

Michael R. Pakko is an economist at the Federal Reserve Bank of St. Louis. David C. Wheelock is a research officer at the Federal Reserve Bank of St. Louis. Heidi Beyer and Kelly Morris provided research assistance.



Monetary Policy and Financial Market Expectations: What Did They Know and When Did They Know It?

Michael R. Pakko and David C. Wheelock

On January 31, 1996, the Federal Open Market Committee (FOMC) voted to ease monetary policy, which was widely reported as a lowering of interest rates. Although some interest rates fell with the Fed's action, the declines were generally small, and over succeeding months market interest rates tended to rise. The yield on the Treasury's 10-year note, for example, which had been 5.63 percent on January 30, and which closed at 5.60 percent on January 31, stood at 6.34 percent on March 29, and reached 7.03 percent by June 12. Other rates behaved similarly over this period.

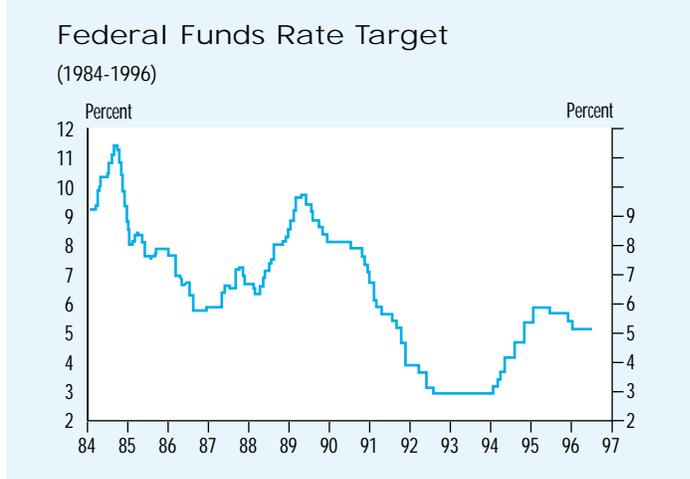
Such seemingly perverse moves in market interest rates have also followed other monetary policy actions, sometimes even on the day those actions were taken. Commonly, Federal Reserve moves to raise or to lower interest rates are followed by changes in market interest rates in the same direction. On May 17, 1994, however, the Fed announced a tightening of monetary policy, which some might expect would cause market interest rates to rise. Instead, many market rates immediately *declined*.

Clearly, the statement that the Fed controls interest rates is, at best, an oversimplification. This article attempts to demystify the relationship between Federal Reserve monetary policy actions and interest rate behavior. Interest rates are set in competitive markets by factors affecting the supply of and demand for individual securities. Monetary policy actions can affect both the supply of and the demand for financial assets, and their effects depend not only on current actions but also on the public's expectations of future policy moves.

We describe in some detail the near-term behavior of government security yields following three recent Federal Reserve policy actions. On the most recent occasion, the Fed's easing action on January 31, 1996, market yields changed little immediately following the policy move, but then yields rose over succeeding months. We contrast this experience with two other events. In early 1994, Fed policy moves to raise interest rates were associated with increases in market interest rates that might be considered greater than justified by the extent of Fed actions. Then, in May 1994, market yields declined following a Fed policy action that was widely interpreted as an effort to raise interest rates. Our review of these episodes reveals how expectations of future monetary policy actions, expectations of the effect of policy on future inflation, as well as nonmonetary influences can cause market interest rates to behave in diverse ways after apparently similar Fed actions.

We begin with a brief description of how the Fed carries out open market policy and the channels through which policy might affect market interest rates. Next, we examine some recent episodes in which market interest rates responded in different ways to Federal Reserve policy moves. Finally, we conclude with a summary of how perceptions of future monetary policy actions affect the behavior

Figure 1



of market interest rates in response to current policy moves and hence complicate the assessment of the Fed's credibility as an inflation fighter.

MONETARY POLICY, EXPECTATIONS AND MARKET INTEREST RATES

Open Market Operations and Short-Term Interest Rates

Although Federal Reserve monetary policy is often described in press accounts as the manipulation of interest rates, in fact, monetary policy is carried out mainly by varying the supply of reserves available to the banking system.¹ Open market purchases of Treasury securities by the Fed supply additional reserves, whereas open market sales withdraw reserves.

Banks hold reserves to meet statutory requirements, as well as to meet the payment demands of their customers. A bank with a reserve deficiency might borrow reserves from the Fed, sell securities from its portfolio, or borrow reserves by purchasing federal funds in the interbank reserves market. Similarly, banks with surplus reserves may choose to convert their surpluses into earning assets by acquiring securities or other assets or by selling federal funds. The interest rate that clears the market for federal funds is known as the

federal funds rate. The Fed can have a considerable effect on the federal funds rate because its open market operations affect the aggregate supply of bank reserves.

It is generally acknowledged that the Fed has considerable influence on the equilibrium federal funds rate, at least for relatively short periods. But do Federal Reserve operations affect other market interest rates?

The Expectations Hypothesis

The *expectations hypothesis* of interest rate determination states that long-term interest rates will reflect current and expected future yields on short-term securities. For example, the yield on two-year Treasury notes should be the average of the current yield on one-year Treasury bills and the expected yield on one-year bills whose holding period begins one year from now. Interest rate arbitrage ensures that this will occur. If, for example, the interest rate on one year securities that is expected to prevail one year from now would suddenly decrease, arbitrage would cause the current demand for two-year securities to rise. This would tend to lower the market yield on two-year securities to an average of the current one-year yield and the (now lower) one-year yield expected to prevail one year from now. Similarly, the yield on three-month Treasury bills should reflect the current and expected future path of the federal funds rate over the next three months. As a result, changes in current or expected future short-term interest rates will tend to cause similar movement all along the yield curve.²

Because long-term rates are linked to the current and expected future path of short-term interest rates, expectations of future Fed policy moves are important to the movements of interest rates today. It is significant therefore that changes in the Fed's target for the federal funds rate tend to be persistent, with a series of changes accumulating over time. This tendency is clearly illustrated in Figure 1, which shows how the Fed's target has evolved over the past several years.

