

Choosing the Federal Reserve Chair: Lessons from History

Christina D. Romer and David H. Romer

Stable, noninflationary growth has been the goal of monetary policymakers since the inception of the modern Federal Reserve in the mid-1930s. Policymakers, however, have come closer to achieving this goal in some eras than in others. Under chairmen William McChesney Martin Jr. in the 1950s and early 1960s and Alan Greenspan in the late 1980s and beyond, the Federal Reserve presided over decades of low inflation and mild real fluctuations. Under Paul Volcker in the 1980s, the Federal Reserve oversaw a significant recession, but one that returned the American economy to near price stability and steady growth. In contrast, under Marriner Eccles in the late 1930s, the Federal Reserve triggered a recession that was second in severity only to the Great Depression and that resulted in severe deflation. And under Arthur Burns and G. William Miller in the 1970s, the U.S. economy experienced high and rising inflation and painfully variable real growth.

An obvious question is why monetary policy has been so much more successful under some Federal Reserve chairmen than others. This question has taken on new urgency because current chairman Alan Greenspan will need to be replaced in the near future. It is crucial to understand what has determined policy success in the past and to identify factors that help predict success. Only by learning the lessons of history will we be able to choose a new Federal Reserve chair who is likely to replicate our policy triumphs and avoid our policy failures.

This paper demonstrates that the key determinants of policy success have been policymakers' views about how the economy works and what monetary policy can

■ *Christina D. Romer is Class of 1957 Professor of Economics and David H. Romer is Royer Professor in Political Economy, both at the University of California, Berkeley, California. They are also Research Associates, National Bureau of Economic Research, Cambridge, Massachusetts.*

accomplish. In the first major section of the paper, we analyze the narrative record of the Federal Reserve to discover what policymakers believed and why they chose the policies they did. We find that the well-tempered monetary policies of the 1950s and of the 1980s and 1990s stemmed from a conviction that inflation has high costs and few benefits, together with realistic views about the sustainable level of unemployment and the determinants of inflation. In contrast, the profligate policies of the late 1960s and 1970s stemmed initially from a belief in a permanent tradeoff between inflation and unemployment, and later from a natural rate framework with a highly optimistic estimate of the natural rate of unemployment and a highly pessimistic estimate of the sensitivity of inflation to economic slack. And the deflationary policies of the late 1930s stemmed from a belief that the economy could overheat at low levels of capacity utilization and that monetary ease could do little to stimulate a depressed economy.¹

The clear implication of this link between ideas and policy outcomes is that in choosing a successor to Alan Greenspan, the key criterion should be economic beliefs. But does the historical record suggest ways of predicting what a Federal Reserve chair will believe while in office? In the second major section of the paper, we find that looking at experience and resumes can provide some information. However, much better predictions of the views that Federal Reserve chairmen held during their tenures come from their speeches, writings and testimony prior to being confirmed. Both Federal Reserve chairmen with beliefs that led to moderate policies and successful outcomes, such as Greenspan, and those with views that led to undesirable policies and poor outcomes, such as Miller, clearly revealed their beliefs before they were appointed. Thus, the way to choose a good Federal Reserve chair is to read what candidates have said about how the economy operates and ask them about their economic beliefs. If what a candidate says is unrealistic or poorly reasoned, move on to another candidate or risk a replay of the 1930s or the 1970s.

The Key Role of Ideas in Determining Policy and Outcomes

To determine what monetary policymakers believed in different eras, we take the straightforward approach of looking at what they said. We examine the stated views within the Federal Open Market Committee (FOMC) under each Federal Reserve chairman since the passage of the Banking Act of 1935, which established the current structure of the Federal Reserve System. We omit the period 1941–1950, when the Federal Reserve was committed to supporting Treasury bond prices, and therefore did not pursue independent monetary policy. Thus, we do not

¹ Our analysis draws upon and extends the findings in Romer and Romer (2002a). Numerous other authors have investigated the impact of ideas on the conduct of monetary policy. Examples include the classic work of Friedman and Schwartz (1963); Orphanides (2003a) on policy in the second half of the 1930s; and DeLong (1997) and Mayer (1998) on the 1970s.

analyze the end of Eccles's tenure or Thomas McCabe's brief period as Federal Reserve chairman in the late 1940s and early 1950s.

The views expressed at FOMC meetings are contained in the detailed *Minutes of Federal Open Market Committee* (abbreviated as *Minutes* in the following analysis), available from 1936 to 1976; the verbatim *Transcripts of Federal Open Market Committee* (*Transcripts*), currently available from 1981 to 1997; and the brief summaries of meetings collected each year in the *Annual Report of the Board of Governors of the Federal Reserve System* (*Report*). We also examine the Congressional testimony of the Federal Reserve chairmen and other Board members collected each month in the *Federal Reserve Bulletin* (*Bulletin*).

We use the same narrative sources to establish the link between policymakers' beliefs and policy actions. We look at what policymakers said they were doing and why. As a supplement to this narrative analysis of policy, we look at estimates of the real interest rate and indicators of economic outcomes. Table 1 presents a thumbnail guide to our findings about monetary policymakers' beliefs and the policies those beliefs inspired in different eras.

The Eccles Era

Marriner Eccles became chairman of the newly restructured Federal Reserve in February 1936. The most important element of monetary policymakers' beliefs during the late 1930s was the notion that speculative excesses and demand-induced inflation could occur in an economy with underused capacity. In this view, full employment was not the dividing line between normal and overheated conditions. Rather, it was possible to have "the development of inflationary trends before a full recovery has been attained" (*Minutes*, 3/22/37, p. 6; see also 3/15/37, p. 12). This view was clearly expressed by the associate economist to the Board. In late 1936, when unemployment was still over 13 percent, he warned that "care should be taken to prevent any maladjustment of the economic structure from possible over-stimulation" (11/19/36, p. 2).² Similarly, despite widespread agreement that the recovery was far from complete, a number of FOMC members expressed concern about demand-driven inflation. For example, in March 1937, George Harrison, president of the Federal Reserve Bank of New York, said that expansionary open market operations "might well add unwise stimulus to the inflation of prices" (3/15/37, p. 9; see also 4/3/37, p. 9).

Policymakers believed that overly easy credit was a key mechanism by which inflation and speculative excess could arise in a depressed economy. The FOMC drew a distinction between "legitimate business use" of credit and unproductive speculative uses, and worried that overly easy credit could set off speculation in commodity and asset markets (*Minutes*, 3/15/37, pp. 6–7). A corollary of this view

² When consecutive citations within a paragraph come from the same source, we omit the repeated material about the source for the later citations. For key beliefs, we provide a number of citations; for less central points, we typically give just one quotation. However, all quotations illustrate important ideas that were mentioned repeatedly.

Table 1

Beliefs and Policy Actions under Federal Reserve Chairmen since 1936

<i>Key beliefs</i>	<i>Resulting policy actions</i>
<u>Marriner Eccles (February 1936–January 1948)</u>	
Inflation and speculative excess are possible before full employment	Increase in reserve requirements in 1936 and 1937
Monetary policy cannot stimulate a depressed economy	Only very limited expansion in 1937–1938 recession
<u>William McChesney Martin Jr. (April 1951–January 1970)</u>	
(Early) Inflation is very harmful	} Tightening in 1955 and especially in 1959 to reduce inflation; generally temperate policy
Inflation responds to the deviation of output from a moderate estimate of capacity	
Federal Reserve can and should respond to recessions	
(Late) Long-run inflation-unemployment tradeoff and low “prudent” unemployment rate	Expansion in 1953–1954 and 1957–1958 recessions
At the very end, natural rate hypothesis with a very low natural rate	Accommodative policy despite rising inflation
	Mild tightening in 1969 to reduce inflation
<u>Arthur Burns (February 1970–January 1978)</u>	
(Early) Natural rate hypothesis with a very low natural rate	Expansion in 1970–1971
(Middle) Extreme pessimism about the sensitivity of inflation to slack	Expansion in 1972–1973; advocacy of incomes policies
(Late) Slack will reduce inflation	} Substantial tightening in 1974 to reduce inflation
Relatively high natural rate	
<u>G. William Miller (March 1978–August 1979)</u>	
Natural rate is relatively low	} Expansion despite high and rising inflation; advocacy of incomes policies
Extreme pessimism about the sensitivity of inflation to slack	
<u>Paul Volcker (August 1979–August 1987)</u>	
Inflation is very harmful	} Severe tightening in 1979–1981 to reduce inflation; thereafter, steady, low-inflation policies
Slack will reduce inflation	
Relatively high natural rate	
<u>Alan Greenspan (August 1987–)</u>	
(Early) Same as Volcker	Moderate tightening in 1988 to reduce inflation; otherwise, steady, low-inflation policies
(Late) Low natural rate; innovation limits inflation	Neutral policy in 1999–2000 despite low unemployment

was that the FOMC was deeply “concerned . . . over the current and potential effects on both the credit and banking situation of the continued increase in the excess reserves of member banks” (11/20/36, p. 10). The meetings in late 1936 and early 1937 were full of discussions of the dangers of the large and growing volume of bank reserves above the statutory minimum (for example, 11/19/36, pp. 1–2;

1/26/37, pp. 1–8; 3/15/37, pp. 7–8). A central reason for this concern was that “a further increase in excess reserves of member banks might give added impetus to existing inflationary tendencies” (3/23/37, pp. 3–4).

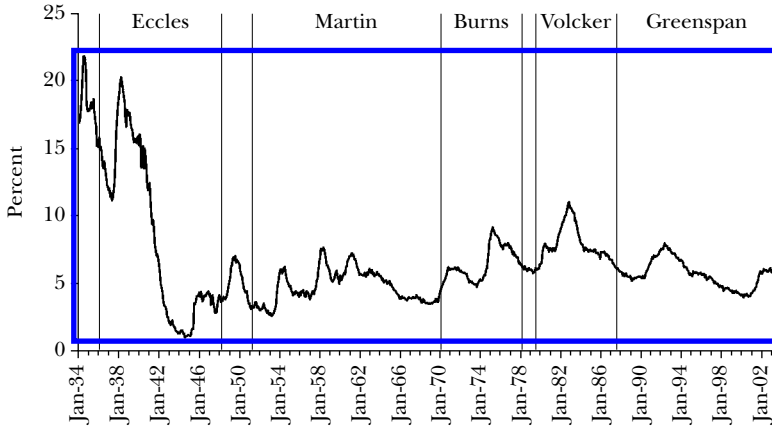
Policymakers in this era also had little faith that monetary expansion could have salutary effects. For example, in November 1937, the economist to the Board urged monetary expansion, but “not with the thought that it would cure the situation” (*Minutes*, 11/29/37, p. 7). Likewise, Harrison said it was a question “whether the System appropriately could take any action which would tend to check a recession and to facilitate the continuation of recovery” (9/11/37, p. 9). He implied that if the depressed level of output was not the result of tight credit, loosening would be of little value. Eccles suggested that adding to excess reserves in a downturn could have at most “a desirable psychological effect” (12/30/38, p. 16).

Monetary policy actions in this period reflected policymakers’ beliefs. The most significant action, a doubling of reserve requirements from August 1936 to May 1937, was motivated by the Federal Reserve’s fear of speculation and inflation. According to the statement released in July 1936 in anticipation of the first part of the increase, the Board believed that existing excess reserves could “create an injurious credit expansion. It is for this reason that the Board decided to lock up this part of the present volume of member bank reserves as a measure of prevention on the one hand and of further encouragement to sound business recovery and confidence in the long-term investment market on the other hand” (*Report*, 1936, p. 217). The economist to the Board argued that raising reserve requirements would help “prevent the development of unsound and speculative situations” (*Minutes*, 1/26/37, p. 3). Policymakers also felt that “the increase in reserve requirements was fully justified in order to put the System in position to exercise credit control through open market operations whenever such action appeared to be necessary” (3/15/37, p. 9; see also 1/26/37, pp. 5–7). While the official statements stressed that such control could be used for expansion or contraction, clearly what the Federal Reserve gained through the elimination of excess reserves was the ability to tighten.

Friedman and Schwartz (1963) argue forcefully that the rise in reserve requirements was the key cause of the recession that began in May 1937. As Eccles realized shortly after the March 1937 increase, “banks have been accustomed . . . to an extremely large amount of excess reserves . . . and . . . it would take the banks some time to accustom themselves to operating with a smaller amount of excess, as evidenced by the fact that they had sold earning assets rather than reduce their balances with correspondents” (*Minutes*, 4/3/37, p. 7). Bank lending declined and the money supply fell sharply in the wake of the increases in reserve requirements. Figure 1 shows the behavior of the unemployment rate starting in January 1934; Figure 2 shows the behavior of the inflation rate. Unemployment rose dramatically in 1938, and prices switched from rising slowly to falling.

