Congress has charged the Federal Reserve with a dual mandate: to achieve and maintain both price stability and high employment. Although there was a time when these two goals were viewed as competitive, today it is largely agreed that price stability provides the foundation upon which households and firms are able to make the decisions that bring the economy to its highest sustainable level of employment and most rapid sustainable rate of economic growth. Moreover, Federal Reserve success in achieving price stability, and in obtaining a high degree of market confidence that price stability will remain the norm for the economy in the future, gives the Fed the freedom to react quickly, and massively if necessary, to shocks that threaten to raise unemployment to unacceptable levels.

I have said previously that I favor a goal of zero inflation, properly measured. In practice, because of various statistical problems in measuring prices, that goal translates, approximately, to price changes of something like a 1 percent annual rate of increase in the chain-price index for personal consumption expenditures—the PCE price index for short.

In its day-to-day policymaking, the Fed focuses on the core PCE price index, which excludes volatile food and energy prices that monetary policy can do little about. On average over time, the total and core indexes change at almost identical rates. Even putting volatile food and energy prices aside, it is not possible to achieve an inflation target precisely year by year; thus, my goal might be stated as a change in the core PCE index of 0.5 to 1.5 percent per year. That range itself needs to be a bit elastic to allow for special circumstances that might be important in a particular year. Others on the Fed’s main policy body, the Federal Open Market Committee (FOMC) might prefer to state the goal somewhat differently, but I believe that all of us have in mind inflation goals that are so close one to the other that differences in the goal are not really an issue.

However, there is an important issue that I struggle with every time I go to an FOMC meeting: What policy will yield an outcome close to the inflation goal? The task is certainly not as easy as it might appear in textbooks. Today, I would like to discuss with you practical aspects of pursuing a policy that yields price stability. My remarks will expand on themes that I have addressed in several previous talks.

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 in the Research Division of the Federal Reserve Bank of St. Louis for their comments; Dick Anderson, vice president, and Kevin Kliesen, associate economist, provided special assistance. I retain full responsibility for errors.

My plan is this: I’ll start with some basic, but very important theory and explain why theory is not enough for practical monetary policymaking. That will bring me to my approach of tracking inflation. Finally, I will discuss briefly the current inflation environment and the near-term outlook for inflation.
MACROECONOMIC THEORY

There is an enormous amount of evidence that inflation is fundamentally a monetary phenomenon, caused by too much money chasing too few goods. Yet, policymakers today spend hardly any effort tracking money growth. How can that be?

There is a proposition in control theory that when control is optimal—policy instruments are optimally adjusted to achieve the intended goal—the correlation between the instrument and the goal will become zero. Consider a car analogy. No one has any doubt that the amount of fuel fed to the engine regulates how fast the car goes. All other things equal, higher fuel flow will yield higher speed. Now consider a car traveling in mountainous country with the cruise control set for 65 miles per hour. Suppose you measured fuel flow and speed. You would record large fluctuations in fuel flow and hardly any fluctuations in speed. Would you conclude that fuel flow has nothing to do with the car’s speed?

Let’s pursue this analogy a bit further. Examining the data closely, you might find a slight negative correlation between speed and fuel flow. When the car is going down hill, speed may rise a bit above 65 and fuel flow be below average; similarly, going up hill you might observe speed a bit below 65 and fuel flow above average. But you would not conclude that higher fuel flow reduces speed. When you understand the fundamental determinants of car speed, you will not be fooled by a short-run correlation between speed and fuel flow.

Knowing the characteristics of the cruise control, a driver can do a bit better in controlling speed than the cruise control by itself. A driver looking ahead can back off the accelerator a bit before the crest of a hill to avoid going above 65 down the hill, and press on the accelerator a little before starting up a hill to avoid dropping below 65. Every driver has the experience of noticing that the cruise control doesn’t look ahead—it only reacts to the speed of the car itself. A successful driver will eliminate the slight negative correlation between speed and fuel flow that arises from the lag in the cruise control’s operation because it cannot look ahead.

As with a car’s cruise control, supplemented by an alert driver, Federal Reserve success in taming inflation has destroyed the statistical correlation between the causal variable and goal variable—money growth and inflation. Because the relationship between money growth and inflation is irregular—especially at a low rate of inflation—the Fed does not attempt to control inflation by achieving a money growth target. Instead, the Fed sets a target for the federal funds rate—the overnight interest rate in the interbank lending market for reserves on deposit at Federal Reserve Banks. The federal funds rate is the base interest rate in the financial system, influencing all other rates such as the rate on home mortgages.

How does the Fed control inflation as successfully as it does? The Fed extracts as much information as it can from all the data and anecdotal reports available. An important aspect of this work is to track the inflation process—the internal dynamics of the inflation rate. That is my main topic today.

