The Role of Interest Rates in Federal Reserve Policymaking

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Frank Morris was an exemplar of public service, American-style. More specifically, he represented the best of what public service at the Federal Reserve System is all about. Perhaps not incidentally—and here I write from my own personal experience of the man—Frank was a fine human being with whom, and for whom, to work. Simply put, I admired him enormously. Looking back, I still do.

Personal qualities aside, Frank Morris's service at the Federal Reserve was unusual in at least two important ways. First, Frank was president of the Federal Reserve Bank of Boston, and therefore a regular participant (albeit not always a voting member) in the deliberations of the Federal Open Market Committee, for fully twenty years. Since World War II only one other person has served on the FOMC for so long a span of time. (Governor J. L. Robertson served as a Member of the Board from 1952 to 1973.) Second, as the discussion below will emphasize, the particular twenty-year period during which Frank served in this capacity saw an unusually large number of changes in the Federal Reserve's conduct of monetary policy, changes that reflected not only the evolution of external economic circumstances but also substantive shifts in fundamental thinking about how monetary policy works and what this implies for the central bank.

Frank responded to the challenges that this unusual time presented with intelligence, good judgment, and a degree of interest and energy that bordered on gusto. At the very outset of his FOMC service he served as a member of the committee's Subcommittee on the Directive (often

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called the Maisel committee after Governor Sherman Maisel, who chaired the effort)—a group that, notwithstanding its technical-sounding name, was asked to think through a variety of fairly fundamental ideas about the conduct of monetary policy that were then new. Soon thereafter Frank initiated, under the Boston Bank's sponsorship, a series of conferences designed to engage not only Federal Reserve officials and staff but also academic researchers, representatives of private-sector financial institutions, and even journalists in continuing this discussion. The first such conference, on "Controlling Monetary Aggregates," took place on Nantucket in June, 1969. To date there have been forty-five such conferences in this series.

Frank clearly regarded the establishment of this conference series, and over time its imitation by so many other Federal Reserve Banks, as one of his most significant contributions to the Federal Reserve System. I think he would have been pleased that we are met today, to debate once again substantive questions about the economics of monetary policy, at a similar conference convened specifically in his memory.

The object of this paper is to look back, and ahead as well, at one of the most central aspects of this ongoing discussion of monetary policy: the proper role of interest rates. When Frank Morris first joined the Federal Open Market Committee, the Federal Reserve, like most central banks at that time, made monetary policy by setting interest rates. The same is once again true today. In retrospect, much of the intervening experience proved to be a historical detour. But as the discussion below emphasizes, the fact that central banks are again (in some cases, still) implementing their monetary policy decisions by setting interest rates nonetheless leaves open a number of potentially important issues.

The first section of the paper sets the stage for this discussion by laying out some familiar fundamentals showing how interest rates can enter the monetary policymaking process in several different ways. The next section reviews the major changes that took place along the way from the Federal Reserve's interest-rate-based monetary policy of the late 1960s to the interest-rate-based policy structure in place at the beginning of the twenty-first century.

The third section takes up three open questions surrounding today's interest-rate-based policy structure: (1) Has the Federal Reserve solved the "nominal anchor" problem inherent in interest-rate-based monetary policymaking? If not, would a shift to explicit inflation targeting (along the lines of what the Bank of England and the Swedish Riksbank, for example, have done) be helpful? (2) Is there a role in the monetary policymaking process for interest rates other than the federal funds rate, or whatever particular rate the Federal Reserve chooses to set? Equivalently, is there a role for the prices of financial assets, including equities? (3) To what extent does the electronic revolution now under way in

banking, and in business more generally, threaten the efficacy of interest-rate-based monetary policymaking?

The final section concludes by posing a yet more fundamental question: Where does the Federal Reserve's once-and-yet-again interest-rate-based policy leave us on the perennial issue of rules versus discretion in monetary policymaking? And is that good or bad?

Distinguishing Three Roles for Interest Rates

The place to begin in understanding not merely the role of interest rates in monetary policymaking but how monetary policy works more generally is to realize that the central bank is a monopolist. In highly developed financial systems like that of the United States, many market participants can and regularly do buy or sell securities in amounts far larger than the Federal Reserve's normal operations. But they usually do not move markets, much less exert a powerful influence over output, employment, and inflation. By contrast, moving financial markets to an extent sufficient to affect nonfinancial economic activity is precisely what central banks seek to do.

The standard explanation for central banks' ability to affect large markets through small operations is that transactions by the central bank are fundamentally different from transactions by private market participants. When the central bank buys securities, it makes payment by increasing the reserve account of the seller's bank, thereby increasing the total volume of reserves that the banking system collectively holds. When the central bank sells securities, it receives payment by reducing the reserve account of the buyer's bank, thereby reducing the total volume of reserves. No other market participant can either increase or reduce the total volume of reserves. The central bank is a monopoly supplier (and withdrawer) of reserves.

This monopoly position matters because under any of a variety of conceptions of the monetary policy process, banks and other financial institutions must hold reserves with the central bank in order to carry out the economic functions that households and firms look to them to perform. The traditional "money view" of monetary policy begins with households' and firms' demand for bank-issued money, against which banks must, by law, hold reserves (usually specified as some set fraction of each bank's outstanding deposits). When the monopolist central bank reduces the supply of reserves, banks therefore must reduce the amount of money that they supply to households and firms. As households and firms compete with one another to hold the now shrunken supply of money, their individual efforts to sell securities for money cannot produce any more money but do, collectively, drive the price of securities down—that is, they drive interest rates up.

Alternatively, in some countries today—for example, in the United

Kingdom and Canada, and increasingly so among small banks in the United States since required reserve ratios were reduced in 1990 and 1991—banks' motivation for holding reserve balances with the central bank actually has little or nothing to do with reserve requirements. These reserves are, instead, a necessary means of settling interbank transactions through the central bank's clearing mechanism. On any given day, a bank may have more checks presented for payment than checks deposited. If its reserve balance is insufficient to cover the difference, its account at the central bank will be overdrawn at the end of the day, in which case most central banks will assess a penalty. If the central bank does not allow "daylight overdrafts," the bank must similarly maintain an adequate reserve balance to cover such contingencies even on an intraday basis. Although the banks' reason for holding reserves is different, as long as the need for settlement balances is related to banks' volume of deposits the implication of central bank operations is the same as under the "money view."