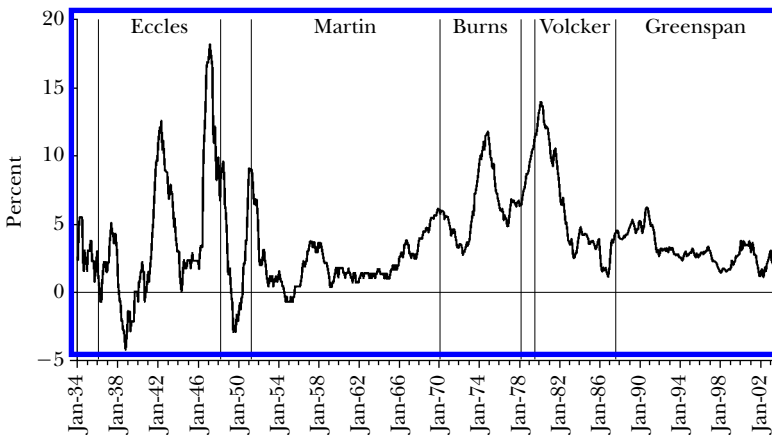
As the recession deepened, the FOMC largely refused to act. This inaction stemmed from the belief that monetary expansion could do little to encourage

Figure 1
Unemployment Rate



Source: Global Financial Data, (<http://www.globalfindata.com>), series UNUSAM. After 1948, the data correspond to the seasonally adjusted series for all workers 16 years and over from the Bureau of Labor Statistics, (<http://www.bls.gov>), series LNS14000000. While the early data are highly suspect and almost surely excessively volatile, there is no question that unemployment surged in the 1937–1938 recession. The vertical lines show the months when each chairman’s tenure began. The gap between Eccles and Martin is the McCabe era, which we do not analyze. The small gap between Burns and Volcker is the Miller era.

Figure 2
Inflation Rate



Source: Bureau of Labor Statistics, (<http://www.bls.gov>), series CUUR0000SA0. The inflation rate is calculated as the 12-month log difference of the Consumer Price Index for all urban consumers. While the early CPI data are surely less accurate than the postwar data, virtually all price series show a return of deflation in 1938. The vertical lines show the months when each chairman’s tenure began.

recovery. For example, in December 1937, the committee felt that “the existing volume of excess reserves and of supplies of private capital is abundant at this time at low rates for continuance of easy credit conditions and for meeting all credit

requirements of commerce, business, and agriculture.” Therefore, “effective action to meet and overcome the present business recession should be taken outside the field of the System’s various monetary powers” (*Minutes*, 12/1/37, p. 2; see also 12/13/37, p. 2; 3/1/38, p. 6). When the Treasury decided to monetize gold in April 1938 to try to stimulate the economy, the FOMC actually debated whether it should sell bonds to counteract the Treasury’s actions (4/21/38, pp. 7–10).

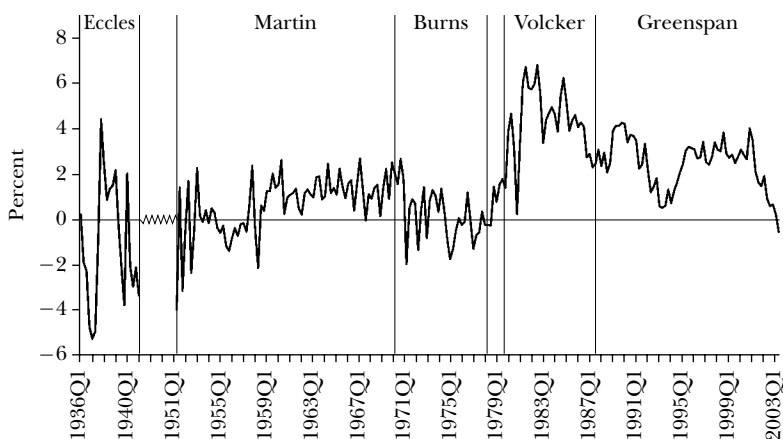
Figure 3 shows estimates of the expected (or ex ante) real interest rate, which is arguably the most fundamental indicator of the stance of monetary policy. The derivation of this series is discussed in the Appendix. The real interest rate was substantially negative during most of the mid-1930s, as gold inflows expanded the money supply greatly and generated expectations of inflation. However, it rose markedly in the third quarter of 1937 (to roughly zero) and was high and positive through most of the 1937–1938 recession. The Federal Reserve clearly did not undertake the kind of aggressive monetary expansion that might have reversed expectations of deflation and lowered real rates. The failure to try to bring the real rate down from its high level is particularly striking when one considers that unemployment reached 20 percent in 1938. This inaction, however, is consistent with policymakers’ fatalistic beliefs at the time.

The Martin Era

William McChesney Martin Jr. was appointed Federal Reserve chairman in April 1951. The Federal Reserve’s worldview in the first decade of Martin’s tenure was surprisingly similar to that since the 1980s (Romer and Romer, 2002b). Policymakers in this period were emphatic that higher inflation would not increase output and employment in the long run; indeed, they believed that its long-run effects were negative. For example, Martin stated in 1958: “If inflation should begin to develop again, it might be that the number of unemployed would be temporarily reduced . . . , but there would be a larger amount of unemployment for a long time to come” (*Minutes*, 8/19/58, p. 57; see also 12/7/54, p. 22; 9/22/59, p. 8). Martin often made statements very similar to ones Volcker and Greenspan would make decades later about the importance of low inflation for long-run growth. In 1957, for example, he said, “stability in the value of the dollar” and “sustained economic growth” “are inseparable. Price stability is essential to sustainable growth. Inflation fosters maladjustments” (*Bulletin*, August 1957, p. 869; see also March 1952, p. 244; February 1959, p. 118). Indeed, Martin may have taken aversion to inflation to an extreme; for example, he argued that “a gradual rise in prices . . . averaging perhaps 2 per cent a year,” if allowed to continue indefinitely, “would work incalculable hardship” (August 1957, p. 872).

In addition, policymakers had an intuitive natural rate framework of inflation dynamics. For example, in 1955, one member of the FOMC said that “[t]he economy was moving nearer capacity in many respects, and as this point approached less efficient means of production would be utilized and prices would tend to rise” (*Minutes*, 10/4/55, p. 8). Similarly, in 1953, Martin stated, “when an economy is running at peak levels of production and employment, creating more

Figure 3

Expected Real Interest Rate

Source: See Appendix. The observations for 1941Q2 to 1951Q1 are missing because we exclude this period from the estimation. The vertical lines show the quarters when each Federal Reserve chairman's tenure began.

money will not create more things to buy. It can only bid up the prices of available supplies" (*Bulletin*, May 1953, p. 453). On the flip side, FOMC members believed that slack was needed to reduce inflation. In 1959, Martin stated that he "hoped that inflation would not get out of hand to such an extent that a very serious price would have to be paid for its correction" (*Minutes*, 1/6/59, p. 37). There was much discussion in late 1958 and 1959 of the "rampant inflationary psychology," and a clear sense that prolonged slowness was needed to change expectations (2/10/59, p. 22; see also 8/19/58, p. 59).

Policymakers also had moderate estimates of sustainable unemployment and capacity. In August 1956, when unemployment had been 4.4 percent the month before, Martin said that "[t]he wage-cost spiral needs no comment," since "we were bordering on a state of over-employment" (*Minutes*, 8/7/56, p. 32). In mid-1959, when unemployment was hovering near 5 percent, the economist to the Board stated that "[t]he economy is approaching the limits of resource utilization" (6/16/59, p. 6).

Finally, policymakers in the 1950s, in contrast to their predecessors in the 1930s, believed that monetary policy could help both limit expansion in good times and stimulate recovery during recessions. As Martin said in 1952: "Basically, the job of the Federal Reserve System is that of monetary management—to increase the money supply and make it more easily available when there is evidence of weakness in the economy and to reduce the volume of money and make it less easily available when indications show that there is excessive expansion" (*Bulletin*, April 1952, p. 348). He later gave the more colorful description: "Our purpose is to lean against the winds of deflation or inflation, whichever way they are blowing" (U.S. Senate,

1956, p. 5). The view that monetary policy should be countercyclical has remained a fundamental tenet of Federal Reserve policymakers throughout the postwar era.

Policymakers' beliefs were central to the conduct of policy in the 1950s. The notion that monetary policy could stimulate a depressed economy led the Federal Reserve to loosen substantially in the recessions of 1953–1954 and 1957–1958. For example, the FOMC adopted a program of “active ease” in September 1953 (*Minutes*, 9/8/53, p. 12), and had as the primary goal of monetary policy “avoiding deflationary tendencies” (9/24/53, p. 29).

More importantly, the belief that inflation was very costly, coupled with the modern view of the determinants of inflation, led to strong actions to control inflation in the mid- and late 1950s. Indeed, in an episode that deserves to be called the Martin disinflation, the FOMC was so concerned about the rise in inflation to slightly over 3 percent in 1958 that it moved to a highly restrictive stance just after the trough of the recession. Martin stated that “[t]he remedy for the inflation . . . was bound to be disagreeable but the problem required taking a stand” (*Minutes*, 9/9/58, p. 50). Another member said that “the country was going to have inflation and . . . there must be serious shock treatment” (9/9/58, p. 27). These views were widely shared on the FOMC (for example, 5/26/59, pp. 17, 37; 6/16/59, p. 30).

Figure 3 shows that real interest rates were on average moderate in the 1950s. The Federal Reserve lowered real rates in response to the recessions of 1953–1954 and 1957–1958, and raised them substantially in response to inflation in 1957 and 1959–1960. The fact that policymakers responded forcefully to economic conditions, but had no systematic tendency toward expansion or contraction, is consistent with their generally moderate beliefs. The result of these policies was that inflation was low and real fluctuations were small. As Figure 2 shows, inflation was typically under 2 percent in the 1950s and early 1960s. Figure 1 shows that there were three recessions between 1950 and 1961, but that they were typically short and fairly mild.

The prevailing intellectual framework at the Federal Reserve changed radically in the 1960s, however. Interestingly, this is one time when the chairman's views did not dominate the FOMC. Martin continued to hold the same views he held in the 1950s.³ But he also believed that policy should be made by consensus, and that the Federal Reserve's independence was—and should be—limited (Kettl, 1986; Meltzer, 2003). As a result, when the Kennedy and Johnson administrations and other FOMC members adopted the “New Economics,” Martin acquiesced.

A key element of the administrations' beliefs was a permanent unemployment-inflation tradeoff, so that “the choice of the ideal level of utilization is a social

³ In 1966, for example, with unemployment at 4.0 percent, Martin said: “The System now would be operating in an entirely new environment . . . of full employment generally and over-full employment of skilled workers. He personally would favor a little inflation if he thought it would benefit the unemployables, but he did not think it would; rather, it would do them harm” (*Minutes*, 1/11/66, pp. 81–82). Thus, he continued to believe not only that there was an adverse long-run tradeoff, but also that the natural rate was above 4 percent.

judgment that requires a balancing of national goals of high employment and reasonable price stability” (*Economic Report of the President*, 1969, p. 62). Furthermore, throughout the 1960s, administration policymakers believed that inflation would be modest at even quite low levels of unemployment, so that 4 percent unemployment was a “reasonable and prudent” goal for aggregate demand policy (1962, p. 46). The Federal Reserve’s acquiescence to these beliefs is revealed by the numerous deferential references in the *Minutes* for this period to the administrations’ views and goals (for example, 2/13/62, p. 5; 3/1/66, p. 44).

The new views were also expressed in the Federal Reserve’s discussions. In 1966, for example, the staff referred to “the trade-off between reduced unemployment and price stability” (*Minutes*, 1/11/66, p. 23). In 1962, with unemployment fluctuating around 5.5 percent, the staff believed that activity could not “be said even to approach an adequate level of resource utilization” (8/21/62, p. 5). And in early 1968, when unemployment was 3.7 percent and the FOMC expected rapid real GNP growth, the Committee’s main concern was not that inflation might increase, but merely that it might continue (*Report*, 1968, p. 115; see also p. 117).

The change in views had a major impact on monetary policy in the second half of the 1960s.⁴ Despite rapid output growth, high resource use and rising inflation, the FOMC did not tighten. The real interest rate series in Figure 3 is essentially flat at a moderate level over this period. The reason appears to have been policymakers’ belief in a long-run tradeoff and their optimistic assessments of the economy’s capacity. A typical sentiment was that of the member who said in early 1968 that he “did not think the Committee should change its position. There was considerable evidence that the main thrust of existing inflationary pressures might be of a short-run nature, and that those pressures might end by the middle of 1968” (*Minutes*, 1/9/68, pp. 68–69). Armed with expansionary fiscal policy and accommodative monetary policy, the economy expanded rapidly, with unemployment dropping to 3.4 percent. Inflation began to creep up; by the end of the decade it was 6 percent.

