

Understanding Inflation

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Our economy is fundamentally sound. The GDP gap is small. Putting aside near-term uncertainties, mostly related to housing and housing finance, economic activity is growing at approximately the same rate as potential. Although fourth quarter GDP growth is now estimated to be a 2.5 percent pace, down from the advance estimate of 3.5 percent, much of this markdown was due to a downward revision in inventory investment. Final sales of domestic output—GDP minus the change in inventories—grew at a robust 3.7 percent annual rate in the fourth quarter and were 3.3 percent higher than a year earlier. Unemployment in the fourth quarter stood at 4.5 percent, as low as any point in the current economic expansion. The employment rate—the fraction of the non-institutional population 16 and older with jobs—stood at 63.3 percent, also its high point in the economic expansion. Forecasters anticipate that these favorable fundamental conditions will continue; they foresee the economy's output during the next two years remaining near potential, with a growth rate averaging approximately 3 percent.

As always, my view on economic growth and inflation emphasizes longer-run conditions. I could point to numerous past episodes of either faster or slower growth for a few quarters that we now ignore because long-run developments dominated the outcome and indeed dominate our current assessment of these periods. In assessing short-run developments, it is also essential to keep in mind that forecasts have standard errors. Over a four-quarter horizon, a GDP forecast has a standard error of about 1.5 percentage points and an inflation forecast has a standard error of about 0.5 percentage points. We know also that

data are often revised. Finally, monetary policy cannot affect near-term conditions anyway. Thus, a focus on medium- and long-term fundamentals is always appropriate.

The causes of our current prosperity will be studied by economists for some time. Today, I wish to discuss one of those: our improved understanding of how price stability contributes to overall economic stability. That understanding is reflected in the Federal Reserve's commitment to maintaining a low, stable rate of inflation. Efforts to improve communications and increase the transparency of policymaking are essential aspects of that commitment. The public must understand not only the policy objectives but also the Fed's objectives and the decision-making process through which it seeks to attain those objectives—something that I have referred to for many years as “synching” the Fed and financial markets. This process is eased if policymakers follow what macroeconomists refer to as “rule-based” behavior, particularly rules focused on price stability.

Before proceeding, I want to emphasize that the views I express here are mine and do not necessarily reflect official positions of the Federal Reserve System. I thank my colleagues at the Federal Reserve Bank of St. Louis for their comments. Richard G. Anderson, vice president in the Research Division, provided special assistance. However, I retain full responsibility for errors.

THE DUAL MANDATE

Under the Federal Reserve Act, the Fed has a dual mandate to foster both maximum employment and price stability. I regard “price stability”

as zero inflation, properly measured. What does “properly measured” mean? Price indexes have biases of various sorts and experts generally believe that U.S. indexes overstate inflation by a modest amount. If statisticians understood these biases with precision, the indexes could be corrected. I myself make a rough guess that, for example, the consumer price index overstates inflation by about one percentage point a year.

With price stability, the average level of all prices—correctly measured—would neither increase nor decrease during the medium- and long-run. Price stability in this sense does not imply, however, that the prices of individual goods and services will not change, nor does it imply that a number of prices cannot change sharply during over the short run, nor does it imply that there cannot be large changes in relative prices. If fossil fuels or metals become more expensive relative to other goods and services, so be it—stabilizing the relative prices of energy and metals is not a responsibility or even within the power of monetary policy. Differentials in productivity growth among goods and services also may cause sharp changes in the relative prices of some products—these are not the responsibility of monetary policy either.

In recent years several FOMC members have referred to a “comfort zone” of 1-2 percent inflation measured by the price index for personal consumption expenditures, excluding the volatile food and energy components. Because agreement on some reasonably low rate of inflation is more important than exactly what that rate is, I am perfectly happy to state my personal inflation objective as an inflation rate measured by the core PCE price index of 1.5 percent, plus or minus 0.5 percent.¹

It used to be thought that the dual mandate required the Fed to temper pursuit of its inflation goal from time to time in the interest of minimizing disturbances to employment. That view began

to change 40 years ago. Over time, the mainstream view in the economics profession has increasingly emphasized the importance of price stability for achieving maximum employment and maximum sustainable economic growth. I myself have become passionate about price stability. It is important to remember that the two greatest employment disasters in U.S. history were the Great Depression and the Great Inflation. Deflation from late 1929 to 1933 drove the U.S. economy down and down, and the unemployment rate rose to 25 percent. During the Great Inflation, from 1965 to 1981, the United States suffered four recessions, the last of which in 1981-82 drove the unemployment rate to a peak of 10.7 percent at the end of 1982, the highest since the Great Depression.

