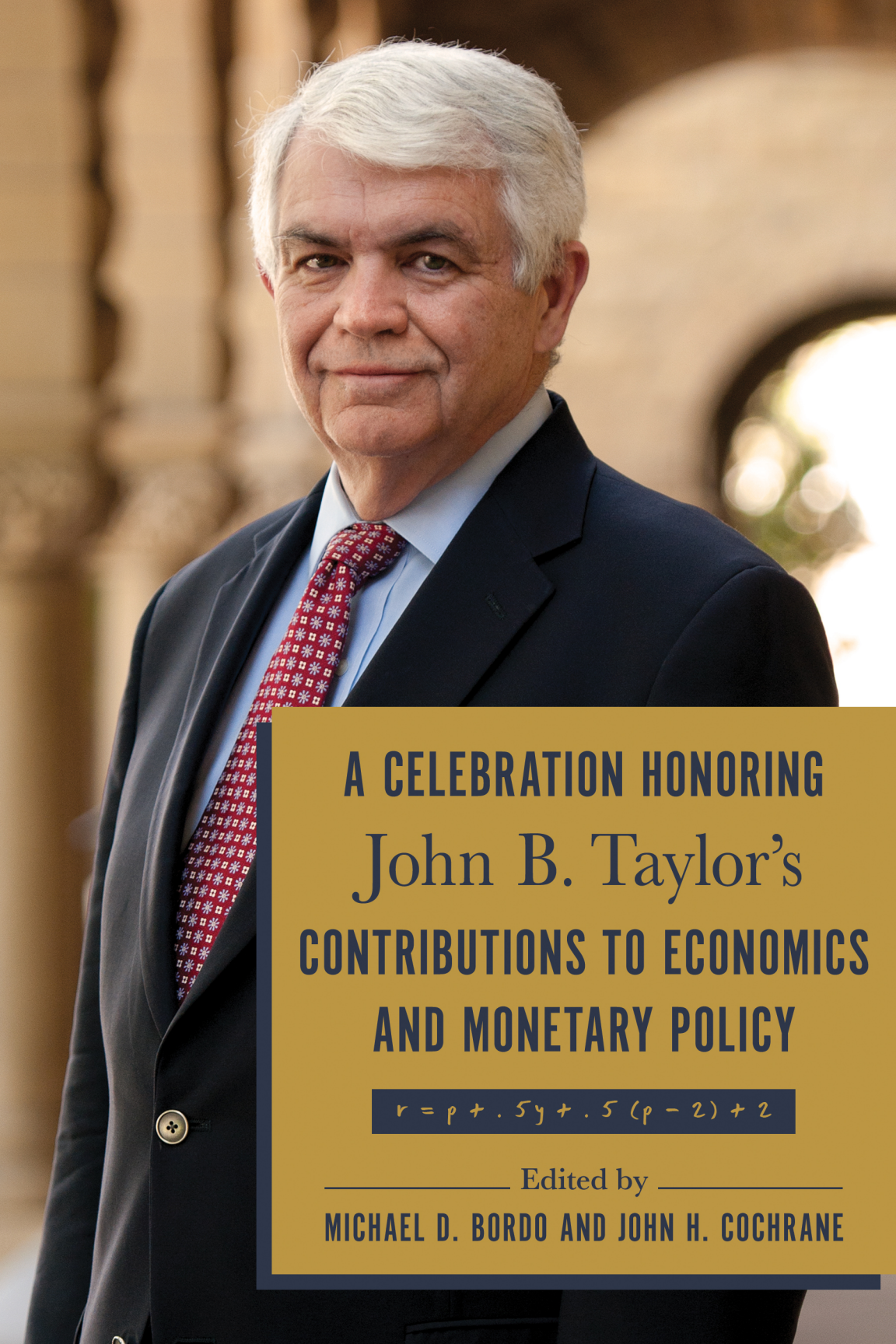

A CELEBRATION HONORING John B. Taylor's CONTRIBUTIONS TO ECONOMICS AND MONETARY POLICY

$$r = p + .5y + .5(p - 2) + 2$$

Edited by

MICHAEL D. BORDO AND JOHN H. COCHRANE

John Taylor and Milton Friedman in San Francisco, August 18, 2006; screen capture from a teleconferenced panel debate on monetary policy for the Festschrift conference in honor of Canadian economist David Laidler

Courtesy of John Taylor

From Friedman to Taylor: The Revival of Monetary Policy Rules in the 1990s

Introduction

John H. Cochrane

It is my great pleasure to introduce our dinner speaker, Ed Nelson. Ed is a senior adviser at the Federal Reserve. Among his many other accomplishments, he is the author of the multivolume definitive intellectual biography of Milton Friedman, which I'm plowing my way through and I heartily recommend.

Ed is a frequent correspondent of mine. Anytime I write a blog post or an article with anything slightly wrong in it, boom, I get an email from Ed in about fifteen seconds. Ed is scholarly, and always includes citations. Frequently he will send along PDFs.

I've learned to rely on him. I wanted to use the phrase "long and variable lags" and find out where it came from. I sent Ed an email, and he answered about ten seconds later along with the PDFs from something Milton Friedman wrote in about 1947. Ed knows exactly where the right quote is, which is the sort of thing historians and economic historians know how to do, and I don't.

So it is a great pleasure to introduce Ed. The topic he's chosen is an important one for history: how the Taylor rule inherited the baton, if you will, from money growth rules, and how Taylor inherited the baton from Friedman.

As you know, Milton Friedman believed in money growth rules. Bob Lucas was also a longtime advocate of money supply control. And as you know, the Fed sort of tried it in the early 1980s and concluded that money growth rules don't work. The Fed went back to targeting interest rates. No central bank targets money anymore.

I gather—actually John Taylor told me this—that at one point here at the Hoover Institution, Milton told John, roughly, "You're right, the Fed does control interest rates. The Taylor rule is the way to do it. But I'm too old to start all over again." In that sense, actually, Friedman personally passed the

baton. Similarly, I talked to Bob Lucas a lot about these things when I was at Chicago. I asked Bob, given that the Fed controls interest rates, not the money supply, what should they do? And he answered: "Follow the Taylor rule." So that baton was officially passed—at least according to my apocryphal stories.