There was a final shift in views at the very end of Martin’s tenure. The Nixon administration’s policymakers (under the leadership of chief domestic policy adviser Arthur Burns) believed that the change in inflation depended on the gap between actual unemployment and the natural rate and, thus, that there was no long-run tradeoff. The new administration’s first *Economic Report of the President* argued that “inflations have seldom ended without a temporary rise in unemployment,” and that under the disinflationary policies it intended to follow, in the short run “output will be below its potential and the rate of inflation, while declining, will probably still be too high” (1970, pp. 21, 65). Since Martin’s own beliefs were still those he had held in the 1950s, he welcomed this shift in views (Wells, 1994). In

⁴ In the first part of the decade, the U.S. balance of payments deficit meant that the Federal Reserve could not loosen without endangering the system of fixed exchange rates; as a result, the new ideas had little impact. As Martin put it in 1962, “the balance of payments problem overshadowed everything else” (*Minutes*, 5/29/62, p. 41).

addition, the steady increases in inflation in the second half of the 1960s led other monetary policymakers to conclude once again that inflation was highly inertial. For example, at the December 1968 FOMC meeting, most members expressed deep concern about inflationary expectations and inflationary psychology (*Minutes*, 12/17/68, pp. 48–90). In early 1969, Martin testified: “Expectations of inflation are deeply embedded” (*Bulletin*, March 1969, p. 238).

However, although policymakers adopted—or returned to—the natural-rate framework, they did not abandon their optimistic assessments of the economy’s capacity. Administration policymakers estimated the natural rate of unemployment at 3.8 percent and the growth rate of potential output at 4.3 percent per year (*Economic Report of the President*, 1970, p. 79). The Federal Reserve staff had similar views (*Bulletin*, March 1969, pp. 245, 251).

The shift in views led the Federal Reserve to tighten substantially beginning in late 1968. Consistent with the natural rate framework, Martin believed that policy needed to reduce output below trend and hold it there until inflation came down. He stated: “A slowing in expansion that is widely expected to be temporary is not likely to be enough to eradicate . . . expectations [of inflation]. . . . The critical test for stabilization policies in 1969 will be their ability to keep . . . a rebound in activity and prices from developing” (*Bulletin*, March 1969, p. 238). The real interest rate rose roughly 2 percentage points, and the economy entered a recession at the end of 1969.

The Burns Era

Arthur Burns became Federal Reserve chairman in February 1970. Initially, there was substantial continuity in beliefs from the end of the Martin era: policymakers believed in the natural rate framework with a very optimistic estimate of the natural rate. For example, Burns testified in February 1970 that because of monetary and fiscal restraint, “this January the unemployment rate again approached 4 per cent,” and “[w]e must now have the patience to wait for the improvement in price performance that will eventually result” (*Bulletin*, March 1970, pp. 248–249). The staff forecasts presented at the meetings in 1970 consistently predicted renewed growth, but nevertheless some moderation in inflation (for example, *Report*, 1970, pp. 99, 133, 145).

The FOMC loosened substantially during Burns’s first two months as chairman and then loosened consistently beginning in June 1970. The narrative record, while not crystal clear, certainly suggests that the policy was motivated by economic beliefs. In August 1970, with unemployment at or slightly below 5 percent in previous months, policymakers believed that “expectations of continuing inflation had abated considerably.” They voted to ease because they felt it was possible for policy to be “sufficiently stimulative to foster moderate growth in real economic activity, but not . . . risk a resurgence of inflationary expectations” (*Report*, 1970, pp. 148–149). Their optimistic estimate of the natural rate appears to have made them feel that there was no conflict between expansionary policy and their goal of lowering actual inflation to validate the reduced expectations.

When inflation failed to fall as quickly as policymakers had hoped, they responded by becoming dramatically more pessimistic about the downward responsiveness of inflation to slack. In July 1971, Burns testified (*Bulletin*, August 1971, p. 656):

A year or two ago it was generally expected that extensive slack in resource use, such as we have been experiencing, would lead to significant moderation in the inflationary spiral. This has not happened, either here or abroad. The rules of economics are not working in quite the way they used to. Despite extensive unemployment in our country, wage rate increases have not moderated. Despite much idle industrial capacity, commodity prices continue to rise rapidly. And the experience of other industrial countries . . . shouts warnings that even a long stretch of high and rising unemployment may not suffice to check the inflationary process.

Burns suggested that the rise of public sector unions, the impact of that rise on the labor movement in general, welfare and other factors might be responsible for the change (*Minutes*, 6/8/71, p. 51). He concluded that “monetary policy could do very little to arrest an inflation that rested so heavily on wage-cost pressures. In his judgment a much higher rate of unemployment produced by monetary policy would not moderate such pressures appreciably” (p. 51). Such views were common at the Federal Reserve in this period (for example, 5/11/71, pp. 28–29; 6/29/71, pp. 34–35).

The new view made policymakers unwilling to tolerate even modest unemployment. For example, in December 1971, “a number of members expressed the view that more aggressive actions to stimulate monetary growth were needed at this time in the interest of fostering the desired expansion of economic activity and employment” (*Report*, 1971, p. 199). Burns and the rest of the FOMC instead became leading advocates of wage and price guidelines and other unconventional policies aimed at changing inflationary expectations directly. In June 1971, Burns testified: “[A] substantial increase of unemployment has failed to check the rapidity of wage advances or to moderate appreciably the rise of the general price level. With increasing conviction, I have therefore come to believe that our Nation must supplement monetary and fiscal policy with specific policies to moderate wage and price increases” (*Bulletin*, July 1971, p. 596; see also March 1971, p. 239; June 1971, p. 481; November 1971, pp. 917–918). In taking this position, Burns was opposing his allies in the White House, so there can be no political motivation (Kettl, 1986, pp. 120–125). Rather, Burns became a vocal advocate for incomes policies precisely because he felt that aggregate demand restraint was no longer an effective way of dealing with inflation.

The expansionary policy pursued by the Federal Reserve in the early 1970s was reflected in the real interest rate and economic outcomes. The real interest rate shown in Figure 3 averaged close to zero during Burns’s first three years in office and was at times strongly negative. Figure 1 shows that the unemployment rate fell

steadily from 1971 to late 1973. As Figure 2 shows, price controls, which were implemented in August 1971, do appear to have reduced inflation temporarily. However, inflation began to rise steadily once controls were relaxed in January 1973. That the Federal Reserve ran such expansionary policy at a time when unemployment was falling and inflation was rising is exactly what one would expect given the economic model held by monetary policymakers at the time.

In the mid-1970s, the extreme pessimism within the FOMC about the sensitivity of inflation to slack gave way to a renewed belief that conventional aggregate demand restraint could reduce inflation. For example, in February 1974, Burns testified: “The objective of public policy in these difficult circumstances must be to establish a dependable framework for a gradual return to price stability over the next few years. In this endeavor we will need to rely principally on sound management of aggregate demand through general monetary and fiscal policies” (*Bulletin*, February 1974, p. 105). In contrast to his earlier exhortations on the ineffectiveness of slack, Burns in 1974 expressed the view that a “slower pace of economic activity, both here and abroad, may well cause a decline in the prices of industrial raw materials and internationally traded commodities” (March 1974, p. 210).

This renewed confidence in the usefulness of slack was accompanied by an increase in estimates of the natural rate. In February 1977, when unemployment was 7.6 percent, Burns said, “As the pace of economic activity quickens in coming months, pressures could develop for larger and more widespread increases in wages and prices than we have recently experienced” (*Bulletin*, February 1977, pp. 121–122; see also March 1977, p. 226). In December 1977, when the unemployment rate was 6.4 percent, another FOMC member suggested that “the high rate of unemployment was a structural problem that could not be solved with monetary policy” (*Report*, 1977, p. 319; see also p. 276).

This greatly increased estimate of the natural rate was also revealed in Burns’s diagnosis of the inflation of the 1970s. He placed little emphasis on supply factors, and took pains to point out that the inflation besetting nearly every country was the result of excessive aggregate demand stimulus. For example, in September 1974, he testified: “For many years, our economy and that of most other nations has been subject to an underlying inflationary bias that has merely been magnified by special influences. . . . governments have often lost control of their budgets, and deficit spending has become a habitual practice. In many countries, monetary policy has supplied an inflationary element on its own, besides accommodating fiscal excesses” (*Bulletin*, October 1974, p. 703).

The changes in beliefs in the mid-1970s were reflected in monetary policy actions. In 1974, the Federal Reserve adopted a significantly contractionary policy at a time when output was already falling. The Federal Reserve was explicit that the action was motivated by its model of inflation dynamics. Burns testified in August: “For a time, we should be prepared to tolerate a slower rate of economic growth and a higher rate of unemployment than any of us would like. A period of slow growth is needed to permit an unwinding of the inflationary processes that have been built into our economy through years of neglect” (*Bulletin*, August 1974,

p. 566). In September, when unemployment was 5.9 percent, Burns stated that he “would not wish to see a prompt recovery in economic activity. If recovery began promptly, economic activity would turn up at a time when inflation was continuing at a two-digit rate” (*Minutes*, 9/10/74, p. 65). This view was seconded by other FOMC members (for example, pp. 66, 68, 80).

After loosening substantially in response to the surge of unemployment in the winter of 1974–1975, the FOMC voted to raise interest rates slightly and then pursued a policy of modest expansion. Burns testified in June 1976 that “we resisted advice to open the tap and let money flow out in greater abundance,” and that “[a]nother indication of our intention to adhere to a moderate course of monetary policy may be found in the prompt actions we took some weeks ago to ward off the threat of excessive growth of the monetary aggregates” (*Bulletin*, July 1976, pp. 578–579). The Federal Reserve’s fairly moderate policy is consistent with its belief at the time that the natural rate was quite high. As Figures 1 and 2 show, the policies of the mid-1970s were accompanied by unemployment consistently over 7 percent and steady declines in inflation.

Figure 3 shows that the real interest rate rose noticeably in the mid-1970s. This behavior is exactly what one would expect given the move to more moderate economic beliefs. However, at the end of 1976, policy became dramatically more expansionary, despite the fact that inflation was rising and unemployment was falling. Interestingly, we see no obvious change in beliefs that would explain this behavior. Greider (1987, pp. 346–347) suggests that Burns may have expanded in an effort to win renomination from President Carter. Thus, this appears to be one episode when politics or personal ambition, rather than economic beliefs, drove policy. Figures 1 and 2 show that the loosening of policy was accompanied by a substantial fall in unemployment and a surge in inflation at the very end of the Burns era.

The Miller Era

G. William Miller was appointed Federal Reserve chairman in March 1978. While certain outspoken members of the FOMC did not change their views, the model of the economy that prevailed within the FOMC changed quite quickly. One important development was that estimates of the natural rate of unemployment became more optimistic. In April 1978, when unemployment was 6.1 percent, one member said that “slack still existed in the utilization of industrial capacity and of the labor force,” and this view was seconded by another member (*Report*, 1978, p. 162). In January 1979, with unemployment at 5.9 percent, Miller testified that signs of tautness in the labor market were “a normal accompaniment of economic expansion and to date have not reached troublesome dimensions” (*Bulletin*, February 1979, p. 119). The view that the natural rate was clearly below 5.9 percent was a decided change from the much higher levels of the natural rate mentioned just the year before.

One sign of this new optimism was that the Federal Reserve attributed the increases in inflation in this period to various special factors, such as reduced

supplies of agricultural goods, increases in the minimum wage and depreciation of the dollar, rather than to demand pressure (for example, *Bulletin*, November 1978, p. 843; *Report*, 1979, p. 139). Indeed, in early 1979 Miller testified: “Even in the absence of excessive aggregate demand pressures last year, inflation accelerated markedly” (*Bulletin*, February 1979, p. 119).

This optimism was also revealed by the Federal Reserve’s views about what was needed to reduce inflation. In November 1978, Miller testified: “If inflation is to be gradually slowed, aggregate demand must not be permitted to expand to the point at which it presses excessively on available supplies of labor and industrial resources. This means that real GNP at this juncture probably should not grow at an annualized rate much above 3 per cent, in line with the prospective growth of potential output” (*Bulletin*, November 1978, p. 844). The Federal Reserve clearly thought that the prevailing unemployment rate of 5.9 percent was above the natural rate; and certainly, the estimated growth rate of potential output was quite high. These optimistic beliefs are particularly striking given that by 1978 the U.S. economy had been suffering from unemployment-increasing demographic changes and the productivity growth slowdown for some time.

A perhaps even more important feature of beliefs in the Miller era was the reemergence of the view that slack could do little to reduce inflation. Miller testified in March 1978: “Our attempts to restrain inflation by using conventional stabilization techniques have been less than satisfactory. Three years of high unemployment and underutilized capital stock have been costly in terms both of lost production and of the denial to many of the dignity that comes from holding a productive job. Yet, despite this period of substantial slack in the economy, we still have a serious inflation problem” (*Bulletin*, March 1978, p. 193). This concern about the difficulty of reducing inflation was echoed by other members of the FOMC (for example, *Report*, 1978, p. 210; 1979, pp. 161–162).

