



HOW WELL DO THE MARKETS UNDERSTAND FED POLICY?

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I appreciate comments provided by my colleagues at the Federal Reserve Bank of St. Louis. I take full credit for errors. The views expressed are mine and do not necessarily reflect official positions of the Federal Reserve System.

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I'm going to discuss a topic tonight that has been a research interest of mine for a long time. Over the years, I have puzzled over what to make of market reactions to news of Federal Reserve policy actions and economic data releases that might logically have implications for Fed actions. Since coming to the St. Louis Fed in March 1998, my views have coalesced into a research program, which I am pursuing with bank colleagues. In fact, given all I have to do, they do most of the work, as you might expect. In this lecture, I'll rely heavily on a paper I wrote jointly with Robert H. Rasche, Director of Research at the St. Louis Fed. The paper, entitled *Perfecting the Market's Knowledge of Monetary Policy*, is available in the working papers section of the St. Louis Fed web site; it will be published in the *Journal of Financial Services Research*.

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 especially thank my St. Louis Fed colleagues who have provided extensive assistance in preparing several lectures on various aspects of the issue at hand. However, I retain full responsibility for errors.

FORECASTING FED POLICY DECISIONS

Let's begin by looking at some recent events in financial markets. I'll examine these events by using several figures, which appear at the end of the text and in a handout everyone should have.

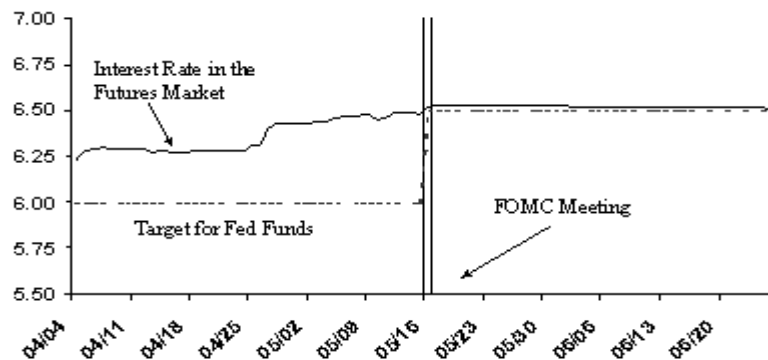
As I think everyone here knows, the Federal Open Market Committee (FOMC), the Fed's main monetary policy body, implements its monetary policy by setting a target level for the federal funds interest rate in the overnight market for bank reserves. The Fed calls this target the "intended rate." Given this mode of operation, the effects of monetary policy work primarily through market

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expectations of future monetary policy actions, because those expectations determine longer-term interest rates that affect economic decisions by firms and households. Thus, the accuracy of market forecasts of future policy actions is at the heart of the transmission of monetary policy to the economy. Expectations about future monetary policy, in turn, depend on expectations about events and new information that may lead the Fed to alter the intended rate.

Now look at **Figure 1** which reports daily data from the futures market for federal funds. The futures interest rate shown here is the market's best guess about the average fed funds rate for June 2000. The figure also shows the level of the Fed's target for the federal funds rate. On May 16, the FOMC raised the intended rate from 6 to 6½ percent. This figure shows the interest rate from trading in the futures market for the 30 days before and the 30 days after the meeting.