¹ The Fed also sets the discount rate, which is the rate charged banks when they borrow reserves from the Fed, and required reserve ratios, that is, the percentage of their deposit liabilities that banks are required to hold in the form of vault cash or deposits at Federal Reserve Banks. Neither is changed frequently, however, and open market policy is the principal mechanism by which the Fed conducts monetary policy.

² See Campbell (1995) for more detail about the term structure of interest rates and empirical evidence on the expectations hypothesis.

Financial market participants are well aware of this pattern. For example, after an increase in the federal funds rate target on February 4, 1994, the *Wall Street Journal* reported, "There is little disagreement on where short-term interest rates will be going over the next year: up. The only question is how far they will rise and how fast."³

The persistence in federal funds rate changes causes current movements of the funds rate to provide information about future changes. When evaluating the course of short-term interest rates over several months, a current increase (decrease) can be expected to result in further increases (decreases). Because longer-term interest rates are affected by anticipated changes in short-term rates, the yield on a given security might respond to a particular change in the federal funds rate by more than the amount of the funds rate change because the security yield will incorporate the expectation of future changes in the funds rate in the same direction.

Monetary Policy, Inflation Expectations, and the Fisher Relationship

Interest rate arbitrage can explain why market interest rates often move upward when the Fed raises its federal funds target, and downward when the Fed lowers its target. Sometimes, however, market rates fall when the Fed raises its target and rise when the Fed lowers its target. Such apparently perverse changes in market rates can occur because Fed operations are not the sole influences on the supply of and demand for securities. Such changes can also happen because monetary policy is the principal determinant of the long-run rate of inflation—and inflation can have a pronounced effect on interest rates.

Because inflation erodes the purchasing power of money, an increase in inflation causes lenders to require higher interest rates as compensation for receiving future payments in money that has declined in value. Borrowers are willing to

pay this *inflation premium* for the same reason. As a result, a fundamental relationship between inflation and interest rates is given by the *Fisher relationship*,

$$(1) \quad i = r + \pi^e,$$

which states that the nominal interest rate (in dollar terms) consists of the following two components: the *real* interest rate (r) and a component that equals expected inflation (π^e).

Thus if market participants interpret a monetary policy action as providing new information about the outlook for inflation, interest rates should change accordingly. This is referred to as the *expected inflation effect* of monetary policy on interest rates. Financial market participants who are interested in the future course of inflation watch Federal Reserve actions closely. If the Fed is viewed as likely to pursue a policy that will prevent significant inflation over time, market yields will be lower. On the other hand, if the public doubts that the Fed is committed to low inflation, then financial markets will reflect fears of future inflation by incorporating an inflation premium in interest rates.

When investors are uncertain about the future course of monetary policy, and hence are uncertain about the future course of inflation, market yields might also be higher than they otherwise would be. For example, although inflation fell substantially in the early 1980s, interest rates remained high, and the difference between the level of market interest rates and the concurrent inflation rate has only recently declined to approximate the difference of the early 1960s. In other words, the *ex post* real interest rate—the difference between the market, or nominal, interest rate and the rate of inflation—was unusually high (see Figure 2).

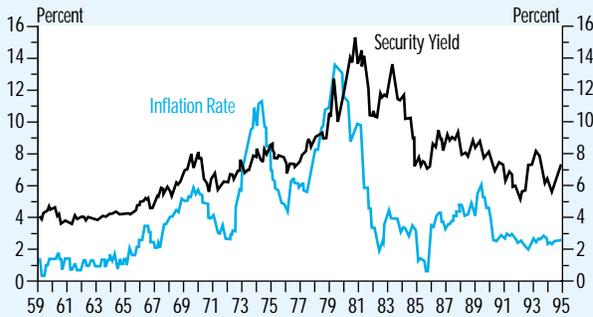
One interpretation of the high *ex post* real interest rates of the 1980s is that, after experiencing rising inflation from 1965 to 1979, investors feared a return of high inflation and thereby demanded high nominal returns on fixed-income assets.

³ Thomas T. Vogel, *Wall Street Journal*, February 7, 1994, p. C1.

Figure 2

Ten Year Government Security Yield and Year-Over-Year CPI Inflation

(January 1959-June 1996)



Alternately, if investors viewed the prospects for economic growth favorably, they may have simply demanded higher real returns on fixed-income investments. Still, because disinflations are often accompanied by high *ex post* real rates, both in the United States and in other countries [see, for example, Dueker (1996)], a fear of renewed inflation is a plausible explanation for high real rates in the 1980s.⁴

Carlstrom (1995) has aptly referred to this effect of Federal Reserve policy on interest rates as a monetary policy paradox. Short-term interest rates can be lowered only by increasing monetary growth, which tends to kindle inflationary expectations and higher interest rates. Lowering interest rates in the long run may require raising them in the short run.

