

Interest Rate Policy and the Inflation Scare Problem: 1979–1992

Marvin Goodfriend

U.S. monetary policy since the late 1970s is unique in the post-Korean War era in that rising inflation has been reversed and stabilized at a lower rate for almost a decade. The current inflation rate of 3 to 4 percent per year, representing a reduction of 6 percent or so from its 1981 peak, is the result of a disinflationary effort that has been long and difficult.

This article analyzes the disinflation by reviewing the interaction between Federal Reserve policy actions and economic variables such as the long-term bond rate, real GDP growth, and inflation. The period breaks naturally into a number of phases, with the broad contour of events as follows. A period of rising inflation was followed by disinflation which, strictly speaking, was largely completed in 1983 when inflation stabilized at around 4 percent per year. But there were two more “inflation scares” later in the decade when rising long-term rates reflected expectations that the Fed might once more allow inflation to rise. Confidence in the Fed was still relatively low in 1983, but the

■ The author is senior vice president and director of research at the Federal Reserve Bank of Richmond. This article originally appeared in this Bank’s 1992 *Annual Report*. The article benefited greatly from discussions with Timothy Cook and Robert King as well as from presentations at the Bank of Canada, the Bank of England, the Bank of Italy, the Board of Governors of the Federal Reserve System, the Federal Reserve Bank of St. Louis, the Graduate School of Business at the University of Chicago, the 1992 National Bureau of Economic Research Summer Institute, the Swedish Riksbank, the Swiss National Bank, and the University of Notre Dame. Comments by John Boschen, Michael Dotsey, Robert Hetzel, Peter Ireland, and George Moore were also very helpful. The analyses and conclusions are those of the author and do not necessarily reflect the views of the Federal Reserve Bank of Richmond or the Federal Reserve System.

central bank has acquired more credibility since then by successfully resisting the inflation scares.

I analyze the conduct of monetary policy using a narrative approach that pays close attention to monthly movements of long- and short-term interest rates. My approach is intended to complement existing studies such as the VAR-based analyses by Bernanke and Blinder (1992) and Sims (1992), and the more conventional studies of the period by Friedman (1988) and Poole (1988). The goal is to distill observations to guide future analysis of monetary policy with the ultimate objective of improving macroeconomic performance. Based on a familiarity with the Fed and the work of Fed economists, I interpret policy actions in terms of the federal funds rate rather than a measure of money. I view the article as a case study of the Federal Reserve's interest rate policy.

The Fed's primary policy problem during the period under study was the acquisition and maintenance of credibility for its commitment to low inflation.¹ I measure credibility by movements of inflation expectations reflected in the long-term interest rate. For much of the period the Fed's policy actions were directed at resisting inflation scares signaled by large sustained increases in the long rate. A scare could take well over a year of high real short-term interest rates to contain. Moreover, just the threat of a scare appears to have made the Fed tighten aggressively in one instance and probably made it more cautious when pushing the funds rate down to encourage real growth on a number of occasions.

Inflation scares are costly because resisting them requires the Fed to raise real short rates with potentially depressing effects on business conditions. Hesitating to react is also costly, however, because by revealing its indifference to higher expected inflation the Fed actually encourages workers and firms to ask for wage and price increases to protect themselves from higher expected costs. The Fed is then inclined to accommodate the higher inflation with faster money growth.

Inflation scares present the Fed with a fundamental dilemma the resolution of which has decided the course of monetary policy in the postwar period. Prior to the 1980s, the Fed generated an upward trend in the inflation rate by reacting to inflation scares with a delay. The more prompt and even preemptive reactions since the late 1970s have been a hallmark of the recent disinflation.

The plan of the article is as follows. First, I discuss the premises that underlie my interpretation of monetary policy. A chronological analysis of policy follows. Finally, I summarize the main empirical findings in a series of observations that sharpen our understanding of the conduct of monetary policy. A brief summary concludes the article.

¹ See Rogoff (1987) for a discussion of credibility, reputation, and monetary policy.

1. PREMISES UNDERLYING THE INTERPRETATION OF POLICY

The first step in any study of monetary history is to choose an indicator of the stance of policy. For example, in their study of U.S. monetary history Friedman and Schwartz (1963) focus on the monetary base (currency plus bank reserves) because it summarizes monetary conditions whether or not a country is on the gold standard and whether or not it has a central bank. Focusing on the base allowed them to tie together a long period marked by many institutional changes, making possible their famous empirical findings about money, prices, and business conditions.

For my purposes, however, the base is not a useful indicator. Although the Fed could have used the base as its instrument by controlling it closely in the short run, it has not chosen to do so. Instead, the Fed has chosen to use the federal funds rate as its policy instrument. Hence this study, which seeks to investigate the short-run interactions between Fed policy and other economic variables, interprets policy actions as changes in the federal funds rate. The remainder of this section discusses the premises underlying my interpretation of policy.

Interest Rate Targeting

Throughout its history the Fed's policy instrument has been the federal funds rate or its equivalent. At times, notably from the mid to late 1970s, it has targeted the funds rate in a narrow band commonly 25 basis points wide (Cook and Hahn 1989). More often, it has targeted the funds rate indirectly, using the discount rate and borrowed reserve targets. Although the funds rate appears noisier under borrowed reserve targeting than under direct funds rate targeting, it is nevertheless tied relatively closely to a chosen funds rate target (Goodfriend 1983). Since a borrowing target tends to be associated with a particular spread between the funds rate and the discount rate, targeting borrowed reserves lets a discount rate adjustment feed through one-for-one to the funds rate. Forcing banks to borrow more reserves at a given discount rate also raises the funds rate (Goodfriend and Whelpley 1986). The Fed has used the borrowed reserve procedure to help manage the funds rate since October 1982 (Wallich 1984; Thornton 1988). Significant funds rate movements since then should be viewed as deliberate target changes.

It is less obvious that federal funds rate changes in the period of the New Operating Procedures from October 1979 to October 1982 should be interpreted as deliberate. Under those procedures, the Fed was to fix the path of nonborrowed reserves available to depository institutions so that increases in the money stock would force banks to borrow more reserves at the discount window and thereby automatically drive up the funds rate and other short-term interest rates.

Despite the widespread emphasis on automatic adjustment in the description of the post-October 1979 procedures, however, it was well recognized at the time that movements in the funds rate would also result from purely judgmental actions of the Federal Reserve (Levin and Meek 1981; Federal Reserve Bank of New York 1982–1984). These actions included: (1) judgmental adjustments to the nonborrowed reserve path taken at FOMC meetings that changed the initially expected reserves banks would be forced to borrow at the discount window (in effect, a funds rate target change by the FOMC), (2) judgmental adjustments to the nonborrowed reserve path between FOMC meetings, (3) changes in the discount rate, and (4) changes in the surcharge that at times during the period was added to the basic discount rate charged to large banks.

Cook (1989) presents a detailed breakdown of policy actions affecting the funds rate during this period showing that two-thirds of funds rate changes were due to judgmental actions of the Fed and only one-third resulted from automatic adjustment. Moreover, as we shall see below, the large funds rate movements in the nonborrowed reserve targeting period are overwhelmingly attributable to deliberate discretionary actions taken by the Fed to manage short-term interest rates. Therefore, it is more accurate to refer to the period from October 1979 to October 1982 as one of aggressive federal funds rate targeting than one of nonborrowed reserve targeting.

