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Marvin Goodfriend
Robert King

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ABSTRACT

Using a simple modern macroeconomic model, we argue that the real effects of the Volcker disinflation in the early 1980s were mainly due to imperfect credibility, evident in volatility and stubbornness of long-term interest rates. Studying recently released transcripts of the Federal Open Market Committee, we find -- to our surprise -- that Volcker and other FOMC members also regarded long-term interest rates as key indicators of inflation expectations and of their disinflationary policy's credibility. We also consider the interplay of monetary targets, operating procedures, and credibility during the Volcker disinflation.

Marvin Goodfriend
Research Department
Federal Reserve Bank of Richmond
701 East Byrd Street
Richmond, VA 23219
marvin.goodfriend@rich.frb.org

Robert G. King
Department of Economics
Boston University
270 Boston University
Boston, MA 02215
and NBER
rking@bu.edu

1. Introduction[1]

In August 1979, when Paul Volcker became chairman of the Federal Reserve Board, the annual average inflation rate in the United States was 9%. Inflation had risen by 3 percentage points over the prior eighteen months and there were indications that it was poised to continue to rise (as it did, rising to a peak of 11% in early 1980). The Fed had pursued restrictive monetary policy to stabilize inflation on a number of occasions in the prior two decades but, each time, inflation moved higher shortly thereafter. Against the backdrop of a volatile international and domestic situation in the early 1980s, the Fed brought the inflation rate down to 4% by the end of 1983. During this period, the U.S. experienced two recessions generally attributed to disinflationary monetary policy, the 1981-82 recession exhibiting the largest cumulative business cycle decline of employment and output in the post-World War II period.

The "rise and fall" of inflation in the post-war period, and the Volcker disinflation in particular, are central events that attracted many economists to macroeconomics and have been the subject of a huge body of research. We first met Bennett McCallum in the late 1970s and have discussed these events many times during a friendship of a quarter century. In these conversations, Ben always stood for three practices: a careful review of the macroeconomic facts, the elaboration of small forward-looking linear macroeconomic models linking the core variables in macroeconomics, and an appraisal of events in light of these models. In this paper, we study the Volcker disinflation using this approach.

We think of the disinflation as "incredible" in three senses. First, looking backward, Volcker initiated a change in the average rate of inflation that has been large and sustained, so that the inflation peak in early 1980 stands out dramatically in the U.S. experience shown in Figure 1. Second, relative to the perspectives of many contemporary

[1]The views expressed in the paper do not necessarily reflect those of the Federal Reserve Bank of Richmond or the Federal Reserve System. The authors thank Carl Christ, Motoo Haruta, Robert Hetzel, Andrew Levin, Allan Meltzer, Athanasios Orphanides (our discussant), Robert E. Lucas, Jr., Bennett T. McCallum, Edward Nelson, Robert Rasche and seminar participants at Johns Hopkins for comments on this research.

observers in 1978, including ourselves, it is remarkable that a reduction in inflation took place since inflation seemed to be a permanent feature of the U.S. economy at the time and the costs of reducing it seemed so large. Third, we believe that "imperfect credibility of monetary policy" was a core feature of the disinflation on several dimensions that we highlight further below.

Prior to the disinflation, most economists thought that there would be large and protracted output losses from reducing the long-term rate of inflation in the United States. Notably, Okun [1978] surveyed six macroeconomic Phillips curves with two common features: (i) "all...are essentially accelerationist, implying virtually no long-run trade-off between inflation and unemployment," and (ii) "all point to a very costly short-run trade-off". Specifically, Okun reported that the average estimate of "the cost of a 1 point reduction in the basic inflation rate is 10 percent of a year's GNP, with a range of 6 percent to 18 percent." Thus, if it had led to a downturn lasting four years, the 6 percentage point reduction in inflation engineered by the Volcker Fed would have led to a modern Great Contraction, with output averaging 9 to 27 percent below capacity for a total loss of 36 to 108 percent.

In fact, the real consequences of the disinflation were sharply smaller than Okun's predictions. Figure 2 shows the decline in inflation and in real activity during the Volcker disinflation, which involves a cumulative output loss of about 20 percent according to traditional calculations. While far less than predicted, the output losses were substantial by the standards of post-war U.S. history and had great effect on the lives of many individuals during the period, as we recall from discussions with friends, relatives, and neighbors. It is now fairly standard for macroeconomists to suggest that the Volcker disinflation had a lower than predicted real output cost precisely because of Volcker's credibility.

By contrast, we think that the reduction in inflation engineered by the Fed under Volcker was accompanied by substantial output losses precisely because it was viewed as *not* credible, in the sense that firms and households believed for several years that the reduction in inflation was temporary with a return to high inflation likely.

Imperfect credibility in a macroeconomic model: We build a very simple macroeconomic model of the Volcker disinflation which attributes *all* output costs to imperfect credibility. To match the actual decline

in inflation, which takes place from 1981 through 1983, our model assumes that inflation declines gradually and cumulatively by 6 percentage points over ten quarters. The economic actors in the model economy, however, think that there is a possibility that the disinflation program will be abandoned and that inflation will return to the level prevailing at the start of the program. Specifically, we assume that the probability of a successful disinflation is zero for the first year of the program and rises linearly thereafter. With these two elements – a gradual disinflation and a gradual increase in the likelihood of a permanent, major reduction in inflation – the model generates an output decline which resembles the 1981-1983 experience in broad form: a gradually intensifying decline in output, relative to capacity, which reaches a trough after two years and then gradually recovers. The imperfect credibility built into our model also implies very stubborn inflationary expectations which are reflected in elevated long-term interest rates.

Imperfect credibility within our interpretative history: Our historical analysis highlights two important indicators of imperfect credibility. First, the behavior of intermediate and long-term interest rates is evidence that the disinflation was incredible. For instance, while inflation fell from over 10 percent in early 1981 to under 6 percent by mid-1982, the 10-year bond rate actually increased from around 13% to over 14% as shown in Figure 3. We interpret this evidence as indicating that financial markets expected high inflation to return. Second, the transcripts of the Federal Open Market Committee indicate that Volcker and other FOMC members thought that acquiring credibility for low inflation was central to the success of their disinflation. Moreover, they regarded long-term interest rates as indicators of inflation expectations and of the credibility of their disinflationary policy. The FOMC viewed the private sector as profoundly skeptical of its inflation-fighting policy actions and, as the recession deepened, they worried that the public would expect a monetary policy "u-turn." The FOMC recognized that such skepticism was understandable given its own past behavior.

Our historical analysis also stresses that the Volcker disinflation did not really start in earnest until late 1980 or early 1981. The policy actions of the Volcker Fed in 1979 and 1980, including the celebrated October 1979 announcement of new operating procedures with greater

emphasis on money, merely contained inflation in the face of sharply rising inflation expectations evident in bond rates in early 1980. The Volcker Fed's initial inflation-fighting effort was abandoned in mid-1980 with the onset of credit controls and a recession that we believe was brought on in part by restrictive monetary policy. Like some members of the FOMC at the time, we believe that this policy reversal likely hurt the Fed's credibility and thereby contributed to the ultimate costliness of the disinflation of 1981-83. By November 1980, inflation was still running at an annual rate of over 10%. The Volcker Fed had behaved in a manner consistent with prior experiences. It had undertaken restrictive monetary policy in the face of rising inflation, but it had promptly reversed field to fight the recession and allowed inflation to continue to rise.

In our view, the "deliberate disinflation" dates from late 1980 when the federal funds rate rose to 19% as a result of restrictive monetary policy in conjunction with a strong recovery from the recession. This time, the move against inflation was sustained. Rising inflation expectations–again evident in bond rates in 1981–convinced the Fed to move decisively to reduce inflation. Volcker and other FOMC members viewed the restoration of Fed credibility for low inflation and the associated real cost of a deliberate disinflation in 1981-82 as necessary to prevent future recessions and inflation scares.

Much has been made of the Volcker disinflation as a grand "monetarist experiment." However, on its own initiative and under the prodding of congressional committees, the Fed had begun to state money growth targets in the early 1970s. These gradually assumed a more prominent role in the FOMC and in popular policy discussions prior to October 1979. Beginning in 1975, Fed presentations to congressional committees included money target ranges; increasingly, at these hearings and in other commentaries the Fed was criticized for missing its monetary targets. The Fed continued to manage the federal funds rate closely prior to October 1979. However, the narrow tolerance ranges for the federal funds rate in FOMC policy directives did not prevent the Fed from raising the funds rate aggressively on occasion, especially in 1973 and 1978. The October 1979 change in operating procedures placed more emphasis on targeting money, in part by allowing dramatically wider federal funds rate tolerance ranges in FOMC directives.

The FOMC transcripts indicate that the October 1979 shift in operating procedures was undertaken initially to improve the Fed's inflation-fighting credibility in order to contain rising inflation expectations.

The organization of the paper is as follows. In section 2, we introduce and describe our model of inflation and output dynamics. In section 3, the main body of the paper, we undertake our interpretative history utilizing four types of information. First, we use macroeconomic data – as currently revised – to describe the broad history of the economy immediately preceding and during the Volcker disinflation. Second, we use the implications of our small macroeconomic model. Third, we use FOMC transcripts, briefings of staff economists at FOMC meetings, and annual summaries of FOMC decisions produced by economists at the Federal Reserve Bank of St. Louis. Fourth, we use information from the *World Almanac*, which reflects contemporary perceptions of major events. In section 4 of the paper we consider the interaction of monetary instruments, targets, and credibility with the help of the transcripts and other contemporary sources. In a final section, we offer brief concluding comments.

2. Deliberate disinflation with imperfect credibility

To develop the idea that the real effects of the Volcker disinflation were largely due to imperfect credibility, we use a very simple model, which contains elements familiar from modern macroeconomics. However, our procedure is somewhat unorthodox: we abstain entirely from discussion of the nature of the monetary policy process, simply assuming that policy engineers a deliberate decline in the inflation rate. After learning about the central features of a deliberate disinflation in this section and then learning about the Volcker Fed's view of the critical role of imperfect credibility in section 3, we return to a more detailed discussion of the monetary policy process in section 4 below. Since our approach is somewhat unorthodox, we introduce the model elements in "blocks" so that the reader can see how model ingredients fit together to produce our results.

2.1. ***Disinflation, credibility, and real activity***

To study the dynamic comovements of output and inflation, we assume only that there is a New Keynesian pricing equation on the part of firms and that there is a disinflation policy on the part of the central bank.

New Keynesian Pricing With price-setting by forward-looking firms along the lines of Calvo [1983], there is a "New Keynesian pricing equation" that links inflation $\pi_t$and real output y_t,

$$\pi_t = E_t\pi_{t+1} + h(y_t - y_t^*). \tag{1}$$

In this expression, y_t^* is a measure of capacity output, so that $y_t - y_t^*$ is a measure of the output gap, and $E_t\pi_{t+1}$ is the expected inflation rate. The parameter h can be related to structural features of the economy such as the frequency of price adjustment, the elasticity of marginal cost with respect to output, and so forth.[2] As has been much stressed in the recent literature, the relevant measure of capacity output is the level of output that would prevail if nominal prices were flexible.[3] That is, capacity output corresponds to the level of output in a real business cycle model that fluctuates through time in response to macroeconomic shocks to productivity, government expenditures, tax rates, and energy prices, etc.