TRACKING INFLATION

The idea I’ll explore is that the Fed leans against pressures that would move the inflation rate outside the desired range, like the driver who watches the speedometer and the terrain ahead to decide whether to step more or less hard on the accelerator or tap the brake.

The basic framework has been around for a long time. Marvin Goodfriend presented a summary of the framework at a conference at the St. Louis Fed last year. He notes that the core ideas of macroeconomists regarding inflation circa 1970 were:

First, prices of goods and services are usefully regarded as markups from unit labor costs,

1 Goodfriend (2005).
adjusted to normal operating rates and productivity trends. Rates of increase of prices and wages depend on recent trends, on expectations of future movements, and on the tightness of markets for products and labor.

Variations in aggregate demand, whether a consequence of policy actions or other events, affect the course of wages, prices, output, and employment by altering the tightness of labor and product markets.

The tightness of markets may be measured by the utilization rates of productive resources, including reported or adjusted unemployment rates and capacity operating rates. At any given utilization rate, real output tends to grow at a steady pace, reflecting trends in supplies of labor and capital and in productivity.

Inflation rises at high employment rates because tight markets systematically and repeatedly generate wage and price increases in addition to those already incorporated in expectations and historical patterns.

There exists a Friedman-Phelps “natural” rate of labor market tightness—the non-accelerating inflation rate of unemployment, or NAIRU—at which the degree of resource utilization generates no upward or downward pressure on wages and prices and is consistent with expected paths of output, employment and prices as seen by workers and firms. In equilibrium, the expected path of prices is a steady rate of inflation, abstracting from temporary disturbances.

The 1970 view contained a causal chain flowing from tightness of labor markets to inflation. Unemployment below the NAIRU would cause wages to rise more quickly. Because productivity growth was viewed as largely independent of wage-price determination, higher wage growth would increase the rate of growth of unit labor costs. Cost increases, in turn, would lead firms to raise prices to maintain normal profit margins. In time, inflation expectations would rise to reflect higher actual inflation and then wages would also rise more rapidly. There could be no equilibrium unless the unemployment rate settled at the NAIRU. Monetary policy was often viewed as passive, accommodating wage and price increases lest a recession result. Researchers commonly added special shocks to the basic framework. Price shocks from food, energy and exchange rate changes were thought to come from outside the fundamental determinants of wage and price inflation.

Academic researchers and Federal Reserve economists and policymakers continue to employ this framework, but important aspects have changed. Most critically, in the 1970 framework the formation of expectations about inflation was assumed to be largely backward-looking; this approach soon changed as a consequence of work by Thomas Sargent, Robert Lucas and others.

Although we could simply observe and track inflation directly, and stop there, the more detailed wage-price framework is useful. In setting monetary policy there is relevant information beyond the inflation rate itself; we gain insight by exploiting the identity that inflation is equal to the rate of change of unit labor costs multiplied by a markup factor.

In working with this conceptual framework, it is sometimes convenient to begin with wage determination in the labor market. But I prefer to think of the description starting with the labor market as simply a convenient place to break into the circle of simultaneous determination, in which wages, prices, employment, output, productivity and profit margins are all determined together. Wage determination depends on all the factors that affect labor supply and demand decisions, including inflation expectations and trend productivity gains. That is, nothing is determined “first” or independently of the other variables.

This is a complex framework and requires judgment in application. The wage determination process involves numerous variables and, most likely, some bargaining situations where the outcome is uncertain. The markup pricing assumption requires information regarding the price elasticities of demand, and how they change through time and over the business cycle. For

\[ 2 \] Kohn (2005b).
example, firms facing intense international competition may have difficulty passing along cost increases. Such firms may suffer lower profit margins in the face of cost increases rather than be able to increase prices.

The direction of causation can run either direction. Suppose a firm finds competitive pressures increasing—it may be able to pass that pressure backward into wages and the labor market. The recent experiences of U.S. airline workers and some automobile parts workers are examples. In other cases, firms may not be able to resist upward pressure on wages and thus wage pressure may show up in pressure on prices. A current example might be wages of truck drivers; with robust demand for drivers and a limited supply of persons willing to spend long periods on the road away from their families, driver wages are rising.

Rapid changes in technology also are not easily addressed within the model: Does a favorable technology shock increase employment because each worker is now more productive, or does it reduce employment, despite decreases in unit costs, because the price elasticity of demand is small? The answers are far from obvious, and answers that might be correct for a single firm need not be correct for the aggregate economy.

