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ly than simulations using fixed-coefficient models have suggested. This finding suggests that a nominal GDP target can serve as a long-run nominal anchor so that prices might be predictable in the long run, but short-run variability will persist.

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Rules and Discretion in Monetary Policy

SHOULD MONETARY POLICY be determined by a legislated rule or by a monetary authority's discretion? Henry Simons (1936) first raised this issue as a choice between *rules* and *authorities*, terms little different than those used in recent discussions. He stresses the value of a rule, such as a law, instead of reliance on an authority's discretion because "definite, stable, legislative rules of the game as to money are of paramount importance to the survival of a system based on freedom of enterprise."[1] Though Simons mentions that laws can change and therefore a rule does not eliminate uncertainty about monetary legislation, his principal focus is the undesirability of delegating power to a monetary authority with a mandate to pursue only very broad goals. Others, for example Modigliani (1977), have argued that monetary policy conducted by just such an expert monetary authority will enhance the economy's performance.

Proposed rules would restrict the Federal Reserve's discretion in various ways. Simons argued that the Federal Reserve be required to keep the price level constant rather than be left to pursue other possible goals. Some proposed rules embody far more radical change in the U.S. monetary system. One rule espoused by some is a constant growth rate of the money stock.[2] With reserve requirements fixed and the discount rate tied to open-market interest rates by law, the only judgment necessary at the Federal Reserve would be the open-market purchases of government securities necessary to generate the mandated growth of the money stock. Another proposed rule would fix the level of the monetary base.[3] With this rule, it would be possible to eliminate any discretion at the Federal Reserve completely. What are the implications of such radical changes?

The purpose of this article is to provide a guide to the current state of the debate on rules discretion. The focus of this article is the basic issue: What are the implications of a rule that commits future monetary policy, thereby limiting the monetary authority's ability to respond to changes in the economy?[4]

RULES VS. DISCRETION

Discussions of rules and discretion sometimes use seemingly similar, but not identical, definitions of the terms. Any discussion of rules and

[1]See Simons (1936), p. 339.

[2]See Friedman (1959) and Lucas (1980).

[3]See Wallace (1977).

[4]The debate about rules vs. discretion in monetary policy has a long and interesting history, summarized by Argy (1988) and Carlson (1988). There is also substantial literature on the implementation of monetary policy and the implications for rules, much of it in this *Review.* Goodhart (1989) presents a detailed analysis of the implementation of monetary policy. The long-standing contrast between the monetarist case for rules and the alternative case for stabilization policy is summarized in Mayer (1978).

discretion requires care in using these terms, as well as other seemingly obvious terms such as *policy*.

Policy and Its Instruments

What does the term *policy* mean? In this article, *policy* means a plan of action or a strategy. A policy may either be the outcome of some process or it may be a plan designed specifically to further some goal. In either case, dynamic aspects of the economy are sufficiently important that no sensible strategy can treat events each day, month or year as independent. For example, suppose that the goal is to have zero inflation. The current inflation rate is affected by expectations of future inflation, which in turn depend on expectations of current and future policy actions. As this simple example illustrates, any policy must consider current and future implications of both current and future actions.

A policy requires *instruments* to implement it. Policy *instruments* are the tools manipulated to produce the desired outcomes. The primary instrument of monetary policy in the United States today is open-market purchases and sales of government securities. Additional instruments include changes in required reserve ratios and changes in the discount rate.

Any particular value of the instruments on any particular date can be consistent with many different policies. Only in the context of expected future actions can the values of instruments be considered part of a coherent policy. It is common to refer to current monetary policy as the values of indicators of the monetary authority's actions this week, perhaps the federal funds rate or the growth of the monetary base. This usage is inconsistent with the definition of *policy* as a plan though, because the current and future implications of today's values of instruments or related indicators are clear only in the context of some expected future actions.

Rules and Discretion

What is a discretionary monetary policy? Under *discretion*, a monetary authority is free to act in accordance with its own judgment. For example, if legislation directed the Federal Reserve to do its best to improve the economy's performance and gave the monetary authority the instruments that it has, the Federal Reserve would have a discretionary monetary policy.

In the context of monetary policy, a *rule* is a restriction on the monetary authority's discretion. A rule involves the exercise of control over the monetary authority in a way that restricts the monetary authority's actions. Rules can directly limit the actions taken by a monetary authority. For example, one simple possible rule would be that the monetary authority hold the monetary base constant. This clearly restricts the use of judgment. A rule need not be as simple as that though. Rules can attempt to limit the objectives pursued by the monetary authority. For example, one possible rule would be that the monetary authority announce a target for monetary base growth over some period to further some well-defined goal and then to hit the target unless predetermined exceptional circumstances arise.

Though a rule imposed by legislation or even constitutionally would be subject to revision, infrequent changes in the rule relative to firms' and households' expectations and decisions make policy more predictable. This would be true even if the application of the rule in a particular instance were sometimes unclear because of ambiguity about the state of the world. The problem facing the monetary authority would be to determine the particular state of the world — for example, whether the economy is in a recession. The rule then would determine the particular choices of the values of the instruments.

Most proposed rules restrict the monetary authority's discretion but do not eliminate it. Simons (1936) proposed a rule that the monetary authority keep the price level constant. Though this rule would restrict the monetary authority's discretion, the authority could still exercise substantial discretion in pursuing this goal. Even with the choice of the particular price index determined and even if the monetary authority had only one possible instrument, perhaps the monetary base, the authority would still have to estimate the growth rate of the monetary base consistent with a constant price level.[5] This estimate requires a forecast of the demand for the

[5]This restriction to the monetary base as the single instrument could be accomplished by eliminating the discount rate and changes in reserve requirements as instruments and making some technical changes in the relationship between the Federal Reserve and the Treasury.

monetary base at zero inflation, which almost inevitably requires judgment. Similarly, a rule that the monetary authority keep the growth rate of the money stock constant at, say, 4 percent per year can allow substantial judgment about the way to hit the target. Even a rule requiring the monetary authority to keep the growth rate of the monetary base constant at 4 percent could allow some choice of instruments or of timing. Nonetheless, it is possible to have rules that allow no discretion under any circumstances. If the monetary authority has only one instrument, a rule that the monetary base grow at 4 percent per year can eliminate discretion.

The Issues

There are two leading arguments concerning the desirability of rules or discretion. The first is the desirability of having elected representatives make choices. Simons' (1936) choice was for monetary policy largely determined by elected representatives rather than by a monetary authority. Part of this conclusion is based on a particular set of values: a preference for monetary policy made by elected representatives rather than by experts subject to looser control by the electorate or their representatives.[6] On the other hand, others have argued that expert economic judgment can contribute to better policy.[7]

The other leading argument concerns the economy's performance under rules and under discretion — that is, the economic implications of committing policy. This argument has two components. The first component is whether, even if policy actions usually would be the same with or without a rule, there are benefits or costs of committing policy. The second component is whether, given the current state of economic knowledge, policy actions that depend on the current state of the economy are likely to improve the economy's performance. These two components of the economic implications of committing policy are closely related. If judgments based on the state of the economy are unlikely to improve the economy's performance, there is little cost of committing policy.

COMMITTING POLICY

A common observation 15 or so years ago was that discretion could be used to produce the same values of the policy instruments as would be feasible with any restriction; hence a rule could not improve on discretion. For example, if a constant growth rate of the money stock were desirable, as Friedman advocated, a monetary authority exercising discretion could produce this outcome.[8] Furthermore, as Turnovsky (1977, p. 351) noted, "with one exception ... [a constant value of the instrument] is never optimal; that is a judiciously chosen discretionary policy will always be superior." According to this view, because a discretionary policy can produce the same values of the instruments as a rule, a discretionary policy can be no worse than a rule and in fact can even be better.

Time Consistency of Policy

In their analyses of the "time consistency of policy," Kydland and Prescott (1977) and Calvo (1978) show that this general argument against rules is wrong. Consistent with Turnovsky's analysis, suppose that the monetary authority sets the instrument each period based on what seems like the best thing to do starting today.[9] Kydland and Prescott (1977), Calvo (1978), and Barro and Gordon (1983b) show that such a policy can result in worse outcomes than will result from a rule determining current and future monetary policy. That is, when the economy adjusts to this method of determining monetary policy given the monetary authority's incentives, the economy's actual performance can be worse with discretion than with a rule.

There can be a positive return to committing policy because committing future policy can have substantial effects on the economy today. Any economic policy implemented today takes past expectations as given, which may seem harmless and possibly even desirable. Suppose, as seems safe, that people's actions today depend on their expectations of the future. In any model of the economy, doing the best that can be done starting today yields a path of the instruments for this period and the future. This path starting from today takes past expecta-

[6]Simons (1936, p. 340) wanted to prevent "discretionary (dictatorial, arbitrary) action by an independent monetary authority." Among others, Lucas (1980) indicates a preference for the electorate's greater involvement in monetary policy.

[7]See Modigliani (1977).

[8]See Friedman (1959).

[9]Pindyck (1973) is one example of such sequential optimization with an estimated model.

the predictable component of y that is not associated with past values of y or the policy instrument. Even though the money stock is not a policy instrument in the United States today, for simplicity suppose that y is the growth rate of nominal GDP and m is the growth rate of the money stock.

The economy, of course, is more complicated than equation (1), but most of the arguments for and against feedback policies can be explained in the context of this equation. Equation (1) includes only a single variable, but this is not a real limitation: y can be interpreted as a set of variables. Equation (1) is assumed to be linear and to have constant coefficients, which are possibly severe limitations largely shared by current econometric models. A major limitation of equation (1) is that expectations are not explicitly included. One reason for the importance of expectations, discussed previously, is their importance for the incentives affecting policy. Another reason for the importance of expectations, discussed later, is that the coefficients in an equation such as (1) reflect households' and firms' expectations about policy. This dependence of the coefficients on expectations affects the actual usefulness of an equation such as (1) for policy. For illustrative purposes though, equation (1) suffices.

The Case for Feedback Policies

On the simplest level, the case for feedback policies is transparent. Suppose that the coefficients in equation (1), α, β and γ, are constant and policymakers know the values of these coefficients. One policy without feedback would be a constant growth rate of the money stock. This and other policies without feedback permit the effects of a shock, ε_t, to persist over time. On the other hand, a feedback policy can eliminate these persistent effects. If the monetary authority cannot predict the shocks to nominal GDP growth, it is not possible for the authority to offset the initial effect of a shock. Nonetheless, a feedback policy can offset all continuing effects of the shocks. Such a feedback policy for equation (1) is

$$(2)\quad m_t = \frac{y^* - \alpha - \beta y_{t-1}}{\gamma},$$

where y^* is the target growth rate of nominal income. Equation (2) is an explicit example of a feedback policy: the lower last period's growth rate of nominal GDP is, the higher is this period's growth rate of the money stock. There is feedback from nominal GDP growth last period to money growth this period.