Holding expectations fixed, the pricing equation implies that an increase in real output brought about by a monetary expansion will increase inflation, since capacity output is independent of monetary policy. Most empirical macroeconomists think that the value of $h$in this setting is fairly small, so that the output gap does not exert too large an influence on inflation. There is no long-run trade-off in the pricing equation since output is at capacity when current and expected future inflation are equal.

Disinflation Policy Our assumption is that the disinflation takes the following form, beginning from an initially high level of inflation $\overline{\pi}$. At the start of the disinflation at t=0, the central bank specifies a path for the inflation rate, which we call $\{\widetilde{\pi}_t\}_{t=1}^T$. The terminal value at $t = T$ of this inflation process is $\underline{\pi}$. Each period, the public knows

[2] See Woodford [2003].

[3] See Goodfriend and King [1997] and Woodford [2003].

that the policy next period will continue with probability γ_t. If it does not continue, then inflation will go up to $\overline{\pi}$and it will stay at that level forever. That is, for simplicity, we assume that the only uncertainty that agents have about inflation is whether the disinflation plan will collapse. We assume that the $\widetilde{\pi}$path is

$$\begin{aligned} \widetilde{\pi}_t &= \overline{\pi} - \mu t \qquad \text{for t=0,1,...T} \\ \widetilde{\pi}_t &= \underline{\pi} \qquad\quad \text{for t=T+1,T+2,...} \end{aligned}$$

with $\mu = (\overline{\pi} - \underline{\pi})/T$. We display a disinflation which reduces the inflation rate from 10% to 4% over the course of 10 quarters in Figure 4. The disinflation is assumed to be imperfectly credible in that agents do not believe that it will succeed at all for the first year and then gradually adjust their assessment upwards over the course of the next three years.[4] Hence, one-step-ahead expected inflation takes the form

$$E_t\pi_{t+1} = \gamma_t E_t\widetilde{\pi}_{t+1} + (1-\gamma_t)\overline{\pi}$$

Given the pricing equation, output in a successful disinflation – one that adheres to the path $\{\widetilde{\pi}_t\}_{t=1}^{T}$ – takes the form

$$y_t - y_t^* = \frac{1}{h}[\gamma_t(\widetilde{\pi}_t - E_t\widetilde{\pi}_{t+1})] - \frac{1}{h}[(1-\gamma_t)(\overline{\pi} - \widetilde{\pi}_t)]$$

The first term in this expression is the positive expected disinflation effect stressed by Ball [1994]. The second term in this expression is the negative imperfect credibility effect introduced by Ball [1995] that we stress in this analysis.

Under these assumptions, the path of output gaps in a successful disinflation is given by

$$\begin{aligned} y_t - y_t^* &= \frac{1}{h}[\gamma_t\mu] - \frac{1}{h}[(1-\gamma_t)\mu t] \quad \text{for } t = 0, 1, 2, T-1 \\ y_t - y_t^* &= -\frac{1}{h}[(1-\gamma_t)(\overline{\pi} - \underline{\pi})] \qquad \text{for } t \geq T \end{aligned}$$

[4]Baxter [1985] provides an early analysis of the dynamics of expectations during stabilization policy, applying Bayesian learning to inflation. It would be desirable to explore the Volcker disinflation in such a framework.

By contrast, the output gap is zero if the plan collapses and remains there, since inflation is forever at $\overline{\pi}$.

At this point, we assume that there are no important variations in capacity output, so we can talk interchangeably about fluctuations in the output gap or in output itself.[5] The path of output depends on two features of the model. First, for fixed probabilities of success ($\gamma_t = \gamma$), output depends positively on the expected disinflation under the $\widetilde{\pi}$ path. Second, for fixed probabilities of success ($\gamma_t = \gamma$), output depends negatively on how long the disinflation plan has been in place because this indexes the size of inflation surge which will occur if there is a failure. Third, the recession can last longer than the disinflation, if there is a lingering probability of failure. Fourth, if the plan becomes more credible as it ages (γ_t increases through time), then the smaller failure probability induces a partial recovery, even though continuing disinflation induces a deepening recession. For these reasons, it is relatively easy for this sort of model to produce a triangular-shaped path of output over the course of the disinflation process.

The top panel of Figure 5 displays the behavior of real output ($y_t - y_t^*$) under our assumptions about the course of the disinflation and the evolution of beliefs pictured in Figure 4. Output reaches a trough two years after the initiation of the policy, somewhat before the disinflation is complete. Output continues below capacity and the output gap closes slowly after the disinflation is concluded because of the continuing imperfect credibility of the disinflation program. The middle panel of Figure 5 shows another key aspect of the disinflation: given that individuals attach a high likelihood to the collapse of the disinflation plan for most of the period, they also entertain a significant possibility that output will return promptly to capacity, so that there is a high expected growth rate of output. Put another way, for most of the disinflation, individuals expect the decline in inflation and output to be temporary.

[5] This assumption facilitates comparison of our model outcomes with the traditional measure of the output gap during the Volcker disinflation shown in Figure 2. However, we recognize that events during the period, which included important changes in fiscal policy, time-variation in productivity, and changes in energy prices likely induced significant variation in capacity output.

2.2. ***Beliefs and interest rates***

Since our analysis assigns substantial importance to the evolution of beliefs, it is useful to spell out additional elements of the model in which beliefs play a role.

The Fisher Equation The link between the nominal interest rate, the ex ante real interest rate, and expected inflation is given by the Fisher equation

$$R_t = r_t + E_t\pi_{t+1}. \tag{2}$$

The Real Interest Rate and Expected Consumption Growth Most macroeconomic models now embody a form of the permanent income hypothesis, which has two components. First, as stressed by Friedman [1957] the present value of consumption is constrained by the present value of income. Second, as stressed by Fisher [1930] there is a positive relationship between the real interest rate and expected consumption growth.

As in many other recent macroeconomic analysis, we assume that all output is consumed so that the ex ante real rate of interest in our model evolves according to

$$r_t = \sigma(E_t y_{t+1} - y_t) + r \tag{3}$$

but we also discuss the behavior of consumption and investment under more realistic assumptions below.

The "natural rate of interest" r_t^* is the ex ante real rate when actual output is equal to capacity output. In the current setting, this is given by

$$r_t^* = \sigma(E_t y_{t+1}^* - y_t^*) + r. \tag{4}$$

More generally, it would be the interest rate consistent with "the real business cycle core" of the relevant macroeconomic model.

The Term Structure of Interest Rates Real and nominal returns on a long-term discount bond (one with L periods to maturity) are based on the expectations theory of the term structure of interest rates. The first specification governs the real term structure

$$r_{Lt} = \frac{1}{L}\sum_{j=0}^{L-1} E_t r_{t+j} + (r_L - r) = \sigma\frac{1}{L}(E_t y_{t+L} - y_t) + r_L \tag{5}$$

and the second specification governs the nominal term structure

$$R_{Lt} = \frac{1}{L}\sum_{j=0}^{L-1} E_t R_{t+j} + (r_L - r) = r_{Lt} + \frac{1}{L}\sum_{j=1}^{L} E_t \pi_{t+j} \tag{6}$$

It is important to stress that longer-term yields reflect permanent variations, since these dominate an expected future average. Accordingly, we will frequently employ the idea that variations in long-term nominal yields are dominated by "expected inflation trends."

Expected Inflation at Various Horizons The bottom panel of Figure 5 shows the response of expected inflation at two horizons under our assumptions. At each date in the figure, we show the expected rate of inflation one-quarter ahead and we also calculate the expected ten-year average inflation rate. Our assumptions about beliefs imply that it takes some time for the one-quarter-ahead expected inflation rate to depart from $\overline{\pi} = .10$ and also that the expected future ten-year average inflation rate is much more stubbornly elevated.

Ex Ante Real Interest Rates Ex ante real interest rates (particularly short-term rates) are high during a deliberate but incredible disinflation because output is temporarily depressed and the public would otherwise like to borrow against brighter future income prospects to smooth current consumption. Expected output growth, and therefore the ex ante real rate, can be especially high because of the possibility that the disinflation might fail and output might snap back to capacity at any time. The middle panel of Figure 5 displays one-quarter-ahead expected output growth at each date, and thereby provides a picture of the path of annualized ex ante real interest rates during the disinflation once an assumption about σ is made. The figure illustrates an important point: ex ante real interest rates must rise as the recession deepens over the course of an incredible disinflation.

In our model, the size of the ex ante real interest rate response to the attempt at consumption-smoothing is implausibly large. In a model with a richer real business cycle core, consumption would be smoothed, ex ante real interest rates would increase less, and investment in business and consumer durables would decline substantially as during the actual recession accompanying the Volcker disinflation (see Figure 2). For instance, Erceg and Levin [2003] study the dynamics of an imperfectly credible disinflation in a sticky price model with investment.

Their more extensive and realistic model exhibits a large decline in investment and a relatively small increase in the ex ante real rate, as agents smooth consumption in the face of an output loss which they presume to be quite transitory.

To sum up, the broad features of a deliberate disinflation with imperfect credibility revealed by our analysis are these: (i) there can be a severe recession if the policy is successful when private agents believe it will not succeed; (ii) the recession can last longer than the disinflation if the credibility of disinflation evolves more slowly than the reality; (iii) real rates will be particularly high in the midst of the recession; and (iv) expected inflation will be stubbornly elevated, particularly at long horizons.

3. Imperfect credibility and the Volcker disinflation

With an understanding of how imperfect credibility governs the dynamics of real output in a deliberate disinflation, we turn now to our study of the actual Volcker disinflation, drawing on our model and the perspectives of members of the FOMC and other contemporary observers to describe and interpret the major features of this remarkable period in U.S. monetary history.

3.1. The inflation background

Figure 1 displays the course of inflation from 1967 through 1987 and highlights prominent episodes and events that we refer to in our discussion. We identify the "Volcker era" at the Fed with the dark portion of the horizontal axis from mid-1979 through mid-1987. Second, we shade the four NBER recessions that occurred during the period. Third, we identify with a diamond '$\Diamond$' the four dates at which Romer and Romer [1989] suggest that anti-inflationary monetary policy actions were initiated. Fourth, we include the four "inflation scare" episodes identified by Goodfriend [1993] via the narrow rectangular boxes.

3.1.1. Inflation 1967-1976

In 1967, inflation was running at about a $2\frac{1}{2}$ % annual rate, but it was poised to increase dramatically over the period. The Fed moved

to fight inflation on two occasions in this period, in December 1968 and April 1974, after sharp increases in inflation. In the first episode, the Fed moved the federal funds rate up by 3 percentage points to around 9% from December 1968 to mid-1969 and held it there until a recession began in late 1969. Inflation peaked in 1970 at around 5% and fell temporarily until 1973. In the second episode, the Fed moved the federal funds rate up aggressively from around 5% beginning in early 1973 and held it in the 10% to 12% range through the recession in 1974. Inflation increased dramatically in the wake of the energy crisis beginning in the fall of 1973, but temporarily slowed to around 5% in 1976.