The Role of Money

The Federal Reserve was established with a mandate to cushion short-term interest rates from liquidity disturbances. Between the Civil War and the creation of the Fed, such disturbances caused short rates to rise suddenly and sharply from time to time. While generally trading in a range between 4 and 7 percent, the monthly average call loan rate reported by Macaulay (1938) rose roughly 5 percentage points in one month on 26 occasions between 1865 and 1914. Moreover, as a result of banking crises, sudden changes of over 10 percentage points occurred eight times during the same period. These episodes were distinctly temporary, ranging from one to four months, with many lasting for no more than one month. Such extreme temporary spikes are absent from interest rates since the founding of the Fed (Miron 1986; Mankiw, Miron, and Weil 1987).

In line with its original mandate, the Fed has routinely accommodated liquidity disturbances at a given targeted level of short-term interest rates. Furthermore, by giving banks access to the discount window, the Fed has been careful not to exert excessively disruptive liquidity disturbances when changing its interest rate target.² It follows that easing or tightening has mainly

² Total reserve demand is not very sensitive to interest rates in the short run. So whenever the Fed cuts nonborrowed reserves to support a higher federal funds rate target, it allows banks to satisfy a roughly unchanged reserve demand by borrowing the difference at the discount

been accomplished by changing the level of short rates to set in motion forces slowing the growth of money demand in order to allow a future reduction in money growth and inflation.

To view the Federal Reserve's policy instrument as the federal funds rate is thus to set money to the side, since at any point in time money demand is accommodated at the going interest rate. This does not say, however, that money can be left out of account altogether. The Fed, the markets, and economists alike recognize that trend inflation is closely connected to trend money growth and that achieving and maintaining price stability requires controlling money. During the period under study, money growth was often viewed as an important indicator of future inflation or disinflation by both the Fed and the markets.

Furthermore, we know from the work of McCallum (1981) and others that an interest rate policy just describes how changes in interest rates correspond to changes in the money stock. At a deeper level, then, there is an equivalence between talking in terms of interest rates or money. The important difference is that simple interest rate rules descriptive of policy have implications for how money and prices actually evolve over time (Goodfriend 1987; Barro 1989). We should keep this in mind when reviewing the current period for clues about how policy influences the inflation rate. Ultimately we seek to understand what it is about interest rate policy that turns one-time macroeconomic shocks into highly persistent changes in the growth of money and prices.

Interpreting Co-Movements Between Short and Long Rates

The Fed targets the funds rate in order to stabilize inflation and real economic growth as best it can. Output and prices, however, do not respond directly to weekly federal funds rate movements but only to longer-term rates of perhaps six months or more. Hence, the Fed targets the funds rate with the aim of managing longer-term money market rates. It exercises its leverage as follows. The market determines longer-term rates as the average expected level of the funds rate over the relevant horizon (abstracting from a time varying term premium and default risk). To see why, consider the pricing of a three-month bank loan. A bank could fund the loan with a three-month CD, or it could plan to borrow federal funds overnight for the next three months. Cost minimization and competition among banks keep the CD rate in line with the average expected future funds rate; competition in the loan market links loan rates to the CD rate and expected future funds rates. Finally, arbitrage among holders of money market securities links Treasury bill and commercial paper rates to CD rates of similar maturity.

window. The negative relation between nonborrowed reserves and the funds rate in part reflects the administration of the discount window, which creates a positive relation between bank borrowing and the spread between the funds rate and the discount rate. Christiano and Eichenbaum (1991) emphasize the importance of this mechanism in understanding the liquidity effect.

Since simplicity is crucial in communicating policy intentions, the Fed tries to manage its funds rate target to maintain an expected constancy over the near-term future. Target changes are highly persistent and seldom quickly reversed, so that a target change carries the expected level of the funds rate with it and thus longer-term money market rates too.³ In this way, interest rate policy as practiced by the Fed anchors the short end of the term structure of interest rates to the current federal funds rate.

By the above argument, the interest rate on long bonds also must be determined as an average of expected future short rates. At best, the Fed affects short-term real interest rates temporarily, so average future short rates over the horizon of a 30-year bond should sum to a real interest rate that varies in a range perhaps 1 or 2 percentage points around 3 percent per year plus the expected trend rate of inflation.⁴ **From this perspective, we can view fluctuations in the long-term rate as driven by: (1) a component connected with the current funds rate target that anchors short maturity rates and (2) a component driven by expectations of inflation.** Because the present discounted value of coupon payments far out in the future is smaller at higher interest rates, we should expect a given funds rate target change to exert a greater effect on the long bond at higher rates of interest.⁵

³ Goodfriend (1991) discusses evidence consistent with this view found in Fama (1984), Fama and Bliss (1987), Mankiw, Miron, and Weil (1987), Hardouvelis (1988), and Cook and Hahn (1989).

⁴ Consider a bond paying nominal interest (i) taxable at rate (τ) when the expected inflation rate is (π^e). The real after-tax ex ante return on such a bond is then $r = (1 - \tau)i - \pi^e$, so the expected inflation rate over the life of the bond may be expressed as $\pi^e = [i - r/(1 - \tau)](1 - \tau)$.

Woodward (1990) reports market expectations of the after-tax real rate of interest on long-term bonds using quarterly data on British index-linked gilt-edged securities from 1982:2 to 1989:1. The ex ante post-tax real rate ranged from 1.5 percent to 3.2 percent per annum with a mean of 2.6 percent.

Assuming investors keep after-tax ex ante rates on long-term government bonds in the United States and United Kingdom roughly equal, we can set $r = 2.6$ in the above expression to infer long-term expected inflation in the United States. A tax rate in the United States of 0.2, for example, yields $\pi^e = [i - 3.2](.8)$. If we take i as the yield to maturity on a 30-year U.S. government bond, then π^e is the average per annum inflation rate expected over the 30-year horizon.

The tax rate in the above expression is the marginal rate that applies to the relevant marginal investor, e.g., individual, corporate, or foreign. The rate is difficult to determine. Its exact value, however, is not important for the analysis in the text. The analysis relies on the view that significant *changes* in the long-term nominal rate primarily reflect movements in inflation expectations, a view supported by the relatively narrow range of ex ante post-tax real rates reported by Woodward.

⁵ A given federal funds rate target change will exert a greater effect on the long-term bond rate the shorter the average life of the security as measured by its duration. The duration of a coupon bond may be thought of as the term to maturity of an equivalent zero coupon bond that makes the same total payments and has the same yield. The duration of a 30-year coupon bond selling at par is approximately $1/r$, where r is the yield to maturity. See Moore (1989). Thus, the duration of the 30-year government (coupon) bond discussed in the text is only about 12.5 years at an interest rate of 8 percent and 7.1 years at a 14 percent interest rate.

