The Incredible Volcker Disinflation*

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Abstract

The change in inflation that occurred during 1980 through 1984, when the Federal Reserve System was headed by Paul Volcker, is arguably the most widely discussed and visible macroeconomic event of the last 50 years of U.S. macroeconomic history. Prior to this time, inflation had been dramatically rising, but under Volcker, the Federal Reserve System first contained and then reversed this process. Using a simple modern macroeconomic model as an organizing principle, we argue that the real effects of the Volcker disinflation were mainly due to its imperfect credibility. In our analysis, the observed stubbornness of long-term interest rates over the course of the disinflation is a key indicator of imperfect credibility. Studying the transcripts of the Federal Open Market Committee during 1979 and 1980, as released to the public within the last year, we find – to our surprise – that Volcker and other participants in the monetary policy process considered the period in similar terms, using the long-term interest rate as an indicator of inflationary expectations and of the credibility of their disinflationary policy. We also use the basic model to explain other features of the inflation process. In terms of the increase in "trend inflation" through 1979, we show that a central bank which seeks to stabilize real output and to assure continuity of the nominal interest rate would, within our model, generate a random walk inflation process, with increases in interest rates associated with adverse real shocks. We interpret the macroeconomic history from 1967-1979 in these terms. In addition, our model predicts that "inflation scares" – sudden increases in expected long-term inflation rates – should lead to higher long-term nominal interest rates and confront a central bank with a difficult trade-off between inflation and real activity. We suggest that the 1977-1981 period is one in which the consequences of such inflation scares, viewed as a legacy of the central bank's prior tossing of the nominal anchor, became important contributors to macroeconomic history.

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1 Introduction

In August 1979, when Paul Volcker became chairman of the Federal Reserve System, the annual average inflation rate in the United States was at high, at 9%. It had risen three percent 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). Previous intervals of high and rising inflation during the prior 20 years had led the FRS to episodes of restrictive monetary policy but, each time, there was higher inflation several years afterward. Against the backdrop of a volatile international and domestic situation, the FRS engineered a decline in the inflation rate to about 5% by the end of 1983. During this period, the U.S. experienced two recessions, which are generally attributed to the anti-inflation policies of the Federal Reserve System, with employment and output displaying the largest business cycle declines in the post-World War II period.

The "rise and fall" of inflation in the post-war period and, in particular, the Volcker disinflation are central events that have attracted many economists to macroeconomics and have been the subject of a huge body of this research. We first met Bennett McCallum during the course of these events and have discussed aspects of them many times during a friendship of a quarter century duration. 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 the events in light of these models. In this paper, we study the Volcker disinflation using this approach. We think of the Volcker disinflation as "incredible" in three senses. First, looking backward, it initiated a change in the average rate of inflation that has been large and sustained, sufficiently so that one is drawn to remarking on it as a key interval when one looks at graphs of post-war U.S. activity. Second, relative to perspectives in 1978 by many observers, including ourselves, it is remarkable that it took place and one is drawn to trying to understand the event. Third, we believe that "imperfect credibility of monetary policy" was a core feature of this interval. We use our simple macroeconomic model to explore the implications of this viewpoint for the comovement of inflation and output over this interval. As part of this project, we have reviewed the transcripts of the FRS open market committee during 1979-1985. A striking feature of these transcripts is that Volcker and other members viewed imperfect credibility as the key feature of the environment that they faced, with evolution of private sector beliefs about inflation – reflected in private markets, but particularly the long-term bond market – being a key constraint, objective and test of their monetary policy decisions.

To understand the rise in inflation, we argue that it is necessary to view the U.S. central bank as typically giving prominence to two objectives, stabilization of economic activity and avoidance of large period-to-period changes in short-term interest rates. We portray the FRS as maintaining these objectives in the face of real devel-

opments that affected the level of output and the level of the real interest rate, thus making inflation variable. We show that a very simple modern macroeconomic model, which we take as embodying key elements in many contemporary model, makes the prediction inflation contains a "permanent component" in the language of modern time econometrics. Thus, the upward drift in U.S. inflation during 1967 through 1979 arises as a consequence of a series of adverse real shocks hitting the macroeconomy and the central bank allowing inflation to randomly walk upward.

This viewpoint embodies the idea that there was no "nominal anchor" for U.S. monetary policy. Hence, by mid 1979, we think that many individuals in the U.S. had come to believe that there was a very wide-range of future inflation scenarios. We suggest that a volatile domestic and international political situation led to volatility in private beliefs, which we call "inflation scares" when these involve sharp increases in long-term expected inflation and long-term interest rates. We believe that Volcker faced very volatile beliefs as he took the chairmanship and a particular "inflation scare" early in his tenure.

There is now a tendency to view the interval from the onset of the new operating procedures in October 1979 through the end of the disinflation, which is variously dated, as one major effort to lower the inflation rate. However, we argue strongly that a finer breakdown is called for and that this subdivision is very important for understanding FRS actions and private sector response. In August 1979 through November 1980, the Volcker Fed sought mainly to control inflation, as the economy experienced a brief recession brought on, we believe, by restrictive monetary policy. But, by November 1980, inflation was running at annual rate of 10.5% and the Volcker Fed had simply behaved in a manner consistent with prior experiences. It had faced a rising inflation and had undertaken restrictive monetary policy, but it had allowed the rate of inflation to be higher at the end of the process.

From our perspective, the start of a "deliberate disinflation" dates to late 1980. The Reagan administration was to come into office in January of 1981 and it had indicated strong support for lower inflation. At the same time, the Volcker Fed saw rising employment as recovered from the recession, but also a rise in inflation and a rise in long-term bond yields. At about this time, we believe that there was a decision to make a decisive move on the inflation front by the Volcker Fed, but that we also believe that its actions looked like familiar to the private economy: restrictive monetary policy undertaken by a central bank facing rising inflation, with little weight placed on the prospect of a dramatically lower future inflation rate. We explore this period from the perspective of incomplete information and incomplete credibility, using the historical record and the implications of our small model.

Our investigation combines four types of information. First, we use macroeconomic data – as currently revised – to describe the broad history of the economy from 1977-1987 as well as the specific Volcker disinflation period. Second, we use an account of major economic events from the World Almanac, which we think is desirable because it is relatively contemporary and compiled in a relatively consistent

manner. Third, we use the transcripts of the Federal Open Market committee and the related reports of the Federal Reserve Board staff. Fourth, we use the implications of our small macroeconomic model.

The organization of the paper is as follows. In section 2, we provide a brief historical overview of the macroeconomic data during 1967-1987, setting the stage for our analysis. In section 3, we specify the model. In section 4, we describe some of the core implications of the model. In section 5, we undertake our interpretative history. In section 6, we provide a brief summary of our paper and offer our main conclusions.

2 Historical overview

We begin by providing a brief historical review of major historical episodes during the middle third of the post-war period, 1967-1987. While we provide some discussion of the full period, our main focus later in the paper is on mid-1979 through the end of 1985, during which we believe that there are important interactions of credibility, inflation and macroeconomic activity: it is this period that we colloquially refer to at the "incredible Volcker disinflation" below and in the title of the paper. However, we think that some elements of this disinflation episode can be best understood against the backdrop of a the prior two decades.

2.1 Inflation

Figure 1 displays the course of inflation from 1967 through 1987, as well as highlighting some particular episodes and events.[1] First, we identify our main "Volcker disinflation" interval by darkening the horizontal axis from mid-1979 through the end of 1985. Second, as is conventional, NBER recession episodes are shaded, with two recessions occurring within our interval of principle interest. Third, we identify with an '$\Diamond$' those dates at which Romer and Romer [1989] have suggested that anti-inflationary monetary policy actions were initiated, with one event occurring during the "Volcker disinflation", October 1979. Fourth, we include "inflation scare" episodes identified by Goodfriend [1993] via solid lines that are connected on the vertical axis. There are two such episodes within our "Volcker disinflation" interval: January-February 1980 and January-October 1981.

We now discuss three aspects of the course of inflation during the 1967 through 1987 period.

[1] Specifically, Figure 1 shows year-over-year changes in two standard price indices, the PCE (Personal Consumer Expenditure index) and the PCEX (Personal Consumer Expenditure index excluding ....).

2.1.1 Rising inflation: 1967-1978

In 1966 and 1967, inflation began to increase in the United States, as the Vietnam War accelerated. By late 1968, both of the inflation measures in Figure 1 were close to 5%, a substantial increase from the experience of the prior decades but mild in comparison with the experience in our main period of interest. This increase in inflation led the Federal Reserve System to undertake a sharp rise in the Federal Funds rate beginning in December 1968, which Romer and Romer [1989] identify as an episode of anti-inflation policy. Never-the-less, inflation continued unabated through late 1971, before dropping to roughly a three percent for about one year.[2]

Inflation accelerated dramatically 1973, rising back to 5% by the end of the third quarter. Many further highlight the inflation effects of the "energy crisis" that began in October 1973. By April 1974, according to the RR chronology, the Federal Reserve began another round of anti-inflation policy. In the "Great Stagflation", the inflation rate accelerated to over 10% by the early 1975 and then fell back down to the 5% in range in late 1976.

Inflation surged again in early 1977 and was running in the range of 7% by the time of the next RR anti-inflation date in August 1978.

2.1.2 High inflation in 1979

At the start of the Federal Reserve chairmanship of Paul Volcker in August 1979, the inflation rate stood at about nine percent per year, having risen about three percent in the past eighteen months. The final RR anti-inflation date in our sample is October 1979, which is the month of the well-known shift in Federal Reserve System operating procedures. But again, inflation continued to rise, reaching a peak of 11% in early 1980.

Such a historically high level of inflation was widely viewed as a relatively permanent feature at that time. In March 1981, for example, Brunner [1981a] argued that "conceptions and policymaking procedures ... (have) created the uncertain drift of an erratic and permanent inflation." In September 1981, Brunner [1981b] noted that even the Reagan administration was divided in its objectives for monetary policy, with a group of supply-side economists advocating growth in nominal income in the range of 10-13% per year for the foreseeable future, which Brunner suggested would mean that little progress would be made on the inflation front. While another group within the administration advocated lowering inflation via restrictive monetary policy and recognized that a recession would likely result, Brunner noted that there seemed likely to be a compromise outcome.

[2] August 1971: departure from the Gold Standard and introduction of Nixon's "New and Economic Policy", which included an initial 90 day freeze on wages and prices.

2.1.3 The decline in inflation, 1981-1985

Inflation began to fall in 1981. By the end of 1983, the inflation rate had decreased to less than 5 percent per year and it declined by another two points during 1984 and 1985. During this interval, the NBER identifies two recessions, January-July 1980 and July 1981-November 1982. By historical standards, the first episode is the shortest recession identified by the NBER and the length of the second is roughly the average duration of recessions. The size and speed of the decline in inflation was a surprise to many commentators, given the backdrop discussed in the prior section.

2.2 Employment

There are a variety of measures of real activity that have been used in the analysis of this and other business cycle episodes. Our benchmark series is the ratio of civilian employment to population, which is shown in Figure 2. One notable feature of this series is that it is growing through out the post-war period. During the 1967-1987 interval, it increases from around 57% to around 62%. Rather than detrending this series in some manner, we have chosen to simply present the employment rate in its basic form and then discuss issues involving trends as they arise.

2.2.1 1970s Recessions

The two recessions of the 1970s each involved employment declining from an initial level of about 58% of the workforce. In each case, it took twelve to eighteen months for employment to reach a trough and about four years for it to recover to its original level. During the "Great Stagflation", the peak decline in the workforce as about 2% and in the earlier episode it was somewhat less.

2.2.2 Employment during the Volcker disinflation

The two recessions during the Volcker disinflation are hard to separate. Employment declined from an initial level of about 60% of the workforce in January 1980 to 59% at the first business cycle trough, recovering about half way through mid 1981,. and then declining to about 57% at the second business cycle trough. It took about 4.5 years (through mid 1984) for employment to recover to its initial level.

2.3 Interest rates

The behavior of interest rates is displayed in Figures 3 and 4, each of which adopts the same episodic decomposition as we used in Figures 1and 2 above. We include three series: the Federal Funds rate; the one-year Treasury bill rate; and the 10 year Treasury bond rate.

2.3.1 Rising interest rates: 1967-1978

During 1967-1978, the level of all three interest rates rose by about 3%, from about 5% in January 1967 to about 8% in December 1978, but Figures 3 (3) and 4 (4) make clear that the rates did not always move in lockstep. This increase mirrored the rise in the inflation rate of roughly 3% from 1967-1978, which we saw previously in Figure 1.

Over the course of 1967, increases in the medium and long term (1 year Tbill and 10 year Tbond) rates preceded the rise in the Funds rate as well as the rise in inflation that occurred in 1968. In early 1968, the Federal Reserve adjusted the funds rate up to the level of the 1 year rate (see Figure 3). Further interest rates increases in all rates occurred in the wake of the December 1968 RR date. With the onset of the recession in late 1969, the Funds and Tbill rates fell, as in other recessions, reaching the levels of early 1967 in 1971 and 1972, but the Tbond stayed higher at above 6%.

Over the course of 1973 though 1978, there was tremendous volatility in the Federal Funds rate and the Tbill rate. At the same time, the 10 year bond rate began a steady climb from its 6% level in 1971 to 8% in 1975 and further.

2.3.2 High interest rates in 1979 and 1980

By July of 1979, all three rates were very high by historical standards. The Federal Funds rate and Tbill rates stood at 10%, while the Tbond rate was slightly above 9%. While these rates were widely discussed as uncharacteristically high at the time, they were low by the standards of the Volcker disinflation. The Tbond rate would not return to its summer 1979 levels until late in 1986 and the shorter-term rates would do not do so until late 1982 (except for a brief dip during the "Credit Controls" episode of spring and summer of 1980).

The interval contains two periods that Goodfriend describes as "inflation scares," which involve rising long-rates driven by expectations of inflation. We indicate these periods in our graphs with boxes: they play an important part in our discussion below.

2.3.3 Interest rates during the decline in inflation, 1981-1985

At the start of 1981, the T bond rate stood at about 13%, while the Funds Rate and Tbill rates stood at much higher levels. The T-bond rate would stay at least this level through the second half of 1982, as inflation plummeted from over 10% to about 5%.

Even when the Funds Rate and the T bond rate fell dramatically to under 9% in late 1982, the Tbond rate stayed stubbornly above 10% and in mid 1983 it began a climb that led it to a peak of over 13% in the late spring of 1984. During this same

period, in which Goodfriend [1993] identifies an additional inflation scare in the bond market, the rate of inflation declined further to about 4%.

3 Model components

We think that there are six critical elements of modern macroeconomic models that we need to incorporate into our study of the "rise and fall" of U.S. inflation. First, there should be a short-run Phillips curve relationship, so that a monetary stimulus raises both inflation and real variables such as output and employment if there are no changes in expected inflation. But, at the same time, there should be no long-run Phillips curve relation, so that a permanent increase in money growth and in inflation has no quantitatively significant effect on employment or output. Second, the model should have a "Real Business Cycle" core, in which macroeconomic activity would respond to a variety of real shocks in the absence of nominal frictions. Such a component is critical, we believe, on both the short-run and long-run fronts. Quarter-to-quarter, there are many changes in current and prospective real conditions that are important for output and the real interest rate. In the longer term, the evolution of economic activity is dominated by growth in productivity. Third, there should be a Fisherian relationship between the real, the nominal interest rate, and expected inflation. Such a specification is critical to understanding the evolution of the nominal interest rate in the U.S. and other countries. Fourth, there should be a transmission mechanism between real interest rates and real economic activity that includes additional expectational elements, because optimizing theories of consumption and investment suggest the importance of this feature and because both consumption and investment appear to be substantially influenced by expectations in the U.S. economy. Fifth, the model should contain the expectations theory of the term structure. While it has been criticized as an incomplete description of long-term yields, we think that the expectations theory never-the-less contains the essential features of bond-pricing for our purposes. Sixth, there should be a model of central banking consistent with available information about the actual behavior of the monetary authority, which we discuss further below.

To exposit these elements, we work with very simple linear macroeconomic models that combine elements of richer models developed merging the approaches of Real Business Cycle (RBC) and New Keynesian (NK) research.

3.1 New Keynesian Pricing

New Keynesian macroeconomics has developed a battery of models to explain price setting by forward-looking firms. The simplest of these models, embedding price adjustment opportunities along the lines of Calvo [1983], leads to a “New Keynesian

pricing" equation that links inflation (π_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 such as the frequency of price adjustment, the elasticity of marginal cost with respect to output, and forth.[3]

As has been much stressed in the recent literature,[4] the New Keynesian approach indicates that the relevant measure of capacity output is the level of output that would prevail if nominal prices were flexible. That is, it is a level of output which can be modeled along the lines of real business cycle analysis and that therefore is expected to fluctuate through time in response to a range of macroeconomic shocks, including productivity, government expenditures, tax rates, and energy prices.

3.1.1 The short-run trade-off

If we hold expectations fixed, then the model implies that an increase in real output brought about by a monetary expansion will increase in inflation, since such an increase does not affect the capacity output term. Most empirical macroeconomists think that the value of h in this setting is fairly small, so that changes in output gaps do not exert too large an influence on inflation.

3.1.2 The long-run trade-off

There is no long-run trade-off indicated by the New Keynesian pricing specification (1), since an equal values of current and expected future inflation leaves output unaffected.[5]

3.2 RBC elements

A drawback of the simple linear model that we employ in this paper is that we cannot fully incorporate the RBC elements that are studied in many analyses in the last decade. [6] To capture these partially, we assume that the "capacity output" evolves according to

$$\Delta y_t^* = \rho\Delta y_{t-1}^* + \eta_t \tag{2}$$

which is a simple difference stationary stochastic process of the form estimated by Nelson and Plosser [1982], which allows for shocks to the level of economic activity

[3] See Woodford pages

[4] references

[5] qualifications: discounting, relative price distortions, price adjustment costs, credit costs,....

[6] FN: Yun, KWolman,Kwatson in 1996

and also to the expected growth rate.[7] This simple specification cannot adequately capture the changes in trend productivity growth which we believe to have occurred over the post-war period, but it has the desirable property that it does let us approximate the comovement of output and the real interest rate in response to permanent shocks to the level of productivity within a more fully articulated model.

3.3 The Fisher equation

The link between nominal interest rates and expected inflation

$$R_t = r_t + E_t \pi_{t+1}. \tag{3}$$

In our study, this linkage will play a key role.