Ed would never tell a story without checking it five times in the archives. So now we'll hear something much more scholarly.

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From Friedman to Taylor: The Revival of Monetary Policy Rules in the 1990s

Edward Nelson

This paper will examine the revival in the analysis of monetary policy rules that took place during the 1990s. The focus is on the role that John Taylor played in this revival. It will be argued that Taylor's role—most notably through his advancing the Taylor rule (developed in 1992–93 and increasingly permeating discussions in research and policy circles over the subsequent several years)—is usefully viewed as one of building bridges. In effect, Taylor built bridges between two traditions:

- A monetary policy rules tradition, associated especially with Milton Friedman. This tradition emphasized the benefits of policy rules, but it was also characterized by a highly negative attitude toward the short-term interest rate as a policy instrument.
- An interest rate–setting tradition, long associated with central banks. This tradition had largely been reestablished at the Federal Reserve by the early 1990s. Correspondingly, during this period, Alan Greenspan's Federal Open Market Committee made clear that its policy instrument was the federal funds rate. In common with the rules approach that Friedman championed, this interest rate–setting tradition was receptive toward focusing monetary policy on the pursuit of price stability. But it viewed approaches centered on policy rules as imposing rigidity and as being antithetical to practical policymaking.

The discussion that follows will consider how Taylor merged elements of these traditions in the course of his development and advocacy of the Taylor

rule (Taylor 1993a). He took a concept associated with Friedman—simple monetary policy rules—and made it a core part of practical discussions. At the same time, the Taylor rule—being a specification of interest rate setting that excluded the money stock and its growth rate from both the left and right-hand sides of the rule formula—represented a departure from Friedman and amounted to a dissent from Friedman's unfavorable perspective on interest rate rules. The synthesis of the two traditions that the Taylor rule represented brought the analysis of policy rules closer to central banking practices, and it also proved helpful in other researchers' development of New Keynesian models.

One aspect of this account should be stressed at the outset. The analysis does not attempt at all to bring the story into the twenty-first century or to draw parallels or contrasts between the 1990s and later decades. The strong focus here on the 1990s helps highlight an important part of the story of the development of monetary policy rules. But it is at the expense of trying to consider more recent decades' developments.

The Precedent: Building Bridges between Rational Expectations and Sticky Prices

A bridge-building role was something that Taylor had played previously in macroeconomics. He had done this in the wake of the rational expectations revolution in macroeconomics in the 1970s. As of 1975, Taylor had expected a rapid professional convergence to models that conducted monetary policy analysis under rational expectations. He was subsequently disappointed to witness, instead, the large-scale splitting of economic researchers into two camps, neither of which he could bring himself to join: subscribers to Keynesian models that had sticky prices but no rational expectations and proponents of rational expectations models that lacked sticky prices (Taylor 1989, 186).

Contrary to Taylor's own perception of rational expectations, the movement associated with it had been widely seen as relaying a message that was adversarial to many of the central precepts linked with empirical macroeconomic model building—including a role for monetary policy in real economic stabilization, the relevance of gradual price adjustment, and the value of optimal control methods and counterfactual policy analysis. In this vein, the well-known contribution that Robert Lucas and Thomas Sargent made to a June 1978 conference at the Federal Reserve Bank of

Boston had suggested that the difficulty of separating expectations from other sources of dynamics "has extremely dire implications for the identification of existing macro models" (Lucas and Sargent 1978, 55). Related work by key exponents of rational expectations had closely associated rational expectations with a negative view about the scope of monetary policy to provide stabilization of the real economy. Writing in late 1978, Bennett McCallum noted the "extent to which the current brand of policy activism has been affected by the analysis and findings of the Lucas-Sargent-Barro school" (McCallum 1979, 244). On the activist side of the debate to which McCallum referred were traditional Keynesians, who saw themselves as under fire, and Taylor would correspondingly look back on the "enormous resistance to rational expectations by Keynesians" (Taylor 1989, 186).

Through his work on nominal wage and price contracts, and via other model-building activities, John Taylor had by the mid-1980s made traditional Keynesians more amenable to rational expectations models. In effect, John Taylor's work helped take the edges off the rational expectations critique of existing macroeconomics by developing a framework in which monetary policy actions, even when largely anticipated in advance, had important short-run effects on output and employment. This work produced the basis for a synthesis of rational expectations and stabilization policy analysis that—combined with the assumption of optimizing behavior on the part of the private sector, and drawing on research contributions that others made during the late 1970s and early 1980s—eventually crystalized into New Keynesian economics.

In his own pioneering research on the matter of aggregate supply relationships, Taylor had agreed with the need for the introduction of rational expectations into macroeconomic analysis but had parted company with the advocacy, in the early rational expectations macroeconomic literature, of flexible-price models. Taylor also dissented from the negative Lucas-Sargent message regarding the impact of the rational expectations revolution on econometric modeling and the analysis of stabilization policy. Taylor argued for the overhaul and modernization of macroeconometric models, rather than for their abandonment. In so doing, he established a middle position between early rational expectations macroeconomics and Keynesian macroeconometric model-building practices (Phelps and Taylor 1977; Taylor 1980a, 1980b, 1982a).

Monetary Policy Rules and the Role of Interest Rates

The rational expectations revolution also provided a prism through which John Taylor looked at Milton Friedman's advocacy of a constant monetary growth rule. As an undergraduate, Taylor's interest in monetary policy rules had evolved from being motivated primarily by the "philosophical reasons" outlined in *Capitalism and Freedom* (Friedman 1962) to being guided by the "operational reasons" associated with the need to complete a dynamic macroeconomic model. Subsequently, as he became a developer of dynamic rational expectations models, his focus on rules intensified. This model environment was a setting in which it was not possible to lay out numerical values of the policy instrument and simply make these an exogenous input into the model. Rather, a law of motion for the instrument had to be specified so that the model could be solved and the implications of nominal contracts for output and price dynamics worked out. Taylor (1989, 186) therefore judged that the rational expectations revolution "placed emphasis on evaluating macroeconomic policy as a rule." He later recalled: "I would put it this way: In those kinds of models, you can't really think about policy without a rule."[1]

In the 1970s and early 1980s, the notion of a monetary policy rule was very strongly associated with monetary growth rules—and, in particular, with the constant monetary growth rule, thanks especially to Milton Friedman's championing of that rule.[2] In the course of this advocacy, Friedman had built up a large body of public statements criticizing the use of short-term interest rates as a policy instrument. His record of acerbic remarks about interest rate policies included his 1976 observations that the Federal Reserve should "forget about interest rates" and that "monetary policy is not about interest rates; monetary policy is about the rate of growth of the quantity of money" (quoted in Nelson 2020a, 246–47).