Actually choosing an appropriate policy is hardly so simple though, because among other things any particular equation such as (2) assumes that much more is known about the economy than is realistic. Few, if any, would argue that knowledge about the economy is so advanced that monetary authorities know the equations that characterize the economy's behavior over time, let alone the values of the coefficients in those equations. Suppose that the economy is characterized by equation (1) and that monetary policy is selected from feedback equations of the general form of equation (2). With uncertainty about the particular equations that characterize the economy, a monetary authority might adopt such a feedback policy as follows:

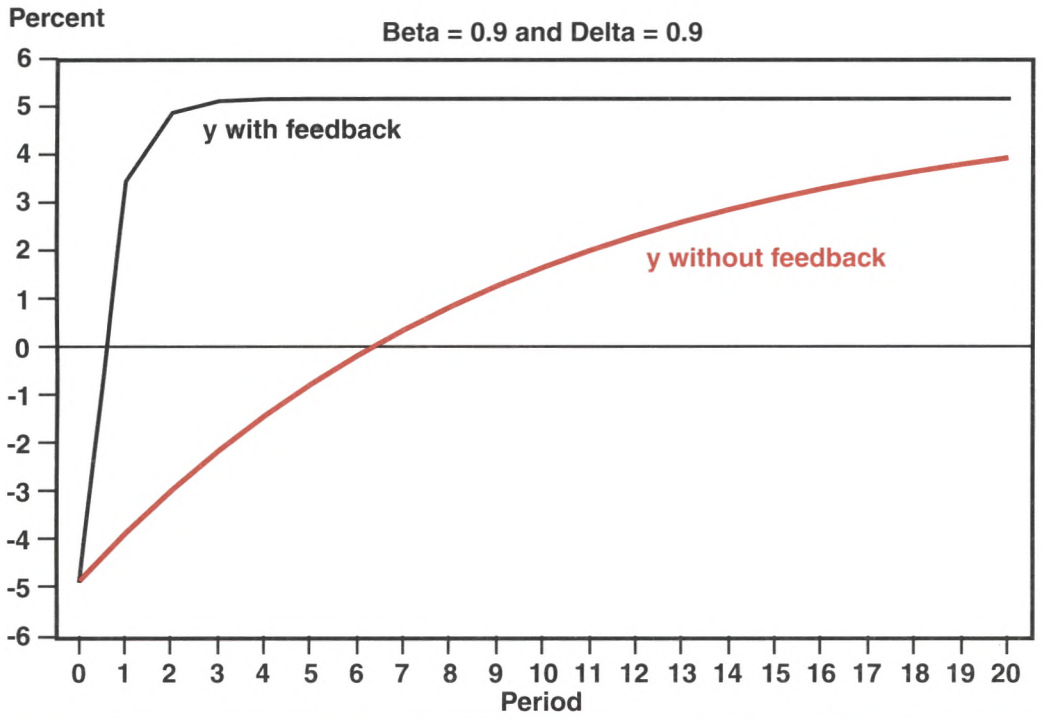
$$(3)\quad m_t = m^* + \delta(y^* - y_{t-1}).$$

In this equation, m^* is the constant growth of the money stock that leads to nominal GDP growth equal to the target growth rate in the long run and δ is a parameter characterizing the response of money growth to deviations of income growth from the target. If the economy is governed by an equation something like (1), a positive response to the observed deviation from the target might seem likely to move the economy toward the target more quickly than it would get there otherwise.

An improvement in the economy's performance with this simple feedback policy is possible. Suppose that feedback equation (3) is consistent with a target annual growth rate of nominal GDP of 5 percent. Further suppose that income growth initially is 5 percent and falls to −5 percent in period 0 because of a shock, that is, $\varepsilon_t = -10$ in period $t = 0$. With substantial persistence in the economy (β is 0.9) and constant money growth (no feedback), the red line in figure 1 shows that the economy only gradually returns to growth of 5 percent after a shock. A feedback policy using equation (3) can speed up the convergence. For example, with δ equal to 0.9, the rapid convergence shown by the black line occurs.

The usefulness of such feedback is the basis of another argument against a rule. Mullineaux (1985) and Lindsey (1986) suggest that actual desirable policies are quite complex and that

Figure 1
Substantial Persistence in the Economy and Substantial Feedback



any desirable rule would be quite complex. If this is true, any desirable rule might be so complex that writing it down would be much more costly than any possible benefits of having it. The only feasible rules may be simple ones that restrict policymakers' responses to the economy's state, and these restrictions could worsen the economy's performance.

The Case Against Feedback Policies

One interpretation of arguments against rules based on the complexity of monetary policy such as Mullineaux's and Lindsey's is that the economy is too complex to specify a useful model of the economy or a policy for the future. If the discussion is about unspecifiable models, however, economic analysis has little, or more likely, nothing to contribute—all is guesswork. In this case, it is not obvious that judgment uninformed by economic analysis has more value than a rule; after all, the benefits of discretion are as speculative as the effects of any rule.

The complexity of a desirable monetary rule depends on what is expected of monetary policy. One objective of monetary policy might be to prevent runs on the banking system.[13] Runs on the banking system occurred at most once every decade or two before the creation of the Federal Reserve.[14] This suggests a low frequency of exceptional circumstances. Other possible purposes of monetary policy, such as stabilizing interest rates on a daily basis, may provide more exceptional circumstances and may be more consistent with an argument that the circumstances are so varied that a useful rule is too complex to be worth trying to formulate it.

Whatever the frequency of exceptional circumstances, feedback policies are not necessarily better than policies without feedback.[15] Knowing whether a particular feedback policy improves or worsens the actual behavior of the

[13]Indeed, this might be a major purpose of monetary policy, a view suggested by Friedman (1959). Friedman's more recent views are presented in Friedman and Schwartz (1986).

[14]See Dwyer and Gilbert (1989).

[15]Phillips (1957) was the first to show this explicitly. In a general context, Friedman (1953) shows the same proposition.

economy depends on detailed knowledge about the response of the economy to different policies. Suppose that the economy has little persistence, for example β is 0.1. Then with no feedback, the red line in figure 2 shows that the economy returns relatively quickly to 5 percent growth of nominal GDP growth after the same shock as in figure 1. If the monetary authority uses the same feedback policy as in the example in figure 1, the oscillations shown by the black line in figure 2 result. If the economy has little persistence, this feedback policy makes the economy more variable after a shock than it would be with a policy without feedback. Doing something (a feedback policy) can be worse than doing nothing (a policy with no feedback).

The importance of the possibility of worsening the economy's behavior is magnified by the prospect that a monetary authority with a feedback policy may never learn the structure of the economy. If the economy's behavior could be summarized by an equation such as (1) and the monetary authority attempted to stabilize the economy, the effects of the policy on nominal GDP and expectations might make it impossible for the monetary authority ever to converge to correct estimates of the economy's responses to different monetary policies.[16] Some economists believe that firms' and households' ability to converge to a reasonable working knowledge about the economy is far from ensured. It is not obvious that a monetary authority can converge to knowledge about the economy when its learning has substantial effects on the economy's behavior.[17]

Evidence on the Value of Feedback Policy

What is the evidence concerning feedback policies relative to policies without feedback? In the context of simple equations such as (1), some evidence about feedback policies has been advanced recently.[18] McCallum (1987) provides some evidence that, since World War II, a simple feedback rule for targeting nominal GDP growth would have been better than either actual policy or a constant growth rate of the monetary base. This evidence is based on taking an equation such as (1) and simulating it under the alternative policies. Taylor (1985) has examined the implications of targeting nominal GDP for the behavior of real GDP. Perhaps his major result is that targeting nominal GDP may have undesirable implications for fluctuations of real GDP. Both of these analyses are based on very simple characterizations of the economy. Whether they constitute more than preliminary evidence is open to serious doubt.

Among other criticisms, these and other analyses of alternative policies must deal with what sometimes is called the Lucas critique. Lucas' (1975) general point was that any evaluation of alternative policies must carefully consider the implications of changes in policy for expectations. Changes in policy generally change expectations, and unless the changes in expectations are handled very carefully, commonly estimated economic models can be worse than useless in predicting the effects of changes in policy. This point can be illustrated in the context of equation (1). With y interpreted as nominal GDP growth and m interpreted as money stock growth, the St. Louis equation and the St. Louis model are examples of models such as equation (1) that could be the basis of a stabilization policy such as equations (2) or (3).[19] Some analyses of the St. Louis equation correctly argued that it is not structural in the sense that the equation is likely to change if the monetary authority's behavior changes. The estimated equation at least partly reflects the monetary authority's be-

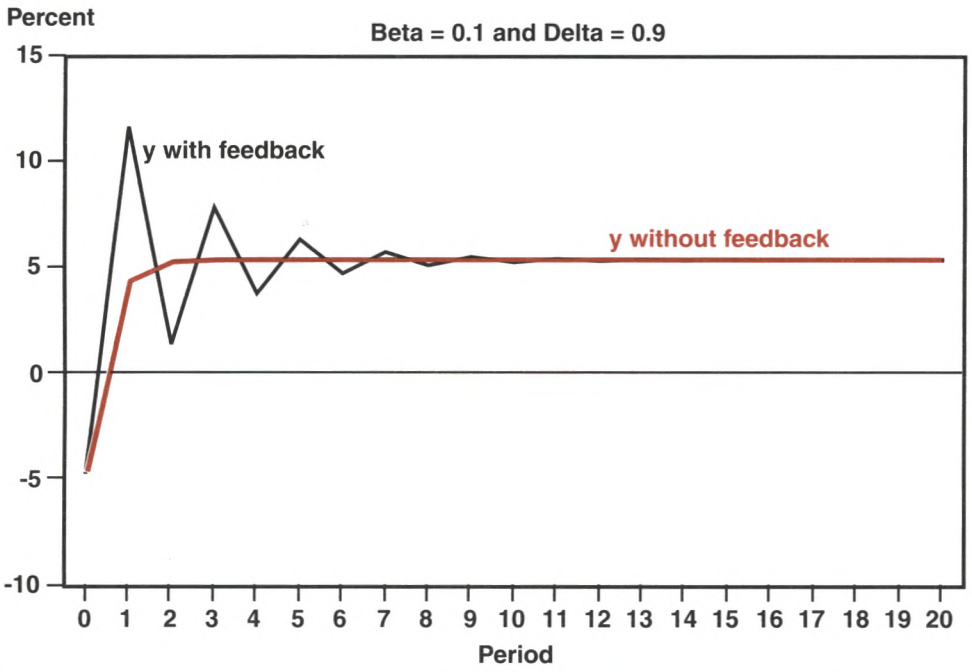
[16]This issue of convergence is similar to the issue of convergence of the economy to an equilibrium when firms' and households' expectations influence the behavior of the economy. More precisely, the issue is convergence of markets to rational expectations equilibria. Bullard (1991) sketches this research and provides references.

