowering the discount rate.

Federal Reserve's policy of monetary restraint has already borne fruit in promoting long-run economic growth.

Economic developments last year were very favorable. Nominal GNP growth of about 9 1/2 percent was in line with FOMC expectations and was accompanied by growth of M1 and M2 near the midpoints of their ranges. Because of favorable supply-side developments—such as declining oil prices, a strong dollar, and continued moderation of labor costs—this GNP growth was associated with more rapid real growth and less inflation than initially anticipated. It is gratifying that larger output and employment gains were possible without producing incipient inflationary pressure that would ultimately undermine economic growth.

Looking ahead to 1985, I believe the approach to monetary policy should be similar to that of the past year. The announced ranges for monetary growth are consistent with continued economic expansion. Private forecasters predict real GNP growth of about 3 1/2 percent this year. Based on experience last year, I believe the Federal Reserve should be prepared to accommodate this or even higher real growth as long as it is not achieved at the price of a higher trend inflation rate. We do not know how rapidly the economy can grow in this third year of recovery without putting excess demands on labor and product markets. We do know that allowing such excess demands to persist will lead eventually to higher actual and expected inflation that would erode the foundation for sustainable growth. It would be irresponsible for the Federal Reserve to pursue such a myopic policy of allowing excess demands to persist. We did not do so last year and should not do so this year.

In summary, the nation's overall economic objectives can best be achieved within a framework of sustainable economic growth.

The major contribution that monetary policy can make to sustained economic growth is to ensure reasonable price stability.

For this reason, both monetary and fiscal policies should be aimed at achieving this laudable goal. The major contribution that monetary policy can make to sustained economic growth is to ensure reasonable price stability.

Commodity Prices and Monetary Policy Reform

By C. Alan Garner

In the 1970s, the United States experienced high and volatile rates of inflation. Although the inflation rate has decreased dramatically in recent years, concern remains about the harmful effects of price instability. Changes in the aggregate price level, particularly when unanticipated, adversely affect economic welfare. Inflation arbitrarily redistributes income and causes uncertainty about future prices, leading to poor resource allocation and reduced real output.

Because of the harmful effects of inflation, the Federal Reserve has sought to stabilize the aggregate level of prices. As part of its stabilization efforts, the Federal Reserve has modified its policy targets and operating procedures in recent years, giving more attention to growth of the monetary aggregates. However, some economists have proposed more extensive changes to constrain money creation and ensure long-term price stability. One set of monetary reform proposals would establish a closer link between money growth and commodity prices.

This article argues that monetary reforms requiring a close link between commodity prices and money growth are inadvisable. In arriving at this position, the first section of the article sets forth criteria for a desirable monetary system and evaluates the current U.S. system relative to these criteria. The second section shows that a commodity standard would result in inefficient resource use and potential economic disruptions without guaranteeing price stability, thus failing to satisfy the criteria for a desirable monetary system. The third section argues that commodity prices would not make a good policy target within the present monetary system but that they might provide useful information for setting money growth targets.

A framework for evaluating monetary systems

Any discussion of fundamental monetary reform requires a set of desired characteristics

C. Alan Garner is an economist in the Economic Research Department at the Federal Reserve Bank of Kansas City.

and an evaluation of the existing monetary system. Countries have tried a variety of monetary systems in the past, but none has been ideal in every respect. The purpose of a monetary system is to promote the smooth and efficient functioning of the economy. As the medium of exchange, money lowers the costs of trading goods and services. Money is also a unit of account and a store of value. Because of the various functions of money, several criteria are relevant in comparing monetary systems.

Monetary reforms requiring a close link between commodity prices and money growth are inadvisable.

Desirable characteristics of a monetary system

One desirable characteristic of a monetary system is that it should ensure reasonable long-run stability of the aggregate price level. The value of money—its purchasing power in terms of goods and services—is inversely related to the general level of prices. Inflation, therefore, reduces the purchasing power of money. Inflation also reduces the real value of financial assets whose value is fixed in money terms. Finally, inflation causes uncertainty about the future price level and so lessens the willingness to make long-term financial commitments. If the inflation rate becomes too rapid, money loses its general acceptability in exchange, thereby reducing the efficiency of the real economy.

To prevent rapid inflation, the monetary system must limit the growth of the money supply. The value of money depends ultimately on its scarcity, which reflects supply and demand conditions. By keeping the money supply from growing more rapidly than needed for sustained economic growth, the monetary system can ensure that money retains a reasonably stable value. Long-term price stability is also enhanced if people believe that money growth will not be excessive in the future. A credible commitment to price stability by the monetary authorities can help avoid inflationary expectations and their attendant economic uncertainties.

A second desirable characteristic of a monetary system is that it should not divert resources unnecessarily from the real sector of the economy to the monetary sector. Economic welfare depends ultimately on the production and consumption of real goods and services. Any monetary system requires some real resources to operate, but unnecessary use of resources in the monetary sector reduces the amount of goods and services for consumers.

A third desirable characteristic of a monetary system is that it should foster short-run stability of prices, employment, and real output. Unpredictable variations in money growth can cause fluctuations in aggregate spending and output. Unless the economy has substantial unemployed resources, a surge in spending can lead to inflationary pressures. Conversely, a drop in spending can create unemployment and excess capacity. At a minimum, the monetary system should not be a source of disturbances to aggregate spending.

Evaluating the current monetary system

The U.S. monetary system is based on fiat money—money not backed by anything of intrinsic value. Examples of fiat money are token coins, Federal Reserve notes, and checkable deposits. Because there is no inherent limit on the supply—or value—of fiat money, individuals hold it only to the extent that they believe their money balances will retain reasonably stable purchasing power.

To ensure long-run stability of prices, the current monetary system requires that the Federal Reserve exercise restraint in creating money. Although money creation depends to some extent on the behavior of depository institutions and the asset preferences of the nonfinancial sector, Federal Reserve policy actions dominate long-term movements of the money supply. Most advocates of a commodity-based monetary system doubt that central banks will exercise adequate restraint. They cite the accelerating inflation of the 1970s as evidence that there must be some institutional constraint on money creation to ensure reasonable price stability. However, rapid inflation is not an inevitable consequence of the current monetary system, and the Federal Reserve has adopted target money growth ranges as an aid in long-run restraint.

A desirable characteristic of the current monetary system is that it diverts few resources from the real sector of the economy. The Federal Reserve can expand or contract the money supply through a series of relatively inexpensive financial transactions. To increase the quantity of money, the Federal Reserve buys securities in the open market, making appropriate bookkeeping entries when the proceeds are added to the reserve accounts of depository institutions. Using these reserves, the institutions can make loans and expand the supply of money. In this process, few real resources are diverted from the production of goods and services.

To prevent rapid inflation, the monetary system must limit the growth of the money supply.

Moreover, the current system need not result in short-run fluctuations of money and prices that disrupt the smooth functioning of the economy. Because there is no inherent constraint on the money supply, the Federal Reserve can take whatever discretionary policy actions seem necessary to reduce short-run fluctuations in output, employment, and prices. Indeed, historical evidence shows that output fluctuations have been smaller under the current monetary system than under previous systems. For example, recessions have been much less severe in the postwar period than in earlier years.[1] Although the current monetary system is not solely responsible for this increased economic stability, the monetary system has undoubtedly contributed to the smooth functioning of the economy.

