
Expectations and the Monetary Policy Transmission Mechanism

By Gordon H. Sellon, Jr.

“For successful monetary policy is not so much a matter of effective control of overnight interest rates as it is of shaping market expectations of the way in which interest rates, inflation, and income are likely to evolve over the coming year and later.”

—Michael Woodford

In principle, the monetary policy transmission mechanism can be described rather simply. When the Federal Reserve raises its target for the federal funds rate, other interest rates also rise—reducing interest-sensitive spending and slowing the economy. Conversely, when the federal funds rate target is lowered, other interest rates tend to fall—stimulating spending and spurring economic activity.

While adequate for some purposes, this stylized description of the transmission mechanism is less helpful in explaining the complex relationship between interest rates and monetary policy that is actually observed in financial markets. In practice, the relationship between changes in the federal funds rate target and market interest rates appears to be looser and more variable than suggested by the stylized view, especially for longer-term interest rates. Moreover, sizable movements in

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market interest rates are often associated with economic data releases or statements by policymakers even when there is no accompanying change in the funds rate target. Indeed, many times market interest rates appear to anticipate rather than react to policy actions.

The stylized view of the transmission mechanism also provides little insight into the source of the Federal Reserve's leverage over market interest rates. Indeed, how does control over a relatively insignificant interest rate—the overnight federal funds rate—allow the Federal Reserve to influence the whole spectrum of short-term and long-term market rates?

This article describes a simple analytical framework that provides a better conceptual understanding of the monetary policy transmission mechanism and also helps explain the complex relationships between monetary policy and interest rates observed in financial markets. In this framework, financial market expectations about future monetary policy play a central role. Indeed, expectations about the path of future policy actions are the driving force in determining market interest rates. Consequently, understanding how financial markets construct this expected policy path and what factors cause the path to change is critical to understanding the transmission process and the behavior of interest rates.

The analysis also has broader implications for the design and implementation of monetary policy. In a world where policy expectations drive interest rates, what a central bank says about its long-run goals and about the economic outlook may be as important, or even more important, than what it does. Consequently, how a central bank communicates with the public and financial markets can play a crucial role in the transmission mechanism and the evolution of market interest rates.

The first section of the article provides a brief overview of the transmission mechanism, highlighting the complex relationships between the federal funds rate target and market interest rates. The second section sets out the framework for the analysis and examines the connection between the expected policy path and the term structure of interest rates. The third section discusses how changes in the policy path cause changes in the term structure. The fourth section illustrates how an estimate of the policy path can be derived from the Treasury yield

curve and shows how new information about the economy and monetary policy influences the policy path and market interest rates. The fifth section shows how historical policy paths can be used to understand the linkage between monetary policy and long-term interest rates. The final section discusses some broader implications for monetary policy when expectations play a central role in the monetary policy transmission mechanism.

I. AN OVERVIEW OF THE POLICY TRANSMISSION MECHANISM

Like many central banks, the Federal Reserve implements monetary policy by setting a target level for a short-term market interest rate. Eight times a year, the Federal Open Market Committee (FOMC) meets to review the outlook for the economy and establishes a target for the overnight federal funds rate that is believed to be consistent with its longer-run objectives for price-stability and economic performance. Once a target level is set, it remains at that level until the FOMC believes it should be changed.¹ For example, signs of inflationary pressures might cause the FOMC to raise the target, while signs of economic weakness might lead to a lower target. Since the federal funds rate itself is a market rate and not set by the Federal Reserve, the Federal Reserve uses open market operations to adjust the supply of reserves in the banking system to keep the federal funds rate close to the target level.

Important features of the federal funds rate target and the relationship between the federal funds rate and the target are shown in Charts 1 and 2. On a daily basis, differences in the two series can be large (Chart 1). The target series is very smooth; the target typically changes in small steps of 25 to 50 basis points in one direction for an extended period of time. Over the period examined, the target has varied from a high of 8.25 percent in early 1990 to a low of 1 percent in 2003-04. In contrast, the federal funds rate can change by several hundred basis points from one day to the next. Despite the daily volatility, though, the trend in the funds rate tends to follow the target series quite closely. Moreover, as shown in Chart 2, over the longer period of a month, the two series are almost identical, suggesting that the Federal Reserve can achieve close control of the funds rate over a relatively short horizon.²

Chart 1
FEDERAL FUNDS RATE AND TARGET: DAILY

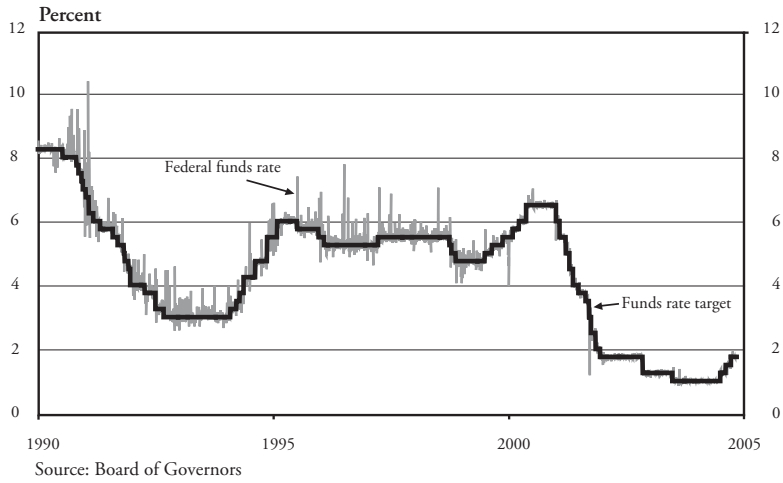


Chart 2
FEDERAL FUNDS RATE AND TARGET: MONTHLY

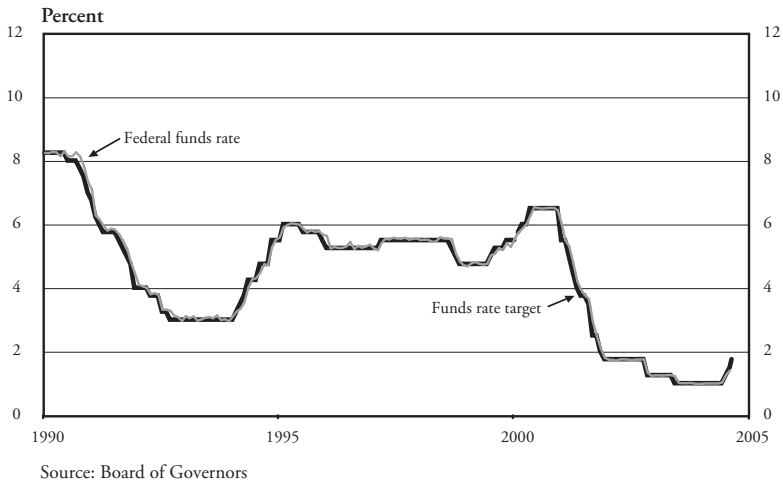
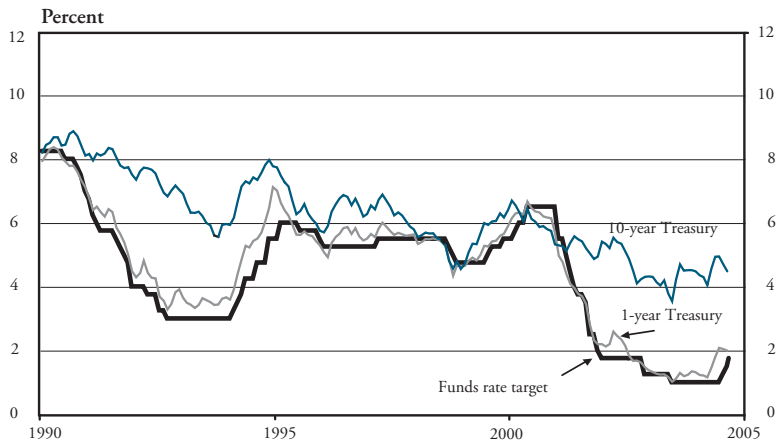


Chart 3

RELATIONSHIP BETWEEN FUNDS TARGET AND LONGER-TERM RATES



Source: Board of Governors

This article focuses on the next step in the transmission process—how control over the federal funds rate allows the Federal Reserve to influence the whole structure of market interest rates. Since households and businesses generally borrow for much longer terms than overnight, how does control over an overnight rate allow the Federal Reserve to affect longer-term borrowing costs?