MONETARY POLICY AND INTEREST RATES IN THE SHORT RUN

To evaluate the effect of Federal Reserve policy actions, we focus on the behavior of market interest rates on dates immediately preceding and immediately following recent actions. The Fed made no changes in its target for the federal funds rate during 1993, but on February 4, 1994, the FOMC announced that it had voted to “increase slightly the degree of pressure on

commercial bank reserve positions,” which it anticipated would increase market interest rates (specifically, the Fed had increased its objective for the federal funds rate by 25 basis points to 3.25 percent).

The official announcement of such a move was unprecedented, and the FOMC stated that it had made the announcement in part because this was the first tightening of monetary policy since 1989.⁵ Although it was noted that such a public announcement should not be interpreted as precedent setting, after its meeting on February 2, 1995, the FOMC announced that after each future meeting it would issue a statement indicating whether there would be any change in policy.

By publicly announcing specific policy moves, the FOMC has eliminated uncertainty about its current operational stance.⁶ But because the future course of policy remains uncertain, market participants continue to expend considerable effort attempting to forecast upcoming policy actions. Speculation about possible near-term actions often seems to affect the market prices and trading volumes of financial assets as much as actual moves do.

Expectations and Treasury Security Yields

Figure 3 plots the market yields on three U.S. Treasury securities on the date of each announced change in open market policy, that is, change in intended federal funds rate, and each meeting of the FOMC during 1994, 1995, and January 1996. The Fed increased its federal funds target six times in 1994 and once in 1995; the Fed reduced its target twice in 1995 and again on January 31, 1996. The change in basis points, if any, in the Fed’s target is noted near the top of each vertical line corresponding to the date of a policy change or FOMC meeting. The market yields on three-month Treasury bills, one-year Treasury bills, and 10-year Treasury notes on each date are plotted, as are the yields five business days before and five business days after the central dates.

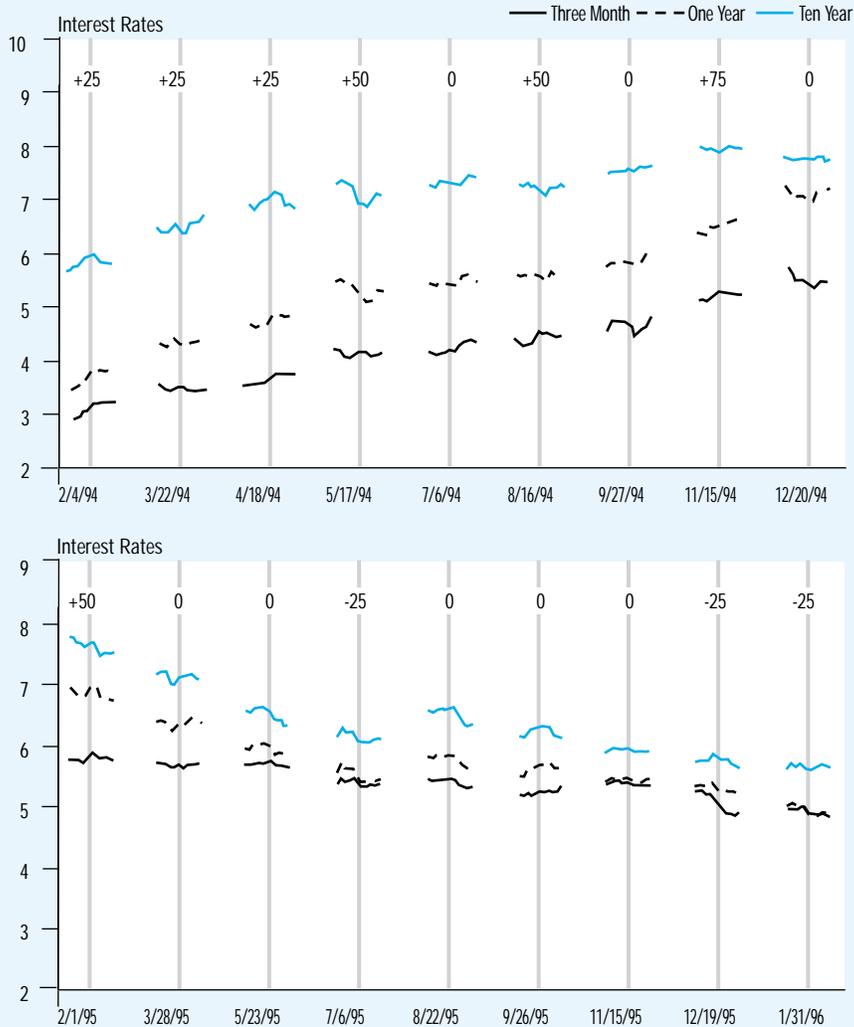
⁴ See Dotsey and DeVaro (1995) for empirical evidence suggesting that much of the disinflation of the early 1980s was unanticipated by the public.

⁵ See Pakko (1995) for a detailed description of FOMC policy moves during 1994 and Gavin (1996) for a discussion of policy moves during 1995.

⁶ Thornton (1996) finds that financial market volatility has been lower around the time of FOMC meeting dates since the policy of announcing federal funds rate changes was implemented.

Figure 3

The Market Response to Changes in the Fed Funds Target and FOMC Meetings



Market yields tended to rise during 1994, coincident with the Fed's target rate increases. Yields generally fell in 1995, and the differences in yields of securities with different maturities narrowed. The term structure of yields is often interpreted as revealing market expectations about the future paths of real returns and inflation. Researchers—including Fama (1990), Mishkin (1990), and Estrella and Mishkin (1995)—conclude that yield spreads contain both types of information. Long-term rates tend to be sensitive to inflation

expectations, whereas short-term rates follow current and expected real short-term rates more closely. Hence the substantial narrowing in the yield spread across securities of different maturities during 1995 could reflect diminished expectations for real returns, inflation, or both.