Commodity standards

A monetary system with a commodity standard requires that the money price of some commodity or group of commodities be fixed. Proponents of commodity standards place primary emphasis on the first desirable characteristic of a monetary system, the ability to provide long-term price stability. They believe the system should be governed by rules and institutions that put inherent limits on the growth of the money supply.[2] It is also important, however, to consider the other two desirable characteristics of a monetary system, low real resource costs and the potential for avoiding economic disruptions. A commodity

[1]The greater stability of the postwar period is partly illustrated by the durations of business cycle expansions and contractions, as determined by the National Bureau of Economic Research. Over the ten peacetime cycles from 1879 to 1914, the average contraction lasted 20 months and the average expansion lasted 23 months. For the six peacetime cycles from 1945 to 1982, the average contraction lasted 11 months and the average expansion lasted 34 months

[2]Advocates of a commodity standard have generally sought to restrict money creation and stabilize the price level, but Leland Yeager pointed out that some recent proponents of the gold standard prefer a system that would encourage money growth and inflation. See Leland B. Yeager, "Supply-Side Inflationism," *Cato Policy Report*, July/August 1984.

standard fares less well on these criteria. This section describes commodity standards in more detail and examines arguments for and against adopting a commodity standard.[3] Particular attention is paid to the gold standard because of its historical importance and recent interest, but the basic arguments are applicable to any commodity standard.

Essential features of a commodity standard

To fix the price of one or more commodities as required by a commodity standard, there must be supporting legal and institutional arrangements. These arrangements assure that the money supply adjusts as necessary to keep a constant price for the commodities. Under a gold standard, for example, the government would set the price of gold by law. To guarantee that the official price prevails in the market, the government would hold substantial gold stocks and agree to buy or sell gold at this price. The official holdings of gold must be large enough to meet current and prospective demands for gold by the private sector.

Under a commodity standard, supply and demand in the private sector create a natural scarcity of the reserve commodity that limits increases or decreases in the money supply. For example, if the government fixes the dollar price of gold, then the purchasing power of the dollar is determined by the scarcity of gold. Under a gold standard, there is a nonmonetary as well as a monetary demand for gold. The nonmonetary demand results from use of gold in the private sector for industrial and ornamental purposes. Similarly, the supply of gold is limited by rising production costs in the mining industry. Together, the supply of and demand for gold by the private sector create a natural scarcity that limits the potential for monetary expansion and thereby limits inflation.

The gold standard reached its peak in the United States from 1879 to 1914. The U.S. monetary system was characterized by a fixed dollar price of gold, a fractional reserve banking system with gold as a primary reserve, and free flow of gold between countries in settlement of international accounts. There was no central bank, but the Treasury stood ready to buy or sell gold at the official price of $20.67 per ounce. Fractional reserve banking reduced the resource costs of the gold standard by allowing a larger amount of money to be based on a given amount of gold reserves. Because the gold standard was international, exchange rates between the dollar and major foreign currencies were fixed, and gold moved freely across national boundaries in response to payments surpluses or deficits.

A commodity standard requires that the money price of some commodity or group of commodities be fixed.

To illustrate the adjustment mechanisms of a gold-standard economy, consider what happens if the prices of consumer goods and services increase. The purchasing power of money and the relative price of gold fall. Over time, the decrease in the relative price of gold discourages new gold production and encourages greater nonmonetary use of gold. Because less gold is sold to the monetary authority, growth of the money supply slows. Slower money growth holds down aggregate

[3]There are many possible commodity-based proposals for monetary reform. Commodity standards and commodity price targets are representative cases for expositional purposes, but some of the recent proposals lie between these extremes. For example, a gold exchange standard was advocated by Robert Mundell, "The Debt Crisis: Causes and Solutions," *The Wall Street Journal*, January 31, 1983. Mundell's plan has a central dollar/gold parity, but the actual dollar price of gold would be allowed to fluctuate in a band around the parity. Such proposals are not discussed explicitly here, but they are subject to the same basic criticisms concerning real resource costs and relative price changes.

spending and puts downward pressure on prices. Also, the initial rise in consumer prices makes exports less competitive and imports cheaper, leading to a trade deficit. Foreign countries with a trade surplus accumulate the domestic currency and convert it to the international reserve asset, gold. The resulting loss of gold reserves to other countries further decreases the domestic money supply and, therefore, spending. Similarly, the lower gold price leads to a decline in gold production, which depresses real income and spending by employees and suppliers of the mining industry. All of these mechanisms tend to pull consumer prices back to their original level.

Much of the appeal of a commodity standard lies in the inherent constraint that it places on money growth.

One alternative to the gold standard is a system in which the dollar is backed by a fixed-weight bundle of several commodities.[4] For example, the monetary authority might fix the dollar price of a resource unit containing one ounce of gold, 100 bushels of wheat, and 500 pounds of cotton. In practice, the resource unit might contain an even wider range of commodities. Under such a multicommodity standard, the monetary authority would permit relative prices between reserve commodities to vary but would buy or sell commodity bundles to maintain the dollar price of the composite unit. In all other respects, a multicommodity standard could function the same as a gold standard.

Most plans to establish a commodity standard in the United States have involved gold. This is not surprising because gold played a role in the U.S. monetary system during most of the period from 1834 to 1973. Some people still have strong emotional attachments to gold, and governments still hold large official stocks. In its 1982 report, however, the U.S. Gold Commission analyzed versions of the gold standard and recommended that there be no fundamental change in the monetary status of gold.[5]

Arguments for a commodity standard

Much of the appeal of a commodity standard lies in the inherent constraint that it places on money growth. Advocates of the gold standard believe that long-term price stability is more likely to be achieved by automatic mechanisms for monetary control than by the decisions of central banks and government agencies. Moreover, the automatic adjustments of a gold standard might increase the credibility of the nation's commitment to moderate money growth and stable prices.

William Fellner has argued that a credible policy stance can control inflation with less loss of real output and less unemployment

[4] In the 1940s, Benjamin Graham and Frank Graham proposed a "commodity-reserve currency." See Benjamin Graham, *World Commodities and World Currency*, McGraw-Hill, New York, 1944; and Frank D. Graham, *Social Goals and Economic Institutions*, Princeton University Press, Princeton, N.J., 1942.

Robert Hall has considered (but not endorsed) a multicommodity plan based on an earlier proposal by Irving Fisher. Hall envisioned a commodity bundle containing aluminum, copper, plywood, and ammonium nitrate. Historically, a weighted average of the prices of these commodities has been highly correlated with the general cost of living. Hall's plan allows periodic redefinitions of the dollar price of the resource unit. See Robert E. Hall, "Explorations in the Gold Standard and Related Policies for Stabilizing the Dollar," in *Inflation: Causes and Effects*, by Robert E. Hall, ed., University of Chicago Press for the National Bureau of Economic Research, 1982, pp. 111-122. Fisher described his plan in his *Stabilizing the Dollar*, Macmillan, New York, 1925.

[5] *Report to the Congress of the Commission on the Role of Gold in the Domestic and International Monetary Systems*, Volumes 1 and 2, Washington, March 1982. For arguments in favor of a gold standard, see Representative Ron Paul and Lewis Lehrman, *The Case for Gold*, Cato Institute, Washington, 1982; and statements by Jastram, Reynolds, and Rothbard in Volume 2 of the Gold Commission report.

than a policy that lacks widespread confidence.[6] According to Fellner, wage and price setting are forward-looking processes that depend crucially on inflation expectations. In turn, inflation expectations reflect the public's confidence in monetary institutions and policies. Therefore, if a commodity standard makes price stabilization policies more credible, expected inflation rates would be lower, the upward momentum of wages and prices would diminish, and inflation might be controlled at a lower cost.

A multicommodity approach has some advantages over a single-commodity standard. Production of the commodities used in a multicommodity standard affects a broader range of industries and a larger percentage of total output and employment than with a single commodity standard. Also, a composite commodity unit would be related more dependably to the aggregate price level than a single commodity such as gold. This is so because relative price disturbances to any one commodity have less effect on the relative price of the bundle to the extent that other reserve commodities experience offsetting price changes.

Problems with a commodity standard

Even if a commodity standard provides automatic adjustment mechanisms, such mechanisms do not guarantee satisfactory economic performance. For example, a gold standard would not do well on the three criteria for evaluating monetary systems. A gold standard might limit money growth and inflation in the long run, but it would also divert resources unnecessarily from the private sector and create the potential for short-run economic disruptions.