The behavior of the 10-year bond rate, shown in Figure 3, mirrors the lower frequency changes in inflation during this period. In early 1967 the 10-year bond rate was just under 5%. It rose to about 8% in early 1970, but fell back to the 6% range in 1971, suggesting that the Fed's inflation-fighting actions in 1969-70 allowed only a 1 percentage point increase in long-term expected inflation. With the dramatic rise in inflation in the wake of the energy crisis of 1973, the 10-year rate then rose steadily from 6% to 8% in 1973-4, straight through the Fed's inflation-fighting actions, and fell back only a little as actual inflation retreated temporarily to 5% in 1976. Overall, the 3 percentage point increase in the 10-year bond rate from 1967 to 1976 suggests a similar increase in trend inflation expectations and a growing skepticism of the permanence of the Fed's inflation-fighting actions.

3.1.2. Rising Concerns: January 1977-July 1979

In November 1976 congressional testimony, Arthur Burns, chairman of the Federal Reserve Board, warned that there might be inflationary consequences of attempts to stimulate the economy through tax cuts, increased government spending, or looser money policy.[6] President-elect Jimmy Carter said he would consider such steps if economic activity continued to be slow. Terming such steps "unnecessary as well as dangerous", Burns said "it seems entirely reasonable to expect a pickup in the tempo of economic activity in the near future" without any special government action. After a weekend flurry over Burns's

[6] See Hetzel [1998].

testimony, Carter announced that he had received a pledge of support from Burns and that he believed they would "find a substantial degree of compatibility."[7] However, in a surprise move in late December 1977 Carter announced the replacement of Burns with G. William Miller.[8]

The Carter administration regarded the use of monetary policy to contain inflation as excessively costly in terms of output and unemployment, so that it built its series of anti-inflation programs around fiscal and regulatory methods. Nevertheless, Carter's programs met with continuing criticism from business and labor leaders; he also faced criticism within his party on unemployment. October 1978 saw the enactment of the Humphey-Hawkins Full Employment Law, which set a national goal for reducing unemployment from the 1978 level of 6% to 4% by 1983. The law also called for inflation to be reduced to 3% by 1983 and to zero by 1988, but specified that this was not impede the reduction in unemployment. However, the legislation authorized no programs, leaving it to the President and Congress to determine the means to achieve its goals.

Beginning in August 1978, the Miller Fed engineered a sharp rise in the funds rate to fight inflation (yielding the Romer date in Figures 1 and 3) which was followed by a highly publicized intervention to support the declining foreign exchange value of the dollar in November. Despite these actions, inflation and the long-term bond rate continued to rise through the middle of 1979, and the dollar continued to depreciate. Late 1978 and early 1979 also witnessed turmoil in Iran, with the return of Ayatollah Khomenei from exile, major increases in oil prices by some exporting nations, and shortage warnings from Energy Secretary James Schlesinger, who described the loss of Iran's oil supply as prospectively more serious than the oil embargo of 1973-5.

By April 1979 Volcker, then president of the Federal Reserve Bank of New York, was sufficiently at odds with the policy actions taken by the FOMC that Chairman Miller noted "Paul, you're just a constant no." (FOMC *transcript*, 4-17-1979, p. 35) In view of later events, Volcker's comments are revealing. First, in continuing committee debates

[7] Quotations and contemporaneous observations are from the *World Almanac*.

[8] Burns's term as chairman was to expire at the end of January 1978; but his term as governor did not expire until 1984 and there was an expectation that he would continue as chairman.

over the relative role of monetary aggregates and interest rates in the directive, Volcker argued that "the only reasonable conclusion is not to put much weight on the aggregates." (FOMC *transcript*, 4-17-79, p. 15). Second, Volcker questioned forecasts for real output and inflation, stressing that inflation was an important problem that required a commitment of policy to long-run objectives

> [Inflation] clearly remains our problem. In any longer-range or indeed shorter-range perspective, the inflationary momentum has been increasing. In terms of economic stability in the future that is what is likely to give us the most problems and create the biggest recession. And the difficulty in getting out of a recession, if we succeed, is that it conveys an impression that we are not dealing with inflation...We talk about gradually decelerating the rate of inflation over a series of years. In fact, it has been accelerating over a series of years and hasn't yet shown any signs of reversing. (FOMC *transcript*, 4-17-79, p. 16)

Third, Volcker was skeptical about the conventional view that policy was tight and inappropriately so in the spring of 1979.

3.2. Containing Inflation: August 1979-October 1980

By the time that Paul Volcker became Fed chairman in August 1979 inflation was rising rapidly. Despite the high inflation-fighting profile adopted by the Fed with its dramatic October 1979 announcement of new operating procedures to improve monetary control, the 15 month period through October 1980 was one in which inflation was barely contained and inflation expectations continued to rise. The aggressive actions undertaken by the Fed succeeded in restraining inflation temporarily, but they did so in the face of a mild recession and the difficult-to-interpret macroeconomic consequences of the credit controls introduced by the Carter administration.

3.2.1. Initial statements and actions

Confirmed on July 30th and sworn in on August 6th, Volcker faced immediate challenges. The *Almanac* documents that the Labor Department reported a 1.1% increase in producer finished goods prices in July and that the Joint Economic Committee of Congress warned that "the average American was likely to see his standard of living dramatically reduced in the 1980s unless productivity growth was accelerated."

In laying out his overall monetary policy philosophy and arguing strongly for a rate increase at the August FOMC meeting, Volcker began by noting that

> When I look at the past year or two I am impressed myself by an intangible: the degree to which inflationary psychology has really changed...I think that people are acting on that expectation [of continued high inflation] much more firmly than they used to...[and] it does produce, potentially and actually, paradoxical reactions to policy...I think we are in something of a box–a box that says that the ordinary response one expects to easing actions may not work...They won't work if they're interpreted as inflationary; and much of the stimulus will come out in prices rather than activity. (FOMC *transcript*, 8-14-79, p. 21)

Volcker went on to say that "it would be nice if...we could restore [the credibility] of economic policy in general on the inflation issue," adding later that we "don't have a lot of room for maneuver and I don't think we want to use up all our ammunition now in a really dramatic action...[which] would not be understood without more of a crisis atmosphere than there is at the moment." Lindsay, Orphanides, and Rasche [2005], page 194, provide longer versions of these latter quotations and highlight their importance for understanding the new chairman's thinking.

3.2.2. October-November 1979

The *Almanac* reports that the dramatic October 6, 1979 adoption of new operating procedures for controlling money came on the heels of

widespread speculative price increases in commodity markets. Lindsay, Orphanides, and Rasche [2005, pp. 196-8] emphasize that there had been a highly publicized for 4-3 split decision on a September 1979 discount rate increase, suggesting that commodity price increases arose from speculator beliefs that a divided FOMC would be unable to control rising inflation. It was in this crisis atmosphere that the Volcker Fed began its aggressive inflation-fighting actions. The result was a swift and substantial rise in the federal funds rate.

We discuss the change in operating procedures further in Section 4 below. At this point, though, we stress that a remarkable feature of the October and November FOMC meetings is the extent to which members discuss market psychology in general and inflation expectations in particular. The November 1979 meeting was lengthy and detailed, focusing initially on the magnitude and consequences of oil price increases and then on the mechanics of the new operating procedures. FOMC members afterwards conducted a wide-ranging discussion that was quite revealing about their evolving perspective. A substantial portion of the discussion centered on the Fed's objectives, the issue of policy credibility and the behavior of the long rate. The rise in interest rates stemming from the October 6 actions had been a major topic of discussion as Volcker had traveled around the county over the intervening month. He noted "the first question I get is "are you going to stick with it?" (FOMC *transcripts*, 11-20-79, pp. 23)

John Balles, president of the Federal Reserve Bank of San Francisco, provides a compact statement containing many of the key themes of the November 1979 meeting and the times,

> [The] real purpose of our October 6 actions was to get inflation under control by bringing about a deceleration of money (growth)...So I think that we're right in the midst of a great credibility test and I wouldn't want to rock the boat...I think that our credibility and hence our impact on long-term rates will be messed up if we don't meet those goals that we've announced. (FOMC *transcripts*, 11-20-79, pp.29-30)

While other participants expressed similar surprise about the behavior of long-term interest rates, a harder line was taken by Robert Mayo, President of the Federal Reserve Bank of Chicago, "there has been, even among sophisticates an almost complete...disillusionment as to whether inflation can be controlled. This is reflected in long-term rates and makes our job even more of a challenge." (FOMC *transcripts*, 11-20-79, p. 30)

These quotations illustrate, we think, one of the major revelations from the FOMC transcripts: under Volcker, the FOMC recognized that inflationary expectations were imbedded in long-term interest rates; that volatile expectations about future inflation made long rates highly sensitive to macroeconomic events including policy actions; that imperfect credibility about future monetary policy made long-term rates stubborn in the face of policy actions; and that the management of inflation expectations was a crucial, but very difficult, part of the FOMC's job. This is a remarkably modern set of viewpoints, which many contemporary observers of the FOMC, ourselves included, did not suspect at the time. Such understanding, however, did not make the job of taming inflation any easier or that of consistently pursuing anti-inflation policy in the face of a weakening real economy less difficult for members of the FOMC, or less costly for the economy.

3.2.3. The first inflation scare: December 1979-February 1980

The Fed paused in its tightening at the end of year with the federal funds rate around $13\frac{1}{2}\%$ and the 10-year rate at $10\frac{1}{2}\%$ at year's end. The 10-year rate then rocketed to nearly 12% by the February 4-5, 1980 FOMC meeting, even as the funds rate fell below 13%. Goodfriend [1993] identifies this as an "inflation scare" and many members of the FOMC similarly interpreted it, although with differing degrees of emphasis.[9]

[9]In his briefing at the February 4-5 FOMC meeting Peter Sternlight, Manager for Domestic Operations, System Open Market Account, reported that long rates rose by around 1 percentage point in the intermeeting period even as the funds rate fell slightly "reflecting...a weakening confidence that the long-term inflation problem can be handled successfully." He added that "there is also a feeling that the System has relaxed its firm resolve of last October to excercise restraint...the particularly severe adjustment at the long end seems to reflect deep discouragement

That the U.S. might have entered a new permanent situation is well-illustrated by the comments of Governor Wallich,

> So we have to consider now that we are in a group of high inflation countries with Italy and the United Kingdom...We've moved very far. (FOMC *transcripts,* 2-5-80, p. 41)

At the same time, the Fed sensed a turning point in economic activity, with economist Joseph Ziesel noting that "fundamental forces are moving us into recession"[10] Hence, the FOMC was confronted with a dilemma: rising inflation, deteriorating credibility, and weakening real activity.

The inflation scare deepened over the course of the ensuing month. In the week prior to the March 18, 1980 FOMC meeting the 10-year rate stood at over $12\frac{1}{2}\%$, having increased by 80 basis points since the prior meeting (and having exceeded 13% a few weeks before). The funds rate had increased as well with an initial rise of about 100 basis points – surrounding a February 15th increase in the discount rate in the face of worsening inflation news – and then a large jump of 150 basis points to 16 $\frac{1}{4}\%$, as the FOMC held an emergency telephone call on March 5th to consider how to reign in growth in broad monetary aggregates, while seeing narrow aggregates decline.

The outcome of the March 18, FOMC meeting included a "discount rate surcharge of 3 percentage points" on transactions with large banks.[11] Within two weeks the funds rate was at 19%. In the wake of these interest rate changes, commodity speculation cooled. The Hunt brothers' silver empire collapsed in the face of large price declines. Altogether, during the December 1979-February 1980 inflation scare, the Federal Reserve took actions that raised interest rates substantially, from $13\frac{1}{2}\%$ to around 19%. Ultimately, however, these aggressive interest rate policy actions would only serve to contain inflation temporarily, not reduce it; in part because they helped to precipitate a recession to which the Fed felt compelled to respond.