3.4 Expectations and aggregate demand

Expectations are important determinants of aggregate demand and the determination of output in model with Keynesian features, such as ours. According to modern consumption theory, the expected growth rate of consumption should be related to the real interest rate, which we write as

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

The "natural rate of interest" thus evolves according to

$$r_t^* = \sigma(E_t y_{t+1}^* - y_t^*) + r \tag{5}$$

With our capacity output process, this implies that the "natural rate of interest"

$$r_t^* = \sigma \rho \Delta y_t^* + r$$

so that we have built in a positive comovement of the real interest rate and output growth present in studies of RBC models with stochastic productivity trends.[8]

3.5 The real and nominal term structure

In our model, we include specifications of the real and nominal returns on a long-term discount bond, i.e., one with L periods to maturity. The first specification governs the real term structure,

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

[7] At the same time, our model does not distinguish between consumption and investment, a key aspect of RBC models.

[8] See, for example, KPR (88b)

and the second specification governs the nominal term structure,

$$R_{Lt} = \frac{1}{L}\sum_{j=0}^{L-1} E_t R_{t+j} = r_{Lt} + \frac{1}{L}\sum_{j=1}^{L} E_t \pi_{t+j} \tag{7}$$

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

3.6 Central bank behavior

In order to close the model, we specify three central bank preferences to guide interest rate policy. First, the central bank is assumed to like to *stabilize the output gap* so that actual output equals potential output, $y_t = y_t^*$. Second, the central bank is assumed to prefer a "*continuity of the short rate,*" so that surprises in the evolution of short-term nominal interest rates are minimized and $R_t - E_{t-1}R_t$ is "smoothed" in a sense to be described in detail in Section 4.. Third, the central bank is assumed to prefer *a fixed low inflation target.*so that $\pi_t = \pi$.

Below, we use our model to show that the central bank cannot, in general, achieve all three objectives simultaneously. We show how different resolutions of this incompaitibility influence the behavior of inflation, interest rates, and output over time. Moreover, we argue that this "fundamental tension of central banking," and the evolution of the Fed's choice of how to resolve it, are central to understanding the rise and fall of inflation in the United States.

4 Putting the model to work

We now investigate the implications of the model for three features of the 1967-1987 interval that we think are important.

Trend inflation: We begin by asking what the model suggests about the evolution of trend inflation. For example, Figure 1 shows that between 1967 and the middle of 1978, inflation increased by several percentage points, from an average level of under 3% to an average level of about 7%.[9]

Expectations about future inflation: We next ask how the model indicates that macroeconomic economic activity is affected by changes in beliefs about expected

[9] Text to possible include somewhere

We are interested in three related questions. First, what economic considerations lead to variation in trend inflation? Second, under these assumptions, what types of shocks would change the trend inflation rate and did these appear to occur in the decade preceding Volcker? Third, what are the implications of this viewpoint for the evolution of beliefs and outcomes during 1979-1984?

future inflation. We stress that the effects depend on how the monetary policy authority responds to shifts in expected inflation..

Disinflation with imperfect credibility: Finally, we ask how inflation, output and interest rates would evolve under an imperfectly credible disinflation, as we believe occurred during 1980 through 1983.

4.1 Trend inflation variability

Suppose that there is a central bank which seeks to have a zero output gap and to also assure that there are small period-to-period changes in the nominal interest rate. Then, the Phillips curve (1) implies that current and expected future inflation must be equated

$$\pi_t = E_t\pi_{t+1} + h(y_t - \kappa_t) = E_t\pi_{t+1}$$

Some analysts have used this model feature to argue for a policy of zero inflation. However, in general, we note that a zero output gap simply means that there is a random walk process for inflation,

$$\pi_{t+1} = \pi_t + \nu_{t+1}$$

with ν_{t+1} being a random shock – to be determined later – with the property that $E_t\nu_{t+1} = 0$. In terms of the six key model characteristics which we stressed above, we note that the absence of a long-run trade-off means that a zero output gap is consistent with stochastically evolving trend inflation.

Suppose also that the central bank seeks to have small expectation errors for the level of the nominal interest rate, in the face of a stochastically evolving real rate, which we here take to be exogenous and governed by $r_t = \rho r_{t-1} + \varepsilon_t$.[10] The Fisher equation (3) implies that

$$R_t - E_{t-1}R_t = (r_t - E_{t-1}r_t) + (E_t\pi_{t+1} - E_{t-1}\pi_{t+1}) \tag{8}$$

Hence, the nominal interest rate can be made perfectly predictable, in a one step ahead sense, by choosing $\nu_{t+1} = -\varepsilon_t$. [11] That is, in ways that are reminiscent of Goodfriend [1993] and Barro and Broadbent [1997], the central bank's concern for smoothing the nominal interest rate produces nonstationarity in a nominal variable. However, in our context, this nominal variable is the inflation rate rather than the price level.

Under this inflation process, the effect of a real interest rate innovation on the path of the nominal interest rate is given by

$$E_tR_{t+j} - E_{t-1}R_{t+j} = (\rho^j - 1)\varepsilon_t$$

[10] In terms of the RBC analysis above, $\varepsilon_t = \sigma\rho\eta_t$

[11] More generally, it can be made more predictable by selecting $\nu_{t+1} = -\phi\varepsilon_t$, with $0 < \phi < 1$, as in the discussion in appendix B

so that a rise in the real rate lowers the future path of the nominal rate by lowering expected inflation. Hence, this model suggests that there should be increases in trend inflation brought about by periods in which the real interest rate is low. For example, surprisingly low productivity growth typically leads a low real interest rate – accompanied by low employment and low output – in real business cycle models. However, more generally, many different kinds of real shocks could be affect the real interest rate: according to this model, such shifts would contribute to the variability of trend inflation.

The nominal long-bond rate would reflect the inflation effects more promptly than the short-rate. According to (7), the response of the long rate is

$$\begin{aligned} R_{Lt} - E_{t-1}R_{Lt} &= \frac{1}{L}\sum_{j=0}^{L-1}[E_t R_{t+j} - E_{t-1}R_{t+j}] \\ &= \frac{1}{L}\sum_{j=0}^{L-1}(\rho^j - 1)\varepsilon_t = [\frac{1-\rho^L}{1-\rho} - 1]\varepsilon_t \end{aligned}$$

so that it is more negative as longer horizons, reflecting the decline in trend inflation.

We think that an interaction between central bank concern for "interest rate continuity" and output gap stabilization is a very real source of variations in trend inflation. This interaction is very stark in the current model, but present in many other modern models as well. As an example, we study the "sluggish inflation" model of Fuhrer and Moore [1995] in appendix B. There, we see that the implication continues to hold and, in fact, concern for interest rate continuity produces even larger variations in trend inflation, although these do not take place immediately as in the present model.

4.2 Inflation scares

Suppose that there is an exogenous, permanent increase in the expected rate of inflation

$$s_t = (E_t\pi_{t+j} - E_{t-1}\pi_{t+j})$$

for all $j > 0$. The effects of this change on the macroeconomy depend importantly on how the central bank allows current inflation to respond.

4.2.1 Full accommodation

The responses are very simple in our model if the current rate of inflation rises by s_t, then there is no effect of the inflation scare on output and there is thus an unchanged path of the real interest rate. Hence, the short-term and long-term real interest rate both rise by s_t. Overall, the economy simple has a higher expected rate of inflation and higher nominal rates, just as it did – in the long-run – in response to the exogenous shocks driving changes in trend inflation in the last section.

4.2.2 Inflation fighting

If the rise is expected inflation is resisted by the central bank, then there is a more complicated pattern of responses. For simplicity, suppose that the central bank keeps inflation at the level prevailing prior to the expectations-shock. In this case, there must be a decline in output,

$$y_t - \kappa = -\frac{1}{h} s_t$$

With output at t less than output at t+1, the real interest rate must rise

$$r_t = \sigma[E_t y_{t+1} - y_t] = \sigma s_t$$

and thus the nominal interest rate increases.

$$R_t = r_t + E_t \pi_{t+1} = \sigma s_t + s_t.$$

Hence, in order to restrain inflation, the nominal rate must aggressively, accompanying a rise in the real rate and a decline in output.

4.3 Disinflation with imperfect credibility

Finally, we use the model to study the effects of an imperfectly credible disinflation, following Ball [1994a]. Our assumption is that the disinflation takes the following form, beginning from a level of inflation $\overline{\pi}$. At the start of the disinflation (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) of this inflation process is $\underline{\pi}$. Each period, agents know 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

$$\begin{aligned} \widetilde{\pi}_0 &= \overline{\pi} - \mu t \qquad \text{for t=0,1,...T} \\ \widetilde{\pi}_t &= \underline{\pi} \qquad\qquad \text{for t=T+1,T+2,...} \end{aligned}$$

with $\mu = (\overline{\pi} - \underline{\pi})/T$. We display a disinflation which reduces the inflation rate from 10% to 4% over the course of three years in Figure 6. The disinflation is assumed to be imperfectly credible in that agents do not believe that it will succeed for the first year and then gradually adjust their assessment upwards over the course of the next three years.

4.3.1 Expected inflation and output

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 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 expected disinflation effect stressed by Ball (1994a). The second term in this expression is the credibility effect introduced by Ball (1995) and that we stress in this analysis.

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

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

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

Note that the path of output then depends on two features. First, for fixed probabilities of success ($\gamma_t = \gamma$), it depends on the expected disinflation under the $\widetilde{\pi}$ path. Second, for fixed probabilities of success ($\gamma_t = \gamma$), the size of the recession depends positively on how long the 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 an 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.

Figure **??** displays the behavior of real output under our assumptions about the course of the disinflation and the evolution of beliefs. Output reaches a trough two years after the initiation of the policy, somewhat before inflation reaches its lowest level. Output continues to be low and rising after inflation has settled down, as a result of the continuing imperfect credibility of the disinflation program.

Figure **??** also displays the real interest rate under the assumption that the preference parameter σ is one, so that this graph is also interpretable as expected output growth. The real interest rate rises over the course of the recession, because output growth is high at each date. This is because individuals in the economy attach a substantial probability at each date in the first two years to the possibility that the anti-inflation program will be abandoned and output will snap back to its capacity

level. From our perspective, this finding illustrates an important point about the real interest rate over the course of an incredible disinflation, in that it is likely to rise as the recession deepens. It also illustrates a limitation of the simple model that we have constructed, in that the magnitude of interest-rate response to this attempt at consumption-smoothing is very large. However, in a model with a better real business cycle core, it should be the case that consumption would be smoothed more substantially, the real interest rate would be less responsive, and investment in business and consumer durables would be particularly responsive to the recession.

Finally, Figure 8 shows the response of expected inflation at various horizons under our assumptions. At each date in the figure, we compute the expected rate of inflation one period ahead as above and we also calculate the expected ten year average rate. Our assumptions about belief means that it takes some time for either inflation rate to depart from $\overline{\pi} = .10$ and also that the expected future average inflation rate is much more stubborn. Such inflation expectations should form an important part of the 10 year bond rate, as indicated by (6).

The broad features of an incredible, gradual disinflation revealed by our analysis are (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 during the midst of the recession; and (iv) expected inflation will be stubborn, particularly at long horizons.

5 Interpretative History

We now turn to our main concern, interpreting the history from 1967-1986 as stemming from the four elements highlighted in the previous theoretical section. First, we use the idea that central bank behavior – particularly a policy of simultaneously seeking output at capacity and continuity in the short rate – interacted with real shocks to produce a steady upward drift in inflation. Second, we use the idea that this upward drift in inflation, combined with a lack of a natural nominal anchor, gave rise to increasingly volatile private sector inflation expectations and in particular inflation scare episodes. Third, we use the idea that the central bank at times resisted the rising inflation or the inflation shocks stemming from oil prices, raising real rates and slowing economic activity. But because it did not do so aggressively and in a sustained manner, the effects of this was to leave the trend rate of inflation higher than previously, a pattern which reinforced the volatility of private sector inflation expectations. Fourth, we use the idea that the ultimate disinflation had large real effects partly because it was associated with imperfect credibility and that the recession ended only as agents began to adjust their inflation expectations downward.

Throughout our interpretative history, we use four sources. First, we look at the macroeconomic time series (two measures of inflation, three interest rates, the employment rate, and output per man-hour) that we looked at previously in section

2. Since a major focal point of the discussion of this is the Volcker disinflation period of mid 1979 through 1986, we reproduce those charts to allow for a more detailed discussion of month-by-month developments. Second, we use the annual World Almanacs 1976-1985 to identify the major world and national events of the period, as catalogued by contemporary observers. One implication is that there are only some intervals during which macroeconomics – inflation, real activity and monetary policy – rises to a level that is occupies a substantial part of the historical record. Third, we employ the transcripts of the FOMC meetings and the associated staff briefing papers to provide an indication of the contemporary viewpoints of FRS decisionmakers. Fourth, we use the model elements above to provide interpretation of the interplay between these historical elements.

We discuss six subperiods of U.S. history in subsections below. First, in subsection 4.1, we provide the relevant background on inflation dynamics, 1967-1976, and interpret the pattern rising inflation and sporadic anti-inflation actions within our model. Second, in subsection 4.2, we discuss rising concerns about inflation during January 1977 through July 1979. Third, in subsection 4.3, we discuss the initial containment of inflation from August 1979 through October of 1980, which left the U.S. with an annual inflation rate in excess of 10%. Fourth, we discuss the deliberate disinflation of November 1980 through June 1982. Fifth, we discuss the return to business as usual during October 1982 through May 1983. Sixth, we discuss a bond market challenge to the disinflation during June 1983 through August 1984.

5.1 The background: inflation dynamics, 1967-1976

We now show how the model can be used to understand inflation dynamics in general, and we illustrate these points by reference to the period of rising inflation from 1967 to 1976. We want to explain three key features of the period: (1) the tendency of inflation exhibit random walk behavior with an upward drift, (2) periodic recessions during which both employment and inflation fell temporarily, and (3) the tendency for inflation scare shocks to become more severe over time.

Our model of inflation dynamics recognizes the incompatibility of the three fundamental objectives of monetary policy. Briefly, these objectives are as follows. First, the Fed was founded in 1913 to smooth short-term nominal interest rates against liquidity disturbances so as to eliminate the kind of short term nominal interest rate spikes that afflicted the US economy in the decades prior to the founding of the Fed. The Fed quickly succeeded in doing that and the "continuity of the short rate" remains a core objective of monetary policy to this day.[12] Second, the Fed gradually assumed responsibility for stabilizing employment, tentatively in the 1920s and 1930s, and again in the 1950s after the Employment Act of 1946 made government formally responsible for macroeconomic stabilization and the Fed regained its monetary policy independence in 1951 from Treasury dominance during World War II. Third, the Fed

[12] See Goodfriend (1991) and Poole (1991)

slowly came to recognize its role in stabilizing inflation, in the 1950s and thereafter, as the gold standard ceased to be an effective protector of the purchasing power of money.

The essence of our model is this: The Fed cannot (1) maintain "continuity of the short rate," (2) stabilize the output gap, and (3) maintain low and stable inflation simultaneously in the presence of a shock to potential output. According to our model, the tension that the Fed faces in trying to pursue these three objectives accounts for the dynamics of inflation and the key features of the inflationary period from 1967 to 1976.

5.1.1 Upward Inflation Drift

We begin by explaining the reasons for the inflation drift during the period in terms of the tensions in the model. To illustrate the nature of these tensions, consider a negative shock to potential output. Since potential output is first-order autoregressive in first differences, potential output continues to fall but at a diminishing rate following a negative shock, asymptotically approaching a permanently lower level. The consumption Euler equation yields the path that the real interest rate that must obtain if actual output is to follow potential output exactly, i.e., for the output gap to be perfectly stabilized. In this case, that "natural" real interest rate must follow a first order autoregressive process because the process for potential output is autoregressive in first differences. Thus, if the output gap is to be stabilized, the real short term interest rate must *jump down* immediately in response to a negative shock to potential output, and the then return to its initial level asymptotically over time. Note that the real short rate must jump *down* to stimulate aggregate demand in response to a negative shock to potential output because, otherwise, aggregate demand would fall below potential output.

The model, therefore, implies that to stabilize the output gap and inflation, the Fed must give up on "continuity of the short rate," move its nominal federal funds rate immediately and discontinuously by whatever is needed to shadow the natural real rate of interest, and persist in shadowing the natural rate with the nominal federal funds rate as it slowly returns to its initial level. In this case, the expectations theory of the term structure of interest rates implies that the short and long nominal interest rates move together with innovations in the short rate having greater variance.

In fact, the Fed did not give up on "continuity of the short rate." It did not begin to move real short term interest rates aggressively enough on a consistent basis to contain inflation until Paul Volcker became Fed chairman in 1979. Instead, the Fed made "continuity of the short rate" and output gap stabilization its primary objectives during the period. The model shows that the pursuit of these two objectives makes the inflation rate behave like a random walk. The reason is this. From the price-setting equation output gap stabilization makes expected inflation equals actual inflation. This is the standard property of the vertical Phillips curve. When the

output gap is stabilized, either inflation is stabilized at its current rate or it behaves like a random walk. We saw above that inflation can be stabilized if the Fed shadows the natural rate exactly with its nominal funds rate instrument.

However, the model implies that inflation must behave like a random walk if the Fed attempts to stabilize the output gap and maintain a continuity of the short rate. To see why, consider again a negative shock to potential output. We model continuity of the short rate as the Fed's reluctance to drop its nominal federal funds rate policy instrument as much as the required fall in the natural real rate consistent with the stabilization of the output gap and inflation. If the public is confident that the Fed will make actual output follow potential output, then price setters respond by raising both current and expected future inflation to satisfy the price-setting equation and make the cut in the real federal funds rate match the required drop in the natural rate consistent with stabilization of the output gap.[13] According to the Fisher equation and the constancy of expected inflation, the Fed is then expected to move the nominal federal funds rate back up with the shadow real natural rate as the latter returns gradually to its long run level. The nominal federal funds rate will move above its initial level by the amount of the upward drift in actual and expected inflation due to the Fed's inclination to maintain a continuity of the short rate.

In general, our model implies that the Fed's joint pursuit of stabilization of the output gap and continuity of the short nominal rate inadvertently caused the inflation rate to behave like a random walk, with positive (negative) innovations to trend inflation associated with negative (positive) shocks to potential output. Thus, the model explains one of the main features of the Great Inflation: the well-documented random walk component in the inflation rate.[14]To reiterate, we are not saying that the Fed was pleased with the drifting inflation rate; it was not. We are saying that of the three fundamental objectives of monetary policy, more often than not the Fed felt compelled to stabilize the output gap and maintain a continuity of the short rate. This is probably because the macroeconomic and financial market benefits of achieving these objectives were immediately apparent, while the problems associated with inflation drift took time to develop.