[17]Dwyer (1992) shows that a standard semi-logarithmic demand for money combined with equation (3) can generate chaos, which suggests that nonconvergence can be dramatic. Butler (1990) provides an introduction to the mathematics of chaos in economics.

[18]Lindsey (1986) reviews earlier work.

[19]See Andersen and Jordan (1968) and Andersen and Carlson (1970). Holbrook (1972) and Cooper and Fischer (1974), among others, analyzed the implications of the St. Louis equation or model for alternative short-run stabilization policy. This has seemed ironic to some because a common tenet of monetarism is that a rule without feedback would be preferable to discretion or a rule with feedback. See Mayer (1978). It is worth noting that forecasting the effects of drastically different policies was not why the originators estimated the model. The force of the observation that a monetarist model could be used for stabilization is muted but not eliminated by recent instability in this equation, instability that can be seen for example in Carlson (1986). Variants of the St. Louis equation are not the only representations of the economy that appear to have nonconstant coefficients over time. This instability is a well-known aspect of large econometric models.

Figure 2
Little Persistence in the Economy and Substantial Feedback



havior and households' expectations of policy. That is, the values of the coefficients β and γ in equation (1) reflect households' expectations of monetary policy. If monetary policy changes, the values of these coefficients are likely to change, and before the new policy is implemented, it may be quite difficult to figure out what the new values will be. Hence without large amounts of judgment, an equation such as (1) cannot be used to estimate the effects of radically different future policy or to formulate a useful feedback policy.

Lucas' point can be applied more generally than just to simple equations such as (1). In many so-called structural econometric models, expected inflation appears in various equations in the model and expected inflation itself is estimated by an equation relating inflation to past values of inflation. Such simple expectations equations generally will be different for different policies. This means that simple evaluations of alternative policies using such structural models are highly suspect. In any evaluation of alternative policies, it is important to be clear about what expectations of prior policy are built into the model and how the model will change with a new policy. In the current state of knowledge, it is dubious whether such an exercise can be more than broadly suggestive and even the suggestiveness is open to doubt.

An alternative and quite likely better way to examine the effects of feedback policies is to compare the U.S. economy's performance under different government policies. It is commonly thought that the government began systematically using policy to stabilize the economy after World War II and, at least to the same degree, did not use such policies before then. Though the conclusions are somewhat controversial, the evidence presented by Romer and by Balke and Gordon suggests that the economy has been no more stable since World War II than it was in prior years.[20] The case has yet to be made that stabilization policy in the postwar period has improved the economy's performance.

SUMMARY

In the last 20 years, the terms of the debate about rules vs. discretion have shifted dramatically. At one time, it was widely believed that discretion could accomplish anything that a rule

[20]See Romer (1989) and Balke and Gordon (1989).

could accomplish. The monetary authority could exercise its judgment to produce whatever policy a rule might specify in advance if the rule were the best policy. If a deviation from the policy that would be imposed by the rule were desirable, the monetary authority's hands would not be tied if it had discretion. The following is a more general but closely related line of argument: A rule is a constraint, and, in general, constraints make it impossible to accomplish what could be done otherwise.

It now is understood that rules can have benefits precisely because they restrict future policy choices. The mere possibility that a monetary authority will take some action can affect households' expectations and the effects on expectations can have negative effects on the economy's performance. Furthermore, some policies depend on committing future policy actions, and leaving judgment in the monetary authority's hands restricts the monetary authority's ability to pursue policies that require commitment.

A judgment about the desirability of rules or discretion hinges in part on judgments about how much control over monetary policy should be given to appointed officials and their advisers. Some proposed rules for the monetary authority leave some discretion. For example, with a rule that the monetary authority keep the price level constant, the monetary authority could exercise substantial judgment about the best means of reaching this end. Nonetheless, even if some discretion remains, there can be a positive return from committing policy. The size of the actual gain in any particular country from committing monetary policy by a law, a constitutional restriction or a similar device depends fundamentally on how much incentive a monetary authority has to generate surprise inflation and how much commitment is implicit in the country's political process.

Judgments about rules vs. discretion and whether a monetary authority should respond to the state of the economy also hinge on what can reasonably be expected from monetary policy given current knowledge about the economy. Responding to the state of the economy can be destabilizing; doing something can indeed be worse than doing nothing. Though many attempts have been made to estimate the effects of feedback polices and rules, estimating the effects of monetary policy on an economy's actual behavior is tricky. Besides the difficulties associated with attempting to specify a model of the economy adequately, estimates of expectations in a very different environment are required. It is dubious whether the effects of feedback policies and various rules estimated to date provide more than broadly suggestive evidence.

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Can Nominal GDP Targeting Rules Stabilize the Economy?

THE FEDERAL RESERVE HAS SHOWN that it would support making price stability the explicit goal of monetary policy.[1] How to accomplish this, however, is a matter of considerable discussion. Some economists have suggested that the best way to ensure that price stability is the foremost goal of monetary policy is to adopt a monetary policy rule. Such a rule would be a verifiable program of action designed to maintain price stability without constricting long-term economic growth. As long as the Federal Reserve faithfully implemented the rule's prescriptions, the public would have cause to believe that prices, once stabilized, would remain stable.

One way to achieve price stability in a growing economy is to have nominal gross domestic product (GDP) grow at the same rate as potential output.[2] One monetary policy rule, proposed by McCallum (1987), provides a systematic way for the Federal Reserve to adjust the monetary base as nominal GDP deviates from desired levels.[3] Simulations of this rule, presented in McCallum (1987, 1988) and Judd and Motley (1991), appear to suggest that the monetary base can be manipulated to keep nominal GDP close to a path consistent with price stability. In these simulations McCallum's rule proves to be robust to a variety of empirical models that relate changes in the monetary base to resulting changes in nominal GDP: Keynesian, Real Business Cycle and atheoretical vector autoregression models. Each empirical specification, however, confronts McCallum's rule with a world in which the structure of the economy is stable: the model's coefficients are held constant.

This article broadens the set of empirical models used to evaluate McCallum's rule to include one in which the relationship between base growth and nominal GDP growth is subject to structural change that takes the form of stochastic changes in the model's coefficients. Such a time-varying parameter (TVP) model presents a new environment in which the properties of McCallum's rule have not yet been examined. Simulation results from the TVP model indicate that McCallum's rule is more prone to the problem of instrument instability than simulations from constant-coefficient models have suggested. The instrument instability can be remedied, however, by targeting nominal GDP less stringently than McCallum's original rule had specified.[4]

[1]See Chairman Alan Greenspan's statement to Congress [Greenspan (1989)].

[2]Because of difficulties in allowing for quality changes and other imperfections in currently available price indices, many economists believe that 1 or 2 percent annual inflation in a measure like the consumer price index is actually consistent with price stability. In this case nominal GDP should grow slightly faster than potential output.

[3]Bradley and Jansen (1989) discuss possible rationale for nominal GDP targeting.

[4]See McCallum (1987).

THE ROLE OF VELOCITY IN SIMULATIONS OF RULES

Simulations present an opportunity to learn how closely nominal GDP can be expected to adhere to its target level and how variable the monetary base will have to be under McCallum's rule. As we will see, McCallum's rule specifies a rate of growth for the monetary base, given the level of nominal GDP relative to its target. Simulations of McCallum's rule *require* a model of how the monetary base is related to nominal GDP, which can be summarized by the income velocity of the monetary base. McCallum (1987) provides a simple model relating changes in the base to nominal income, where MB is the monetary base and e is a mean-zero random disturbance with variance σ_e^2:

$$(1)\quad \Delta lnGDP_t = \alpha + \rho \Delta lnGDP_{t-1} + b\Delta lnMB_t + e_t,$$

or, restating the model in terms of velocity growth,

$$(2)\quad \Delta lnGDP_t - \Delta lnMB_t = \alpha + \rho \Delta lnGDP_{t-1} + (b-1)\Delta lnMB_t + e_t.$$

This model illustrates the way in which velocity is generally modeled in simulations of McCallum's rule: the percentage change in the velocity of the monetary base is modeled as a function of time $t-1$ variables, base growth at time t and a random disturbance. The model also raises questions about the constancy of the parameters in the model of velocity growth: $\alpha, \rho, b, \sigma_e^2$. Simulations using a calibrated version of a constant-coefficient model will represent the economy's behavior under the rule only to the extent that the coefficients do not change in the long time span the rule is to be in effect. As an alternative, this article posits a simple short-run forecasting model of velocity with time-varying parameters and tests the restriction that the coefficients are constant over the sample period. Then simulations of McCallum's rule are run using a calibrated time-varying parameter model of velocity growth. The article next discusses the role of velocity forecasts in formulating McCallum's rule, in contrast to the foregoing paragraphs which discussed their role in simulating the rule.

ROLE OF VELOCITY IN NOMINAL GDP FEEDBACK RULES

McCallum's Rule

McCallum (1987) proposes a monetary policy rule that uses the monetary base to target nominal GDP. The rule employs a four-year moving average of past growth in base velocity to forecast its growth in the coming quarter. Based on this forecast, the rule then specifies the percentage of the gap between target and actual levels of nominal GDP that policymakers should try to close in the coming quarter.