The "credit view" of monetary policy focuses on a different aspect of the relationship between the financial and nonfinancial worlds, but for this purpose it too leads to the same conclusion. Households and firms look to banks to extend loans (credit). Banks can do so only to the extent that they simultaneously create money—in other words, the respective totals on the two sides of any bank's balance sheet must always remain equal. But if banks must create money in order to advance credit, and creating more money means requiring more reserves, the central bank's role as monopoly supplier of reserves is again crucial. When the central bank reduces the supply of reserves, banks have to cut back on their lending, and the loan market will clear at a higher interest rate.

Under any of these different views of why monetary policy matters, therefore, by exercising its monopoly power over the supply of its own liabilities the central bank can influence the market-determined array of interest rates (and prices) on all financial assets. Alternatively, instead of supplying a set quantity of its liabilities, the central bank can directly determine the interest rate on any *one* class of debt instrument by simply buying or selling whatever amount of securities—and therefore supplying whatever amount of bank reserves—is consistent with market equilibrium at the chosen level for the designated interest rate. In this case the market equilibrium still determines all *other* interest rates, and the prices of all other financial assets, but the central bank in effect fixes one interest rate.

As William Poole's seminal paper (1970) neatly showed, if all other influences bearing on output and inflation (or whatever else constitutes the ultimate objective of monetary policy) were completely known in advance, it would make no difference whether the central bank conducted policy by fixing the supply of reserves or by setting an interest rate. These alternative operating strategies would be fully equivalent.

Because many forces bearing on the central bank's objectives are unpredictable, however, the choice of "instrument" by which to implement policy matters for the effectiveness of policy. As Poole and a series of subsequent researchers showed, in general the more uncertainty surrounds the behavior of households and firms in the markets for goods and services—for example, the strength of consumer spending, or of business investment—the more advantage there is to fixing the *quantity* of reserves. By contrast, the more uncertainty surrounds behavior in the financial markets—households' and firms' demands to hold deposits versus other assets, their desire to borrow, the willingness of banks to lend, and so on—the more advantageous it is for the central bank to set the *price* of reserves: in other words, an interest rate.

Hence the first potential role of interest rates in the monetary policy process—importantly, for *one* interest rate only—is as the instrument variable that the central bank sets in order to implement its chosen policy. Even if the central bank uses an interest rate instrument, however, there remains the question of how it decides what level is appropriate. The most straightforward approach would be to infer directly, from historical or other relationships, the interest rate level that corresponds to whatever level of nonfinancial economic activity, and hence whatever pace of price inflation, the central bank seeks to achieve.

Here again, the fact that many influences bearing on output and inflation are uncertain and, moreover, that the effect of interest rates on both output and inflation plays out only over an extended period of time, is crucial. To the extent that it is possible to observe along the way the fluctuation of other variables that might convey useful information about imminent but as yet unseen movements of output and inflation, adjusting the central bank's chosen interest rate level in light of those observations is clearly helpful. In the limit, if some one observable variable were to bear a sufficiently close relationship to subsequent movements of output and inflation, a plausible way to conduct monetary policy would be to determine what path for that variable most closely corresponds to the central bank's ultimate objectives and then adjust the interest rate instrument in whatever way is necessary to keep that variable as close as possible to this implied path— in other words, to treat that variable as an "intermediate target" of monetary policy.

What observable variable might exhibit such highly desirable properties? Probably none. But following the work of Milton Friedman and Anna Schwartz (1963) and their many followers, the candidate that has attracted by far the most attention during the last half-century of monetary policymaking, not just in the United States but in many countries with highly disparate economic structures and financial systems, is one or another measure of deposit money. A second potential role for interest rates in the monetary policy process, therefore, is again as an instrument variable, but as the instrument that the central bank varies

with an eye not toward steering output and inflation directly, but rather toward targeting the money stock.

Finally, regardless of how the central bank perceives its interest rate instrument—indeed, regardless of whether the central bank uses an interest rate instrument at all (as opposed to fixing the quantity of reserves)—the central bank is able to fix *at most* one interest rate. Is there a role for the others? More specifically, and in practical terms, most central banks use an extremely short-term interest rate as their monetary policy instrument variable. In the United States, the Federal Reserve has for many years used the overnight federal funds rate. Is there a role in the monetary policy process for long-term interest rates? Or for equity prices?

Once again, uncertainty and lags are the heart of the matter. If the fluctuations of long-term interest rates or equity prices contain information about future movements of output and inflation—and, crucially, if this information is incremental, in the sense of going beyond what is knowable from simply observing the past movements of output and inflation themselves, or the movement of the central bank's own instrument—then in general it is helpful to adjust the instrument in light of this observed information. Treating long-term interest rates or equity prices as an "information variable" in this way is conceptually equivalent to treating money growth, for example, as an information variable. But since no one expects the central bank to be able to keep either long-term interest rates or equity prices closely along a designated trajectory, so that the question of treating these variables as intermediate targets does not arise, the idea is perhaps even more straightforward.

How can the central bank decide whether any or all of these three roles for interest rates—as an instrument variable directly linked to the ultimate policy objectives, as an instrument variable used in pursuit of an intermediate target, or as one or more information variables—constitutes a good way to conduct monetary policy? The answer in each case is empirical. Moreover, because objective circumstances change over time, so does the state of the relevant empirical evidence. It is not surprising, therefore, that actual central bank practice changes over time as well.

Interest Rates in Federal Reserve Policymaking Since 1968

When Frank Morris first joined the Federal Open Market Committee, in 1968, the committee made monetary policy decisions by setting a short-term interest rate. Today, the FOMC makes monetary policy decisions by setting a short-term interest rate. The fact that the rough outlines of the policymaking process are the same at these somewhat arbitrary beginning and ending points, however, masks what in reality was an extremely rich set of developments along the way.