A major disadvantage of a gold standard is that scarce resources are locked up in monetary reserves. Gold is absorbed by official stocks and by any increase in private stocks due to gold's monetary role. If a fiat standard can efficiently perform the basic monetary functions, then gold is released for alternative uses such as ornamentation or the production of other goods and services.

A major disadvantage of a gold standard is that scarce resources are locked up in monetary reserves.

Another disadvantage of a gold standard is that changes in the relative price of gold could have adverse short-run effects on aggregate employment and output. For example, suppose that a technological innovation creates new industrial demands for gold. Because gold becomes scarcer, its price must rise relative to other goods and services. But the dollar price of gold is fixed because the monetary authority sells gold from its reserves to maintain the official gold price. Gold sales by the monetary authority withdraw reserves from the banking system and cause a drop in the money supply. A fall in the money supply decreases spending on all other goods and services, reducing their dollar prices and raising the relative price of gold. Since many product prices adjust slowly, substantial declines in real economic activity may be required to produce the necessary changes in relative prices. Equally painful adjustments must occur in labor markets, where substantial unemployment could precede wage declines.

In the long run, a change in the relative price of gold would affect the aggregate price level but not real output. Consider, again, the

[6]William Fellner, "The Credibility Effect and Rational Expectations: Implications of the Gramlich Study," *Brookings Papers on Economic Activity*, 1979:1, pp. 167-178. Although sympathetic to the gold standard, Fellner does not believe a return to gold is feasible at this time.

case of new industrial demands for gold. The fall in prices and wages resulting from the higher relative price of gold would ultimately lead to restoration of full employment and production. However, the aggregate price level would be permanently lower because of the drop in the money supply. Conversely, a major gold discovery would lead to an increase in the money supply and higher aggregate spending. Higher spending would reduce the relative price of gold by raising the dollar prices of all other goods and services—that is, by general inflation. Because of the potential for relative price changes, a gold standard could never guarantee long-run stability of the aggregate price level.

During the years from 1879 to 1914, the U.S. gold standard permitted substantial variation in both prices and real output. Gold did limit long-run movements in the price level. Over periods of many years, price level movements in one direction were typically followed by price level movements in the opposite direction. Empirical evidence suggests that short-run price uncertainty under the gold standard may have been just as great as in recent years.[7]

Furthermore, two of the major forces that helped stabilize money growth and prices under the historical gold standard would not be effective if the United States were to adopt a gold standard now. A major adjustment mechanism under the classical gold standard was the movement of gold between countries to settle international trade imbalances. With the current flexible exchange rate system, though, exchange rates adjust to prevent sustained trade imbalances. As a consequence, there would be no international gold flows to affect bank reserves or the money supply if exchange rates remained flexible.[8] Moreover, expansion or contraction of domestic gold production would have very little direct effect on employment and spending because gold production now accounts for a negligible fraction of GNP in the United States.

In addition, changes in the structure of the gold market have reduced the stabilizing response of gold output to a change in the relative price of gold. More than 70 percent of world production now comes from the Republic of South Africa or the Soviet Union. Because gold production is highly concentrated, gold output may not respond to price changes in the expected way. For example, world gold production declined during the 1970s despite a dramatic rise in the relative price of gold. Moreover, a gold standard could

Changes in the relative price of gold could have adverse short-run effects on aggregate employment and output.

[7]Richard Cooper has shown, for example, that the annual changes in both wholesale prices and real per capita income were more variable under the gold standard than in the postwar period. See "The Gold Standard: Historical Facts and Future Prospects," *Brookings Papers on Economic Activity*, 1982:1, pp. 1-56. For further discussion of the historical gold standard, see Roy W. Jastram, "The Golden Constant, or the Gold Standard and the Behavior of Commodity Price Levels," and Anna Schwartz, "The Past, Current and Prospective Role of Gold in the U.S. Monetary System," both in *The Gold Problem. Economic Perspectives*, by Alberto Quadrio-Curzio, ed., Oxford University Press for the Banca Nazionale del Lavoro and Nomisma, Oxford, 1982.

[8]Any modern U.S. gold standard would probably be a domestic standard with flexible exchange rates. Some proponents of gold have assumed that U.S. adoption of a gold standard would necessarily lead to a world system with fixed exchange rates, but there is no persuasive reason to support this view. The current flexible exchange rate system gives individual countries a substantial degree of monetary independence, whereas a fixed rate system would compel small countries to follow world trends of money growth and inflation. Because countries attach high priority to domestic objectives such as full employment and economic growth, they are unwilling to surrender the policy independence provided by a flexible rate system. At present, there is no movement toward an international gold standard, and any effort at resumption would face serious problems such as the large size of foreign dollar holdings relative to the existing U.S. gold reserve.

inject international politics into the domestic monetary system. The United States might be forced to abandon or modify its monetary standard if the government of South Africa or the Soviet Union tried to manipulate the price of gold for political purposes.[9]

Resumption of a gold standard after a long period under a fiat money system would raise special problems. It would be difficult to determine the proper "reentry price" for gold because the new monetary framework could alter the private sector's demand for and supply of gold.[10] If so, historical prices would not be a good guide to the new equilibrium price, and the selection of an incorrect reentry price could have serious inflationary or deflationary consequences.

Despite claims to the contrary, returning to a gold standard might not substantially increase the credibility of monetary policies designed to achieve price stability. Recognizing the dangers of an incorrect reentry price, the public would not immediately assign high credibility to the new monetary standard. Even after a period of successful operation, there still might be pressures for abolition or modification of the gold standard, as there were during the earlier gold standard period. At its height, the U.S. gold standard was controversial. In addition to an extended interruption of the gold standard from 1862 to 1878, there were several temporary suspensions of gold convertibility. The precariousness of the gold standard, even during its period of widest scope and acceptance, suggests that return to a gold standard might not substantially improve the credibility of the government's commitment to price stability.

Although preferable to the gold standard in some respects, a multicommodity system also has drawbacks. The major drawback is that storage costs would generally be higher than under the gold standard. Whereas gold is extremely durable, commodities such as wheat, corn, and coal would deteriorate over time. Commodities with a low value relative to their physical volume would require costly warehouse facilities for storage. Moreover, a multicommodity standard would share with the gold standard potential defects such as relative price changes and political manipulation of commodity supplies.

Evaluating commodity standards

A commodity standard does relatively well with respect to the first desirable characteristic of a monetary system, long-run price stability. By linking money creation to the market-determined scarcity of commodities, a commodity standard restrains money growth and inflation. However, the aggregate price level would not be perfectly stable in the long run because of trends in the price of commodities relative to other goods and services. A commodity standard might provide greater price stability than a poorly managed fiat system, but a well managed fiat system could certainly prove superior.

With respect to the other two desirable characteristics, a commodity standard would be inferior to the current fiat system. A commodity standard would divert commodities into the monetary system when these resources could instead add directly to consumer welfare. Furthermore, a commodity standard would permit substantial disruption of economic activity by microeconomic and political factors that influ-

[9]A flexible exchange rate system would not prevent a foreign shock to the gold market from disturbing domestic U S. production, employment, and prices A change in the relative price of gold abroad would cause the dollar to appreciate or depreciate relative to foreign currencies, and this would affect U S. imports and exports.

[10]For additional discussion of the reentry problem, see Henry C Wallich, "Obstacles to a Return to the Gold Standard," in *The Gold Problem· Economic Perspectives*.

ence relative commodity prices. From a macroeconomic standpoint, these disturbances are arbitrary and harmful.

Therefore, when judged against the three basic criteria, a commodity standard seems worse than the present fiat system. Unless one is extremely skeptical about the ability of central banks to achieve reasonable price stability, there is little reason to accept the disadvantages of a commodity standard.