On February 1, 1995, the Fed made the last in a series of federal funds target increases. Although market interest rates rose that day, on subsequent days they resumed a decline that had begun in late

THE FEDERAL FUNDS FUTURES MARKET¹

Federal funds futures (formally known as 30-Day Interest Rate futures) have been actively traded at the Chicago Board of Trade since October 1988. The federal funds futures contract is based on the monthly average federal funds rate as reported by the Federal Reserve Bank of New York.

The contract itself calls for delivery of the interest paid on a principal amount of \$5 million in overnight federal funds held for 30 days. Contracts are priced in units of 100, with the federal funds rate being 100 minus the price (for example, a price of 92.75 implies a 7.25 percent funds rate). Contracts are settled daily, with the purchaser of a contract paying the seller \$41.67 (per \$5 million contract) for each basis point increase in the implied federal funds rate (or each 1/100 of a point decline in the contract price) at the close of business. This tick size has been set by using a 30-day month: $\$5 \text{ million} \times 30/360 \times 0.0001 = \41.67 .

The following example helps explain the potential hedging use of federal funds futures. Consider a bank that is a consistent buyer of \$75 million in federal funds at a current rate of 7 percent. The bank is worried that the federal funds rate will rise in the current month, raising its cost of funds. By selling 15 futures contracts ($15 \times \$5 \text{ million} = \75 million), the bank stands to profit from the futures transactions in the event that it suffers a loss from a higher cost of funds. For instance, suppose that on the first day of the month, the bank purchases the contracts at 93.00—implying a federal funds rate of 7 percent. If the funds rate immediately rises to 7.2 percent, the bank ends up paying \$450,000 in interest on its federal funds purchases over the course of the month [$\$75 \text{ million} \times .0720 \times (30/360)$]. However, the buyer of the federal funds futures contract pays the bank \$12,501 [$15 \text{ contracts} \times 20 \text{ ticks} \times \41.67]. The net cost to the bank is \$437,499. The bank's effective cost of funds has been locked in at 7 percent [$(\$437,499/\$75 \text{ million}) \times (360/30)$].

In addition to banks like the one described in the preceding example—seeking to hedge positions in the federal funds market—futures trade is also carried out by speculators who are betting on a particular course of monetary policy. Each type of trader has an incentive to consider the most likely outcome of monetary policy when deciding whether to participate in a transaction, so the price of federal funds futures represents the market's best estimate of the federal funds rate over the course of the contract month.

¹ A more complete description of the federal funds futures market can be found in Chicago Board of Trade (1995).

1994. Security yields continued to decline throughout 1995, with the Fed lowering its funds rate target in July and December and again in January 1996.

It is apparent from Figure 3 that when the Fed changes its federal funds target, market rates sometimes, but not always, move in the same direction as the Fed's adjustment. Even when market rates do move in the same direction, they do not move by the same amount as the change in the federal funds rate. A change in expected inflation accompanying a monetary policy action could explain otherwise counterintuitive changes in market interest

rates, such as a decline in market rates following a tightening of monetary policy or an increase in market rates following an easing of policy.

In the next sections we examine in more detail the behavior of market rates around three recent episodes of changes in the Fed's target federal funds rate. Knowledge of the extent to which financial market participants anticipated a policy move is important for interpreting each event. Monetary policy actions that are widely anticipated will not convey new information about future inflation, but actions that take markets by surprise may

alter forecasts of future inflation. The effect of a policy move on interest rates thus depends on whether the move was expected. One source of information about market expectations of Fed policy moves is the federal funds futures market.

Information from the Federal Funds Futures Market

Since 1988, the Chicago Board of Trade has offered a market in futures contracts based on the federal funds rate. (See the shaded box, *The Federal Funds Futures Market*.) Contracts in this market are based on the monthly average federal funds rate, as reported by the Federal Reserve Bank of New York. The market is used both by financial institutions to hedge their federal funds market positions against changes in the funds rate and by speculators attempting to predict Federal Reserve monetary policy. Because the contracts are based on future monthly averages of the federal funds rate, price movements directly reflect market participants' expectations of policy actions.

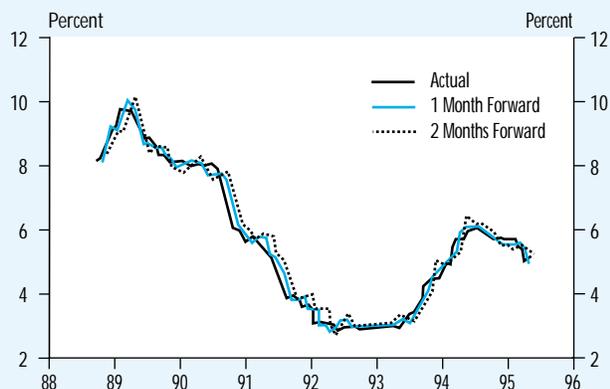
Figure 4 shows the accuracy with which the federal funds futures market has predicted actual movements in the funds rate. Both the one-month ahead and two-month ahead rates track the actual funds rate closely, although the two-month ahead forecast fails to predict turning points as accurately as the one-month ahead forecast, lagging behind actual funds rate movements. Nevertheless, Krueger and Kuttner (1995) and Rudebusch (1996) find that one-month, two-month, and three-month future rates are all accurate predictors of subsequent federal funds rate movements.