Specifically McCallum's rule takes the following form:

$$(3)\quad \Delta lnMI_t = \lambda_0 - \frac{1}{16}(lnV_{t-1} - lnV_{t-17}) + \lambda_1 (ln\hat{GDP} - lnGDP)_{t-1}$$

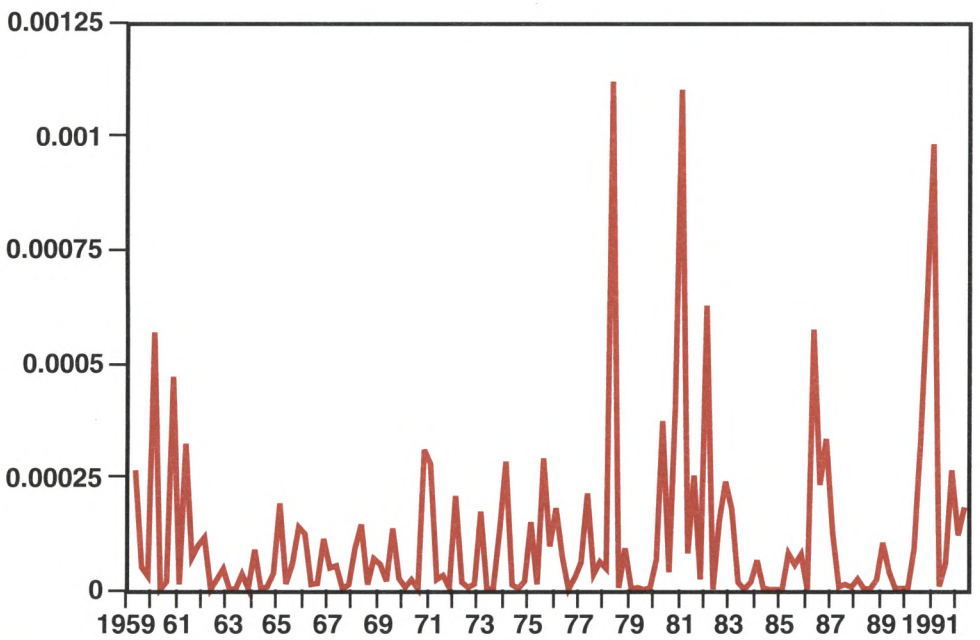
$$(4)\quad \Delta \ln \hat{GDP}_t = \lambda_0 \quad \forall t$$

where MI is the monetary instrument, V is the income velocity of the monetary instrument, $\hat{GDP}_t$ is the target level of nominal GDP at time t, and GDP_t is the actual level of GDP at time t. Also, $\lambda_0 > 0$ and $\lambda_1 > 0$. The second term on the right-hand side of equation (3) is the average velocity growth in the previous 16 quarters. The rule calls for the monetary authority to adjust the growth in the monetary instrument according to this velocity forecast. The third term represents the percentage gap between target and actual nominal GDP and thereby provides the feedback. When the gap is positive, the rule seeks but does not guarantee (because of surprise changes in velocity) GDP growth greater than the growth rate of target GDP (λ_0).

McCallum uses average velocity growth because trends in velocity growth can shift over time, but not every change in base velocity represents a long-lasting shift in the trend. McCallum's velocity forecast, however, uses only the past 16 values of velocity. In the next section an alternative monetary rule is described. This rule differs from McCallum's in that it uses explanatory variables to help forecast velocity; it also uses a time-varying parameter model. By allowing for time-varying coefficients, the forecasting model will be less prone than fixed-coefficient models to breaking down as time passes.

Figure 1

Squares of Deviations in Base Velocity Growth from Its Mean



A Forecasting-Based Monetary Rule

A short-run velocity forecasting model with time-varying parameters offers a possible source of one-step-ahead velocity forecasts required by a monetary rule such as McCallum's. This type of model would adapt in a systematic way to structural changes, that is, to changes in the relationships between velocity and the variables used to forecast velocity, such as interest rates.

The forecast-based feedback rule considered in this paper takes the form

$$(5)\quad \Delta lnMI_t = \lambda_0 - (\Delta lnV)_{t|t-1} + \lambda_1(ln\widehat{GDP} - lnGDP)_{t-1}$$

$$(6)\quad \Delta ln\widehat{GDP}_t = \lambda_0 \quad \forall t$$

where the variables are as defined in equations (3) and (4), and the second term on the right-hand side of equation (5) is the forecast of velocity growth for period t based on information available through period t−1. This rule differs from McCallum's rule in that it uses an explicitly derived forecast of velocity growth, rather than an average of past velocity growth. The next section details the velocity forecasting model.

A Forecasting Equation

This article reports results on one of many possible velocity forecasting equations. The velocity forecasting model employed here allows for time-varying coefficients on the explanatory variables, which are the lagged change in the three-month Treasury bill rate and lagged growth in the monetary instrument. Velocity growth should be positively related to the lagged change in the Treasury bill rate, because this short-term interest rate indicates the opportunity cost of money; velocity growth should be negatively related to lagged growth in the monetary instrument, because if nominal GDP is somewhat sluggish, part of additional money growth will lead to decreased velocity in the short run. The velocity forecasting equation employed here uses the Kalman filter and generalizes Bomhoff's (1991) velocity forecasting equation in three ways: it includes lagged money growth, lets the interest elasticity vary over time, and allows the variance of the error term to change.

Figure 1 shows squared deviations from the mean in the quarterly percentage change in the velocity of the St. Louis monetary base. The figure suggests that the volatility of velocity is not constant. This is not too surprising: econo-

mists believe that velocity is related to interest rates and expected inflation. Research has found that interest rates and inflation do not have constant volatilities, so we might expect velocity to share this property.[5]

The particular specification used to generate short-run forecasts is

$$(7)\ \Delta lnV_t = \beta_{0t} + \beta_{1t}\Delta TB3_{t-1} + \beta_{2t}\Delta lnMI_{t-1} + e_t$$

$$e_t \sim Normal\ (0,\ h_t)$$

$$h_t = \sigma_0^2 + (\sigma_1^2 - \sigma_0^2)\ S_t$$

$$S_t \epsilon \{0,\ 1\}$$

$$\sigma_1^2 > \sigma_0^2$$

$$Probability(S_t = 1 \mid S_{t-1} = 1) = p$$

$$Probability(S_t = 0 \mid S_{t-1} = 0) = q$$

where V stands for the velocity of the monetary instrument, MI, and TB3 is the three-month Treasury bill rate.[6] The errors in equation (7), e_t, have time-varying volatilities in that their variance is assumed to switch between a low and high level according to a first-order Markov process.[7]

With time-varying coefficients, equation (7) will be estimated using the Kalman filter under the assumption that the state variables, β_t, follow random walks:[8]

$$(8)\ \beta_t = \beta_{t-1} + V_i$$

$$V_i \sim \text{Normal } (0,\ Q)$$

In a short-run forecasting context, the assumption that the coefficients follow random walks suggests that people need new information before changing their views about the relationships among variables. This is essentially why Engle and Watson (1985) advocate the view that time-varying coefficients should have unit roots. The innovations to the coefficients, v, are assumed to be uncorrelated, so the covariance matrix Q is diagonal. Kim (forthcoming, b) discusses the specific form the Kalman filtering takes for this model and the evaluation of the likelihood function, which is maximized with respect to $(\sigma_0^2, \sigma_1^2, p, q, Q)$, where $Q_{ii} = \sigma_{vi}^2$, $i = 1,2,3$. The appendix also includes a summary of the filtering algorithm used in simulations.

By construction, this model allows for two sources of forecast error: error in predicting the value of the coefficients and the heteroscedastic random disturbance. In general, in a model with time-varying coefficients

$$(9)\ y_t = X_{t-1}\beta_t + e_t,$$

the one-step-ahead forecasts are

$$(10)\ y_t = X_{t-1}\beta_{t|t-1}.$$

Thus the forecast errors have two components which equal $X_{t-1}(\beta_t - \beta_{t|t-1}) + e_t$. If the variance of $(\beta_t - \beta_{t|t-1}) \equiv R_{t|t-1}$ and $var(e_t) \equiv \sigma_e^2$, the one-step-ahead forecast error variance is

$$(11)\ H_t \equiv H_{1t} + H_{2t} = X_{t-1}R_{t|t-1}X_{t-1}' + \sigma_e^2$$

The first component (H_{1t}) is called the variance due to time-varying parameters (TVP); the second (H_{2t}) is simply the variance of the random disturbance *e*. Inferences about the relative sizes of the two sources of forecast error variance play an important role in updating the coefficients. Using the Kalman filtering equations in the appendix, one can write the forecast $y_{t+1|t}$ as

$$(12)\ y_{t+1|t} = X_t\beta_{t|t-1} + Z_t\eta_{t|t-1}$$

where X_t are the explanatory variables, $\eta_{t|t-1}$ is last period's forecast error (and is thus the new information available), and Z_t is proportional to

$$\frac{H_{1t}}{H_{1t} + H_{2t}}.$$

[5]References are Bollerslev (1986) for inflation and Engle, Lilien and Robins (1987) for interest rates.

[6]Only one lag of each explanatory variable appears in equation (5), but, unlike a constant-coefficient model, the time-varying parameter model uses past values of the explanatory variables and forecast errors in generating its forecast. The appendix describes how the inferred coefficients embody past information.

[7]The combination of time-varying parameters and this type of heteroscedasticity was introduced by Kim (forthcoming, b). Kim (forthcoming, b) also illustrates that this model of heteroscedasticity is quite similar in practice to the well-known autoregressive conditional heteroscedastic (ARCH) model of Engle (1982). Basically, the Markov model tries to match the persistence of periods of high and low volatility in the data, where persistence of high and low volatility states is increasing in *p* and *q*, respectively.

[8]Bomhoff (1991) and Hein and Veugelers (1983) also use the Kalman filter to forecast velocity. Bomhoff (1991) holds the interest elasticity (β_{1t}) constant and restricts β_{2t} to equal zero, so past money growth is not included in the set of information used in his forecasts; Hein and Veugelers (1983) restrict both β_{1t} and β_{2t} to equal zero, further restricting the information set used for forecasting.