Nothing in our theory of inflation drift due to central bank interest rate smoothing and output gap stabilization necessarily predicts upward drift. The model predicts upward inflation drift only if the preponderance of shocks to potential output during a particular period is negative. Our theory of inflation drift is symmetric; it predicts downward inflation drift in a period of positive shocks to potential output growth, or the reversal of negative shocks. That said, our model does predict upward inflation drift in the 1970s given the negative shocks to potential output that occurred then, associated with the general slowdown of productivity growth in the second half of the decade and the negative shocks to potential output associated with such drags as the

[13]Price-setting firms respond this way in equilibrium because they know that if they do not, then the central bank can respond so as to make them worse off.

[14]See, for instance, Cecchetti (1995), and Cogley and Sargent (2001, 2004).

oil price increases, the increasing tax rates on personal income and on capital income due to the incomplete indexation of tax rates to inflation.[15]

5.1.2 Inflation Fighting Episodes

Generally speaking, inflation did not greatly concern the Fed or the public when it was reasonably steady and predictable. That is why, for the most part, the Fed continued to give precedence to its continuity of the short rate and output gap stabilization objectives during the period. Individuals and firms are inconvenienced only slightly by steady inflation as long as wages, prices, and asset values move up in tandem, there need be no big financial consequences, especially if inflation remains reasonably low. However, a significant, persistent departure of inflation above a previous trend causes anxieties because people wonder where a new trend will be established. Financial intermediaries worry about how high nominal interest rates will go, investors worry about how much of a premium to price into long bond rates, businesses worry about how aggressively to price in order to cover increasing costs, workers worry about maintaining the purchasing power of their wages. Everyone worries about possible real effects of inflation associated with possible high real short-term interest rates due to Fed inflation-fighting actions, rising real tax rates due to imperfect indexation of tax rates, and potentially disruptive wage, price, credit, or other controls on economic activity to fight inflation. In effect, once inflation appears to become unhinged, the Fed *must* address the widespread insecurities that rising inflation creates, even if doing so creates insecurities about jobs and interest rates. Thus, sharply rising inflation overcomes the usual Fed priorities on employment and interest rate smoothing.

Romer and Romer [1989] document that the Fed moved to fight inflation on two occasions between 1967 and 1977, respectively, in December 1968 and April 1974. Both inflation fighting episodes were preceded by sharp increases in inflation. Inflation rose from around 2 1/2% in mid-1967 to around 4 1/2% by the end of 1968. And inflation rose from around 3% at the end of 1973 to over 9% by April 1974, with core inflation rising to 6%. In both cases, the significant, persistent departure of inflation above the previous trend created anxieties that temporarily caused the Fed to move its federal funds rate policy up aggressively and *tolerate an output gap* to contain the rising inflation trend. 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 employment began to contract as the recession began in late 1969. Inflation peaked in 1970 at around 5% and fell temporarily until 1973. The Fed began to move the federal funds rate up sharply in early 1973, as employment grew rapidly and inflation began to rise, from around 5% and held it in the 10% to 12% range through most of 1974 as employment contracted in the recession; and inflation temporarily slowed to around 5% in 1976.

[15] See Feldstein (1983).

In terms of our model, it is obvious that the oil price shock in the fall of 1974 was a major contributor to rising inflation then, directly and through its negative effect on potential output. The inflation of the late 1960s is usually attributed to the Vietnam War. In terms of the model, the increase in government purchases that occurred in connection with the Vietnam War acts like a negative shock to potential output *available for consumption*. An expected *buildup* of government purchases connected with a widening war in Vietnam would have similar effects in our model to a negative shock to potential output expected to cumulate, as long as one defines potential output as output net of government purchases for the war effort.

5.1.3 Growing Exposure to Inflation Scare Shocks

In light of developments in the 1970s, perhaps the most disturbing consequence of the Fed's inclination to pursue continuity of the short rate and output gap stabilization was that such central bank behavior made the innovations in trend inflation depend on the shocks to potential output, something largely outside the central bank's control. If inflation was low and shocks to potential output were small, then such "business as usual" central bank behavior would not entail much risk of inflation drift. However, the model predicts that inflation drift becomes more serious if the economy enters a period in which shocks to potential output become larger. In fact, *negative* shocks to potential output did become larger in the second half of the 1970s as the great productivity slowdown became increasingly apparent. According to our model, in that environment "business as usual" at the Fed should expose the economy to greater upward drift in inflation and inflation expectations. And a pronounced upward inflation drift did resume after 1976. Furthermore, the upward drift in inflation created secondary negative effects on potential output as higher inflation raised effective tax rates and reduced the incentive to work and invest.[16]

Moreover, the model predicts that in an environment of prolonged upward inflation drift the public will become more nervous about the *threat* of shocks to potential output that *could* raise trend inflation. Financial markets would be susceptible to "inflation scare shocks," sharp increases in long term bond rates due to rising expected trend inflation. Inflation scare shocks could be connected with news of current negative shocks to potential output; but they need not be. Inflation scares could be triggered by economic data, political developments or any news thought to have predictive content for negative shocks to potential output and inflation in the future. Thus, inflation scares can take on a life of their own. When this happens, inflation scares may become a possibly *independent* source of shocks to the economy, separate from actual shocks to potential output.

Inflation scare shocks greatly complicate monetary policy because they confront the central bank with a dilemma. On one hand, the central bank can continue to try to stabilize the output gap and pass higher expected inflation to actual trend inflation.

[16] Feldstein (1983).

Pass-through, however, may not relieve the upward thrust of inflation expectations if the underlying reason is an expected future negative shock to potential output. And pass-through might invite more upward pressure on expectations if it is interpreted as a sign that the central bank is unwilling to give up on output gap stabilization to fight the inflation scare. On the other hand, the central bank can fight the inflation scare by creating an output gap to offset the effect of higher expected inflation on current inflation, hoping that it can reverse the increase in inflation expectations and contain trend inflation without a prolonged recession.

It is interesting to note that the 10-year bond rate rose by around 2 percentage points from 1968 from around 6 to 8 percent, and then fell all the way back to the 6 percent range in 1971, suggesting that the Fed's inflation-fighting actions in 1969-70 fully reversed the rise in expected inflation that occurred at the time. However, the 10-year rate then rose steadily from 6% to 8% straight through the Fed's inflation-fighting actions in 1973-4, and fell back only a little as actual inflation troughed temporarily in 1976. Apparently, the public was already aware of the growing potential for upward drift in inflation to come.

5.2 Rising concerns: January 1977-July 1979

During January 1977 through July 1979, there was a widespread and rising concern about high and increasing inflation in the United States, on the part of the public and the Federal Reserve System. In this section, we review elements of this crucial period, with the time-line from the Almanac reported in Table 1.

Although inflation was running at 5% rate in early 1977, it increased to over 9% in July 1979, as shown in Figure 1 (1). By mid-1977, the employment rate had returned to the level of 58% that had prevailed before the recession of 1973-1975 and it then increased to an all time high-time of about 60% by mid 1979 as shown in Figure 2 (2). Turning to a closer examination of these series, we can see that employment and inflation both rose sharply from January 1977 through July of 1977, with inflation reaching the 6% level by the middle of the year. At the start of the year, the Federal Funds rate stood at 5%, having ranged from that level up to 5.5% during the previous year. Such policy choices implied that the real interest rate was about zero for a year prior to the surge in inflation and employment. The long-term rate stood at 7% at the start of 1977, but it immediately began a steady climb to 8% by year's end. During this period, the Federal Funds rate stayed flat during the first quarter and then followed rising T-bill and T-bond rates upward until it reached 6.5% at the end of 1977. But this still left the real interest short-term rate close to zero. Inflation and employment both continued to increase rapidly through the second-half of 1977 and the first-half of 1978.

Beginning in August 1978, the FRS engineered a sharp rise in the funds rate, which results in an RR date for this month. But despite this action, inflation and the long-term bond rate continued to rise through the middle of 1979 and employment

reached its highest level in the post-war period in early 1979 before leveling off the rate of 60%, which was sustained through the middle of 1979. At the same time, output per man-hour fell from about 2% per annum in early 1977 to close to zero in mid 1979. Presumably, some part of this is the normal decrease in output per man-hour that occurs in expansions, particularly the latter stages, but an important component was likely the continuing decline in underlying productivity growth.

5.2.1 Controversies over monetary policy

In November 1976, in testimony before the Senate Banking committee, Arthur Burns warned that there might be inflationary consequences of attempts to stimulate the economy through tax cuts, increased government spending, or looser money policy. President-elect Jimmy Carter had said he would consider such steps if economic activity continued to be slow on his taking office in January 1977. 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 the Burns 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."[17]

In late December 1977, in a surprise move, Carter announced the replacement of Arthur F. Burns with G. William Miller, chairman of Textron. While Burns' term as chairman was to expire a the end of January 1978, his term as a governor did not expire until 1984 and there was some expectation that he might continue as chairman. [MG: elaborate]. But Vice President Walter Mondale, Treasury Secretary W. Michael Blumenthal and other liberal counselors had lobbied to replace Burns.

During October and November 1978, the Federal Reserve System surfaces in the historical record with increases in the discount rate to 8.5% in October and to 9.5% in November. These increases capped a sequence of earlier smaller changes to raise the discount rate substantially relative to the June 1978 level of 7%; the October and November increases were each taken after a major slide in the U.S. dollar and each set a historical record high for the widely visible discount rate.

By April 1979, Volcker was at odds with the policy actions taken by the FOMC, sufficiently so that Chairman Miller noted "Paul, you're just a constant no."[18] In view of later events, his comments are revealing. First, in continuing committee debates over the relative role of monetary aggregates and interest rates in formulating the directive, he argued

> "that the only reasonable conclusion is not to put much weight on the aggregates. We see relationships that go way out of the range of historical experience. We haven't any idea of the validity of the forecast [for the

[17] Quotations are from World Almanac.

[18] Transcripts, 4-17-1979, p. 35

monetary aggregates], I'm afraid, and the combination of those two events does not make me want to linger over the aggregates." (FOMC *transcript*, 4-17-79, p. 15)

Second, he question forecasts for real output and inflation, stressing that inflation was an important problem and it required a commitment of policy to long-run objectives

"When I look at the outlook for real GNP, it does seem to me that the staff forecast of six quarters of approximately 1 percent growth in GNP per quarter is inherently improbable. I don't think that has ever happened...

The inflation projections have been consistently on the low side. And I'm not just talking about the staff's projections; I think that has been true of most forecasters. And [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. I'm afraid that is the impression that we are conveying. 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. 15-16)

Third, he was skeptical about the conventional view at the time that policy was tight and inappropriately so.

"I think the economy is essentially at full capacity and there is a real chance that the concern about a recession will be justified. But I also think there's some possibility we will have more of a boom for a longer period of time than we hope. I think it's clear that real interest rates are falling and the rate of inflation is up....the expected rate of inflation has increased somewhat in the last six months and the nominal rate of interest has not. Therefore, the real rate of interest has declined. I don't see any reason why the profitability of investment under present conditions would be declining..., so I think policy has probably gotten somewhat easier." (FOMC *transcript*, 4-17-79, p. 16)

5.2.2 Anti-inflation policy of the Carter administration

In January 1977, as the Carter administration took office, government statistical agencies reported that the unemployment had fallen to 7.9% in December, a decrease of 0.2% from the November rate, and that consumer prices had risen a modest 0.4% in December, capping capped a year with the lowest rate of inflation in consumer prices since 1972.

In April 1977, Carter revealed his administration's anti-inflation program, designed to reduce inflation from 6% to 4% by the end of 1979, which relied on overall fiscal and economic policy as well as cooperation from business and labor, rather than on price and wage controls. But, inflation was again picking up, with sharp rises in wholesale price index (1.1% monthly increases in both March and April). In May 1977, unemployment hit a 29-month low, falling from 7.3% to 7%, while the total number of persons employed hit 90 million for the first time, with a second consecutive monthly gain of more than 500,000 jobs.

Yet, in October 1977, despite a national unemployment rate of 6.9% in September, government officials stated there was little long-term improvement in the employment situation, particularly for blacks. William Proxmire, the Wisconsin Democratic Senator and gadfly, said that the data indicated the economy was still in a period of "stagflation," i.e., a time when economic growth is stagnant while inflation grows. In particular, Proxmire argued that "the whites are doing pretty well, but the blacks are taking it on the chin."

Rising inflation then prompted Carter to announce an additional Anti-Inflation plan in April 1978, including limiting salary increases for government workers. He appealed to industry and labor leaders to show restraint in price and wage increases, but his plan met was not supported by AFL-CIO president George Meany. A May 22 *Business Week* special report on the economy described the country as being "caught in the grip of the worst, most prolonged and most pernicious inflation in its history." Carter's program met with continuing criticism from business and labor leaders; he also faced criticism within his party on lack of administration attention to unemployment, which stood at 5.9% in August 1978.

In late October 1978, the Humphey-Hawkins Full Employment Law was passed in Congress and signed by President Carter. As its title suggests, even though the US employment rate was at its highest historical level, increasing employment was the principle intent of this legislation.

> "An Act...to assert the responsibility of the Federal Government to use all practicable programs and policies to promote full employment, production, and real income, balanced growth, adequate productivity growth, proper attention to national priorities, and reasonable price stability;"[19]

[19] This part of the preamble of the Humphrey-Hawkins Act did not appear in the Almanac.

The Humphrey-Hawkins law set national goals of reducing unemployment from the 1978 level of 6% to 4% by 1983. It also set the goal of reducing inflation to 3% by 1983 and to zero by 1988, but specified that this was not impede reducing unemployment. At the same time, the legislation initiated no programs, leaving it to the President and Congress to determine the means to achieve its goals.

Late 1978 and early 1979 also witnessed turmoil in Iran, 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 Middle East oil embargo of 1973-1975.

In addition to these events, the Almanacs also record continued increases in inflation in March 1979, which "deeply disturbed" President Carter ; the Domestic Summit of July 1979, at which Carter described "an erosion of confidence in the future that is threatening the very fabric of America"; and the nomination and swift confirmation of Paul Volcker to replace G. William Miller as the chairman of the Federal Reserve Board.

5.2.3 Interpretation

During the early Carter administration, there was rising inflation, mainly driven by increasing inflation expectations and lower growth in productivity. Later, these factors were accompanied by rising energy prices, but at least some observers interpreted the oil price adjustment as responses to declines in the value of the dollar. The Carter administration viewed the use of monetary policy to contain inflation as potentially very costly in terms of real activity in general and unemployment in particular, so that it built its anti-inflation programs around fiscal and regulatory methods.

While the Fed under Burns had engineered a decline in inflation to the 5% by the end of 1976, policy during 1977 involved a low funds rate as the inflation rate accelerated. Continuing this pattern, the Fed under Miller was slow to respond to rising inflation and its interest-rate actions between August 1978 and November 1978 essentially adjusted nominal rates to the rise in expected inflation.

Looking at the record before and after Romer and Romer [1989] dates, there is a recurrent pattern, highlighted previously by Shapiro [1994] and displayed in Table 2. The RR dates follow periods of rising inflation in each case, so that it is arguable that the Fed is responding to rising inflation. However, within two or three years, inflation is no lower than at the time of the policy action, indicating that these events were potentially attempts at inflation containment or, at best, aborted attempts at reducing the inflation rate. The anti-inflation policy actions in August 1978 and November 1978 follow this pattern.

5.3 Containing Inflation: August 1979-October 1980

When Paul Volcker became chairman in August 1979, he faced a rapidly rising inflation rate. We describe the 15 month period through October 1980 as a involving inflation containment. By this, we mean that the Federal Reserve System took actions to restrain a rising inflation rate, which it accomplished by the early fall of 1980, but 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.

5.3.1 Initial statements and actions

Confirmed on July 30th and sworn in on August 6th, Paul Volcker faced immediate challenges. The Almanac reports that the Labor Department unveiled 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." The Almanac also reported the JECs finding that output per man-hour in the total private business sector had decreased at a 3.3% annual rate, while that in the nonfarm business sector had fallen at a 5.7% annual rate. [20] The Fed's response also made the news, in the sense that the Almanac reports an increase in the discount rate from 10 to 10.5% on August 16th and to 11% on September 18th.[21]

In laying out his overall monetary policy philosophy and arguing strongly for a rate increase in the August 14th 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. It's not that we didn't have it before, but I think people are acting on that expectation [of continued high inflation] much more firmly than they used to. That's important to us because it does produce, potentially and actually, paradoxical reactions to policy. Put those two things together and 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, although there would be differences of judgment on that. 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).

He also stressed that "it would be nice if ... we could restore [the credibility] of economic economy policy in general on the issue." He also argued that the FOMC didn't

[20] Figure – shows a decline in productivity in the first half of 1979, albiet a smaller one because of our use of year-over-year changes.

[21] [fn Marvin material on why rate increased on 8-16].?

"have a lot of room for maneuver and I don't think that 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 (2004, page 11) provide longer versions of these latter quotations and highlight their importance for understanding the new chairman's thinking.

The basic macroeconomic model that we described in section 2 above highlights the role of expectations, so that there is ready potential for the type of perverse effect of policy actions described by Volcker. In particular, if growth in nominal aggregate demand is interpreted as permanent, then it will exert no effect on output and have a major effect on inflation and the nominal term structure.

5.3.2 October-November 1979

The FRS change in operating procedures is arguably the best-known central banking event of post-war U.S. macroeconomic history. The Almanac reports that this event came on the heels of wide-spread speculative increases in commodity markets. Lindsay, Orphanides, and Rasche (2004, page 15) emphasize that there had been a highly publicized for 4-3 split decision on the September 1979 discount rate increase. The commodity market developments may have arisen from speculator beliefs that a divided Federal Open Market Committee would be unable to control rising inflation. In the crisis atmosphere, a range of actions was taken in October 1979 (See the Almanac Record in Table 3), with the overall result being a swift rise and major rise in the funds rate.