Information from the federal funds futures market is used in Figure 5 to show expectations of movements in the funds rate implied by futures prices in the days leading up to and following FOMC meetings and policy changes in 1994 and 1995. The figure shows two series of futures yields. One series is the funds rate the market predicts will prevail after the meeting (see the appendix for details of the calculations). The second series is the funds rate derived from a three-month for-

Figure 4

Federal Funds Futures

Actual, 1 month forward and 2 months forward through 3/96



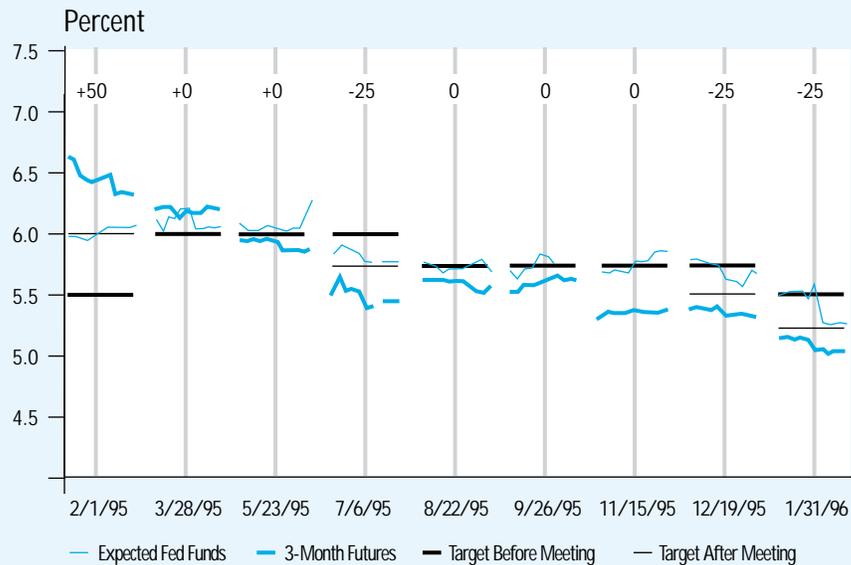
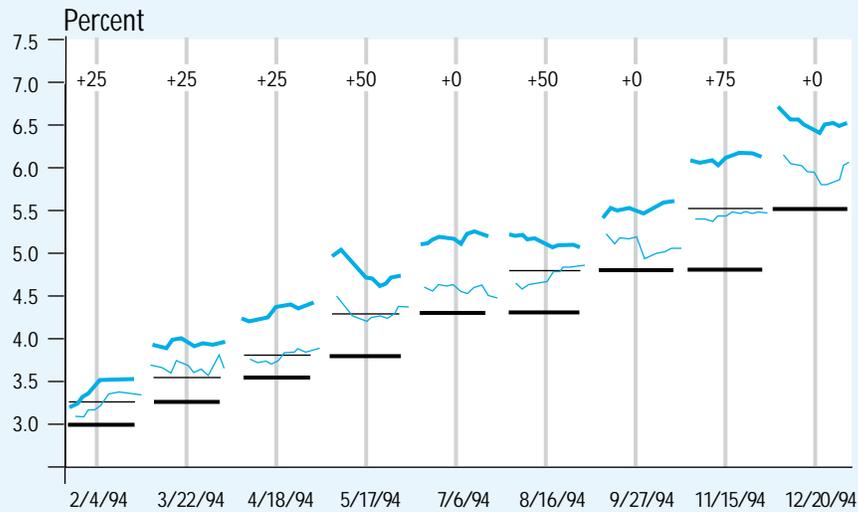
ward contract, indicating market expectations for future levels of the federal funds rate.

Figure 5 illustrates several notable points. First, the three-month ahead futures rate was above the one-month futures rate throughout 1994 and into early 1995. But when the Fed lowered the funds rate in July 1995, its first such move since 1992, the three-month futures rate was below both the spot rate and the current month's predicted funds rate. The market had thus correctly forecast the directional change in Fed policy.

The data in Figure 5 also show that many of the Fed's policy actions during 1994 were at least partly anticipated. That is, futures contracts were priced to reflect changes in the federal funds rate before the Fed altered its target. On occasions when it appears that funds rate changes were not fully anticipated, the three-month forward forecast moved in the same direction as the forecast funds rate for the remainder of the current month. In other words, unexpected changes in the Fed's target led market participants to expect further adjustments to the rate in the same direction as the initial move. The evidence thus indicates that, at least since 1994, the federal funds futures market has forecast specific Fed policy actions fairly well and that futures prices reflect

Figure 5

Fed Funds Expectations Derived from



— Expected Fed Funds — 3-Month Futures — Target Before Meeting — Target After Meeting

the Fed's tendency to make multiple moves in one direction before reversing course.

Evaluating Market Responses to Specific Monetary Policy Actions

For both policymakers and market participants, the information about expected monetary policy and inflation embedded in

interest rates would be useful. As our analysis suggests, however, the effects of monetary policy moves on interest rates can be difficult to dis-en-tangle. This difficulty is illustrated by a look at three specific episodes of Federal Reserve policy moves.

February 1994

On February 4, 1994, the FOMC voted

to “increase slightly the degree of pressure on reserve positions,” resulting in an increase of 25 basis points in the federal funds rate. At the time, some financial analysts claimed that the move took markets by surprise. The move, however, was foreshadowed by Federal Reserve Chairman Alan Greenspan only days earlier. On January 31, 1994, the chairman stated that, “at some point . . . we will need to move [short-term interest rates] to a more neutral stance.”⁷ This comment was interpreted by some analysts as indicating, “It’s a question of when, not whether, they will tighten.”⁸

The path of federal funds rate expectations illustrated in Figure 5 makes it clear that the move was anticipated. Beginning on January 31, the expected funds rate rose gradually to the point where the 25 basis point move was almost fully anticipated on the day it occurred. Figure 3 shows that long-term interest rates rose along with the expected federal funds rate. However, bond rates tended to rise by more than the expected funds rate. From January 28 through February 4, the expected federal funds rate rose by 22 basis points, whereas the three-month, one-year, and 10-year Treasury security yields rose by 30, 35, and 26 basis points, respectively.