To begin, two aspects of the pre-1968 experience are particularly

relevant to this story. First, the Treasury–Federal Reserve Accord, concluded in 1951, relieved the U.S. central bank of its World War II obligation to support the prices of government debt obligations. Only then did the deliberate use of monetary policy to achieve macroeconomic objectives become possible. Rather than immediately turn to setting interest rates, however, in the years following the Accord the Federal Reserve focused on controlling the net free reserves (excess reserves less borrowed reserves) of the banking system. Although most participants in the process understood that, under certain conditions, variations in the banking system's net free reserves position closely corresponded to movements of short-term interest rates, the FOMC nonetheless framed its decisions in terms of free reserves. (One advantage of doing so was being able to duck political responsibility for interest rate movements, on the ground that it was "the market" that set interest rates; the Federal Reserve merely set free reserves. This rationale has sometimes proved appealing in subsequent years too, most obviously between 1979 and 1982.)

Second, in the early 1960s a number of economists, including most prominently Karl Brunner and Allan Meltzer (1964), had raised telling objections to the free reserves strategy for conducting monetary policy. In retrospect, a part of this line of analysis was not a valid criticism of what the Federal Reserve was doing. One of the critics' key points was that setting free reserves was not a good way to control the money stock; but the Federal Reserve at this time was not seeking to control the money stock anyway. But other objections to the free reserves strategy, especially the empirical finding that banks' demand for excess reserves was interest elastic, were closer to the mark.

By the late 1960s, therefore, the FOMC had largely given up its free reserves strategy for simply setting a short-term interest rate (at first the Treasury bill rate, after a while the federal funds rate). But as inflation developed into a, and then *the*, major economic policy issue, critics now raised a new set of objections against the committee's interest rate strategy: First, there seemed to be a persistent tendency for the committee to confuse the level of interest rates as the instrument of monetary policy with the level of interest rates as an independent objective of monetary policy. As a result, the committee often waited too long before changing its designated interest rate level and, even then, made changes of insufficient magnitude.

Second, once inflation became a problem, Federal Reserve policymakers—like everyone else—found it difficult to distinguish movements of nominal versus real interest rates. As a result, the FOMC sometimes associated higher observed interest rates with a tighter monetary policy stance even when the nominal increase merely kept pace with, or even lagged behind, rising inflation expectations.

Third, ever since Knut Wicksell's (1907) classic contribution early in the twentieth century, economists had fully understood that fixing a

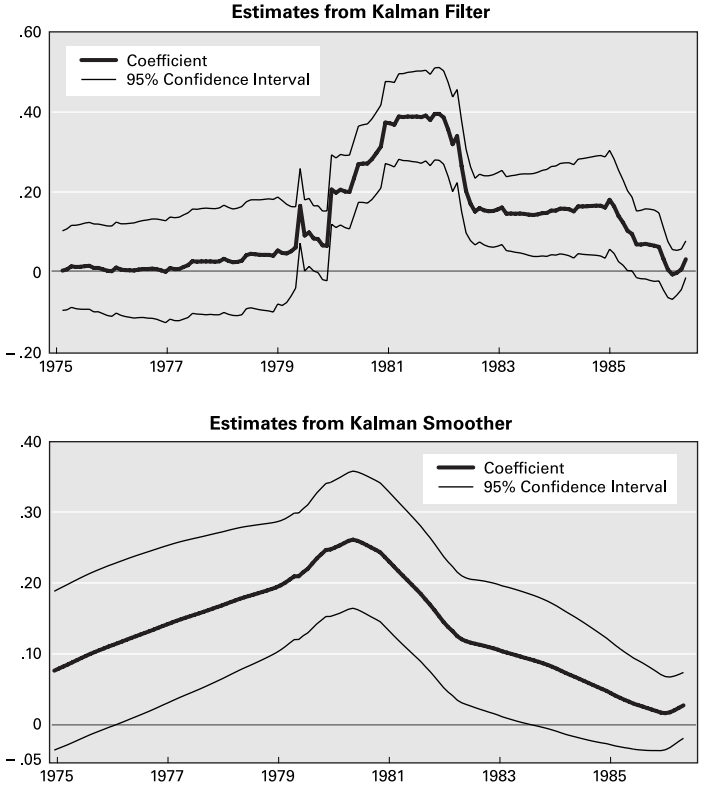
nominal interest rate rendered stability of the aggregate price level problematic over the long run. The events of the 1960s and early 1970s now caused some economists, most prominently Thomas Sargent and Neil Wallace (1975), to raise this instability question about the short run as well. In what became the conventional shorthand of the day, an interest rate strategy for monetary policy left prices with no "nominal anchor."

Following the empirical work of Friedman and Schwartz, and in light of the analytical insights provided by Poole and others, one obvious answer to each of these three problems was to adopt an intermediate target based on some measure of money (or credit) growth. The FOMC experimented with a variety of ways of doing so in the late 1960s and early 1970s, though with little if any detectable impact on the Federal Reserve's actual monetary policy operations. Beginning in 1975, however, the U.S. Congress, under Concurrent Resolution 133, required the Federal Reserve to set explicit targets for money (and credit) growth, to announce these targets in advance, and to report back to Congress on its success or failure in meeting them. In October 1979, as U.S. inflation reached double-digit levels in the wake of the second increase in world oil prices imposed by the OPEC cartel, the Federal Reserve publicly declared that it had intensified its dedication to controlling money. For a while the FOMC even gave up directly setting the short-term interest rate, instead using the quantity of nonborrowed reserves as a (supposedly) superior instrument for hitting a money growth target.

The reversal came quickly. In October 1982 the Federal Reserve publicly announced that it had lessened its dedication to its money growth targets, a fact that had already become obvious to close observers of U.S. monetary policy during the preceding summer. In 1987, Frank Morris's last full year at the FOMC, the committee gave up setting a target for the narrow money stock (M1) but continued to set targets for broader measures of money (M2 and M3). In 1993 the Federal Reserve publicly acknowledged that it had "downgraded" even its broad money growth targets—once again a change that most observers of U.S. monetary policy had long since noticed. From 1993 until just this year, when Resolution 133 finally lapsed, the Federal Reserve continued to report to Congress "ranges" for broad money growth, but it scrupulously avoided either designating these ranges as "targets" or giving any other clue to their relevance, if any, to monetary policy. In July, 2000, for the first time in a quarter century, the Federal Reserve submitted its regular monetary policy report to Congress with no mention of future money growth rates.