Fig. 1: Fed Funds Futures and the Fed's Interest Rate Target



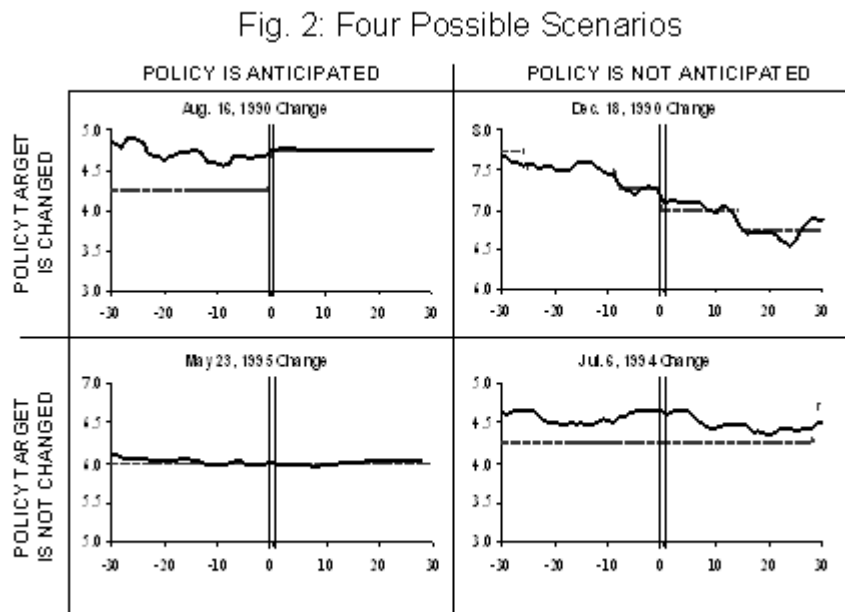
The interesting thing about this figure is the accuracy of the market's forecast despite the fact that a fed policy action to change the intended rate by 50 basis points is a rare event. The first trading day shown on the figure is April 4. On this day, the intended rate was 6 percent. The June fed funds futures contract price reflected a market expectation that the average fed funds rate in June would be 6¼ percent. When the Fed changes the intended rate, the change is usually 25 basis points, and that is what the futures market was expecting. The June futures rate was steady until the last week of April when it jumped pretty quickly in a couple of days. Then it continued to rise during the next few weeks, gradually increasing to 6½ percent. On May 16, the FOMC voted to raise the intended rate to 6½ percent. Since it is unlikely that the Fed would raise the target between the FOMC meetings – the next meeting was held on June 27-28 – by May 15 the market perfectly predicted what the FOMC would do at its meeting the next day.

What do we make of this situation in which the market correctly forecasts what the Fed is going to do? Is the Fed just following the market? Is the Fed leaking to the market what it intends to do? Is it a good thing that the market can predict Fed actions? To answer these questions it helps to consider the relationship between the futures market and Fed policy actions in more detail.

FOUR POSSIBLE SCENARIOS

Figure1 illustrates the situation in which the market correctly forecasts a Fed decision to change the intended rate. In fact, there are four possible combinations to consider. The Fed might change the intended rate, or not change it, and in each case the market might correctly forecast the Fed's decision, or not forecast correctly.

Figure2 contains a matrix of actual examples for each outcome from the fed funds futures market. It is possible that the market anticipates the policy decision or that it does not. The two figures on the left side of **Figure2** show examples where the policy decision was correctly anticipated. The two on the right show examples where it was not. Let's look at these cases a little further.



The upper left panel of **Figure2** shows trading in the futures contract for September 1990 and the FOMC meeting held August 16, 1990. In this case, the futures market expected a relatively large (50 basis point) increase in the intended fed funds rate, and the FOMC raised the rate 50 basis points. This case is like the one examined in **Figure1**.

The upper right panel of **Figure2** shows trading in the futures contract for January 1991 and the FOMC meeting held December 18, 1990. Before the meeting, the markets were not anticipating that the FOMC would reduce the intended rate; the rate for the January futures contract did not fall until after the FOMC acted. In fact, during the life of this contract the FOMC reduced the fed funds target three times, and each change appears to have surprised the market.

The two panels in the bottom half of **Figure2** show examples where the FOMC's decision was to leave the intended rate unchanged. The bottom left panel shows trading in the futures contract for June 1995 and the FOMC meeting held May 23, 1995. In this case, the markets expected no change in the fed funds target, and the FOMC left the target unchanged.

Finally, the bottom right panel of **Figure2** shows trading in the fed funds futures contract for August 1994 and the FOMC meeting held July 6, 1994. Before the meeting, the markets were anticipating a large increase in the target rate, but the Fed did not change the rate at its July meeting. However, in this case the futures rate did not change much after the meeting; the market was still expecting the Fed to act, which it eventually did at its meeting of August 16, 1994.

Before going any further, let me mention briefly a few general findings from my research on this subject. First, the accuracy of market predictions of Fed policy improved dramatically in 1994. Second, most of the changes in the fed funds futures rates are driven by economic news such as the monthly employment report and the inflation data. A relatively small part of the changes in the futures rates comes on days Fed officials give speeches or testimony. Although Rasche and I did not investigate the issue of leaks in our research, I am convinced that leaks are extremely rare. I know of only one example of a leak since I arrived at the St. Louis Fed – it received attention in the press in the spring of 1998 – and it only indirectly concerned the probable future setting of the intended funds rate anyway.