In modern macroeconomic models, market behavior depends on central bank behavior, because market expectations depend on what the central bank is expected to do. Thus, in these models the behavior of the central bank is governed by rules, and central banks are almost always assumed to conduct monetary policy by choosing a target for a short-term nominal rate of interest.

Perhaps the best-known policy rule is that proposed by John Taylor in 1993. I have previously discussed the relationship between the Taylor rule and current Fed policymaking. Here, I wish to note two aspects. First, central banks that use a nominal interest rate as the policy instrument must adjust that target more than one-to-one in response to movements in inflation, so as to increase the real short rate when actual and expected inflation increase and to decrease the real short rate when actual and expected inflation decreases. Second, policy outcomes generally will be better when the target rate responds to the gap between economic activity and the economy's potential level of activity.

A prominent result obtained from these modeling efforts is that the ease with which the central bank achieves its goals of price stability and maximum sustainable economic growth is directly related to the transparency and credibility of its policymaking. This idea, by itself, of course, is not new. But the models make clearer the inter-relationship between the decisionmaking processes of central bank policymakers and those of households and firms.

In part because both households and firms are modeled as primarily forward-looking, the preferred variable for tracking the likely future path of inflation in such models is the market's own expectation of future inflation. Data regarding market expectations of inflation are available from surveys—including the Michigan, Blue Chip, and Philadelphia Fed surveys—and from the market for Treasury inflation-protected securities (TIPS). Within the Federal Reserve, forecasting inflation based on current and proposed future policy settings is an important responsibility of the FOMC staff.

Although market expectations of inflation are extremely important for Fed policymaking, they are not enough. The Fed wants to look down the road, so that it can adjust its fed funds rate target to prevent inflation and inflation expectations from changing in the first place. Clearly, the inflation rate does change and so the Fed is not completely successful. But inflation expectations have been quite stable in recent years, which means that the Fed does a good job of responding to available information, and in retaining market confidence, so that the market does not have a solid basis for major changes in its inflation outlook.

3 Poole (2005b).
EMPIRICAL EVIDENCE AND TRACKING INFLATION

In a 2005 paper, James Stock and Mark Watson, using data through the end of 2004, conclude

- that inflation has become “easier” to forecast, in the sense that models have low forecast errors because inflation rates have been low and stable; and
- that inflation has become “more difficult” to forecast in the sense that the contribution to the forecast of variables other than lags of inflation has largely vanished.

On balance, Stock and Watson’s results tell us that “tracking inflation” has become easier than it was a decade ago—because the rate is lower and varies less—but also is more difficult because future inflation is far less sensitive to measures of real economic activity. These results are fundamentally a consequence, I believe, of the Fed’s success in forecasting inflation, and in adjusting policy so that inflation remains quite steady.

REAL-WORLD POLICY MAKING

Forecasts presented to the FOMC by its staff combine model-based information with judgment. A major element of the story is that the Fed is successful in extracting information from observable data used in models by applying information beyond observable data. That is where judgment is critically important.

Policymakers often have to act “observation by observation,” evaluating incoming data and responding to events. Examples include the Asian financial market crisis; the international capital markets events that felled Long Term Capital Management; the 9/11 terrorist attacks; and, most recently, Hurricanes Katrina and Rita. Moreover, large shocks often differ from each other in their size and effect, further taxing the knowledge, skills and judgment of policymakers.

Finally, there are some “shocks” that appear gradually, surrounded by controversy and disagreement—the 1990s rise of productivity growth is such an example. FOMC transcripts show that Chairman Greenspan was concerned as early as 1992 that official data were understating productivity growth.4 No model would have substituted for his experience, intuition, and discussions with industry contacts.

The theoretical price determination model provides the framework within which detailed judgments based on anecdotal and other information are brought into policy decisions. Inflation-tracking involves tracking market expectations of inflation and a careful analysis of wage trends, productivity and profit margins. All of these help me to frame my outlook for inflation and what monetary policy would be appropriate to maintain an inflation rate that can be described as “low and stable.”

It is highly desirable that policy practice be formalized to the maximum extent possible—that is a clear implication of modern forward-looking models. However, monetary economists have not yet developed a formal rule that is likely to have better operating properties than the Fed’s current practice. Current Fed policy practices have a large systematic component, even though I could not write down that practice in its entirety in either a single equation or a set of equations.

Consider a recent example. In the absence of other information, slow employment growth in September and October 2005 would ordinarily be interpreted as evidence that the economy is weakening and that, in time, inflation risks would probably fall. However, both the market and the Fed realized that recent employment data were of limited value because distortions from Hurricanes Katrina and Rita were so large. The data were discounted for good reason; the interpretation of the data was transparent and predictable, once the aberrations in the data were observed. But it would not have been possible to explain in advance exactly how to handle the suspect data.