It is useful to distinguish three sources of interaction between the federal funds rate and the long-term rate:

Purely Cyclical Funds Rate Policy Actions

The Fed routinely lowers the funds rate in response to cyclical downturns and raises it in cyclical expansions. I call such policy actions purely cyclical if they maintain the going trend rate of inflation. Even purely cyclical policy actions exert a pull on longer rates, however, so they are a source of positive co-movement between the funds rate and the long rate. But because cyclical actions strongly influence only the first few years of expected future short-term interest rates, only a relatively small fraction of purely cyclical funds rate changes are transmitted to the long rate.

Long-Run Inflation

Changes in the trend rate of inflation are a second source of positive co-movement between the funds rate and the long rate. The long rate moves automatically with inflation expectations. The funds rate does not, however, unless the Fed makes it do so. Nevertheless, the Fed often chooses to hold short-term real rates relatively steady in the presence of rising or falling inflation by moving the funds rate up or down to allow for a rising or falling inflation premium. Doing so causes short and long rates to move together.

Aggressive Funds Rate Policy Actions

The Fed occasionally takes particularly aggressive funds rate policy actions to encourage real growth or to stop and reverse a rising rate of inflation. Aggressive actions combine an effect on the long-term real rate with a potential change in the long-run rate of inflation. The real rate effect moves the long rate in the same direction as the funds rate, while the inflation effect moves the long rate in the opposite direction. Thus the net effect of aggressive actions on the long rate is somewhat complex.

Consider an aggressive reduction in the funds rate to encourage real growth. Initially, funds rate actions taken to fight recession pull the long rate down too. However, excessive easing that raises expected inflation can cause the long rate to reverse direction and begin to rise, even as the Fed continues to push short rates down. Thus we might expect to see the long rate move in the opposite direction from the funds rate near cyclical troughs. A funds rate tightening during the ensuing recovery exerts two conflicting forces. It tends to raise the long rate by reversing the cyclical funds rate decline, but it also reverses somewhat the expected rise in inflation, tending to lower the long rate. For a relatively brief recession with little excessive easing, the cyclical funds rate effect would dominate the inflation effect, so the long rate would tend to rise with the funds

rate during the recovery. Thus, the long rate would move opposite from the funds rate for only a few months near a recession trough.

Now consider an aggressive increase in the funds rate intended to bring down the trend rate of inflation. Such a tightening potentially shifts both components of the long rate since short rates rise and expected long-run inflation may fall. One expects the first effect to dominate initially, however, because a large aggressive increase in short rates exerts an immediate significant upward pull on the long rate, while the public may not yet have confidence in the disinflation. If the Fed persists with sufficiently high short-term real rates, however, inflation and real growth eventually slow and the Fed can tentatively bring rates down somewhat. A declining long rate, at this point, would suggest that the Fed's disinflation has acquired some credibility.

Inflation Scares

I call a significant long-rate rise in the absence of an aggressive funds rate tightening an inflation scare since it reflects rising expected long-run inflation.⁶ Inflation scares are of concern because higher inflation, if realized, would reduce the efficiency of the payments system, with negative consequences for employment, productivity, and economic growth. Moreover, scares are costly because they present the Fed with a difficult dilemma. Resisting them requires the Fed to raise real short rates with potentially depressing effects on business conditions. Failing to respond promptly, however, can create a crisis of confidence that encourages the higher inflation to materialize; workers and firms ask for wage and price increases to protect themselves from higher expected costs. In short, by hesitating, the Fed sets in motion higher inflation that it is then inclined to accommodate with faster money growth. The record of rising inflation and disinflation reviewed below contains examples of scares followed by higher money growth and inflation, as well as scares successfully resisted by the Fed.⁷

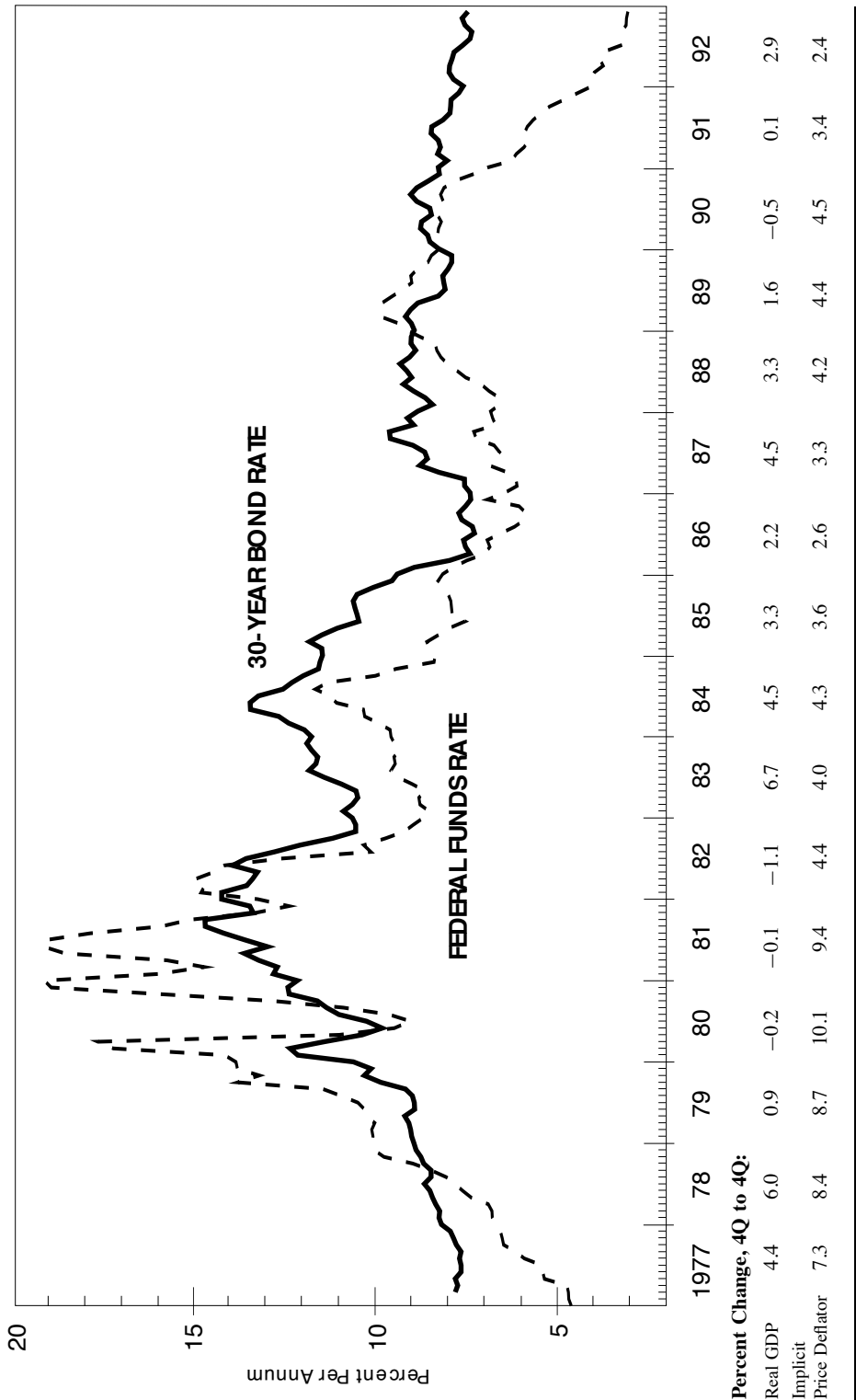
2. A REVIEW OF INTEREST RATE POLICY

This study focuses on the period of inflation fighting beginning in October 1979. Nevertheless, I begin my review by briefly describing conditions in the immediately preceding years. For the most part, data discussed throughout are shown in Figure 1 and are given in the tables included at the end of the article.