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. Arguing for the new operating system, Volcker made his position clear on three elements:

> "we can capitalize psychologically on monetarist support throughout Europe in particular, as well as in the Congress of the United States and much of the journalistic fraternity today. ... They can give us support in what is essentially a psychological situation";
> (FOMC *transcript*, 10-6-79, p. 17)

Second, he stressed that interest rate policy was potentially compatible with monetary targeting:

> "This is not black and white. We could decide–to use an extreme example–that we don't want to say anything about a federal funds range in the directive today, but keep to ourselves the idea that the Desk should have plenty of leeway. If the market dictates– in the way it responds to what we're doing–that the federal funds rate should go temporarily to

15 percent, we'd let it go. I wouldn't worry about that. If sometime after 90 days–or it may take even longer–we find that this [new operating technique] has served its purpose, we can go back to including a federal funds range that is broad but nevertheless there, if we wish to.". (FOMC *transcript*, 10-6-79, p. 17)

Third, that the operating change was essential to anchoring the economic system:

"If we believe in targets at all and believe that we have a responsibility to meet our targets, I think our best bet–not our riskiest–at this point is to take the bull by the horns and change our emphasis of operations." (FOMC *transcript*, 10-6-79, p. 17)

The November 1979 FOMC meeting was lengthy, focusing initially on the magnitude and consequences of oil price increases and then on the mechanics of the new operating policy. Yet, after these activities, the FOMC members conducted a wide-ranging discussion that was quite revealing about their evolving perspective. A substantial portion of the discussion centered around the objectives of the FRS, the issue of policy credibility and the behavior of the long rate. The rise in interest rates stemming from the October 6 action 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. 23-24)

Governor John Balles provides a compact statement containing many of the key themes of the meeting and the times,

"The only bad result I see from our October 6 actions is the very sharp rise in long-term interest rates. Maybe the school of rational expectations has an answer (to why that occurred), Mark[22], because I can't get an answer from anybody else, including my own staff. To the extent that those rates are influenced by expectations of inflation I'm still wondering why – I'm totally nonplussed – they went up instead of coming down. I think that underscores the point that many people around the table have already made, which is that psychology is so important now. As you so well articulated, 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

[22] The reference is to Mark Willes, president of the Federal Reserve Bank of Minneapolis.

> 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*, 11-20-89, pp.29-30.

While other participants expressed similar surprise about the behavior of long-term interest rates, a harder line was taken by Governor Mayo,

> "My answer to John Balles on the reason why long-term interest rates have gone up is that 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*, 11-20-89, 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 changing expectations about future inflation had led these rates to be highly variable in response to macroeconomic events including policy actions; that imperfect credibility about future monetary policy could lead them as well as to be stubborn in the face of policy actions; and that the management of inflation expectations was a crucial, but highly difficult, part of its job. This is a remarkably modern set of viewpoints, which many contemporary observers of the FOMC would not have suspected at the time.[23] But these perspectives did not mean that the job of taming inflation was easier or that the holding anti-inflation policy constant in the face of a weakening real economy was less difficult for members of the FOMC (or less costly to the economy).

5.3.3 The initial inflation scare: December 1979-February 1980

Against the backdrop of these events, the next three months were shocking to outsiders and to the FOMC. alike. The FRS stopped tightening at end of year, holding the discount rate at an all time of 13.75% with the funds rate at 13.49% and the 10 year rate at 10.45% at year's end. Over the course of the next month, by the FOMC meeting of February 4-5, the 10 year rate had rocketed to 11.71% while the funds rate had dipped slightly to 12.80%. Goodfriend [1993] identifies this as "an inflation scare" and many members of the FOMC similarly interpreted it, although with differing degrees of emphasis.[24]

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

[23] We include ourselves in this list.

[24] During Peter Sternlight's presentation, Governor Wallich asked "Could you expand a little on what you perceive as market expectations about future inflation? I see that Treasury bill futures, for instance, have changed by a very substantial amount, something close to 100 basis points over a

"So we have to consider now that we are in a group of high inflation countries with Italy and the United Kingdom. Then comes a tier of moderate inflation countries and then come the low inflation countries. So we've moved really far." FOMC *transcripts* 2-5-80, p. 41.

At the same time, the Fed sensed a turning point in economic activity, with staff economist Joseph Ziesel noting that the economy was "moving into recession."[25] 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 FOMC meeting of March 18, the 10 year rate stood at 12.54%, having increased by 80 basis points since the prior meeting (and having reached a high of 13.2% several weeks before). The funds rate had increased as well with an initial rise of about 100 basis points – surrounding the February 15th increase in the discount rate in the face of worsening inflation news – and then a large jump of 150 basis points to 16.2%, 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 meeting included a "discount rate surcharge of 3%" on transactions with large banks and, within two weeks, the funds rate was at 19%. In the wake of these interest rate changes, commodity speculation cooled, with the Hunt brothers silver empire collapsing in the face of large price declines. So, during the December 1979-February 1980 inflation scare, the Federal Reserve took actions that raised nominal rates substantially. However, ultimately, its policies would only serve to contain inflation.

5.3.4 The recession of 1980

As the recession intensified, the Fed faced substantial pressures. Credit controls were introduced by the Carter administration in March 1980 (add to Table 3) and the administration acknowledged the ongoing recession in April.

In the March 18 meeting, the declining level of real activity concerned FOMC members. The tensions were well illustrated by the remarks 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

month or so." Sternlight replied: "I hadn't focused on that particular quantity, Govern Wallich. It's just that 'expectations of inflation seems to be the most commonly cited factor for this very marked rise in the longer end of the market, with the longer bonds up about 100 basis points over the past month."

[25] add reference to staff document

> 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 painting a picture of an economy was running well and left the FRS 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. 35-36.

Responding to concerns about the effects of high interest rates and credit controls on financial institutions, Volcker argued that

> "I am worried about those financial institutions, and 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. But the way to get the interest rate turned is not by hastening it prematurely. another false start, we'll be in considerable trouble even though that clearly runs the risk of overkill. That risk is greater in its inverse logic than if it's not killed at all; we'll be faced with the same dilemma later on." FOMC *transcripts* 3-18-80, p. 36

5.3.5 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 circustances, 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."[26] The credit controls were complex, consisting of volunary lending guidlines 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.[27]

Schreft [1990] 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."[28] 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 June that the credit control program was phased out in early July.[29]

5.3.6 Summing up

This pivotal period involved a rise in long-term expected inflation, which led to a series of Federal Reserve actions to control the rate of inflation. These actions included the introduction of new operating procedures and increase in short-term interest rates to unprecedented levels in the Spring of 1980. In response to the sharp decline in economic activity that was associated with credit controls, the Fed eased policy in the summer of 1980 and then tightened it again in early Fall.

The net effect of this year is best summarized, in our view, by the following comparisons. In November 1979, the funds rate averaged 13.24% and the 10 year rate averaged at 10.65%. At the close of October 1980, the funds rate stood at 13.17% and the 10 year rate was at 12.37%. Inflation had been contained in the range of 10–11%, according to various measures.

However, from our standpoint as modern observers and the standpoint of individuals at the time, the events from August 1980 through October 1980 had been another example of a recurrent monetary policy phenomenon: rising inflation bringing about restrictive monetary policy, but a legacy of a higher inflation rate after the completion of the episode. In this regard, the anti-inflation efforts in the first year of the Volcker chairmanship looked not too different from the earlier efforts identified by the Romers and listed in Table 2.

[26] See Schreft (1990), pp. 32-3.

[27] The description of the details of the credit control program and its affect are taken from Schreft (1990).

[28] Schreft (1990), page 41.

[29] Schreft (1990) page 43.

5.4 Deliberate disinflation: November 1980-June 1982

We think that the true onset of the Volcker disinflation dates to November 1980 or slightly later. In that month, Reagan beat Carter in a landslide, which would bring about a new course in economic policy in terms of regulation, taxes, and so forth. The Reagan administration voiced support for a monetary policy aimed at reducing inflation (document). Further, beginning in November 1980, the Iran-Iraq war intensifies, increasing concerns about rising energy prices. The Almanac reports a December 1980 jump in CPI inflation to a 12% annual rate of increase (these and other historical events are reported in Table 3).

In late Fall of 1980, the FRS took policy actions that led to a dramatic increase in the Fed Funds rate: it went up from an average of 12.28% in October to 15.85% in November and 18.9% in December, with 1 year Tbill increasing by several percentage points. The funds rate was to stay at 19% through July of 1981, although it dipped due to technical factors associated with reserve management in the Spring.[30] During this dip, the 1 year rate barely responded at first and then increased further to about 16%.

In undertaking the sharp rise in rates, the FOMC understood that its tight policy was risking a renewed recession, but Volcker argued that holding the line against inflation was warranted. In the December FOMC meeting, the Volcker described the FOMC as being "presented with a gloomy forecast by some standards", elaborating that the forecast did not include a recession but also mean 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 shrink back very far; that is my general bias for all the reasons we have state in our rhetoric but don't always carry through on." (FOMC *transcripts* 10-21-80 p. 129)

[30] In March and May, the FOMC was preoccupied with the decline in the funds rate resulting from the new operaring procedures in the face of nationwide adoption of "NOW". While the funds rate dropped, Sternlight indicated that little effect was anticipated on longer-term rates, saying "we've let the markets know."(May 18 2001).

5.4.1 The second inflation scare, Spring 1981

Having raised the short-term rate to 19%, the FOMC must have been shocked to encountering a period of substantial long-rate increases during the Spring of 1981, paralleling the increase that it had experienced in late 1979 and early 1980. In September, the funds rate averaged 10/87%; the 1 year rate averaged 11.52% and the 10-year rate averaged 11.51%. In January, after the aggressive actions of the late Fall, these rates averaged 19.08%; 14.08% and 14.10%. In May, the funds rate averaged 18.52%; the 1 year rate averaged 16.2% and the 10 year rate stood at 14.1%. Long-term inflation expectations appeared to many observors to be moving up, rather than declining in the face of a restrictive monetary policy.

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. 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*, 2-03-81, p. 54).

Expectations had come to be an important constraint on policy, as because as Frederick 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). .

5.4.2 Staying the course

The theme of staying the course was recurrent with Volcker and with other committee members. In July 1981, there were signs that inflation was declining and possibly that a recession was underway, as the NBER would later determined. Volcker argued for continued tight policy,

> "(O)ur job is in assessing where the risks lie... I haven't much doubt in my mind that it's appropriate in substance 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 to the extent it exists. 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 economic 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 and the latent demands in the economy immediately reasserted themselves. Then

> we would look forward to another prolonged period of high interest rates and strain and face the same dilemmas over and over again. Neither of these outlooks is very simple or happy in a sense. But between the two I suspect, hard as it is to say, that the lesser risk in the long run is taking a chance on more sluggishness in the short run rather than devoting all our efforts to avoiding the sluggishness in the short run." FOMC *transcripts* 7-6/7-81, p. 36

In October 1981, President Corrigan of the New York Fed stressed that the crunch was coming, with financial strains are starting to hit.[31]. In the same meeting, FRB staff member Kickline reported that the economy was in recession.

In November, Volcker stresses the unchanged central problem of managing inflation expectations, now compounded by a softening economy.

> "we've got sour business in the very short run. We still have high inflation expectations. I suspect they may be improving a little, but ...I think inflationary expectations are going to be very sluggish to change. Part of the nature of our problem is that the business picture can move much faster up or down. At the moment it is down. Then some other things may change, such as inflation and inflationary expectations and long-term interest rates in particular after all those markets have gone through. That in itself means 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 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).

More detailed macroeconomic data presented at the December 1981 meeting, suggesting a deep real recession, did not budge Volcker and the FOMC much from seeking a reduction longer-term inflation and using long-term rates as a guide to inflation expectations,

> "We may have an insoluble problem. It is not impossible and may even be likely, apart from the short-run question, that we will have the immediate problem of a recession and not want to aggravate that and want to facilitate recovery and all the rest. In that process, I don't think

[31](FOMC *transcripts* 10-5/6-81, p. 12).

> we can forget about what happens when the economy turns around and begins to rise again. If it does, we will just run into another blank wall on sharply rising interest rates–with precipitous increases in money market rates and long-term rates, not just reflecting what is going on but in anticipation of budgetary deficits and economic recovery and restrictive monetary policy–and I'm not sure we will have served the country well. We have to think a bit about strategies to minimize that possibility; we can't eliminate it. The reason the problem may be insoluble is that the only way we are really going to deal with this, I suspect, apart from the budgetary consideration, 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, there were signs of substantial economic weakness accompanied by reductions in inflation. Volcker returned from an emergency phone call to note that

> "On policy, I was going to interject a few comments of my own here. I don't know whether it's time to do that or not but I heard some concerns, which I well understand, and I heard various bits of analysis. I'm sorry I missed the earlier discussion. I think we are in a stage where we could tell ourselves 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. We have a situation where prices are moving much more favorably than can be sustained on the basis of cost trends, and we have costs rising at a somewhat slower rate of speed, but a modestly slower rate of speed. There is a real prospect, I think, of further progress in that direction over a period of time. It is going to take some time. (FOMC *transcripts* 5-18-82, p. 33)

At the next FOMC meeting, Volcker stressed that despite much bad news on the macroeconomic front, it was important to recognize that progress on inflation was being made,

> "The inflation improvement is no longer just a statistical aberration: it's very real. We have a situation where in my judgment, for the first time perhaps in the postwar period, businesses are really looking at themselves.

> They are not just going through the superficial aspects of counting noses and cleaning house in the conventional ways. Beyond that. I think we do recognize that the consumer has done a reasonable job of getting his balance sheet in order." (FOMC *transcripts* 6-30-82, p.)

5.4.3 Expectations and imperfect credibility during the disinflation

As outlined in section 3, our basic modern macroeconomic model implied that there would be important real consequences of an imperfectly credible disinflation. In this section, we have seen that the FRS leadership aimed at keeping policy tight so as to as to bring about a decline in inflation and were successful in doing so, with the annual average inflation rate having fallen to the range of 5.5% by mid 1982.

Yet, in June of 1982 about six quarters into the disinflation, the term structure was relatively flat with the funds rate at 14.15%, the 1 year rate at 14.07% and the 10 year rate at 14.30%. The implied *ex post* real interest rates were above 8%, levels that many observers found staggering.

The U.S. economy was in the midst of a deep recession in mid 1982.. A very simple method of determining deviations from trend in Figure 14 is suggestive of the output gap which contemporary observers may have calculated: it shows that by mid 1982, output had declined nearly twice as far as during the prior recession and it was poised to fall further.

Our basic model predicts extremely high nominal and *ex post* real interest rates over the course of an incredible disinflation, peaking prior to the recession trough but staying very high after the disinflation is completed as a consequence of lingering imperfect credibility. In this regard, the model appears to be consistent with important elements of the Volcker disinflation.[32] However, the model also predicts that real rates will be three times as high as actual experience. As discussed above, this strong implication arises because consumption in the model is equal to output and the real interest rate is related to expected consumption growth as calculated by the economy's agents, who recognize the potential for an aborted disinflation.

In the U.S. economy, as shown in Figure 15, there is a fairly standard business cycle pattern of the components of real output over the course of the 1979-1985 period. Consumption of services – the actual data which most closely resembles the construct in the model – is not very volatile, even during the major recession. Total consumption expenditure is far less volatile than output, even though it contains consumer durables expenditure. Business fixed investment is dramatically more volatile than output. An extended macroeconomic model that incorporated distinct consumption and investment expenditures would surely generate such a pattern and, in the process, moderate the effects of the disinflation policy on the real interest rate.

[32] King and Watson [1996] argue that high real interest rates precede recessions in sticky price models such as the one that we use here. Future research should investigate the timing relations between real rate movements and output movements in greater detail.

5.5 The tipping point: July-August 1982

The Fed brought deliberately disinflationary policy to a surprisingly abrupt end between the July and August 1982 FOMC meetings with a sharp reduction in the federal funds rate from over 14 1/2 percent in early July to around 10 percent in late August.[33] With inflation then running between 4 and 5 percent at the time, the move brought the real federal funds rate down sharply from around 9 percent, where it had been since early 1981, to around 5 percent.

Other interest rates followed the federal funds rate down during the period. Bill rates fell about 3 1/2 to 5 1/2 percentage points, the fall in excess of the federal funds rate reflecting flight-to-quality considerations. For instance, 3-month bill rates fell from over 13 percent to under 8 percent. The prime rate fell in several steps from 16 1/2 to 13 1/2 percent. Intermediate-term Treasury issues–2 to 10 years–were down about 2 to 3 percentage points in yield, and longer-term issues were off about 1 3/4 percentage points.

The first reason the Fed cut the federal funds rate sharply in July and August was to *relieve financial stress* in the domestic and international markets created in part by the high real interest rates associated with deliberately disinflationary monetary policy. Peter Sternlight, chief economist at the New York Fed Trading Desk, described the situation this way in a briefing at the August FOMC meeting:

> "In a market still apprehensive after the mid-May collapse of Drysdale Securities and the smaller scale demise of Comark in June, the July 5 failure of Penn Square Bank had particularly wide repercussions. While Penn Square was only a medium sized bank, it had sold a substantial volume of energy related loans, now regarded as weak, to other banks, notably Continental Illinois. Continental soon began to have difficulty in the CD market, culminating in its decision to acknowledge that its CDs could no longer trade in the top-tier group of major money market banks. The market was not yet calmed from earlier disturbances when another non-reporting dealer firm, Lombard-Wall, filed for bankruptcy, naming Chase Bank among its unsecured creditors. Chase, already hit with a heavy loss from Drysdale and a smaller involvement with loan participations from Penn Square, also began to experience some difficulty with its CD funding, though to a lesser degree than Continental. The Lombard-Wall incident is also having repercussions on the repurchase agreement mechanism as a vehicle for short-term financing and investment arrangements. Finally, near the close of the period, rumors swept the market of heavy losses at major U.S. banks due to exposure to Mexican loans—causing a rush of demand for Treasury bills and a temporary shying away from private short-term paper. So far, the U.S. banking and financial system

[33] The description of intermeeting interest rate behavior comes from a transcript of Peter Sternlight's briefing at the August 24, 1982 FOMC meeting.

has been resilient enough to weather the storm, but market participants are understandably frayed around the edges."

The Almanac noted the Mexican financial crisis in both its August and September 1982 entries. The August entry starts "Peso Falters: Bankers met with leading Mexican officials, Aug. 19, in Mexico City in an effort to devise a plan to prevent the Mexican government from running out of money or defaulting on their debts." The September entry starts "Mexico's Financial Woes Mount: President Jose Lopez Portillo of Mexico announced Sept. 1, that the country's private banks would be nationalized to end what he termed the 'looting' of Mexico through the flight of capital." Among other things, the report went on to say that in the United States, bankers applauded the nationalization because the move assuaged fears that the Mexican government would not have stood behind the debts of private banks."