A good starting point for seeing how changes in the funds rate target are transmitted to longer-term rates is to look at historical relationships between the funds rate target and longer-term interest rates. Chart 3 shows the relationship since 1990 between the funds rate target, the one-year Treasury rate, and the ten-year Treasury rate. Both the one-year and ten-year rates play an important role in the economy. For example, many adjustable-rate mortgages are tied to the one-year rate, while rates on 30-year, fixed-rate mortgages tend to move with the ten-year rate.

Although the three series generally move up and down together, as shown in the chart, the relationship between the funds rate target and ten-year rate is clearly much looser than the relationship between the target and the one-year rate. In particular, the ten-year rate appears to

respond much less to decreases in the funds rate target than to increases. Moreover, the ten-year rate appears to move considerably in advance of changes in the target, a particularly notable feature from 1999 to 2000. From this chart, it would appear that the Federal Reserve has much less leverage over longer-term rates than short-term rates.

To understand these differences and explore the connection between monetary policy actions and market interest rates in more detail requires a model describing these relationships. The next section presents a simple framework showing how market interest rates depend, not only on today's federal funds rate target, but also on expected future targets. The following section describes how changes in current and future targets affect the entire term structure of interest rates.

II. POLICY EXPECTATIONS AND THE TERM STRUCTURE

The model of interest rates most widely used by economists and financial market practitioners is the expectations theory of the term structure. According to the expectations theory, the interest rate on any security can be viewed as an average of today's federal funds rate target and the entire series of future targets expected by financial markets over the life of the security. Knowledge of this path of expected future targets provides important insight into the term structure of interest rates and its evolution over time.

The "policy path"

The expectations theory of the term structure provides a convenient framework for connecting the federal funds rate target to the entire structure of market interest rates. According to the expectations theory, any long-term interest rate can be viewed as an average of today's short-term rate and a series of expected future short-term rates, plus a term premium.³ For example, today's two-year rate can be expressed as an average of today's one-year rate and the one-year rate that is expected to prevail in one year, plus a term premium:

$$(1) \quad \begin{aligned} 2\text{-year rate} &= \frac{1}{2}(\text{1-year rate} + \text{expected 1-year rate in one year}) \\ &+ \text{term premium} \end{aligned}$$

The same formula can be used to express the one-year rates in equation (1) as an average of rates of shorter maturity. Thus, for example, today's one-year rate can be expressed as an average of today's one-month rate and the series of expected one-month rates over the next 11 months (plus a term premium):

$$(2) \quad \begin{aligned} 1\text{-year rate} &= \frac{1}{2}(\text{1-month rate} + \text{sum of expected 1-month rate} \\ &\text{over 11 months}) + \text{term premium} \end{aligned}$$

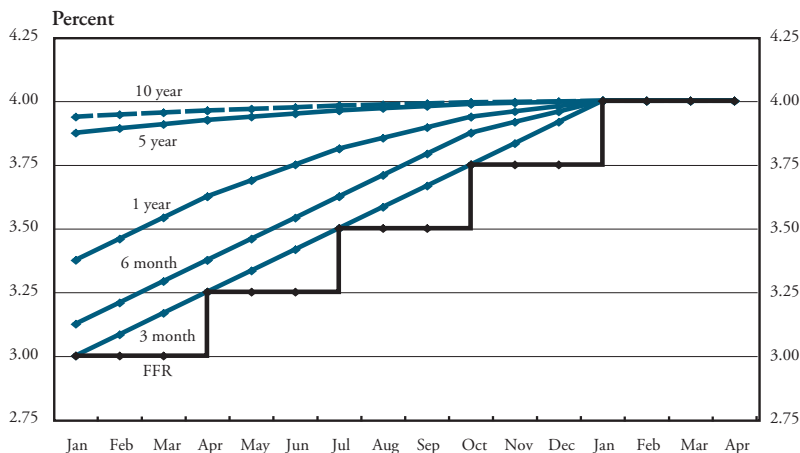
As shown in Chart 2, the Federal Reserve controls the federal funds rate very closely over a month. Consequently, the one-month rate in equation (2) should be closely tied to the current funds rate target, and the expected one-month rates over the next 11 months should be closely tied to the expected level of the target in each month over the remainder of the year. In this way, the one-year rate can be expressed as a simple average of the current target and the expected target over the balance of the year. Then, by equation (1), the two-year rate also can be expressed as an average of the current funds rate target and the expected target over the next two years.

Following this logic, market rates on longer-term securities can also be expressed as an average of the current funds rate target and the series of expected targets over the life of the security.⁴ In the remainder of this article, the term "policy path" denotes this sequence of current and expected future funds rate targets.

The policy path and the term structure of interest rates

To understand the close relationship between the policy path and market interest rates implied by the expectations theory, it may be helpful to see what happens to market rates when the Federal Reserve follows a simple policy path. Chart 4 shows a situation where the funds rate target is 3 percent in the initial month (January), and financial markets expect the target to rise 25 basis points every three months (April, July, October, January) until it reaches 4 percent in a year. Once

Chart 4
POLICY PATH AND INTEREST RATES OVER TIME



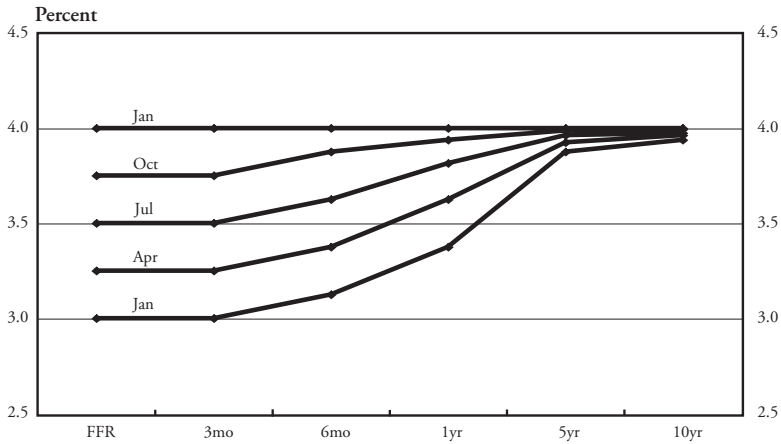
it reaches 4 percent, the target is expected to remain there indefinitely. This sequence of targets is the policy path expected by financial markets as of January. Chart 4 shows how the three-month, six-month, one-year, five-year, and ten-year rates will change over time as the funds rate target is raised over the next 12 months, assuming the Federal Reserve follows the expected policy path.⁵

This chart illustrates three important features of the relationship between the policy path and interest rates. First, interest rates at all maturities rise through time when markets expect the funds rate target to rise. The increase in rates is a direct result of the averaging process implied by the expectations theory. As time goes by, lower target rates drop out of the average and are replaced by higher target rates.

Second, interest rates tend to rise in anticipation of the expected changes in the target rate and exhibit little response on the day the target is actually changed. This behavior is a direct result of the assumption that the Federal Reserve adjusts the funds rate target exactly as markets expect. If instead, the Federal Reserve deviates from the expected path, market rates would likely react strongly to the unexpected target change, as discussed in more detail in the next section of the article.

Chart 5

CHANGES IN YIELD CURVES WHEN POLICY IS TIGHTENED



Third, over the year in which the target rises, short-term rates increase by a much larger amount than longer-term rates. For example, the three-month rate rises the full 100-basis-point increase of the target rate, while the five-year rate increases only 12.5 basis points, and the ten-year rate only 6.25 basis points. This difference reflects the fact that the full extent of policy tightening is already built into longer-term rates even before the tightening begins, while the full extent of tightening is only reflected in short-term rates over time.⁶

Another useful way of looking at the relationship between the policy path and interest rates is to see how the path is related to the yield curve or term structure of interest rates. Chart 5 shows yield curves derived from the example in Chart 4 for the initial month of January and for each month the target rate is increased (April, July, October, and January). Each yield curve is simply the cross-section of interest rates at each date and can be constructed by looking at the vertical distance between rates for each date in Chart 4. For the initial month of January, the yield curve is steeply upward-sloping with short-term rates well below longer-term rates, reflecting the anticipated policy tightening. Over time, the yield curve becomes flatter as the expected

changes in the target rate actually occur. Once the target rate reaches 4 percent in a year's time, the yield curve becomes horizontal, reflecting the assumed constancy of the target rate beyond one year.