Likewise, the monetarist literature often seemed to take it as axiomatic that, in executing the task of inflation control, central banks would inevitably have to follow a monetary aggregates-focused approach. In keeping with this line of thinking, Phillip Cagan—a former student of Friedman and a senior colleague of John Taylor when Taylor was at Columbia University in the 1970s—had stated in 1979: "Monetary policy has to rely very greatly on monetary aggregates. The monetary authorities have to have a growth path of some total quantity of financial assets that they believe will help them control aggregate expenditures. I really don't believe we can get away from

that. As much as looking at interest rates may help, we have got to rely on the growth of financial assets."[3] Similarly, Cagan (1982, 3) remarked: "Monetary targeting is the only feasible method of stabilizing prices, whether one likes it or not."

A look at Friedman's case for preferring a monetary growth rule to an interest rate rule shows, however, that his arguments against policy rate rules, though strongly held, at heart consisted of doubts about whether they could be successfully implemented in practice.[4] His basis for favoring constant monetary growth did not amount to a contention that interest rate rules were analytically untenable or inherently not viable. Notably, in the course of a 1982 discussion that was negative about the *practical* operation of interest rate–setting regimes, Friedman granted that it was "[i]n principle . . . hypothetically possible" to secure monetary control through the use of an interest rate instrument.[5]

Essentially, Friedman's argument against interest rate rules boiled down to the fact that an interest rate policy designed to deliver price stability would require that the interest rate be adjusted vigorously in response to the state of the economy. In contrast to the case in which the central bank used a quantity variable as an instrument, it was not an option to specify a univariate law of motion for the instrument when the instrument was an interest rate: Monetary policy behavior would have to be written in terms of a feedback rule or reaction function. And, in order for the policy rule to deliver price-level stability, the nominal interest rate would need to be varied in a manner that both (1) avoided real interest rate movements that would produce prolonged swings in inflation and (2) generated real interest rate movements when these were necessary to secure price stability. In terms of Wicksellian analysis—which Friedman accepted as conceptually valid and had used in his American Economic Association presidential address—an interest rate rule would need to avoid systematic departures of the actual (or "market") rate of interest from the unobserved natural rate of interest (Friedman 1968a, 7–8). But Friedman was doubtful of the authorities' scope to judge accurately the requisite movements and to implement them promptly. For example, he described the Federal Reserve from the mid-1960s to the late 1970s as "adjust[ing] its interest rate targets only slowly and belatedly" (Friedman 1984, 27).[6]

In light of his concern that interest rate policies, in their practical implementation, would lack the needed vigorous responses to inflation, Friedman favored quantity targets—in particular, a simple rule of constant growth in the money stock, to be pursued using a quantity instrument, such as the

monetary base or total reserves. His policy recommendation therefore bypassed interest rates—which he did not deny mattered for the transmission of monetary policy actions to the economy—in favor of a rule that appealed to long-run reduced-form relationships between monetary growth and other nominal variables, like nominal income growth and inflation.

John Taylor was sympathetic toward the notion of policy rules but was not an adherent to the constant monetary growth rule—preferring a rule that reacted to economic developments (Taylor 1982b). Taylor's preference for strategies that targeted final objectives rather than intermediate objectives like monetary growth was also evident in remarks delivered in congressional testimony in June 1989, in connection with his confirmation as a member of the Council of Economic Advisers: "The most important thing for the Federal Reserve and for the government in general to be thinking about is an aim to stabilize prices and keep inflation low in the United States, and that goal will lead to more growth and a healthier economic environment, if met."[7]

Furthermore, sharing the disaffection that the wider economics profession had with the use of monetary aggregates and other quantity variables in monetary policy—a disaffection that was evident during much of the 1980s and that hardened in the early 1990s—Taylor over these years was reconsidering the appropriateness of a focus on quantity instruments and was turning instead to short-term interest rates as a candidate instrument.

Central Banks' Interest Rate–Setting Tradition

In gravitating toward the idea of an interest rate policy that was designed to deliver economic stabilization, Taylor was in effect building bridges with a long-standing central bank tradition that emphasized the management of interest rates in the pursuit of macroeconomic goals. In 1931, the United Kingdom's Macmillan Committee had given expression to this tradition when it remarked that "Bank Rate policy is quite a proper instrument . . . for regulating the pace of expansion and enterprise at home and for putting pressure on costs"[8] Correspondingly, after the end of the early postwar period's interest rate–pegging policies, an article on the international practice of monetary policy had noted that "variations in interest rates, brought about or furthered by action on the part of the central bank . . . [are] the old-established, 'classical' method of exerting authoritative influence on monetary conditions" (Crick 1956, 117). Similarly, in the UK in 1957, Richard Sayers noted that "the return to a movable Bank Rate has been in

some quarters acclaimed as a return to traditional technique" (Sayers 1957, 59).

Friedman and Schwartz's *Monetary History* (1963) had essentially acknowledged that interest rate setting had a strong association with monetary policy by describing the events leading to the advent of the Accord—a period that saw the resumption of the Federal Reserve's active management of interest rates—as the "Revival of Monetary Policy." Similarly, Friedman would note that steps to raise interest rates to fight inflation—steps seen in multiple countries in the years following World War II—represented a return to "so-called orthodox measures" (Friedman 1968b, 439). As already indicated, he found fault with these interest rate–based "orthodox measures" because he believed that policies centered more directly on the control of monetary growth would avoid the cyclical instability in the money stock and in economic activity that could be associated with interest rate policies that delivered a satisfactory *trend* in the price level. For example, Friedman commented favorably on numerous aspects of the monetary policy that the Federal Reserve pursued in the 1950s, but he felt that the recessions of 1957–58 and 1960–61 could have been avoided, or made less severe, by a constant monetary growth rule or by policies moving toward such a rule.