Experience abroad confirms the connection between price instability and unemployment. For one example, Japan suffered a decade of deflation in the 1990s; economic growth was minimal and unemployment rose.

SOLIDIFYING PRICE STABILITY

The central bank’s primary tool to maximize employment and growth is price stability. The central bank can refine its pursuit of price stability in three important ways. First, the leadership of a central bank should form a consensus around the goal of a specific low inflation rate; the particular chosen number is less important than commitment to a specific goal. Second, the central bank must develop a consistent policy model, or decision framework, for responding to incoming data. The framework must explain how policy-makers reconcile near-term movements in inflation, over which monetary policy has almost no influence, with the path of medium- to long-term inflation, for which the central bank is almost wholly responsible. Constructing the policy

¹ I have discussed this range in several previous speeches. For a recent example, see W. Poole, “Inflation, Financial Stability, and Economic Growth,” Global Interdependence Center Abroad in Chile Conference, Santiago, Chile, March 5, 2007 [http://www.stlouisfed.org/news/speeches/2007/pdf/03_05.pdf]. Earlier examples include W. Poole, “The Monetary Policy Model,” *Business Economics*, October 2006, 41, pp. 7-10, and W. Poole, “Inflation Targeting,” Junior Achievement of Arkansas Inc., February 16, 2006, published in the Federal Reserve Bank of St. Louis *Review*, May/June 2006, 88(3) pp. 155-163.

model is far from a trivial task. And, third, the central bank must communicate this framework to the public in a credible and transparent way.

Over the past decade or so, the Fed has gravitated to the position of placing primary emphasis on the core rate of inflation, as measured by the PCE price index excluding food and energy. The reason is that food and energy prices are subject to large short-run disturbances that are beyond the ability of monetary policy to control. If we examine total and core price inflation over three years, the averages are quite close. Food and energy prices display substantial short-run variability that does not affect longer-run inflation. The basic, strategic goal is all-items or headline inflation; core inflation is a tactical goal in the short run.

However inflation is measured, economists agree that monetary policy has at most a minimal influence on the rate of change in the price level over relatively short time periods—months, quarters or perhaps even a year. Central banks are responsible for medium- and long-term inflation—such inflation, as Milton Friedman wrote, is a monetary phenomenon that depends on past, current and expected future monetary policy. As a practical matter, the medium- to long-term likely is a period of two to five years.

The phenomenon of modern inflation—a sustained, broad-based increase in the economy's average price level—is one that depends on the use of an inconvertible “fiat” money. Because fiat money is not legally linked to specific quantities of any metal or other commodity, it is subject to indefinite expansion. Monetary policymakers are acutely aware of the linkages between excessive money creation and inflation. Although today central banks do not conduct policy by targeting monetary aggregates, the classic linkage between money and inflation persists. Figure 1 shows the correlation during three decades, for a cross-section of approximately 70 countries as available on the International Financial Statistics database. Inflation is measured as the country's headline inflation measure, and money is measured as a broad money aggregate (the sum of the variables labeled “money” and “quasi money”

in the database). The scales in all three panels are the same. A regression line also is shown, although it must be interpreted only as a descriptive statistic because money and inflation are endogenous, jointly determined variables. Generally, both the rates of inflation and money growth have decreased over the three decades, and the scatter of points has become somewhat tighter.

The U.S. inflation record is shown in the table of the handout. The data are the implicit price deflator for personal consumption expenditures in the national income accounts; the PCE chain-price index behaves similarly except fewer historical observations are available. The table shows decade-average mean inflation rates and their standard deviations; the left-side columns are annual averages, the right-side columns Q4-to-Q4 changes. For most periods, the CPI also behaves similarly, except in 1980 when rising mortgage rates contributed to a large jump in the CPI but are not included in the PCE index.