Did this sequence of developments over more than three decades correspond to changes in how the Federal Open Market Committee really made U.S. monetary policy? Or was all this mostly a matter of public announcements and formalisms without substantive connection to actual

Figure 1
Coefficient on Money Deviation Term in Monetary Policy Reaction Function with M1



Source: Friedman and Kuttner (1996).

monetary policy? The evidence is clear that, at least in rough outline, what the FOMC did bore a strong relationship to what was said.

Figure 1, reproduced from Friedman and Kuttner (1996), plots for 1975 through 1987 the point estimates and associated 95 percent confidence intervals for the coefficient, in a standard monetary policy reaction function, on the observed percentage deviation of the actual M1 money stock from the midpoint of the corresponding target range designated by the FOMC. Specifically, the estimated reaction function relates each month's federal funds rate to twelve lags of itself, two lags of observed inflation, two lags of the difference between the observed unemployment rate and Robert Gordon's (1993) estimate of the corresponding "natural"

rate, and the percentage "miss" in hitting the M1 growth target. Importantly, the data for both the observed and the target values of M1 at each point refer to the M1 definition in use at the time as well as to the data that the Federal Reserve had in hand at the time. (The common practice of estimating such relationships using data revised long after the fact is clearly misleading.)

The estimates plotted in Figure 1 rely on a time-varying-parameter model that explicitly allows the interest rate response to an "M1 miss" to vary over time. The upper panel displays the time series of recursively updated estimates computed from the Kalman filter, in which any given month's estimate of this response relies on data only through that month, and therefore corresponds to the behavior of monetary policy as observers at each point in time could have assessed it. The lower panel displays the equivalent time series of response estimates computed from the Kalman smoother, which uses data from the entire sample to construct the retrospective minimum-mean-square-error estimate of each month's coefficient.

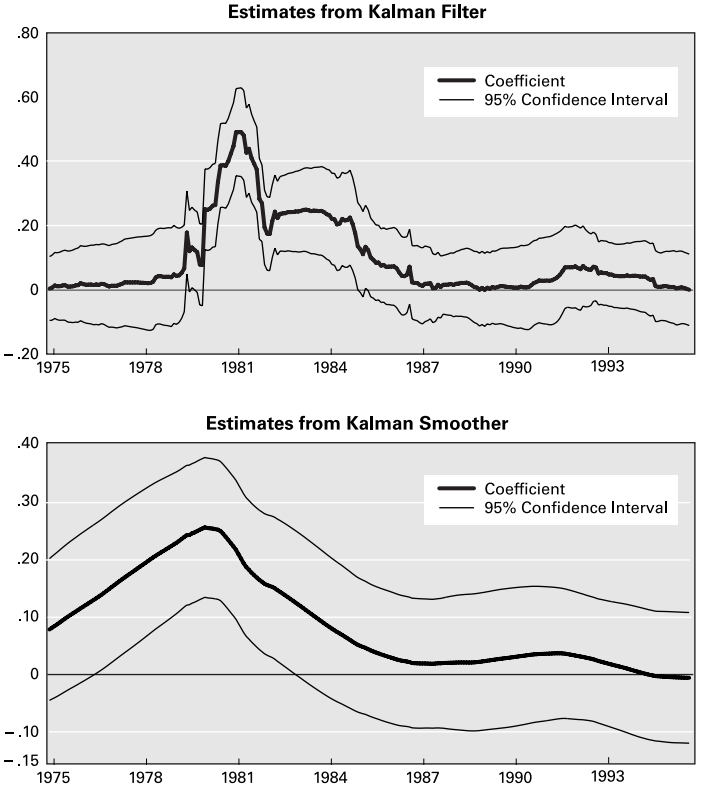
The filtered estimates provide no evidence that the M1 growth target actually mattered for Federal Reserve policy in the first two years or so following the adoption of Resolution 133. The estimated coefficient on the M1 "miss" begins to rise modestly in late 1977, but it does not become consistently significant until early 1980, when it rises much more sharply. It declines sharply in mid 1982, but remains significant. It begins to decline again in early 1985 and continues to do so, ceasing to be significant some time in 1986.

The smoothed estimates tell much the same story. From its peak in late 1980 the coefficient on the M1 "miss" declines steadily, and it has become statistically insignificant by mid 1984. Only for the late 1970s do the two sets of time-varying-parameter estimates present differing views of monetary policy, in that the smoothed estimates indicate a positive influence on the federal funds rate due to the gap between observed money and the target range midpoint. In part, however, this apparent difference merely reflects the imprecision of the estimated coefficient in the early part of the sample.

Figure 2, also reproduced from Friedman and Kuttner (1996), presents the results of a similar analysis for the Federal Reserve's M2 target, but extending through the end of 1995. The results are roughly in line with those reported above for M1. The response to the M2 "miss" is clearly significant from mid 1980 through late 1986. Thereafter the estimated coefficient remains positive, but it is never again statistically significant.

In sum, the evidence is clear that the Federal Reserve did—for a while— target money, in the sense that it directly varied the federal funds rate in response to observed fluctuations of either M1 or M2 that departed from the corresponding stated targets. The failure to do so in

Figure 2
Coefficient on Money Deviation Term in Monetary Policy Reaction Function with M2



Source: Friedman and Kuttner (1996).

the first few years after Congress adopted Resolution 133 can easily be explained away as a delayed, or cautiously gradual, response to the new legislation. More interesting is the effective abandonment of the money growth targets in the mid 1980s, when the pertinent legislation remained in force.

The reason is not hard to discover. At some point in the 1980s—just when is subject to dispute, and the answer differs between M1 and M2 in any case—the relationship between money and either output or inflation in the United States simply disappeared. Observed fluctuations in money no longer conveyed information about future movements of either

macroeconomic variable. The rationale underlying the use of money as an intermediate target variable was gone. As a result, the Federal Reserve once again sets the federal funds rate with an eye directly on output and the implications of output for inflation. In this respect (although, notably, not in others), the wheel has come full circle.