⁶ Since short maturity rates are anchored to the federal funds rate target, they cannot convey as clear a signal of inflation expectations as the long rate. See Dotsey and King (1986) for an analysis of the informational implications of interest rate rules.

⁷ An inflation scare may be consistent with either a positive or a negative association between money or prices, on one hand, and unemployment or real growth on the other, depending on the nature of the underlying macroshock that sets it off. For example, an investment boom tends to generate a positive association, and an oil price rise, a negative one.

Figure 1 Federal Funds Rate and 30-Year Bond Rate, January 1977–December 1992



Rising Inflation: The Late 1970s

Inflation was rising gradually in the late 1970s, with rates of 7.3 percent, 8.4 percent, and 8.7 percent in 1977, 1978, and 1979 as measured by fourth quarter over fourth quarter changes in the GDP deflator. The corresponding real GDP growth rates were 4.4 percent, 6.0 percent, and 0.9 percent. Rising inflation throughout the late 1970s carried the 30-year government bond rate from 7.8 percent in early 1977 to 9.2 percent by September 1979. Over the same period, the Fed steadily increased the federal funds rate from around 4.7 percent to 11.4 percent, raising short-term real rates from a range between 0 to -2 percent to between 0 and +2 percent. The negative short-term real rates at the beginning of the period suggest that initially the Fed was stimulating real growth, though the steady increase in real short rates represented a modest effort to resist inflation.

Aborted Inflation Fighting: October 1979 to July 1980

By the time Paul Volcker became Fed Chairman in August 1979, oil price increases following the Iranian revolution in November 1978 greatly worsened the inflation outlook. Oil prices were to double by early 1980 and triple by early 1981 from November 1978 levels, and by the fall of 1979 the Fed felt that more drastic action was needed to fight inflation. The announcement on October 6, 1979, of the switch to nonborrowed reserve targeting officially opened the inflation-fighting period.

The first aggressive policy actions in this period took the monthly average funds rate from 11.4 percent in September 1979 to 17.6 percent in April 1980. Cook (1989) reports that only 1 percentage point of this 6 point rise can be attributed to automatic adjustment. Virtually all of it represented deliberate policy actions taken by the Fed to increase short-term interest rates. It was the most aggressive series of actions the Fed had taken in the postwar period over so short a time, although the 5 percentage point increase from January to September of 1973 was almost as large.

For its part, the 30-year rate rose sharply from 9.2 percent in September to a temporary peak of 12.3 percent in March, after which it fell back to 11.4 percent in April. A closer look reveals the sources of this sharp rise in the long rate. The sharp 2.3 percentage point funds rate jump from September to October raised the long rate by 0.7 percentage points. The funds rate then held in a range between 13.2 percent and 14.1 percent through February. January 1980 later turned out to be an NBER business cycle peak, and evidence of a weakening economy caused the Fed to pause in its aggressive tightening. But with the funds rate relatively steady, the long rate jumped sharply by around 2 percentage points between December and February, signaling a serious inflation scare.

The scare was probably caused in part by the ongoing oil price rises, with the Soviet invasion of Afghanistan in December also playing a role. The

Fed's hesitation to proceed with its tightening, however, probably contributed to the collapse of confidence. In any case, the Fed reacted with an enormous 3 percentage point increase of the monthly average funds rate in March, only 1 percentage point of which was due to the automatic adjustment. The long rate hardly moved in response, suggesting that the positive effect on the long rate of the aggressive tightening was offset by a decline in expected inflation. Moreover, the long rate actually came down by 0.9 percentage points in April even as the Fed pushed the funds rate up another 0.4 percentage points, suggesting that the Fed had already begun to win credibility for its disinflationary policy.

When one considers that business peaked in January, there is reason to believe that inflation would have come down as the recession ran its course in 1980 if the Fed had then sustained its high interest rate policy. The imposition of credit controls in March, however, forced the Fed to abort that policy. Schreft (1990) argues persuasively that by encouraging a decline in consumer spending, the credit control program was largely responsible for the extremely sharp -9.9 percent annualized decline in real GDP in the second quarter of 1980. Supporting her view is the fact that personal consumption expenditures accounted for about 80 percent of the decline in real output, more than twice its average 35 percent contribution in postwar U.S. recessions.

Accompanying the downturn in economic activity was a sharp fall in the demand for money and bank reserves that, according to Cook (1989), caused a 4.2 percentage point automatic decline of the funds rate from April to July. The Fed enhanced the automatic easing with judgmental actions, e.g., reducing the discount surcharge, that reduced the funds rate by an additional 4.3 percentage points over this period.

The sharp interest rate decline coupled with the lifting of credit controls in July led to strong 8.4 percent annualized real GDP growth in the fourth quarter of 1980. Because the credit controls caused the Fed to interrupt its inflation-fighting effort, inflation rose through the year from an annual rate of 9.8 percent in the first quarter to 10.9 percent in the fourth quarter as measured by the GDP deflator.

Aggressive Disinflationary Policy: August 1980 to October 1982

It was clear in late summer and early fall of 1980 that inflationary pressures were as strong as ever. After being pulled down about 1.6 percentage points by the aggressive funds rate easing from April to June, the 30-year rate rose by about 40 basis points between June and July as the Fed continued to push the funds rate down another 40 basis points. The reversal signaled an inflation scare induced by the excessively aggressive easing, and the Fed began an unprecedented aggressive tightening. Of the roughly 10 percentage point rise in the monthly average funds rate from July to December 1980, Cook (1989) attributes only about 3 percentage points to the automatic adjustment. Thus,

the run-up of the funds rate to its 19 percent peak in January 1981 marked a deliberate return to the high interest rate policy. As measured by the GDP deflator, which was rising at nearly a 12 percent annual rate in the first quarter of 1981, real short-term rates were a high 7 percent at that point.

As soon as the funds rate peak had been established, however, very slow growth in M1 and bank reserves automatically put downward pressure on the funds rate. According to Cook (1989), about 3.4 percentage points of the 4 percentage point drop in the funds rate between January and March was attributable to the automatic adjustment. Since the automatic adjustment had correctly signaled weakness in the economy in the second quarter of 1980, the Fed was initially inclined to let rates fall in early 1981. However, real GDP actually grew at a 5.6 percent annual rate in the first quarter, and when the strength of the economy became clear, the Fed took deliberate actions to override what it took to be a false signal that disinflation had taken hold. Reversing field, it ran the funds rate back up to 19 percent by June, using a series of deliberate tightening actions to supplement what Cook (1989) reports would only have been a 0.8 percentage point automatic funds rate rise.

It was not long before the aggressive disinflationary policy began to take hold. Annualized real GDP growth was -1.7 percent in the second quarter of 1981. The third quarter posted 2.1 percent real growth, but an NBER business cycle peak was reached in July and real growth fell to -6.2 percent in the fourth quarter of 1981 and -4.9 percent in the first quarter of 1982. Meanwhile, the quarterly inflation rate as measured by the GDP deflator fell from 11.8 percent in the first quarter of 1981 to the 4.5 percent range by early 1982.