Figure 2 shows 10-year trailing moving averages, in the spirit of a backward-looking adaptive expectations model. The figure shows the extent to which monetary policymakers failed citizens of the United States during the 1970s, a decade when both the level of inflation and its variance approximately tripled. Today, both the level and variance of inflation have returned to their values of the late 1950s and early 1960s.

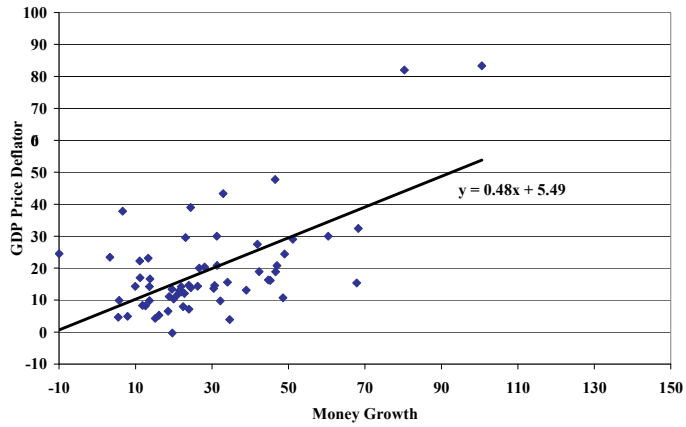
The challenge for policymakers is to be certain that the recent behavior of inflation persists. To explain what we know about how to do that, I next discuss the period of the Great Inflation of the 1970s and what lessons it taught us.

THE GREAT INFLATION AND REFORM OF OCTOBER 1979

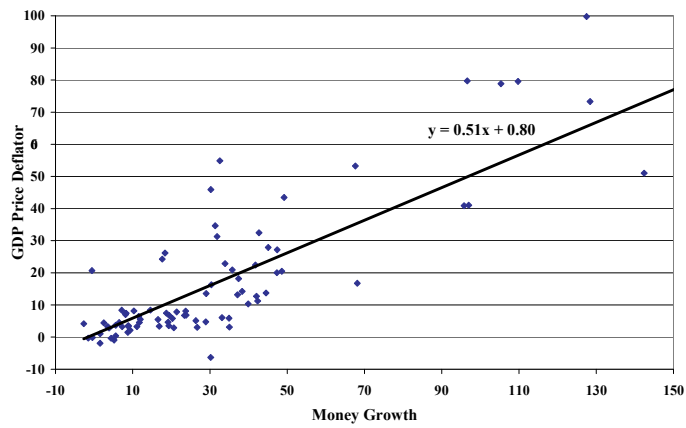
Understanding inflation in the U.S. economy cannot omit discussion of the Great Inflation that ended with the policy reform of October 1979—the premier event in U.S. inflation history. During the 1970s, consumer price inflation (measured by the price deflator for personal consumption expenditures) averaged 6½ percent, approxi-

Figure 1

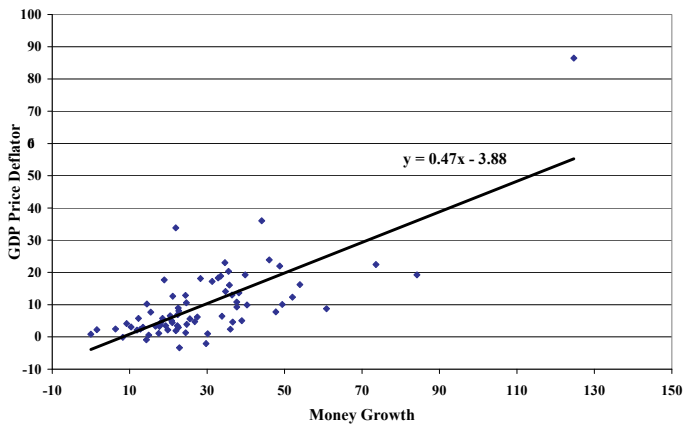
Average Inflation and Growth Rate of Money Across Countries, 1975 to 1985