The banking crisis gave the Fed an opportunity to *test the credibility of its disinflation* by observing the behavior of long term interest rates as it pulled the real federal funds rate sharply lower. The fact that long rates moved down with the funds rate throughout the period demonstrated that the Fed had acquired significant credibility for its disinflation by then, and probably encouraged the Fed to proceed with the aggressive easing of monetary policy that relaxed the disinflationary pressure and ended the recession in November 1982.

The Fed was *willing* to bring deliberate disinflation to an end because it had already achieved an acceptable disinflation by mid-1982, having taken the inflation rate from over 10 percent down to 4 to 5 percent. Moreover, the staff emphasized at the July FOMC meeting that the output gap created by restrictive monetary policy was large enough and likely to persist long enough to stabilize the growth of unit labor costs around 4 percent for the remainder of 1983 and in 1984, so that inflation would likely remain low.

This "tipping point" period is a fascinating one from the perspective of our model. It appears that the inflation scare in bond markets ended *discontinuously* when the Fed demonstrated the credibility of its disinflation by pulling the real federal funds rate down sharply. We are puzzled as to why bond rates did not come down more gradually while the Fed plausibly acquired credibility as the recession persisted. What is needed is a theoretical understanding of the "game" played between the bond market and the Fed that fits the observed behavior.

5.6 Business as Usual: October 1982-May 1983

The Fed returned to what we call "business as usual" in October 1982 when Chairman Volcker announced that the Fed was going to temporarily place less emphasis on the money stock (M1) in its policy deliberations. This announcement effectively marked the end of the new operating procedures adopted in October 1979 to place more emphasis on managing the growth of bank reserves in order to improve monetary control. Monetary targeting played a valuable role as a signal of the Fed's

commitment to fighting inflation. But while monetary targeting helped the Fed build credibility, it was not without cost. On some occasions, e.g., during early 1981, monetary targeting produced movements in the federal funds rate that were inconsistent with the Fed's preferred interest rate policy stance. By October 1982, the Fed was satisfied with the reduction in trend inflation from above 10 percent to around 5 percent. Moreover, the inflation scare in bond markets had broken earlier in the summer, and long bond rates had fallen by over 2 percentage points since then. Hence, the Fed judged that it could dispense with the credibility benefits of monetary targeting in order to manage the federal funds rate more closely as usual. Managing the federal funds rate directly meant, among other things, returning to a "continuity of the short rate."

A second sense in which the Fed returned to business as usual is that instead of creating and tolerating a significant output gap, as it had during the deliberate disinflation, by October the Fed once more adopted an interest rate policy stance designed to close the output gap. And indeed, the deep 1981-82 recession bottomed out in November 1983. Nevertheless, the Fed was careful about administering too much monetary stimulus. Although the employment rate would not return to its 1979 peak until early 1985, the Fed persisted with a relatively high real short rate–holding the federal funds rate in the 8 to 9 percent range through the first half of 1983, even as inflation moved down to the 4 percent range. The Fed did bring the federal funds rate down sharply by around 5 percentage points, but stopped when the long bond rates failed to fall below 10 percent, suggesting that financial markets thought trend inflation was perhaps 3 percentage points or so above the then current 4 percent rate of inflation. Having struggled so hard for so long to fight the inflation scare in bond markets, the Fed remained cautious in easing policy too much too soon.

To summarize the data during this period: inflation continued to fall, from about 5 to 4 percent; employment continued to contract at first and then began to rise sharply in early 1983; short and long nominal interest rates were stable, in the 8-9 percent, and 10 percent ranges, respectively; productivity growth rose sharply with the cyclical upturn, hourly compensation continued to fall sharply as a result of the recession, and unit labor cost inflation plunged during the period, from about 8 percent in mid-1982 to -2 percent in mid-1983; and real GDP grew by 0.6, 2.6, and 11.3 percent annual rates in the 4th, 1st, and 2nd quarters of 1982-83, respectively.

The prospects for a robust non-inflationary recovery from the deep recession looked good as early as November 1982. According to the Almanac "the unprecedented sharp advance on Wall Street continued, with record highs being set in the stock averages and in the volume of shares traded." The Almanac noted 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. It also noted that a 43 point gain on Nov. 3 to close at 1065, "which occurred on the day after the Nov. 2 midterm election, in which Democratic gains were smaller than some investors had expected , was laid to the apparent conclusion that President Reagan's economic policies would

remain basically unchanged." In February 1983, the Almanac reported: "President Reagan, in releasing, Feb. 2, both his 1983 report on the economy and a report by his Council of Economic Advisors, stressed that the keys to recovery were a moderate growth in the money supply and a continuation of free trade. The latter assertion came at a time when Congress was showing support for legislation to safeguard US industry from foreign competition." For March the Almanac reported that the economic upturn pick[ed] up steam. Auto production was 53 percent higher than a year earlier. And that the index of leading indicators had risen 3.6 percent in February, the then second highest monthly advance ever. March was also a month in which particularly harsh rhetorical exchanges between the United States and Russia dominated the continuing debate over weapons systems, according to the Almanac. Reagan characterized the Soviet Union as an "evil empire" and as the "focus of evil in the modern world." And the Almanac reported that Tass rebuked Reagan for his "bellicose lunatic anticommunism." Reagan also called for development of an anti-ballistic missile system. The Almanac also reported the headline for March ,"Reagan-Senate Budget Rift Deepens," and that the "Republican-controlled committee ignored Reagan's wishes and approved...a 5 percent increase in defense spending for fiscal 1984. (Reagan had asked for twice that increase.)"

Our model can be used to characterize developments in this period as follows. First, the fall in inflation expectations early in the period meant that the Fed could relax its pressure on the output gap somewhat without incurring an increase in actual inflation. It could gauge the degree to which policy could be relaxed by the behavior of the long bond rate as an indicator of inflation expectations. The fact that long bond rates remained high relative to current inflation indicated that the Fed had still not achieved full credibility, and that it still needed an output gap of some size to prevent high inflation expectations from increasing actual trend inflation. The stability of inflation, interest rates, and bond rates during this period indicated that the Fed was neither acquiring nor losing credibility for low inflation–the acquisition of credibility was in a holding pattern. The good news was that the stock market seemed to predict a non-inflationary recovery. And the Reagan administration seemed to support relatively restrictive Fed policy against a resurgence of inflation. The Reagan administration was also showing strength against protectionism, and the negative consequences for potential output, which our model predicts would be inflationary. On the other hand, our model suggests that the prospects of a huge defense buildup could be inflationary, if the Fed returned to "business as usual" and returned to putting greater weight on stabilizing the output gap and maintaining a continuity of the short rate than on stabilizing actual and expected inflation.

5.7 Defending disinflation: June 1983-August 1984

The period of relative quiet described above was followed beginning in June 1983 by an aggressive challengein the bond market to the Fed's credibility for low inflation.

From May 1983 to June 1984, long bond rates rose sharply from around 10.5 percent to peak of about 13.5 percent. Amazingly, the June 1984 peak was nearly as high as the levels reached in 1981 and 1982 even though by 1984 inflation was about 6 percentage points lower. The Fed responded to the inflation scare by moving the federal funds rate up from the 8.5 percent range to a peak of around 11.5 percent in August 1984, after which it brought the federal funds rate back down sharply as bond rates continued to retreat. The decline in long bond rates that followed was the largest on record. The 10-year bond rate fell from the 13 percent range in mid-1984 to the 7 percent range by early 1986, fully reversing the 1983-4 inflation scare, and indicating that the Fed had acquired another 3 percentage points of credibility for low inflation by then.

In one sense, the defeat of the 1983-4 inflation scare is even more remarkable than the initial disinflation itself. As Shapiro [1994] emphasizes, the Fed succeeded on a number of occasions prior to October 1979 in reducing inflation, only to allow the gains against inflation to be reversed shortly thereafter. Three of these temporary disinflations, following the December 1968, April 1974, October 1979 Romer dates were discussed above. Moreover, the decline in employment following the April 1974 disinflation is comparable to that following the 1982 Volcker disinflation, suggesting that comparable forces would have pressured the Fed to reinflate in 1983-4 as in 1977-8. There were two other notable similarities between 1984 and 1976. First, long bond rates in 1984 exhibited the same kind of nervousness as in 1976, remaining in the 7 to 8 percent range even as actual inflation fell to the 4 to 5 percent range. Second, 1984 and 1976 were both presidential election years in which a loss by the party in power could plausibly have been expected to result in less pressure on inflation in order to stimulate employment. On this basis, it is reasonable to think that the 1983-4 inflation scare was severe because of the presumption that the disinflation would prove to be temporary once again. The period began with a boost for the Fed in June 1983 when President Reagan renamed Volcker as chairman of the Federal Reserve Board, hailing the chairman as being "as dedicated as I am to continuing the fight against inflation," according to the Almanac. At his confirmation hearings in July the Almanac reported Volcker to have told the Senate Banking Committee that the Fed was acting to slow the growth of the money supply as a curb on inflation. Thus, the Volcker Fed recognized early in this period that it would need to rely more heavily on monetary targeting once more to defeat the coming challenge to its credibility.

5.7.1 Defense Spending, the Budget Deficit, and Interest Rates

The large federal budget deficits incurred during the period in connection with the huge defense buildup also contributed to the inflation scare problem. To understand fully the exceptional nature of these developments and the extent to which national defense and the federal deficit dominated public discourse during the period, we

chronicle news related to these issues reported in the Almanac in some detail below, followed by the Almanac's reports on high interest rates, the economy, and financial crises during the period.

National Defense President Reagan's massive proposed defense buildup gathered support as international tensions worsened in 1983-84. The Almanac reported that in July Chancellor Kohl of West Germany "received warnings from Soviet leaders not to permit the planned deployment in West Germany of US medium-range nuclear missiles." And in August the Soviet Union shot down a South Korean airliner, killing all 269 persons aboard. In October a truck bomb killed 241 US Marines in Beirut, Lebanon and another simultaneously killed 58 French soldiers. Also in that month Reagan sent US armed forces into Grenada to depose a hard-line Marxist regime that had seized power a few days earlier. In November 1983 the deployment of US intermediate-range missiles in Western Europe began in England, causing harsh reactions from the Soviet Union, according to the Almanac.

The war between Iran and Iraq worsened in 1984 with the first bombardment of a civilian center during the war by Iraq in February. Then in May, the Almanac reported that the war took a dangerous turn as both countries attacked ships in the Persian Gulf. The Almanac added that the escalation threatened to embroil other nations in the war and endangered the flow of oil to the rest of the world. Also in May Marshall Dimitri Ustinov, the defense minister of the Soviet Union was reported to have announced that the USSR had increased the number of submarines carrying nuclear missiles off the coasts of the United States. He said the missiles could hit US targets within 8 to 10 minutes. Ustinov said the subs were one of the countermeasures taken in response to the deployment of US intermediate-range nuclear missiles in Europe, according to the Almanac.

The Federal Budget Deficit The administration's drive to increase defense spending, its reluctance to raise taxes to finance that spending, and the relatively low cyclical revenues during the recovery from the deep 1981-82 recession, created the prospect of federal budget deficits unprecedented in peacetime. Concerns about the deficit were reported repeatedly in the Almanac during the period. The Almanac reported the headline "Reagan-Senate Budget Rift Deepens," in May 1983, saying that the Republican-controlled committee ignored Reagan's wishes and approved only half the increase in defense spending that Reagan had asked for. In August, the Almanac reported that the Congressional Budget Office warned that prospective federal budget deficits in the $200 billion range for the next few years could result in higher interest rates and slower economic growth. Treasury Secretary Donald Regan is reported in the Almanac to have criticized financial institutions for maintaining high interest rates even though inflation had declined considerably.

The following year, the Almanac reported the headline in February 1984 that "Big Budget Deficit Stirs Debate." It also reported Paul Volcker's comments that

deficits "pose a clear and present danger" to economic growth "helped trigger a sharp drop on Wall Street, where the Dow-Jones Industrial Average, which had already been slipping, fell to 1156 on Feb. 8, a 10 percent decline in just 5 weeks." A bipartisan congressional delegation met with White House officials, Feb. 8, to seek ways to cut the deficits. However, according to the Almanac, Democrats indicated that progress was impossible unless the administration cut the proposed increase in military spending.

5.7.2 Interest Rates, the Economy, and Financial Crises

As interest rates moved higher in the spring of 1984, the Almanac reported the headline in March 1984 "Jump in Prime Rate is Only Cloud on Economy," and that the unemployment rate continued its steady decline in February to 7.7 percent. In April the Almanac reported "Key Interest Rates Edge Upward," referring to increases in the prime rate and the Fed's discount rate, which it noted the Fed had not changed since December 1982. Real GDP was also reported to have grown at an annual rate of 8.3 percent in the 1st quarter of 1984. Major banks raised their prime rates again in May to 12.5 percent.

By May, however, the strain of high interest rates started to take a toll. The Almanac reported in May: "Fearing that rising interest rates could have a negative impact on the electorate, administration spokesman criticized Federal Reserve Board policies." President Raul Alfonsin of Argentina said that rising US interest rates were "madness" and could jeopardize Argentina's social peace." according to the Almanac. The Almanac also reported the headline "US Props Up Continental Illinois Bank," in May, evidence of general stress on the financial system caused by high interest rates. Later, in July, the Almanac reported "US Buys Loans of Ailing Illinois Bank" when a rescue package for the shaky bank, the nation's 8th largest bank holding company, was unveiled. Major banks raised their prime rates again to 13 percent in June, which the Almanac reported as the highest level since October 1982 [even though inflation was still in the 4 to 5 percent range]. The Almanac added that President Reagan said he could see "no excuse" for the increase. The unemployment rate fell to 7.0 in June, which the Almanac reported to be the lowest since the spring of 1980.

5.7.3 The End of the Inflation Scare

The Almanac reports three important developments in June.and July that worked to end the inflation scare. First, the Almanac reported that former Vice President Walter Mondale claimed victory, June 6, in his long struggle with Sen. Gary Hart for the Democratic presidential nomination. It also reported that United Press International reported that Mondale had 1969 delegates, Hart 1220, and the Rev. Jesse Jackson 373; and that a compilation by *Congressional Quarterly* showed that in the primary voting Mondale had captured 39 percent of the popular vote, Hart 36, and Jackson 18 percent. In retrospect, Hart's defeat virtually assured a Reagan

victory in the upcoming election. Second, the Almanac noted that Congress on June 27 approved a package of budget cuts and tax increases designed to make a "down payment" against the enormous budget deficits projected for the next few years. Both of these political developments probably helped to build confidence that low inflation would endure and, probably contributed to the decline in long term interest rates which began shortly thereafter in July.

Finally, the Almanac reported that the stock market rocketed in August in the heaviest trading volume ever, even as signs grew that the economic recovery was slowing down. It also reported that the jobless rate rose to 7.4 percent, the first jump in that figure since the depths of the 1982 recession. It went on to say that the stock market concluded a phenomenal week, Aug. 3 with the Dow rising 36 points to 1202, and that the Dow's gain for the week 87 points, set another record. According to the Almanac, analysts said that evidence of lower economic activity meant that pressure on interest rates would be reduced. Finally, the Almanac said that the market also took heart from a July 25 statement by Paul Volcker, chairman of the Federal Reserve Board that the Fed would *not* seek to tighten the growth of the money supply to control inflation. In effect, Volcker's statement signalled the Fed's belief that the inflation scare had ended, and that the weakening economy would call for sharply lower short term interest rates in the coming months.

5.7.4 FOMC Transcripts

The FOMC transcripts show that Fed officials were well aware of what was at stake during this tumultuous period.. For instance, at the very start of the inflation scare period at the May 1983 FOMC meeting president Corrigan of the Minneapolis Fed asks the rhetorical question,

> "What will happen to bond rates if we do snug up a little, recognizing that they have already increased by 50 basis points in the last two weeks? On the other hand, what would happen to bond rates if we didn't do anything? In some ways I think this is the $64 question. My instinct is that in the current circumstances a gentle move in the direction of snugging might well produce the result of helping to stabilize long-term interest rates."[34]

At the July 1983 FOMC meeting staff economist James Kichline said "What has influenced us particularly on long rates, is the feeling that we are most likely to see a much better inflation performance than markets generally anticipate and that , as each month goes by and we see low rates of inflation, double digit long rates indeed will look pretty attractive so there is room for some decline in 1984."[35] The Board staff gave an extensive briefing on the theory of inflation at the November 1983 FOMC

[34] FOMC Transcript, May 1983, pp. 27-8.
[35] FOMC Transcript, July 1983, page 9.

meeting. Staff economist Stockton concluded the briefing saying "Price expectations and the psychology of inflation...are critical factors in wage and price determination. To the extent that credible public policies could help reduce inflation expectations, the adjustment to lower rates of inflation would be faster and achieved at lower cost of lost output."[36]

At the March 1984 FOMC meeting, Chairman Volcker spoke of "lots of vulnerabilities" including the thrift industry, the LDC problem, the high foreign exchange rate, the fact that businessmen don't want the Fed to raise rates, and the risk of a discontinuity in the response of business if the Fed does push rates up. Volcker concluded that "we're dealing with that kind of atmosphere and I think we're living to some degree with all these distortions on borrowed time."[37] At the same FOMC meeting, Governor Gramley said "I think we're in very serious danger of losing credibility as an agency that is trying to hold down inflation. It seems to me that the numbers have been coming in very strong on the real economy. We are looking at money and credit numbers that are very strong in any kind of historical perspective. We are doing so in the second year of a recovery when expectations have been greatly exceeded. We are doing so in the context of a fiscal policy that is the most stimulative we've ever seen. I just don't know how we can talk about making sure we don't ease. The situation calls for more than that. It calls for more, in my judgment, than just confirming for the market the fact that interest rates have gone up in recent weeks."[38]

Chairman Volcker summarized the conflicted view of the policy options at the July 1984 FOMC meeting. He concurred with the widely shared view in the FOMC that there is "just a lot of plain forward momentum" in the real economy. He saw "very little slowing, except possibly in housing," and said that without any of the financial problems, he would be more restrictive because he thought "that's where the risks lie." However, taking the financial system into account, he thought that the Fed was "coming close to running out of maneuvering room in terms of monetary policy." He didn't conclude that "any kind of easing signal [was] justified or appropriate.". But he did say that "it [was] not the time to take a strong initiative in the restraining direction."[39] Fortunately, long-term interest rates soon began to fall, real economic activity moderated, financial strains eased, and before long it became clear that the Fed had defeated the 1984 inflation scare and saved the disinflation.