The Fed’s current policy rule is a pattern of behavior which yields an environment in which policy actions are highly, though not perfectly, predictable in the markets. Operating policy by such a rule makes tracking inflation a far simpler task than in the “bad old days” when markets formed their expectations and forecasts without a clear understanding of the policymaking process.

CURRENT INFLATION DEVELOPMENTS

So far, I have spoken primarily about the macroeconomics of tracking inflation. I’ll close with a brief discussion of the current inflation environment.

Energy prices are the big story. Since February 2002, the energy component of the PCE price index has increased by 85 percent, while the core PCE (that is, excluding food and energy) has increased less than 7 percent. Neither the Fed nor the market anticipated energy price increases anything close to what we have observed.

Measures of total inflation reflect the effect of energy prices. Through the first nine months of 2005, the total PCE index increased at a 4 percent annual rate, on track for the fastest annual increase since 1990. The total consumer price index (CPI) shows an even bleaker picture, increasing to date at a 5 percent annual rate, the fastest since 1981. Such inflation rates raise concerns regarding erosion of households’ real purchasing power, even if they are not due to monetary factors.

To date, it appears that little of the energy price increase has bled over into core inflation. Core PCE inflation has been fairly stable for the past several years, and I anticipate it will remain so. My prediction that little of the energy price inflation will bleed into core inflation is based on my belief that inflation expectations are well-anchored and my observation that the FOMC has tightened its policy stance considerably. Moreover, the FOMC has a clear commitment to price stability, and that leads me to believe that the Committee will adjust its policy stance in the future as required by incoming information. If new information calls for further tightening—and I emphasize the “if” because I do not have a crystal ball that permits me to predict incoming information—then that is what the FOMC will do.

Numerous improvements in its communication with the public during the last decade have increased the public’s understanding of monetary policymaking, and made clear the Fed’s commitment to price stability. Nevertheless, higher energy prices are a change in relative prices that will inevitably lead to changes in other relative prices—an increase in the price of gasoline relative to other goods and services, for example, affects SUV prices and sales.

Energy price increases will affect other prices, at least for the medium term, but should have little impact on longer-run inflation expectations. In my earlier analysis of New Keynesian models, I suggested that evidence regarding the appropriateness of monetary policy’s stance can be gleaned from market inflation expectations. What are these data saying? For TIPS, current rate spreads relative to non-indexed Treasuries suggest all-items CPI inflation of approximately 2.5 percent, essentially unchanged from last year. Since increases in the CPI tend to be approximately half a percentage point greater than the core PCE deflator, these figures suggest the market has considerable faith in the FOMC’s commitment to price stability.

The Survey of Professional Forecasters and the University of Michigan’s Survey of Consumer CPI inflation expectations yield similar results. I would offer a word of caution, however, regarding over-interpreting market-based expectation measures. Paradoxically, if the Fed ever becomes perfectly credible with respect to its policy goals, the resulting credibility will destroy the information flowing back to it from financial markets:

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5 Annual inflation is measured December-to-December.

6 Poole (2005a) provides a chronological list of such communication improvements.
whenever the Fed looked into the mirror of the private sector, it would see reflected back only its own image. It is for this reason that I have emphasized that policymakers cannot relax—we need to do the best we can digging into information of all sorts to provide the clearest possible view down the road so that policy adjustments preempt inflation. My goal is for the Fed to become perfectly credible.

Although analyzing the likely effect of energy prices on core prices is a major issue today, because energy price changes have been so large, we are also faced with some puzzles elsewhere. In the third quarter, wages as measured by nonfarm compensation per hour are 5.8 percent above the year-ago level, whereas the Employment Cost Index is only 2.9 percent higher than a year ago. I do not myself understand fully the discrepancy between these two measures of wage change. Productivity growth is holding up well, with the third quarter observation for nonfarm output per hour 2.9 percent above its level a year ago. The corporate profits share of GDP is back to its 1997 peak, suggesting that companies do have increased pricing power enabling them to expand profit margins.

Putting all these indicators together, core inflation and inflation expectations have been contained, but underlying determinants of inflation suggest caution. Depending on what measure is used, wage change has been about steady or has risen. The profit share of GDP has risen, suggesting that firms have increased pricing power. Fortunately, productivity growth remains robust.

To move to a pre-automobile metaphor, we are doing our best to keep the door closed before the core inflation horse leaves the barn. The situation is a bit complicated. The energy price horse did escape the barn and, in my view, there wasn’t a thing the Fed could do about it without wrecking the barn. But we have done what we could to keep the other horses in the barn. My outlook is that the other horses will stay in the barn and that we have been wise not to have overreacted to energy price increases.

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