Those in, or closely linked to, central banking circles in the 1950s associated monetary policy strongly not only with interest rate policies but also with flexibility. They perceived this flexibility as essential and as making rule-based approaches inadmissible. In his 1957 book, Sayers referred to the revival of an active interest rate policy as "the return to a flexible monetary policy" and concluded a chapter on the theoretical basis of central banking by noting, "we must have central bankers to exercise a discretionary influence upon the monetary situation," while lamenting the fact that "[e]ven in our own generation" there were advocates of rules like Friedman.[9]

Makers of monetary policy in the United States shared the skepticism about monetary policy rules associated with this central banking tradition. For example, Federal Reserve Chair Martin observed in 1965: "It is doubtful . . . that anyone will ever be able to devise formulas that can provide infallible guides to monetary action" (Martin, 1965, 4). Likewise, in December 1987, several months after becoming the head of the Federal Reserve, Alan Greenspan remarked: "If we could find particular indicators or fixed sets of rules which worked all the time, I would subscribe to that. The difficulty that we have is that we don't find such stabilities."[10]

As of the late 1980s, however, the Federal Reserve had a more ambivalent connection with central banking tradition with regard to interest rate management. "Determination of the level of short-term interest rates has traditionally been considered an important instrument of central bank policy," two Federal Reserve Board officials had written in 1947 (Thomas and Young, 1947, 102). Forty years on, however, reluctance to be publicly characterized as determining US interest rates—along with the legacy of the critiques by Friedman and others of policy strategies that entailed explicitly setting interest rates—had left the Federal Reserve entering the Greenspan era managing the federal funds rate but not being forthright in public statements about the fact of this management. This situation was about to change dramatically.

The Federal Reserve Breaks Cover on Interest Rates, 1990–95

David Lindsey—a former Friedman student who served as a senior Federal Reserve Board staff member over most of the Greenspan years—gave a talk on US monetary policy in November 1992, the same month in which John Taylor delivered his Taylor rules paper. Lindsey (1992, 365) noted that the Federal Open Market Committee (FOMC) had restored the interest rate as its policy instrument a decade earlier: "Since late 1982 . . . sustained, sizable movements in the federal funds rate have been the result of discretionary Federal Reserve decisions."

Nevertheless, during the Paul Volcker years, formal public acknowledgment of this management of the federal funds rate had been missing. "We have no interest rate policy," Chairman Volcker had told the Joint Economic Committee in January 1983.[11] Volcker's public position was also reflected in a headline in the same year, titled "Volcker Denies Fed Had Any Part in US Interest Rate Rise" (Farnsworth, 1983).[12]

In Volcker's final five years in office and in the early Greenspan period, Federal Reserve policymakers in most of their external statements, and in many of their internal deliberations, took the stand that the FOMC was actually setting a quantity variable—borrowed reserves. This arrangement was, however, tantamount to management of the federal funds rate. Reflecting this reality, the Federal Reserve in the years leading up to John Taylor's unveiling of the Taylor rule became more overt about its employment of the funds rate as its main policy instrument.[13] Notably, in a July 1990 congressional hearing, after he had referred to a recent policy "adjustment," Alan Greenspan was

asked, "The adjustment you made was in lowering the federal funds rate, right?"—to which Greenspan replied, "Well—yes."[14]

These developments were followed, in the mid-1990s, by breakthroughs in FOMC communications.[15] When the Committee raised the federal funds rate in February 1994, a brief press release accompanied the decision, and by July the following year, when the FOMC lowered the funds rate, the press release was including the new value of the target funds rate and the economic rationale for the policy move.[16] These steps built on the progress that the Greenspan Federal Reserve had made over the previous five years toward greater explicitness about the FOMC's use of an interest rate instrument.

The Launch of the Taylor Rule

The mid-1990s changes to FOMC communications amounted to an acknowledgment of the widely recognized fact that the Committee managed short-term interest rates. In his November 1992 talk, David Lindsey had been blunt on this point (359): "The Federal Reserve itself, along with market participants, thinks of the federal funds rate as the main policy instrument."[17] In fact, when he was serving on the Council of Economic Advisers, John Taylor's attention to this matter came out clearly in the February 1990 *Economic Report of the President*'s passage covering recent years' monetary policy. This discussion had noted that the Federal Reserve "has focused more directly on interest rates—especially the federal funds rate, the interest rate on overnight interbank loans—in implementing monetary policy." It also put federal funds rate management in reaction-function terms: "The Federal Reserve generally increases interest rates when inflationary pressures appear to be rising and lowers interest rates when inflationary pressures are abating and recession appears to be more of a threat."[18]

After returning to academia, Taylor was, along with Bennett McCallum, an invited contributor to a Federal Reserve System conference on operating procedures, held at the Federal Reserve Bank of St. Louis on June 18–19, 1992 (see Goodfriend and Small, 1993). Taylor observed in his conference summary (Taylor, 1992a, 2): "Almost every paper assumed that the interest rate rather than reserves was the immediate target variable for monetary policy. This reflects recent experience in the United States and many other countries."[19] The reference to the international baseline, rather than just to the US experience, was significant. Other countries' central banks had in the 1980s

been much more explicit than the Federal Reserve about their use of an interest rate instrument. This situation was brought out by Rudiger Dornbusch's remark at a July 1988 congressional hearing: "Short-term interest rates are determined by the monetary authorities."[20]

Taylor's interest in, and growing receptiveness toward, interest rate rules reflected in part his exposure to this international practice. One facet of his immersion in the global monetary policy scene was Taylor's continuing activity during the early 1990s in the development of large macroeconometric models.[21] This work, together with his frequent interactions with central banks worldwide, led to his involvement in a multipronged project—spread across various sets of researchers—whose result was the conference volume of Bryant, Hooper, and Mann (1993). The volume in question studied nine multicountry econometric models, most of them produced by policy agencies.