1985 to 1995



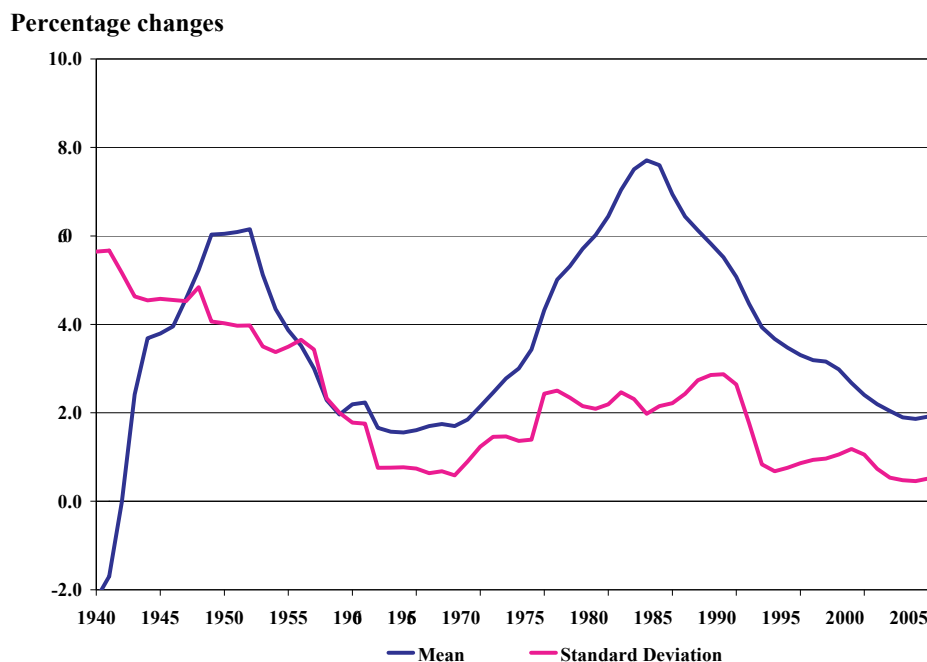
1995 to 2005



SOURCE: International Monetary Fund/Haver.

Figure 2

**U.S. Personal Consumption Expenditures: Implicit Price Deflator
10-Year Moving Averages of Annual Data**



SOURCE: Bureau of Economic Analysis/Haver.

mately double the historical average since 1930 and triple the average of the prior two decades. Inflation wasn't steady over the decade either—the year-to-year variance was triple that of the previous two decades and there were two periods of double-digit inflation, more than 11 percent during 1974 and more than 10 percent from 1978-80, measured by the PCE deflator.

The 1970s illustrate the importance of a well-thought-out commitment to price stability as a bulwark against large shocks to individual commodities—that is, large relative price changes—feeding through into more general inflation. In a 1982 paper, Alan Blinder sought to quantify this process. First, he measured the baseline inflation rate, the medium- to long-term trend inflation due to monetary policy. In the early 1960s, it was near 1 to 2 percent, in the early 1970s near 4 to 5 percent, and in 1980 near 9 to 10 percent. Although

he doesn't mention it, the University of Michigan's survey of inflation expectations began in January 1978. At its inception, the median expected rate was 5 percent; two years later, it was 10 percent. Clearly, monetary policy had become unhinged from price stability during this period. But what was the role of relative prices?

The energy shock of 1973-74 was the largest shock of its type, up to that time. Energy prices increased approximately 25 percent in 1974, boosting near-term inflation to a pace more than twice the estimated baseline, or trend, rate. Inflation slowed quickly in 1975, however, as energy prices steadied, with headline inflation at approximately a 5 percent pace in the second quarter of 1975 and as low as 3 percent in 1976's second quarter. Thereafter, however, inflation rebounded to a relatively stable baseline pace of approximately 5½ to 6½ percent.

Table 1

U.S. Inflation Rates by Decade
Personal Consumption Expenditures: Explicit Price Deflator

Dates	Annual average percent change		Annual Q4/Q4 percent change	
	Mean	Standard deviation	Mean	Standard deviation
1930-1939	-2.21	5.65		
1940-1949	6.05	4.03		
1950-1959	2.19	1.78	2.31	1.59
1960-1969	2.15	1.23	2.26	1.41
1970-1979	6.44	2.19	6.64	2.55
1980-1989	5.07	2.64	4.82	2.46
1990-1999	2.41	1.06	2.37	1.16
2000-2006	2.32	0.52	2.25	0.59

SOURCE: Bureau of Economic Analysis/Haver.