Table 1
Quarterly Growth in Velocity of St. Louis Base

Variable	Parameter	Parameter value	Standard error
Low variance	σ_0^2	0.643	.125
High variance	σ_1^2	1.230	.262
Constant	σ_{v1}^2	0.019	.051
ΔTB3	σ_{v2}^2	0.533	.268
ΔlnMI	σ_{v3}^2	0.027	.022
Probability($S_t = 1 \mid S_{t-1} = 1$)	p	0.781	.203
Probability($S_t = 0 \mid S_{t-1} = 0$)	q	0.869	.123
Log-likelihood		−167.800	
Q-statistic (24 lags)		21.000	
Q^2-statistic (24 lags)		22.700	

Table 2
Quarterly Growth in Velocity of Board Base

Variable	Parameter	Parameter value	Standard error
Low variance	σ_0^2	0.694	.125
High variance	σ_1^2	1.260	.328
Constant	σ_{v1}^2	0.044	.043
ΔTB3	σ_{v2}^2	0.604	.275
ΔlnMI	σ_{v3}^2	0.023	.034
Probability($S_t = 1 \mid S_{t-1} = 1$)	p	0.760	.237
Probability($S_t = 0 \mid S_{t-1} = 0$)	q	0.892	.124
Log-likelihood		−168.700	
Q-statistic (24 lags)		17.800	
Q^2-statistic (24 lags)		21.500	

If H_{2t} is large relative to H_{1t}, observers would attribute less of a forecast error to a change in coefficients; instead, they would believe that it was probably an outlier. A large value of H_{2t} then implies that last period's forecast error would play a relatively small role in determining next period's forecast.

FORECAST RESULTS

The forecasting model was estimated for quarterly data from III/1959 to II/1992 on the velocities of the following monetary aggregates: the St. Louis measure of the monetary base, the Board of Governors monetary base, M1 and M2. The latter three measures are included to provide some context for the St. Louis base results. Tables 1 through 4 contain parameter estimates of the forecasting model of equations (7) and (8) for each monetary aggregate.

For the two measures of the monetary base and M1, the coefficient with the most significant variation is the interest rate elasticity. Because

Table 3
Quarterly Growth in Velocity of M1

Variable	Parameter	Parameter value	Standard error
Low variance	σ_0^2	0.680	.189
High variance	σ_1^2	1.160	.322
Constant	σ_{v1}^2	0.018	.053
ΔTB3	σ_{v2}^2	0.905	.350
ΔlnMI	σ_{v3}^2	0.054	.023
Probability($S_t = 1 \mid S_{t-1} = 1$)	p	0.580	.392
Probability($S_t = 0 \mid S_{t-1} = 0$)	q	0.723	.425
Log-likelihood		−173.600	
Q-statistic (24 lags)		27.100	
Q^2-statistic (24 lags)		21.600	

Table 4
Quarterly Growth in Velocity of M2

Variable	Parameter	Parameter value	Standard error
Low variance	σ_0^2	0.729	.071
High variance	σ_1^2	1.370	.217
Constant	σ_{v1}^2	0.033	.043
ΔTB3	σ_{v2}^2	0.001	.183
ΔlnMI	σ_{v3}^2	0.004	.096
Probability($S_t = 1 \mid S_{t-1} = 1$)	p	0.955	.039
Probability($S_t = 0 \mid S_{t-1} = 0$)	q	0.898	.091
Log-likelihood		−171.400	
Q-statistic (24 lags)		16.100	
Q^2-statistic (24 lags)		27.100	

McCallum's rule is written for the St. Louis base, specification tests are done for the St. Louis base. The log-likelihood for the TVP model with Markov switching is −167.8. The log-likelihood with Markov switching and constant coefficients is −175.1. This implies a likelihood-ratio statistic of 14.6, which is rejected as a χ_3^2 variable at the 99 percent confidence level. Thus, while the variance due to time-varying parameters in figure 2 appears to account for a relatively small portion of the overall forecast error variance for St. Louis base velocity, the model's parameters exhibit statistically significant variation. The log-likelihood for OLS is −184.4, so we can similarly reject homoscedasticity in the error term in an OLS regression. This means

Table 5
Velocity Forecast Error Variances

	St. Louis Base	M1	M2
Total forecast error variance H_t	0.992	1.050	1.040
Variance due to disturbance term H_{2t}	0.831	0.813	0.945
Variance due to TVP H_{1t}	0.161	0.236	0.098

that σ_e^2 does not remain constant throughout the sample period.

The Q-statistics test for serial correlation, and all are insignificant as are the Q^2-statistics, which test for serial correlation in the squared forecast errors. (The distribution of the Q- and Q^2-statistics is χ^2_{24} under the null hypothesis of no serial correlation; the 5 percent critical value is 36.4.) The lack of serial correlation indicates that the model avoids making persistent errors in its forecasts. Significant Q^2-statistics would indicate that the Markov model of heteroscedasticity is an inadequate model of the persistence in the variance of the error terms. The sum $p + q$ indicates the persistence of the volatility of the error term. If $p + q > 1$, the Markov process is called persistent. Interestingly, M2 has the most persistent volatility states with $p + q = 1.85$, which is not far from the upper bound of 2. This finding suggests that when policymakers are finding relatively large forecast errors in M2 velocity, they will likely continue to be plagued with large forecast errors (in either direction) in the near term.

Table 5 compares the relative importance of the two sources of forecast uncertainty: the variance due to coefficient variation and the variance of the disturbance term, e_t. (Because of the great similarity between the results for the two measures of the monetary base in tables 1 and 2, only results for the St. Louis monetary base will be presented hereafter.)

Even though the numbers in table 5 cannot be directly compared across monetary instruments, they do illustrate that M2 has the most stable coefficients among the three monetary aggregates, measured as a percentage of total forecast variance. By this measure, M1 has less stable coefficients than the monetary base, so the narrowness of the monetary aggregates is not necessarily inversely related with coefficient stability.

Figures 2 through 5 divide the conditional forecast error variance into its two components, H_{1t} and H_{2t}, for the four monetary aggregates examined in this paper. As the figures show, the relative sizes of H_{1t} and H_{2t} are not constant over time. One should point out that, if the magnitude of the variance of the random disturbances, H_{2t}, is generally large relative to the variance caused by time-varying coefficients, H_{1t}, it does not mean that H_{1t} is too close to zero to be important: the likelihood-ratio test reported previously rejects the hypothesis that the forecast error variance due to time-varying parameters is equal to zero for the velocity of the St. Louis base. The velocities of all four aggregates show heightened forecast error variance due to time-varying coefficients from 1979 to 1982, the period of nonborrowed reserves targeting and financial deregulation. For reference the time-varying coefficients for St. Louis base velocity are shown in figures 6 through 8. The estimated coefficients generally have their expected signs: a positive interest rate elasticity and a negative money growth elasticity. Dickey-Fuller unit root tests do not reject the hypothesis that each of these three coefficients follows a random walk; thus the inferred coefficient values do not contradict the assumed random walk specification.

Given that two monetary rules, which differ only in their velocity forecasts, will be simulated, it is useful to compare the forecast errors from the forecasting equation with time-varying parameters and McCallum's 16-quarter moving average. As table 6 shows, the 16-quarter moving average is close to the TVP model in mean squared forecast error only for the velocity of the St. Louis base. For the broader aggregates, the mean squared errors are at least 33 percent higher for the moving-average forecast than for the TVP model. If the forecast errors are persistent, they can compound errors in targeting nominal GDP. Thus, we also report Q-statistics which test for serial correlation in the forecast