The Fed brought the funds rate down from 19 percent at the business cycle peak in July to 13.3 percent in November and held the funds rate in the 13 to 15 percent range until the summer of 1982, when it brought short rates down another 4 percentage points to around 10 percent. The funds rate reduction through November 1981 was large in nominal terms, but when one considers that inflation had declined to the 4.5 percent range by early 1982, the funds rate decline actually represented a 1 or 2 percentage point rise in short-term real rates. Thus, one should still view policy as aggressively disinflationary in early 1982. As calculated by Cook (1989), automatic adjustments accounted for only 1 percentage point of the final 9 percentage point funds rate decline in the nonborrowed reserve targeting period, which ended formally in October of 1982. This last great decline should be seen as a deliberate funds rate easing calculated to achieve a sustained reduction in inflation without excessive harm to real growth.

The long rate provides a picture of the Fed's progress in reducing the trend rate of inflation. The 30-year rate rose about 5 percentage points from a trough in June of 1980 to its 14.7 percent peak in October 1981. About 2 percentage points of that rise represented a reversal of the decline in the second quarter of 1980. The remaining 3 point gain through October 1981 reflected a continuing

inflation scare. The sharp rise in the long rate after the funds rate had reached its peak in early 1981 probably contributed to the Fed's inclination to persist with its 19 percent funds rate until August 1981. Moreover, the discernable declining trend in the long rate from October 1981 to August 1982 indicated that the policy was still exerting disinflationary pressure. When the Fed finally decided to relax its disinflationary policy by dropping the funds rate by over 4 percentage points in the summer of 1982, the long rate also fell by around 3.5 percentage points.

We can decompose this last decline in the long rate into a real component and an inflation-expectations component using evidence from earlier in the aggressive funds rate targeting period. The sharp 2.3 percentage point funds rate rise from September to October 1979 pulled the long rate up 0.7 percentage points; and the sharp 8.6 percentage point funds rate reduction between April and June 1980 pulled the long rate down 1.6 percentage points. Taking 25 percent as the fraction of aggressive funds rate policy actions transmitted to the long real rate, about 2.5 percentage points of the 3.5 percentage point fall in the long rate in the summer of 1982 reflected a reduction of inflation expectations.

Establishing Credibility: November 1982 to Spring 1986

Real GDP growth was still poor in the second half of 1982, running -1.8 percent and 0.6 percent in the third and fourth quarters, respectively. Consequently, the Fed continued to ease after relaxing its disinflationary policy, pushing the monthly average funds rate down to 8.5 percent by February 1983. November 1982 turned out to be an NBER business cycle trough, and real GDP growth was 2.6 percent in the first quarter of 1983. But the Fed kept the funds rate around 8.6 percent through May while the long rate remained steady at around 10.5 percent. It gradually became clear, however, that a strong recovery had begun. Real GDP grew at a spectacular 11.3 percent annual rate in the second quarter of 1983 and at rates of 6.1 percent, 7.0 percent, 7.9 percent, and 5.4 percent in the following four quarters.

The long rate rose from 10.5 percent in May 1983 to 11.8 percent in August, initiating an inflation scare only a year after the Fed had relaxed its disinflationary policy. The Fed reacted by raising the funds rate from 8.6 percent in May to 9.6 percent by August. Annualized quarterly inflation as measured by the GDP deflator was 4.8 percent or below throughout 1983 and 1984 with the exception of the first quarter of 1984, when it was 6 percent. Nevertheless, the long rate continued its rise in early 1984, moving up from the 11.8 percent level it had maintained since the previous summer to a 13.4 percent peak in June 1984. Amazingly, this was only about a percentage point short of its October 1981 peak, even though by 1984 inflation was 4 or 5 percentage points lower than in 1981.

The Fed tightened in an effort to resist the ongoing inflation scare, raising the funds rate to an 11.6 percent peak in August of 1984. The long rate began to decline in June 1984, indicating that the scare had been contained. The 7 percent real short rates needed to contain the scare ultimately brought quarterly real GDP growth down to the more normal 2 to 3 percent range in the second half of 1984. The Fed then lowered the funds rate rapidly by 3.2 percentage points from August to December and held it around 8 percent through 1985.

Meanwhile, the long rate fell about 6 percentage points from its June 1984 peak to the mid-7 percent range by the spring of 1986. By then, the long rate was 3 percentage points below where it had been at the start of the 1983 scare. The Fed's containment of the scare apparently made the public confident of another 3 percentage point reduction in the trend rate of inflation.

Maintaining Credibility: Spring 1986 to Summer 1990

Real GDP growth weakened considerably in the second quarter of 1986 to -0.3 percent from the strong 5.4 percent rate in the first quarter. With inflation appearing to have settled down in the 4 percent range, the Fed moved to encourage real growth by dropping the funds rate to the mid-6 percent range. Strong real growth in 1987 was accompanied by still another inflation scare in which the long rate rose 2 full percentage points from around 7.6 percent in March to 9.6 percent in October.

Although real GDP growth was very strong throughout the year, this time the Fed responded to the scare with only a relatively modest increase in the funds rate. As it happened, the scare eased somewhat after the October stock market crash, although the long rate remained above 8 percent. With real growth still reasonably strong in 1988, the Fed proceeded to raise the funds rate sharply from the 6 to 7 percent range in early 1988 to a peak of 9.9 percent in March 1989.

Though there was some evidence of a modest rise in inflation in 1988, the sustained funds rate tightening during the year is unique in that it was undertaken without a rise in the long rate. A preemptive tightening may have been needed to reverse the perception that policy had eased permanently following the stock market crash. At any rate, the result was an increase in credibility reflected in a further decline in the long rate in 1989. Though that fall was partially reversed in early 1990, a gently declining trend in the long rate was discernable by then, indicating growing confidence on the part of the public in the Fed's commitment to low inflation.

The 1990-91 Recession

The period of weak real growth in 1989 ending in an NBER business cycle peak in July 1990 may have been partly due to the high real short rates. Temporary oil price increases following the invasion of Kuwait, however, also

helped account for the -1.6 percent real growth in the third quarter of 1990, -3.9 percent real growth in the fourth quarter, and -3.0 percent in the first quarter of 1991.

The Fed responded to the recession by bringing the funds rate down from slightly above 8 percent in the fall of 1990 to around 3 percent by the fall of 1992. It is remarkable that this sustained easing has not yet caused the long rate to rise, even though real short rates are now around zero. Real short rates were also about zero when excessive easing sparked the inflation scare in the summer of 1980, but they were around 4 percent when excessive easing triggered the summer 1983 scare, and around 3 percent at the time of the scare in the spring of 1987. The real short-rate floor at which easy monetary policy becomes excessive depends on such factors as the unemployment rate, government fiscal policy, and the strength of investment and consumption demand.⁸ For example, the depressing effect of the credit control program on consumer spending may help account for the real rate getting as low as it did in 1980 before triggering a scare. Long rates, however, may also be more tolerant of aggressive funds rate easing when the public is more confident of the Fed's commitment to maintain a low trend rate of inflation.