Commodity prices within a fiat system

Recognizing the problems inherent in a commodity standard, some advocates of monetary reform have proposed a more limited role for commodity prices in the existing fiat system. One proposal is for the Federal Reserve to target commodity prices as a way of ensuring that money growth is consistent with long-run price stability. Commodity prices could become the intermediate target of monetary policy within the current institutional framework because commodity price targets would not require official commodity reserves. Even if commodity prices are not a good policy target, they still might provide useful information for the implementation of monetary policy.

Features of an intermediate target

An intermediate target is an economic variable that is the predominant determinant of monetary policy actions.[11] The intermediate target value is not itself a policy goal. Instead, the target variable should be so closely related to the macroeconomic goal variables that achieving the desired intermediate target value can be relied on to produce the desired macroeconomic outcomes.

A variable used as an intermediate target should have two characteristics. First, the target variable should be closely related to real output growth and inflation, the two primary goals of monetary policy. Second, the target variable should be affected quickly and reliably by open market operations and changes in the discount rate, the two primary instruments of monetary policy. The theory underlying use of intermediate targets is that the channels of monetary policy are so complex and the time lags so long that an intermediate variable between the policy instruments and the macroeconomic goals is needed as a policy guide. If the target variable is closely related to the policy goals, then maintaining the proper value of the intermediate target will achieve the desired values of the goals. And, if the target variable is reliably related to the instruments of monetary policy, then the Federal Reserve can maintain the value of the intermediate target.

Some advocates of monetary reform have proposed a more limited role for commodity prices in the existing fiat system.

Arguments for commodity price targets

Several recent proposals have called for using either the price of gold or an index of sensitive commodity prices as an intermediate target of monetary policy.[12] For example, due

[11]For further discussion of intermediate targets, see Gordon H. Sellon, Jr., and Ronald L. Teigen, "The Choice of Short-Run Targets for Monetary Policy: Part 1," *Economic Review*, Federal Reserve Bank of Kansas City, April 1981, pp. 3-16, and Henry C. Wallich, "Recent Techniques of Monetary Policy," *Economic Review*, Federal Reserve Bank of Kansas City, May 1984, pp. 21-30.

[12]Robert J. Genetski, "The Benefits of a Price Rule," *The Wall Street Journal*, December 10, 1982; Alan Reynolds, "The Trouble with Monetarism," *Policy Review*, 21, Summer 1982, pp. 19-42; and Jude Wanniski, "The Fed: On Target for Snail-Paced Recovery," *The Wall Street Journal*, November 9, 1983

to concern about deflationary pressures, Jude Wanniski in late 1983 advocated easing monetary policy to stabilize the price of gold at $425 per ounce. He argued that "the price of gold, not the quantity of money, is the best leading indicator of future inflations and deflations." Robert Genetski proposed that movements of sensitive commodity prices be emphasized in adjusting the instruments of monetary policy. Genetski recommended that a monthly "range of discretion" be established for the monetary base. As long as the monetary base remains within the specified range, the Federal Reserve may conduct policy as it sees fit. However, increases in sensitive commodity prices would automatically lower the range of discretion and decreases in commodity prices would automatically raise it. Both Wanniski and Genetski claimed that their proposed commodity price targets would be superior to money growth targets in achieving general price stability.

Commodity prices are not likely to satisfy the requirements for a good intermediate target.

Although commodity prices have not traditionally been viewed as a policy target, there is some basis for thinking they might meet the requirements for an intermediate target. First, changes in commodity prices are related to monetary policy's goal variables. The percentage change in prices of sensitive materials is one component of the widely followed composite index of leading indicators. Because of the auction character of commodity markets, sensitive commodity prices respond quickly to aggregate supply and demand conditions. Because of this, commodity prices may reflect a broad range of macroeconomic information. In addition, there are direct linkages from commodity markets to the aggregate economy. Commodity production affects real income and expenditure, and commodity prices influence the costs of other goods and services. Second, there are channels by which monetary policy affects, and could conceivably control, commodity prices. Monetary policy influences real economic activity, thereby affecting the current consumption and industrial use of commodities. Policy actions also influence real interest rates and expected inflation, factors that affect desired commodity holdings.

Problems with a commodity price target

In spite of the linkages between commodity prices and macroeconomic variables, commodity prices are not likely to satisfy the requirements for a good intermediate target. Policymakers would have difficulty extracting reliable macroeconomic information from commodity prices because of relative price changes, the same basic problem that plagues commodity standards. Also, precise control of commodity prices would be difficult because the linkages to the instruments of monetary policy are indirect and hard to measure.

Relative price changes would pose severe problems for monetary policy with respect to the first requirement—a close relationship to goal variables. Large fluctuations in the relative prices of commodities are not uncommon. Because market-specific disturbances could lead to changes in the prices of commodities relative to other goods and services, movements in a commodity price index could be a misleading guide to future inflation and future economic activity. Unless policymakers recognized these market-specific disturbances and adjusted the target accordingly, a policy response based on changes in commodity prices could have undesirable effects on aggre-

gate output and prices.[13] Unfortunately, it is difficult to determine whether changes in commodity prices are due to market-specific disturbances or aggregate economic fluctuations. As a result, commodity prices are not closely related to inflation or other monetary policy goal variables.

There is another important caveat concerning the empirical relationship between commodity prices and macroeconomic goal variables. Historical evidence might give a misleading impression of the size of relative price movements under a commodity price target. In the postwar period, commodity prices did not play a major role in monetary policy. A shift toward a policy regime based on commodity prices could alter economic behavior.[14] For example, inflation expectations are a major determinant of commodity prices and would be changed by adoption of a commodity price target. Because of the increased importance of commodity prices in policy implementation, commodity prices would fluctuate less relative to the general price level. As a consequence, historical experience does not provide conclusive evidence on the significance of relative price changes under a commodity price target.

Moreover, the Federal Reserve could not control commodity prices satisfactorily, thus violating the second requirement for a good intermediate target. The channels through which monetary policy affects commodity prices are complex and circuitous. Policy actions influence current consumption and industrial use of commodities through their effect on the overall level of economic activity. Monetary policy also affects price expectations and interest rates, which influence speculative holdings of commodities. These different effects do not operate with the same time lag, and because of differences in price elasticities and storability, not all commodities are affected equally. Also, price expectations are difficult to measure or control.[15] As a result, it would be difficult for policymakers to produce the desired movements in an index of sensitive commodity prices.

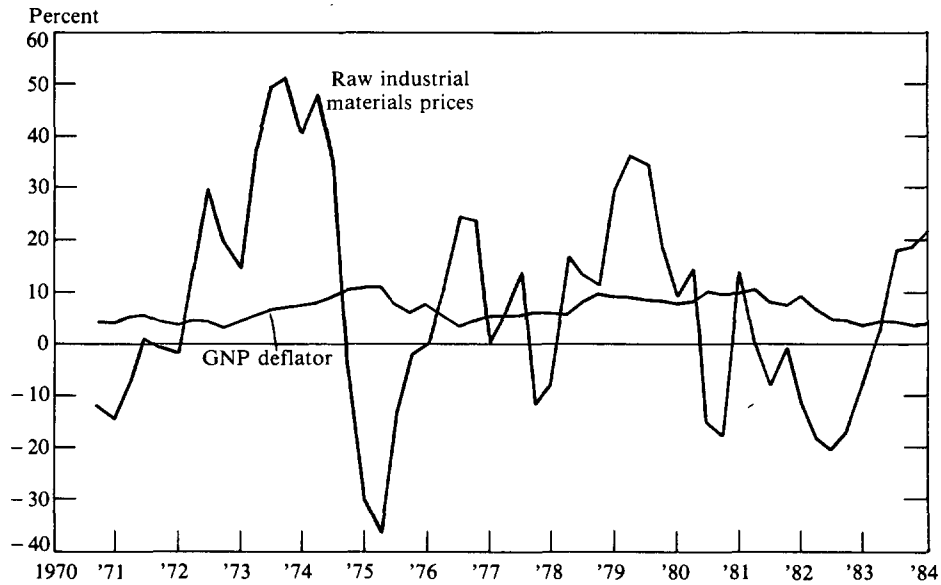
The monetary aggregates seem to satisfy the basic criteria for good intermediate targets much better than commodity prices do. Admittedly, the monetary aggregates are not ideal policy targets. Shifts in the money demand function or changes in the interest sensitivity of private spending can alter the relationship between the monetary aggregates and macroeconomic goal variables. Similarly, changes in the deposit preferences of the nonfinancial sector or in the willingness of banks to borrow from the Federal Reserve impair short-run monetary control. Nevertheless, both theoretical and empirical studies confirm that money growth is closely related to aggregate spending. Moreover, the Federal Reserve can control money growth better than commodity prices because the policy instruments directly affect the money supply. For these reasons,