Figure 2

Variance Decomposition of St. Louis Base Velocity Growth

Forecast Error Variance

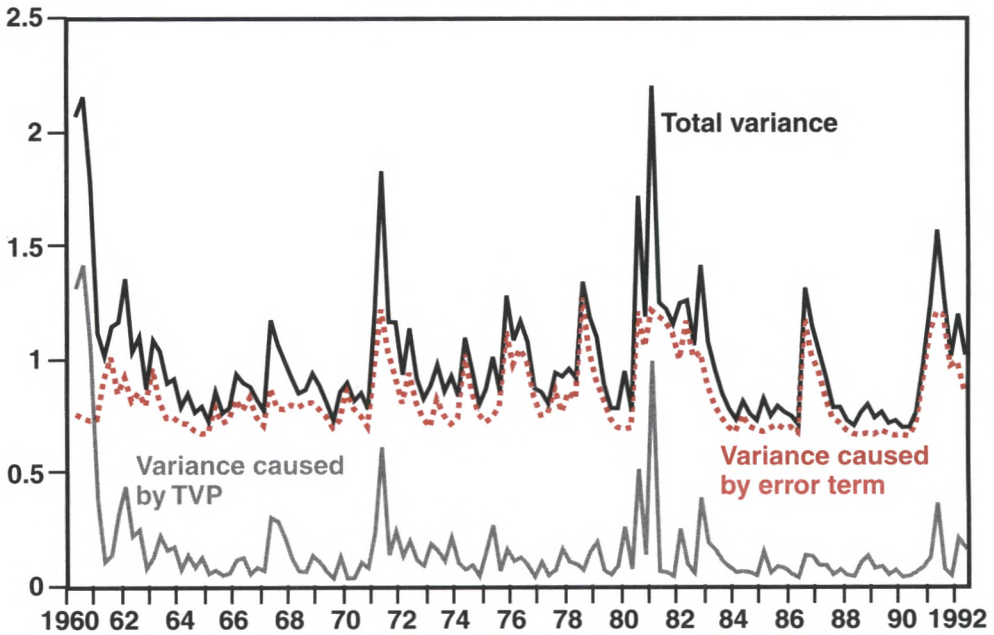


Figure 3

Variance Decomposition of BOG Base Velocity Growth

Forecast Error Variance

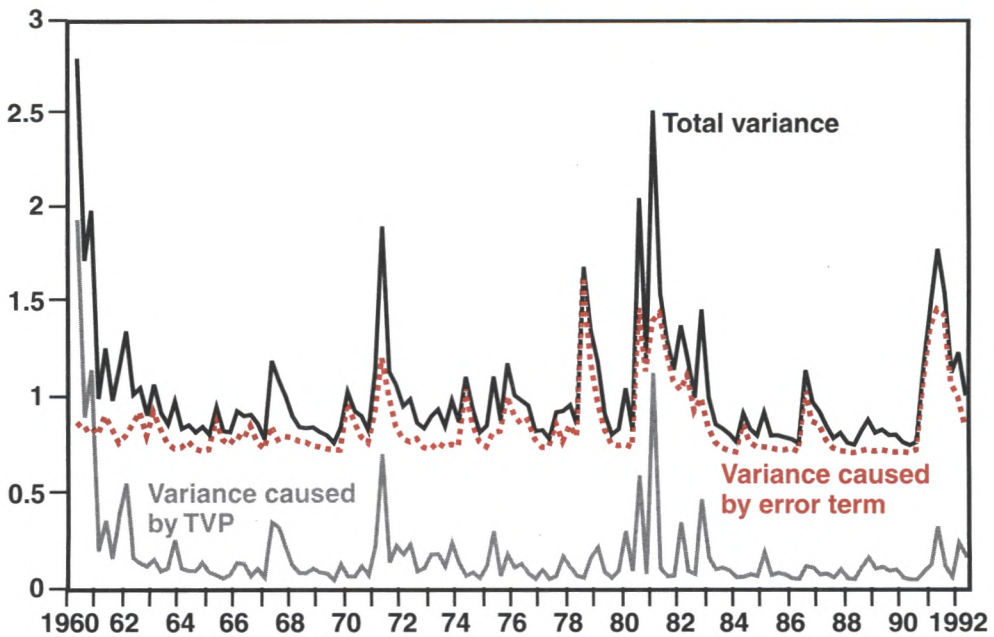


Figure 4

Variance Decomposition of M1 Velocity Growth

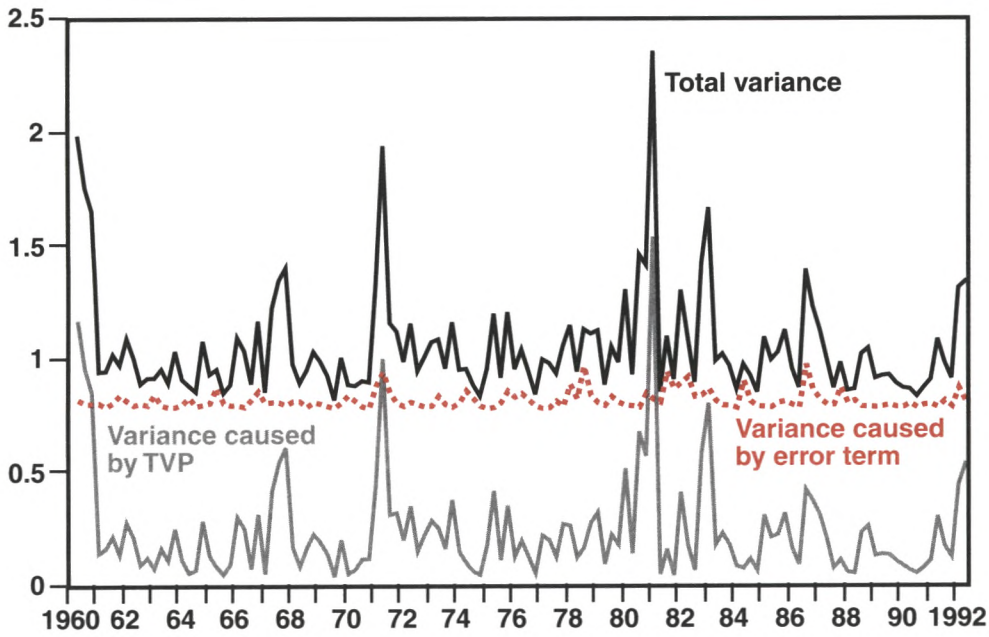


Figure 5

Variance Decomposition of M2 Velocity Growth

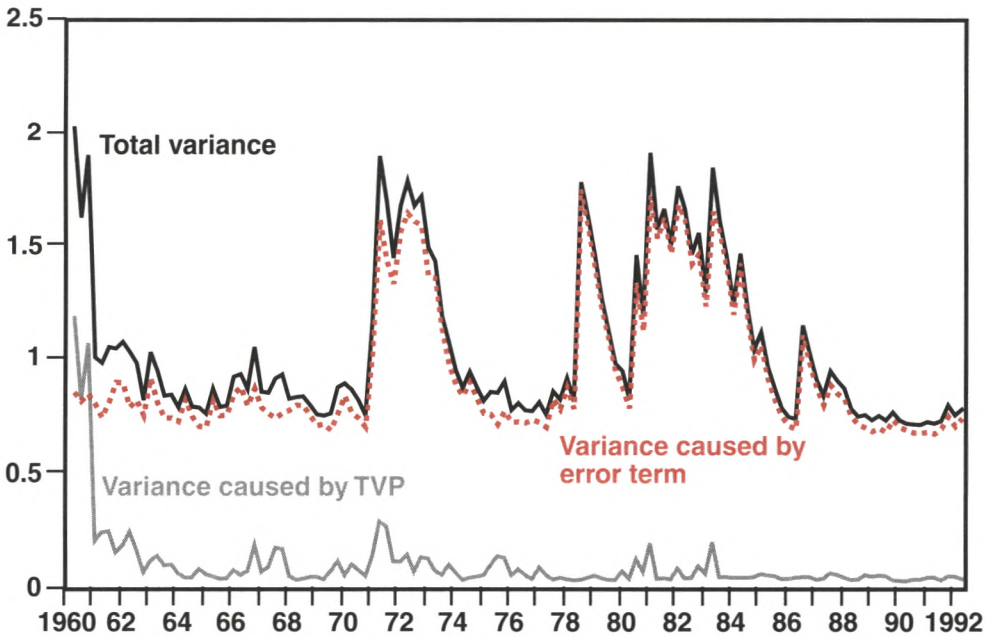


Figure 6

Intercept for St. Louis Base Velocity Growth

Figure 7

Effect of Lagged Base Growth on Growth of St. Louis Base Velocity

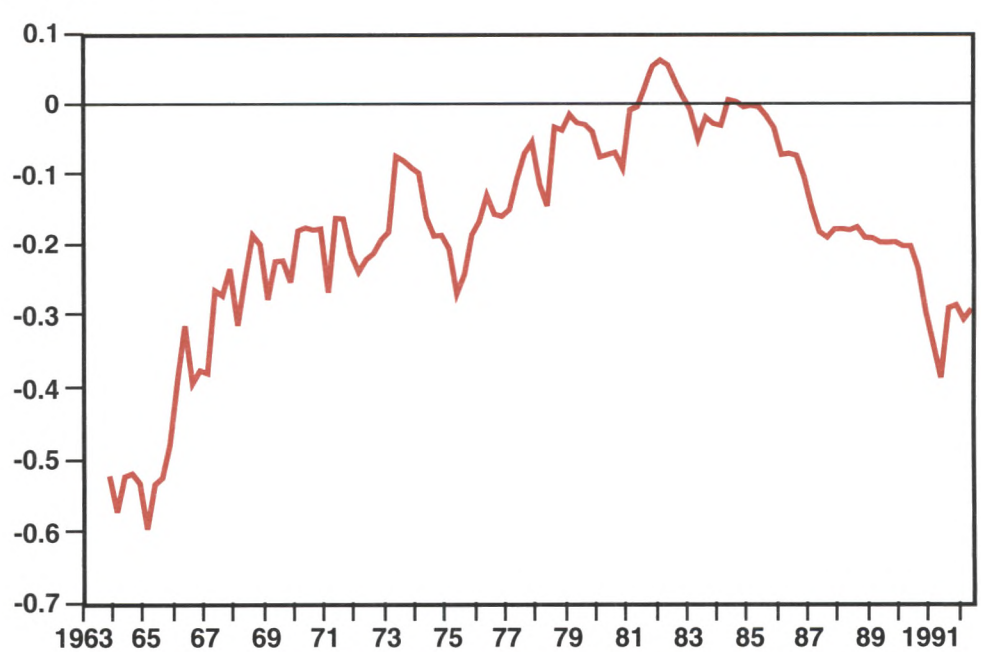


Figure 8

Effect of Lagged Change in the Three-Month T-Bill Rate on Growth of St. Louis Base Velocity

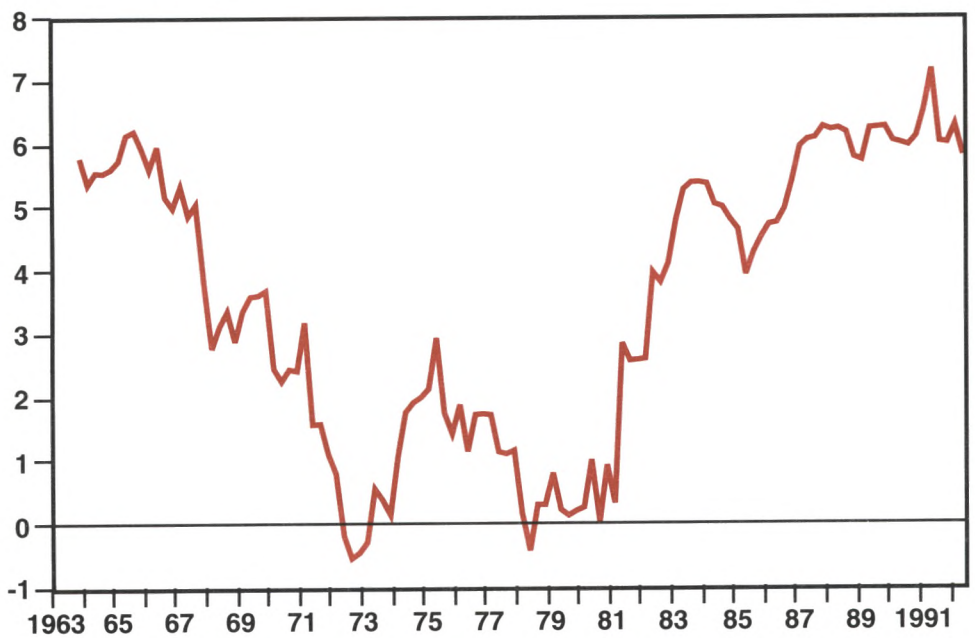


Table 6

Velocity Forecast Error Comparison

	St. Louis Base	M1	M2
Mean squared forecast error TVP model	.981	1.03	.994
Q-statistic (24 lags) for TVP model	21.0	27.1	16.1
MSFE from McCallum's 16-quarter moving average	1.08	1.62	1.34
Q-statistic (24 lags) for 16-quarter moving average	36.5	59.6	44.6

errors. With a χ^2_{24} critical value of 36.4 at the 5 percent significance level for the Q-statistics, the 16-quarter moving average forecast errors are significantly serially correlated for all three monetary aggregates.

Estimating a velocity forecasting equation with time-varying coefficients (equations (7) and (8)) not only provides a way to modify McCallum's rule (equation (5)), it also provides estimates of the variances of the coefficients that can be used to calibrate a data-generating process for velocity to be used in simulations of McCallum's rule. We also run simulations on the forecast-based rule to learn about its properties. The object here is to learn something about the feasibility of nominal GDP targeting when velocity's relationship with other variables is subject to structural change.