3. OBSERVATIONS

The record of interest rate policy reviewed above contains a number of empirical findings that are important for interpreting and evaluating monetary policy. This section summarizes the main findings in a series of observations.

1. Inflation scares appear to be central to understanding the Fed's management of short-term interest rates. The gradual funds rate rise from January 1977 to October 1979 was undertaken in an environment of slowly rising long rates. The sharp long-rate rise in early 1980, during a four-month pause in the funds rate tightening, was probably an important factor inducing the Fed to undertake its enormous 3 percentage point tightening in March. Sharply rising long rates in the first nine months of 1981 indicated that the Fed had yet to win credibility for its disinflationary policy, and probably contributed to the Fed's maintaining very high real short rates for as long as it did. On the other hand, the declining long rate from October 1981 to October 1982 encouraged the Fed to ease policy by indicating the public's growing confidence in the disinflation.

The serious inflation scare set off in the summer of 1983 largely accounts for the run-up of the funds rate to August 1984. The credibility acquired by the Fed in containing that scare yielded a 3 percentage point

⁸ See, for example, the discussions in Campbell and Clarida (1987) and Poole (1988).

reduction in the long rate that allowed the funds rate to come down too. There was no inflation scare per se when the Fed raised the funds rate in 1988. Nevertheless, that series of actions may be understood as preemptive, taken to reverse a public perception that policy had permanently eased following the stock market crash. The current funds rate easing has yet to trigger a rise in the long rate, but the possibility of an inflation scare has probably limited the funds rate decline somewhat.

2. One might reasonably have expected the aggressive disinflationary policy actions taken in late 1979 to reduce long-term interest rate volatility by quickly stabilizing long-term inflation expectations at a low rate. Yet the reverse was true initially. Long rates turned out to be surprisingly volatile due to a combination of particularly aggressive funds rate movements and inflation scares. Amazingly, it took until 1988 for the unusual long-rate volatility to disappear.
3. One might also have expected the aggressive funds rate actions beginning in October 1979 to be accompanied by opposite movements in the long rate. Again, the result was just the reverse. The aggressive actions moved the long rate in the same direction, apparently influencing the long rate primarily through their effect on shorter maturity rates. Only at funds rate peaks and troughs did the long rate move in the opposite direction from the funds rate. The long rate appeared to be influenced by a change in expected inflation only after sustained aggressive funds rate actions.
4. The long rate reached its peak in October 1981, indicating that it took two years for policy to reverse the rise in the trend rate of inflation. It would be a mistake, however, to conclude that acquiring credibility necessarily takes so long. On the contrary, a close look reveals that the long rate had already turned down in April 1980 while the funds rate was still rising, suggesting that some credibility had been won by then. Credibility might even have been achieved sooner if the Fed had not hesitated temporarily between December 1979 and February 1980 to continue the aggressive funds rate tightening begun in October. In any case, the credit control program interrupted the disinflationary policy actions in May 1980 and high interest rates were restored fully only in early 1981. The automatic adjustment feature of the nonborrowed reserve operating procedure then caused a sharp decline in the funds rate between January and March of 1981 that was only fully reversed by June. Thus, three unfortunate interruptions account for the delay in the Fed's acquisition of credibility for its disinflationary policy.
5. Interestingly enough, the long rate was roughly in the same 8 percent range in the early 1990s as it was in the late 1970s, in spite of the 4 or 5 percentage point reduction in the inflation rate. Apparently, investors then perceived the 7 to 9 percent inflation rate as temporarily high, while, if anything, they perceive the current 3 to 4 percent rate as a bit below trend. The slowly declining long rate in the current period is indicative of the

steady acquisition of credibility, but the high long rate indicates a lingering lack of confidence in the Fed.

6. The Fed appears to have had remarkable latitude to push the federal funds rate down in the recent recession and recovery without triggering a rise in the long rate. On three occasions when trying to encourage real growth in the 1980s (summer 1980, summer 1983, and spring 1987) it could not push the funds rate more than 1 or 2 percentage points below the long rate before triggering an inflation scare; yet it pushed the funds rate 4 percentage points below the long rate in 1992.

The greater flexibility to reduce short rates evident in the current recession is reminiscent of that in early postwar recessions when the Fed presumably had more credibility. The funds rate was pushed almost 3 percentage points below the long rate during the August 1957–April 1958 recession before the long rate began to rise. It was pushed more than 2 percentage points below the long rate in the April 1960–February 1961 recession without much of a rise in the long rate.⁹

7. The preceding observation suggests an attractive argument in favor of a congressional mandate for price stability. By reducing the risk of inflation scares, such a mandate would free the funds rate to react more aggressively to unemployment in the short run. Thus, a mandate for price stability would not only help eliminate inefficiencies associated with long-run inflation, it would add flexibility to the funds rate that might improve countercyclical stabilization policy as well.¹⁰

4. CONCLUSION

The article used institutional knowledge of Fed policy procedures, simple economic theory, and the inflation scare concept to analyze and interpret interest rate policy as practiced by the Fed since 1979. It focused on the primary policy problem during the period: the acquisition and maintenance of credibility for the commitment to low inflation. We saw that the Fed might have acquired credibility for its disinflation relatively quickly in early 1980 had it been able to sustain high interest rates then. After all, long-term rates were roughly equal to the inflation rate in 1979, indicating that the public believed inflation was only temporarily high at the time. Unfortunately, a series of interruptions delayed the actual disinflation for two years, probably raising the cost in terms of lost output of acquiring credibility.

⁹ Kessel (1965) contains a good description and analysis of the historical relation between long and short rates over the business cycle.

¹⁰ Black (1990) discusses the benefits of price stability. Hetzel (1990, 1992) discusses a proposal that the U.S. Treasury issue indexed bonds to provide a better indicator of long-run inflation expectations.

Only a year after relaxing its disinflationary policy in 1982, the Fed's credibility was again challenged with a serious inflation scare that carried the long rate up from 10.5 percent to 13.4 percent. It took 11 months and 7 percent real short rates to contain the scare, indicating how fragile the Fed's credibility was in 1983 and 1984. The long-rate decline to the 7.5 percent range by the spring of 1986 reflected a big gain in credibility. Yet the Fed was tested by another scare in 1987 that ended with the stock market crash. The crash itself, however, then set in motion expectations of excessive easing that the Fed resisted with a 3 percentage point funds rate rise in 1988 and 1989, a tightening that probably weakened real growth somewhat in 1989 and 1990.

Reviewing the policy record makes one understand how fragile the Fed's credibility is and how potentially costly it is to maintain. Even after inflation had stabilized at around 4 percent in 1983, inflation scares and the Fed's reaction to them were associated with significant fluctuations in real growth. With that in mind, one cannot help but appreciate the potential value of a congressional mandate for price stability that would help the Fed establish a credible commitment to low inflation. In fact, there is evidence that an interest rate policy assisted by such a mandate would work well. The Bundesbank and the Bank of Japan follow interest rate policies resembling the Fed's and yet, for the most part, they have achieved better macroeconomic performance. Perhaps it is because they each enjoy a stronger mandate for price stability than does the Fed.