Policymakers’ beliefs were again reflected in the policies they chose. Members of the FOMC expressed grave concern about inflation and genuinely wanted to reduce it. But their optimistic estimates of the natural rate led them to avoid seriously contractionary actions. Miller testified: “The Federal Reserve, for its part, is continuing to pursue a monetary policy that aims at a reduction of inflationary pressures while encouraging continued economic growth and high levels of employment” (*Bulletin*, December 1978, p. 943). Policymakers’ belief that slack would have little impact on inflation reinforced their conviction that they should avoid genuine contraction. This sentiment was expressed in 1979 when Miller testified: “The Federal Reserve does not consider a recession desirable. ‘Stop-go’ patterns of economic growth have . . . brought no lasting relief from inflation” (February 1979, p. 120).

The belief that aggregate demand restriction was not an effective way to reduce inflation also led the Federal Reserve to advocate various nonmonetary policies. In early 1978, Miller testified that aggregate demand policies “need to be complemented by programs designed to enhance competition and to correct structural problems, in particular labor and product markets” (*Bulletin*, March 1978,

pp. 193–194). Similarly, the February 1979 “Monetary Policy Report to Congress” concluded that “it may be necessary to augment monetary and fiscal policies with carefully focused programs to facilitate job placement and to provide skill training” (March 1979, p. 189).

Our estimate of the real interest rate given in Figure 3 was negative at the beginning of Miller’s tenure, but then rose somewhat. Even so, as Miller himself noted on a number of occasions, “Real interest rates . . . still appear to remain low by historical standards and thus continue to facilitate an expansion of overall demands” (*Bulletin*, March 1979, p. 227). Setting such modest real interest rates when inflation was already high is exactly what one would expect given the Federal Reserve’s model of the economy at the time.⁵ The effects of Miller’s relatively expansionary policy (as well as the lagged effects of Burns’s last hurrah) are obvious in Figures 1 and 2. The unemployment rate fell steadily in 1978 and early 1979, and inflation surged even before the oil price shock in the second half of 1979.

The Volcker and Greenspan Eras

With the appointment of Paul Volcker as Federal Reserve chairman in August 1979, the views guiding monetary policy changed fundamentally. The central elements of those views have remained quite stable since then, continuing after Volcker was succeeded by Alan Greenspan in August 1987.

A fundamental tenet of monetary policymakers over the past quarter century has been the critical importance of low inflation. High inflation, in this view, disrupts the economy and depresses long-run growth. For example, Volcker stated in 1981 that “we must not lose sight of the fundamental point that so many of the accumulated distortions and pressures in the economy can be traced to our high and stubborn inflation.” He went on to say, “progress on inflation is a prerequisite for . . . sustained, balanced growth” (*Bulletin*, August 1981, pp. 613, 616). Similarly, Greenspan testified in 1995, “I believe firmly that a key ingredient in achieving the highest possible levels of productivity, real incomes, and living standards is the achievement of price stability” (April 1995, p. 342). Both Volcker and Greenspan stressed the benefits of low inflation virtually every time they testified to Congress about monetary policy during their tenures.

A second central element of policymakers’ beliefs has been a conventional view of inflation behavior: inflation responds to the output gap, and there is no substitute for aggregate demand restraint in controlling inflation. In 1980, Volcker

⁵ Orphanides (2003b) argues that monetary policy in the 1960s and 1970s conformed well with modern practice, providing one uses the estimates of the output gap policymakers had at the time. This finding is consistent with our view that ideas have been crucial, since beliefs about normal unemployment were a key determinant of historical gap estimates. At the same time, however, this characterization of the source of policy in these decades is too simple. For much of the period, prevailing beliefs about the output gap were not the product of a modern natural rate framework, but reflected assessments of the economy’s maximum reasonable capacity. As a result, the historical gap numbers are not conceptually comparable to modern estimates. In addition, we find that beliefs about the costs of inflation and the sensitivity of inflation to slack were also important determinants of policy.

said, “Monetary policy—restraint on growth of money and credit—is only effective over time; but experience shows that, with perseverance, it can and will be effective” (*Bulletin*, February 1980, p. 140; see also March 1980, p. 214). His comments about even mild incomes policies were few and not encouraging (February 1980, p. 142; August 1983, p. 604). Greenspan held similar views of inflation dynamics. In 1993, for example, he argued that real interest rates “persisting above [their equilibrium] level, history tells us, tend to be associated with slack, disinflation, and economic stagnation, and rates below that level tend to be associated with eventual resource bottlenecks and rising inflation” (September 1993, p. 853; see also April 1995, p. 342).

A final key ingredient of modern policymakers’ economic framework has been a relatively high estimate of the natural rate. Under Volcker, policymakers believed that the level of unemployment needed to reduce inflation was substantial. In March 1980, for example, when the staff forecast projected unemployment to rise above 8 percent, FOMC members expected that “the underlying inflation rate would not be reduced very much in the short run by the rather moderate contraction in activity generally being projected” (*Report*, 1980, p. 108; see also 1981, p. 116). During the first decade of Greenspan’s tenure, estimates of the natural rate were certainly lower than in the Volcker era. For example, in 1994, with unemployment hovering around 6 percent, Greenspan testified that “the amount of slack in the economy, though difficult to judge, appears to have become relatively small” (*Bulletin*, September 1994, p. 794). However, these estimates were still relatively high considering the changes in the U.S. labor market toward lower normal unemployment that occurred in the 1990s.

Policy actions under Volcker and Greenspan have followed from policymakers’ beliefs. The Volcker disinflation is the most striking example: the FOMC’s central focus on low inflation, its belief that slack would reduce inflation and that other policies would not, and its high estimate of the natural rate led it to respond to the high inflation of the late 1970s with extremely contractionary policy and to maintain that policy in the face of a severe recession. By our measure, the real interest rate rose over 5 percentage points from the third quarter of 1979 to the second quarter of 1981, and remained high until well after the severe recession of 1981–1982. In 1980, Volcker explained the policy (*Bulletin*, March 1980, p. 214; see also *Report*, 1980, pp. 100–102):

In the past, at critical junctures for economic stabilization policy, we have usually been more preoccupied with the possibility of near-term weakness in economic activity or other objectives than with the implications of our actions for future inflation. . . . The result has been our now chronic inflationary problem. . . .

The broad objective of policy must be to break that ominous pattern. . . . Success will require that policy be consistently and persistently oriented to that end. Vacillation and procrastination, out of fears of recession or otherwise, would run grave risks.

Since the mid-1980s, the Federal Reserve has followed a moderate real interest rate policy; it has raised the real rate when inflation threatened and lowered it when real activity weakened, but never pursued extreme expansion or contraction. For example, the FOMC tightened moderately in the late 1980s in response to a modest resurgence of inflation. Our estimated real interest rate rose roughly 2 percentage points in 1988 and 1989. Greenspan explained: “[T]he current rate of inflation, let alone an increase, is not acceptable, and our policies are designed to reduce inflation in coming years. This restraint will involve . . . some slowing in the underlying rate of growth of real GNP” (*Bulletin*, April 1989, p. 274). Greenspan recognized that the policy could cause a recession, but felt that making progress against inflation was crucial (September 1989, p. 616). Conversely, in response to the 1990–1991 recession and the ensuing “credit crunch,” the Federal Reserve expanded aggressively. Our estimate of the real interest rate fell roughly 3 percentage points in the early 1990s. Greenspan testified in 1994: “Over a period of several years starting in 1989, the Federal Reserve progressively eased its policy stance . . . in response to evidence of a variety of unusual restraints on spending” (April 1994, p. 304). These carefully calibrated policies were obviously consistent with the Federal Reserve’s emphasis on low inflation and its moderate beliefs about the sustainable level of unemployment. As can be seen in Figures 1 and 2, the result of these policies was that inflation was low and recessions were few and mild.

The surprising behavior of inflation beginning in the mid-1990s appears to have led Greenspan and some other members of the FOMC to change their views about the determinants of inflation. Greenspan testified in 2000 that “there is still uncertainty about whether the current level of labor resource utilization can be maintained without generating increased cost and price pressures” (*Bulletin*, September 2000, p. 650). By raising the possibility that labor market conditions in mid-2000 might be sustainable, he was in effect suggesting that the natural rate might have fallen to 4 percent. At times, Greenspan also suggested that there had been a qualitative change in inflation behavior. He argued that the economy had become much more competitive and that, as a result, forces that would otherwise cause firms to raise prices could instead prompt them to find offsetting cost reductions. In 1999, for example, he suggested that technological progress had “created a broad range of potential innovations that have granted firms greater ability to profitably displace costly factors of production whenever profit margins have been threatened” (September 1999, p. 627; see also April 1999, p. 247).

The FOMC left the real interest rate essentially unchanged during the strong expansion of the late 1990s. As Figure 1 shows, unemployment fell to levels not seen since the late 1960s. But in contrast to other episodes when the Federal Reserve did not tighten in the face of strong expansion, inflation remained low. Although there was clearly a shift in the FOMC’s beliefs that could explain its policy, it is hard to know how large a role the shift actually played: inflation was so subdued that even policymakers with conventional views had little grounds for advocating significant tightening.

Taken together, our analysis of the six chairmen's tenures shows that economic beliefs have been the critical determinant of policy and outcomes. Over the past half-century, certain views about how the economy works have led to moderate policies and desirable outcomes. In particular, under Martin in the 1950s and Volcker and Greenspan after 1979, policymakers believed that inflation had no long-run benefits and, indeed, high long-run costs; that inflation responds to the deviation of output from a moderate estimate of capacity; and that monetary policy can be used both to lower inflation and to stimulate a depressed economy. Because of these beliefs, policymakers in these eras adopted policies designed to restrain inflation and minimize real fluctuations. In each case inflation was indeed restrained and the economy avoided "boom-bust" fluctuations in output and employment.

In contrast, whenever policymakers have strayed significantly from these sensible views, the result has been misguided policies and unfortunate outcomes. Under Eccles in the 1930s, the Federal Reserve believed that demand-induced inflation was possible at unemployment rates above 10 percent, and so adopted a highly restrictive policy that caused a devastating recession. In the 1960s, the majority of the FOMC (though not Martin) believed that sustainable unemployment was very low. Under Burns and Miller in the 1970s, policymakers believed that the natural rate was quite low and that slack could do little to reduce inflation. The misguided beliefs of the 1960s and 1970s led to policies that were systematically too expansionary. As a result, the economy experienced high inflation and a number of engineered recessions to bring inflation down.

Predicting Policymakers' Views

Our finding that ideas have been the key determinant of policy success has an obvious implication: in choosing the Federal Reserve chair, it is crucial to find someone who will be guided by a sensible economic framework. But how does one predict who will have sensible beliefs? To address this question, we again use the lessons from history. We look for factors that have predicted what previous Federal Reserve chairmen believed while in office.

Of course, a sensible framework is not all that matters. A Federal Reserve chair with sound beliefs might be unable to impose those beliefs on an FOMC with radically different views. However, the experience of the Federal Reserve since 1936 has been that the chairman's beliefs are almost always central to policymaking. In the one significant period when the chairman's views did not prevail, the 1960s, Martin did not insist on his own sensible beliefs, but rather chose to defer to the proponents of the New Economics. And even Miller, who was not particularly skilled or savvy as a leader, was able to impose his views on the FOMC almost immediately. Furthermore, the success and prominence of Volcker and Greenspan have surely enhanced the deference that will be given future chairs. Therefore, it

is extremely unlikely that a future chair will be unable to fashion policy according to his or her economic framework.

It is also true that what constitutes sensible beliefs may change over time. Our previous analysis has shown what constituted reasonable views in the past. But as the economy changes, reasonable beliefs about the determinants of inflation and the effects of monetary policy could change as well. For example, as we have described, Greenspan's and Miller's estimates of the natural rate were at times quite similar. Yet, Greenspan's estimate was realistic for the economy at the time, whereas Miller's was much too low given economic fundamentals during his tenure. Going forward, what is crucial is that a future chair's beliefs be reasonable relative to the economy at the time, in the way that Martin's, Volcker's and Greenspan's were reasonable relative to the economies they faced. If we can identify factors that predicted the sensible views of these past chairmen, this may help predict whether a future chair's beliefs will be sensible in relation to the economy he or she confronts.⁶

Predicting Beliefs Using Biographical Information

One way to attempt to predict the quality of chairmen's economic frameworks is to examine their background characteristics. Basic biographical information that could plausibly be related to economic understanding is given in Table 2.⁷ Obviously, because there are only six observations, the most one can hope to see are suggestive patterns.

Formal training in economics has an obvious problem as a predictor of sound understanding of the economy. Burns, who was a distinguished economics professor and president of the National Bureau of Economic Research, was unquestionably the best-trained chairman. Yet his rapidly fluctuating and often unrealistic views had severely adverse consequences for policy. Nonetheless, the record suggests that training in economics is desirable. The two chairmen with essentially no training in economics, Eccles and Miller, had deeply flawed understandings of the economy that led to highly misguided policies. Greenspan and Volcker, two chairmen with sensible economic beliefs, were both economics majors who did graduate-level work in the field. Martin, the third chair with realistic beliefs, did not major in economics, but he did study it at Yale. His interest in economics was fostered by his father, who helped write the original Federal Reserve Act and served as governor and president of the Federal Reserve Bank of St. Louis.