[13]Brunner emphasized that the relationship between sensitive materials prices and the general price level is apparently nonstationary. See Karl Brunner, "From the 'Upper Tail Theory of Inflation' to the 'Lower Tail Theory of Deflation,'" mimeo, Shadow Open Market Committee, 1984. Further criticism of commodity price rules is found in R.W. Hafer, "Monetary Policy and the Price Rule: The Newest Odd Couple," *Review*, Federal Reserve Bank of St. Louis, 65, February 1983, pp. 5-13.

[14]The general point that a change in the monetary policy regime can alter the behavior of producers and consumers is often called the "Lucas critique." See Robert E. Lucas, Jr., "Econometric Policy Evaluation: A Critique," in *The Phillips Curve and Labor Markets*, by Karl Brunner and Allan Meltzer, eds., Carnegie-Rochester Series on Public Policy, North-Holland, Amsterdam, 1976.

[15]E.C. Hwa found that price expectations had a significant effect on commodity prices during the 1973-75 period but no significant influence before 1973. He concluded that "... the underlying forces that govern price expectations may be very unstable at times ... unless the variability of price expectations can somehow be captured, forecasting commodity prices will be a risky venture." See E.C. Hwa, "Price Determination in Several International Primary Commodity Markets: A Structural Analysis," *International Monetary Fund Staff Papers*, 26, March 1979, pp. 157-188.

CHART 1
Changes in raw industrial materials price index and GNP deflator
(Two-quarter changes at annual rates)



the monetary aggregates deserve greater weight than commodity prices in determining how to adjust the policy instruments in order to achieve the desired objectives.

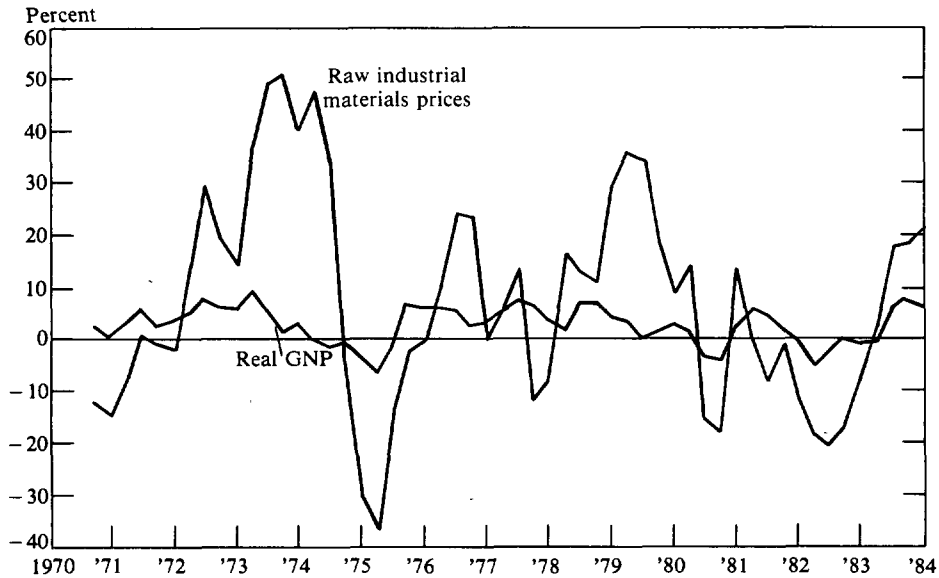
Commodity prices as an information variable

Although commodity prices do not satisfy the requirements for a good intermediate target, they may be useful as information variables. An information variable helps policymakers determine the true relationship between the intermediate targets and the goal variables. Many economic variables can serve simultaneously in this capacity. The Federal Reserve assigns primary importance to the growth rates of the monetary aggregates in seeking to achieve long-run price stability and high economic growth. However, if the economic structure changes or if the targets are set incorrectly because of inadequate economic knowledge, money growth targets may need to be modified. Commodity prices may help determine when and to what extent such modifications are necessary.

Empirical evidence suggests that commodity prices provide only limited information about the future course of the economy. Although commodity prices are a leading economic indicator, their relationship to the goal variables is not reliable enough to justify a central place in monetary policy. Charts 1 and 2 demonstrate how weak the relationship between commodity prices and the ultimate policy objectives really is. Chart 1 plots percentage changes in

The monetary aggregates deserve greater weight than commodity prices in determining how to adjust the policy instruments.

CHART 2
Changes in raw industrial materials price index and real GNP
(Two-quarter changes at annual rates)



raw industrial prices and the GNP deflator from 1970 through 1983. Chart 2 plots changes in raw industrial prices and real GNP over the same period.[16] In neither case is the relationship particularly close, and there are clear examples of false signals. For example, Chart 1 shows that the rate of change of sensitive commodity prices increased substantially in 1978 and decreased sharply in 1979 even though the rate of change in the GNP deflator remained quite stable. Similarly, in the second half of 1978, a rise in the rate of commodity price inflation was accompanied by a decline in the growth rate of real output.

Other statistical evidence supports the view that raw industrial prices are at best a weak leading indicator of real GNP. This is confirmed by the evidence in Table 1. The first three rows of Table 1 report correlations of quarterly real GNP changes with contemporaneous and lagged values of quarterly commodity price changes for various sample periods. The correlations are typically small and positive. Other studies have focused on the turning points of economic time series rather than on simple correlations.[17] These studies have found

[16]The index of raw industrial materials prices in Charts 1 and 2 covers a narrow group of industrial commodities such as tin, zinc, rubber, burlap, and cowhides. Both charts display two-quarter changes expressed as annual rates The prices of these commodities are believed to be especially sensitive to changes in demand pressures. Genetski used the same index in his discussion of commodity price rules.

[17] This approach establishes dates for peaks and troughs in materials price changes and examines the length and regularity of the lead or lag relative to turning points in other cyclical variables. In contrast, the correlation method considers all observations on the relevant variables and assigns no special significance to turning points.

Researchers at the National Bureau of Economic Research developed the turning-point methodology, and Geoffrey Moore has applied it to inflation forecasting. See Geoffrey H. Moore, "Sequences in the Inflation Cycle," *The Morgan Guaranty Sur-*

TABLE 1
Correlations between changes in commodity prices and changes in macroeconomic variables

Macroeconomic Variable	Sample Period	Lag in Commodity Prices 0	1	2	3	4
GNP	1955-84	0.32*	0.28*	0.19*	0.10	0.17
GNP	1955-70	0.34*	0.22	-0.04	-0.18	0.03
GNP	1970-84	0.28*	0.27*	0.22	0.12	0.14
GNP Deflator	1955-84	0.04	0.01	-0.02	-0.04	-0.06
GNP Deflator	1955-70	0.21	0.00	-0.08	-0.01	0.04
GNP Deflator	1970-84	-0.20	-0.20	-0.25	-0.32*	-0.38*

*Significantly different from zero at the 0.05 level.

Note: The sample periods are 1955:Q2-1984:Q1, 1955:Q2-1970:Q1, and 1970:Q2-1984:Q1. The data are quarterly changes at annual rates. Similar results are obtained with two-quarter changes.

that peaks in commodity price changes usually precede peaks in industrial production and troughs in commodity prices usually precede troughs in industrial production. The studies also find that the usefulness of commodity prices in economic forecasting is reduced by occasional false signals and considerable variation in lead times. For the most part, then, the turning-point evidence suggests that commodity prices do provide some useful information about the future course of the economy.