**Table 1 Quarterly Changes in Real GDP and
GDP Implicit Price Deflator, 1977:1–1992:4**
Percent seasonally adjusted compound annual rates

Year/ Quarter	Real GDP	Implicit Price Deflator	Year/ Quarter	Real GDP	Implicit Price Deflator
1977			1985		
1	6.0	6.1	1	2.7	4.9
2	6.9	8.4	2	3.2	3.0
3	5.7	7.4	3	5.2	2.6
4	−0.8	7.3	4	2.3	3.9
1978			1986		
1	2.8	5.7	1	5.4	2.1
2	13.5	10.7	2	−0.3	2.1
3	3.1	8.3	3	2.3	2.9
4	4.8	8.8	4	1.3	3.3
1979			1987		
1	0.1	8.6	1	3.0	3.3
2	0.4	8.4	2	5.1	2.9
3	2.5	9.6	3	4.0	3.3
4	0.7	8.1	4	5.9	3.6
1980			1988		
1	1.7	9.8	1	2.6	3.6
2	−9.9	9.6	2	4.3	4.4
3	0.1	10.0	3	2.5	5.1
4	8.3	10.9	4	3.9	3.9
1981			1989		
1	5.6	11.8	1	3.2	5.4
2	−1.7	7.5	2	1.8	4.6
3	2.1	9.6	3	0.0	3.8
4	−6.2	8.8	4	1.5	3.7
1982			1990		
1	−4.9	4.5	1	2.8	4.4
2	1.6	5.5	2	1.0	4.8
3	−1.8	4.4	3	−1.6	4.7
4	0.6	3.4	4	−3.9	3.9
1983			1991		
1	2.6	4.8	1	−3.0	5.3
2	11.3	2.8	2	1.7	3.5
3	6.1	4.2	3	1.2	2.4
4	7.0	4.2	4	0.6	2.4
1984			1992		
1	7.9	6.0	1	2.9	3.1
2	5.4	4.1	2	1.5	2.7
3	2.2	4.5	3	3.4	2.0
4	2.7	2.6	4	3.8	1.7

Source: Bureau of Economic Analysis.

Table 2 Federal Funds Rate and 30-Year Government Bond Rate, January 1977–December 1992											
Percent per annum											
Year/ Month	Federal Funds Rate	30-Year Govt. Bond Rate	Year/ Month	Federal Funds Rate	30-Year Govt. Bond Rate	Year/ Month	Federal Funds Rate	30-Year Govt. Bond Rate	Year/ Month	Federal Funds Rate	30-Year Govt. Bond Rate
1977			1981			1985			1989		
J	4.61	—	J	19.08	12.14	J	8.35	11.45	J	9.12	8.93
F	4.68	—	F	15.93	12.80	F	8.50	11.47	F	9.36	9.01
M	4.69	7.80	M	14.70	12.69	M	8.58	11.81	M	9.85	9.17
A	4.73	7.73	A	15.72	13.20	A	8.27	11.47	A	9.84	9.03
M	5.35	7.80	M	18.52	13.60	M	7.97	11.05	M	9.81	8.83
J	5.39	7.64	J	19.10	12.96	J	7.53	10.45	J	9.53	8.27
J	5.42	7.64	J	19.04	13.59	J	7.88	10.50	J	9.24	8.08
A	5.90	7.68	A	17.82	14.17	A	7.90	10.56	A	8.99	8.12
S	6.14	7.64	S	15.87	14.67	S	7.92	10.61	S	9.02	8.15
O	6.47	7.77	O	15.08	14.68	O	7.99	10.50	O	8.84	8.00
N	6.51	7.85	N	13.31	13.35	N	8.05	10.06	N	8.55	7.90
D	6.56	7.94	D	12.37	13.45	D	8.27	9.54	D	8.45	7.90
1978			1982			1986			1990		
J	6.70	8.18	J	13.22	14.22	J	8.14	9.40	J	8.23	8.26
F	6.78	8.25	F	14.78	14.22	F	7.86	8.93	F	8.24	8.50
M	6.79	8.23	M	14.68	13.53	M	7.48	7.96	M	8.28	8.56
A	6.89	8.34	A	14.94	13.37	A	6.99	7.39	A	8.26	8.76
M	7.36	8.43	M	14.45	13.24	M	6.85	7.52	M	8.18	8.73
J	7.60	8.50	J	14.15	13.92	J	6.92	7.57	J	8.29	8.46
J	7.81	8.65	J	12.59	13.55	J	6.56	7.27	J	8.15	8.50
A	8.04	8.47	A	10.12	12.77	A	6.17	7.33	A	8.13	8.86
S	8.45	8.47	S	10.31	12.07	S	5.89	7.62	S	8.20	9.03
O	8.96	8.67	O	9.71	11.17	O	5.85	7.70	O	8.11	8.86
N	9.76	8.75	N	9.20	10.54	N	6.04	7.52	N	7.81	8.54
D	10.03	8.88	D	8.95	10.54	D	6.91	7.37	D	7.31	8.24
1979			1983			1987			1991		
J	10.07	8.94	J	8.68	10.63	J	6.43	7.39	J	6.91	8.27
F	10.06	9.00	F	8.51	10.88	F	6.10	7.54	F	6.25	8.03
M	10.09	9.03	M	8.77	10.63	M	6.13	7.55	M	6.12	8.29
A	10.01	9.08	A	8.80	10.48	A	6.37	8.25	A	5.91	8.21
M	10.24	9.19	M	8.63	10.53	M	6.85	8.78	M	5.78	8.27
J	10.29	8.92	J	8.98	10.93	J	6.73	8.57	J	5.90	8.47
J	10.47	8.93	J	9.37	11.40	J	6.58	8.64	J	5.82	8.45
A	10.94	8.98	A	9.56	11.82	A	6.73	8.97	A	5.66	8.14
S	11.43	9.17	S	9.45	11.63	S	7.22	9.59	S	5.45	7.95
O	13.77	9.85	O	9.48	11.58	O	7.29	9.61	O	5.21	7.93
N	13.18	10.30	N	9.34	11.75	N	6.69	8.95	N	4.81	7.92
D	13.78	10.12	D	9.47	11.88	D	6.77	9.12	D	4.43	7.70
1980			1984			1988			1992		
J	13.82	10.60	J	9.56	11.75	J	6.83	8.83	J	4.03	7.58
F	14.13	12.13	F	9.59	11.95	F	6.58	8.43	F	4.06	7.85
M	17.19	12.34	M	9.91	12.38	M	6.58	8.63	M	3.98	7.97
A	17.61	11.40	A	10.29	12.65	A	6.87	8.95	A	3.73	7.96
M	10.98	10.36	M	10.32	13.43	M	7.09	9.23	M	3.82	7.89
J	9.47	9.81	J	11.06	13.44	J	7.51	9.00	J	3.76	7.84
J	9.03	10.24	J	11.23	13.21	J	7.75	9.14	J	3.25	7.60
A	9.61	11.00	A	11.64	12.54	A	8.01	9.32	A	3.30	7.39
S	10.87	11.34	S	11.30	12.29	S	8.19	9.06	S	3.22	7.34
O	12.81	11.59	O	9.99	11.98	O	8.30	8.89	O	3.10	7.53
N	15.85	12.37	N	9.43	11.56	N	8.35	9.02	N	3.09	7.61
D	18.90	12.40	D	8.38	11.52	D	8.76	9.01	D	2.92	7.44

Source: Board of Governors of the Federal Reserve System.