III. HOW DO CHANGES IN THE POLICY PATH AFFECT INTEREST RATES?

The expectations theory suggests that, at any point in time, the current structure of market interest rates contains an implied path for the federal funds rate target. As discussed in the previous section, this path determines how interest rates will evolve over time. The policy path is not set in stone, however. As financial markets receive new information about the economic outlook and monetary policy, they are likely to revise the policy path. These changes mean that interest rates may evolve differently from the pattern implied by the current policy path. Thus, it is important to understand how changes in the policy path affect market interest rates.

Although a change in the policy path could take many forms, three general factors are important in determining how market rates will respond: how long the change in the path is expected to persist, the timing of the expected change in the path, and the size of the expected change in the path.

Persistence of changes in the policy path

The expected persistence of a change in the policy path plays an especially important role in the response of interest rates to a change in the path. Persistence refers to the length of time a change in the path is expected to last. Generally speaking, the more persistent a change in the policy path, the larger the effects on longer-term interest rates.

The role of persistence is illustrated in Chart 6. For simplicity, it is assumed that financial markets initially expect a flat policy path with the funds rate target remaining at its current level of 4 percent indefinitely. In this situation, according to the expectations theory, the yield curve will be horizontal at 4 percent.⁷ Next, assume the Federal Reserve unexpectedly raises the funds rate target to 5 percent. The response of market rates to the change in the policy path will depend on how long

the new target rate is expected to last. As shown in Chart 6, if markets believe that the new rate will last for at least ten years, the entire yield curve will shift upward in a parallel fashion, and all market rates, even longer-term rates, will increase by 100 basis points. In contrast, if the new target is expected to be relatively short-lived, the response of longer-term rates will be much smaller. As shown in Chart 6, a 100-basis-point increase in the target that is expected to last only a year will raise rates out to one year by 100 basis points but will only lead to a 20-basis-point increase in the five-year rate and a 10-basis-point increase in the ten-year rate. Even maintaining the target increase for two years will lead to only a 40-basis-point increase in the five-year rate and a 20-basis-point increase in the ten-year rate.

Persistence provides a possible explanation for the different policy leverage over short-term and longer-term interest rates, as shown in Chart 3. Thus, the relatively tight relationship between target changes and the one-year rate is consistent with market expectations that target changes are somewhat persistent, that is, will generally last at least a year. In contrast, the relatively loose relationship between target changes and the ten-year rate could occur if markets believe that target changes are not likely to be highly persistent or if the degree of expected persistence varies over time.⁸

Timing of policy path changes

The second factor influencing the response of market rates to changes in the policy path is the market's estimate of when the expected change in the policy path is likely to occur. Generally speaking, the further in the future a change in the path is expected, the smaller the response of short-term rates relative to longer-term rates.

The influence of timing is illustrated in Chart 7. Initially the yield curve is flat, incorporating market expectations that the funds target will remain at its current level of 4 percent. Then, the markets receive new information suggesting that the target is likely to increase to 5 percent in six months time. Very short-term rates—three-month and six-month rates—do not respond at all to the revision in the policy path because it occurs beyond their maturity. The one-year rate rises immediately by 50 basis points, reflecting the fact that the 5 percent target

Chart 6
CHANGES IN YIELD CURVE FROM PERMANENT AND TEMPORARY POLICY ACTIONS

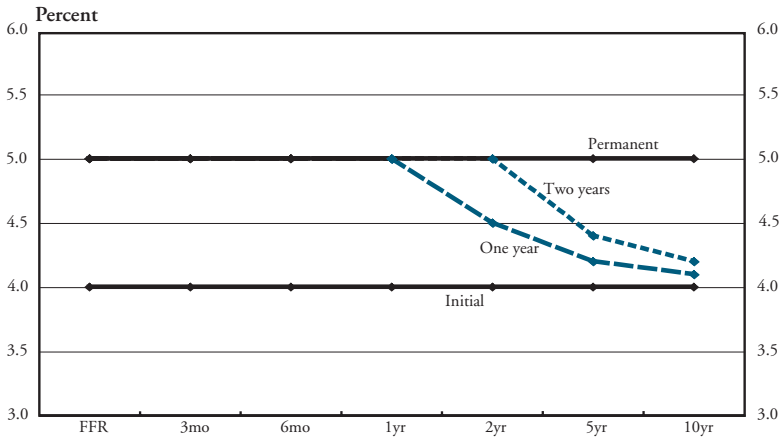
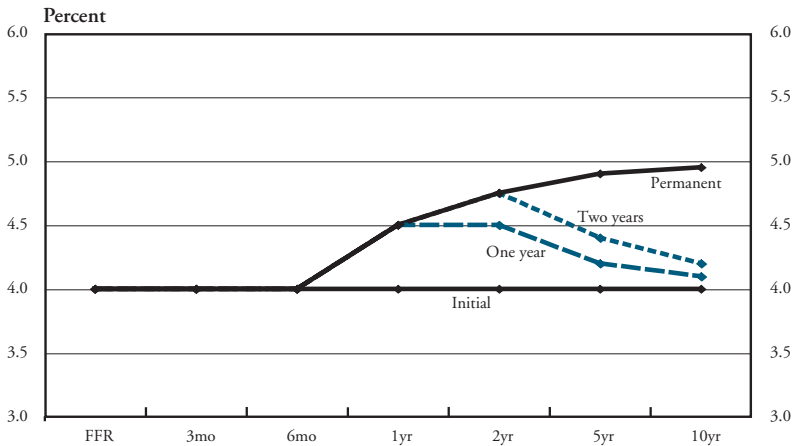


Chart 7
CHANGES IN YIELD CURVE FROM DELAYED PERMANENT AND TEMPORARY POLICY ACTIONS



will be effective for half of its maturity. What happens to rates beyond a year depends on how persistent the change in the policy path is expected to be, as in Chart 6. Even a change in the policy path expected to last ten years causes a steepening of the yield curve rather than a parallel shift because short-term rates do not initially respond to the shift in the policy path. Thus, the main message of Chart 7 is that short-term rates may respond less than longer-term rates to a change in the policy path to the extent that the change is expected to occur in the more distant future. If so, the slope of the yield curve may change well in advance of a change in the target rate.

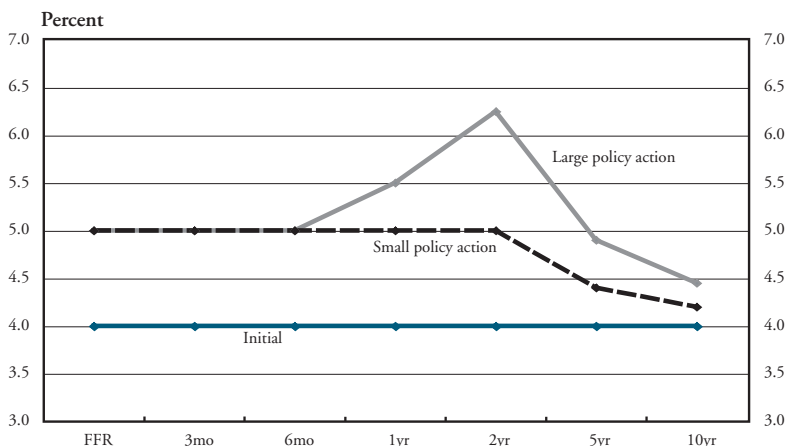
Size of policy path changes

A third factor influencing the response of market rates to changes in the policy path is the size of the change in the policy path. The examples considered so far focus on single, relatively small changes in the expected target rate. As shown in Chart 1, however, a tightening or easing cycle typically involves multiple, small target changes that can cumulate into a large total change. For example, both easing cycles in 1990-93 and 2001-04 involved a reduction in the funds rate target of over 500 basis points, while the tightening cycle in 1994-95 involved an increase of 300 basis points. Thus, it is important to consider what might happen to market rates if market participants build a series of target changes into a revised policy path.

Generally speaking, a small initial change in the funds rate target can be associated with large changes in market rates, even long-term rates, when the initial target change leads markets to believe that additional changes will be forthcoming. This point is illustrated in Chart 8. Similar to the two previous examples, the target is initially expected to remain constant at 4 percent, and the yield curve is flat. Now, consider two alternative scenarios. In the first scenario, there is an immediate 100-basis-point increase in the funds rate target from 4 to 5 percent, which markets expect to last two years. As shown in the chart, the yield curve shifts up 100 basis points out to a maturity of two years, while the five-year and ten-year rates rise 40 and 20 basis points, respectively. In the second scenario, markets are assumed to build an additional 100-basis-point increase into the target in six months time and another

Chart 8

EFFECTS ON YIELD CURVE OF DIFFERENT SIZE POLICY ACTIONS



100-basis-point increase in a year, for a total increase of 300 basis points.⁹ In this scenario, the yield curve shifts up by a much larger amount. Indeed, the one-year and two-year rates rise more than the amount of the initial target increase, the five-year rate rises almost 100 basis points, and the ten-year rate rises 45 basis points.