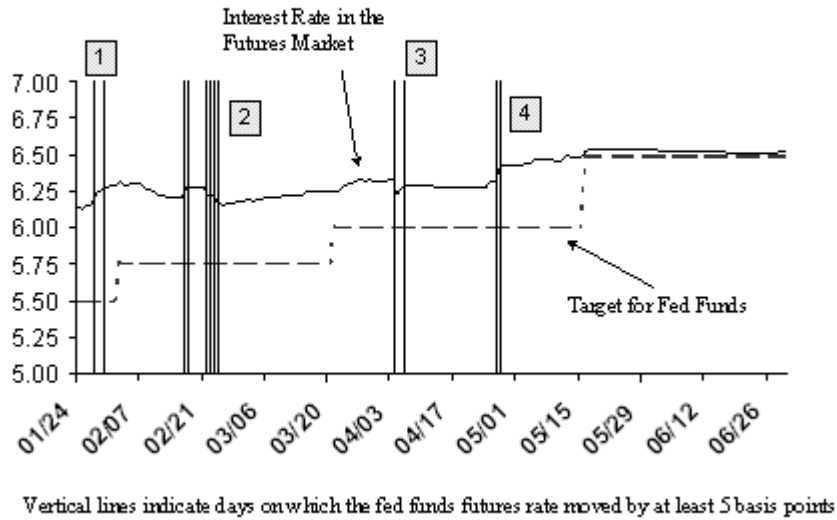
UNDERSTANDING MARKET SUCCESS IN FORECASTING FED POLICY ACTIONS

I'm now going to illustrate the key issues concerning market success, or lack thereof, in forecasting Fed actions by analyzing more closely the case discussed in **Figure1**. Let's put aside the relatively infrequent cases in which speeches or testimony by Fed officials seem to telegraph Fed intentions. And I also want to put aside the hypothesis that the Fed is simply following the market, because I'm convinced from my own observation of the process that this hypothesis is not true.

If the market can predict Fed policy actions quite consistently, then Fed behavior must be systematic and regular enough that the market can make accurate predictions. Thus, the ability of the market to predict Fed policy actions means that the market understands the Fed's objectives and the Fed and the markets are reading the flow of incoming information the same way. In this situation, Fed policy adjustments will not take markets by surprise.

Now look at **Figure3**. This figure provides a more detailed examination of trading in the June 2000 fed funds futures contract from the initial trade on January 24, 2000 to maturity on June 30, 2000.

Fig. 3: June Contract for Fed Funds and Economic News



The figure also includes the history of the fed funds target, which stood at $5\frac{1}{2}$ percent on January 24; the FOMC raised the intended rate to $5\frac{3}{4}$ percent at its first meeting of the year on February 1-2. The FOMC raised the target again, by another 25 basis, at its meeting on March 21. As we already saw in [Figure 1](#), the final, 50-basis-point increase came on May 16.

The opening price of the contract on January 24 implied a June fed funds rate of 6.14 percent. Private forecasters were expecting some slowing in the economy. For example, the January Blue Chip consensus forecast was for 3.0 percent real GDP growth in 2000:Q1 and 2.9 percent for the year. The upward trend in inflation that had occurred in 1999 was expected to continue in 2000. The best way to interpret the June fed funds futures rate of 6.14 percent on January 24 is that market participants placed a probability a bit above 0.5 that the Fed would raise the intended rate by 25 basis points and a probability a bit below 0.5 that the Fed would leave the intended rate unchanged. [Figure 3](#) includes vertical lines on days when there were relatively large changes in the interest rate on the June futures contract. The threshold I've used for defining a "relatively large" change was ± 5 basis points. During the life of this contract, there were 8 days on which the absolute change was 5 basis points or larger. These days are sorted into 4 episodes.

The first episode included a Friday and a Monday, January 28 and 31. On Friday, January 28, the fed funds futures rate rose nine basis points. On that day, the 1999 fourth quarter GDP data were released showing that real GDP had grown 5.8 percent at an annual rate, well above market expectations. The January Blue Chip consensus, for example, had been 4.5 percent. Inflation also came in higher than expected—2.0 versus 1.6 percent at an annual rate. On Monday, the stock markets rose sharply and the fed funds futures rate rose another 5 basis points as markets digested the unexpectedly good news about economic growth and the effect that it was having on forecasts

for future interest rates. After receiving this information, the market expected the fed funds target rate to average 6.25 percent in June.