6 Summary and Conclusions

During the course of the Volcker disinflation, in which inflation was reduced from over 10 percent to about 4 percent, there was a major multiyear decline in real activity and

[36] November 1983 FOMC Inflation Briefing–Part III, page 6.
[37] FOMC Transcript, March 1984, pp. 56-7.
[38] FOMC Transcripts, March 1984, page 85.
[39] FOMC Transcript, July 1984, pp.55-57.

long-term nominal interest rates that were very stubborn, in that they did not fall substantially until the end of the disinflation. The original objective of this research project was to evaluate whether a simple modern macroeconomic model (stressing the expectations theory of the term structure as well as forward-looking price-setting and consumption behavior) could give a reasonable account of the comovement of interest rates, output, and inflation if the disinflation was imperfectly credible. The idea of imperfect credibility seemed intrinsically important to us, as well as being compatible with both the outcomes of prior episodes of monetary restraint (such as those identified in various monetary histories) and with the stubborn behavior of long-term rates during the Volcker disinflation.

Since the modeling of the dynamics of credibility is very subtle, we opted for a strategy of assuming an exogenous path of beliefs about the credibility of the disinflation to see if the core features of our model were compatible with the events under such an assumption. To give it content, our modeling strategy thus utilized the idea that long-rates were indicators of long-term expected future inflation.

In many macroeconomic models, expected future short-term inflation is very important for price-setting if there is stickiness in individual prices. As well, these models provided general equilibrium linkages between inflation and fluctuations in output. Typically, with respect to unexpected and permanent movements in nominal aggregate demand, these models produce positive responses of both output and prices, but they also are structured so that there are no important real effects of sustained inflation.

Working with this model, we found that our assumed process for beliefs about policy credibility was relevant to the joint dynamics of output, inflation and real activity, and interest rates of various terms to maturity. Importantly, we found that such a model could readily explain the general pattern of comovement of these variables during the Volcker disinflation, although much additional work remains to be done with more complete models.

As we worked further with our framework, we found that its "superneutrality" property meant that it could potentially help us understand the rise in inflation in the post-war U.S as the outcome of more primitive assumptions on a central bank's objectives, namely that the simultaneous pursuit of (i) continuity of the short-term rate of interest and (ii) stabilization of at its "neutral" level. The influence that the model assigns to expected inflation in price-setting means that this model can produce real effects of inflation scares – defined as situations of rapidly changing beliefs about the course of inflation – or rapid transmission to inflation, depending on the response of the monetary authority.

Since the modeling of credibility is difficult, we also found it attractive to employ two sources of historical information. The summary narrative information, provided by the World Almanacs, was a convenient compilation of economic and political events which accompanied the disinflation. This source had the advantage that it reflected the appraisals of contemporary observers with a perspective that seems

relatively constant over time. The transcripts of the Federal Reserve Open Market Committee's meetings in 1979, released to the public about a year ago, provided an additional source of information about the implicit models, data, and actions of the U.S. monetary authority.

A surprising feature of our work with the FOMC transcripts was that FOMC members – particularly Volcker, Willes, Schultz and Wallich – frequently based their analysis features of the macroeconomy that have been subsequently incorporated into much central banking discussion and macroeconomic modeling. Far from being the prisoners of abandoned doctrine, they were shrewd and committed, while operating in very uncertain times.

In particular, the FOMC viewed a central part of its job as managing expected inflation, accepting this responsibility during a period of high and volatile beliefs. They viewed the long-term interest rate as a central measure of their success in this task and understood that incomplete credibility was the legacy of prior history. At the same time, they were not blind to the potential and actual real consequences of monetary actions. But they understood that they had a central responsibility of establishing credibility for low inflation in particular and for the monetary authority in general.

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A Interest rate rules

There has been much recent work on the design and estimation of interest rate rules for monetary policy. The discussion in the main text is not couched in these terms, but rather explores the effects of a posited inflation path on macroeconomic activity. In this appendix, we provide a link to the work on interest rate rules as appropriate by section.

A.1 Link to section 4.1

In the text discussion of the "interest rate continuity" model, we have discussed these events without saying anything about the form of the central bank's behavior. Letting the behavior of the inflation rate derived in the text be $\overline{\pi}_t$, one interest rate rule consistent with a unique, stable rational expectations equilibrium would be

$$R_t = r_t + \overline{\pi}_t + \tau(\pi_t - \overline{\pi}_t)$$

with $\tau > 1$. Under this rule, the central bank responds to deviations of inflation from the solution path sufficiently aggressively that these never take place. Formally, combining this interest rate rule and the Fisher equation, while using the fact that $\overline{\pi}_t = E_t\overline{\pi}_{t+1}$, we find that $E_t\pi_{t+1} - E_t\overline{\pi}_{t+1} = \tau(\pi_t - \overline{\pi}_t)$ so that the stable forward-looking solution which we employ in the text is $\pi_t = \overline{\pi}_t$.

B Robustness of trend inflation

Consider modifying the New Keynesian Phillips curve to

$$\pi_t = (1-\theta)E_t\pi_{t+1} + \theta\pi_{t-1} + h(y_t - \kappa_t)$$

as suggested by Fuhrer and Moore [1995]. Under the assumption that there is no output gap, we can rewrite this equation as

$$E_t\pi_{t+1} = -\frac{1}{1-\theta}\pi_t + \frac{\theta}{1-\theta}\pi_{t-1}$$

There are two roots of this difference equation: 1 and $\frac{\theta}{1-\theta}$. Accordingly, if $\theta < 1/2$, then there is a stable rational expectations solution of the form

$$\pi_{t+1} - \pi_t = \frac{\theta}{1-\theta}(\pi_t - \pi_{t-1}) + \nu_{t+1}$$

Hence, the forecast error for the nominal interest rate

$$R_t - E_{t-1}R_t = (r_t - E_{t-1}r_t) + (E_t\pi_{t+1} - E_{t-1}\pi_{t+1})$$

can be written as

$$\varepsilon_t + \nu_t = (1-\phi)\varepsilon_t$$

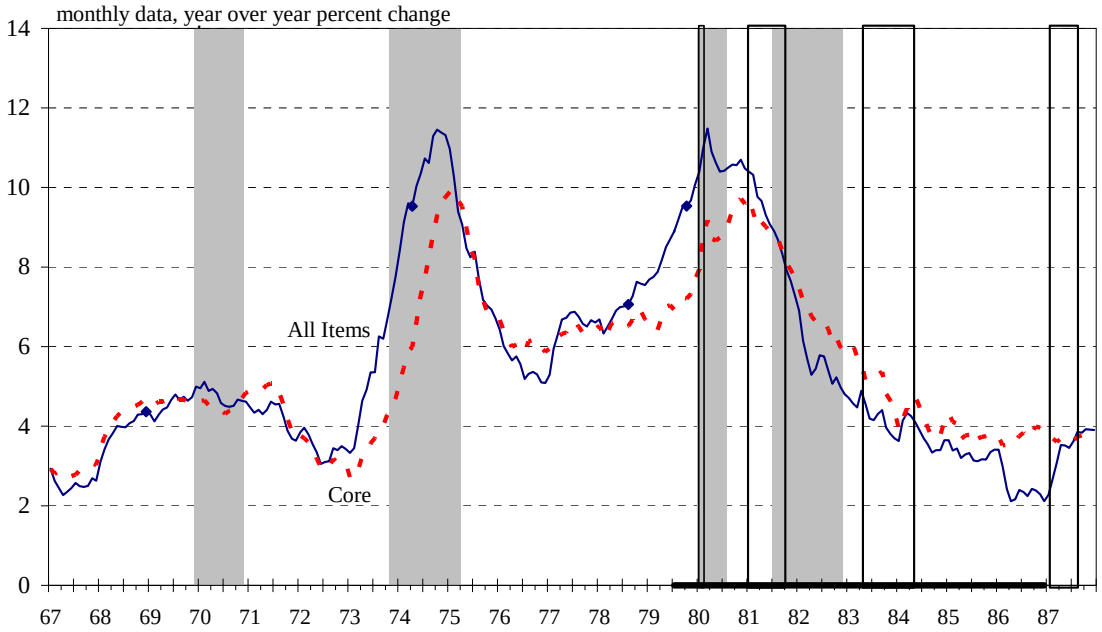
where we specify that $\nu_t = -\phi\varepsilon_t$ to allow for some additional generality in the interest-rate response. Finally, the forecast revisions for changes in inflation are given

$$E_t\Delta\pi_{t+j} - E_{t-1}\Delta\pi_{t+j} = (\frac{\theta}{1-\theta})^j\nu_t$$

and those for the levels of inflation are

$$\begin{aligned} E_t\pi_{t+j} - E_{t-1}\pi_{t+j} &= [\sum_{h=0}^{j}(\frac{\theta}{1-\theta})^h]\nu_t \\ &= \frac{1-\theta}{1-2\theta}[1-(\frac{\theta}{1-\theta})^{j+1}]v_t \\ &= -\frac{\phi}{1-2\theta}[1-(\frac{\theta}{1-\theta})^{j+1}]\varepsilon_t \end{aligned}$$

That is: with structural inflation persistence, there is greater variability of trend inflation in response to real rate shocks.



* Notes: Diamonds indicate "Romer and Romer dates".
Shaded areas indicate NBER recessions. Boxes indicate Goodfriend inflation scares.
Dates are under 1st Month of Year; tick marks are every 3 months.

Figure 1: Personal Consumption Expenditure (PCE) inflation rate, all items and core

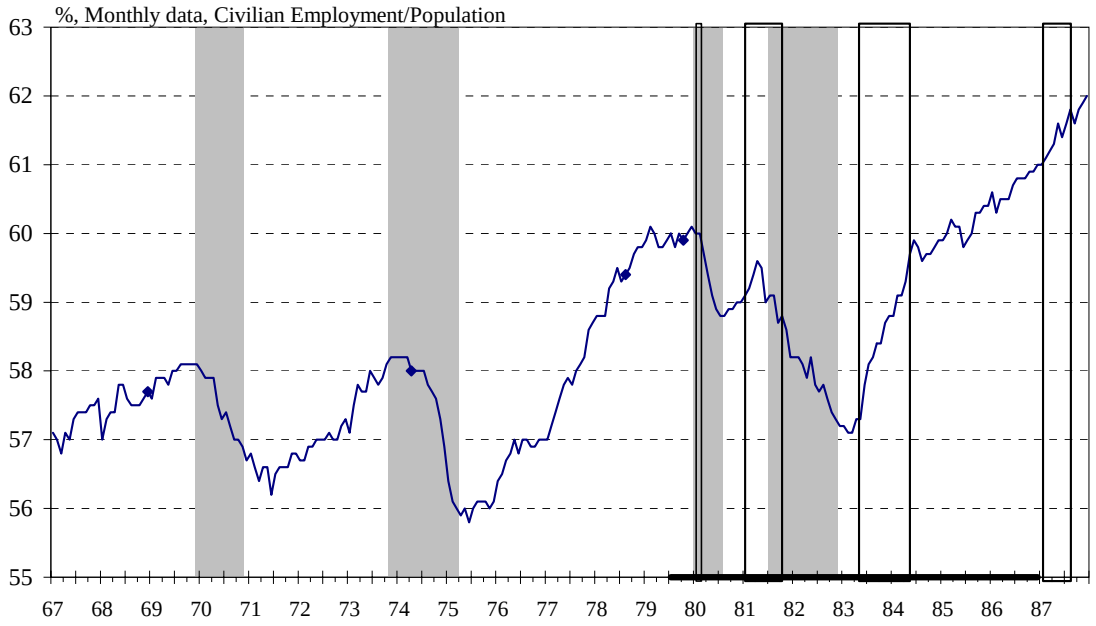


Figure 2: Civilian employment rate

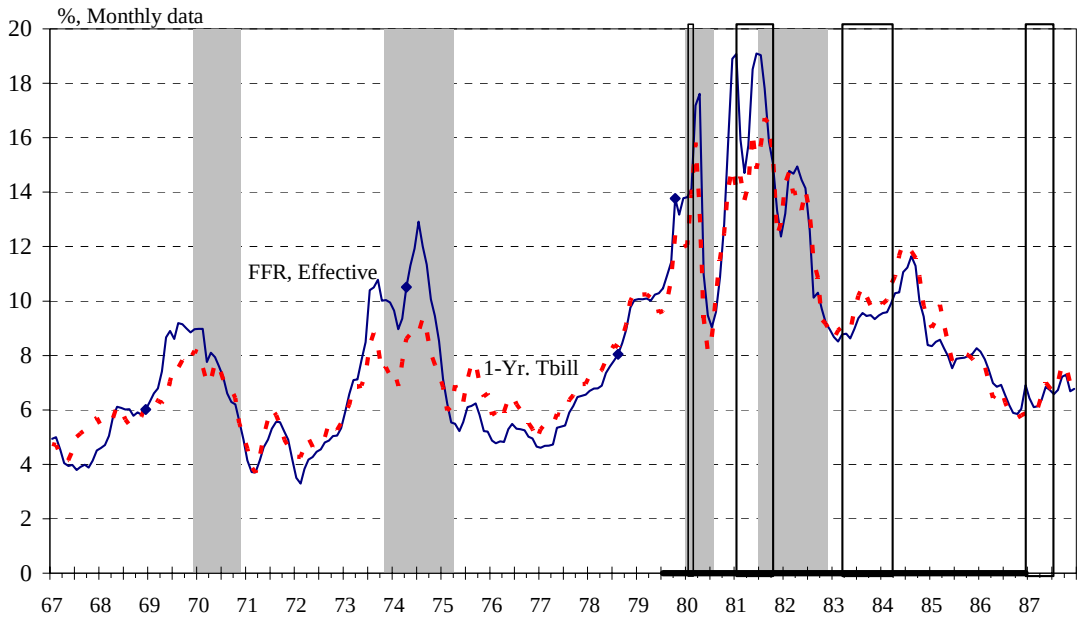


Figure 3: Federal funds rate and 1 year Treasury bill rate

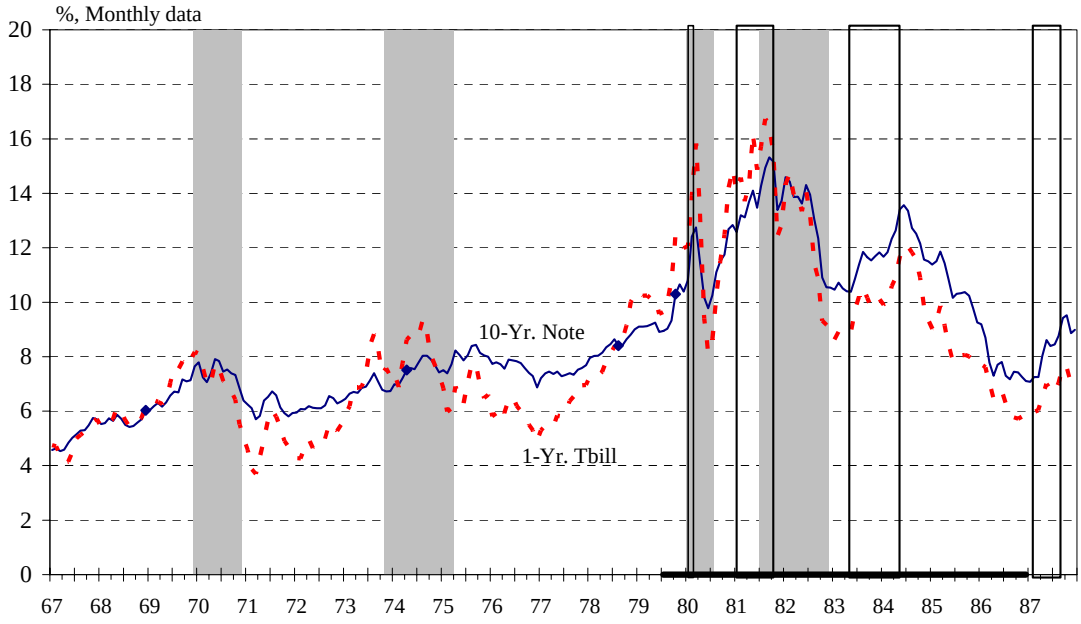
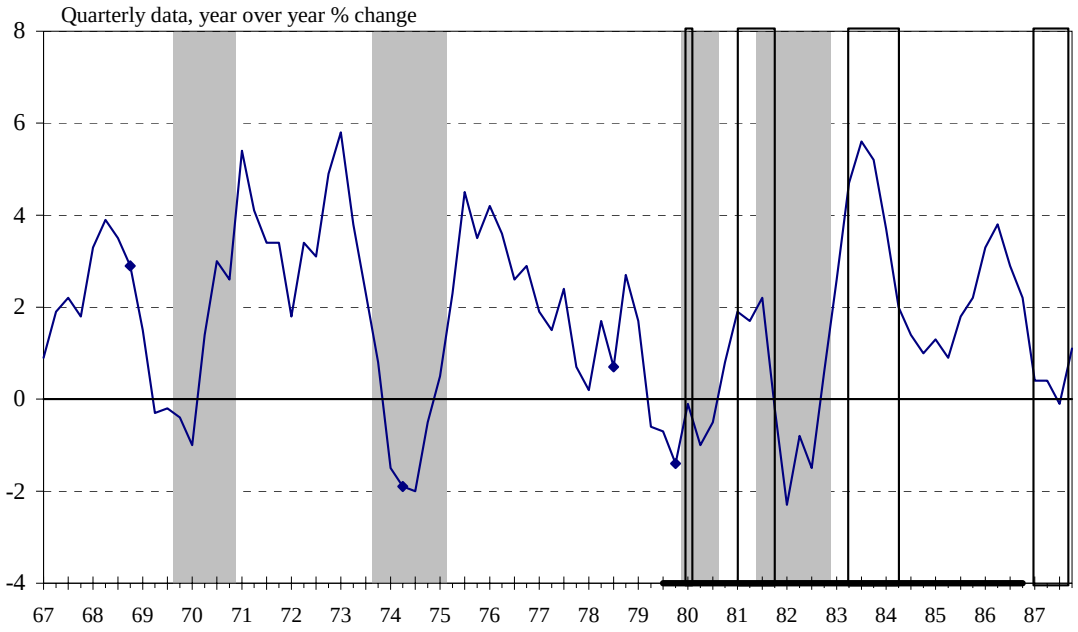


Figure 4: 1 year Treasury Bill rate and 10 year Treasury Note rate



* Notes: Diamonds indicate "Romer and Romer dates".
Shaded areas indicate NBER recessions. Boxes indicate Goodfriend inflation scares.
Dates are under 1st quarter of the year; tick marks are every quarter.