Commodity prices are even less closely related to inflation. The last three rows of Table 1 report correlations of changes in the quarterly GNP deflator with changes in quarterly raw industrial prices. Most of the correlations are small, and only two of the 15 are statistically significant. The switch from positive to negative correlations between the 1955-70 and 1970-84 periods shows that this is a particularly unreliable relationship on which to base policy decisions. The turning-point studies do provide some support for the view that commodity prices lead movements in the general inflation rate, but again there are false signals and inconsistent lead times.[18]

vey, April 1980, pp. 12-14, and Geoffrey H. Moore, *Business Cycles, Inflation, and Forecasting*, Ballinger Publishing for the National Bureau of Economic Research, Cambridge, Mass., 1983.

[18]Further statistical tests support these general impressions. Yeats examined the predictive powers of the Federal Reserve Board Sensitive Price Index He concluded that this index performed well as an indicator of real variables, such as industrial production and personal income, but did not help in forecasting changes of a broad price index, such as the CPI or the WPI. Neftci tested whether selected "leading" time series improved predictions of industrial production and the unemployment rate. With seasonally adjusted data, crude materials prices did not prove useful; with seasonally unadjusted data, they did Finally, Brunner tested whether sensitive commodity prices lead movements of the CPI or the GNP deflator. He concluded that they are not a good indicator of impending inflation or deflation.

See Karl Brunner, "From the 'Upper Tail Theory of Inflation' to the 'Lower Tail Theory of Deflation;'" Salih N. Neftci,

Because their relationship to the goal variables is weak and unreliable, the best policy role for commodity prices is to serve as one of a set of information variables used by policymakers to evaluate economic conditions and to set money growth targets. In this capacity, commodity prices are subordinate to the monetary aggregates but may provide information that improves the Federal Reserve's ability to reduce short-run economic fluctuations and achieve long-run price stability. Commodity prices could at least reveal market-specific supply shocks, which the Federal Reserve may want to accommodate in the short run to prevent undue economic disruptions. More generally, commodity prices may signal cyclical turning points or major changes in inflation expectations, thereby providing information useful in setting money growth targets.

Conclusion

After a period of high inflation and general economic uncertainty, it is tempting to seek reforms that hold out the prospect of a more stable price level. The costs and benefits of such proposed changes should be evaluated carefully, however. The costs of commodity standards and commodity price targets are clearcut, but their benefits are questionable. A commodity standard would impose real resource costs on the economy. Commodity prices are not a feasible policy target because they cannot be adequately controlled. Moreover, relative price changes would have adverse effects on the aggregate economy whenever commodity prices have a prominent role in monetary policy. There is little evidence that such a prominent role for commodity prices would improve short-run economic performance. Even in the long run, neither a strict commodity standard nor commodity price targets would ensure greater stability in the aggregate price level. It seems best, therefore, to concentrate on improving current monetary institutions and procedures. One possibility is to employ commodity prices as one of several information variables used to determine the monetary targets most likely to be consistent with the ultimate policy goals.

"Lead-Lag Relations, Exogeneity and Prediction of Economic Time Series," *Econometrica*, 47, January 1979, pp 101-113; and A.J. Yeats, "An Evaluation of the Predictive Ability of the FRB Sensitive Price Index," *Journal of the American Statistical Association*, 68, December 1973, pp. 782-787.

Price Stability and Public Policy

One of the major policy issues of the day is how to consolidate the gains made against inflation while sustaining economic growth. To examine this important issue, the Federal Reserve Bank of Kansas City brought together several leading economists for a symposium on price stability and public policy at Jackson Hole, Wyoming, on August 2 and 3, 1984. Contents of the 227-page proceedings are listed below.

Moderator: *Gardner Ackley*

The Causes of Inflation,
Frederic S. Mishkin
Commentary, *William Nordhaus*

The Benefits of Price Stability, *Stanley Fischer*
Commentary, *Robert J. Shiller*

Estimated Tradeoffs Between Unemployment and Inflation, *Ray C. Fair*
Commentary, *Robert J. Gordon*
Rejoinder, *Ray C. Fair*

The Role of the Central Bank in Achieving Price Stability: An International Perspective, *Helmut Schlesinger*

Moderator: *Paul W. McCracken*

Credibility and Monetary Policy,
Bennett T. McCallum
Commentary, *Alan Blinder*

Monetary Strategy with an Elastic Price Standard, *Robert E. Hall*
Commentary, *Raymond Lombra*

The Value of Intermediate Targets in Implementing Monetary Policy,
Benjamin M. Friedman
Commentary, *Stephen M. Goldfeld*

Overview Panel, *James Tobin* and *Allan H. Meltzer*

For a free copy of the proceedings of this symposium, or any of the previous symposiums listed below, write the Public Affairs Department, Federal Reserve Bank of Kansas City, 925 Grand Avenue, Kansas City, Missouri 64198

Industrial Change and Public Policy (1983)

Monetary Policy Issues in the 1980s (1982)

Modeling Agriculture for Policy Analysis in the 1980s (1981)

Future Sources of Loanable Funds for Agricultural Banks (1980)

Western Water Resources: Coming Problems and the Policy Alternatives (1979)

World Agricultural Trade: The Potential for Growth (1978)

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?

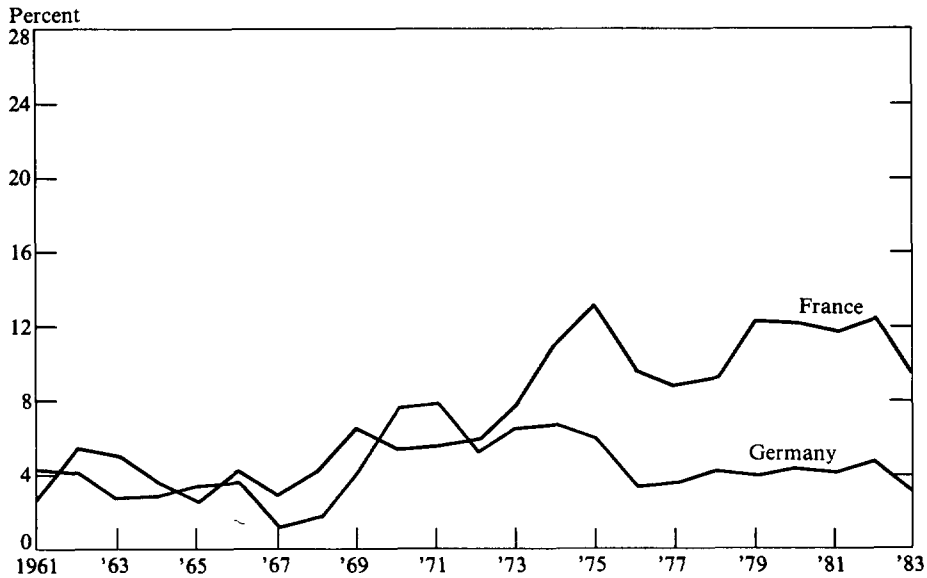
After reviewing the inflation experience of six countries since 1965, this article uses a simple economic model to break changes in inflation into inertia, supply, and demand components. Estimates from the model show generally that the same factors that explained the cross-country rise in inflation in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

George A. Kahn is an economist with the Economic Research Department of the Federal Reserve Bank of Kansas City. Kermit Daniel provided research assistance.

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.