The principal message of this example is that the response of market rates to changes in the policy path also depends on the size of expected changes in future funds rate targets. If markets sometimes build single target changes and sometimes build multiple target changes into a revised policy path, the response of market rates may differ greatly in the two situations. This factor may also help explain some of the variability in the relationship between the funds rate target and the ten-year rate shown in Chart 3.

IV. A CLOSER LOOK AT THE POLICY PATH

Because central banks do not generally provide detailed information about future policy actions, financial market participants must develop their own estimate of the policy path based on their understanding of central bank behavior and a forecast of the economic

outlook. The market's estimate of the policy path can then be derived from information on market interest rates and can be used to provide valuable insight into the relationship between monetary policy and market interest rates.

Obtaining an estimate of the policy path from market interest rates

In recent years, the Federal Reserve and many other central banks have greatly increased the amount of monetary policy information released to the public. For example, the FOMC now announces policy decisions on the day of its meetings and provides additional information about the rationale for its decisions, its views on the balance of risks to the economic outlook, and the votes of committee members.¹⁰ However, like most other central banks, the Federal Reserve does not provide detailed information about the future policy path beyond today's federal funds rate target.¹¹

Whether central banks should provide a more detailed policy path has been the subject of an ongoing debate among academic economists and central bank policymakers. Some economists have suggested that monetary policy would be more effective if central banks were to publish their economic forecasts and to specify the future path for their interest rate target. In response, central bank policymakers have emphasized the conceptual and practical difficulties in determining the path and have also questioned the usefulness of providing this information to financial markets.¹²

Without going into the details of this debate, it is important to recognize that a policy path must exist even if it is not provided by the central bank.¹³ As discussed in the previous section, a path is implicit in market interest rates. Consequently, even if central banks do not specify a policy path, it should be possible to extract the financial markets' estimate of the policy path from data on market interest rates.

Indeed, economists have devised a number of methods for deriving estimates of the policy path from financial markets.¹⁴ One of the more popular approaches is to use data on financial futures. For example, the federal funds futures market provides a direct estimate of the federal funds rate that investors expect several months ahead. By combining

information on federal funds rate futures and eurodollar futures, it is possible to estimate the federal funds rate targets expected by financial markets over a period out to five years ahead (Sack).

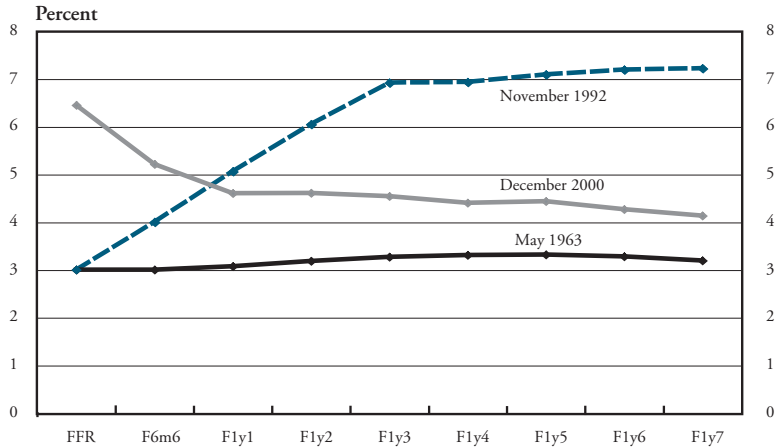
Another method uses data on the Treasury yield curve to construct a policy path. This approach calculates expected future rates on Treasury securities to obtain an estimate of the policy path.¹⁵ As compared to using futures market data, the use of the Treasury yield curve allows an estimate of the policy path over a longer time horizon (beyond five years) and also is more useful for historical analysis.¹⁶

Three examples of historical policy paths derived from the Treasury yield curve are shown in Chart 9.¹⁷ These paths were chosen to illustrate situations in which markets expected the funds target to remain constant at its current level or expected policy to be tightened or eased. In each case, the path shows the current funds rate target and the expected target at horizons of six months and at one-year intervals out to seven years.¹⁸

As shown in the chart, in May 1963 the policy path was very flat. That is, financial markets expected the current 3 percent level of the funds rate to continue indefinitely.¹⁹ In contrast, in November 1992 and December 2000 financial markets expected the funds rate target to change over the next few years. In November 1992, the policy path was steeply upward-sloping; the current target of 3 percent was expected to rise to about 7 percent over the next three to four years. In contrast, in December 2000 financial markets expected the current funds rate target of 6.5 percent to be reduced to about 4.25 to 4.5 percent over a two- to three-year period.

These three examples of policy paths highlight some important features that appear to characterize policy paths more generally. First, the paths tend to be relatively flat beyond a horizon of three to four years, suggesting that financial markets expect the federal funds rate target to be unchanged over long time horizons. One interpretation of this feature is that markets have a view as to what an equilibrium or normal funds rate target should be, and when the current target is above or below the equilibrium level, it is expected to return to that level within a relatively short period of time. That is, when the Federal Reserve eases

Chart 9
HISTORICAL POLICY PATHS



Source: Author's calculations from zero-coupon Treasury yield curve

policy to offset economic weakness or tightens policy to head off inflationary pressures, the target changes are expected to be reversed within a few years.

A second general feature of policy paths illustrated in this chart is that financial markets' estimate of the equilibrium funds target appears to change over time.²⁰ In May 1963, the markets' estimate of the equilibrium level was approximately 3 percent. By November 1992, the estimated equilibrium level had risen to around 7 percent. Then, in December 2000, the estimate of the equilibrium target had declined to about 4.25 to 4.5 percent.

A third general feature of policy paths illustrated in these examples is that the target is expected to return to its long-run equilibrium level relatively quickly. In both November 1992 and December 2000, the estimated policy paths suggest that markets thought the target would change about 100 basis points per year, with the total adjustment completed in less than four years.²¹

How do markets get the information for the policy path?

The features exhibited by the policy paths shown in Chart 9 raise some interesting questions. For example, what determines the level of the equilibrium funds rate target and causes it to change over time? What determines the speed that the current target returns to equilibrium? And, more generally, what information do financial markets use to construct these policy paths?

Because a policy path reflects market expectations of future monetary policy, to construct a policy path, financial markets are in the position of trying to guess the Federal Reserve's outlook for the economy and how it is likely to adjust the funds rate target in light of this outlook. More specifically, markets essentially need three pieces of information to construct a policy path: information on the Federal Reserve's long-run goals or objectives, an estimate of the Federal Reserve's own economic forecast, and an assessment of how fast the Federal Reserve will adjust the funds rate target if its forecast suggests that the economy will not achieve its long-run goals.

A convenient way of summarizing these three factors is to use a Taylor rule as a simplified model of central bank behavior. A Taylor rule specifies how a central bank might adjust its interest rate target to try to maintain price stability and full employment.²² A simple form of the Taylor rule is:

$$R_t = R^* + \gamma (Y_t^e - Y^*) + \lambda (\pi_t^e - \pi^*)$$

In this equation, R_t is the central bank's current interest rate target, R^* is the equilibrium interest rate target, $Y_t^e - Y^*$ is the expected output gap, and $\pi_t^e - \pi^*$ is the expected inflation gap. According to the Taylor rule, the central bank will set its interest rate target above the equilibrium level when the output gap is positive (expected output exceeds potential output Y^*) or when the inflation gap is positive (expected inflation exceeds the inflation objective p^*).²³ Conversely, it will set the current interest rate target below the equilibrium level if the output or inflation gap is negative. The parameters γ and λ determine how fast the central bank changes the interest rate target to eliminate the output and inflation gaps.