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about prospects for dealing successfully with inflation." (pp. 3-4)

[10] FOMC *transcripts*, Ziesel FOMC briefing, 2-5-80, p. 1.

[11] Cook [1989] describes and evaluates the role of discount rate policy actions in the 1979-82 period.

3.2.4. The recession of 1980

The Fed faced substantial pressures as the recession, which the NBER dates from January 1980, intensified. Credit controls were introduced by the Carter administration in March 1980 and the administration acknowledged the ongoing recession in April.

Declining real activity concerned FOMC members at their March 18 meeting. The tensions were well illustrated by the remarks of Governor Partee, who had carefully reviewed the effects that the Carter credit controls and other financial market developments were having on spending. He closed by warning,

> That brings me to one more point, which is that I would hate to have somebody ask me what I was doing during the crash and have to remark that I was defending our credibility. The people who say let's keep those interest rates up there, regardless of what happens, are really walking into a major trap for the economy and for the Federal Reserve. (FOMC *transcripts* 3-18-80, p. 34)

But Volcker's counterargument held for the time, with the chairman doubting the weakness in the economy, and painting a picture that left the Fed little room for maneuver,

> What stands out to me is that we haven't any room to grow here, given the declines in productivity and other pressures on the economy. And if we tried to stimulate growth very much, we really would have no chance of dealing with the inflationary psychology; we'd in fact face a blow-off on the inflation side if we don't already have a blow-off. (FOMC *transcripts* 3-18-80, p. 35)

Responding to concerns about the effects of high interest rates and credit controls on financial institutions, Volcker argued that "the worst thing that can happen to them is [for us to] fail to do the job and get the interest rate turn fairly soon." (FOMC *transcripts* 3-18-80, p. 36)

3.2.5. Credit controls and policy easing

In a widely-watched speech from the White House on March 14, 1980 President Carter announced the imposition of "credit controls" as the centerpiece of the fourth anti-inflation program of his presidency: "Just as our governments have been borrowing to make ends meet," he said, "so have individual Americans. But when we try to beat inflation with borrowed money, we just make problems worse." Carter went on to say "Inflation is fed by credit-financed spending. Consumers have gone into debt too heavily. The savings rate in our nation is now the lowest in more than 25 years..." Carter justified the credit control program saying: "The traditional tools used by the Federal Reserve to control money and credit expansion are a basic part of the fight on inflation. But in present circumstances, those tools need to be reinforced so that effective restraint can be achieved in ways that spread the burden reasonably and fairly." Carter authorized the "Federal Reserve to impose new restraints on the growth of credit on a limited and carefully targeted basis." The credit controls were complex, consisting of voluntary lending guidelines for banks, special reserve requirements for selected consumer credits, managed liabilities, and money market funds, and a surcharge on Fed discount window borrowings for large banks.[12]

Schreft [1990, p. 41] documents that: "The consumer credit controls were largely symbolic and without teeth; however, they induced consumers to alter their buying behavior. Consumer spending, especially credit-financed expenditures, fell off dramatically." Data released July 9 showed that consumer installment credit fell a record 13 percent in May. New consumer credit extensions were 25 percent lower than the September 1979 peak. These declines were attributed to the effect of the controls on consumers. Led by a collapse of consumer spending, the economy was so weak in June that the credit control program was phased out in early July.

3.2.6. Inflation containment in historical perspective

The August 1979-October 1980 period saw a rise in actual inflation and in long-term inflation expectations, which led to a series of Fed-

[12]The description of the credit control program is taken from Schreft [1990].

eral Reserve actions to contain inflation. These actions included the introduction of new operating procedures and an aggressive increase in short-term interest rates to unprecedented levels in the spring of 1980. In response to the sharp decline in economic activity associated with credit controls, the Fed began to ease policy in April. It took the federal funds rate down to 9% by July 1980 (the NBER recession trough), when it began to tighten policy again as the economy recovered from recession.

The net effect is best summarized as follows: In November 1979, the funds rate averaged 13 $\frac{1}{4}$% and the 10-year rate was around 10$\frac{1}{2}$%. In October 1980, the funds rate and the 10-year rate were roughly where they had been in November of the preceding year. After all the turbulence, inflation had barely been contained in the 10 to 11% range.

As emphasized previously by Shapiro [1994], there is a recurrent pattern evident in Figure 1. The Fed moved the federal funds rate sharply higher at Romer dates in response to rising inflation. But within two or three years, inflation was no lower. In retrospect, we can see that these inflation-fighting episodes merely contained inflation temporarily. Thus, it is reasonable to think that contemporaneous observers saw the Fed's inflation-fighting actions from August 1979 through October 1980 as another example of a familiar pattern: rising inflation followed by temporarily restrictive monetary policy actions, a recession, and a subsequent policy reversal which results in little if any progress against inflation. In this sense, the dramatic high-profile policy actions of the first year of the Volcker era at the Fed looked not too different from previous inflation-fighting episodes.

3.3. Deliberate disinflation: November 1980-June 1982

The true onset of the Volcker disinflation dates to November 1980 or early 1981. In November, Reagan beat Carter in a landslide and brought about a new course in U.S. economic policy. Among other things, the Reagan administration voiced strong support for Fed monetary policy to reduce inflation.[13] Moreover, in November long-running

[13] See, for instance, *A Program for Economic Recovery*, February 18, 1981, the briefing book prepared by the incoming Reagan administration outlining its economic policies. Pages 2 through 9 emphasize the Administration's support for the

skirmishes between Iran and Iraq erupted into full-scale war, increasing concerns about rising energy prices. The *Almanac* reports a December 1980 jump in CPI inflation to a 12% annual rate of increase.

Restrictive monetary policy in conjunction with the robust recovery from the 1980 recession took the federal funds rate from 9% in July of 1980 to nearly 19% in December, with 6 percentage points of that increase coming in November and December alone. The 1-year T-bill rate increased from about 8% in July 1980 to over 14% by year-end as well. The funds rate stayed at 19% through July of 1981, although it dipped due to technical factors associated the Fed's new reserve-targeting procedures and the introduction of nationwide NOW accounts in the spring.[14] Financial markets were aware of the temporary nature of the dip, and the 1-year T-bill rate fell slightly at first and then rose further to exceed 16% by July 1981.

The FOMC understood that its tight policy risked a renewed recession, but Volcker argued that holding the line on inflation was warranted. At the February 1981 FOMC meeting Volcker described the FOMC as "presented with a gloomy economic forecast by some standards," elaborating that the forecast did not include a recession but that one could not "discount having something that would be called a real recession." But he nevertheless noted,

> There is a general question, which I guess is the most important question, of how serious we are in dealing with inflation. I got a little feeling, as I listened to the conversation, that we're like everybody else in the world on that: Everybody likes to get rid of inflation but when one comes up to actions that might actually do something about inflation, implicitly or explicitly, one says: "Well, inflation isn't that bad compared to the alternatives." We see the risks of the alternative of a sour economy and an outright recession this year. So, maybe there's a little tendency to shrink back on what we want to do on the inflation side. I don't want to

Fed's effort to slow the growth of money in order to return the economy to price stability.

[14] See Cook [1989].

> shrink back very far; that is my general bias for all the reasons we have stated in our rhetoric but don't always carry through on. (FOMC *transcripts* 2-2/3-81, p. 129)

3.3.1. The second inflation scare: January-October 1981

With the federal funds rate at 19% in 1981, the FOMC must have been shocked to encounter a period of rising long-term interest rates paralleling the increase that it had experienced in early 1980. By late 1980, the 10-year bond rate had reversed the 2 percentage point decline associated with the 1980 recession and was back above 12%. It continued climbing steadily to a peak in excess of 15% in October 1981. The 3 percentage point gain from January to October 1981 reflected a second inflation scare even greater than the first in 1980. The second inflation scare was particularly disturbing to the Fed because it occurred in spite of an even more determined tightening of interest rate policy than occurred in late 1979. Long-term inflation expectations appeared to many observers to be moving up, rather than declining in the face of a restrictive monetary policy. The 3 percentage point rise in long-term interest rates in 1981 encouraged the Fed to persist with its 19 percent federal funds rate.

In our view, this was a pivotal moment in U.S. monetary history, when Volcker and the FOMC came to view a disinflation as both desirable and inevitable. At the same time, this interval is overlaid with a great deal of attention to the tactical issues of formulating monetary policy in terms of monetary targets. Yet, when a fellow governor expressed concerns about the extent to which the monetary targeting procedure could be introducing volatility in interest rates, Wallich argued "the main volatility that carries into long-term interest rates comes from inflation and not from our procedures." (FOMC *transcripts*, 2-3-81, p. 54). Expectations had come to be an important constraint on policy because as Governor Schultz argued "if we were to attempt to ease, it's pretty clear that everybody would think we had let the inflationary cat out of the bag. And it seems to me that interest rates would be even higher under those circumstances." (FOMC *transcripts* 3-31-81, p. 29). In our view, this second great inflation scare was pivotal because it convinced the Fed that the cost of a deliberate disinflation in

1981-82 was acceptable in light of the recurring recessions that would be needed to deal with inflation scares in the future.

3.3.2. Staying the course

The FOMC was determined to stay the course in the fight against inflation. Even as evidence accumulated that the economy was moving into another recession, which the NBER dates from July 1981, Volcker argued for continued tight policy,

> [Our] job is in assessing where the risks lie... I haven't much doubt in my mind that it's appropriate...to take the risk of more softness in the economy in the short run than one might ideally like in order to capitalize on the anti-inflationary momentum...That is much more likely to give a more satisfactory economic as well as inflationary outlook over a period of time as compared to the opposite scenario of heading off...sluggishness or even a downturn at the expense of rapidly getting back into the kind of situation we were in last fall where we had some retreat on inflationary psychology...Then we would look forward to another prolonged period of high interest rates and strain and face the same dilemmas over and over again. (FOMC *transcripts* 7-6/7-81, p. 36)

In October 1981, Gerald Corrigan, president of the Federal Reserve Bank of Minneapolis, stressed that the crunch was coming with financial strains starting to hit.[15]. At the same meeting economist James Kichline reported that the economy was in recession. But in November 1981, Volcker stressed the unchanged central problem of managing inflation expectations, now compounded by a softening economy, "we're in a kind of no-win situation. If we deal with the inflation and long-term interest rate problem, we cannot deal with the business problem; or if we deal with the business problem aggressively, we can't deal with the

[15] See FOMC *transcripts* 10-5/6-81, p. 12.

long-run inflation, long-term interest rate problem, I suspect. There is no way we can do it with the limited tools that we have." (FOMC *transcripts* 11-17-81, p. 32).