Table 2 reveals some stronger correlations. The three chairmen with the most

⁶ What constitutes sensible beliefs could also change because of changes in the key issues facing monetary policymakers. For example, it is conceivable that problems involving exchange rates or financial crises will become central, so that the critical determinant of future monetary policymakers' success will be their views about these issues. But the history of monetary policymaking we have described strongly suggests that such issues will remain secondary to the more basic macroeconomic issues of inflation, capacity and the possible contribution of monetary policy.

⁷ Most of this information is available from Katz (1992). Where necessary, we supplement this source with published interviews, other biographies and the biographical sketches and statements included in the chairmen's confirmation hearings.

Table 2

Biographical Information on Federal Reserve Chairmen since 1936

<i>Education</i>	<i>Primary occupation</i>	<i>Prior public service</i>	<i>Political involvement</i>
<u>Marriner Eccles (b. 1890; d. 1977)</u>			
Attended high school, but did not graduate	Banker; president of a Utah bank holding company	Special assistant to the secretary of the Treasury for one year	Republican, but strong supporter of Roosevelt
<u>William McChesney Martin Jr. (b. 1906; d. 1998)</u>			
B.A. in English and Latin from Yale; attended law school, but did not finish	Stockbroker; president of NY Stock Exchange; public servant	President of Export-Import Bank; assistant secretary of the Treasury for international affairs	Democrat, but widely perceived as non-partisan
<u>Arthur Burns (b. 1904; d. 1987)</u>			
A.B., A.M. and Ph.D. in economics from Columbia	Professor at Columbia; research director, and later president, of NBER	CEA chairman under Eisenhower; cabinet-rank counselor to the president under Nixon	Republican; key domestic policy adviser to Nixon's presidential campaign
<u>G. William Miller (b. 1925)</u>			
B.S. in marine engineering from Coast Guard Academy; J.D. from U.C. Berkeley	Businessman; CEO of Textron	Volunteer posts dealing with employment of the disadvantaged; class B director of Federal Reserve Bank of Boston	Democrat; chairman of Pell's senate campaign; chairman of Businessmen for Humphrey-Muskie
<u>Paul Volcker (b. 1927)</u>			
A.B. in economics from Princeton; M.A. in public administration from Harvard	Banker; monetary analyst; public servant	Researcher at Federal Reserve Bank of NY; various positions, eventually under secretary for monetary affairs, at the Treasury; president of Federal Reserve Bank of NY	Democrat, but widely perceived as non-partisan
<u>Alan Greenspan (b. 1926)</u>			
B.A. and M.A. in economics from NYU; began Ph.D. at Columbia; later received Ph.D. from NYU	Economic consultant and forecaster; founder of Townsend-Greenspan	Domestic policy adviser under Nixon; CEA chairman under Nixon and Ford; many task forces; chairman of National Commission on Social Security Reform	Republican; strong libertarian beliefs; active in Republican presidential campaigns

sensible views, Martin, Volcker and Greenspan, were all at some time associated with the New York financial services industry: Martin was a stockbroker who became president of the New York Stock Exchange at age 29; Volcker alternated between positions at the Federal Reserve Bank of New York and Chase Manhattan; and Greenspan founded a successful New York consulting firm that had many of the

nation's leading banks as clients. In contrast, Eccles was a relatively small-time banker from Utah, and Miller was CEO of a large corporation based in Rhode Island. Both were quite successful in business, but somewhat provincial. That these two had particularly flawed models shows that even extensive business experience does not guarantee a realistic understanding of the economy. Burns, the third chairman with flawed beliefs, also had no significant Wall Street connection.

The three chairmen with the most realistic frameworks also had extensive, relatively nonpartisan public service. Martin left Wall Street at age 36 when he was drafted into the army, and he served as head of the Export-Import Bank and assistant secretary of the Treasury before becoming Federal Reserve chairman. Volcker spent the majority of his time in public service; his positions included under secretary of the Treasury and president of the Federal Reserve Bank of New York. Extensive public service in areas related to monetary policy may foster pragmatic, sensible views of how the economy operates. Consistent with this, Greenspan, the third successful chairman, was chairman of the Council of Economic Advisers and served on (and typically chaired) a number of blue-ribbon commissions, such as those setting up the volunteer army and reforming the Social Security system.

Two of the Federal Reserve chairmen with misguided models are notable for their lack of public experience of all types. Eccles had come to Washington for a meeting and somehow ended up as a special assistant to the secretary of the Treasury. He held this position for just a year before being appointed to the Federal Reserve Board. Miller held no government positions prior to becoming Federal Reserve chairman. He volunteered in local programs aimed at providing jobs for veterans and disadvantaged youths, and was a member of the Board of Directors of the Federal Reserve Bank of Boston. Again, Burns is the exception: he was chairman of the Council of Economic Advisers in the 1950s and remained active in economic policy debates in the 1960s, and yet he held flawed and volatile views. In contrast to Martin, Volcker and Greenspan, however, he lacked nonpartisan public experience.

Table 2 suggests little correlation between political affiliation and understanding of the economy. A more plausible link may be from partisanship. Highly partisan chairs may tend to have unrealistic views because they are chosen for their partisanship rather than for their expertise, or because their partisanship clouds their judgment. Two of the chairmen with the soundest views, Martin and Volcker, had little political involvement and believed that the Federal Reserve chair should not be involved in issues unrelated to monetary policy. At the other extreme, the chairmen with misguided models were quite partisan. Burns was a key adviser to Nixon during the campaign and served as a cabinet-rank counselor to the president on all domestic issues for the year before becoming Federal Reserve chairman. Miller was active in Democratic politics and was chairman of Businessmen for Humphrey-Muskie. And although Eccles was initially a Republican, he advised Roosevelt on a wide range of issues and was a vocal champion of Roosevelt's expansionary fiscal policy. Greenspan, however, is an exception to this pattern: he

has strong (and sometimes extreme) political views and has taken partisan stands on fiscal policy, and yet he has a sound monetary policy framework.

This analysis suggests that concrete background characteristics have been highly imperfect indicators of future views. Training in economics, experience on Wall Street, nonpartisan public service in economic policymaking and limited political involvement have been correlated with sensible beliefs, but there are exceptions to nearly every rule. It is therefore useful to consider other ways of predicting beliefs. The obvious alternative is to analyze the public statements of each nominee prior to becoming chairman. We look to see whether the writings, speeches and initial confirmation hearings of the Federal Reserve chairmen provided a reliable preview of the beliefs that determined policy during their tenures.

Eccles

Eccles's prior record shows that he was an intuitive Keynesian.⁸ Unlike many policymakers in the 1930s, he did not view the Depression as helpful or immutable. He was a constant advocate of deficit spending and other measures to stimulate aggregate demand, and he believed that procyclical movements in the money supply were undesirable (for example, U.S. Senate, 1933; Eccles, 1935).

Other aspects of Eccles's prior views, however, prefigured the Federal Reserve's key beliefs in the second half of the 1930s. Crucially, Eccles believed that monetary expansion by itself could do little to stimulate a depressed economy. For the most part, his view was that monetary expansion that did not get money directly to consumers and firms would have no effect. In 1933, he stated: "[Y]ou can print money, you can remonetize silver, you can reduce the gold content of the dollar and it is not going to raise your price level unless you start the purchasing power at the source with the consumer" (U.S. Senate, 1933, p. 710). In 1935, he said: "Money is extremely plentiful," and increasing the money stock "would accomplish nothing toward either price raising or increasing business activity" (U.S. House, 1935, pp. 276, 312; see also p. 404). When one member of Congress said, "I think it would be interesting to Members of Congress . . . to know what your [monetary] policy would be under present conditions," Eccles responded by saying, "Under present circumstances there is very little, if anything, that can be done." When another representative interjected, "You mean you cannot push a string," Eccles answered, "That is a good way to put it, one cannot push a string" (p. 377). This is exactly the view that led the Federal Reserve to do little to stem the severe recession of 1937–1938.

Despite this view, Eccles believed that policymakers needed to be on guard against excessive monetary expansion even in a depressed economy. He worried that such expansion could lead to speculation and inflation. He therefore advocated acting preemptively "to so regulate underlying conditions as to diminish the

⁸ Eccles's brief confirmation hearing focused entirely on potential conflicts of interest stemming from his business dealings in Utah (U.S. Senate, 1935). For this reason, we rely on other sources to determine Eccles's prior beliefs.

possibility of a speculative boom getting under way” (U.S. House, 1935, p. 180). When the possibility of a massive open market operation to combat the prevailing high levels of unemployment and slack was suggested, he replied, “it would be necessary to increase the reserve requirements by that amount in order to extinguish the reserves; otherwise this operation could carry possibility of credit inflation to almost unknown heights” (p. 322). Similarly, he said: “If we begin to get recovery and private credit begins to expand, . . . by the time the banking system had used up their present excess reserves of 2 billion dollars, you would have a volume of money far in excess of anything that the banking system has ever had, . . . it seems to me you could have a great inflation” (p. 420). These views clearly presage the FOMC’s concern about speculation and excess reserves under Eccles’s leadership.

Martin

Martin’s public statements and writings were relatively few before he joined the Federal Reserve. Nevertheless, in the available speeches and in his confirmation hearing, one can see definite indications of the views he held as chairman.

As assistant secretary of the Treasury, Martin revealed some of the aversion to inflation and the realistic estimates of capacity that were crucial to the conduct of policy in the 1950s. In discussing the recovery of the world economy after the war, he stated, “The extent of the postwar inflations has upset many calculations and postponed the attainment of financial stability” (Martin Papers, Box 15, Folder 7, Address, 2/27/50, p. 2). Perhaps more revealing was Martin’s statement that the “defense program . . . cannot be carried out without some lowering of consumption standards and some curtailment of investment” (reported in the *New York Times*, 10/31/50, p. 39). Given that the U.S. unemployment rate for the previous month was 4.4 percent, the statement that the United States and the countries of western Europe were at potential and thus faced a guns versus butter tradeoff suggests a realistic view of capacity.

Martin’s role in negotiating the Treasury-Federal Reserve Accord of 1951 also provides prior evidence of Martin’s opposition to inflation and support for independent monetary policy. At a time when the secretary of the Treasury and President Truman were strongly advocating the continued pegging of bond prices, Martin took the position that the policy was dangerous and needed to be stopped. He played a key role on the administration’s side in bringing about the Accord, which ended the policy. As one news report put it, “Mr. Martin was the first official of the Treasury to recognize the board’s responsibility to minimize the monetization of the public debt” (*New York Times*, 3/16/51, p. 50).

Much of Martin’s confirmation hearing in March 1951 was spent discussing the Accord. A number of senators expressed concern that Martin’s ties to the Treasury would make it difficult for him to assert the Federal Reserve’s independence. Martin reassured them by expressing his deep aversion to inflation. When one senator asked, “[B]ut do you think it is more dangerous to the country generally to have a continuing inflation such as we have been experiencing, than it is to let the cost of government go a good bit higher than it is?” Martin replied, “I do, I do

definitely” (U.S. Senate, 1951, p. 18). He also said: “I don’t want to see interest rates kept low if it is going to promote inflationary pressures. I don’t think that is sound, and I don’t think that helps matters” (p. 12).

Martin also gave a clear indication of the policies he was likely to follow. He stated, “I shall resist to the *n*th degree efforts or a temptation that might occur in the Government to debase the currency” (U.S. Senate, 1951, pp. 13–14). He reiterated both his view that inflation was very costly and his willingness to take harsh measures to fight inflation in the short statement he made upon taking the oath of office: “Unless inflation is controlled, it could prove to be an even more serious threat to the vitality of our country than the more spectacular aggressions of enemies outside our borders. I pledge myself to support all reasonable measures to preserve the purchasing power of the dollar” (*Bulletin*, April 1951, p. 377). These views formed the core of Martin’s economic framework during his tenure as Federal Reserve chairman.

Burns

An important feature of Burns’s macroeconomic framework while chairman was that it changed frequently. Thus, his prior statements and writings are inherently unlikely to provide a precise indication of his beliefs while in office. Nevertheless, we do find clear precursors of Burns’s views as chairman in his prior statements. Perhaps more importantly, we find that his prior beliefs fluctuated substantially, foreshadowing the variability of beliefs during his chairmanship.

One constant in Burns’s beliefs was a conviction that inflation was very costly. From the late 1950s on, Burns railed against, to quote from the title of one of his talks, “the perils of inflation” (reprinted in Burns, 1969, p. 286). In a lecture in 1957, for example, he said, “we have slighted the injustice and hardships that flow from inflation, when in fact these have been multiplying for a generation” (p. 142). Likewise, in July 1969, shortly before becoming Federal Reserve chairman, Burns said in an interview: “The immediate problem of greatest urgency is certainly inflation” (*U.S. News & World Report*, 7/14/69, p. 60).