The second episode included a rise and then a decline surrounding Fed Chairman Alan Greenspan's congressional testimony about monetary policy. The first day of his testimony was on February 17. That day the fed funds futures rate for June rose six basis points to 6.27 percent. The next day, *The Wall Street Journal* reported, "Greenspan signaled that the Fed will keep boosting rates unless both consumer spending and the stock market quickly cool down."

On February 22, the fed funds futures rate fell 6 basis points. There were no significant economic data released, and so we cannot link that decline to any particular piece of new information. On February 24, the fed funds futures rate fell another 5 basis points after the government reported that orders for durable goods fell 1.3 percent in January, suggesting that the economy might be slowing a bit.

The FOMC did raise the fed funds target to 6 percent on March 21; from examining the April fed funds futures contract, we know that this increase was well anticipated by the market. As can be seen in [Figure 3](#), at this point the fed funds futures rate for June was 6.24 percent, indicating that the market expected another 25 basis point increase at the May FOMC meeting.

During the third episode, the fed funds futures rate fell 10 points on April 4 and then bounced back up 5 points on April 5. It is not clear what was the cause of the initial decline. The stock market had been very volatile on the 4th—the Dow Jones industrials fell over 500 points early in the day and then recovered to finish the day down only 57. On the 5th, the Dow fell another 131 points but Greenspan gave a speech that left markets believing the Fed would lift the fed funds target in May. At the end of this episode, the fed funds futures rate for June was 6.28.

The final episode occurred on April 27 with the release of the advance GDP report for the first quarter. This report showed that real GDP rose at a 5.4 percent rate in the first quarter, with consumer spending jumping 8.3 percent, which was the largest quarterly increase in more than 17 years. Labor costs rose 4.3 percent and consumer prices continued to rise. It is interesting to note that the news was exceptional in one way: The market was surprised by *both* higher than expected real growth and higher than expected inflation. Since 1994, there had been many upside surprises about real GDP growth, but they had typically been accompanied by lower than expected inflation. *The Wall Street Journal* reported that, "The inflation news boosts the odds that the Fed will soon raise interest rates by an aggressive half a percentage point." The fed funds futures market seemed to agree as the rate rose by 11 basis points on that day to close at 6.41. The rate then rose gradually to 6.49 on the Friday before the May 16 meeting.

I've recounted the story of the June 2000 fed funds futures contract in some detail to illustrate a general point. How can the market participants successfully predict what the FOMC will do at its next meeting? That is, how do they know the interpretation the FOMC will place on the flow of incoming information, such as that recounted in the history of the June futures contract? Part of the answer is that market participants carefully follow speeches by FOMC members, especially those by the chairman, Alan Greenspan. The track record of FOMC actions is also obviously important.

Understanding how the FOMC has reacted to information in the past aids in predicting how the Committee will respond to similar information in the future.

Market participants pull together other types of information as well. They receive the minutes of the FOMC meetings with a six or seven-week delay, a few days after the next scheduled meeting. These minutes reveal the topics discussed, summarize views about the state of the economy and describe the reasons for dissenting votes. The minutes are thorough, which provides an important vehicle for keeping the markets and the public well informed about Fed thinking.

Markets have been able to forecast Fed policy actions partly because the policy process is becoming more transparent than it was in the past. Since February 1994, the FOMC has announced changes in the fed funds target the same day that the decisions were made. As recently as the late 1980s, the Federal Reserve was still using a complex signaling method of conducting open market operations to inform markets about changes in the fed funds rate target. This complex method sometimes took several days to transfer information about policy changes. Occasionally, the signals were crossed and markets perceived changes when there were none. Not only was the process inefficient, but also it tended to favor the bond market dealers who had a special arrangement to participate in the execution of open market operations. Announcing target changes the day they are made makes knowledge about policy changes immediately known to all.

Another important feature of post-1994 Fed practice is that almost all policy actions came at regularly scheduled meetings of the FOMC. Before 1994, the Fed changed the intended rate more often between regular meetings than at regular meetings. Clearly, before 1994 the market was almost always taken by surprise by Fed policy actions because the timing of the policy decisions between scheduled FOMC meetings could not be predicted.