Soon after this project's completion, both Taylor (1993a) and Henderson and McKibbin (1993) presented work associated with the project. Taylor's paper was presented at the Carnegie Rochester Conference in Pittsburgh that took place on November 20–21, 1992. The rule that he analyzed in that study—which was also released as a working paper in the same month of its first presentation (Taylor 1992b)—was stimulated by the prior project's results on the cross-model comparisons of alternative policy rules. These results suggested that this particular rule performed satisfactorily across models. In his Carnegie-Rochester paper, however, Taylor highlighted a further property of the rule. He found that it characterized well the first five years of Alan Greenspan's tenure as head of the Federal Reserve.

The rule in question consisted of an equation governing the setting of the federal funds rate, with the rate being adjusted in response to inflation (in relation to a 2% objective) with a coefficient of one and a half and to the output gap with a coefficient of one-half. Several years later, after the Taylor rule had become part of the monetary policy idiom, Milton Friedman remarked to Taylor, "I think it's almost impossible to predict what will be influential. You know that from your own work. You never dreamed when you presented the Taylor rule that it was going to become worldwide conventional wisdom" (quoted in Taylor 2001, 129). At the Carnegie Rochester event, Taylor's paper was well received, but there was no hint of the sensation to which the paper would eventually give rise. As Taylor himself described it, he was seeking in the paper to synthesize existing research findings by himself and others in recent years that had tried to make concrete the notion of

monetary policy rules, while doing so in the context of federal funds rate policy and concentrating on a rule that had acceptable properties across various models.

As a description of the first five years of Greenspan's tenure, the Taylor rule was notable not only because of its match with interest rate values of that period but also because of its favorable verdict on US monetary policy. It cast new light on a verdict on Greenspan's record (to date) that had been given by Friedman and by some Keynesians, too—that US monetary policy, especially in the early 1990s, had been too tight. A month before Taylor delivered his paper, Friedman (1992) had remarked: "The Fed has temporarily overshot. Continuation of M2 growth at two percent per year would imply actual deflation, not negligible inflation." And a month after Taylor's conference presentation, Paul Samuelson testified about what he called "over-conservative monetary policy in the early 1990s," while adding: "The low grade earned in 1990–92 by our Fed is not unique to America. The 1990s have been bad years for rational central banking."[22]

Taylor's evaluation contrasted with these judgments. His results suggested that the FOMC's policy rate adjustments over the 1987–92 period had actually been approximately in line with a long-run inflation objective of 2% (as well as with a notable countercyclical response, via the federal funds rate reacting to the output gap). That is, the Greenspan regime was found to have generated interest rate outcomes that were in the vicinity of the prescriptions of a rule—the Taylor rule—that had been found to perform creditably across a variety of large econometric models. Consequently, Taylor's finding amounted to a break with Friedman not only in decisively endorsing the choice of an interest rate instrument but also on the empirical matter of whether US monetary policy settings in the early 1990s had been broadly appropriate.

The Coefficients in the Taylor Rule

A significant part of what Friedman called the "worldwide conventional wisdom" embedded in the Taylor rule was, of course, its use of an interest rate instrument. Also important, however, were the rule's right-hand-side inputs: inflation and the output gap. It is worth considering these right-hand terms and how the associated policy response coefficients related to Friedman's thinking on these matters. The inflation response will be considered first.

The interest rate rules explored in the 1980s literature, in such studies as McCallum (1981), had largely limited themselves to the level of the money

stock or the price level as the right-hand-side nominal variable.[23] In view, however, of the emphasis given to inflation, rather than to the absolute level of prices, in modern stabilization policy, an inflation term in the reaction function was also a logical candidate. Indeed, in a major theoretical analysis, Leeper (1991) had focused on nominal interest rate rules in which inflation was the sole right-hand-side variable—that is, in which the monetary authority followed what would become known as a Taylor rule, but with an output-gap response omitted. Leeper, in common with much of the later literature on the Taylor rule, had concentrated on the economic implications of responses to inflation that were less than one-for-one and on the contrast between the resulting economic outcomes and those associated with greater-than-unity responses of the policy rate to inflation.

Friedman had repeatedly suggested that an obstacle to a successful short-term interest rate policy was that such a policy called for vigorous responses to the state of the economy. John Taylor's June 1992 discussion had observed that "the sluggishness of the interest-rate targeting regime" was "a very significant lesson [drawn] from monetarism" (Taylor, 1992a, 3). His assignment of a response coefficient of one and a half with respect to inflation was in part motivated by this lesson.[24] The Taylor rule, like some of the rules considered in the Leeper (1991) theoretical study, therefore featured interest rate responses that embraced what Michael Woodford (2001, 2003) would label the "Taylor principle"—the idea that the appropriate reaction of the federal funds rate in the face of inflation overshoots (or undershoots) should be greater than one-for-one.[25]

As far as Friedman was concerned, he had a long-standing objection to putting either the price level or the inflation rate into policy rules, beyond concern about the appropriate size of the response. He stressed that inflation reacted to monetary policy actions with a lag—and so central bank actions taken in response to actual inflation would not imply policy adjustments prompt enough to achieve a noninflationary stance.[26] By the 1990s, wide agreement prevailed in the economics profession that US inflation typically took a year or more to register sizable responses to monetary policy actions. Consequently, there was force in the Friedman position that deviations of inflation from the central bank's objective largely reflected *past* monetary policy actions—and, therefore, responding to those deviations did amount to a belated course correction. But this force was reduced somewhat in forward-looking rational expectations models of the kind that Taylor used. In these models, even a monetary policy response to past or current inflation rates

was anticipated in advance by the private sector—a mechanism that helped stabilize inflation before the policy action was actually taken.

The output gap response was also a source of Friedman's reservations. With John Taylor—based, like Friedman, at Stanford University—now a prominent champion of characterizing monetary policy through interest rates, Friedman had to pay more attention to the issue of interest rate rules. "Milton was a very gregarious person—he was very, very interested in what I was doing," Taylor would recall. "I was flattered that he had any interest. He'd comment on papers, was always interested in the Taylor rule and things like that." The output gap reaction figured prominently in these discussions. Taylor would recall of Friedman's reaction to the Taylor rule: "I think the notion of a rule he liked a lot. [But] I think he was very concerned about the gap. The measure of utilization was probably of the most concern to him."