Inflation rose sharply once again during 1977-1980. Blinder estimates that the baseline rate reached 8½ percent in 1979 and 10 percent in 1980. The Michigan survey hit 10 percent in November 1979 and remained at that level until May 1980—when the combination of tighter monetary policy and the credit controls, authorized by President Carter on March 14, sharply slowed second-quarter economic activity. Relative-price changes affecting food, energy and mortgage interest rates pushed headline CPI inflation far above the baseline pace—at that time, the CPI included mortgage rates. CPI inflation moved above 10½ percent in January 1979, and exceeded 12 percent in nine of the year’s 12 months; the annual average, December to December, was 13¼ percent. But 1980 was worse, as the CPI rose at a 14.6 percent pace during the year’s first half. Not until March 1981 did the inflation rate slip consistently below 10 percent. The behavior of energy prices, measured as the energy price component of the CPI, was extraordinary. Energy prices increased 37 percent during 1979 on a fourth quarter-to-fourth quarter basis, increased during 1980’s first quarter at a 41 percent annual rate,

and increased during 1981’s first quarter at a 28 percent pace, before stabilizing after March 1981.

The inflation of the 1970s was a combination of large, rapid changes in relative prices for food and energy overlaid on top of a rising underlying inflation trend. Economists have long debated the direction of causation: Did the increasing trend in inflation cause the relative price changes—for example, as oil producers sought to offset falling real prices—or did the shocks to relative prices tend to push upward the trend? And, did FOMC actions worsen the situation by seeking to sustain the pace of economic activity? Blinder concludes that the “behavior of money supply tells us almost nothing about the bursts of double digit inflation in 1974 and 1979-80.” Perhaps this claim is true. But, why did the medium- and long-term baseline inflation rate, *primarily due to monetary policy*, continue to increase during the 1970s? Why didn’t the prices of other goods decrease significantly as energy prices increased?

I have elsewhere recently discussed some of these issues; so, let me be brief.² There is no reason, logically, why changes in *relative* prices—even large changes—should pass through

² W. Poole, “Inflation, Financial Stability, and Economic Growth,” presented at Global Interdependence Center (GIC) Abroad in Chile Conference, Universidad Adolfo Ibáñez, Santiago, Chile, March 5, 2007.

automatically into headline inflation. Shouldn't the rate of increase of some other prices slow or, perhaps, some prices even fall as the relative price changes alter nominal demand? I have suggested, as have various research studies, that the reason such changes did not occur during the Great Inflation was that the FOMC lacked a clear, forward-looking framework for monetary policy-making containing a commitment to price stability. Without it, the Committee reacted to events as they happened; that is, its behavior consisted of a series of individual policy *actions* that did not add up to define a coherent policy *regime*. Critics have argued that superior policy would have occurred if the Committee had operated according to a regime, in which the policy instrument is a *rule* for the conduct of policy. The essential difference is the extent to which the markets and the public understand that (1) policy is forward looking, according to a rule or strategy, and (2) can therefore infer the future course of policy.

The predominant school of thought during the 1960s and 1970s taught that inflation possessed an inherent momentum. Generally, it was argued that consumers and businesses formed their inflation expectations in an adaptive, autoregressive manner—essentially, a long distributed lag with fixed coefficients. Academic efforts tended to focus on whether the length of the distributed lag was invariant to the rate of inflation—some evidence suggested a shorter lag at higher inflation rates or during a period of more variable inflation—and whether the coefficients summed to unity or not.

These approaches never examined whether the fixed-coefficient model was correct in the first place. Although the distributed lag gave the inflation process persistence, current-period actual inflation, it was argued, depended only weakly on the unemployment rate—high unemployment tempered wage increases which, after subtracting productivity gains, were the primary determinant of changes in the baseline inflation

rate. Superimposed on this framework was the concept of a long-run “equilibrium” unemployment rate, which we will call “ U^* .” Proponents acknowledged that U^* could never be measured precisely from aggregate data because of shifting demographics and for other reasons. More recent econometric studies suggest that U^* cannot be estimated accurately in almost any case—even the best estimates have standard errors of 2 percentage points of unemployment or more.³ Finally, some proponents—and many critics of this view—noted that the underlying inflation-unemployment tradeoff, commonly referred to as the Phillips curve, tended to shift for a large number of reasons, including changing expectations of future inflation and supply shocks.