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)

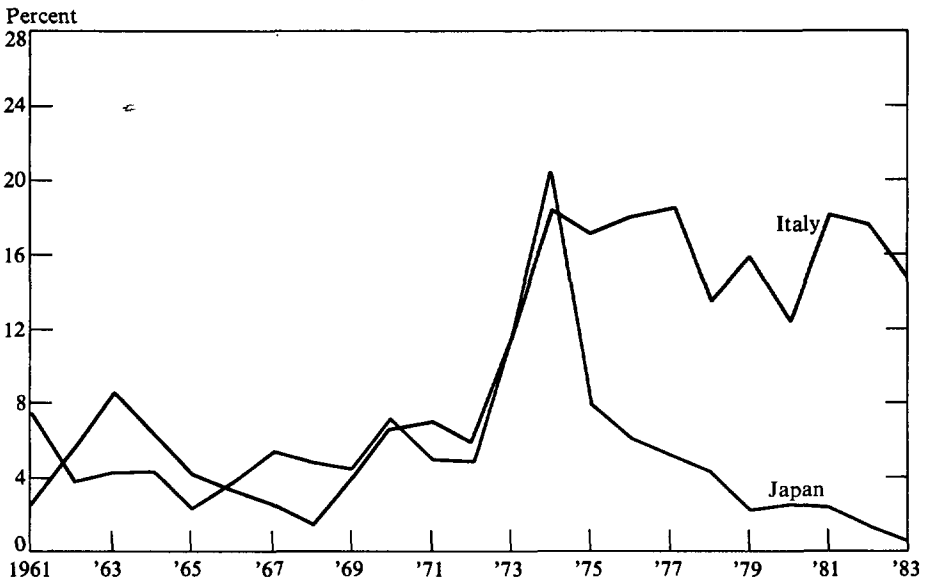
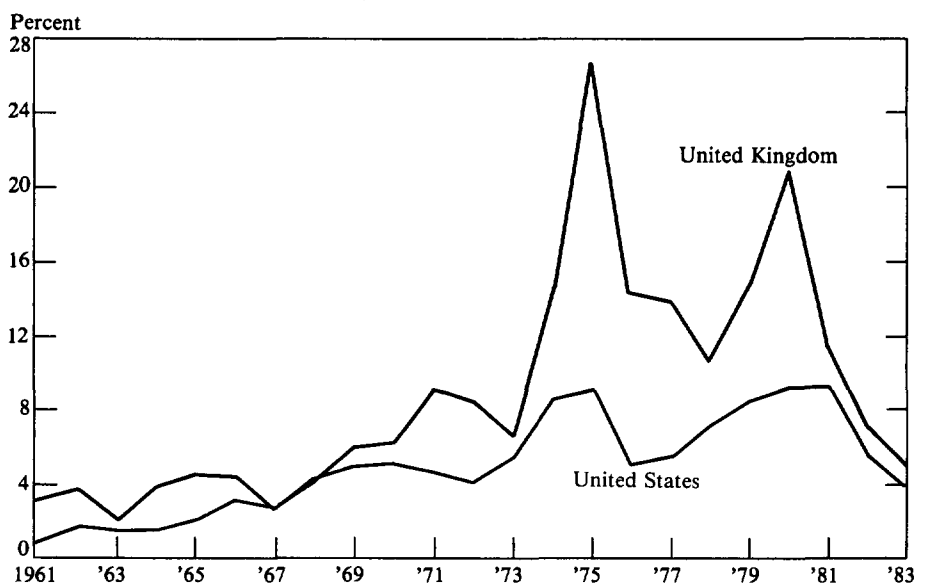


CHART 3

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 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 to the labor militancy view of creeping inflation.[7]

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

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

[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.

[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

Because of the appreciation of the dollar, lower inflation in the European countries was not easy to accomplish.

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

[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.

[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.

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 Kingdom. 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 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.

Because of differences in economic institutions, the relative importance of various causes of inflation is expected to differ across countries.

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

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

[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 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

---

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.

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

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

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

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

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,

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

[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

Variable	France	Germany	Italy	Japan	United Kingdom	United States
P	0.931	0.131+	0.793	1.024	0.467+	0.736
	(4.290)	(0.421)	(3.945)	(4.763)	(1.946)	(3.573)
GAP	-0.751+	-0.127+	-0.364	-0.324	-1.006+	-0.374
	(1.747)	(0.676)	(0.680)	(1.906)	(1.870)	(2.968)
POIL	0.047	0.019+	0.086	-0.003	0.082	0.022
	(3.133)	(1.727)	(3.071)	(0.150)	(4.316)	(2.875)
X	0.032	0.028	0.0021	-0.019	0.298	-0.121
	(0.492)	(0.424)	(0.145)	(0.288)	(2.525)	(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.

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

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

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

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

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

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

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

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

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

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 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

[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.