Table 7

Simulation Results for Forecast-Based Rule (Averages across 200 simulations)

Forecasting Rule: $\lambda_0 = .00985$; $\lambda_1 = .25$

Mean value of $lnGDP_t - \widehat{lnGDP_t}$	−.0174
Mean square error of $lnGDP_t - \widehat{lnGDP_t}$	.0007
High value of $lnGDP_t - \widehat{lnGDP_t}$	.025
Low value of $lnGDP_t - \widehat{lnGDP_t}$	−.060
Mean annual growth rate of monetary base	4.66
Standard deviation of annual base growth	2.89
High value of annual base growth	15.70
Low value of annual base growth	−2.19

SIMULATIONS OF THE RULES

All of the velocity models employed in simulations of McCallum's rule in McCallum (1987, 1988), Judd and Motley (1991, 1992), Rasche (1993) and Thornton (forthcoming) have assumed constant coefficients. This paper takes a different tack by estimating time-varying parameter models of velocity growth. A data-generating process with stochastic coefficients is then used to generate data in simulations. In this way, we attempt to study how a monetary rule would perform when the velocity relationship is subject to unpredictable structural change.

Simulations were run for a data-generating process calibrated to the velocity growth of the St. Louis base. The modifications to the forecasting model of equations (7) and (8) are the following:

1. Short-term interest rates are dropped as an explanatory variable and the model is then re-estimated. This approach is adopted because we have no good way to determine interest rates using any of the equations we have estimated. In effect, we are forecasting with a smaller information set, which will make the forecast error variance larger. Without interest rates in the forecasting equation, the actual increase in the forecast error variance is less than 7 percent, so the quantitative effect of this change should be small.
2. The error term e_t is assumed to be homoscedastic for simplicity. This allows us to drop Markov switching from the simulations.
3. The coefficient on lagged base growth, β_{2t}, is no longer assumed to have a unit root; instead it is modeled as an autoregressive process with a near-unit root: $\beta_{2t} = .95\beta_{2t-1} + v3_t$. When running the simulation for 400 quarters, it is not realistic to allow β_{2t} to become less than negative one indefinitely, though it is allowed to do so for lengthy periods.[9]
4. The starting values for $\beta_{t=0}$ are randomized from their calibrated values to reduce dependence on a particular choice of starting values.

Details on this simulation are in the appendix. The other choices to be made in the simulation are the parameters in the monetary rule of equation (7). The target for quarterly nominal GDP growth was set to $\lambda_0 = .00985$, which corresponds with 4 percent annual growth. The value of λ_1 determines how much of the gap between the target and actual levels of nominal GDP policymakers should try to eliminate in the coming quarter. For λ_1, we follow McCallum's (1987) suggestion by setting it equal to 0.25.

The exercise consists of simulating particular monetary rules 200 times for periods of 400 quarters each. To reiterate, the important point of this exercise is to study the performance of a monetary policy rule under a data-generating process for velocity that includes unpredictable structural change. The desired information is how closely nominal GDP might be kept to its target path and how variable the growth rate of the monetary instrument would have to be. The numbers in table 7 represent averages across the 200 simulated 400-quarter periods for the forecast-based rule.

The results in table 7 show that simulated nominal GDP in levels is on average 1.7 percent below its target, with extreme deviations of 2.5

[9]This is somewhat analogous to models of nominal interest rates that assume unit roots. Random walk behavior might provide a very close approximation to interest rate behavior in the short run, but long-run simulations cannot plausibly assume a unit root, or negative nominal interest rates would eventually result.

Table 8

Simulation Results for McCallum's Rule (Averages across 200 simulations)

Forecasting Rule: $\lambda_0 = .00985$; $\lambda_1 = .10$	
Mean value of $lnGDP_t - \widehat{lnGDP_t}$	.038
Mean square error of $lnGDP_t - \widehat{lnGDP_t}$	.009
High value of $lnGDP_t - \widehat{lnGDP_t}$	.108
Low value of $lnGDP_t - \widehat{lnGDP_t}$	−.057
Mean annual growth rate of monetary base	1.92
Standard deviation of annual base growth	1.20
High value of annual base growth	6.20
Low value of annual base growth	−0.827

percent above and 6 percent below the target. Considering that the simulations ran for 400 quarters, the differences between target and actual GDP are small. The simulated rate of base growth averages 4.7 percent per year across the 200 replications, with extremes of 15.7 percent and −2.2 percent annual growth. The latter figure should be small in absolute value, because of the political difficulty in selling a monetary rule that would potentially call for substantial decreases in the monetary base for as long as a year. The former figure suggests that double-digit base growth would occasionally occur under a policy of nominal GDP targeting.

In contrast, McCallum's rule, which uses moving-average forecasts of velocity growth, proved to be unstable with λ_1 equal to 0.25. (Average base growth was *negative* 6 percent per year.) The results for McCallum's rule presented in table 8 are for simulations run with λ_1 equal to 0.10, so the rule attempts to close gaps between target and actual nominal GDP more slowly to prevent instrument instability.

McCallum's rule no longer displays instrument instability once the feedback parameter, λ_1, is reduced: the average gap in levels between actual and target nominal GDP is 3.8 percent. The mean square error of the gap between actual and target nominal GDP is higher than that of the forecast-based rule, however. Nevertheless, McCallum's rule appears to be robust to a world in which the growth rate of base velocity is subject to structural change, albeit with a lower value on the feedback parameter, λ_1, which means that nominal GDP cannot be targeted as stringently period-by-period as it can with the forecast-based rule.

CONCLUSIONS

This paper confronts McCallum's nominal GDP targeting rule in simulations with a world in which coefficients in the velocity equation for the monetary instrument are subject to unpredictable stochastic change. Hypothesis tests on the estimated model of the velocity of the St. Louis base reject coefficient stability. To account for unstable coefficients, a time-varying parameter model of velocity is estimated and used to calibrate the data-generating process used in simulations. These simulations suggest that McCallum's rule can stabilize nominal GDP growth in a time-varying parameter framework. Nominal GDP cannot be targeted as closely as when an alternative forecast-based monetary rule is used, however. In addition, nominal GDP cannot be targeted as closely as previous studies that simulated McCallum's rule using constant-coefficient models of velocity have suggested.

Overall, McCallum's approach to nominal GDP targeting proves to be simple yet robust to velocity behavior that is quite complex. The alternative forecast-based rule performed somewhat better in simulations in which velocity was generated in a time-varying parameter model, but it has the disadvantage of being more difficult for the public to verify.[10] Given that it would be easier for the public to verify that the Fed is following McCallum's rule, relative to the forecast-based rule, the former may garner the Fed more credibility, even though it is technically less able to stabilize nominal GDP growth.

[10]Until the public was able to observe low inflation and relatively stable nominal GDP growth for a considerable length of time, the credibility of a rule-based policy would likely depend on the public's ability to verify that the monetary authority was actually following the rule when setting targets for money growth.

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Appendix
Kalman Filtering

The Kalman filter is a set of recursive equations that determine how the *inferred* regression coefficients are updated as new observations are added. The Kalman filtering without Markov switching used in the simulations consists of the following equations:

$$\beta_{t|t-1} = G\beta_{t-1t|t-1} \tag{13}$$

$$R_{t|t-1} = GR_{t-1t|t-1}G' + Q \tag{14}$$

$$\eta_{t|t-1} = y_t - X_{t-1}\beta_{t|t-1} \tag{15}$$

$$H_t = H_{1t} + H_{2t} = X_{t-1}R_{t|t-1}X'_{t-1} + \sigma_e^2 \tag{16}$$

$$K_t = \frac{R_{t|t-1}X'_{t-1}}{H_t} \tag{17}$$

$$\beta_{t|t} = \beta_{t|t-1} + K_t\eta_{t|t-1} \tag{18}$$

$$R_{t|t} = (I - K_tX_{t-1})R_{t|t-1} \tag{19}$$

The term K_t, called the Kalman gain, determines how much new information, summarized by the latest forecast error $\eta_{t|t-1}$, is allowed to affect the inferred β coefficients. Equation (18) shows that the inferred coefficients are updated using the product of the Kalman gain and the latest forecast error. Thus the inferred coefficients themselves are functions of past values of the explanatory variables and the dependent varia-

ble. In this way the current forecasts in a time-varying parameter model that uses the Kalman filter are based on a larger information set than just last period's values of the explanatory variables.

Combining the equations for K_t and $\beta_{t|t}$ and multiplying through by X_{t-1} shows how new information, $\eta_{t|t-1}$, is used in updating forecasts of the dependent variable:

$$(20)\quad X_{t-1}\beta_{t|t} = X_{t-1}\beta_{t|t-1} + \frac{H_{1t}}{H_{1t}+H_{2t}}\eta_{t|t-1}$$

This relation demonstrates the assertion that the relative sizes of H_{1t} and H_{2t} determine the weight put on new information when updating the inferred coefficient values.

Calibrating the Simulations

As discussed in the text, the forecasting equations were estimated for base growth without interest rates as an explanatory variable. The only explanatory variables with time-varying coefficients were the intercept and lagged base growth. In the simulations we need to specify starting values for the true parameter values, the inferred parameter values and the variances of v_t, where $\beta_t = G\beta_{t-1} + v_t$. G is a (2 x 2) diagonal matrix with $G_{11} = 1$ and $G_{22} = .95$. The coefficient variances were set to 1E-05 for the intercept and .05 for lagged base growth. The variance of e_t, the disturbance term, was set to 1.08. These values come from the estimated forecasting model, where the value of σ_e^2 is placed near the value of the estimated unconditional value between σ_0^2 and σ_1^2. Finally the starting values for the inferred coefficient values were randomized by adding noise to the true starting values. This was done to reduce dependence on particular initial values in the Kalman filter and also to mimic uncertainty that would pertain to the initiation of a new monetary policy regime, the rule. Thus the simulations should roughly resemble the data-generating process governing the growth of base velocity, including changes in the structural coefficients.

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The FOMC in 1992: A Monetary Conundrum

A WEAK, HESITANT AND protracted recovery was under way during 1992. Real gross domestic product (GDP) did not regain its prerecession level until third quarter 1992, a year and a half after the recession's trough. On the whole, however, incoming data were less negative during 1992 than in 1991 and the Federal Open Market Committee (FOMC) generally displayed more confidence that the economy was growing in 1992.[1] As concern about a further economic downturn receded, troubling aspects of the monetary aggregates' behavior became more prominent in FOMC deliberations.