Evidence presented at the December 1981 FOMC meeting suggested that the recession was deepening. Nevertheless, Volcker and the FOMC continued to seek lower inflation and a reduction in long-term interest rates indicative of lower inflation expectations,

> [The] only way we are really going to deal with this...is to convince people that we have a hold on inflation and have created a climate in which interest rates, particularly long-term rates, will tend to go down. But how do we create that climate and that expectation without in some sense risking being overly tight in the short run? And because people are so skeptical about whether that is going to happen, the long-term rates won't come down fast enough to facilitate the recovery we want. (FOMC *transcripts* 12-21-81, p. 49)

By May 1982, the substantial economic weakness was accompanied by evidence of lower inflation. Volcker noted that "nobody said it was going to be easy to change these expectations and behavior patterns. I don't think we have changed them completely...It is going to take some time..." (FOMC *transcripts* 5-18-82, p. 33). By the next FOMC meeting, Gerald Corrigan noted that despite much bad news on the macroeconomic front, it was important to recognize that progress on inflation was being made. He pointed out that "[t]he inflation improvement is no longer just a statistical aberration: it's very real." (FOMC *transcripts* 6-30-82, p. 18)

3.4. Return to business as usual: October 1982

In October 1982, Chairman Volcker announced that the Fed would place less emphasis on monetary targeting in its policy deliberations. The announcement marked the formal end to operating procedures adopted in October 1979 to target bank reserves more closely and allow wider fluctuations in interest rates. The Fed returned to "business as

usual" in two senses. First, it moved to manage the federal funds rate more closely. Second, it moved to a policy stance designed to close the output gap that it had created during the deliberate disinflation. By October 1982 inflation had fallen to around 5%, the 10-year bond rate had fallen by 2 percentage points since the summer, and the Fed had brought the federal funds rate down from over 14% to around 9% since July. Those developments convinced the FOMC that the cost, in terms of short-term interest rate volatility, of monetary targeting and the new operating procedures now outweighed the benefits.

The Fed was also aware that the fall in interest rates associated with the disinflation would give rise to a substantial increase in the quantity of money demanded, and that the Fed would have to accommodate the increased demand for money with a temporarily high rate of money growth. Governor Gramley had stressed this effect as early as the July 1981 FOMC meeting and it was again an object of discussion in October 1982.

The sharp reduction in interest rates and return to "business as usual" ended the deep 1981-82 recession in November 1982. The Fed held the federal funds rate in the 8 to 9% range through the first half of 1983 as inflation moved down to the 4% range because the long-term interest rates failed to fall below 10%, indicating that the disinflation still lacked full credibility. According to our model, an output gap of some size was still needed to block the pass-through of expected inflation to current inflation. The stability of inflation, interest rates, and bond rates during this period indicates that the acquisition of credibility was in a holding pattern.[16] Nevertheless, the prospects for a robust non-inflationary recovery from the deep recession looked good. In November 1982, the *Almanac* reported "the unprecedented sharp advance on Wall Street" noting that "the Dow Jones average had risen almost 300 points since the series of sharp advances began in August when interest rates began to fall." The Dow passed 1000 in early November 1982.

[16] Credibility for the Volcker disinflation was secured more firmly only after the Fed defeated a third inflation scare in 1983-4 and the 10-year bond rate fell to 7 1/2% in 1986. The Volcker Fed's credibility was challenged by a fourth inflation scare in 1987, the year in which the leadership of the Fed passed to Alan Greenspan. Goodfriend [1993]

4. Targets, instruments, and credibility

The Volcker disinflation is often described as involving a "regime change" in U.S. monetary policy, since it reversed the rise of inflation. The nature of the regime change, however, has been described in two quite different ways. It is sometimes portrayed as a great "monetarist experiment" beginning in October 1979 in which the Fed gave priority to controlling the monetary aggregates relative to other considerations, and thus brought about a decline in inflation. Alternatively, the regime change is sometimes portrayed as giving primacy to controlling inflation with a new willingness to sustain elevated short-term interest rates to bring inflation down. These alternative perspectives yield very different assessments of the "new operating procedures" adopted by the Fed in October 1979 to target reserves and money more closely. Within the former, reserve targeting was a central component of the new policy regime designed to improve monetary control in order to bring inflation down. Within the latter, reserve targeting simply allowed the Fed to ascribe interest rate movements to market forces and thereby create the leeway to raise interest rates as needed to break the inflation.

In this section, we use FOMC transcripts to shed light on the nature of the "regime change". We see that the FOMC initially adopted reserve targeting and greater emphasis on monetary control in October 1979 to help acquire credibility for stabilizing inflation expectations. Thereafter, the FOMC felt compelled to respect its monetary targets so as not to jeopardize its credibility. However, doing so was not without cost in greater short-term interest rate volatility, which at times produced short rates that FOMC members thought counterproductive, either for real activity or inflation.

4.1. Monetary targeting: context and framework

We begin by providing background: the history of monetary targeting; the evolution of the federal funds rate prior to October 1979; the new operating procedures announced on October 6, 1979 and an overview of monetary targets after 1979.

4.1.1. Monetary targets: 1970-1979

The Fed placed increasing emphasis on the monetary aggregates in its policy deliberations in the 1970s. In January 1970, at its last meeting under William McChesney Martin, the FOMC "stated its desire to have increased emphasis placed on achieving specified growth rates of certain monetary aggregates", according to the review of 1970 monetary policy by Jordan and Stevens [1971]. However, these economists at the Federal Reserve Bank of St. Louis noted that "the amount of emphasis placed on achieving growth targets of these aggregates, however, varied considerably throughout the year." In March 1975, a concurrent resolution of Congress called for (i) the adoption and prompt public disclosure of long-run monetary targets by the FOMC, and (ii) the initiation of regular consultations on monetary policy with congressional committees. The first monetary targets were announced soon after. By 1978, under the leadership of G. William Miller, the FOMC employed short-run monetary targets to help guide policy between FOMC meetings, together with annual monetary targets which it reported to Congress in widely publicized testimony.

Thus, a monetary aggregate targeting framework was well established by October 1979. In 1979, for example, the FOMC set one-year money growth target ranges of $1\frac{1}{2}$ to $4\frac{1}{2}$ % for M1 and 5 to 8 % for M2. In addition, at each meeting, the FOMC set short-run growth targets for M1 and M2. At the September 1979 meeting, for instance, the FOMC set short-run ranges of 3 to 8% for M1 and $6\frac{1}{2}$ to $10\frac{1}{2}$% for M2. (Lang [1980]). Yet, while the Fed placed increasing emphasis on monetary targeting in the late 1970s, it had not contained inflation by doing so. As Lindsey, Orphanides and Rasche [2005] stress, the growth rate of either M1 or M2 had exceeded the upper bound of its announced annual target range in 1976, 1977, and 1978.

4.1.2. The federal funds rate prior to October 1979

Prior to October 1979, the FOMC's monetary policy directive specified a narrow range for the federal funds rate, a range that was often left unchanged for lengthy periods. For example, during the first five months of 1979 the funds rate traded in the target range of $9\frac{3}{4}$ to $10\frac{1}{2}$ % (see Figure 6). In early 1979, amid increasing international tensions

and highly publicized warnings of impending oil shortages, Volcker and other members of the FOMC dissented repeatedly against the decision to leave the funds rate range unchanged, arguing that inflationary pressures and expectations were rising.

Such "funds rate inertia" was criticized by many observers. Monetarist economists had long argued that the sluggishness of the funds rate led the money stock to be procyclical and thereby exerted a destabilizing influence on real activity and inflation.[17] Governor Wallich, who would have bristled at being lumped in with monetarists, nevertheless also suggested that FOMC management of the funds rate figured importantly in the departures from targeted money growth in the late 1970s.[18]

However, the use of narrow funds rate ranges did not impede a major upward movement in the funds rate at other times. In fact, the funds rate increased from 6 1/3 % in April 1978 to $10\frac{1}{2}$ % in December of that year, in a series of incremental steps. From this perspective, the sluggishness of the funds rate in early 1979 seems attributable to internal debate within the FOMC about macroeconomic conditions, specifically whether prior rate increases were bringing on a recession, rather than to any inherent inertia in the decision process itself.

4.1.3. The new operating procedures: October 6, 1979

In proposing the "new operating procedures" to the FOMC in a telephone conference call on October 5, 1979, Volcker began by noting that "the general issue, of course, is whether the present situation requires some monetary policy action and if so, what kind...we really want to consider a change in operating technique of the kind that we have often discussed one way or another in the past...an approach that

[17] See, for instance, Poole [1978], pp. 105-10.

[18] Wallich [1983], pp. 147-8, argues "What changed in October 1979 was not the target, but the techniques of implementing it. Up to that time, the Fed had sought to implement its Ml and M2 targets and, at times, other targets by adjusting the federal funds rate (i.e., the interbank rate) to influence the demand for money. This was a workable technique, but it suffered from a reluctance of the FOMC to move the funds rate fast enough and far enough to keep the money supply on track, even over intervals of several months or longer. Because nobody, including the Fed, likes to see interest rates go up, there was, overtime, a bias in policy which allowed the money supply to expand excessively."

involves leaning more heavily on the aggregates in the period immediately ahead...And the complement of that is leaning less heavily on the federal funds rate in terms of immediate policy objectives." (p. 2) Volcker asked the FOMC to consider "whether we want to adopt that approach, not as a permanent [decision] at this stage, but as an approach for between now and the end of the year, roughly." (p. 2) As mentioned in section 3.2.2 above, the adoption of new operating procedures for controlling money on October 6th was prompted by increasing speculation in commodity and financial markets, associated with rising inflationary expectations. The new procedures involved a shift in the method by which monetary policy was implemented: open market operations were used to bring about a specified path for nonborrowed reserves, with the intent of hitting a desired path for the money supply and influencing the evolution of the economy.

The memo introducing the new operating procedures to the FOMC by Axilrod and Sternlight [1979] considered both tactical and strategic objectives. They began by noting that "The rate of inflation continues unabated and inflation psychology seems more and more to be generating speculative pressures..." They pointed out that "The rate of growth in the money supply has become the most widely publicized indicator of the stance of monetary policy. Recently, money growth has been quite rapid and, if continued, would result in failure by the FOMC to achieve its monetary targets for 1979." And they went on to "propose a reserve targeting procedure that would, [they believed], provide greater assurance than present operating techniques that the FOMC will in fact achieve [its] money supply targets for the [year]." Finally, they described potential strategic objectives as follows: "Announcement of such a shift in procedure may itself have a beneficial calming effect on inflationary psychology. However, the considerable slowing in monetary growth rates from their current pace that the public would expect from the announcement of such a shift in approach would, of course, have to be rather soon achieved if any benefits from the announcement are not to be dissipated – if indeed an announcement is not to be counterproductive." (p. 1)

The dramatic rise in the federal funds rate that immediately followed the adoption of the new operating procedures is consistent with either way to view the October 1979 "regime change" sketched above.

The funds rate rise can be seen as a consequence of strict reserve targeting undertaken to improve monetary control; or it can be regarded as a deliberately aggressive interest rate policy action that the Fed conveniently ascribed to market forces.

4.1.4. Monetary targets after October 1979

The FOMC policy directive was revised in a number of ways upon the adoption of the new operating procedures. The revised directive gave primacy to maintaining various measures of the money supply (M1, M2 and M3) within their "long-run" ranges, i.e., the annual targets for 1979. However, the FOMC also raised the 1979 target for M1 to 3 to 6% from the previously specified $1\frac{1}{2}$ to $4\frac{1}{2}$ % range. The revised directive also specified a wider $11\frac{1}{2}$ to $15\frac{1}{2}$% range for the federal funds rate. Figure 6 shows the dramatically wider federal funds rate ranges beginning in October 1979.