With regard to the output gap response in the Taylor rule, Friedman could take some comfort from the fact that it reflected, after a fashion, a message of his own work. The Taylor rule embodied a zero output gap target, in keeping with Taylor's (1988, 33) earlier remark: "I like to think of the ideal policy rule as minimizing the deviations of real output from normal or natural levels, with a correction for inflation." The zero-gap criterion was an obvious specification to Taylor, because it captured the message of the natural-rate hypothesis.[27] Taylor had repeatedly endorsed this hypothesis in his writings. He had urged that models should incorporate into their specifications, and policymakers should take into account in their decisions, the notion that "the economy tends to return to the natural rate of unemployment" irrespective of the form of the monetary policy reaction function (Taylor 1987, 351). Directing monetary policy toward output gap stabilization, rather than toward an attempt to set the level of output, was a way in which central banks and the modern analysis of stabilization policy reconciled the existence of a real-activity goal for monetary policy with the natural rate hypothesis.[28]

Friedman was not, however, placated by the point that, in the Taylor rule's formulation, policymakers focused on output in relation to its natural level. Friedman's objection to having the output gap in the policy rule instead centered on the likelihood of measurement errors involving the output gap—a problem whose importance Taylor (1988, 33) had himself granted when he stated, with regard to any rule that entailed a reaction to the gap: "The main difficulty with this rule is determining what is the normal or natural level of output."

Friedman had far less objection to responding to *changes* in real economic activity. A constant monetary growth rule entails an implicit interest rate reaction to output growth (see Woodford, 2003, 109), and on many occasions Friedman had pointed—implicitly in some places, explicitly in a few instances—to the desirability of relying on the growth rates, rather than the levels, of series (see, for example, Orphanides and Williams, 2005). The notion that monetary policy should refrain from responses to the level of the output gap had some support among those active in the late 1990s in the monetary policy research field—see, for example, McCallum (2001) and Orphanides (2003)—but was certainly a minority position among economists.

The Rules Literature Revived

The Taylor rule work would generate a very large economic literature. In retrospect, the Taylor paper can be viewed as having been part of a surge in research activity starting in 1992 concerned with viewing US monetary policy via a framework centered on rules—in particular, interest rate rules. Taylor's characterization of US monetary policy as following a parsimonious interest rate feedback rule gained ground, with empirical studies of the reaction function largely confirming that the Federal Reserve's average responses took the form that Taylor had specified. Several studies relaying aspects of this finding appeared, most prominently the 2000 paper by Clarida, Galí, and Gertler (CGG), "Monetary Policy Rules and Macroeconomic Stability: Evidence and Some Theory." The main modifications that CGG made to Taylor's 1993 representation of monetary policy behavior were twofold: CGG found that the Taylor rule well characterized both the Volcker and Greenspan regimes, rather than just Greenspan's; and their estimated specification indicated that dynamics appeared to feature in the estimated rule, in the form of an interest rate smoothing term and, possibly, in the fact that the expected future inflation rate, rather than current inflation, was the nominal series to which the federal funds rate responded.[29]

In this research, Taylor's (1995, 779) conjecture that "the adoption of a monetary policy with greater concern for inflation in the early 1980s" was a major break with the past was borne out. Estimated interest rate reaction functions showed that the response to inflation changed from below unity until the late 1970s to above unity thereafter.[30] It has already been indicated that, *conditional on the fact* that the Federal Reserve was following an interest rate instrument, Milton Friedman believed that it was appropriate

for monetary policy to respond vigorously to economic developments, including on the inflation front. The research literature's estimates of post-1979 monetary policy reaction functions indicated that US interest rate policy had moved in that direction.

The agenda that the Taylor (1993a) paper helped set over the subsequent decade was felt in conference activity, including an NBER conference on monetary policy rules in January 1998, organized by Taylor (1999).[31] The agenda was also reflected in the title of the first chapter of Michael Woodford's (2003) monograph *Interest and Prices: Foundations of a Theory of Monetary Policy*, "The Return of Monetary Rules."

The Greenspan Federal Reserve and the Taylor Rule

In September 1997, Alan Greenspan gave a speech specifically on policy rules. The occasion was a Stanford University event hosted by Taylor at which Greenspan was introduced by Friedman. In his speech, Greenspan (1997) granted the "attractive features" of the Taylor rule, but he also underscored his view that "these types of formulations are at best 'guideposts' to help central banks, not inflexible rules that eliminate discretion" and suggested that the need to estimate both the (steady state) equilibrium real federal funds rate and potential output amounted to limitations of the rule's practical applicability.

Greenspan also acknowledged the upsurge in activity in the area of policy rules that the Taylor rule had helped generate: Greenspan noted that the Taylor rule "has attracted widening interest in recent years in the financial markets, the academic community, and at central banks." In the Federal Reserve specifically, a notable development was that, by the time of Greenspan's speech, the Federal Reserve Board staff's central macroeconomic modeling had undergone a shakeup, with the new FRB/US model analyzing alternative monetary policies in terms of interest rate rules or reaction functions (see Brayton et al. 1997).[32]

The Taylor rule had also appeared in the briefing materials provided by Federal Reserve Board staff for FOMC discussions starting in November 1995 (Kahn, 2012, 73).[33] The situation prevailing at the time of the January 1998 conference on monetary policy rules that John Taylor organized was reported by senior Federal Reserve Board staff member, Donald Kohn.[34] Kohn (1999, 195) noted that Taylor rule prescription as well as other rules provided on a regular basis to FOMC policymakers and served as a benchmark and to help structure thinking. Kohn added, however, that his judgment

was that, through the end of 1997, "only a few members" of the Committee gave detailed consideration to the rules-based material on a regular basis.

Milton Friedman: Not Completely Reconciled

As for Milton Friedman, it deserves emphasis that, although Taylor brought the analysis of interest rates much closer to the monetary policy rules literature, it remained the case that Friedman was not completely won over. The adjustment, through conscious central bank decisions, of interest rates in response to the state of the economy—even when this adjustment was in the form of a policy rule—still contrasted heavily with the leaving of the short-term interest rate to market forces that was implied by Friedman's ideal of the adoption of a reserves-type instrument. As Taylor had put it shortly before he advanced the Taylor rule (Taylor 1992a, 4): "Some automaticity is lost when interest rates are targeted, at least in comparison with targeting quantities."