It is useful to emphasize that this set of developments over roughly thirty years—in particular the same adoption and then rejection of money growth targets, and for the same reason (that money lost its predictive content with respect to output and inflation)—is more than just a U.S. phenomenon. To cite just one example, the Swiss National Bank (SNB), long regarded as one of the most "monetarist" among the world's central banks, has traveled roughly the same route. As Georg Rich, the bank's long-time director of research, has described the evolution of the bank's monetary policymaking, beginning in the mid 1970s the SNB's "operational framework rested on growth targets for the money supply. The SNB employed this framework until the end of 1999, when it abandoned monetary targeting" (Rich 2000, p. 439). And the reason? Again in Rich's words, now referring to the SNB among other central banks, "many central banks that had opted for monetary targeting woke up to the unpleasant fact that the demand for money was highly unstable . . . money growth often proved to be an unreliable predictor of inflation" (p. 444).

We have returned to a world in which the central bank sets interest rates, interest rates influence output, and output in part determines inflation. In many respects this is where Frank Morris entered in 1968.

Three Remaining Issues

U.S. monetary policymaking is, of course, not simply back where it was thirty-odd years ago. Both the economy and the financial system are different today. Policymakers have learned more about what the central bank can and cannot do. So have economic researchers, and so has the general public. As a result, many aspects of the prior experience that most observers would identify as mistakes are unlikely to be repeated.

But challenges remain. Looking forward, in the specific context of the role of interest rates in monetary policymaking, three sets of questions seem most apt.

The Nominal Anchor Problem: Is Inflation Targeting the Answer?

One issue that is not new is the need for a nominal anchor for the economy in a regime based ultimately on the central bank's setting a nominal interest rate. As Bennett McCallum (1981) showed nearly two decades ago, the limiting case of Wicksellian instability that Sargent and

Wallace had identified as an indeterminacy of the aggregate price level is a consequence of a "pure interest rate peg" but is not a consequence of a regime in which the central bank sets (and, presumably, varies) a nominal interest rate at least in part as a means of influencing some nominal magnitude. Although McCallum's original demonstration of this distinction relied on an example in which the central bank sets the short-term interest rate in part as a way of targeting the money stock, the more general point carries over in full to the case in which the interest rate is the instrument used to target inflation, among other macroeconomic variables—which is exactly what the Federal Reserve now does. (McCallum showed that merely having at least one nominal target, among others that may be real—for example, output or employment—is sufficient to dispose of the price indeterminacy.)

These theoretical insights notwithstanding, it is fair to say that the return to an interest-rate-based monetary policy regime, with neither money nor any other nominal variable as an intermediate target, has left many observers uneasy. In some countries—the United Kingdom, Sweden, Canada, Australia, among others—the chosen solution has been to adopt a formal "inflation target." Whether doing so is of positive value remains to be seen. As Ben Bernanke and coauthors (1999) have shown, in many cases the countries that have adopted inflation targeting do now enjoy significantly lower inflation rates than they did earlier on. But in most cases the slowing of inflation in these countries had occurred *before* the new regime was adopted. Hence the value of inflation targeting per se remains unproved.

Exactly what "inflation targeting" consists of also remains unclear. In the early stages of debate over this idea, it was sometimes taken to mean that monetary policy would focus exclusively on inflation, with no regard for real outcomes. (Parts of the bill offered in the U.S. Congress in 1996 by the chairman of the Joint Economic Committee read in just this way.) Although some economists and many central bankers probably would favor such a change, the idea of relieving central banks of any responsibility for output and employment attracted widespread criticism, and advocates of inflation targeting quickly backed away from this interpretation. In Mervyn King's (1997) much-quoted phrase, such a regime would amount to a policy of "inflation nutters."

As Lars Svensson's work (1997) has made clear, a different interpretation of inflation targeting—the interpretation that seems to be accepted by most of the central banks that have adopted this regime—is that it is, in formal terms, fully consistent with the standard maximization of a monetary policy objective function including both inflation and output. One way to understand Svensson's point is simply to recall that no matter how many target variables monetary policymakers seek to influence, in the end they have only one instrument with which to do so. Once having decided on the setting of their instrument variable (that is, the level of the

short-term interest rate), it is then straightforward to express the chosen policy in terms of *any* of the target variables, including inflation.

The logical question to ask about all this is what, then, is new or different? The usual answer given by advocates of inflation targeting is that it makes explicit, and therefore transparent to the public, the central focus of monetary policymaking. On close inspection, however, this claim seems dubious.

The one part of the claim for transparency that seems unquestionable is that inflation targeting, as it is now conventionally understood, obligates the central bank to identify, quantitatively, its long-run inflation objective. All inflation-targeting central banks do so. But if that were all there is to it, inflation targeting would amount to no more than King's "inflation nutter" policy. If it is to be more than that, target(s) for one or more aspects of real economic activity must also be involved. And if explicitness and transparency are what inflation targeting is supposed to be all about, those features should presumably apply to the central bank's real target(s) as well.

For example, Svensson has usefully shown that there is a direct relationship between the relative strength of policymakers' preferences with respect to inflation and real output (or employment) and the length of the time interval over which it is optimal for monetary policy to seek to return inflation to the target rate, once some unforeseen development has rendered it different. If the policy weight on output is large vis-à-vis that on inflation, it is best to return to the targeted inflation rate slowly, so as to minimize the associated dislocation of real economic activity. With only a small weight on output, it is optimal to return to the targeted inflation rate more rapidly. In the limit, with no weight at all on output or any other real variable—King's "inflation nutter" case—the central bank would always seek to return inflation to the targeted rate immediately after any disturbance.

Genuine transparency in an inflation targeting regime would therefore include not only an explicit, publicly stated, quantitative inflation target but also an explicit statement of the speed with which the central bank would seek to return to that target after a departure from it. Although a few central banks that have adopted inflation targeting regimes have taken this step (the Bank of Canada, for example), most have not. As a result, either the inflation targeting regime is not really transparent—in which case the "what is new?" question continues to be apt—or inflation targeting is really an "inflation nutter" policy after all. On either interpretation the policy seems unsatisfactory.