The wider target range for M1 allowed the Fed to hit its M1 target for 1979; M2 slightly exceeded the 8% upper bound of its unchanged range at year's end. The slowing of money growth in the last quarter of 1979 was associated with the dramatic rise in the funds rate discussed above and shown in Figure 6.

In 1979 and 1980, the introduction of two new transactions accounts, ATS (automatic transfer services between savings and checking accounts) and NOW (negotiable order of withdrawal) accounts, complicated monetary targeting. The difficulties posed by ATS and NOW accounts were partly behind the increase in the M1 target in October 1979 and prompted the development of an alternative measure of M1 during 1980, so-called M1B with the prior measure renamed M1A. .

Policy directives in 1980 provided increasingly detailed information on the money stock targets. For example, the directive from the April 1980 FOMC meeting specified that reserve aggregate management should be undertaken consistent with three different short-run monetary targets: $4\frac{1}{2}$% for M1A, 5% for M1B, and $6\frac{3}{4}$% for M2. These "short run" targets were designed to be consistent with annual 1980 target growth rates of $3\frac{1}{2}$ to 6% for M1A, 4 to $6\frac{1}{2}$% for M1B, and 6 to 9% for M2 that had been set at the February 1980 FOMC meeting. As shown in Figure 7, taken from Gilbert and Trebbing [1981], the

FOMC's short-run monetary targets varied substantially through time in 1980. Over the year, the figure shows that M1B ended up within the 1980 target range; not shown, M1A grew at less than $3\frac{1}{2}\%$ and M2 grew at more than 9% in 1980.

4.2. Was monetary targeting a vise or a veil?

Our reading of evidence from FOMC transcripts below indicates that monetary targets were neither a vise nor a veil during the Volcker disinflation. Monetary targets were not a vise in the sense that they did not prevent the FOMC from managing short-term interest rates to some degree. Neither were they a veil that provided an excuse for high interest rates without exerting any constraint on interest rate policy. The FOMC recognized that it had to show respect for its monetary targets in order to enjoy their credibility-building benefits, so that on occasion it had to allow short-term interest rates to move in ways it deemed detrimental for real activity or inflation.

4.2.1. The reserve instrument

From the many pages of FOMC transcripts devoted to issues of reserve targeting, it is clear that the FOMC took the new operating procedures and the task of setting and adhering to the inter-meeting path for reserves very seriously. There was a real change in operating method.

4.2.2. Funds rate ranges and decision inertia

Yet, while it gave priority to reserve and money targeting in its directive, on occasion the FOMC used two techniques to maintain tight control of the federal funds rate at the expense of its monetary targets. First, the FOMC at times adopted a tolerance range for the federal funds rate that was considerably narrower than the wide ranges reported in its policy directives. Second, the FOMC at times adopted reserve paths that were aimed at maintaining a relatively stable funds rate even in the face of rising monetary growth.

For instance, at the April 1980 FOMC meeting, with money and real activity falling, the FOMC agreed on a funds rate range of 13 to 19%

along with the monetary targets discussed above. But it also agreed on a narrow "15 to 16% notional range" for the funds rate, with movements outside of this range to trigger a telephone consultation by the FOMC.[19] Within a week of the April FOMC meeting, the declining demand for reserves and money due to the developing recession of 1980 pushed the funds rate against the lower part of the notional range and triggered a telephone conference call at which the FOMC debated maintaining the funds rate but ultimately decided to let it fall somewhat.

The situation was reversed at the October 1980 FOMC meeting when a rapidly expanding demand for money and reserves associated with the recovery from the 1980 recession put upward pressure on the funds rate. The funds rate range specified in the prior directive had been very wide, 8-14%, and the funds rate was still in the middle of that range at about $12\frac{1}{2}$% when the FOMC met in October. After a vigorous debate, however, the committee adopted a proposal by Volcker for a reserve path that was estimated to maintain the funds rate at the $12\frac{1}{2}$% level or slightly higher in spite of booming money growth. (see Figures 6 and 7).

We thus see vestiges of interest rate smoothing and decision inertia in these two meetings. In one situation (April 1980), the FOMC considered maintaining a high funds rate as money growth fell, so as to continue to fight inflation. In the other (October 1980), it maintained the funds rate while the monetary aggregates grew rapidly because some FOMC members viewed the rate as sufficiently restrictive. In both cases, economic circumstances that seemed so critical in these FOMC meetings were soon swept away by larger events.

On the other hand, even the wide federal funds rate tolerance ranges stated in the FOMC directive were not always maintained. For instance, in May 1981 a booming economy, accelerating money growth, and rising interest rates associated with the second inflation scare pushed the funds rate above the 13-18% tolerance range that had been set at the April FOMC meeting and triggered a telephone conference call on May 6. However, in light of the extraordinary circumstances, the FOMC opted simply to treat the 18% upper bound as a "checkpoint" rather than a constraint. At Volcker's urging, the FOMC released a statement after the conference call stressing that the reserve and money supply

[19] See FOMC transcripts, conference call on 4-29-80, p. 1.

targets from the April FOMC meeting were unchanged.

These episodes highlight that the FOMC managed the reserve aggregate and the federal funds rate with some discretion in light of real economic activity and inflation. Monetary targeting was far from a mechanical rule.

4.2.3. Prisoner of the monetary targets?

At the April 1980 FOMC conference call mentioned above, no progress had yet been made on inflation. Volcker, Anthony Solomon (president of the Federal Reserve Bank of New York) and Governor Wallich all expressed concern about allowing the federal funds rate to fall. Wallich was most forceful, arguing: "we've become prisoners here of our technique. I don't think from an overall point of view that we want such a sudden degree of easing...It is not going to help us to say that we haven't changed policy and we're following the same targets as before. People would perceive the big change in interest rates. And I think substantively they would be right; it is a change in policy if we let interest rates drop dramatically." (p. 4) Robert Forrestal of the Federal Reserve Bank of Atlanta agreed: "Basically we're on target with what we intended to do last October. I think the greater risk at this point, both domestically and internationally, would be to run the risk of underkill on inflation. Without any reduction of the inflation rate we'd be making a serious mistake if we didn't [show] some resistance at this point to a precipitous decline in interest rates." (p. 6)

On the other hand, Governor Partee and Frank Morris, president of the Federal Reserve Bank of Boston, argued vigorously that the rapidly dropping monetary aggregates indicated in Morris's words "a dramatic and very widespread weakening in the economy" that called for lower interest rates to stimulate the economy. Morris also expressed concern about the FOMC "moving back to the management of interest rates," adding that "[this operating technique] has turned the situation around a lot faster than would have occurred if we had been managing interest rates on the up side. For us to turn around and try to manage them on the down side...would be a mistake." (p. 6)

Finally, the monetarist wing of the FOMC represented by Robert Black, president of the Federal Reserve Bank of Richmond and Lawrence

Roos, president of the Federal Reserve Bank of St. Louis, argued forcefully that the FOMC should provide countercyclical stimulus by hitting its monetary targets.

The April 1980 debate nicely illustrates the tensions in the FOMC involving the use of monetary targets. In April 1980 and subsequent months, an unusual coalition of FOMC members – some concerned with monetary targets and others with preventing declines in real activity – carried the day against the reservations of Volcker and others who sought to keep the funds rate high to combat inflation. But, tensions over monetary targets also surfaced at other meetings. As we saw earlier, with money growth running above the target in October 1980, the FOMC decided to resist upward pressure on the funds rate.

4.2.4. Credibility and monetary targets

The FOMC transcripts also show that a wide range of committee members were concerned with the credibility effects of missing monetary targets. For instance, at the October 1980 FOMC meeting mentioned above, three members of the FOMC dissented against the decision to target a rapid growth of reserves to stabilize the funds rate at $12\frac{1}{2}\%$. Of the three–Morris, Roos, and Wallich–the first two expressed concerns about the adverse effects on credibility. Morris, in particular, engaged in a lengthy discussion with Volcker about the importance of hitting the monetary targets, warning that the financial community was "watching us like hawks" and that "we...need....to get expectations working for us rather than against us." (p. 28) More predictably, Roos took a hard line on the links between performance vis-a-vis monetary targets, arguing "inflationary expectations [might be rekindled] because of the loss of credibility in our October program and we'd have high interest rates and inflation...I think it's a very critical time for our credibility." (p. 35)

4.2.5. Monetary targeting with evolving aggregates

One particular challenge for the FOMC was that the committee members increasingly came to distrust M1. At the July 1981 meeting in which the FOMC was to choose money target ranges for 1982, Morris argued that "we ought to face up to the fact that we do not know

how to measure transactions balances in our present society. M1B is somewhat of a nostalgic attempt to maintain a concept of transactions balances and I think it's leading us into all kinds of problems." (p. 24) Governor Schultz continued: "it seems to me that this is only half of the problem...we don't know what the monetary aggregates are...[and]...we don't know what the relationship is between the aggregates and GNP." (p. 25) But Volcker responded: "We unfortunately have to use these fragile numbers...we happen to have a law as well as an expectation that says that we have to review our present targets and have to put down some new ones for next year." (p. 33)

4.2.6. Strategy, tactics, and outcomes

The increased emphasis on monetary targets in October 1979 was initially designed to signal the Fed's unwillingness to tolerate a rising rate of inflation, in part by widening the tolerance ranges for the federal funds rate. We noted above, however, that at important junctures, such as the April 1980 and October 1980 meetings, the FOMC made decisions on reserve management that took into account potential effects of these actions on both the path of the funds rate and on economic activity. That is, in each of these meetings the FOMC had in mind smaller ranges for federal funds than those publicly discussed. At other junctures, such as in April and May 1981, when faced with rising monetary growth and increasing long-term interest rates, the FOMC sought to send a strong signal that the funds rate was not being implicitly targeted and, to do so, emphasized its support for a stable reserve path.

During the disinflation, then, our sense is that the Volcker-led FOMC undertook a delicate balancing act. It sought to manage short-term interest rates and to respect monetary targets. It also sought to reduce inflation while avoiding undue losses in real economic activity. It did so while experimenting with a new operating procedure, facing significant evolution of the banking sector, significant fluctuations in expected inflation, and the imposition of credit controls.

The complexity of the monetary policy behavior evident in the transcripts led us to adopt the strategy that we used in the paper. We described the course of the deliberate disinflation in our model without

utilizing a policy rule. Instead, we focused on the interplay between inflation, output, interest rates, and credibility. Ultimately, one would like to add the "missing policy equation" to better understand the incredible Volcker disinflation.

4.3. The behavior of money growth

Figure 8 displays annual growth rates of M1B and M2 from 1976 through 1985. The dashed line in the figure shows the behavior of the inflation rate during the period; the two vertical lines mark the October 1979 and October 1982 regime changes discussed above. There are several striking features of this figure. First, there is little evidence of a low-frequency relationship between money growth and inflation during the 1978-1980 rise in inflation or in the 1981-83 decline in inflation. Second, the monetary time series are not evidently smoother during the period of increased emphasis on monetary targeting.

This behavior is, we think, important for understanding the evolution of the credibility of the Volcker disinflation. Monetary aggregates did not, at the time or in retrospect, signal to individuals that there was a sharp break in actual Fed behavior. By contrast, interest rate behavior was clearly different, but subtle to interpret. The public was left to decide whether a high general level of nominal interest rates and high short-term nominal interest rates, in particular, reflected an accommodation of high inflation or a policy to contain inflation and bring it down.