Friedman's frame of mind was reflected in a letter that he wrote to *Newsweek* in 1994 objecting to the magazine's characterization of his views. Friedman told *Newsweek* (Friedman, 1994): "You refer to 'Milton Friedman's theory that the Federal Reserve could manage the economy by focusing on money-supply measures.' This is almost the opposite of what I have in fact argued." The day when a monetary policy rule was imposed in place of an activist policy of "managing the economy" was, Friedman indicated, the day he lived for.

Although Friedman was not fully reconciled to the Taylor rule, Taylor benefited from the extensive dialogue that he had with Friedman on the subject: "And we talked about that a lot, and I don't know if I completely convinced him, but that was, I think, a fruitful exchange for me, in seeing his reaction to that. I'd say that I think he generally was quite positive about it."

Notes

The author is grateful to conference participants for useful suggestions. The views expressed here are those of the author and should not be interpreted as being official positions of the Federal Reserve System or the Board of Governors.

1. Unless otherwise noted, quotations come from the author's interview with John Taylor, July 2, 2013. The quotations are taken from the parts of the interview excerpted in Nelson (2026b, chapter 4).

2. The rule itself predated Friedman—a fact stressed in some studies that appeared in this period, including Tavlas (1977) and Bordo and Schwartz (1983).

3. Testimony of May 14, 1979, Committee on Banking, Housing, and Urban Affairs, US Senate, *Monetary Policy Improvement Act of 1979*: Hearings, February 26, March 26, 27, 28, and May 14, 1979 (US Government Printing Office), 788.

4. This is also true of the arguments of other key monetarists, such as Allan Meltzer. See also King (2000, 75) on Friedman's critique of interest rate rules.

5. Friedman (1982, 101). This Friedman discussion was in the context of using interest rates to pursue monetary-aggregate targets, but his discussion of what was in principle possible has a logical counterpart in the case of using interest rates to pursue direct inflation targets.

6. This way of describing his reservations reflected a concern that slow adjustment would imbue an interest rate policy with the same flaws as those of an outright interest rate peg, of the kind that the Federal Reserve had pursued during World War II and its aftermath. Friedman and Schwartz (1963, 628) argued that the Federal Reserve's interest rate policies prior to the pegging regime were "cut from the same cloth" as the pegging policy. Along these lines, Goodfriend and Hargraves (1983, 7) characterized US monetary policy in the 1920s as consisting of "influencing the general level of short-term interest rates."

7. Testimony of June 8, 1989, Committee on Banking, Housing, and Urban Affairs, US Senate, *Nominations of John B. Taylor and John Michael Farren*: Hearing, June 8, 1989 (US Government Printing Office), 26.

8. In Committee on Finance and Industry (Macmillan Committee), Report, Cmnd. 387: Her Majesty's Stationery Office, (1931), 98, paragraph 221.

9. The quotations are respectively from pages 59, 7, and 6 of Sayers (1957).

10. Testimony of December 18, 1987, Committee on Banking, Finance and Urban Affairs, US House of Representatives. 1988. *International Coordination of Economic Policies and in the Conduct of Monetary Policy*: Joint Hearings, November 5, 17, and December 18, 1987 (US Government Printing Office), 159.

11. Testimony of January 27, 1983, Joint Economic Committee, US Congress, *The 1983 Economic Report of the President*: Hearings, Part 1: January 26, 27, and 31, and February 2, 1983 (US Government Printing Office), 80.

12. By this stage, the FOMC had certainly resumed management of the federal funds rate. This followed the 1979–82 period, during which the FOMC had sought to use nonborrowed reserves at its operating target. Over 1979–82, policymakers had permitted wide fluctuations in the federal funds rate to take place as they concentrated on the attainment, through open market operations, of the desired nonborrowed-reserves value. Earlier, from 1951 to 1979, the Committee had centered its decisions on short-term interest rates, and by the late 1960s, they had settled on the federal funds rate as the short-term rate on which to focus. Even in this pre-1979 period, however, the public remarks of Federal Reserve officials—particularly those made during the William McChesney Martin tenure—frequently aimed (as Volcker later would) to discourage perceptions that the Committee managed short-term interest rates. For example, a 1961 submission by Martin's Board of Governors

stated that "Federal Reserve actions to implement monetary policy are generally focused on the volume and availability of bank reserves rather than on any particular level or pattern of interest rates" and implied that "policies aimed particularly at influencing interest rates" were appropriate only rarely (in Commission on Money and Credit, 1963, 14). As discussed in Nelson (2020a, Chapter 10), this reticence may have reflected a concern that, if public commentary firmly associated the Federal Reserve with rate setting, it would become more difficult for the FOMC to move interest rates when it judged this to be appropriate.

13. The Federal Reserve Board staff documents that went to the FOMC before each policy meeting were, until the end of the 1980s, usually quite opaque about the committee's use of an interest rate instrument. In this connection, Rotemberg (2013, 80) observed: "One has to wait until October 1989 to find a Bluebook [at the time, a document regularly prepared by Federal Reserve Board staff] that lays out policy alternatives in terms of levels of the federal funds rate."

14. Exchange in the hearing of July 24, 1990, Committee on Banking, Finance and Urban Affairs, US House of Representatives, *Conduct of Monetary Policy*: Hearing, July 24, 1990 (US Government Printing Office), 9.

15. Ahead of this time, public statements by Federal Reserve officials had often stopped short of acknowledging that the federal funds rate was the policy instrument. In his introduction to Goodfriend and Small (1993), Donald Kohn (then director of the Division of Monetary Affairs at the Federal Reserve Board) stated that since 1982, the FOMC had moved from "reserve-based operating procedures" to "discretionary changes in reserve conditions." As already indicated, however, internal discussions had become more explicit by this stage. For example, a staff memorandum (originally written in April 1992 and distributed to the FOMC in May 1993) observed: "Officially, the Committee is still using borrowed reserves as its short-term operating instrument—i.e., setting short-term targets for borrowed reserves and attempting to hit these targets via open market operations. For several reasons, however, it has approached the borrowing targets 'flexibly' in recent years, with the results that for all practical purposes it is targeting the funds rate and controlling it quite tightly." (See https://www.federalreserve.gov/monetarypolicy/files/FOMC19930507memo01.pdf.)