An analogy to yet another aspect of central banks' responsibilities may help to explain this tension. The point of having a lender of last resort is that, under some circumstances, the central bank will come to the rescue of a bank that is facing difficulty in meeting its obligations. But the more banks come to rely on this potential safety cushion, the more risks

they will take in conducting their business and the greater is the prospect that the central bank will actually be called upon to come to their aid. Hence most central banks would prefer that bank decision-makers believe that (and therefore act as if) lender-of-last-resort actions were much less forthcoming than is actually the case. In short, the goal is the *opposite* of transparency: to induce the belief that banks are pretty much on their own, and so had better structure their balance sheets soundly, even while maintaining the lender-of-last-resort facility at the ready.

Similarly, many monetary policymakers today seek to benefit from the "credibility" that goes with being perceived as all-out inflation fighters, while at the same time in fact taking real considerations like output and employment into account. The object is not to *be* an "inflation nutter," merely to be seen as one. Once again, the tension with the often-avowed goal of transparency is clear.

In the United States, which has not adopted inflation targeting, the "inflation nutter" policy would be precluded by law. The prevailing legislation charges the Federal Reserve to conduct monetary policy "so as to promote effectively the goals of maximum employment, stable prices, and moderate long-term interest rates." Abjuring any responsibility for real outcomes would not be legal even if it were somehow thought desirable. By contrast, there is nothing in the law to prevent the Federal Reserve from defining "price stability" as a specific rate of change (perhaps zero) of a particular price index, and quantifying the relative weight on "maximum employment" in terms of a Svensson-type speed of return in the event of a departure.

Would the additional explicitness and transparency be valuable? In particular, would they contribute to addressing the "nominal anchor" problem inherent in interest rate-based monetary policymaking? No one really knows. But at least on the basis of the experience of the past decade and a half, it is hard to know what visible shortcoming in U.S. monetary policy such a change might be expected to correct. To the extent that setting interest rates leaves monetary policy without a nominal anchor, that lacuna has had little apparent consequence recently.

Long-Term Interest Rates and Equity Prices as Information Variables?

The widely discussed recent experiences of two countries, the United States and Japan, have raised once again a question of long standing: Is there a role in the monetary policy process for interest rates other than the short-term rate that the central bank uses as its policy instrument? And, in parallel, is there a role for equity prices?

The aspect of the U.S. experience that has called renewed attention to this issue is the dramatic rise in equity prices in the latter half of the 1990s. Innumerable analyses have examined the effect of higher stock market wealth in spurring consumer spending, the use of stock market assets as

credit collateral, the impact of a lower cost of equity capital on corporate capital spending, and so on. More recently, some of the same questions have also begun to appear in the context of residential real estate prices. In short, the issue is whether the Federal Reserve should tighten monetary policy in light of these developments in U.S. asset markets.

The Japanese experience is more dramatic and also two-sided. In the 1980s both equity prices and real estate prices (including prices for commercial property) surged in Japan, in what has subsequently become known as the "bubble economy." In the early 1990s both equity prices and real estate prices fell sharply, triggering bankruptcies and rendering most if not all major Japanese banks insolvent. As a result, the Japanese economy has stagnated for much of the last decade. Many analyses of Japanese monetary policy have concluded in retrospect that policy should have been tighter than it actually was during the "bubble" period, and easier than it was once the bubble collapsed.

Following the discussion in the first section of this paper, it is clear that asset prices and long-term interest rates can potentially play a useful role in the monetary policy process if they contain incremental information about output or inflation, or any other macroeconomic targets that policymakers seek to influence. The obvious question is, do they?

Tables 1 to 4 report the results of estimating a series of equations designed to address just this question for the United States. Table 1 shows the F-statistics summarizing a pair of baseline equations, one for real output growth and one for inflation, that do *not* include any asset price or long-term interest rate variables. Each equation includes four lags on both the output variable (real GDP growth) and the price variable (growth of the chain-weighted GDP price index), four lags on the federal funds rate (taken as the Federal Reserve's policy instrument), and four lags on the growth of the M2 money stock. Data are quarterly. The sample is 1970:I to 2000:II. Data for all variables other than the federal funds rate are seasonally adjusted.

The results for the baseline equations reported in Table 1 are roughly consistent with familiar findings throughout the empirical literature of U.S. macroeconomic relationships. Inflation in particular is very highly serially correlated on a quarterly basis. The federal funds rate contains highly significant further information about the subsequent movement of both output growth and inflation. The M2 money growth rate contains information that is marginally significant in predicting output, but not inflation.

Table 2 reports the F-statistics associated with adding to these two baseline equations, one at a time, each of a series of further interest rate and asset price variables: the long-term (10-year) Treasury bond yield, the difference between the 10-year bond rate and the 1-year bond rate, the difference between the Baa corporate bond rate and the Aaa rate, the difference between the 3-month commercial paper rate and the

Table 1
Significance of Variables in Baseline Equations
Quarterly Data, 1970:I to 2000:II

	Equation for:	
F-Statistic for:	Output Growth	Inflation
Output Growth	.14	2.53**
Inflation	1.16	46.98***
Federal Funds Rate	5.14***	4.47***
Money Growth (M2)	2.17*	1.01

*** significant at 1% level
** significant at 5% level
* significant at 10% level

3-month Treasury bill rate, and the rate of growth of stock prices (measured by the Standard & Poor's 500 index). Hence for each of these variables the question being asked is whether that variable has *incremental* information content, beyond that already contained in the variables included in the baseline equations. In each case what is added to the equation is a four-quarter lag, just as for the variables included in the baseline equations.

In line with prior research, both the credit quality spread and the paper–bill spread contain significant incremental information about subsequent movements in real output. None of the other three variables do, and none of the five variables contain incremental information about inflation.

Tables 3 and 4 report analogous results based on monthly data. Here the real output variable is industrial production, the price variable is the consumer price index (CPI-U), and the sample is 1970:1 to 2000:7. Interestingly, the federal funds rate has significant predictive content

Table 2
Significance of Potential Information Variables
Quarterly Data, 1970:I to 2000:II

	Equation for:	
F-Statistic for:	Output Growth	Inflation
Long-Term Bond Rate	1.90	1.54
Term Structure Spread	1.36	1.29
Credit Quality Spread	2.75**	1.95
Paper–Bill Spread	2.73**	1.63
Stock Price Increase	.91	1.09

*** significant at 1% level
** significant at 5% level
* significant at 10% level

Table 3
Significance of Variables in Baseline Equations
Monthly Data, 1970:1 to 2000:7

	Equation for:	
F-Statistic for	Output Growth	Inflation
Output Growth	1.85**	1.28
Inflation	1.36	14.08***
Federal Funds Rate	1.37	2.65***
Money Growth (M2)	1.55	1.33

*** significant at 1% level
** significant at 5% level
* significant at 10% level

with respect to inflation but not output growth. Money growth helps to predict neither output growth nor inflation. Among the other financial variables, *all except stock prices* contain at least some incremental information about subsequent movements of both output growth and inflation.