INTERPRETING MARKET SUCCESS IN FORECASTING FED POLICY ACTIONS

I'll now offer several possible interpretations of market success in forecasting Fed policy actions. The first is that the Fed is simply following the market. I can dispose of this argument on two levels. First, from my own experience I'm convinced that it is not true. Even recently, the Fed has sometimes surprised the market. A clear example is the fall of 1998, when the bond and stock markets were upset following the Russian default in August 1998. By reducing the intended fed funds rate on October 15, between regularly scheduled meetings, the FOMC led interest rates lower. On a theoretical level, the market equilibrium is not defined if the central bank simply follows the market, because the interest rate depends on the rate of inflation. The inflation rate is not pinned down at all if the central bank simply follows the market.

Another possibility is that Fed officials, especially the chairman, signal the market as to what the policy decision will be. Rasche and I investigated all daily changes in the one-month ahead federal funds futures contract from October 1988, when the market began, through February of this year. We identified all daily changes of five basis points or more, which we defined as "large" changes, and examined the news arriving in the market on those days. Of the 57 large changes, only 6 occurred on days when speeches or testimony by Fed officials might have been responsible. Twelve of the large changes occurred in response to Fed policy actions. On 25 occasions, press speculation

about policy actions was evident; for nine of these, the speculation seemed related to release of employment data.

Let me step back to suggest another approach to understanding market success in forecasting Fed policy actions. Consider a formal mathematical model of the economy. To write the model, we have to specify a policy rule for the central bank. The equation specifying that rule contains the policy objective or objectives and a precise description of how the central bank sets its policy instruments. The policy rule, presumably, feeds back from data on realizations of exogenous and endogenous variables, or forecasts derived from these variables.

In the United States, the Federal Reserve and the market receive new data from government statistical releases at essentially the same time. Thus, in the mathematical model of the economy the only reasonable assumption is that the market knows the policy rule, having learned it from experience or some other way, and draws the same implication for policy actions the central bank does from the arrival of new information. To run a model simulation, we could set the model in motion by imposing stochastic shocks in the various equations. What we would observe in a simulation of this model is that the market's forecasts of policy actions – forecasts embedded in the term structure of interest rates – would be driven by the arrival of new information. Let me emphasize again that the new information that affects the market is the exact same information that controls the policy decisions.

The most reasonable interpretation of the Poole-Rasche empirical findings, I believe, is that in the United States today the market acts as if it pretty closely understands the policy model the Fed uses. There is a mystery, however. The FOMC does not follow a well-specified monetary rule that can be written down as an equation or formula. How is that the market and the Fed can so consistently agree on the interpretation of new information and its significance for policy actions, or lack thereof? I don't know the answer to this question. Finding the answer may be important for carrying into the future the market's current success in forecasting Fed policy actions. If we can formalize what the Fed does, it should be possible to further improve transparency and accuracy of communication with the market in the future. As successful as monetary policy has been in recent years, there is still a major agenda for the Federal Reserve and for scholars of monetary policy in assuring that the success continues.

This framework also provides an agenda for improving policy outcomes in the future. We need more work on how the central bank can better communicate its policy intentions to the market. Perhaps my biggest single surprise since moving from academia to the Federal Reserve is how difficult this task is. The issues are often technically complicated; a Ph.D. in economics – or knowledge from day-to-day immersion in monetary policy over a span of years – really does help in understanding the issues. Members of the press through whom we must communicate rarely have this background, and a very small fraction of those reading press reports has this background. As an academic, I could talk in the abstract about central bank transparency, openness and communication of policy objectives and strategies; as a central banker intensely interested in these matters, I find the task extremely difficult. It is so very easy to say things that are misinterpreted that sometimes it seems that the most effective communication is to say little and let policy actions speak for themselves. However, in the end I believe it important that we central bankers be more

effective in communicating what we are doing and why. Modern democracies demand openness, and I think we just must respond.

WHEN THE MARKETS AND THE CENTRAL BANK DISAGREE

I've argued that in an ideal world the markets and the central bank should arrive at the same conclusions from the same data. What if they do not?

Before addressing this question, let me emphasize that I know of no models that point to the desirability of taking action for the express purpose of surprising the market. There are situations in which randomizing policy is clearly desirable, such as in the routing of armored trucks carrying large amounts of currency, or the timing and commuting route of officials who may be subject to terrorist attacks. But I know of no such examples in the monetary policy literature.