5. Conclusions

In the late 1970s, there was considerable doubt about the ability of interest rate policy to deliver low and stable inflation. On the academic side, the provocative work of Sargent and Wallace [1975] argued that the price level was indeterminate within a rational expectations macro model if the central bank employed a short-term interest rate as its policy instrument. On the practical side, inflation and inflation expectations were rising rapidly, perhaps because central banks *actually used* interest rates as policy instruments. Hence, both academics and central bankers looked to the alternative of monetary targeting using

reserve instruments.

One of Ben McCallum's classic papers provided a middle ground by showing that the short-term nominal interest rate could be used as a policy instrument if it is part of a monetary targeting rule which provides a nominal anchor so that the path of the price level is determinate (McCallum [1981]). Working within a rational expectations model, McCallum showed that a credible central bank using an interest rate instrument could potentially bring about low and stable inflation**.** Together with work of Michael Parkin [1978] on this topic, McCallum's paper opened the door to modern analysis of interest rate rules now standard in academia and central banking. The essential linkage is that private agents could form expectations about future central bank behavior and that such future behavior could be consistent with a unique process for inflation. Crucially, McCallum's analysis presumed that the central bank followed a policy rule which was *fully credible*, in the sense that private inflation expectations were consistent with the central bank's intentions for inflation.

In contrast, during the Volcker disinflation the Fed needed to *acquire credibility* for low and stable inflation. We studied this episode without having a firm understanding of Fed behavior, so instead we adopted an analytical strategy that focused on the interplay between inflation, expected inflation, credibility and real activity without specifying the monetary policy rule. We sought to document how the Volcker FOMC tried to acquire credibility: with an initial appeal to monetary targets as a nominal anchor, with new operating procedures designed to allow greater scope for short-term interest rates to be determined by market forces, and ultimately by employing an interest rate and reserve aggregate policy mix to work the actual inflation rate down. Our methodology for studying the disinflation without a firm understanding of the Fed's behavioral rule places us in a position similar to the public and the FOMC itself. To improve our understanding of the Volcker disinflation, it will be necessary to specify Fed behavior explicitly and to model the interaction of Fed policy with the dynamics of private sector beliefs about inflation. Requiring these beliefs to be consistent with the financial market data will allow a clearer understanding of the role of imperfect credibility in the Volcker disinflation.

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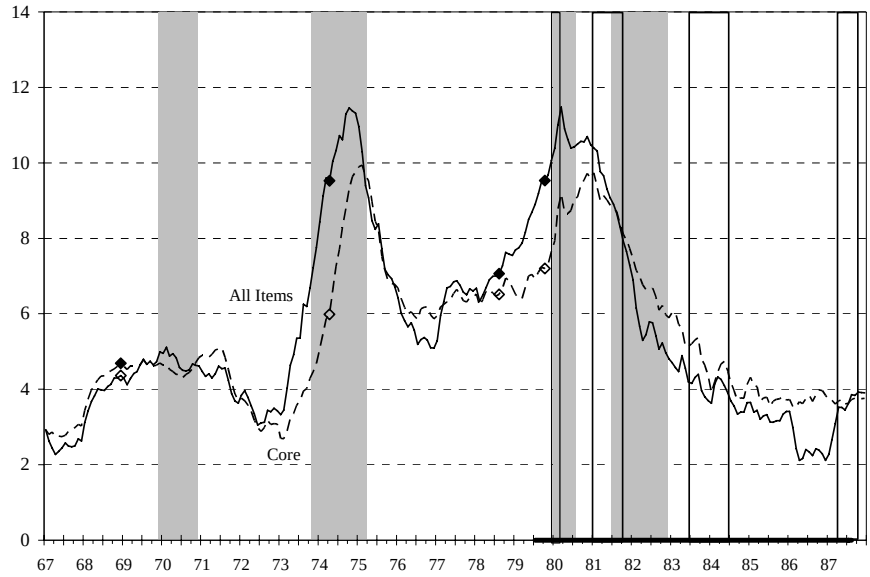

Figure 1: Inflation rates (annual percentage change of PCE and Core PCE indices). NBER recessions indicated with shaded areas; Romer and Romer [1989] "inflation-fighting" dates indicated with ◊; Goodfriend [1993] "inflation scare" intervals marked with vertical boxes; Volcker term as Fed chairman indicated with dark line on the horizontal axis.

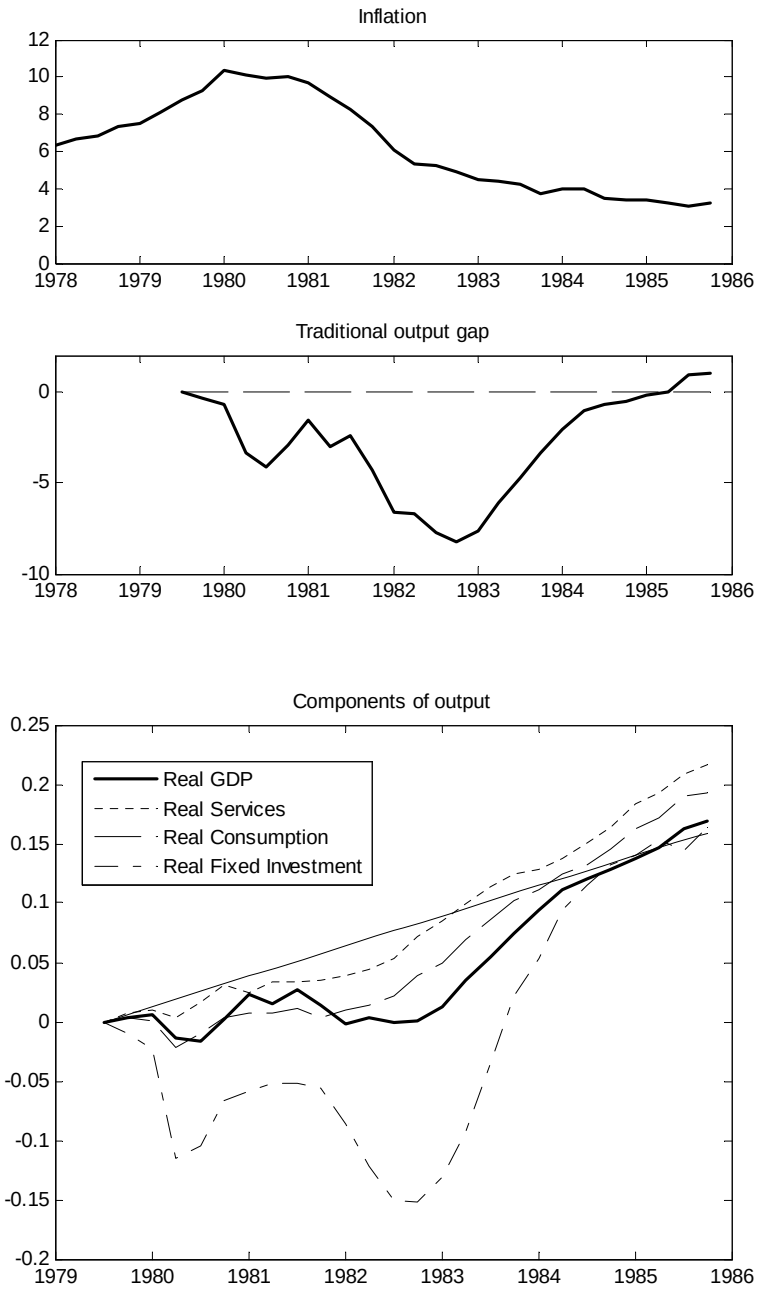

Figure 2: Inflation, traditional output gap, and components of output during the Volcker disinflation. Inflation (annual percent change in PCE); traditional output gap is deviation of output from linear trend line under assumption that economy is at capacity in 1979:QIII and in 1984:QIV; components of output are services (PCESVC96), total consumption (PCECC96), and business fixed investment (GDPIC1).

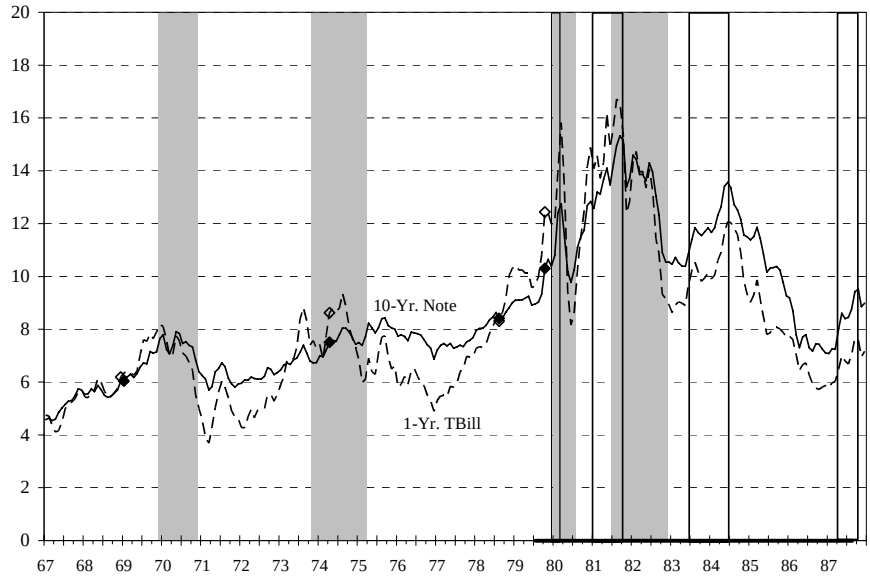

Figure 3: Interest rates on 1-year and 10-year bonds (percent per annum). NBER recessions indicated with shaded areas; Romer and Romer [1989] "inflation-fighting" dates indicated with ♢; Goodfriend [1993] "inflation scare" intervals marked with vertical boxes; Volcker term as Fed chairman indicated with dark line on the horizontal axis.

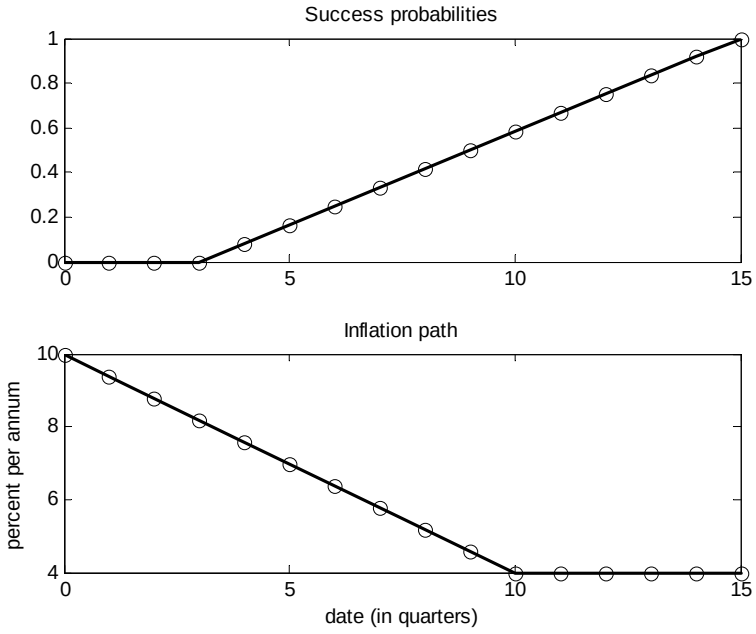

Figure 4: Deliberate disinflation with imperfect credibility in a simple model. Inflation falls by 6 percentage points over 10 quarters starting at quarter 1; probability of success rises from zero over 12 quarters starting at quarter 4.