In the Taylor rule, the equilibrium interest rate target R^* plays a particularly important role. Since R^* is a nominal interest rate, it can be broken down into two parts: an estimate of the long-run equilibrium real interest rate for the economy and a measure of long-run inflationary expectations. The economy's long-run equilibrium real interest rate is generally thought to vary little over time. Moreover, if the central bank has a credible long-run inflation objective, financial markets' estimate of long-run inflation expectations should equal this inflation objective. In this situation, R^* will be relatively constant. However, if the central bank's inflation objective is not credible or is not well-understood, financial market's estimate of long-run inflation expectations may change over time, causing the market's estimate of R^* to vary over time.²⁴

The Taylor rule provides a useful framework that shows how financial markets might develop an estimate of the policy path. Markets know the current interest rate target and can calculate the equilibrium target from an estimate of the long-run equilibrium real interest rate and an assumption about long-run inflation expectations. Then, with forecasts of output and inflation and estimates of potential output and the central bank's inflation objective, markets can estimate future output and inflation gaps. Finally, markets can get an idea of how fast the central bank is likely to try to close output and inflation gaps by estimating the parameters γ and λ from historical information on central bank behavior. By substituting this information into the Taylor rule, financial markets can project the sequence of future interest rate targets that would be required for the central bank to eliminate output and inflation gaps and return the interest rate target to its equilibrium level over time. In this way, they can develop an estimate of the policy path.

The Taylor rule also provides a natural interpretation of the three general features of policy paths illustrated in Chart 9. First, the tendency of the policy paths to flatten out over time suggests that financial markets do, indeed, employ an estimate of the equilibrium funds rate target when constructing a policy path. If so, longer-term expected rates derived from the Treasury yield curve can provide a measure of the market's estimate of the equilibrium rate. Second, as noted above, the equilibrium target R^* in the Taylor rule is constant only if both the

equilibrium real interest rate and long-run inflation expectations are constant. The three historical policy paths shown in Chart 9 suggest that the markets' estimate of the equilibrium target rate is not constant. Indeed, since these three paths were associated with very different inflation rates, there is reason to believe that changing inflation expectations may be an important factor in causing shifts in the policy path over time.²⁵ Finally, the relatively rapid adjustment of the funds rate target back to equilibrium expected by markets in November 1992 and December 2000 suggests that markets thought the Federal Reserve would be relatively aggressive in eliminating output and inflation gaps and restoring the funds rate target to its equilibrium level.

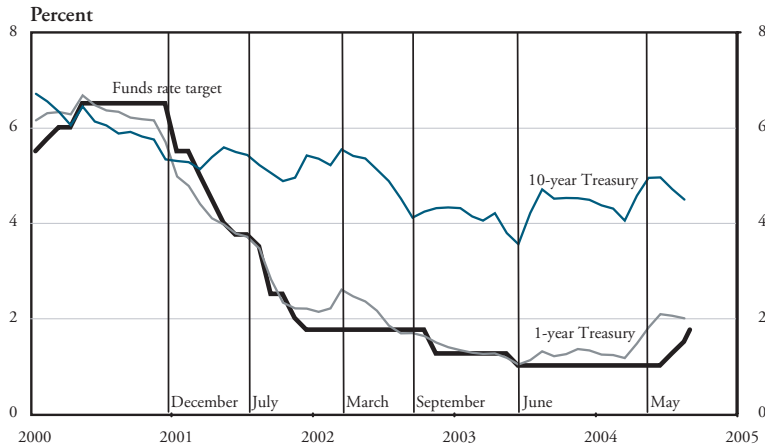
V. USING POLICY PATHS TO UNDERSTAND INTEREST RATE BEHAVIOR

Once constructed, historical policy paths can provide insight into the behavior of interest rates and help explain how current and prospective monetary policy influences the yield curve. Indeed, over the most recent cycle of policy easing that began in January 2001 and ended in June 2004, changes in the policy path help explain the somewhat puzzling behavior of long-term interest rates in response to changes in the federal funds rate target.

The behavior of the federal funds rate target and market interest rates over the recent easing cycle is illustrated in Chart 10. In December 2000, the federal funds rate target was 6.5 percent and over the next three years was lowered to 1 percent as the Federal Reserve attempted to offset a series of negative shocks to the U.S. economy. As shown in Chart 10, short-term rates as represented by the one-year Treasury rate followed the funds target fairly closely in its descent. However, long-term rates, such as the ten-year Treasury rate, behaved very differently. As shown in Chart 10, longer-term rates came down considerably before the Federal Reserve began lowering the funds rate target in January 2001. Then, despite a sharp reduction in the funds rate target in 2001 in response to economic weakness and the events of September 11, longer-term rates moved very little. However, as the Federal Reserve made small reductions in the funds rate target in 2002 and 2003,

Chart 10

FEDERAL FUNDS RATE AND MARKET INTEREST RATES: 2000-04



Source: Board of Governors

longer-term rates began to fall much more. Finally, longer-term rates started to rise again well before the Federal Reserve raised the funds target to 1.25 percent in June 2004.

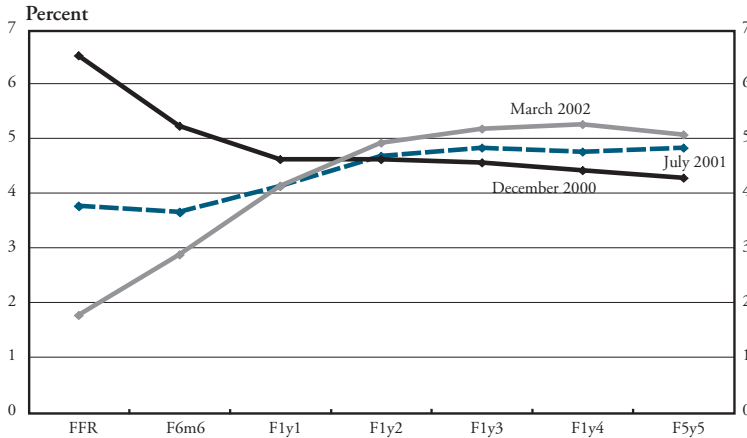
Policy paths derived from the Treasury yield curve can help explain the behavior of market interest rates over this period. For convenience, the whole period is divided into three parts: December 2000 to March 2002, March 2002 to June 2003, and June 2003 to May 2004.

December 2000 to March 2002

Policy paths for December 2000, July 2001, and March 2002 are shown in Chart 11.²⁶ In December 2000, the month before the Federal Reserve began easing, the policy path was downward-sloping with markets expecting the funds rate target to fall from 6.5 to 4.5 percent over two years and eventually to about 4.25 percent. The expected reduction in the funds rate target was the principal factor causing the ten-year rate to lie below the current funds rate target of 6.5 percent. Indeed, the ten-year rate had already fallen from 6.4 percent in May

Chart 11

POLICY PATHS IN RECENT EASING CYCLE: PHASE I
DECEMBER 2000 TO MARCH 2002



Source: Author's calculations from zero-coupon Treasury yield curve

2000 to 5.3 percent in December. Moreover, markets apparently believed much of the reduction in the expected target was likely to occur over the next six to 12 months, causing the one-year rate to lie below the current funds target as well.

As it turned out, Federal Reserve easing in the spring of 2001 was much more aggressive than markets anticipated. Indeed, by July 2001, the funds rate target had been lowered from 6.5 percent to 3.75 percent. Longer-term rates were essentially unchanged during this period, however; the ten-year rate had actually risen slightly from 5.3 percent in December 2000 to 5.4 in July 2001. The policy path for July 2001, shown in Chart 11, reveals that financial markets thought that the Federal Reserve had finished easing and that the funds rate target would return to 4.5 percent within two years.²⁷

In July 2001, financial markets were underestimating the degree of future easing once again. In response to weaker economic activity and the terrorist attacks of September 11, the Federal Reserve lowered the funds rate target to 1.75 percent by December. However, by March 2002, an improving economic outlook caused markets to anticipate a relatively aggressive tightening of policy. Thus, the policy path for

March 2002 suggested that the funds rate target would rise to 5 percent within a two-to-three-year horizon. Moreover, despite the 200-basis-point reduction in the funds rate target over this period, the ten-year Treasury rate in March 2002 had risen slightly to 5.5 percent.