There are many potential explanations for the larger increases in Treasury security yields. One explanation is rather unique to this particular occasion. It holds that the Fed’s policy adjustment was a preemptive move to head off a possible rise in inflation rather than a response to an already-observed increase in inflation. Yet many observers had not seen the emergence of inflation as imminent, so the move was interpreted by some as indicating that the FOMC had information or insight about inflation that was not generally available to the public. Hence inflation expectations were revised upward, and market yields rose.

A related explanation for the large increases in security yields is that the public viewed the relatively small policy move as inadequate to have much effect on incipient inflationary pressures. The

market expected a more forceful move from the Fed and in the absence of such a definitive move, revised inflation expectations upward. Either explanation is consistent with the increase in market interest rates that accompanied the Fed’s tight-ening move.

A third explanation—which does not involve any revision to expectations of inflation—seems more plausible, however. Because the FOMC tends to move the federal funds rate in a series of increments, the increase on February 4, 1994 led market participants to anticipate further increases. As a result, long-term rates, which reflect current and expected short-term rates, increased by more than the federal funds rate.

Figure 5 supports the notion that the 25 basis point increase on February 4 led market participants to expect further increases. At the same time that the expected funds rate for February rose in anticipation of the move on February 4, the implied three-month future yield also rose. By the time the February increase in the federal funds rate was announced, the futures market was already predicting another 25 basis point increase within the next three months. This expectation was mirrored in the comments of market analysts at the time: for example, one market observer interpreted the funds rate increase as “the first step on a journey that is going to last some time.”⁹

So the behavior of market rates at the time of the Fed’s first move to tighten policy could have been caused by an awakening of inflation fears, by the arbitrage effect of current and prospective increases in the federal funds rate, or conceivably by some combination of these effects.

May 1994

After two more increases of 25 basis points each in March and April, the FOMC raised its objective for the federal funds rate by 50 basis points on May 17, 1994. The response in the bond market was the reverse of previous funds rate increases. As the May FOMC meeting approached, long-term bond yields *declined*. After the funds

⁷ Statement before the Joint Economic Committee, United States Congress, January 31, 1994. *Federal Reserve Bulletin* (March 1994, p. 233).

⁸ Joseph Liro, chief economist at S.G. Warburg, quoted by Thomas D. Laurencella and Laura Young, *Wall Street Journal*, February 1, 1994, p. C23.

⁹ John Lipsky, chief economist at Salomon Brothers, quoted by Thomas T. Vogel, *Wall Street Journal*, February 7, 1994, p. C19.

Figure 6

The Market Response to Changes in the Fed Funds Target

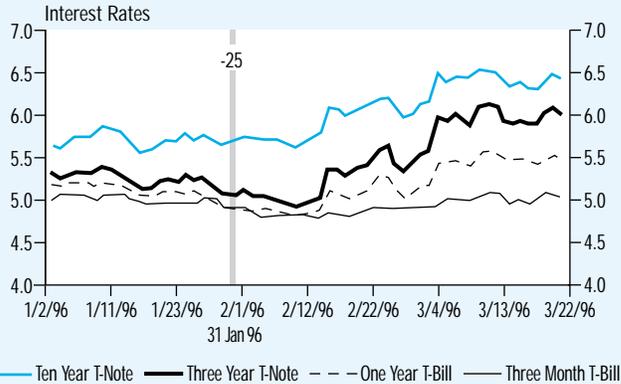


Figure 7

Fed Funds Futures Market Implied Expected Funds Rate



rate increase was announced, bond yields continued to decline. On the day of the funds rate change, the yield on 10-year Treasury notes, for example, fell by 21 basis points.

The decline in bond yields appears to have been directly related to the Fed's move. Reports in the financial press suggest that there was a great deal of uncertainty about the timing and magnitude of the policy move. On the morning of the meeting, a *Wall Street Journal* reporter noted that "several interest-rate watchers expect an increase in rates. The only question is how much?"¹⁰ Figure 5 shows that the federal funds

futures market was predicting a high probability of a 50-basis-point increase.

Did the magnitude of the funds rate increase convince market participants that the Fed's anti-inflation strategy would be successful? That is one explanation of the decline in bond yields. That conclusion, however, cannot be drawn with certainty. Once again, the expectations hypothesis suggests an alternate, though not mutually exclusive, interpretation. After the 50-basis-point increase, there was speculation that the FOMC would not have cause to raise the funds rate again in the near future. The official statement released by the FOMC following its meeting contributed to this sentiment: "These actions . . . substantially remove the degree of monetary accommodation which prevailed throughout 1993."¹¹ A *Wall Street Journal* writer interpreted this statement as being quite clear: "Yesterday's declaration means that the Fed now believes it is very close to neutral and doesn't expect any further rate increases soon."¹² To the extent that bond market participants lowered their expectations of further increases in the funds rate, the expectations theory of interest rates would predict a decline in bond yields, even if inflation expectations remained unchanged.

The reaction of the federal funds futures markets gives some credence to this view. As shown in Figure 5, the implied rate on three-month futures was falling for a period both before and after the meeting. Nevertheless, it continued to indicate that at least one more increase of 25 basis points was likely within the next three months. Hence it is unclear whether the bond market's reaction to the policy move on May 17, 1994, indicated a reduction in expected inflation, a change in the short-term outlook for Fed policy, or both.