REFERENCES

- Barro, Robert J. "Interest Rate Targeting," *Journal of Monetary Economics*, vol. 23 (January 1989), pp. 3–30.
- Bernanke, Ben, and Alan Blinder. "The Federal Funds Rate and the Channels of Monetary Transmission," *American Economic Review*, vol. 82 (September 1992), pp. 901–21.
- Black, Robert P. "In Support of Price Stability," Federal Reserve Bank of Richmond *Economic Review*, vol. 76 (January/February 1990), pp. 3–6.
- Campbell, John Y., and Richard H. Clarida. "The Dollar and Real Interest Rates," *Carnegie-Rochester Conference Series on Public Policy*, vol. 27 (1987), pp. 103–40.
- Christiano, Lawrence, and Martin Eichenbaum. "Liquidity Effects, Monetary Policy, and the Business Cycle," Working Paper 70. Minneapolis: Federal Reserve Bank of Minneapolis, June 1991.
- Cook, Timothy. "Determinants of the Federal Funds Rate: 1979–1982," Federal Reserve Bank of Richmond *Economic Review*, vol. 75 (January/February 1989), pp. 3–19.
- _____, and Thomas Hahn. "The Effect of Changes in the Federal Funds Rate Target on Market Interest Rates in the 1970s," *Journal of Monetary Economics*, vol. 24 (November 1989), pp. 331–51.
- Dotsey, Michael, and Robert G. King. "Informational Implications of Interest Rate Rules," *American Economic Review*, vol. 76 (March 1986), pp. 33–42.
- Fama, Eugene F. "The Information in the Term Structure," *Journal of Financial Economics*, vol. 13 (1984), pp. 509–28.
- _____, and R. Bliss. "The Information in Long Maturity Forward Rates," *American Economic Review*, vol. 77 (1987), pp. 680–92.
- Federal Reserve Bank of New York. "Monetary Policy and Open Market Operations in 1983," Federal Reserve Bank of New York *Quarterly Review*, vol. 9 (Spring 1984), pp. 39–56.
- _____. "Monetary Policy and Open Market Operations in 1982," Federal Reserve Bank of New York *Quarterly Review*, vol. 8 (Spring 1983), pp. 37–54.
- _____. "Monetary Policy and Open Market Operations in 1981," Federal Reserve Bank of New York *Quarterly Review*, vol. 8 (Spring 1982), pp. 34–53.
- Friedman, Benjamin M. "Lessons on Monetary Policy from the 1980s," *The Journal of Economic Perspectives*, vol. 2 (Summer 1988), pp. 51–72.
- Friedman, Milton, and Anna J. Schwartz. *A Monetary History of the United States*. Princeton: Princeton University Press, 1963.

- Goodfriend, Marvin. "Discount Window Borrowing, Monetary Policy, and the Post-October 6, 1979 Federal Reserve Operating Procedure," *Journal of Monetary Economics*, vol. 12 (September 1983), pp. 343–56.
- . "Interest Rate Smoothing and Price Level Trend-Stationarity," *Journal of Monetary Economics*, vol. 19 (May 1987), pp. 335–48.
- . "Interest Rates and the Conduct of Monetary Policy," *Carnegie-Rochester Conference Series on Public Policy*, vol. 34 (Spring 1991), pp. 7–30.
- , and William Whelpley. "Federal Funds: Instrument of Federal Reserve Policy," Federal Reserve Bank of Richmond *Economic Review*, vol. 72 (September/October 1986), pp. 3–11.
- Hardouvelis, Gikas A. "The Predictive Power of the Term Structure during Recent Monetary Regimes," *Journal of Finance*, vol. 43 (1988), pp. 339–56.
- Hetzel, Robert L. "Indexed Bonds as an Aid to Monetary Policy," Federal Reserve Bank of Richmond *Economic Review*, vol. 78 (January/February 1992), pp. 13–23.
- . "Maintaining Price Stability: A Proposal," Federal Reserve Bank of Richmond *Economic Review*, vol. 76 (March/April 1990), pp. 53–55.
- . "Monetary Policy in the Early 1980s," Federal Reserve Bank of Richmond *Economic Review*, vol. 72 (March/April 1986), pp. 20–32.
- Kessel, Reuben A. *The Cyclical Behavior of the Term Structure of Interest Rates*. New York: National Bureau of Economic Research, 1965.
- Levin, Fred J., and Paul Meek. "Implementing the New Operating Procedures: The View from the Trading Desk," in Stephen H. Axilrod, ed., *New Monetary Control Procedures*. Washington: Board of Governors of the Federal Reserve System, 1981.
- Macaulay, Frederick R. *Bond Yields, Interest Rates, and Stock Prices*. Cambridge, Mass.: National Bureau of Economic Research, 1938.
- Mankiw, N. Gregory, Jeffrey Miron, and David N. Weil. "The Adjustment of Expectations to a Change in Regime: A Study of the Founding of the Federal Reserve," *American Economic Review*, vol. 77 (June 1987), pp. 358–74.
- McCallum, Bennett T. "Price Level Determinacy with an Interest Rate Policy Rule and Rational Expectations," *Journal of Monetary Economics*, vol. 8 (November 1981), pp. 319–29.
- Miron, Jeffrey. "Financial Panics, the Seasonality of the Nominal Interest Rate, and the Founding of the Fed," *American Economic Review*, vol. 76 (March 1986), pp. 125–40.
- Moore, George. "Forward-Looking Bond Yield Approximations." Washington: Board of Governors of the Federal Reserve System, September 1989.

- Poole, William. "Monetary Policy Lessons of Recent Inflation and Disinflation," *The Journal of Economic Perspectives*, vol. 2 (Summer 1988), pp. 73–100.
- Rogoff, Kenneth. "Reputation, Coordination, and Monetary Policy," *Carnegie-Rochester Conference Series on Public Policy*, Spring 1987, reprinted in Robert J. Barro, ed., *Modern Business Cycle Theory*. Cambridge, Mass.: Harvard University Press, 1989, pp. 236–64.
- Schreft, Stacey L. "Credit Controls: 1980," Federal Reserve Bank of Richmond *Economic Review*, vol. 76 (November/December 1990), pp. 25–55.
- Sims, Christopher. "Interpreting the Macroeconomic Time Series Facts: The Effects of Monetary Policy," *European Economic Review*, vol. 36 (1992), pp. 975–1000.
- Thornton, Daniel. "The Borrowed-Reserves Operating Procedure: Theory and Evidence," Federal Reserve Bank of St. Louis *Economic Review*, vol. 70 (January/February 1988), pp. 30–54.
- Wallich, Henry C. "Recent Techniques of Monetary Policy," Federal Reserve Bank of Kansas City *Economic Review*, vol. 69 (May 1984), pp. 21–30.
- Woodward, G. Thomas. "The Real Thing: A Dynamic Profile of the Term Structure of Real Interest Rates and Inflation Expectations in the United Kingdom, 1982–89," *Journal of Business*, vol. 63 (July 1990), pp. 373–98.