Figure 5: Output per man-hour

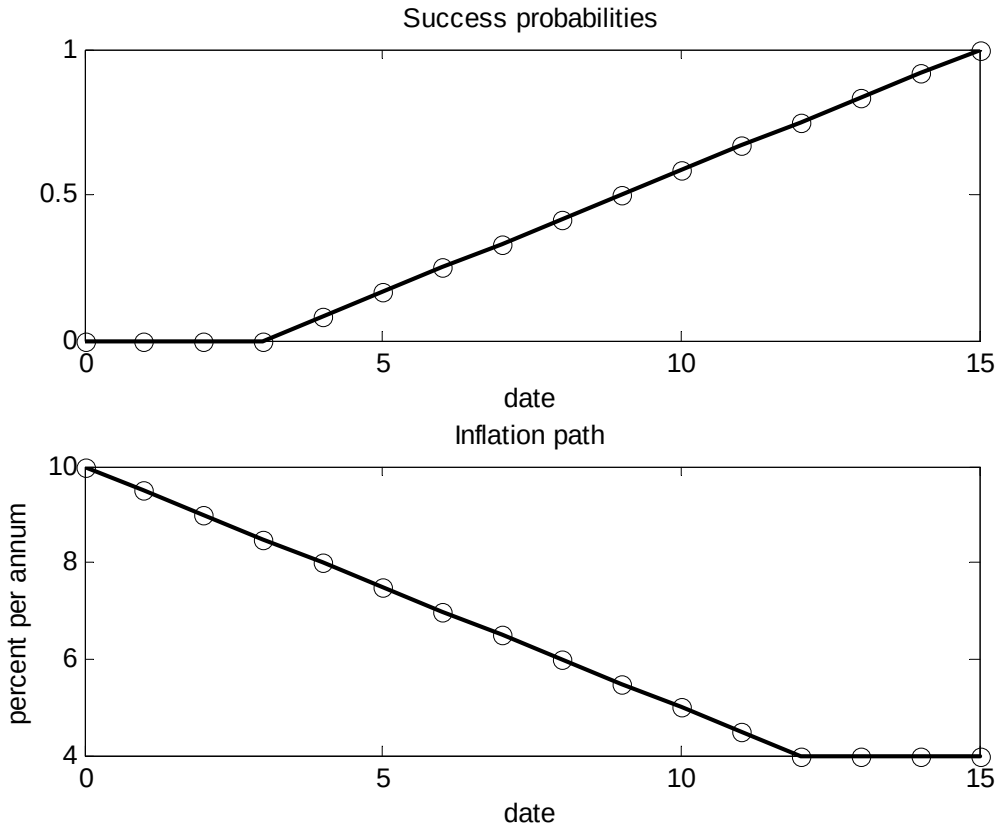


Figure 6: Disinflation success probabilities and actual inflation path for successful plan

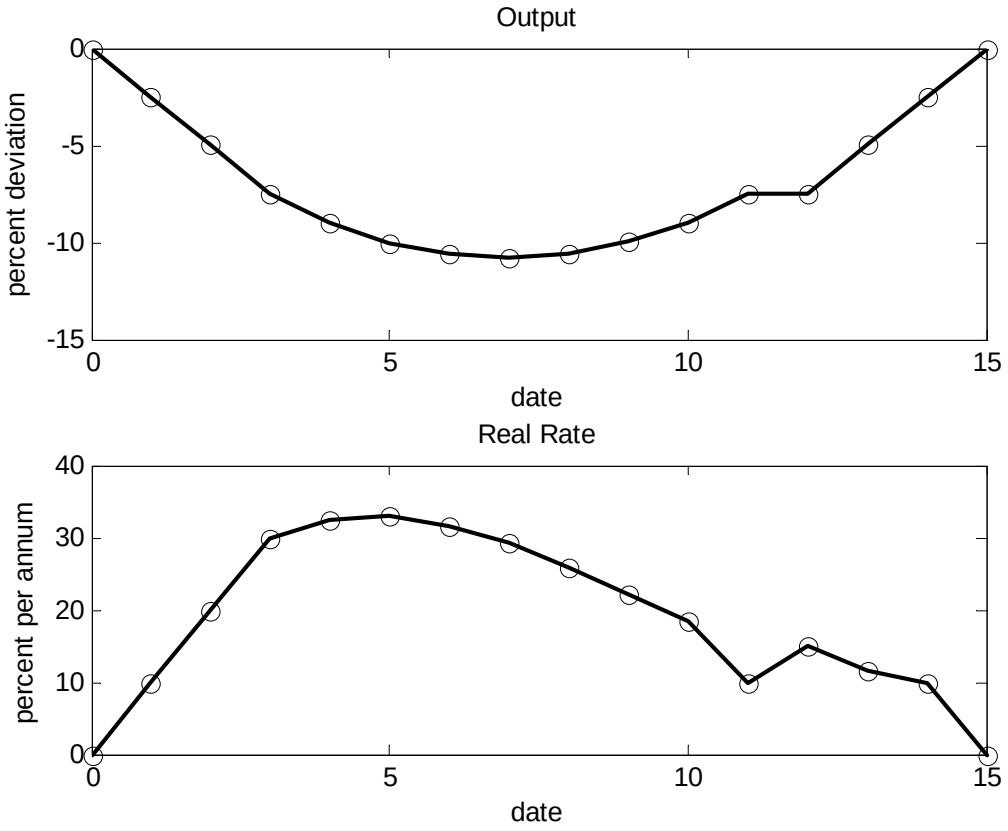


Figure 7: Output and real interest rate during a successful, but imperfectly credible, disinflation

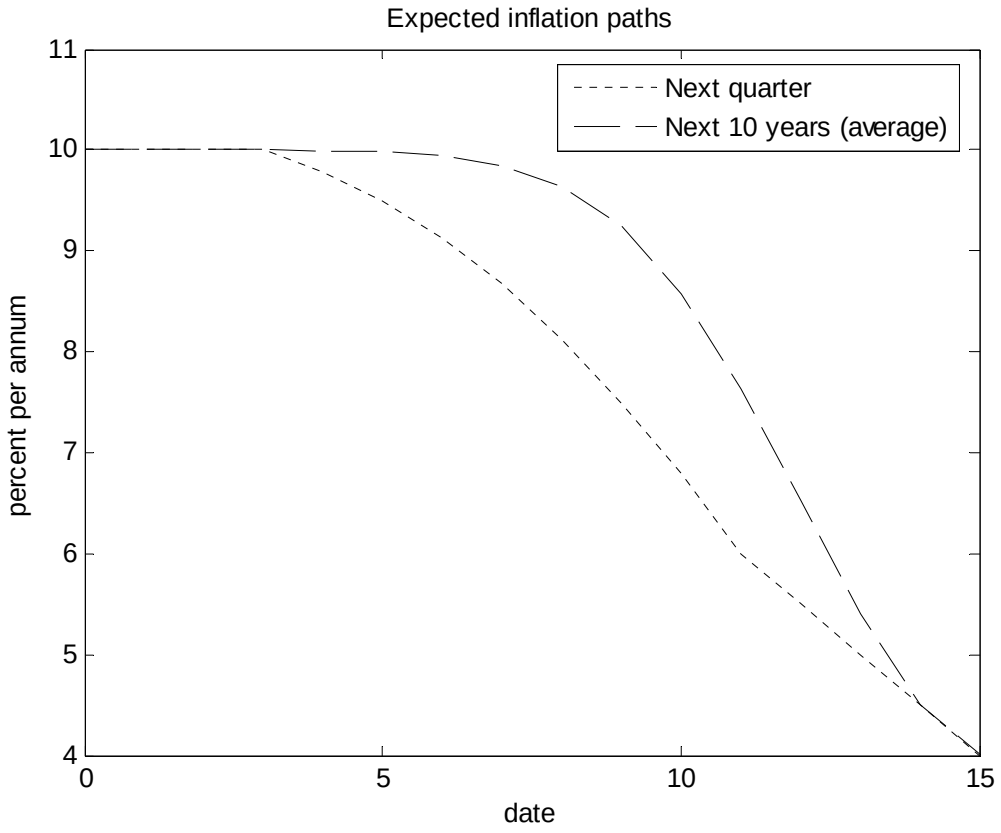
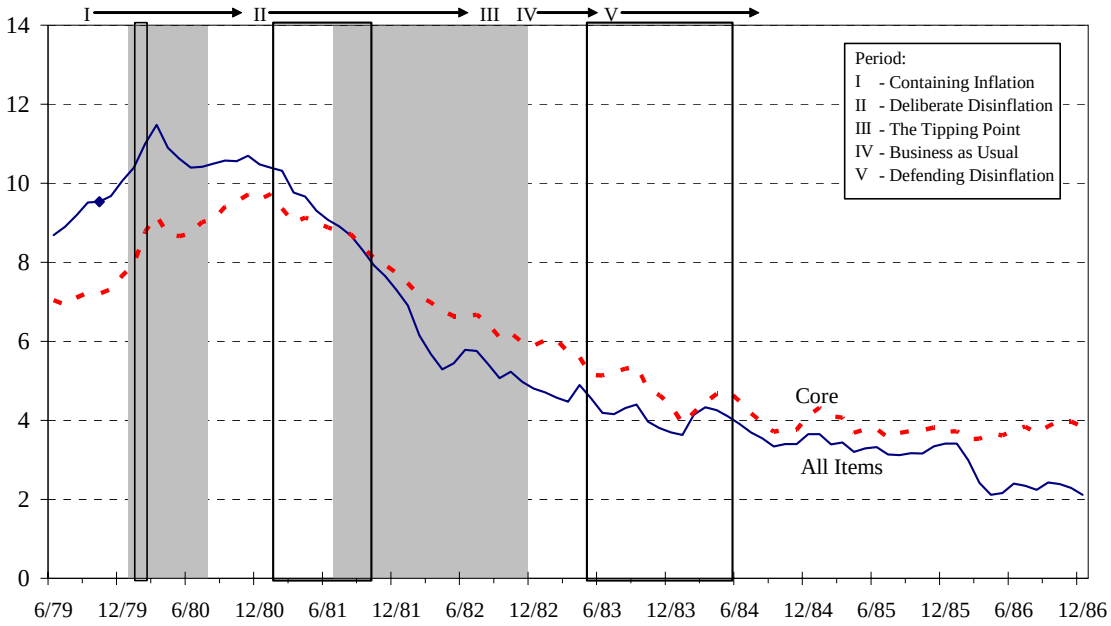


Figure 8: Expected inflation at various horizons, relevant for pricing of one quarter and ten year bonds



* Notes: Diamonds indicate "Romer and Romer dates".
Shaded areas indicate NBER recessions. Boxes indicate Goodfriend inflation scares.
Dates are under 1st Month of Year; tick marks are every 3 months. Series is year over year percent change as in Figure 1

Figure 9: Inflation during the Volcker period

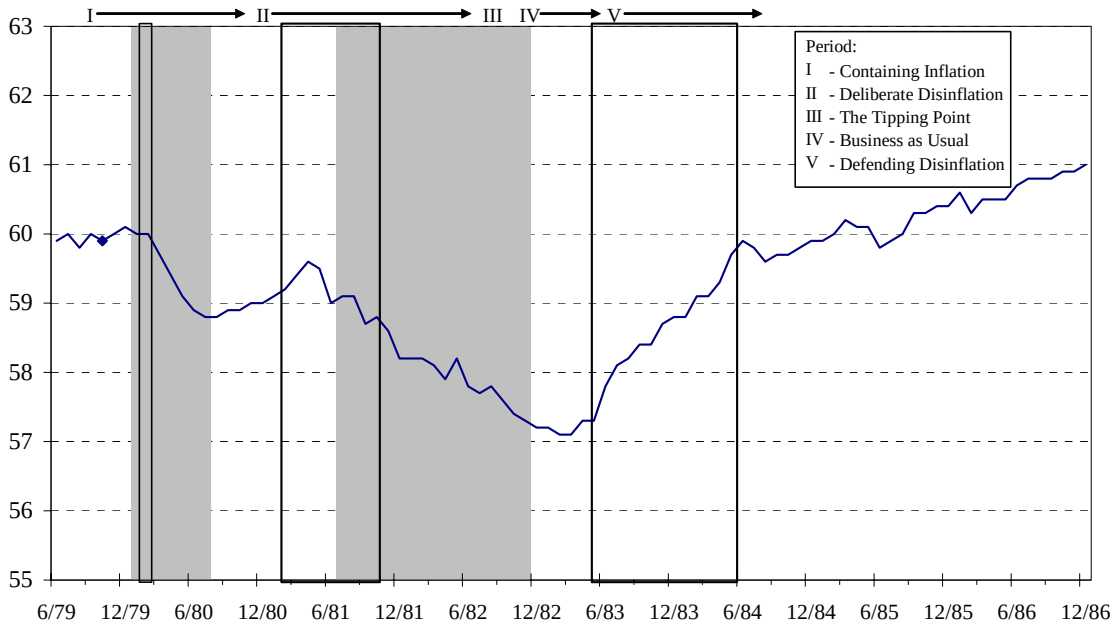
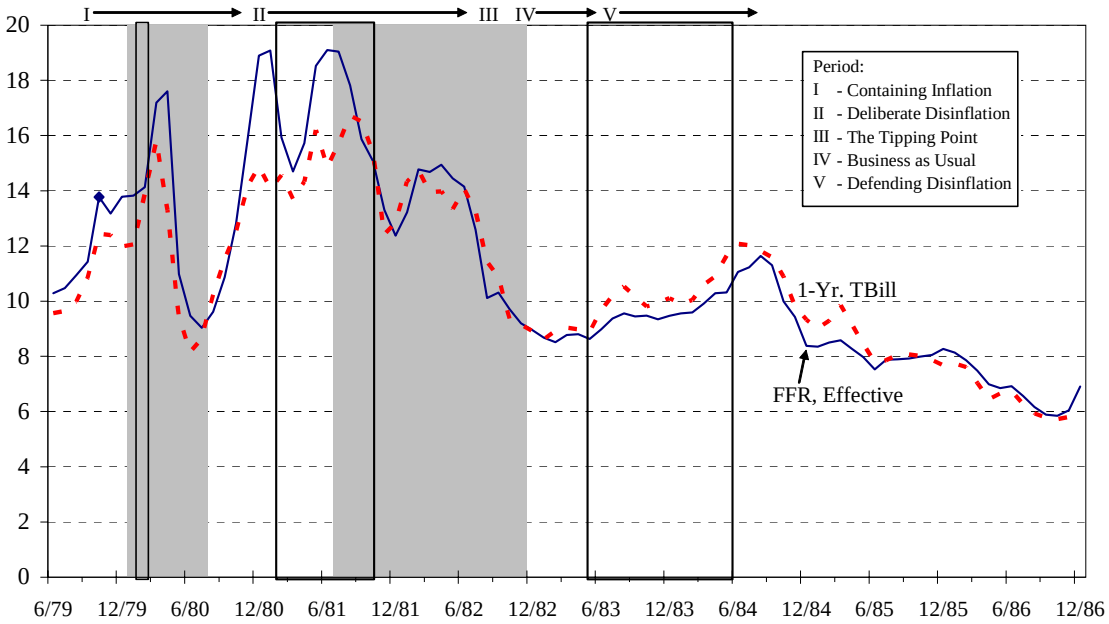
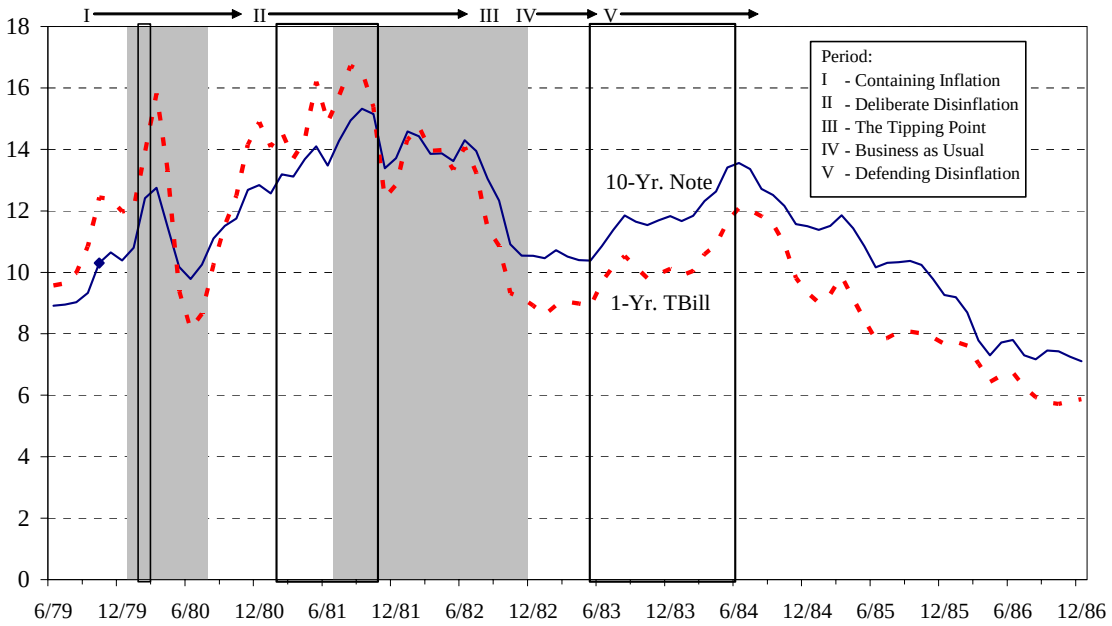


Figure 10: Employment rate during Volcker period



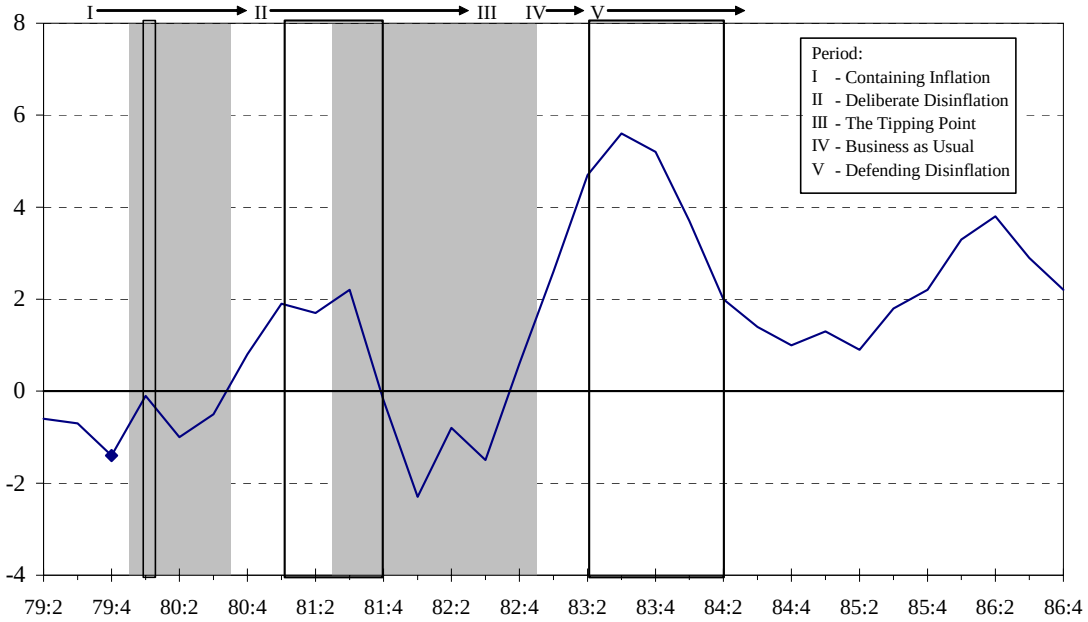
* Notes: Diamonds indicate "Romer and Romer dates".
Shaded areas indicate NBER recessions. Boxes indicate Goodfriend inflation scares.
Dates are under 1st Month of Year; tick marks are every 3 months.