January 1996

A third example serves to show the dynamic nature of market expectations and their responses to Federal Reserve policy. On January 31, 1996, the Fed voted, in effect, to reduce its target for the

¹⁰ Dave Kansas, *Wall Street Journal*, May 17, 1994, p. C2.

¹¹ *Federal Reserve Bulletin*, July 1994, p. 610.

¹² David Wessel, *Wall Street Journal*, May 18, 1994, p. A3.

federal funds rate by 25 basis points, from 5.50 percent to 5.25 percent. (At the same time, the Fed lowered the discount rate from 5.25 percent to 5.00 percent.) According to the financial press, the Fed's action was widely expected and the rise in short-term security prices in preceding days reflected anticipation of the move.¹³ Between January 1 and January 30, 1996, market yields on short-term Treasury securities fell some 20 to 30 basis points. The yields on government securities with maturities of seven years or more, however, did not fall over the period.

Government security yields did decline, but only modestly, after the Fed's cut in its funds rate target on January 31. Although the Fed reduced its target by 25 basis points, market yield declines ranged from eight basis points on three-month bills to just one basis point on 30-year bonds. Yields on short- and medium-term securities continued to decline through mid-February, however, but those on long-term government securities changed little—some even increased. Then, from mid-February through March, yields on all securities rose. For illustration, the daily yields on three-month, one-year, three-year and 10-year Treasury securities are plotted in Figure 6.

How might we interpret the behavior of interest rates both before and after the Fed's reduction in its funds rate target on January 31, 1996?

The modest changes in interest rates that occurred on January 31, support the press's view that the Fed's action had been widely anticipated. Further evidence of this can be seen in Figure 7, which plots the expected average federal funds rate in different months using data from the federal funds futures market. On January 30, the funds rate the market expected to prevail during February lay between the prevailing Fed target of 5.50 percent and the new target of 5.25 percent established on January 31. That the expected rate lay closer to the new target indicates that on January 30 the market believed that the Fed was more likely than not to reduce its target on January 31. When the Fed

validated these expectations, the expected funds rate for February fell immediately to 5.25 percent.

The data charted in Figure 7 also illustrate that on January 30 the futures market expected not only the funds rate cut on January 31, but also further cuts from March through July. After the Fed reduced its target, these expectations only hardened.

Further evidence that the Fed's action on January 31 was widely anticipated is reflected in the lack of change in intermediate- and long-term Treasury security yields on that date. The failure of long-term yields to change significantly on the Fed's easing move is thus consistent with the behavior of short-term rates, the federal funds futures market, and the financial press, all of which suggest that the Fed's move was widely anticipated.

Between mid-February and March 31, 1996, market interest rates generally rose. As illustrated in Figure 6, rates made two especially large jumps in mid- and late February and one more in early March. Throughout the period, new data suggested that the economy was growing more quickly than some previously released indicators had suggested. Moreover, in mid-February, rising commodity prices suggested to some market participants that inflation was likely to rise, causing market security yields to rise.¹⁴ Although yields rose across the spectrum of maturities, long-term security yields rose most. This pattern of rate changes suggests that the new information caused market participants to revise their expectations of the Fed's target for the federal funds rate upward over ensuing months, and possibly expectations of inflation as well.

Market interest rates again rose when Federal Reserve Chairman Greenspan testified before Congress about monetary policy and the state of the economy on February 20, 1996, which many analysts interpreted as confirmation that additional funds rate reductions over the near term were unlikely. Finally, the release of new employment data on March 8, 1996,

¹³ See, for example, Dave Kansas, *Wall Street Journal*, January 31, 1996, p. C1.

¹⁴ For example, see Dave Kansas, *Wall Street Journal*, February 15, 1996, p. C1.

revealing an unexpectedly large increase in employment during February is widely cited for a sharp increase in bond yields on that date. According to one report, “The carnage [in the bond market] began immediately after a stronger-than-expected employment report snuffed out hope that Federal Reserve policymakers would lower short-term interest rates anytime soon.”¹⁵

The evolution of expectations about the course of Fed policy was reflected in the federal funds futures market. In addition to the expected future funds rate path implied by market pricing on January 30 and January 31, Figure 7 plots the implied path based on futures market data from March 8. In contrast to the earlier dates, when further funds rate cuts were expected, on March 8 the market expected the funds rate to remain at 5.25 percent through July 1996.

According to the expectations hypothesis, the rise in long-term interest rates on March 8 reflected the expectation that short-term rates would rise in the future. The increase in long-term rates could also reflect a revised anticipation of higher inflation in the future, though other explanations, such as an increase in the real interest rate, could also explain the rise. Inevitably, because many factors affect the supply of and demand for securities, any one move in market yields can have several non-mutually exclusive explanations. Nevertheless, the behavior of market rates after January 31, 1996, is consistent with, first, a period of relative calm in which markets anticipated further reductions in the Fed’s interest rate target, with little apparent change in inflation expectations. Then, following new information about the health of the economy and new speculation about Fed behavior, markets changed their expectations about the near-term course of monetary policy and perhaps revised their expectations of future inflation upward.

CONCLUSION

Evaluating the credibility of monetary policy by observing bond market reactions

can be difficult. Sometimes market rates rise when the Fed’s target is raised, and sometimes they fall. Sometimes rates move by more than the change in the funds rate and sometimes by less. These responses can be interpreted as an amalgam of inflation expectations, anticipated future monetary policy actions, and changes in real rates of return.