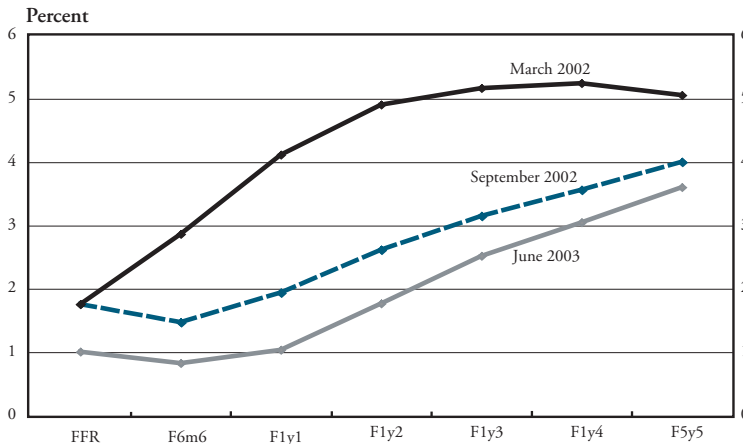
The three policy paths shown in Chart 11 provide an explanation for the failure of longer-term interest rates to fall in line with the reduction in the federal funds rate target during 2001. Four factors appear responsible for the small change in long-term rates during this period. First, a large change in long-term rates had already occurred prior to the first cut in the funds rate target in January 2001 as financial markets fully anticipated the initial series of target reductions. Second, according to these policy paths, Federal Reserve easing was not expected to be very persistent. Throughout this period, the funds rate target was expected to return to around 4.5 to 5 percent within a two-to-three-year time frame. Thus, according to the expectations theory, even the large easing that occurred would be expected to have only a relatively small effect on long-term rates. Third, while the December 2000 policy path incorporated a series of reductions in the funds rate target, the paths for July 2001 and March 2002 did not. That is, markets appear to have been repeatedly surprised by the worsening economic outlook and additional policy easing and did not build additional policy easing into the policy path. Fourth, Chart 11 shows the market's estimate of the equilibrium funds rate target increased slightly as policy eased, perhaps suggesting some increase in long-run inflation expectations. Thus, longer-term rates did not fall much when policy eased in 2001, partly because some easing had already been factored into market rates, partly because policy easing was not expected to be very persistent, partly because markets did not build multiple easing into the policy path, and partly because of an increase in the equilibrium funds rate target.

March 2002 to June 2003

The relationship between target changes and long-term rates was much different over the next 15 months. While the funds target fell only 75 basis points from March 2002 to June 2003, the ten-year Treasury rate fell from 5.5 percent to 3.6 percent during this period. Once again, policy paths can help illuminate this behavior.

Chart 12

POLICY PATHS IN RECENT EASING CYCLE: PHASE 2
MARCH 2002 TO JUNE 2003



Source: Author's calculations from zero-coupon Treasury yield curve

Chart 12 shows policy paths for March 2002, September 2002, and June 2003. This chart has several notable features. First, between March 2002 and September 2002, the policy path changed substantially without any accompanying policy action. In March, as noted earlier, financial markets expected the Federal Reserve to raise the funds rate target by about 100 basis points in the next year. By September, however, markets believed that the Federal Reserve was likely to reduce the funds rate target in the next year rather than raising it. Moreover, they anticipated a much less aggressive pace of policy tightening than they expected in March. For example, in March, markets expected the target to be raised to 4 percent within two years; but by September, markets thought that it would take three to four years for the target to reach that level. Second, in June 2003, after the Federal Reserve had reduced the funds target to 1 percent, markets expected that it would now take even longer for the funds rate target to reach 4 percent. Third, the policy paths shown in Chart 12 indicate that financial markets' estimate of the equilibrium target had drifted down, offsetting the increase in the earlier period.

The policy paths shown in Chart 12 suggest two reasons for the relatively large decline in long-term interest rates during this period. First, over time, markets became convinced that the pace of future policy tightening would be much less rapid than previously thought. This change in expectations caused the policy paths to become flatter. Put another way, markets believed the current low levels of the funds rate target would be more persistent than previously expected, putting downward pressure on longer-term rates. Second, the decline in the market's estimate of the equilibrium target may have contributed to reducing long-term rates through a lowering of long-run inflationary expectations.

June 2003 to May 2004

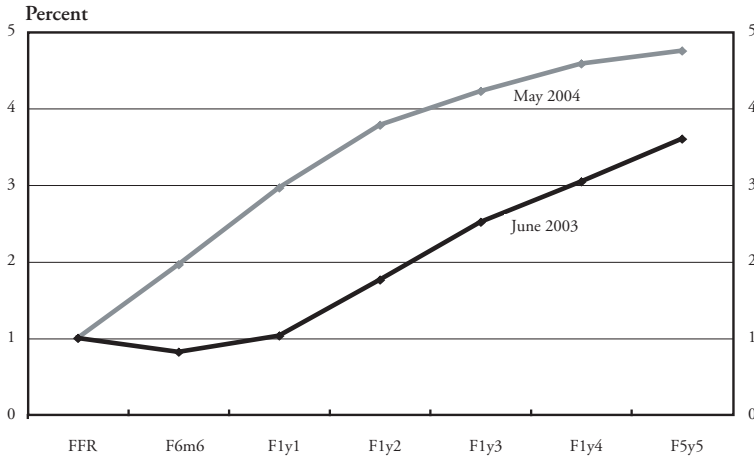
After lowering the funds rate target to 1 percent in June 2003, the Federal Reserve maintained that level until June 2004. Despite the fact that policy was unchanged during this period, long-term interest rates rose as financial markets revised their estimate of the policy path.

Chart 13 shows financial markets' estimate of the policy path in June 2003 and then in May 2004, just before the Federal Reserve raised the funds rate target from 1 to 1.25 percent. In June 2003, markets expected the funds rate target to remain at 1 percent for at least a year and then to rise modestly to an average of 1.5 percent over the subsequent year. However, by May 2004, markets believed that the Federal Reserve would tighten more aggressively with the funds rate target averaging 2 percent in the second half of 2004. In addition to an increased pace of monetary tightening, the policy paths shown in Chart 13 also indicate that the markets' estimate of the equilibrium target increased by about 50 basis points over this period.

The evolution of the policy path from June 2003 to May 2004 appears to have been heavily influenced by economic developments and especially by Federal Reserve statements about the likely pace of policy tightening (Bernanke). Beginning in the late spring of 2003, the FOMC began to express a concern about continuing disinflation and became quite explicit that the pace of policy tightening would be less rapid than markets were expecting. For example, in the press release following the August 12, 2003, meeting, the FOMC indicated that

Chart 13

POLICY PATHS IN RECENT EASING CYCLE: PHASE 3
JUNE 2003 TO MAY 2004



Source: Author's calculations from zero-coupon Treasury yield curve

“policy accommodation can be maintained for a considerable period” and in the January 28, 2004, release noted that “the Committee believes that it can be patient in removing its policy accommodation.” These statements appear to have had some effect in maintaining a flatter policy path for an extended period. By the spring of 2004, however, employment growth had picked up, inflation measures were beginning to increase, and the FOMC indicated that it was poised to begin moving to a less accommodative policy stance at a measured pace. In this context, the policy path steepened considerably.

From June 2003 to May 2004, the ten-year Treasury rate rose from 3.6 percent to 4.9 percent even as the funds rate target remained at 1 percent. The shift in the policy path shown in Chart 12 suggests that part of the increase in long-term rates was due to a change in market expectations about the pace of policy tightening. In addition, the increase in the markets’ estimate of the equilibrium target rate indicates markets may have revised their long-run inflation expectations as concerns about disinflation dissipated amid signs of increasing inflation pressures. Notably, most of the increase in the ten-year rate occurred

just in advance of the increase in the funds target in June 2004, suggesting that FOMC policy statements may have been influential in delaying the rise in rates.

VI. SOME IMPLICATIONS FOR MONETARY POLICY

When financial market expectations play a key role in the monetary policy transmission mechanism, a central bank's influence on the structure of market interest rates depends crucially on its ability to influence financial market expectations about the future path of policy. This provides a new perspective on how monetary policy works and highlights the important role of central bank communications in the transmission process.

How does a central bank influence the policy path?

This article has emphasized the importance of the "policy path" in the determination of market interest rates. In this framework, a central bank's ability to alter the policy path is a key element in the monetary policy transmission mechanism. However, as discussed earlier, most central banks do not explicitly specify a policy path. Thus, financial markets are left to construct the expected policy path themselves. How, then, does a central bank influence the markets' estimate of the policy path to change market interest rates?