While Burns’s concern about inflation never varied, his beliefs about the policies necessary to control it changed over his career. In 1969, Burns expressed great optimism in the country’s ability to control inflation without a recession. In response to the question, “Do you expect unemployment to rise substantially as inflation is brought under control?” Burns replied, “No, I do not” (*U.S. News & World Report*, 7/14/69, p. 61). At his confirmation hearing Burns implied that an anti-inflationary gap could be created by lowering the natural rate rather than by raising actual unemployment. He stated: “I think we ought to be able in the years ahead to pursue, when we need to, a restrictive financial policy without significantly increasing unemployment. I have great faith in well-managed job banks. I think they will prove tremendously helpful” (U.S. Senate, 1969, p. 24). Whatever the particulars of the mechanism, Burns’s statements signaled the optimistic framework that led him to expect disinflation during his first year in office despite only a very mild downturn.

At other times, Burns's prior statements show the skepticism about the effectiveness of slack that was central to his views in the period 1971–1973. Creeping inflation and increasing wage and price rigidity were a common theme in his writings, especially in the late 1950s. For example, in his 1959 presidential address to the American Economic Association, he stated: “[T]he once familiar parallelism of the short-term movements in the physical volume of total production, on the one hand, and the average level of wholesale or consumer prices, on the other, has become somewhat elusive” (Burns, 1969, p. 123). In 1967, he testified: “Unhappily, even a mild recession would probably not suffice to bring cost inflation to a halt under current conditions” (Burns, 1967, p. 127). As in the 1970s, Burns concluded that this ineffectiveness of slack meant that policies other than aggregate demand restraint should be sought. He stated in 1957: “However necessary and helpful a balanced budget and a restrictive monetary policy may be in the age-old struggle against inflation, it is doubtful whether they alone can cope with the threat of creeping inflation” (Burns, 1969, p. 150).

Finally, in the mid-1960s, Burns espoused the more realistic views that guided policy in the mid-1970s. Arguing against the prevailing belief in a permanent inflation-unemployment tradeoff in 1967, he said: “Once forces of inflation have been released, it becomes very difficult to bring them under control without some sizable readjustments in the economy” (Burns, 1969, p. 277). Burns also believed that the sustainable level of unemployment had risen over the previous decade. In 1965, he stated that “there are cogent grounds for believing that if the pressure of aggregate demand had remained at the boom level of 1956–1957, the unemployment rate would still have been higher in recent years than it was then” (Burns, 1966, p. 42). To rein in inflation, in 1964 Burns rejected not only wage and price controls, but even voluntary guideposts (Burns, 1969, pp. 232–253). Instead, he stressed “the need for prudent control of the money supply and the need for maintaining and enhancing the forces of competition” (p. 253; see also p. 284). Reading Burns's statements in the mid-1960s, one can see not only the Burns who tightened substantially while the economy was reeling from the first oil price shock in 1974, but also the fine Federal Reserve chairman he could have been had his economic beliefs been less mercurial.

Miller

The prevailing beliefs at the FOMC during Miller's tenure included a very optimistic estimate of the natural rate and extreme pessimism about the effectiveness of slack in reducing inflation. In his prior writings and speeches and at his confirmation hearing, Miller expressed precisely these views. To put it bluntly, President Carter and Congress had to have known what they were getting when they chose Miller as Federal Reserve chairman.⁹

First, consider the natural rate. In January 1977, Miller declared, “fiscal and

⁹ McKinney (1992) argues persuasively that it was apparent before Miller was appointed that he was primarily concerned about employment and growth and, hence, would run inflationary policy.

monetary policies can be applied to reduce unemployment quickly—from 8 percent to 5 ½ percent (or perhaps even 5 percent) within two years without triggering a renewed bout of inflation” (Miller, 1977, p. 341). For this statement to be consistent with a natural rate framework, Miller had to believe that the natural rate was 5 or 5 ½ percent—much lower than the estimates being mentioned at the Federal Reserve during this period. Miller expressed views consistent with this optimistic estimate at his confirmation hearing (U.S. Senate, 1978, pp. 20–21).

More striking than Miller’s optimism about the natural rate were his views on the ineffectiveness of slack in reducing inflation. In 1977, Miller implied that both the level and duration of unemployment that would be needed to reduce inflation were very large. His explanation for this was that unemployment compensation and other social welfare programs had made workers unwilling to lower wage demands even in the face of high unemployment. He stated: “The Phillips’ curve has an error. The real relationship is between inflation and *uncompensated* unemployment. To the extent that unemployment is *compensated* . . . there is an overstatement of the economic impact of unemployment. . . . The result is that a significant portion of the unemployed *act* in an economic sense as if they were employed, *spend* as if they had jobs” (Miller, 1977, p. 341, emphasis in original). Miller reiterated this view at his confirmation hearing (U.S. Senate, 1978, p. 74). The implication that he drew from his analysis was: “If the economy is behaving as if the unemployment rate was lower, then we might as well pursue macro-economic policies which will lower the unemployment rate in fact and at the same time improve the social fabric by offering more people the greater dignity and self respect that comes from having a decent job” (Miller, 1977, p. 341).

At his confirmation hearing, Miller took his beliefs about the ineffectiveness of slack a step further. He asserted that unemployment not only failed to reduce inflation, it actually caused it. He stated (U.S. Senate, 1978, p. 38; see also pp. 56, 72):

[U]nder the ethical values in this Nation, unemployment also breeds inflation. Today there is no question but that high rates of unemployment mean large Federal deficits and large Federal deficits mean inflation.

So I think the answer is that we must fight both at the same time. I think the traditional connections between inflation and unemployment have been disrupted by social concepts that have resulted in the adoption of programs that would create higher deficits in times of economic distress.

While this is not a view we see carrying weight in the FOMC during Miller’s tenure, it is indicative of the basic macroeconomic confusion that did hold sway.

The policy implication that Miller drew from his beliefs was that means other than aggregate demand restraint were needed to control inflation. Initially, his idea was “to employ selective demand and supply management to overcome bottlenecks or to increase availability of goods” (Miller, 1977, p. 340). Among the specific controls and inducements he mentioned were selective consumer credit controls,

an interest surcharge on loans for low priority purposes, a variable investment tax credit, a three-year moratorium on strikes, workfare and job-training programs (Miller, 1974, p. 16). At his confirmation hearing, Miller backed off somewhat from such highly specific interventions, but he continued to advocate nonmonetary approaches to controlling inflation. He testified: “The best chance for dampening down inflation is in an area where the Fed does not have direct control. That is, by trying to stimulate business fixed investment. . . . that requires a policy on the fiscal side” (U.S. Senate, 1978, p. 84). This view that inflation was not a problem to be solved by monetary policy was one that Miller carried to the Federal Reserve, with severe consequences.

Volcker

In his prior writings and speeches, Volcker expressed many of the views that became the hallmark of his tenure. He consistently extolled the benefits of low inflation and the critical importance of monetary policy in achieving it. In 1977, he stated, “over time, an excess supply of money contributes nothing to employment, nor to real income, nor to real wealth, but only to inflation” (Volcker, 1977, p. 24). He went on to say, “My own judgment is that we already have ample evidence that strong inflationary forces . . . damage rather than help our prospects for employment and growth” (p. 27). His policy prescription was simple: “[W]e will need to act to bring monetary growth targets gradually down to noninflationary levels” (p. 28). He reiterated these views at his confirmation hearing. He said, “the only sound foundation for the continuing growth and prosperity of the American economy is much greater price stability” (U.S. Senate, 1979, p. 16). He repeatedly made statements such as, “The most fundamental thing we can do . . . is to deal with internal inflation” (p. 8). He described zero inflation as his ultimate goal (p. 13), though he did caution that it “must be considered an objective that can be reached only over a period of years and toward which we should move in prudent steps” (p. 15).¹⁰

Volcker recognized that inflation control would have costs, saying that “price stability is devoutly desired by most. But . . . policies to achieve that goal can have particular short-term effects that may be distinctly unpopular” (Volcker, 1978, p. 333). However, his statements before his confirmation hearing do not show that he had a fully realistic assessment of the natural rate and the output costs of disinflation, or that he believed it would be worth bearing very large output costs to reduce inflation. For example, at a time when unemployment was slightly under 7 percent, he stated that in addition to gradually eliminating inflation, “we also must sustain the momentum of expansion and cut into unemployment” (p. 333). He also said: “The ‘optimistic’ view suggests that at a time when unemployment is

¹⁰ In his four years on the FOMC before becoming Federal Reserve chairman, Volcker dissented from the monetary policy directive four times, three times in support of tighter policy and once on technical grounds (*Reports*, 1975–1979). Dissents on the FOMC are uncommon; thus, this record also suggests relatively hawkish views on inflation.

still above ‘full employment’ . . . , some moderation of inflation should still be possible as unemployment is reduced” (p. 337).

At his confirmation hearing, however, Volcker expressed the much more realistic views that led him to undertake the most aggressive disinflation in Federal Reserve history. He made clear that he believed that the natural rate was at least in the vicinity of 6 percent. He testified: “[E]arlier this year . . . , with the unemployment rate still not much below 6 percent . . . we had at the same time evidence of the beginnings and the actuality of shortages in some industries, of insufficient capacity, rising price pressures. All of which suggested that the answer to that remaining unemployment problem wasn’t going to be found in overall demand measures” (U.S. Senate, 1979, pp. 17–18). He clearly understood that substantial unemployment would be required to reduce inflation. Nevertheless, he argued that the benefits of low inflation were large enough that it was worth bearing those costs. In response to a question about a study suggesting “a terrific price” to reducing inflation through monetary policy, Volcker responded: “I don’t think we have any substitute for seeking an answer to our problems in the context of monetary discipline” (pp. 4–5). Similarly, in response to a question expressing concern about unemployment rising to “7 or 9 [percent] or somewhere in that range,” Volcker stressed the importance of achieving “stability” in terms of “domestic inflation” (by which he meant low inflation, not stable high inflation) and “international markets” (p. 18).

Greenspan

Greenspan’s prior writings and confirmation hearing presage the views that have dominated Federal Reserve policymaking under his leadership. Greenspan consistently held that low inflation is critical to long-run growth. In 1979, for example, he argued that inflation “skews the investment pattern toward shorter-lived projects” and away from research and other long-term investments. As a result, inflation was causing “our economic system . . . to lose its productive efficiency” (Greenspan, 1979). At his confirmation hearing, he said, “it is absolutely essential that [the Federal Reserve’s] central focus be on restraining inflation because if that fails, then we have very little opportunity for sustained long-term economic growth” (U.S. Senate, 1987, p. 29).

Greenspan’s beliefs about the natural rate and the determinants of inflation before joining the Federal Reserve are not completely clear. One source of evidence about his beliefs comes from the *Economic Reports of the President* during his tenure as chairman of the Council of Economic Advisers in the mid-1970s. The macroeconomic framework in these *Reports* was dramatically more realistic than that in the *Reports* that came either before or after. Indeed, one of Greenspan’s key contributions as CEA chairman was to raise substantially the estimate of the natural rate used in the Council’s forecasts and discussions (*Economic Report of the President*, 1977, pp. 48–51). Greenspan’s later statements on these issues, however, were less realistic. In a 1977 debate with Arthur Okun, he argued that low inflation was so beneficial that a “phased, moderate decline in the rate of growth in money supply

need not have any significant negative effects on real growth” (Greenspan and Okun, 1977, p. 117). In 1978, he stated that “[o]ur problem is one for which we have no firm theoretical understanding,” and that the United States was experiencing “a condition of chronic inflation in a period of less than full utilization of resources” (Daly, 1979, p. 24).

Importantly, even when Greenspan was espousing questionable views about the determinants of inflation, his policy prescriptions were sensible. In 1977, he stated: “A necessary and sufficient condition [for eliminating inflation] is to adopt a monetary and fiscal policy that would allow unit money supply to grow at a rate that implies a noninflationary price increase” (Greenspan and Okun, 1977, p. 120). Likewise, in 1978, he argued, “The fact is that we know the solution” to high inflation—monetary and fiscal restraint that would increase unemployment (Daly, 1979, p. 25). He opposed controls, guidelines and other nonstandard means of controlling inflation (for example, Daly, 1979, pp. 3, 7). Furthermore, he made clear that inflation control was worth an extremely high price. At his confirmation hearing, a senator suggested that the tight monetary policy of the early 1980s was excessive. Greenspan defended the policy: “[W]e allowed our system to take on inflationary biases which threw us into such a structural imbalance that, in order to preserve the integrity of the system, the Federal Reserve had to do what it did. Had it not acted in the way which it did at that time, the consequences would have been far worse than what subsequently happened” (U.S. Senate, 1987, p. 35). Thus, as with all of the other chairmen, Greenspan’s prior beliefs provide a clear indication of the economic framework that guided policy during his tenure.

Conclusions

The history of the Federal Reserve shows that ideas have been crucial. When a realistic model of how the economy works and what monetary policy can accomplish prevailed within the FOMC, as in the 1950s and the 1980s and beyond, policy was appropriate and macroeconomic outcomes were desirable. When an unrealistic and misguided model prevailed, as in the 1930s and in the late 1960s and 1970s, policy was similarly misguided and outcomes were poor. The fact that monetary policymakers’ views have played such a central role in determining the success of policy in the past suggests that the key characteristic to look for in future policymakers is a realistic understanding of how the economy works. This lesson holds for any position on the FOMC, but especially for the chair, whose views typically dominate policymaking.