When the markets and the central bank disagree, implementing policy is more difficult. By "disagreement" I mean a situation in which the market's forecast of central bank policy action differs from what the central bank is contemplating. Disagreement may indicate that the market really does not understand what the central bank is doing. A clear example from U.S. experience is the 1979-82 period. The Federal Reserve was determined to bring the rate of inflation down substantially, but prior experience led the market to doubt the Fed's resolve. Restoring credibility once it is impaired is extremely difficult. In the early 1980s, many market participants expected the inflationary policies to continue, and it took perhaps two years of determined Fed actions to alter that presumption. In this period, the Fed was clearly correct to falsify the market's expectations as to future monetary policy.

If the central bank is going to falsify market expectations, it needs a clear conception of its policy objectives and the benefits of having the markets learn of those objectives. The central bank needs to think through tradeoffs among objectives, and how far it is willing to go in pursuing its policy in opposition to market expectations. Situations differ in different countries; in the United States, I believe that the medium-term inflation objective is paramount and that the Federal Reserve ought not trade off that objective against others. However, I also believe that within the inflation objective it is perfectly feasible for the Fed to use correctly timed policy actions to increase the stability of short-run output and employment. To me, however, it is important that the Fed not overemphasize any of the short-run objectives because doing so may create expectations in the market that, under certain circumstances, will be inconsistent with the inflation objective. When a central bank begins to lose credibility on the inflation objective, all sorts of other things are likely to go wrong.

More routinely, the market and the Fed may disagree with respect to the interpretation of the latest data release. Suppose the Fed believes that a change in the intended rate is appropriate, but the market is not predicting such a change? Given the very strong inflation-fighting credibility the Fed now enjoys, my instinct is to wait in such circumstances. It is hard for me to believe that the course of the economy will be affected dramatically if the FOMC acts at a particular meeting or at its next meeting six weeks later. By waiting, the markets and the Fed can digest additional data, which may make the appropriate course of action much clearer.

The FOMC also provides guidance to the market about its thinking through its press release at the end of every meeting indicating its view on the balance of risks in terms of higher inflation or higher unemployment. Other information in the press release and in its meeting minutes helps the market to understand the Fed's policy outlook. Ideally, the Fed should disclose as much information as possible so that the markets and the Fed will interpret incoming data the same way. But when the Fed believes that quick action is advisable, then it should act to lead the market. Explaining the reasoning behind the action is especially important in such circumstances. The clearest such case since I came to the St. Louis Fed was in the fall of 1998, a situation I've already discussed.

One other observation: At times, a central bank may want to act in a non-standard way to send a clear message to the markets. The clearest way to send such a message is by implementing policy actions that are out of the ordinary. And that requires that most policy actions be "ordinary." That is, a benefit of making policy as routine and predictable as possible is that the central bank establishes the circumstances that enable it to act decisively to lead the market when doing so makes good sense.

CONCLUDING THOUGHTS

My theme tonight has been the accuracy with which the market today can forecast Fed policy actions. How is the market so successful? The market has an excellent understanding of the process by which the Fed reaches its policy decisions. That understanding in turn reflects Fed efforts to be more transparent and more systematic. For the most part, the Fed and the market read the flow of new information the same way. As information arrives, the market changes the probability it assigns to Fed action at its next policy meeting. That is the same process I go through myself, changing my view bit by bit as new information arrives. At the time of an FOMC meeting, I collate all the information, including the expert Fed staff analysis, and settle on a tentative position going into the meeting. That position is subject to change, depending on the force of the arguments my colleagues make during the course of the meeting.

The goal of the policy actions is to achieve low and stable inflation for the United States over the long run. The Fed can do little that is constructive about short-run fluctuations in the rate of inflation, but is responsible for the long-run outcome. The market understands the policy objective and therefore can judge what policy actions are required to achieve the goal, given the ever-changing economic environment. In the research that Rasche and I have conducted, most large changes in rates in the Fed funds futures market make good sense given the nature of the new information that apparently drives these changes.

This convergence of Fed and market opinion about what needs to be done is a relatively new development. Although the convergence is still somewhat incomplete, its importance for a successful monetary policy should not be underestimated. I am continuing to work to understand how the Fed might further improve its communication with the markets. The task is not as easy as it might seem, given the complexity of the economics and the short-run focus of many market participants and press representatives. A more thorough examination of possible steps to improve market understanding further is a subject for another day.

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