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

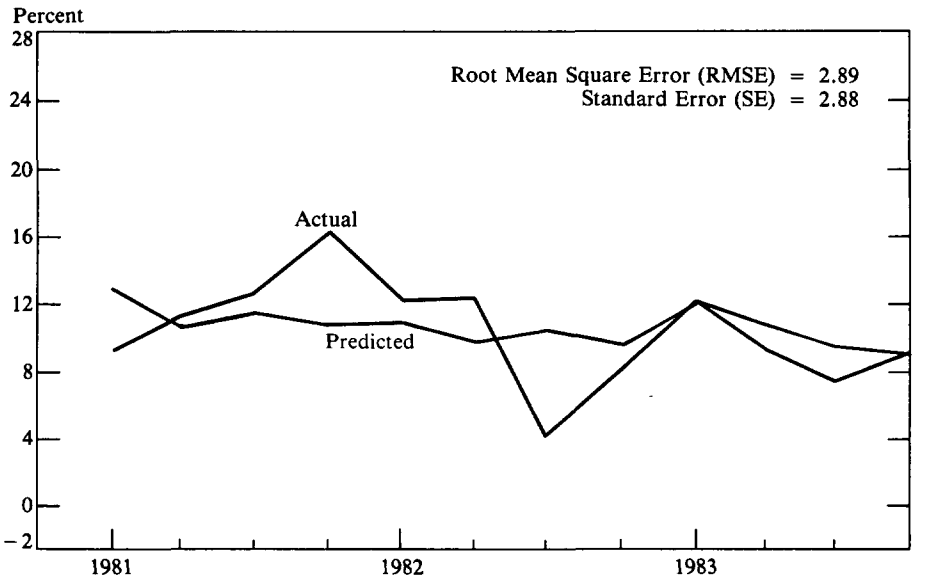


CHART 5
Actual and Predicted Inflation in Germany

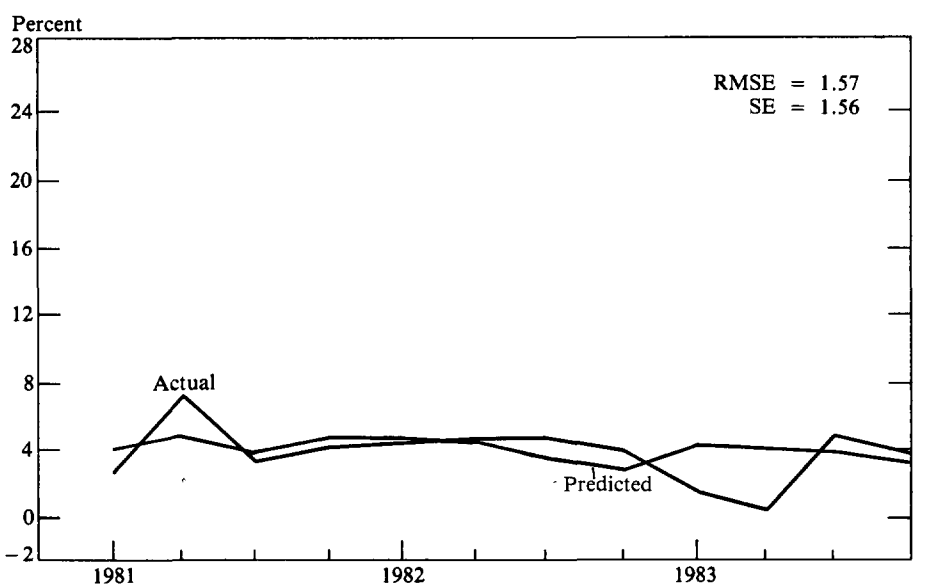


CHART 6

Actual and Predicted Inflation in Italy

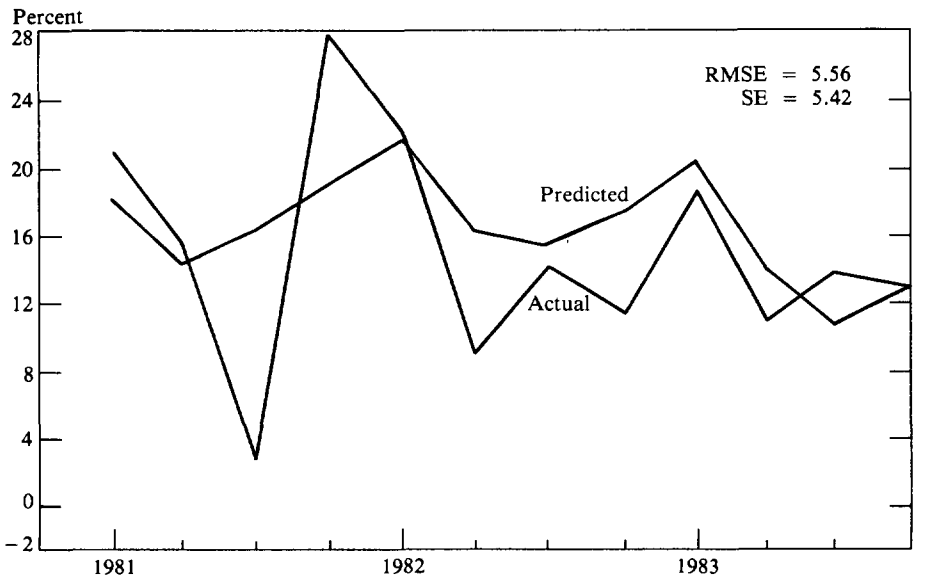


CHART 7

Actual and Predicted Inflation in Japan

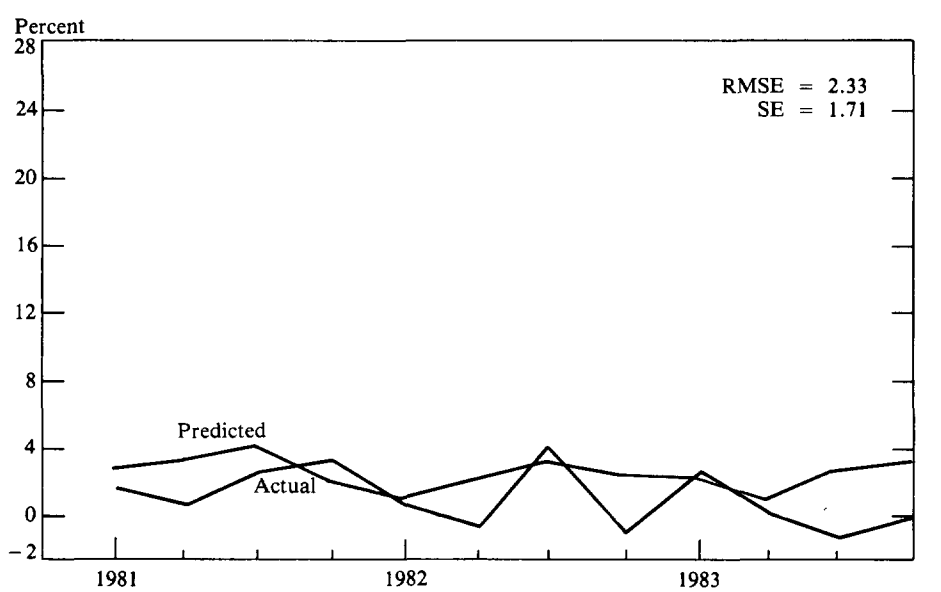


CHART 8
Actual and Predicted Inflation in the United Kingdom

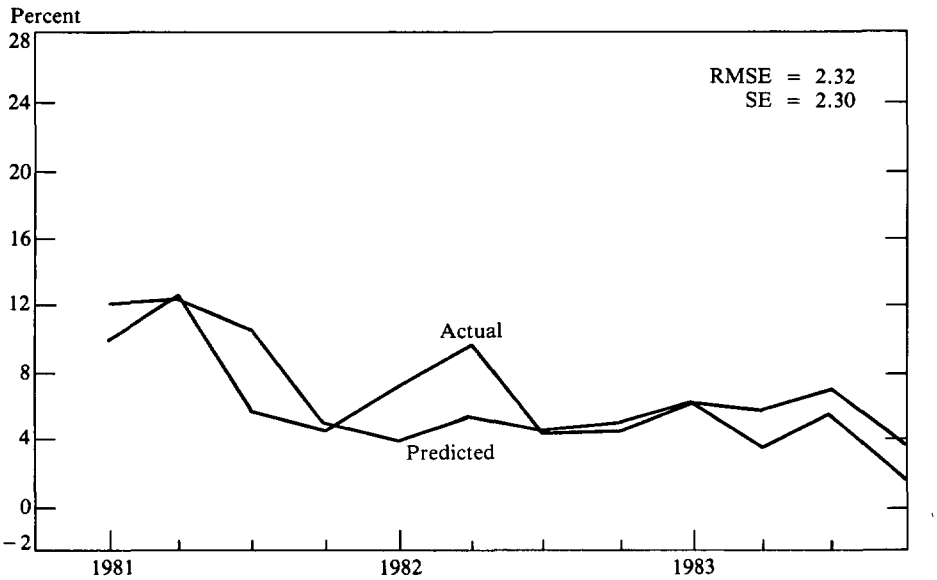
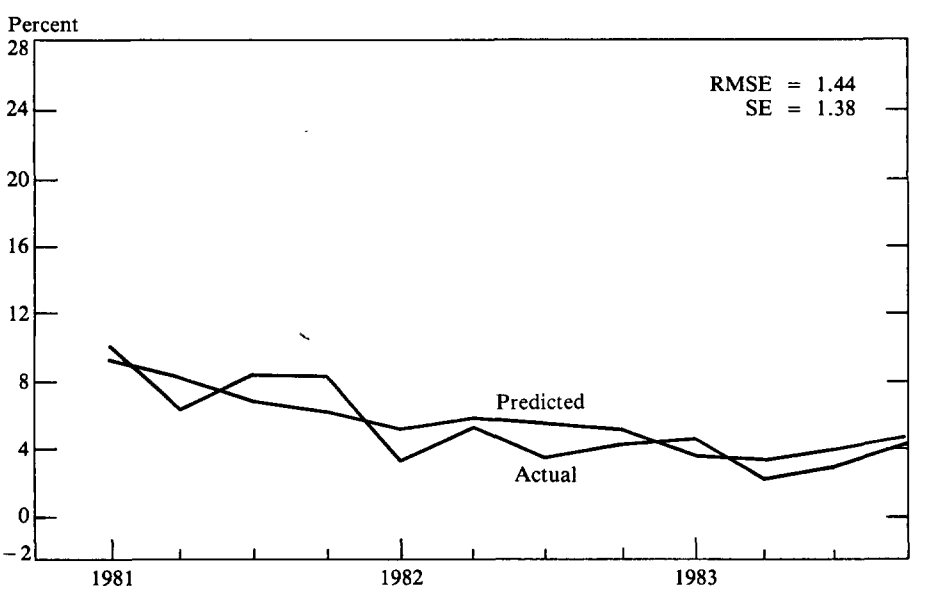


CHART 9
Actual and Predicted Inflation in the United States



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 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

[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.

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 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.

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

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.

Economic Review
Federal Reserve Bank of Kansas City
Kansas City, Missouri 64198
February 1985, Vol. 70, No. 2