This framework predicted a very high cost to reduce inflation: a typical estimate was that each 1 percentage point reduction in the baseline inflation rate would cost approximately 1 percent of annual GDP. Many analysts concluded that, in present value terms, the cost over the infinite future of steady inflation at the baseline rate was less than the near-term disinflation cost measured in foregone output.

The flaws in this model are now well-known. Last year in my NABE lecture I outlined the current state of macroeconomic theory for monetary policy.⁴ The emphasis today is on forward-looking behavior. The introduction of model-consistent, or “rational,” expectations into macroeconomics during the 1970s emphasized a simple but essential idea: consumers and businesses in the economy understand the dynamic economy in which they live. This theory does not deny the persistence in inflation—the persistence is real, not an illusion. But the *cause* of the persistence is not an inherent momentum unique to the social psychology of inflation. If the central bank is perceived as being prepared to acquiesce in higher inflation and unprepared to pursue policies consistent with lower inflation, then both inflation expectations and actual infla-

³ Staigher, Stock and Watson (1997)

⁴ W. Poole, “The Monetary Policy Model,” *Business Economics*, October 2006, 41, pp. 7-10.

tion will rise. And the reverse is also true: If the central bank is perceived as unwilling to underwrite higher inflation and prepared to pursue policies consistent with lower inflation, then expectations and actual inflation will fall.

This line of thought has profoundly altered our understanding of inflation and monetary policymaking. When expectations are assumed to be formed in a sluggish autoregressive manner, it is natural to view policymaking as a series of individual actions—determined meeting-by-meeting and based heavily on the incoming data. In such a framework, it also is natural to view the FOMC as having a single policy instrument—the overnight federal funds rate. Policy conducted in this fashion leaves ill-defined the decision structure governing future policy, and makes it difficult, and perhaps impossible, to communicate clearly to the public the longer-term objectives and strategy of policy. Policymakers may lack credibility, and their actions may lack transparency.

The rational expectations literature makes clear that policy *regimes* are the correct way to interpret policy. Tom Sargent has defined a regime as “a function or rule for repeatedly selecting settings for economic policy variables as a function of the state of the economy.”⁵ Others have labeled this “rule-like behavior.” A policy regime, in some cases, might be as simple as a single equation; an example is the Taylor Rule, which I and many others have discussed elsewhere. In this case, the *policy rule*, rather than federal funds rate, is the instrument of monetary policy—the federal funds target is an endogenous variable within the larger model. The precise form of the rule, so long as it is consistent with price stability, is less important than policymakers displaying rule-like behavior. The “rule” certainly need not be a simple linear equation. Rather, the rule is a method of decision-making and a commitment to a specific, articulated

objective. Nobel laureate Robert Lucas (1981) credits the introduction of this concept to Milton Friedman in his 1948 *A Monetary and Fiscal Framework for Economic Stability*.⁶ In the same article, Lucas notes that Friedman’s maxim was lost to policymakers during the two decades of prosperity that followed the 1948 Employment Act, setting the stage for the Great Inflation.

Actual policymaking, of course, requires large doses of experience and judgment—former Chairman Alan Greenspan argued that model uncertainty counseled caution in policymaking. Models omit many real-world problems such as incomplete and asymmetric information, the high cost of information and the value to both workers and firms of multi-period contracts. Nevertheless, the essential insight of rational expectations survives—a sound policy rule or regime is essential for a good outcome.

Some analysts have argued against rules for monetary policymaking, viewing them as strait-jackets for policy. If policymakers adopt a model, how do they respond when the economy changes significantly? Modern models clarify that the benefits of “rule-like” behavior accrue even if the central bank from time to time changes its policy regime or rule.⁷ What *is* required is that at each instance when policymakers decide to take an action that is not consistent with their extant rule, the new action must be consistent with *some* policy rule that, in the medium- to long-term, will achieve the stated policy objective. Surely it cannot be the case that an optimal policy response to a new set of circumstances could be determined by consulting a table of random numbers.

When policy departs from usual practice, it is incumbent that policymakers communicate the change—its nature and rationale—carefully to the public. Monetary policy is more powerful, and better able to achieve its goals, if the forward-looking behavior of consumers and businesses is consistent with the forward-looking behavior

⁵ Sargent (1986). See also Sargent (1982) and Sargent (1999).