Empirical evidence aside, does the Federal Reserve take equity prices or long-term interest rates into explicit account in making monetary policy? Some observers clearly think so. Just last spring, for example, Albert Wojnilower described the outlook for forthcoming FOMC decisions as follows: "Their likely decision, therefore, will be to raise the federal funds rate one-quarter percent every time the open-market committee meets. When and if both the NASDAQ and Dow averages are soaring, the increase might be one-half percent. If the NASDAQ were falling significantly, maybe there would be no increase at all. A drop in the Dow alone would have to be quite severe to stay the Fed's hand. The authorities will justify their actions on the basis of macroeconomic data,

Table 4
Significance of Potential Information Variables
Monthly Data, 1970:1 to 2000:7

	Equation for:	
F-Statistic for:	Output Growth	Inflation
Long-Term Bond Rate	2.85***	2.57***
Term Structure Spread	1.97**	2.24**
Credit Quality Spread	5.64***	3.82***
Paper–Bill Spread	3.49***	1.59*
Stock Price Increase	1.62	.67

*** significant at 1% level
** significant at 5% level
* significant at 10% level

but in reality the stock market climate is in charge of both the economy and monetary policy" (Wojnilower 2000, p. 1).

Alan Greenspan has offered a somewhat different view: "that there is a form of asymmetry in response to asset rises and asset declines but not if the rate of change is similar. In other words, central banks do not respond to gradually declining asset prices. We do not respond to gradually rising asset prices. We do respond to sharply reduced asset prices, which will create a seizing up of liquidity in the system. But you almost never have the type of 180-degree version of the seizing up on the up side. If, indeed, such an event occurred, I think we would respond to it. The actuality is that it almost never occurs, so it appears as though we are asymmetric when, indeed, we are not. The markets are asymmetric; we are not" (Greenspan 1999, p. 143).

In light of empirical evidence like that reported in Tables 2 and 4, in what way either the one-for-one linear approach inferred by Wojnilower or the nonlinear (and, because of market behavior, asymmetric) approach articulated by Chairman Greenspan corresponds to the optimal exploitation of any information that might be contained in fluctuations of stock prices is, to say the least, a matter for further research.

Does the Electronic Revolution Threaten Interest-Rate-Based Monetary Policy?

Electronic advances in banking practices, including some already in hand and others not yet visible but plausibly just over the horizon, present opportunities as well as complications for central banks. The question has recently arisen whether these technological advances might threaten the efficacy of monetary policy's influence over inflation and economic activity. That potential threat is worth considering, particularly in the context of a monetary policy based on setting a short-term interest rate.

More specifically, the threat to monetary policy from the electronic revolution in banking is the possibility of a "decoupling" of the operations of the central bank from the markets in which financial claims are created and transacted in ways that, *at some operative margin*, affect the decisions of households and firms on such matters as how much to spend (and on what), how much (and what) to produce, and what to pay or charge for ordinary goods and services. As the discussion in the first section emphasizes, all standard theories of how monetary policy works have some explicit coupling mechanism that connects the purely financial operations of the central bank to the nonfinancial decisions made by households and firms: Banks are legally required to hold reserves at the central bank in order to issue the claims that the public uses for everyday transactions. Or, banks are required to hold reserves at the central bank

in order to create money, which does not matter in and of itself, but only by issuing money can banks create the credit that the public needs. Or, banks have to hold settlement balances at the central bank in order to carry out their business, and the settlement balances they need are naturally related to the size of their operations. Each of those stories has in it a mechanism that links the operations of the central bank not just to financial quantities, interest rates, and other asset prices but, via well-understood accounts of household and firm behavior, to the evolution of output and prices in the nonfinancial economy.

There is both a price (interest rate) and a quantity interpretation of what "decoupling" would mean in this context. The price interpretation, which is what is relevant to this discussion, is that the interest rate that the central bank can set on the exchange of its own liabilities for other claims becomes, at the margin of increase or decrease, less tightly (in the limit, not at all) connected to the interest rates and other asset prices that matter for ordinary economic transactions.

Some specific examples may help to illustrate the central idea. One is the loan-shark industry, in which some lenders charge, and some borrowers pay, extremely high interest rates compared to prevailing rates in more conventionally constituted credit markets. The interest rate in this market is simply not connected, at the relevant margin of increase or decrease, to most interest rates that prevail in the rest of the financial world. In technical terms, it is an outcome determined by the actions of decision-makers who are at a corner solution.

A second example: Within the past year an unusually wide spread has opened up between the interest rate on long-term U.S. Treasury securities and interest rates on similar instruments like high-grade corporate bonds and securities collateralized by insured mortgages. The apparent reason is the projected scarcity of long-term Treasury bonds. If the U.S. government continues on its currently projected path, in which all outstanding Treasury obligations are to be retired within another decade or so, this scarcity value will become progressively greater. When only, say, $100,000 of long-term Treasury bonds are left outstanding, it will be very easy for the Federal Reserve—or anybody else, for that matter—to drive the interest rate on these bonds arbitrarily close to zero (or even below zero, should anyone choose). But by that time, this interest rate will have become completely disconnected from the interest rates that matter for the public's ordinary economic transactions.

Students of monetary policy have long understood that the coupling, *at the margin*, of operations by the central bank and the decisions of households and firms is crucial to monetary policy's influence over output and inflation. The issue today is whether new technological developments, over the foreseeable future, may plausibly threaten a *de*coupling at the relevant margin. Such a decoupling could come about in either of two basic ways.