Figure 11: Federal funds and 1 year Treasury bill rates during Volcker period.



* Notes: Diamonds indicate "Romer and Romer dates".
Shaded areas indicate NBER recessions. Boxes indicate Goodfriend inflation scares.
Dates are under 1st Month of Year; tick marks are every 3 months.

Figure 12: 1 year Treasury Bill and 10 year Treasury Bond rates during Volcker period



* Notes: Diamonds indicate "Romer and Romer dates".
Shaded areas indicate NBER recessions. Boxes indicate Goodfriend inflation scares.
Dates indicate Quarters. Series is year over year percent change as in Figure 5

Figure 13: Output per man-hour during the Volcker period

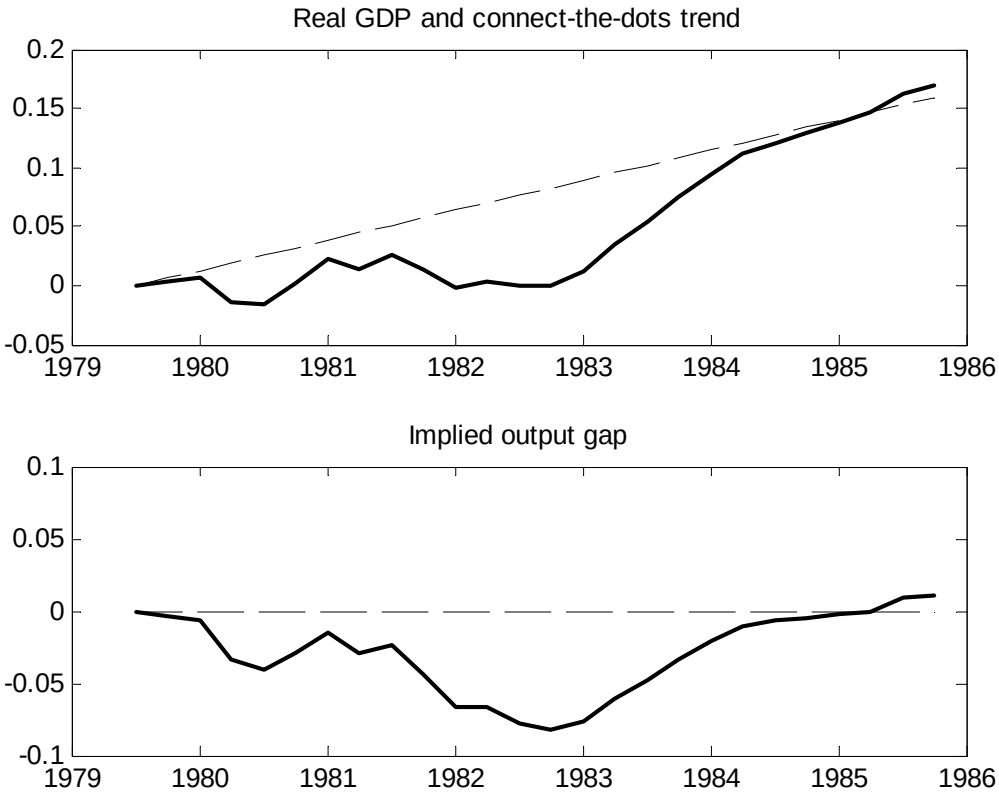


Figure 14: Real output, July 1979-December 1985

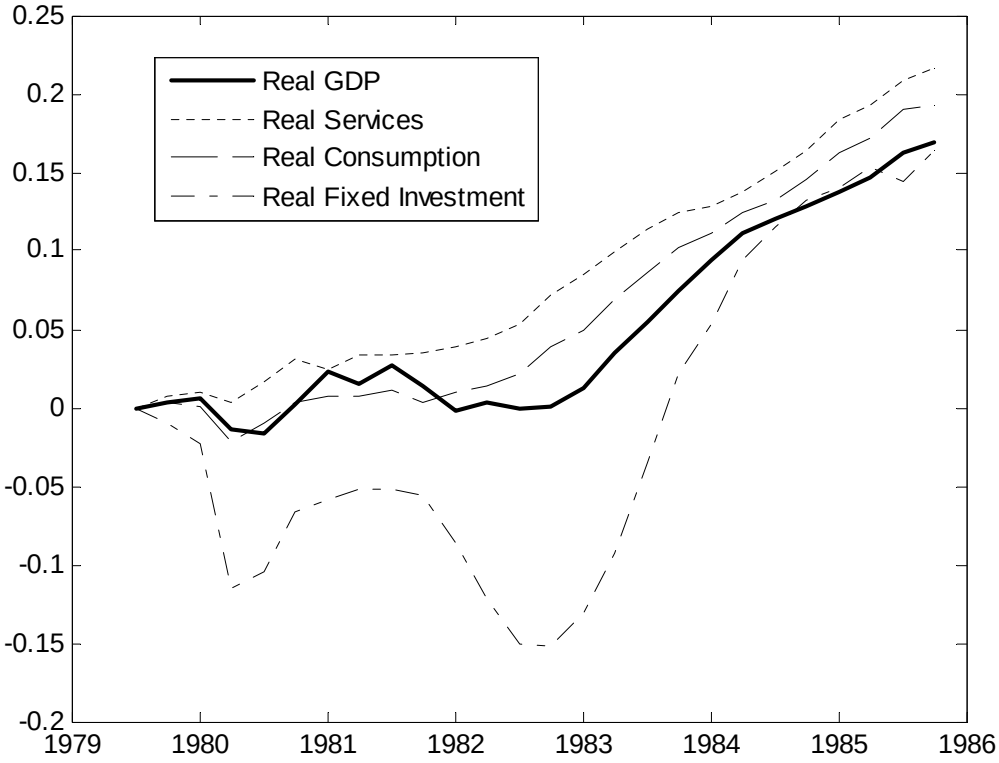


Figure 15: Components of output, July 1979 through December 1985

Table 1:
Almanac News: Rising Inflation Concerns, January 1977-July 1979

January 1977: Unemployment falls from 8.1% to 7.9% in December 1976. With CPI inflation at 4.8% a.r. in December, 1976 shows lowest rate of increase since 1972.
April 1977: Carter offers plan to reduce inflation from 6% to 4% by the end of 1979.
May 1977: WPI inflation reported at 13.2% a.r. in both March and April
May 1977: Unemployment rate hits 29-Month low, falling in April from 7.3% to 7%
October 1977: Unemploment rate drops from 7.1% to 6.9% in September, but government officials see little long-term improvement, particularly for blacks.
December 1977: Burns Out as Federal Reserve Chairman, Miller in
April 1978: Carter anti-inflation plan; rules out mandatory wage- price controls.
May 1978: AFL-CIO rejects voluntary wage controls
September 1978: Representative John Conyers stalks out of White House after Carter rejects call for "Camp David summit" on unemployment. Rate in August was 5.9%.
September 1978: FRS raises discount rate to 8%
October 1978: Humphrey-Hawkins Full Employment Law
October 1978: Dow Jones index falls 105 points to 792 in last two weeks of month
October 1978: Carter reveals anti-inflation plan; appoints Alfred Kahn to head it
October 1978: Dollar hits record lows; FRS raises discount rate to a record 8.5%
November 1978: Carter announces steps to strengthen dollar, including immediate discount rate increase by FRS to 9.5 % from 8 .5% and FX interventions
December 1978: Administration changes wage-price guidelines. Kahn says successful guidelines should limit inflation to 6.5% in 1979.
December 1978: Iran violence threatens to topple the Shah; strike cuts oil output.
February 1979: Khomeini returns to Iran
February 1979: Schlesinger issues oil warning; markets react
February 1979: Kuwait, Venezuela raise oil prices; Carter asks for gas rationing power
March 1979: PPI increases at 12% a.r. in February; administration threatens to identify companies not complying with Federal anti-inflation guidelines.
March 1979: Kahn argues “business on trial” after corporate after-tax profits rise
March 1979: CPI rises at 14.4% a.r. in February; Carter is "deeply disturbed" by news
June 1979: Components of wage-price Guidelines upheld on appeal in AFL-CIO suit
July 1979: Carter retreats to Camp David for 10 day ‘domestic summit’; gives energy speech outlining broad program to control energy use and prices.
July 1979: Gold surpasses $300 (up $100 in year) as market react to energy program.
July 1979: Paul Volcker nominated on Jul25 and easily confirmed on July 30

Table 2:
Infaltion and Romer Anti-Inflation Dates

Panel A

	Past Inflation			Inflation	Future Inflation		
	12	**8**	**4**	**Current**	**4**	**8**	**12**
1968:12	1.7	3.1	2.6	4.4	5.0	4.6	3.6
1974:04	4.3	3.6	4.6	9.5	9.1	5.7	6.7
1978:08	7.7	5.3	6.8	7.1	9.2	10.5	8.7
1979:10	5.3	6.5	7.6	9.5	10.6	7.9	5.2

Panel B

	Past Inflation			Core Inflation	Future Inflation		
	12	**8**	**4**	**Current**	**4**	**8**	**12**
1968:12	1.3	2.9	3.0	4.7	4.7	4.8	3.7
1974:04	4.9	3.4	3.2	6.0	9.5	6.0	6.3
1978:08	7.5	6.1	6.5	6.5	7.1	9.1	8.7
1979:10	6.2	6.3	6.9	7.2	9.5	8.1	6.2

This table shows the inflation rate at the time of a Romer date; the inflation rate 4, 8, and 12 quarters prior to the event; and the inflation rate 4, 8, and 12 quarters after the event. Inflation series are those in Figure 1.

Table 3:
Almanac News: Inflation Containment, August 1979-October 1980

August 1979: Inflation jolt report, finished producer goods inflation at 13.2% a.r
August 1979: JEC warns of drastic declines in U.S. standard of living
August 1979: FRS raises discount rate from 10 to 10.5%
September 1979: Unemployment increases to 6%; PPI inflation at 14.4% a.r.
September 1979: FRS raises discount rate from 10.5% to 11%
October 1979: PPI inflation at 17%, highest in 5 years; unemployment falls to 5.8%
October 1979: Sweeping FRS actions: discount rate increase to 12%; increased reserve requirements. New FRS operating procedure would attempt to control money supply and allow interest rates to rise as much as necessary; new operating procedures announced; dramatic move in wake of rampant speculation in financial and commodity markets
October 1979: Banks react by raising prime rate to unheard of 14.5%; panic selling on Wall street by small investors
November 1979: US embassy seized in Iraq, hostages taken; Mecca mosque seized by militants; US embassy partially burned by mob in Pakistan
December 1979: 5000 Soviet troops enter Afghanistan to shore up its government
January 1980: U.S. agrees to sell arms to China; 85,000 Soviet troops enter Afghanistan
January 1980: December unemployment up only from 5.9% to 6%, easing recession fears
January 1980: CPI inflation for 1979 at 13.3%, highest in 33 years; December at 14.4%
February 1980: Unemployment jumps to 6.2%, 18 month high
February 1980: PPI inflation at 19.2% a.r. in January
February 1980: FRS raises discount rate by 1% to 13%
February 1980: U.S admits supply light weapons to Afghan resistance
February 1980: CPI inflation at 16.8% a.r., driven by 7.4% increase in gas prices
February 1980: Carter describes inflation at “crisis stage” and points to Congressional failure to adopt a comprehensive energy policy
March 1980: Carter announce anti-inflation program, including ELEMENTS
March 1980: FRS announces 3% discount rate surcharge on large banks
March 1980: Silver drop (from $16 to $11 per ounce) shakes Hunt’s silver empire
April 1980: Banks raise prima rate to 20%
April 1980: March unemployment to 6.2%; Carter: short recession has probably begun
April 1980: CPI inflation in March at 16.8%
May 1980: Recession deepens: 7% unemployment , industrial output down 1.9% in April
May 1980: CPI inflation in April continues at 16.8% a.r., but PPI inflation only 6% a.r.
June 1980: Jobless rate soars to 7.8%, Output declines (8.5% a.r. in second quarter) Inflation eases: smallest monthly PPI change in 32 months, CPI inflation at 10% a.r.
August 1980: Unemployment holds steady
September 1980: Recession believed ending with 3rd quarter GDP unchanged.
October 1980: Recession ends, revised figures show 3rd quarter GDP increase at 1% a.r. and industrial production increasing 1% in September alone
October 1980: In last inflation report before election, Labor department reports CPI inflation at 1% “showing that the economy continued to be susceptible to inflation”

Table 4:
Almanac News: Deliberate Disinflation, November 1980-June 1982

November 1980: Reagan beats Carter in landslide
November 1980: Iran-Iraq war intensifies
December 1980: FRS raises discount rate from 12 to 13%
December 1980: Unemployment falls, 7.6% to 7.5%; CPI inflation at 12% a.r.
January 1981: Reagan abolishes oil price controls and Council on Wage and Price Stability; supports 30% tax cut and elimination of Education and Energy Depts.
January 1981: GM reports that 1980 witnessed first full year loss since 1921.
March-April 1980: Reagan shot in assignation attempt and then appears before Joint Session of Congress a month later to press tax cut.
April-May 1981: Much positive economic news, indicating strong growth in real gdp (variously reported as 6.5%-8.4% annual rate in first quarter); stable unemployment and rapidly rising employment; PPI inflation at 15.6% a.r.; energy price increases.
June 1981: Unemployment jumps, 7.3% to 7.6%; finished goods inflation, 4.8% a.r.
June 1981: Israeli warplanes destroy Iraqi nuclear reactor
July 1981: Rising unemployment, slowing inflation. Reagan administration predicts lower interest rates in next few months
July 1981: Tax cut approved in decisive Reagan victory; 3 years of reductions totaling 25% in individual tax rates; oother reductions in business and oil production taxes.
October 1981: unemployment rises to 7.5% in September, from 7.2% in previous month, extensive adult job loss; unprecedented layoffs of construction workers, school teachers.
October 1981: President Anwar Sadat of Egypt assassinated.
October 1981: CPI inflation rose at 3.2% a.r., smallest rise in more than 3 years.
November 1981: Unemployment rate reaches 8% in October, highest in 6 years.
December 1981: Nov. unemployment at 8.4%; layoffs in heavy industry.
December 1981: CPI inflation at 6% a.r. in November; BLS predicts that 1981 CPI inflation might be as low as 8.9 % (12.4% in 1980) and lowest rate since 1977
January 1982: Unemployment rate went from 8.4% to 8.9% in December; adult male rate at 8%, a post WW II high, and rate among blacks was 16.1%
January 1982: PPI finished goods inflation at 3.6% annual rate in December; 1981 rate was only 7%; CPI inflation at 4.8% in December; 1981 rate only 8.9%
February 1982: Unemployment rate declines .3% in January, but BLS commissioner sees no real improvement on job front.
February 1982: CPI rises at 3.6% a.r.. in January, lowest rate since July 1980.
March 1982: Unemployment climbs back to 8.8% in February
March 1982: PPI falls at 1.2% a.r. in February, first dip since 1976. "Some economists were predicting that inflation was slowing down."
April 1982: Unemployment up to 9% in March (9.9 million people out of work, highest since World War II). US GNP falls 3.9% a.r in Q1, indicating continuing recession.
April 1982: PPI falls at 1.2% a.r.; CPI falls at 3.6% a.r., first decline in 17 years
May 1982: PPI rises at 1.2% a.r.; profits decline by 17.5% in 1st quarter; CPI inflation 2.4% a.r.; Labor department predicts recession lasts through June
June 1982: Israel invades southern Lebanon seeking to destroy PLO

July 1982: CPI inflation at 12% in June; rate in double digits for second month
August 1982: Unemployment at 9.8% in July, a post-WW War II record. With 10,790,000 unemployed, BLS estimates 1.5 million discouraged workers.
August 1982: Peso Falters and US outlines aid package to Mexico, including loans from IMF and foreign central banks, as well as US guarantees for bank loans. Estimates that US investors in Mexico have lost “hundreds of millions”.
August 1982: CPI inflation at 7.2% in July.
September 1982: Unemployment unchanged at record high 9.8% in August
September 1982: Mexico financial woes mount; exchange controls; banks nationalized.
October 1982: Unemployment rises to 10.1% in September, highest in 42 years. Reagan administration fears that statistics will adversely effect upcoming midterm elections.
October 1982: FRS cuts discount rate from 10% to 9.5%, market rates follow.
November 1982: Sharp Wall Street advance continues with DJ rising 43 points to record of 1065 on Nov. 3, after smaller Democratic midterm election gains than some investors expected, apparently leading to conclusion that Reagan economic policies would stick. Capped rise of almost 300 points since interest rates had begun declining in August.
November 1982: Recession depends as unemployment rose to 10.1% in October; Industrial output declines 0.8% in October, 13th decline in 15 months.
November 1982: FRS reduces discount rate from 9.5% to 9.5%
November 1982: CPI increases 6% a.r., continuing moderate trend
December 1982: Unemployment rises to 10.8% in November
December 1982: Housing starts and leading economic indicators rise
December 1982: CPI rises at 1.2% annual rate, but economists attributed declining rate of inflation to the weakness of the economy.