Generally speaking, a central bank can influence the policy path in two ways. First, and most directly, a central bank can change its interest rate target. Today's interest rate target serves to anchor the near end of the policy path, and changes in the target can cause the policy path to shift. As shown earlier, however, there is not a simple relationship between changes in a central bank's interest rate target and changes in the policy path. Indeed, a change in the target rate will only have a large influence on the policy path to the extent that financial markets see the target change as being very persistent. In contrast, if financial markets were to believe today's target change would be reversed at the next policy meeting, there would be little impact on the policy path and

little or no effect on market interest rates. Similarly, a target change that is only expected to last a year will have a large effect on short-term market rates but very little impact on longer-term rates.²⁸

The second way a central bank can influence the policy path is through its communications policy. Central bank communications can take a variety of forms: from official press releases to less formal speeches and media contacts. Financial markets are likely to be heavily guided by central bank statements about the state of the economy and the likely course of future policy in judging the degree of persistence of the current stance of policy. Consequently, if a central bank can influence market views about the expected persistence of policy actions, it may be able to alter the slope of the policy path.

Central bank communications can also affect the policy path in another way—by influencing market estimates of the equilibrium interest rate target. As discussed earlier, historical policy paths for the United States suggest that financial market estimates of the equilibrium federal funds rate target change over time. To the extent these shifts in the policy path reflect changes in long-run inflation expectations, a central bank may be able to reduce these shifts through a clear communication of its long-run inflation objective. If financial markets believe a central bank's inflation objective is credible, this will help anchor long-run inflation expectations. In this situation, financial markets' estimate of the equilibrium target rate will also tend to be more stable, and most changes in the policy path will reflect expected changes in the target interest rate designed to smooth out short-run economic fluctuations.²⁹

Monetary policy as information policy

The analysis in this article also has some broader implications for how to think about monetary policy and the transmission mechanism. Most traditional discussions of the transmission mechanism focus on a central bank's interest rate target as the primary source of its influence on market interest rates. When expectations about future policy are the key factor driving market interest rates, however, changes in the central bank's target rate play a less prominent role. Indeed, in this setting it may be useful to think of the source of monetary policy's influence as coming from the information a central bank provides to financial

markets. While target changes can be informative, so are central bank communications about its longer-run objectives and its views about the economic outlook.

Generally speaking, the information a central bank provides to financial markets comes in several forms. One important piece of information is a central bank's long-run inflation objective, which helps markets pin down an estimate of the equilibrium interest rate target and stabilizes the endpoint of the policy path. As discussed previously, this information may contribute to reducing the volatility of long-term rates caused by variation in market estimates of long-run inflation expectations.³⁰

A central bank can also provide information to financial markets that either confirms or corrects market estimates of the short-run policy path. When financial markets' estimate of the policy path is consistent with the central bank's views, the central bank can confirm the markets' estimate by changing its interest rate target exactly as markets expect. Because this action has been fully anticipated by financial markets, there should be little response of market rates to the action. This does not imply that policy has no effect on market rates, but rather that the effects of the policy change have already been incorporated into the policy path and market rates.³¹ Nor does it imply that the central bank is merely following the market's lead, but rather that financial markets and the central bank have consistent views about the policy path.

Alternatively, when its views differ from those in financial markets, a central bank can attempt to correct market estimates of the policy path. One way a central bank can correct market views is by not changing its interest rate target as markets expect: either by making an unexpected change in the target or by not making a target change that markets expect. For example, when a central bank makes an unexpected change in the target interest rate, this new information is likely to lead markets to revise their estimate of the policy path causing a change in market interest rates.

Similarly, when a central bank does not change its target as expected, markets are also likely to adjust their estimate of the policy path. In this situation, the response of interest rates will depend on whether markets believe the postponement in the expected target change is temporary or more permanent. A temporary postponement

will tend to have relatively large effects on very short-term rates but little effect on longer-term rates. In contrast, if central bank inaction leads markets to completely remove an expected change in the target, longer-term rates may be affected as well.³²

A central bank can also correct financial market views through its communications policy. That is, a central bank can be more explicit than usual about its economic outlook or the factors that would cause it to change policy in the future to get markets to revise the policy path. When the differences of views are mainly about the expected timing of future policy actions, central bank communications are likely to influence mainly short to medium-term interest rates with little effect on longer-term rates. For example, a central bank may wish to signal that an expected policy tightening will be delayed for a year. In this situation, the markets' revision to the policy path will likely have only small effects on longer-term rates because the expected tightening is only temporarily postponed, not eliminated. However, when financial market and central bank views about long-run inflation expectations differ significantly, central bank communications about its inflation outlook may have larger effects on longer-term rates.

Attempts to influence market expectations are likely to be most useful when these expectations are fundamentally different from the views of the central bank and when changes in the interest rate target may not be sufficient to convey the central bank's views.³³ A good illustration of this point is the evolution of the FOMC's press release during 2003-04. As discussed in the previous section, the FOMC introduced language that "policy accommodation can be maintained for a considerable period" (August 2003) and that "it can be patient in removing its policy accommodation" (January 2004). Financial markets viewed these statements as indicating that the pace of policy tightening would be slower than previously expected, resulting in a flatter policy path. In contrast, when the FOMC substituted the phrase "policy accommodation can be removed at a pace that is likely to be measured" (May 2004), financial markets interpreted the statement as indicating a faster pace of tightening, and the policy path became steeper.

As noted by Bernanke, these statements by the FOMC were associated with substantial changes in market interest rates during a time that the federal funds rate target was unchanged. Indeed, it could be argued

that these statements may have had a larger effect on market rates than would result from a further reduction in the funds rate target. The reason is that financial markets might view a further target reduction as only temporary and so would not revise the policy path enough to generate a significant fall in market rates. The wording of the FOMC statements suggested that an accommodative policy stance would be maintained for a longer period of time, leading financial markets to make a more substantial change in the estimated policy path.

This episode serves to highlight the importance of central bank communications when financial market expectations play a key role in the monetary transmission mechanism. In this context, central bank communications can help shape financial market expectations so that the views of the central bank and financial markets are better aligned. Moreover, this episode underscores the central idea that monetary policy works, not just through changes in the central bank's interest rate target but, more broadly, through the information a central bank provides to financial markets.

VII. SUMMARY AND CONCLUDING COMMENTS

This article uses a simple analytical framework to provide insight into the relationship between monetary policy and market interest rates. In this framework, financial market expectations about the future path of monetary policy are the driving force behind the behavior of market interest rates. Consequently, understanding how financial markets determine this policy path and what factors cause the path to change is central to understanding how monetary policy influences the entire term structure of interest rates.

This approach also suggests a broader perspective on how monetary policy works. Indeed, when expectations play a part in the monetary policy transmission mechanism, the information that the central bank provides to financial markets about its long-run goals and the economic outlook may be as important, or even more important, than changes in its short-run interest rate target. Thus, this approach highlights the key role that central bank communications can play in the transmission mechanism.

ENDNOTES

¹While target changes are generally made at FOMC meetings, they may also be made between regular meetings as a result of a conference call among FOMC members. In the past decade, intermeeting target changes have been very rare, but they were quite prevalent in earlier years.

²Chart 1 shows a remarkable reduction in the daily volatility of the federal funds rate since about 2000. This reduction in daily volatility reflects a number of institutional changes in the market for bank reserves and in the implementation of open market operations and the structure of the discount window. For more detailed discussion, see Federal Reserve Bank of New York.

³For more discussion of the economic rationale for the expectations theory, see Roley and Sellon (pp. 77-78). A term premium can be thought of as the extra compensation required for an investor to purchase a longer-term security rather than a series of short-term securities. That is, even if short-term rates are expected to remain unchanged, an investor may want some additional return (premium) for purchasing a longer-term security.

⁴At this point, a reader might think that the logic of the expectations theory has been stretched a bit far. After all, is it really useful to think of the ten-year Treasury rate as being the average of today's federal funds rate target and the sequence of approximately 3600 expected daily funds rate targets over the next ten years? How could financial markets possibly compute the expected policy path over such a long time horizon?

There are two answers that lend support to this approach. First, as hard as it may be, financial market participants must perform this exercise in order to price long-term securities. That is, an investor thinking of purchasing a ten-year bond must form some opinion about how the economy and monetary policy are likely to evolve over his investment horizon. Second, because of the difficulty in doing so, market participants are likely to simplify the process. One way this can be done is by taking the view that there is a long-run equilibrium federal funds rate target. That is, changes in the funds rate target by the Federal Reserve to stabilize the economy will eventually be unwound, and the target rate will return to its long-run equilibrium level. For example, if this process is expected to be completed over a three to five-year time frame, market participants can assume that the policy path will be constant at the equilibrium target rate after three to five years. In addition, since target changes are typically made in discrete units of 25-50 basis points, market participants will typically only have to predict a relatively small number of changes to move the current level of the funds rate target back to its equilibrium value. A later section of this article shows that policy paths derived from the Treasury yield curve provide strong support for this view. A further complication is introduced if inflation expectations in financial markets are not well-anchored since, in this situation, the markets' estimate of the equilibrium target can change over time. This issue is discussed in more detail later in the article.