Although these influences are difficult to disentangle, the information from the federal funds futures market can help identify the role of expectations in the determination of market interest rates. Specifically, with an understanding of the extent to which a Fed policy action is anticipated in financial markets, we can better interpret subsequent changes in market interest rates.

Throughout 1994 and 1995, however, the behavior of the federal funds futures market suggests that most Fed actions were at least partly anticipated. Moreover, the Fed’s tendency to move its target for the federal funds rate incrementally in one direction before reversing course is built into market expectations of future policy actions, as revealed in both the spot markets for Treasury securities and the federal funds futures market. The incremental nature of Fed policy moves, along with interest rate arbitrage, likely also explains why market interest rates typically moved in the same direction as changes in the federal funds rate during 1994–95. When a policy move is widely anticipated, and particularly if it is expected to be one of many in a series of moves in the same direction, market expectations about inflation are not altered. Only surprise moves, or moves that are widely taken as turning points, will typically alter expectations about inflation.

REFERENCES

- Campbell, John Y. “Some Lessons From the Yield Curve,” *Journal of Economic Perspectives* (Summer 1995), pp. 129–52.
- Carlson, John B., Jean M. McIntire and James B. Thomson. “Federal Funds Futures as an Indicator of Future Monetary Policy: A Primer,” *Federal Reserve Bank of Cleveland Economic Review*, vol. 31, no. 1 (1995 Quarter 1), pp. 20–30.

¹⁵ Vogelstein and Jereski, *Wall Street Journal*, March 11, 1996, p. C1.

REVIEW

JULY/AUGUST 1996

Carlstrom, Charles T. "A Monetary Policy Paradox," *Economic Commentary*, Federal Reserve Bank of Cleveland (August 15, 1995).

Chicago Board of Trade, "Flexible Futures For Managing Interest Rate Risk," 1995.

Dotsey, Michael, and Jed L. Devaro. "Was the Disinflation of the Early 1980s Anticipated?" Federal Reserve Bank of Richmond *Quarterly Review* (Fall 1995), pp. 41–59.

Dueker, Michael. "When Are Low-Inflation Policies Credible?" Federal Reserve Bank of St. Louis *Monetary Trends*, January 1996.

Estrella, Arturo, and Frederic S. Mishkin. "The Term Structure of Interest Rates and Its Role in Monetary Policy for the European Central Bank" NBER Working Paper #5279, 1995.

Fama, Eugene F. "Term-Structure Forecasts of Interest Rates, Inflation, and Real Returns," *Journal of Monetary Economics* (January 1990), pp. 59–76.

Federal Reserve Bulletin, various issues.

Gavin, William T. "The FOMC in 1995: A Step Closer to Inflation Targeting?" this *Review* (forthcoming).

Krueger, Joel T., and Kenneth N. Kuttner. "The Fed Funds Futures Rate as a Predictor of Federal Reserve Policy," Federal Reserve Bank of Chicago, working paper WP-95-4, March 1995.

Mishkin, Frederic S. "What Does the Term Structure Tell Us About Future Inflation?" *Journal of Monetary Economics* (January 1990), pp. 77–95.

Pakko, Michael R. "The FOMC in 1993 and 1994: Monetary Policy in Transition," this *Review* (March/April 1995), pp. 3–25.

Rudebusch, Glenn D. "Do Measures of Monetary Policy in a VAR Make Sense?" working paper, Federal Reserve Bank of San Francisco (March 1996), #96-05.

The Wall Street Journal, various issues.

Thornton, Daniel L. "Does the Fed's New Policy of Immediate Disclosure Affect the Market?" this *Review* (forthcoming).

Appendix

CALCULATIONS UNDERLYING FIGURE 5

Figure 5 presents estimates of expected FOMC policy actions, as derived from the federal funds futures market. To isolate the funds rate that is expected to prevail *after* an FOMC meeting, some calculations are necessary. At any point during a month, the current-month federal funds futures rate (i^f) can be thought of as a weighted average of two components—the actual funds rate experienced to date (i^a), and the rate expected to prevail for the rest of the month (i^m):

$$(1) \quad i^f = \frac{T}{N} \times i^a + \frac{N-T}{N} \times i^m,$$

where T is the number of days passed to date and N is the number of days in the month. This equation can be solved for the rest-of-month expected rate.

If there is a meeting of the FOMC, however, then the expected rate for the rest of the month can be similarly expressed as a weighted average of two components—the prevailing federal funds target, (i^*) and the rate expected to prevail after the meeting:

$$(2) \quad i^m = \frac{M-T}{N-T} \times i^* + \frac{N-M}{N-T} \times i^e,$$

where M is the FOMC meeting date.

Combining these two expressions and solving for i^e gives the following:

$$(3) \quad i^e = \frac{N \times i^f - T \times i^a - (M-T) \times i^*}{N-M}.$$

Hence we can find the rate expected to prevail following an FOMC meeting by taking the rate implied in the current futures contract and subtracting components related to the actual funds rate to date and the target funds rate expected to prevail between the current

date and the FOMC meeting. This is the calculation underlying the expected funds rate measures illustrated in Figure 5 for days leading up to FOMC meetings. For the days following the meeting, the following for days leading up to FOMC meetings. For the days following the meeting, the following more simple formula

$$(4) \quad i^e = \frac{N \times i^f - T \times i^a}{N-T},$$

is used.[‡]

[‡] To prevent distortions that sometimes appear toward the end of the month (because of the nature of the futures contract), the implied funds rate from the subsequent month is used for days following FOMC meetings in cases where the meeting date falls within the last five business days of a month. See the shaded box, p. 24.