First, various forms of e-balances—smart cards, stored value cards, and the like—may increasingly compete with bank checking accounts and, further, develop to the point at which balances on the books of the nonbank entities that issue such cards are accepted in payment by third parties. What matters for the efficacy of monetary policy is that the claims people exchange in order to execute transactions continue to be claims on the books of banks (or, equivalently, claims backed one-for-one by bank deposits). The possibility that this may cease to be true is a key part of the threat that the e-revolution presents for monetary policy.

Once again, it is important to emphasize that the argument is one that pertains *at the margin*. The question is not whether bank deposits will disappear altogether (they will not), or whether no one will any longer use currency (some people will), but whether plausible alternatives not backed by bank deposits—credits on the books of the telephone company, for example—will weaken the connection between the expansion or contraction of reservable bank deposits, and hence the increase or decline of whatever interest rate the central bank sets, and the expansion or contraction of economic activity.

In theory, of course, one could always get around this problem by simply defining as a "bank," for purposes of meeting reserve requirements, any entity in the business of providing such claims: the telephone company, the New York City subway system, Microsoft, in principle any firm whose product would be in sufficiently broad demand to render its liabilities generally valued. In Friedman (1999) I considered the possibility of a race between authorities seeking to contain this activity within the fence of such regulation and innovators seeking to escape it. I am skeptical of the regulators' prospects for success. History suggests that the innovators are likely to be fleeter of foot. (A potential solution that I suspect has a greater likelihood of success is for the Treasury to require all tax payments to be made by checks against reservable bank deposits.)

The second way in which a decoupling of the central bank's operations from the markets that matter for monetary policy could come about is the possibility that *banks*' demand for central bank liabilities, for use as settlement balances, may atrophy. The main question here is whether the central bank will continue to have enough of a natural advantage in the provision of net interbank settlement services so that banks will always need central bank liabilities for this purpose—and, if not, whether regulation can solve the problem. It is important to emphasize once again that nobody denies that the central bank can determine the quantity of claims outstanding on its own balance sheet, or the interest rate at which those claims exchange for something else. Here too the issue is one of decoupling *at the margin*: whether the increase or decrease of the exchange rate on central bank liabilities against some other asset would continue to be connected to the broader constellation of

interest rates and asset values that matter for nonfinancial economic activity.

What if either or both of these two technological possibilities were to become reality? One view, these days often expressed, is that the central bank need not *do* anything: that a mere expression of intentions (what Charles Goodhart (2000) has called "open mouth policy") is sufficient. A point I have now sought to make in several papers is that stated intentions matter only if there is something credible to back them up—and, moreover, that whether the central bank can or cannot back up its intentions is a matter of institutional arrangements, subject to change.

The image that I used in Friedman (1999) to illustrate this point, taken from a 1965 film directed by Henry Levin, is that of the twelfth-century Chinese emperor Wang Wei-shao composing a poem in elegant Chinese calligraphy and explaining that the poem, if read carefully enough to catch the subtle nuance, hints at his displeasure with the Mongol barbarians who are currently creating a disturbance on the Ch'in empire's western frontier—and, further, that this veiled expression of disapproval on his part will be sufficient to cause the barbarians to desist and go away. The point of the story, which becomes clear later in the film, is that Wang Wei-shao was the emperor defeated by Genghis Khan. There may once have been a time when a subtle poem in an emperor's elegant calligraphy was sufficient to make attackers break off, but by Wang Wei-shao's day that time had obviously passed.

The generic point applies to central banks as well. Alan Greenspan will not be the Wang Wei-shao of the twenty-first century. But circumstances change, especially when political institutions and advancing technology are central to the issue. Expressions of intent on the central bank's part may be sufficient if the capacity exists to back them up. And if everybody has grown up in a world in which that capacity existed, people may continue for some time to behave in the same way even after it has atrophied or disappeared. But eventually objective reality catches up.

Concluding Remarks: Rules versus Discretion

One final aspect of interest-rate-based monetary policymaking remains to be addressed in conclusion: Interest rates do not conveniently serve as the fulcrum for straightforward, easily articulated rules governing the conduct of monetary policy. For Wicksellian reasons, it is implausible to think in terms of a fixed interest rate. And once a central bank bases its policy on setting but varying an interest rate, the considerations it will want to take into account in doing so will normally be far too complex to embody in any simple rule. For just this reason, advocates of monetary policy rules have traditionally thought in terms of variables other than interest rates.

How important a consideration is this? Twenty or so years ago, when

persistently high and rising inflation was the major economic problem in much of the industrialized world, the theory of time inconsistency suggested that this chronic inflation was a natural consequence of discretionary monetary policymaking. The inferred gain from adopting some kind of policy rule was large. One often unstated implication of this line of argument was that central banks should frame their monetary policymaking in terms of variables other than interest rates.

Today the explanation of inflation as a consequence of time inconsistency—and in particular the implied preference for monetary policy rules—is far less persuasive. Not only have most industrialized countries succeeded in slowing their inflation, but in most cases they managed to do so without changing (in some cases, *before* changing) their monetary policymaking arrangements. The United States certainly stands as a case in point.

This experience has not necessarily invalidated the underlying time inconsistency theory. As researchers investigating the consequences of time inconsistency pointed out, solutions other than policy rules—for example, influences stemming from the reputation of the central bank and from policymakers' awareness of those influences—can also suffice to mitigate any resulting inflation problem. What this experience has shown, however, is that a monetary policy governed by rules is not a necessary part of a successful noninflationary strategy. The implied presumption against making policy by setting interest rates therefore does not follow.

Even apart from the specifics of the debate over time inconsistency and the origins of the postwar inflation, the case for rules governing monetary policy has always been problematic at best. The difficulty—as many economists as well as central bankers have long recognized—is the tension between rules that are simple enough to be externally monitorable, and hence to achieve the goals that advocates of monetary policy rules are seeking in the first place, and rules that are sufficiently complex (if this is even possible) to encompass the many and diverse influences that a real-world central bank presumably will, indeed should, take into account. This difficulty is not new, nor is it specific to monetary policy. As Aristotle wrote in *The Politics*, "it is impossible that all things should be precisely set down in writing; for enactments must be universal, but actions are concerned with particulars" (p. 39).

Most central banks, including the Federal Reserve, implement their monetary policy by setting interest rates. At least in today's world, there is little reason to do otherwise.

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