⁵Each of these rates is computed as a simple average of the expected level of the funds rate target over the maturity of the security, ignoring any term premia.

⁶Recall that each rate is calculated, using the expectations theory, as the average of expected future target rates over the life of the security. Thus, the higher targets expected in the future affect longer-term rates immediately but are only gradually reflected in short-term rates as time goes by.

⁷For simplicity, the examples shown in Charts 6, 7, and 8 ignore term premia.

⁸The importance of the persistence of target changes, reflecting the practice of interest rate smoothing by central banks, has been emphasized by a number of authors. See, for example, Goodfriend, Rudebusch, and Woodford.

⁹As in the first scenario, the target is assumed to return to 4 percent at the end of two years.

¹⁰Prior to 1994, the FOMC did not make any formal announcements after a committee meeting. Markets generally learned about policy actions by observing open market operations in the days following the meeting and received more detailed information only with the later publication of the minutes of the meeting.

¹¹The principal exception to this rule is the Reserve Bank of New Zealand, which for several years has published a path for short-term interest rates for a horizon of two to three years ahead.

¹²For some of the issues in this debate, see Svensson and Mishkin.

¹³Even if a central bank were to provide an explicit policy path, such a path would be expected to change with the arrival of new information about the economy. For example, the Reserve Bank of New Zealand, one of the few central banks to provide projections of future interest rates, updates its projections as part of its quarterly Monetary Policy Statement.

¹⁴For a more technical description of some of these methods, see Söderlind and Svensson.

¹⁵While these various approaches have advantages and disadvantages, they share one common difficulty: the need to obtain reliable estimates of term premia. Most recent research on term premia suggests that they vary over time. Consequently, for small changes in interest rates it may be very difficult to distinguish changes in term premia from changes in the policy path.

¹⁶Using data from futures markets, it is possible to obtain estimates of the policy path only out to about five years. The market for federal funds rate futures was started in 1988 and the eurodollar futures market began in 1981.

¹⁷These policy paths are derived from the zero coupon Treasury yield curve in a two-step process. First, the expectations model is used to derive an estimate of market expectations of future interest rates. Then, these expected future interest rates are converted into expected funds rate targets. The following example illustrates this procedure. The expected six-month rate for the horizon of six months ahead is backed out of the expectations model using today's one-year rate, today's six-month rate and an assumed term premium of 6 basis points. Then, the six-month ahead funds rate target, $F6m6$, (the average target over the six-month period, six months ahead) is obtained by subtracting a 6 basis point term premium from the expected six-month rate. A similar procedure is used to obtain expected one-year rates at horizons of one to seven years, assuming a 12 basis point term premium. Then, one-year expected funds rate targets at various horizons are obtained by subtracting a 12 basis point term premium from each of the

expected one-year rates. These targets ($F1y1$, $F1y2$, ... $F1y7$) should be interpreted as the average target expected over a one-year period at horizons of 1, 2, 3, 4, 5, 6, and 7 years ahead.

¹⁸Because this example looks at six-month and one-year averages of the expected funds rate target, it does not attempt to capture the timing of expected target changes. Timing changes are more accurately obtained from futures data.

¹⁹Prior to the late 1970s, the Federal Reserve did not have formal targets for the federal funds rate, so the actual federal funds rate is used for 1963. The small variation in the estimated path shown in Chart 9 is most likely due to variation in term premia.

²⁰A more technical explanation of the first feature is that short-term interest rates are expected to be mean reverting, while the second feature suggests that this mean shifts over time. Research by Kozicki and Tinsley (2001) provides strong empirical support for these two features and shows that shifts in the mean are associated with changes in long-run inflation expectations. Also, see Fama.

²¹The longer adjustment period in 1992 as compared to 2000 may reflect the view that the target was further from its estimated equilibrium level in 1992.

²²For a more detailed discussion of Taylor rules, see Kozicki.

²³The parameters γ and λ are assumed to be positive.

²⁴For a discussion of how market estimates of the central bank's inflation objectives may change over time and the implications for interest rates, see Kozicki and Tinsley (2001, 2003). It is important to note that the view that the long-run equilibrium real rate is relatively constant is not uncontroversial. For the analysis in this article, it is sufficient that variation in the equilibrium real rate is relatively small compared to that in long-term inflation expectations.

²⁵In May 1963, the 12-month change in core CPI was 0.96 percent. Inflation rates in November 1992 and December 2000 were 3.5 percent and 2.5 percent respectively. Since these differences in actual inflation are smaller than the differences in the estimates of the equilibrium rate shown in Chart 9, part of the explanation may be that long-horizon inflation expectations differed from short-run inflation in 1992 and 2000.

²⁶To obtain these paths, expected funds rate targets are derived from zero coupon Treasury yield data as in Chart 9 out to a horizon of four years ahead. Beyond four years, instead of using expected one-year rates as in Chart 9, the expected target is constructed from the expected five-year rate, five years ahead. This expected five-year rate is constructed from the current ten-year and five-year Treasury rates using the expectations theory and assuming a constant term premium of 30 basis points. A term premium of 60 basis points is subtracted from the expected five-year rate to get the expected funds rate target. Thus, the endpoint of each of the policy paths shown in Charts 11, 12, and 13 is a measure of the markets' estimate of the average funds rate target over the five-year period, five years ahead. This endpoint is interpreted as the markets' estimate of the equilibrium target at each point in time. An important caveat in using these policy paths is that they are derived under the assumption of constant term premia. To the extent that term premia vary over time, part of the change in a policy path could be due to changes in term premia rather than changes in future interest rate targets. That said, the relatively large changes in policy paths shown in Charts 11 to 13 are unlikely to be driven by changes in term premia. An additional caveat is

that the level of the policy path at a given point in time depends upon the assumption about term premia. Thus, these policy paths should be viewed only as estimates of the policy path.

²⁷At the time, financial market commentary emphasized dissents by two FOMC members to the decisions to ease in May and June 2001. President Hoenig dissented from the May policy decision because he favored a 25 basis point reduction in the federal funds rate target rather than a 50 basis point cut. President Poole dissented against the decision to lower the target at the June meeting.

²⁸Financial markets' views about the expected persistence of a target change are largely reflected in the slope of the policy path. In the framework of the Taylor rule, the slope of the policy path will depend on how long output and inflation gaps are expected to last and how long it will take the central bank to restore the interest rate target to its long-run equilibrium level. For example, if markets believe that an economic downturn will be relatively brief, they are likely to conclude that policy easing to counteract the downturn will also be short-lived. In this situation, the policy path will have a relatively steep slope. Conversely, if markets believe an economic downturn will be more protracted, they are likely to think that it will take the central bank longer to restore the economy to equilibrium, and the policy path will have a flatter slope.

²⁹The idea that longer-term rates contain important information about inflation expectations provides the basis for methods of forecasting inflation using the slope of the yield curve at longer maturities (Frankel). More recently, Buttiglione, Del Giovane, and Tristani, Kozicki and Tinsley (2001), and Gurkaynak, Sack, and Swanson have provided empirical support for using longer-term forward rates to gauge changes in long-term inflation expectations.

³⁰There is some evidence that countries that have adopted explicit inflation targets have been able to better anchor long-term inflation expectations. See, for example, Levin, Natalucci, and Piger, Kozicki and Tinsley (2002), and Gurkaynak, Sack, and Swanson.

³¹Put another way, markets react to new economic information that is thought to cause monetary policy to be changed in the future. Later, when the policy action occurs, market rates do not respond to the policy action because it provides no new information.

³²For example, a three-month postponement would have a very large effect on the three-month rate but much smaller effects on securities of longer maturity. The effect of completely removing an expected target change from the policy path will depend on how long the target had been expected to remain at its anticipated level. This latter effect may be especially important near turning points in the business cycle if markets remove a series of expected policy actions.

³³Interest in the role of central bank communications has been stimulated recently by the zero bound problem which arises when the central bank's interest rate target cannot be reduced below zero. Considerable attention has focused on the situation in Japan. For more discussion, see Bernanke, Reinhart and Sack, Eggertsson and Woodford, and Sellon. Empirical evidence that central bank talk can influence market interest rates can be found in Kohn and Sack and in Bernanke, Reinhart, and Sack.

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