16. See https://www.federalreserve.gov/monetarypolicy/fomc_historical_year.htm. Since the early Martin years, the Federal Reserve Board (rather than the FOMC) had sometimes included a brief discussion of the economic basis for its interest rate (in the Board's case, discount rate) decisions when announcing those decisions in press releases.

17. By this time, greater interest in the federal funds rate in the research world was evident in such key studies as Bernanke and Blinder (1992).

18. Council of Economic Advisers (1990, 85). See also Taylor (1993b, 209).

19. The papers to which Taylor referred included Fuhrer and Moore (1995), which had been presented as a working paper at the June 1992 conference.

20. Testimony of July 12, 1988, Committee on Banking, Housing, and Urban Affairs, US Senate, *Federal Reserve's Second Monetary Policy Report for 1988*: Hearings, July 12 and 13, 1988 (US Government Printing Office), 63.

21. See also Taylor (1993b).

22. From Samuelson's testimony of December 30, 1992, *Joint Economic Committee, US Congress, Monetary Policy for 1993*: Hearing, December 30, 1992 (US Government Printing Office), 11.

23. In good part, this focus stemmed from the fact that a major concern in this 1980s literature was the ability of an interest rate rule to "pin down," or establish a specific value for, the price level.

24. Taylor's work appeared in 1993 in an environment in which interest rate rules featuring sizable responses to inflation were gaining more attention in policy-oriented research, as well as in theoretical studies like Leeper (1991). In the US context, Henderson and McKibbin (1993) was one such paper, but the process was also in motion in other countries. On the empirical front, a cross-country study of the international relationship between short-term interest rates, written by Reserve Bank of Australia researchers and issued in mid-1991, reported that, in contrast to the 1970s, in the period since 1984 "the slope coefficient . . . is significantly greater than unity"—a result that the authors suggested was indicative of a shift to more inflation-responsive monetary policies (Bullock and Rider, 1991, 6). And in a contribution to a July 1992 conference held at the Reserve Bank of Australia, Goodhart (1992, 324) suggested that a useful criterion by which UK monetary policy might be judged was a "rule" under which the short-term interest rate was adjusted by 1.5 percentage points in response to a rise in inflation—the same numerical response later embedded in the Taylor rule.

25. The notion that real interest rates should rise with inflation for inflation control was present in policy-related discussions before 1992. For example, a Federal Reserve Bank of New York official, Paul Meek, observed at a 1982 conference on monetary targeting (see Meek, 1983, 70) that an interest rate regime could be attractive "provided the authorities move rates enough in a timely fashion." It should be noted that, in forward-looking models, the presence of contemporaneous interaction between interest rates and inflation means that the stabilization of inflation implied by the Taylor principle may not actually feature an observed rise in real interest rates. The difference between the intuition implied by backward-looking models and the mechanisms operating in forward-looking models was stressed, in the context of interest rate rules, by John Cochrane, beginning with Cochrane (2007).

26. As of the 1990s, a fairly recent expression of this long-standing Friedman point had been Friedman and Friedman's (1984, 100) statement that "using today's prices to determine today's monetary growth is like fighting the last war."

27. The rule also respected the fact that central banks could only influence another real variable—the real interest rate—in the short run. In mid-1993 testimony, Greenspan (1993) had cited the possibility of the difference between the real short-term real interest rate and its steady-state value serving as one basis on which to

make monetary policy decisions. In an op-ed published the following September, Friedman (1993) had reacted negatively, taking Greenspan as endorsing the use of a fixed value of the real interest rate as a monetary policy target. Friedman argued that this was neither desirable (because the appropriate real interest rate varied over time) nor feasible (as the central bank could not, ultimately, fix the real interest rate). Greenspan had not actually endorsed real-rate targeting, but neither had his testimony spelled out the conditions under which it would be appropriate for monetary policy to vary over time the real interest rate (in relation to its steady-state value) in order to secure economic stabilization. The Taylor rule was one way in which this void could be filled. The Taylor rule can be rewritten as a rule for a type of real interest rate (the federal funds rate minus the four-quarter inflation rate). The rule lays out specific conditions under which monetary policy should vary the real interest rate, while also implying that the long-run value of the real rate is insensitive to monetary policy actions.

28. For further discussion, see Nelson (2020b, chapter 13; 2026a, chapter 2).

29. CGG's (2000, 156–57) baseline estimate had the FOMC responding to the one-period-ahead expected inflation rate. Judd and Rudebusch (1998, 5–6) used the current four-quarter inflation rate in their estimated reaction functions. Other studies appearing over this period that provided estimates of a post-1979 US monetary policy rule included Rotemberg and Woodford (1997) and Ireland (2000).

30. The understanding of the change in US monetary policy in terms of a shift in the coefficients in the interest rate reaction function represented an advance on many discussions in the 1980s, when the rules literature had been largely moribund. For example, the OECD (1985, 93), although it recognized correctly that "failure to adjust interest rates rapidly enough in the face of upward pressure" had been a feature of pre-1979 Federal Reserve practice, characterized the change effected since then merely in terms of a move to wider target ranges for the funds rate.

31. Thanks to Taylor's inviting us to be involved, the present author had a paper, coauthored with Bennett McCallum, on the program of this event (held in Islamorada, Florida, on January 16–18, 1998) as well as in the resulting conference volume. I was fortunate enough to participate in the conference as well as the corresponding preconference (held on October 31, 1997, at the National Bureau of Economic Research's office in Cambridge, Massachusetts).

32. This 1997 paper had been presented at the Carnegie-Rochester Conference held in Pittsburgh in November 1996. Thanks to Taylor's attendance (see Taylor, 1997), the present author (a graduate student at Carnegie Mellon University at the time) first met John Taylor at this conference. This was followed by a great many further meetings over three decades, including at numerous monetary policy-related conferences and workshops.

33. Kahn (2012), originally presented at a Federal Reserve Bank of Dallas conference in October 2007, has detailed information on the references made to the Taylor rule in internal Federal Reserve discussions during the 1990s.

34. The same conference also had a research paper by Federal Reserve Board economists on interest rate rules: see Levin, Wieland, and Williams (1999).

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