How then does the country go about finding a Federal Reserve chair with sensible views? Choosing a chair on the basis of background characteristics is risky. While some education in economics, experience on Wall Street and largely non-partisan public service may increase the odds that a nominee will be guided by sensible views, they provide no guarantee. Fortunately, there is something else that predicts chairmen’s views exceptionally well: their own writings and statements.

Each of the past Federal Reserve chairmen expressed quite clearly the views that dominated policymaking during his tenure at the confirmation hearing or before. This finding suggests a crucial strategy for evaluating potential candidates for Federal Reserve chair: find out their beliefs about how the economy works and what monetary policy can contribute. Read their previous writings. Ask them about their model of the economy and listen very carefully to the answers. People evaluating a candidate for Federal Reserve chair must engage in an intellectual discussion and must be willing to reject a candidate whose views are worrisome.

In this regard, the confirmation process of G. William Miller is an important cautionary tale. The Senate Banking Committee is often mocked for having spent inordinate amounts of time investigating possible misdeeds of the Bell Helicopter subsidiary of Miller's corporation while letting Miller's unconventional macroeconomic framework go unchallenged. But in truth, the committee asked Miller enough questions about his beliefs and prior writings to get a clear picture of his views. And a number of committee members expressed great skepticism about Miller's answers. What is shocking is that the committee nevertheless voted overwhelmingly to confirm him. It is as if, when the senators did not find enough evidence to reject Miller on the basis of corporate malfeasance, they felt that fundamentally flawed beliefs about how the economy worked were not an adequate reason for blocking his confirmation. Yet, Miller's flawed beliefs are precisely what caused monetary policy to be so disastrous in the late 1970s.

The experience of the 1960s and 1970s is also an important argument against complacency. It is tempting to think that since monetary policymakers in general, and Federal Reserve chairmen in particular, have had a largely sensible model for almost 25 years, it is unlikely that any future candidate for Federal Reserve chair could have misguided views. But policymakers had also developed a realistic framework in the 1950s, only to have it replaced by a deeply flawed model in the 1960s and 1970s. And there is certainly no shortage of highly questionable monetary policy frameworks being promulgated by pundits, politicians and even professional economists today. The fact that a very costly wrong turn in economic understanding occurred once means that we must remain vigilant in the future. The only way we will know if we are choosing a good Federal Reserve chair is to focus closely on candidates' beliefs and to reject those whose frameworks are likely to lead them astray.

Appendix

Estimation of the Expected Real Interest Rate

To estimate the expected (or *ex ante*) real interest rate, we begin with data on the three-month Treasury bill rate in the secondary market, converted to quarterly averages. These data are from the Board of Governors, (<http://www.federalreserve.gov>), series TMSM3M, and are available starting in 1934Q1. We subtract off the log

difference of the quarterly GDP deflator (at an annual rate) to create a series on the realized (or ex post) real rate. Quarterly data for the GDP deflator and real GDP (which we use later in the analysis) are from the Bureau of Economic Analysis, (<http://www.bea.doc.gov>), beginning in 1947Q1. To extend these series back before 1947, we begin with annual data from the BEA. We then derive quarterly values of both series using the quarterly series constructed by Balke and Gordon (1986, pp. 789–810). Specifically, we derive new series that have quarter-to-quarter percentage changes within each year equal to those in the corresponding Balke-Gordon series, but year-to-year percentage changes equal to those in the annual BEA estimates.

The Fisher identity implies that the realized real interest rate equals the expected real rate minus unanticipated inflation. If expectations are rational, the expectation of unanticipated inflation using information known at the time the expectation is formed is zero. Therefore, if one regresses the realized real rate on current and lagged information, the fitted values provide an estimate of the expected real rate (Mishkin, 1981). To implement this procedure, we use as explanatory variables the contemporaneous value and four lags of each of the nominal Treasury bill rate, the growth rate of the GDP deflator, and the growth rate of real GDP, as well as a constant and a linear trend. We estimate the regression over the period 1935Q1–2003Q1, leaving out the war years and the early postwar era (1941Q2–1951Q1). The contemporaneous and first lagged values of the explanatory variables have the most predictive power and the coefficient estimates are much what one would expect: the realized real rate responds positively to the nominal rate and negatively to inflation and output growth. Because the R^2 of the regression is fairly high (0.58), the behavior of the estimated expected real rate is qualitatively similar to that of the realized real rate.

■ *We are grateful to Bradford DeLong, William Niskanen, Andrei Shleifer, Timothy Taylor, Michael Waldman and Janet Yellen for helpful comments and suggestions, and to the National Science Foundation for financial support.*

References

- Balke, Nathan S. and Robert J. Gordon.** 1986. "Appendix B: Historical Data," in *The American Business Cycle: Continuity and Change*. Robert J. Gordon, ed. Chicago: University of Chicago Press for NBER, pp. 781–850.
- Burns, Arthur F.** 1966. *The Management of Prosperity*. 1965 Benjamin F. Fairless Memorial Lectures. New York: Columbia University Press.
- Burns, Arthur F.** 1967. Excerpts from Congressional Testimony. *Congressional Digest*. April, 46, pp. 123–27.
- Burns, Arthur F.** 1969. *The Business Cycle in a Changing World*. New York: Columbia University Press for NBER.
- Daly, John Charles, moderator.** 1979. *Weapons against Inflation*. Washington, D.C.: American Enterprise Institute for Public Policy Research.
- DeLong, J. Bradford.** 1997. "America's Peacetime Inflation: The 1970s," in *Reducing Inflation: Motivation and Strategy*. Christina D. Romer and David H. Romer, eds. Chicago: University of Chicago Press for NBER, pp. 247–76.
- Eccles, Marriner S.** 1935. "Monetary Problems of Recovery." Address to the Ohio Bankers Association. Reprinted in *Congressional Record*. February 14, 79, Part 2, pp. 1915–918.
- Friedman, Milton and Anna Jacobson Schwartz.** 1963. *A Monetary History of the United States, 1867–1960*. Princeton: Princeton University Press for NBER.
- Greenspan, Alan.** 1979. "Inflation's Effect on Investment." *New York Times*. August 8, p. D2.
- Greenspan, Alan and Arthur Okun.** 1977. "Debate: How to Stop Inflation." *Fortune*. April, 95:4, pp. 116–20.
- Greider, William.** 1987. *Secrets of the Temple: How the Federal Reserve Runs the Country*. New York: Simon & Schuster.
- Katz, Bernard S., ed.** 1992. *Biographical Dictionary of the Board of Governors of the Federal Reserve*. New York: Greenwood Press.
- Kettl, Donald F.** 1986. *Leadership at the Fed*. New Haven: Yale University Press.
- Martin, William McChesney Jr.** Papers. Missouri Historical Society, St. Louis.
- Mayer, Thomas.** 1998. *Monetary Policy and the Great Inflation in the United States*. Cheltenham, U.K.: Edward Elgar.
- McKinney, Marie.** 1992. "G. William Miller," in *Biographical Dictionary of the Board of Governors of the Federal Reserve*. Bernard S. Katz, ed. New York: Greenwood Press, pp. 234–44.
- Meltzer, Allan H.** 2003. "A New Beginning, 1951–60." Manuscript, Carnegie-Mellon University.
- Miller, G. William.** 1974. "A Businessman's Anti-Inflation Formula." *Business Week*. October 5, p. 16.
- Miller, G. William.** 1977. "The Not Impossible Goal: Full Employment and Price Stability." *Vital Speeches of the Day*. March 15, 43, pp. 339–44.
- Mishkin, Frederic.** 1981. "The Real Interest Rate: An Empirical Investigation." *Carnegie-Rochester Conference Series on Public Policy*. Autumn, 15, pp. 151–200.
- Orphanides, Athanasios.** 2003a. "Monetary Policy in Deflation: The Liquidity Trap in History and Practice." Unpublished paper, Board of Governors.
- Orphanides, Athanasios.** 2003b. "The Quest for Prosperity without Inflation." *Journal of Monetary Economics*. April, 50:3, pp. 633–63.
- Romer, Christina D. and David H. Romer.** 2002a. "The Evolution of Economic Understanding and Postwar Stabilization Policy," in *Rethinking Stabilization Policy*. Kansas City: Federal Reserve Bank of Kansas City, pp. 11–78.
- Romer, Christina D. and David H. Romer.** 2002b. "A Rehabilitation of Monetary Policy in the 1950s." *American Economic Review*. May, 92:2, pp. 121–27.
- U.S. Board of Governors of the Federal Reserve System.** Various years. *Annual Report of the Board of Governors of the Federal Reserve System*.
- U.S. Board of Governors of the Federal Reserve System.** Various years. *Federal Reserve Bulletin*.
- U.S. Board of Governors of the Federal Reserve System.** Various years. *Minutes of Federal Open Market Committee*.
- U.S. Board of Governors of the Federal Reserve System.** Various years. *Transcripts of Federal Open Market Committee*.
- U.S. House of Representatives.** 1935. Committee on Banking and Currency. *Banking Act of 1935*. Washington, D.C.: Government Printing Office.
- U.S. Office of the President.** Various years. *Economic Report of the President*. Washington, D.C.: Government Printing Office.
- U.S. Senate.** 1933. Committee on Finance. *Investigation of Economic Problems*. Washington, D.C.: U.S. Government Printing Office.
- U.S. Senate.** 1935. Committee on Banking and Currency. *Nomination of Marriner S. Eccles*. Washington, D.C.: U.S. Government Printing Office.

U.S. Senate. 1951. Committee on Banking and Currency. *Nomination of William McChesney Martin, Jr.* Washington, D.C.: U.S. Government Printing Office.

U.S. Senate. 1956. Committee on Banking and Currency. *Nomination of William McChesney Martin, Jr.* Washington, D.C.: U.S. Government Printing Office.

U.S. Senate. 1969. Committee on Banking and Currency. *Nomination of Arthur F. Burns.* Washington, D.C.: U.S. Government Printing Office.

U.S. Senate. 1978. Committee on Banking, Housing, and Urban Affairs. *Nomination of G. William Miller.* Washington, D.C.: U.S. Government Printing Office.

U.S. Senate. 1979. Committee on Banking, Housing, and Urban Affairs. *Nomination of Paul A. Volcker.* Washington, D.C.: U.S. Government Printing Office.

U.S. Senate. 1987. Committee on Banking, Housing, and Urban Affairs. *Nomination of Alan Greenspan.* Washington, D.C.: U.S. Government Printing Office.

Volcker, Paul A. 1977. "A Broader Role for Monetary Targets." *Federal Reserve Bank of New York Quarterly Review.* Spring, 2:2, pp. 23–28.

Volcker, Paul A. 1978. "The Role of Monetary Targets in an Age of Inflation." *Journal of Monetary Economics.* April, 4:2, pp. 329–39.

Wells, Wyatt C. 1994. *Economist in an Uncertain World.* New York: Columbia University Press.