⁶ Friedman made similar arguments in his 1968 presidential address to the American Economic Association. Poole (1986) analyzes the ways that political pressures push policymakers away from rule-like behavior and toward acting event-by-event to offset the problem of the moment.

⁷ Woodford (2003).

suggested by the policy rule or regime. For several years, I have referred to this as “synching” the markets and monetary policy. The fundamental *mechanism* for making synching work is communicating the policy regime or rule—but rule-like behavior must be adopted by policymakers in the first place before it can be communicated to the public.

During the latter 1970s, the FOMC’s minutes, transcripts and public statements suggest frustration with an economy in which inflation increased with ease but decreased reluctantly; the Committee’s response was the monetary policy reform of October 1979. Two years ago, we held a special conference at the St. Louis Fed, on the occasion of the 25th anniversary of reform, to reflect on that monetary policy change. The papers from the conference are available in a special issue of our *Review*. In the conference opening remarks, Chairman Alan Greenspan noted that by 1979 the inflation situation had deteriorated to such an extent that “if the Fed had not opted to initiate a sharp interest rate increase in this country, the market would have done it for us.” He emphasizes that the 1970s inflation experience reinforces the role of price stability as a prerequisite for the efficient allocation of resources in the economy and for fulfilling the Fed’s goal of promoting maximum sustainable economic growth.

Allan Meltzer, in his paper for the conference, considered a wide variety of explanations, including political business cycles, dynamic inconsistency in policymaking, and the use of incorrect economic theories and data. He concludes that the policy failure was so large that no single theory can account for it—multiple, mutually reinforcing failures are required. Among these was the failure of FOMC members to distinguish between the corrosive effects of more rapid inflation as a *cause* of slower economic activity, because inflation increased uncertainty, and their fear that seeking to reduce inflation would, itself, further slow economic activity. Today, we appreciate that slowing inflation in the absence of a clearly defined and well-articulated policy

regime will be costly—the concerns of these Committee members were well-founded. We also understand, however, that a clear policy regime focused on price stability can sharply reduce, if not eliminate, the likelihood of finding ourselves in such a situation.⁸

CONCLUSIONS

For the United States, the last four decades may be viewed as one “long cycle” in inflation. That experience, plus developments in economic theory, have permanently altered our understanding of inflation. The cycle began as inflation increased during the mid-1960s with the FOMC’s accommodation of Vietnam-era deficit spending, and reached full stride during the 1970s as monetary policy hesitated to slow inflation during episodes of major changes in relative prices. The cycle peaked and changed direction with the October 1979 regime shift in monetary policy, brought about by Chairman Paul Volcker’s keen understanding of what was at stake and skill in changing policy direction. The disinflation of the last 25 years has restored, today, both the low level and low volatility of inflation that we enjoyed prior to the Great Inflation. The disinflation has brought to us an era of price stability in which recent energy price shocks have had but modest near-term effects on inflation. Price stability has contributed to a resurgence of productivity growth by creating an environment in which innovations in information and communication technology may be confidently deployed through increased capital investment. The duration and amplitude of business cycle slowdowns also has diminished, a change that Chairman Bernanke has labeled the “Great Moderation.”

What longer-term lessons has the decade brought to our understanding of how monetary policy affects inflation? The most important lesson is that policymakers must regard consumers and businesses as understanding the dynamic nature of the economy—and the impacts of policy

⁸ A number of papers have studied the October 1979 policy shift as a policy regime change. For a recent example, see Cecchetti, et al. (2007).

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on the economy—as well as they do. This lesson tells us to focus on monetary policy regimes and policy rules as the instrument of policy, not the near-term choice of the federal funds rate target. By doing so, the Committee’s actions affect the expected future path of interest rates and anchor inflation expectations. If the Committee communicates its objectives and strategy in a transparent and credible fashion, the bond market and other forward-looking financial markets will amplify the Committee’s near-term decisions and thereby do a good deal of its work for it.

As always in an important line of research, understanding remains incomplete. In particular, we need to focus effort on improving the policy rule—the regularity of policy actions that stabilize the economy and make planning in the markets possible. But we should not sell short the enormous advances already in place.

Thank you and I’d be delighted to take your questions.

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