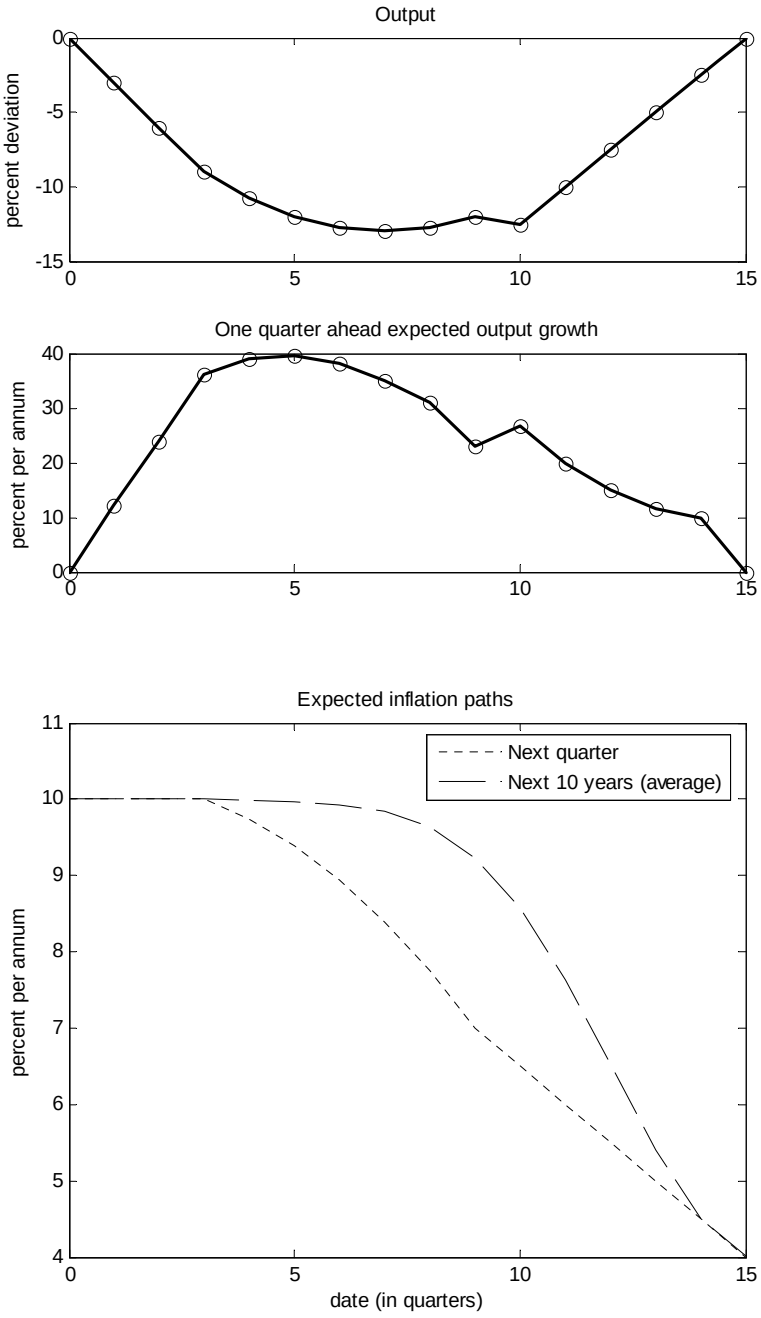

Figure 5: Deliberate disinflation with imperfect credibility in a simple model. Output, expected output growth, and expected inflation at 1-quarter and 10-year horizons (all under assumptions in Figure 4).

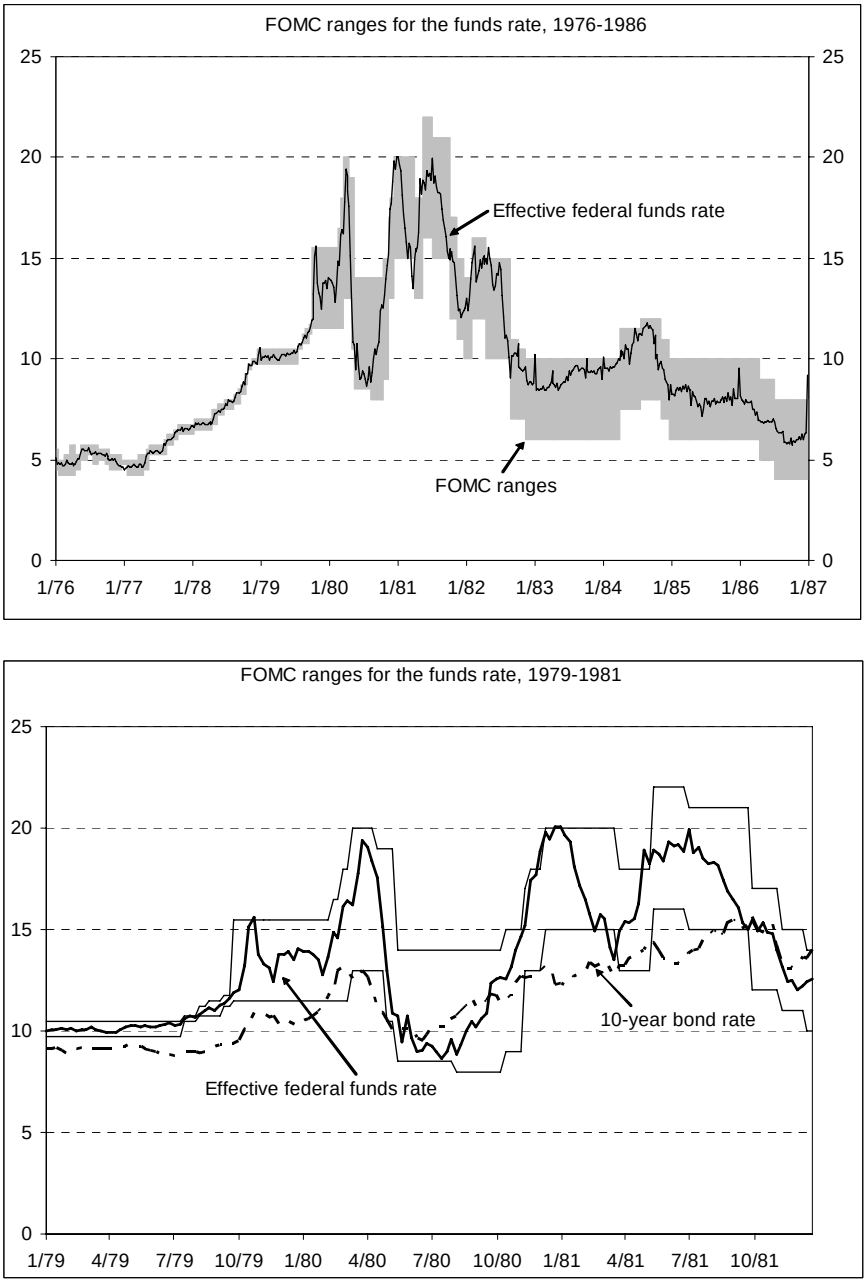

Figure 6: Effective federal funds rate and FOMC ranges. Dashed line in bottom panel is the 10-year bond rate. All series are percent per annum, weekly data.

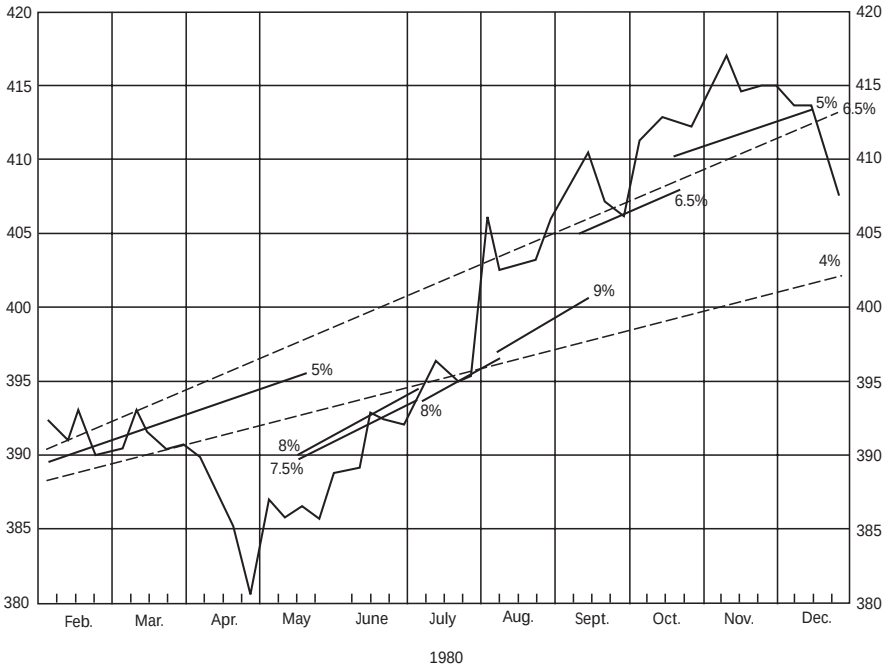

Figure 7: M1B money stock (in billions of dollars) with long-run and short-run target ranges for 1980. Actual money stock (solid line) is weekly data. Source: Gilbert and Trebbing [1980].

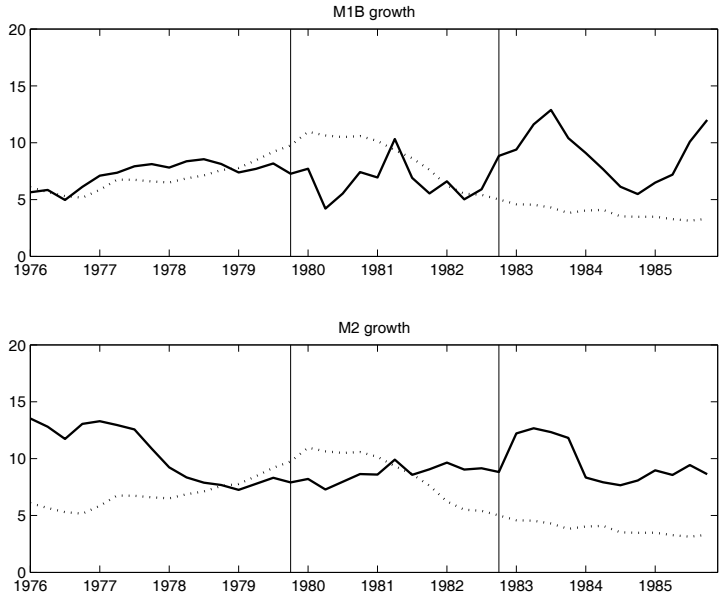

Figure 8: M1B and M2 money growth, 1976-1985 (annual percent change, quarterly data). Dashed line in both panels is PCE inflation rate