This article has been cited by:

1. Sebastian Laumer, Collin Philipps. 2024. Government Spending Between Active and Passive Monetary Policy: An Invariance Result. *The B.E. Journal of Macroeconomics* 24:1, 561-590. [[Crossref](#)]
2. Dawid van Lill. 2024. Changes in monetary policy implementation over time. *Studies in Economics and Econometrics* 96, 1-25. [[Crossref](#)]
3. Jinshun Wu, Luyao Wu. 2023. Bayesian Local Likelihood Estimation of Time-Varying DSGE Models: Allowing for Indeterminacy. *Computational Economics* 85. . [[Crossref](#)]
4. Michael Bordo, Klodiana Istrefi. 2023. Perceived FOMC: The making of hawks, doves and swingers. *Journal of Monetary Economics* 136, 125-143. [[Crossref](#)]
5. Christine Strong, Constant L. Yayi. 2023. The political affiliation of central bankers and government debt: Evidence from Africa. *International Review of Economics & Finance* 85, 603-620. [[Crossref](#)]
6. Alessandro Riboni, Francisco Ruge-Murcia. 2023. THE POWER OF THE FEDERAL RESERVE CHAIR. *International Economic Review* 64:2, 727-756. [[Crossref](#)]
7. Yue Fu, Yiqing Shi, Yuyue Zhuang. 2022. Consumer Industry in this Turn's Monetary Policy: Evidence from Necessity and Non-Necessity Goods in US. *BCP Business & Management* 34, 399-409. [[Crossref](#)]
8. Francisco Ruge-Murcia. 2022. How do central banks make decisions?. *Canadian Journal of Economics/Revue canadienne d'économique* 55:4, 1643-1670. [[Crossref](#)]
9. Christopher Gust, Edward Herbst, David López-Salido. 2022. Short-Term Planning, Monetary Policy, and Macroeconomic Persistence. *American Economic Journal: Macroeconomics* 14:4, 174-209. [[Abstract](#)] [[View PDF article](#)] [[PDF with links](#)]
10. Antonella Rancan. 2022. THE "PLACE OF THE PHILLIPS CURVE" IN MACROECONOMETRIC MODELS: THE CASE OF THE FEDERAL RESERVE BOARD'S MODEL (1966–1980s). *Journal of the History of Economic Thought* 44:2, 161-181. [[Crossref](#)]
11. Edward Nelson. 2022. How Did It Happen?: The Great Inflation of the 1970s and Lessons for Today. *Finance and Economics Discussion Series :2022-037*, 1-44. [[Crossref](#)]
12. David Mathuva, Moses Nyangu. 2022. Does banking regulatory regime affect the quality of bank earnings in the East African region?. *Journal of Accounting in Emerging Economies* 12:3, 433-467. [[Crossref](#)]
13. Vasso Ioannidou, Sotirios Kokas, Thomas Lambert, Alexander Michaelides. 2022. (In)Dependent Central Banks. *SSRN Electronic Journal* 95. . [[Crossref](#)]
14. Yoosoon Chang, Junior Maih, Fei Tan. 2021. Origins of monetary policy shifts: A New approach to regime switching in DSGE models. *Journal of Economic Dynamics and Control* 133, 104235. [[Crossref](#)]
15. In Do Hwang, Thomas Lustenberger, Enzo Rossi. 2021. Does communication influence executives' opinion of central bank policy?#. *Journal of International Money and Finance* 115, 102393. [[Crossref](#)]
16. Ulrike Malmendier, Stefan Nagel, Zhen Yan. 2021. The making of hawks and doves. *Journal of Monetary Economics* 117, 19-42. [[Crossref](#)]
17. Peterson K. Ozili. 2020. Does competence of central bank governors influence financial stability?. *Future Business Journal* 6:1. . [[Crossref](#)]
18. Eric Monnet, Damien Puy. 2020. Do old habits die hard? Central banks and the Bretton Woods gold puzzle. *Journal of International Economics* 127, 103394. [[Crossref](#)]
19. Alan S. Blinder. 2020. What does Jerome Powell know that William McChesney Martin did not—And what role did academic research play in that?. *The Manchester School* 88:S1, 32-49. [[Crossref](#)]

20. Michael McLeay, Silvana Tenreyro. 2020. Optimal Inflation and the Identification of the Phillips Curve. *NBER Macroeconomics Annual* **34**, 199-255. [[Crossref](#)]
21. Christopher Gust, Edward Herbst, J. David López-Salido. 2020. Short-term Planning, Monetary Policy, and Macroeconomic Persistence. *Finance and Economics Discussion Series* **2020:003**. . [[Crossref](#)]
22. Alexander Dentler. 2019. Did the fed raise interest rates before elections?. *Public Choice* **181**:3-4, 239-273. [[Crossref](#)]
23. Ayse Kaya, Stephen Golub, Mark Kuperberg, Feng Lin. 2019. THE FEDERAL RESERVE'S DUAL MANDATE AND THE INFLATION-UNEMPLOYMENT TRADEOFF. *Contemporary Economic Policy* **37**:4, 641-651. [[Crossref](#)]
24. PRACHI MISHRA, ARIELL RESHEF. 2019. How Do Central Bank Governors Matter? Regulation and the Financial Sector. *Journal of Money, Credit and Banking* **51**:2-3, 369-402. [[Crossref](#)]
25. Klodiana Istrefi. 2019. In Fed Watchers' Eyes: Hawks, Doves and Monetary Policy. *SSRN Electronic Journal* **20**. . [[Crossref](#)]
26. Jacek Suda, Anastasia S. Zervou. 2018. INTERNATIONAL GREAT INFLATION AND COMMON MONETARY POLICY. *Macroeconomic Dynamics* **22**:6, 1428-1461. [[Crossref](#)]
27. Aurélien Goutsmedt. 2018. Thomas Sargent face à Robert Lucas : une autre ambition pour la Nouvelle Economie Classique. *OEconomia* :8-2, 211-241. [[Crossref](#)]
28. Michael D. Bordo, Klodiana Istrefi. 2018. Perceived FOMC: The Making of Hawks, Doves and Swingers. *SSRN Electronic Journal* . [[Crossref](#)]
29. Yoosoon Chang, Junior Maih, Fei Tan. 2018. State Space Models with Endogenous Regime Switching. *SSRN Electronic Journal* . [[Crossref](#)]
30. Katrin Wölfel, Christoph S. Weber. 2017. Searching for the Fed's reaction function. *Empirical Economics* **52**:1, 191-227. [[Crossref](#)]
31. Yoosoon Chang, Boreum Kwak. 2017. U.S. Monetary-Fiscal Regime Changes in the Presence of Endogenous Feedback in Policy Rules. *SSRN Electronic Journal* . [[Crossref](#)]
32. Stefano Moroni. 2016. Interventionist responsibilities for the emergence of the US housing bubble and the economic crisis: 'neoliberal deregulation' is not the issue. *European Planning Studies* **24**:7, 1295-1312. [[Crossref](#)]
33. Tito Belchior Silva Moreira, Benjamin Miranda Tabak, Mario Jorge Mendonça, Adolfo Sachsida. 2016. An Evaluation of the Non-Neutrality of Money. *PLOS ONE* **11**:3, e0145710. [[Crossref](#)]
34. Mark A. Carlson, David C. Wheelock. Navigating Constraints 50-88. [[Crossref](#)]
35. Elizabeth A. Shuey, Tama Leventhal, Rebekah Levine Coley. 2016. Housing Characteristics over Time: Identifying Patterns for Low-Income Families. *Journal of Poverty* **20**:1, 102-125. [[Crossref](#)]
36. Jacek Suda, Anastasia Zervou. 2016. International Great Inflation and Common Monetary Policy. *SSRN Electronic Journal* **70**. . [[Crossref](#)]
37. Emmanuel Carré. 2015. Communication de la BCE et crise financière. *Économie et Institutions* :22. . [[Crossref](#)]
38. Makram El-Shagi, Alexander Jung. 2015. Does the Greenspan era provide evidence on leadership in the FOMC?. *Journal of Macroeconomics* **43**, 173-190. [[Crossref](#)]
39. ###, ###. 2015. Time Series Properties of the Real Interest Rates of Hong Kong. *The Journal of International Trade & Commerce* **11**:1, 365-375. [[Crossref](#)]
40. KEVIN LEE, JAMES MORLEY, KALVINDER SHIELDS. 2015. The Meta Taylor Rule. *Journal of Money, Credit and Banking* **47**:1, 73-98. [[Crossref](#)]

41. Leonie B. Janssen-Jansen, Frans P.W. Schilder. 2015. How healthy and sustainable is the Dutch housing mix? Measuring and comparing the theoretical housing market balance of Dutch regional housing markets. *Urban, Planning and Transport Research* 3:1, 88-108. [[Crossref](#)]
42. Yiyao Wang, Tae-Hwy Lee. 2014. Asymmetric loss in the Greenbook and the Survey of Professional Forecasters. *International Journal of Forecasting* 30:2, 235-245. [[Crossref](#)]
43. Ricardo Reis. 2013. Central Bank Design. *Journal of Economic Perspectives* 27:4, 17-44. [[Abstract](#)] [[View PDF article](#)] [[PDF with links](#)]
44. Tito Belchior Silva Moreira, Geraldo Silva Souza, Roberto Ellery. 2013. An Evaluation of the Tolerant to Higher Inflation Rate in the Short Run by the Brazilian Central Bank in the Period 2001-2012. *SSRN Electronic Journal* . [[Crossref](#)]
45. Jinho Bae, Chang-Jin Kim, Dong Heon Kim. 2012. The evolution of the monetary policy regimes in the U.S. *Empirical Economics* 43:2, 617-649. [[Crossref](#)]
46. Sheheryar Malik, Anindya Banerjee. 2012. The Changing Role of Expectations in US Monetary Policy: A New Look Using the Livingston Survey. *SSRN Electronic Journal* 50. . [[Crossref](#)]
47. Jacek Suda, Anastasia S. Zervou. 2012. International Great Inflation and Common Monetary Policy. *SSRN Electronic Journal* . [[Crossref](#)]
48. David Gbaguidi. 2012. La courbe de Phillips : temps d'arbitrage et/ou arbitrage de temps. *L'Actualité économique* 88:1, 87-119. [[Crossref](#)]
49. Adolfo Sachsida, Jose Angelo Divino, Daniel Oliveira Cajueiro. 2011. Inflation, unemployment, and the time consistency of the US monetary policy. *Structural Change and Economic Dynamics* 22:2, 173-179. [[Crossref](#)]
50. Marcelo Ferman. 2011. Switching Monetary Policy Regimes and the Nominal Term Structure. *SSRN Electronic Journal* 20. . [[Crossref](#)]
51. JAN MARC BERK, BEATA K. BIERUT. 2010. MONETARY POLICY COMMITTEES: MEETINGS AND OUTCOMES. *Contemporary Economic Policy* 28:4, 569-588. [[Crossref](#)]
52. Daniel O. Cajueiro, Benjamin M. Tabak. 2010. Fluctuation dynamics in US interest rates and the role of monetary policy. *Finance Research Letters* 7:3, 163-169. [[Crossref](#)]
53. Alex Cukierman. 2010. How Would Have Monetary Policy During the Great Inflation Differed, if it Had Been Conducted in the Styles of Volcker and Greenspan and with Perfect Foresight?. *Comparative Economic Studies* 52:2, 159-179. [[Crossref](#)]
54. Jesús Fernández-Villaverde, Pablo Guerron-Quintana, Juan Francisco Rubio-Ramirez. 2010. Reading the Recent Monetary History of the U.S., 1959-2007. *SSRN Electronic Journal* 20. . [[Crossref](#)]
55. Alan S. Blinder. 2009. Making Monetary Policy by Committee *. *International Finance* 12:2, 171-194. [[Crossref](#)]
56. Edward Nelson. 2009. An Overhaul of Doctrine: The Underpinning of UK Inflation Targeting. *The Economic Journal* 119:538, F333-F368. [[Crossref](#)]
57. William Poole, Robert Rasche, David C. Wheelock. 2009. The Great Inflation: Did the Shadow Know Better?. *SSRN Electronic Journal* . [[Crossref](#)]
58. Riccardo DiCecio, Edward Nelson. 2009. The Great Inflation in the United States and the United Kingdom: Reconciling Policy Decisions and Data Outcomes. *SSRN Electronic Journal* 36. . [[Crossref](#)]
59. Mikael Juselius. 2008. Testing the New Keynesian Model on U.S. and Euro Area Data. *Economics* 2:1. . [[Crossref](#)]
60. Carlos Capistrán. 2008. Bias in Federal Reserve inflation forecasts: Is the Federal Reserve irrational or just cautious?. *Journal of Monetary Economics* 55:8, 1415-1427. [[Crossref](#)]

61. ALESSANDRO RIBONI, FRANCISCO J. RUGE-MURCIA. 2008. The Dynamic (In)Efficiency of Monetary Policy by Committee. *Journal of Money, Credit and Banking* **40**:5, 1001-1032. [[Crossref](#)]
62. Adolfo Sachsida, Jose Angelo Divino, Daniel O. Cajueiro. 2008. Inflation, Unemployment, and the Time Consistency of the US Monetary Policy. *SSRN Electronic Journal* . [[Crossref](#)]
63. Mikael Juselius. 2008. Testing the New Keynesian Model on U.S. And Euro Area Data. *SSRN Electronic Journal* . [[Crossref](#)]
64. Edward Nelson. 2008. An Overhaul of Doctrine: The Underpinning of U.K. Inflation Targeting. *SSRN Electronic Journal* . [[Crossref](#)]
65. Brian Snowdon. 2007. The New Classical Counter-Revolution: False Path or Illuminating Complement?. *Eastern Economic Journal* **33**:4, 541-562. [[Crossref](#)]
66. Alessandro Riboni, Francisco J. Ruge-Murcia. 2007. The Dynamic (In)efficiency of Monetary Policy by Committee. *SSRN Electronic Journal* . [[Crossref](#)]
67. Markku Lanne. 2006. Nonlinear dynamics of interest rate and inflation. *Journal of Applied Econometrics* **21**:8, 1157-1168. [[Crossref](#)]
68. Burton A. Abrams. 2006. How Richard Nixon Pressured Arthur Burns: Evidence from the Nixon Tapes. *Journal of Economic Perspectives* **20**:4, 177-188. [[Abstract](#)] [[View PDF article](#)] [[PDF with links](#)]
69. Ellyn Boukus, Joshua V. Rosenberg. 2006. The Information Content of FOMC Minutes. *SSRN Electronic Journal* . [[Crossref](#)]
70. Carlos Capistrán. 2005. Bias in Federal Reserve Inflation Forecasts: Is the Federal Reserve Irrational or Just Cautious?. *SSRN Electronic Journal* . [[Crossref](#)]