Since mid-1991, an unusual combination of very slow M2 growth and rapid growth of reserves and M1 has drawn considerable attention.[2] The juxtaposition of fast M1 and reserve growth and slow M2 growth was an important conundrum for policymakers in 1992: Was slow M2 growth constricting economic recovery (though slowing inflation at the same time), or was rapid M1 growth a signal of future inflationary pressure (though perhaps supporting rapid recovery)? These worst-case interpretations highlight the range of uncertainty raised by anomalous behavior of an important set of indicators.

The article begins with an outline of major economic developments in 1992 followed by an examination of the aforementioned monetary conundrum. These first two sections provide a backdrop for more detailed discussion in the third section of the eight FOMC meetings and policy actions taken between meetings. Because discussion of monetary policy often uses potentially ambiguous terms such as *easing*, I have included a shaded insert, "Translating the FOMC Policy Directives," which explains how some of these terms are used in FOMC directives and in discussions of monetary policy.

ECONOMIC DEVELOPMENTS IN 1992

A month-by-month account of economic developments makes it is easy to lose sight of broader patterns. Figure 1 illustrates some of these patterns. A wide-angle view reveals that

[1]The FOMC comprises the seven governors of the Federal Reserve System, the president of the Federal Reserve Bank of New York, and, on a rotating basis, the presidents of four of the other 11 regional Federal Reserve Banks. The seven remaining presidents attend the meetings and present their views but do not vote.

[2]M1 comprises currency, traveler's checks and checkable deposits. M2 combines M1 with savings deposits, money market mutual funds, small time deposits, and some smaller items.

Translating the FOMC Policy Directives

The domestic policy directives issued by the FOMC in recent years have contained two parts. The first part summarizes available information about the economy that provides a context for the actions taken. The second part is a discussion of policy and the actual directive. In 1992 the directive used the following wording:

> In the implementation of policy for the immediate future, the Committee seeks to _____ the existing degree of pressure on reserve positions. In the context of the Committee's long-run objectives for price stability and sustainable economic growth, and giving careful consideration to economic, financial, and monetary developments, slightly greater reserve restraint _____ or slightly lesser reserve restraint _____ be acceptable in the intermeeting period.

The words that fill in the blanks are the keys to translating the directive. The first blank gives the main thrust of the directive. The choices here are *decrease* (known as easing), *increase* (known as tightening) and *maintain*. Interpretation of the first two choices is straightforward, but they were not used in 1992.

The second two blanks determine the so-called bias of the directive and are particularly important when the main thrust is *maintain*. The choices for both the second and third blank are the words *would* and *might*. The key insight is that *would* is stronger than *might*. If the main thrust of the directive is *maintain* and the directive says that "slightly greater reserve restraint *might* or slightly lesser reserve restraint *would* be acceptable," the directive is referred to as *biased or asymmetric toward ease*. Pairing might with *might* or *would* with would gives a *symmetric directive*. Pairing *would* and *might*, is known as *biased* or *asymmetric toward restraint*. A directive that is biased toward ease is intended to give the Chairman somewhat more leeway in the direction of ease in the day-to-day implementation of policy between meetings. On some occasions there is an unusually strong presumption that the Chairman will act on the bias toward ease. See, for example, the discussion of the October 6 meeting in the text. This understanding is not included in the directive itself but is clearly stated in the record of Committee discussions.

The FOMC directives do not state how these somewhat imprecise words are translated into specific dollar sales or purchases of government securities, but in recent years, outside observers have regularly focused at-

the 1991-92 recovery was the slowest since World War II, with growth below the long-run average for several quarters and little employment growth. A narrower focus highlights the fact that the economy was substantially stronger in 1992 than in 1991 and that the second half of 1992 was substantially stronger than the first half, despite pessimistic expectations from midyear onward. An important feature of 1991 and 1992 was the dramatic fall of interest rates (see figure 2). A notable aspect of this decline was the sharp steepening of the yield curve; short-term interest rates fell much more than long-term rates. The increase in the rate spread between 10-year and three-month Treasury rates following the business cycle trough in March 1991, for example, is larger than that in any postwar recovery period.

The U.S. economy ended 1991 with a whimper: GDP grew at an annual rate of less than 0.6 percent in the fourth quarter. The FOMC ended the year with a significant easing that coincided with a 1 percentage point cut in the discount rate.[3] The federal funds rate then hovered around 4 percent until April (see figure 2). During the first months of 1992 new economic data suggested that the risk of sliding back into recession had receded; indeed it turned out that the economy grew at a 3 percent rate in the first quarter.

M2 started the year with a month of strong

[3]Throughout this article the terms *ease* and *easing* used in connection with specific policy actions have a narrow meaning that is spelled out in the shaded insert "Translating the FOMC Policy Directives." In other instances, *easy* and *tight* are used in a more general way to refer to the overall stance of monetary policy, a much less well-defined concept.

tention on a federal funds rate target, or an *expected federal funds rate*, that helps the New York Bank implement the directive on a day-to-day basis.[1] An easing (tightening) action is taken relative to a particular reserve baseline (and the implied federal funds rate) settled on at an earlier date. The easing (tightening) action itself is a purchase (sale) of more Treasury securities than envisioned in the baseline and tends to decrease (increase) the federal funds rate.[2]

Whether monetary policy is *easy* or *easier* in a broader sense following an easing action is a complex issue. For example, despite 10 easing actions during 1991, 1992 still presented the monetary conundrum described in this paper–was M2 growth sufficient?[3]

In the last two years the tilt of the directive has been important. As table 1 on p. 42 indicates, there has been only one easing directed by the main thrust wording, but under language asymmetric toward ease, the federal funds rate has fallen by several percentage points (figure 2). Several times in the last two years, significant changes in the federal funds rate have been associated with changes in the discount rate voted by the Board of Governors (the FOMC comprises the Board plus five of the presidents of the regional Federal Reserve Banks). See, for example, the discussion in the text of the easing action taken in early July.

[1]A more comprehensive discussion of the relationship between the expected federal funds rate and other aspects of Federal Reserve operating procedures can be found in Sternlight et al. (1992).

[2]Banks and other depository institutions in the United States are required to keep reserves against certain kinds of deposits. The reserves can be in the form of vault cash or deposits with the Federal Reserve. When a bank finds itself short of reserves, it can borrow from the Federal Reserve at the discount window or from other banks in the federal funds market. The federal funds rate is determined by supply and demand in this market for reserves. Open market operations conducted by the Federal Reserve System change the supply of reserves available to the market. When the System sells Treasury securities, it effectively takes reserves out of the system, decreasing supply. This tends to cause the federal funds rate to rise.

[3]The issue of judging the overall stance of monetary policy is discussed in Bullard (1992), p. 44.

growth but then began to decline. In April, falling M2, together with "indications that the economic expansion was not as strong as its pace early in the year," prompted an easing action.[4] Immediately following this action, the federal funds rate fell substantially but then stabilized around 3.75 percent until the end of June.

Data for April and May were more positive, but many indicators for June (released around the beginning of July) led to a swing toward pessimism. Industrial production, employment, retail sales, M1 and M2 all tilted down. The growth of real GDP had fallen to only 1.5 percent in the second quarter. Both the Board staff and private forecasters became more pessimistic about growth prospects for the second half of the year. The private sector Blue Chip consensus forecasts for GDP growth in the second half of the year made in June, July and August were 3.2 percent, 3.0 percent and 2.8 percent, respectively.[5]

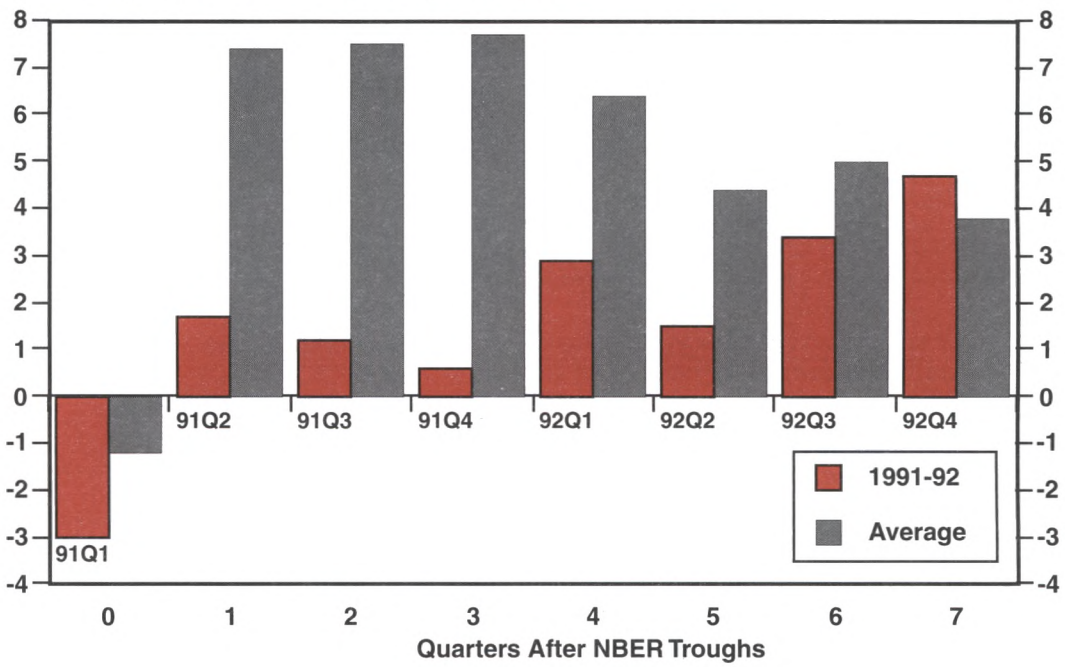
At the beginning of July the Board of Governors cut the discount rate from 3.5 percent to 3.0 percent. This was accompanied by open

[4]See Federal Reserve press release July 2, 1992, p. 4. The press releases referred to in the remainder of this article are dated March 29, 1991; April 3, 1992; May 22, 1992; July 2, 1992; August 21, 1992; October 9, 1992; November 20, 1992; December 24, 1992; and February 5, 1993. All press releases will be referred to by date. Reserve requirements on transactions deposits were reduced from 12 percent to 10 percent on April 2. The reduction was intended to "strengthen the financial condition of banks and thereby improve their access to capital markets, thus putting them in a better position to extend credit" (*Federal Reserve Bulletin*, April 1992, p. 272). The change apparently had no significant effect on monetary aggregates and no bearing on the decision to ease later in the month.

[5]See Eggert (1992).

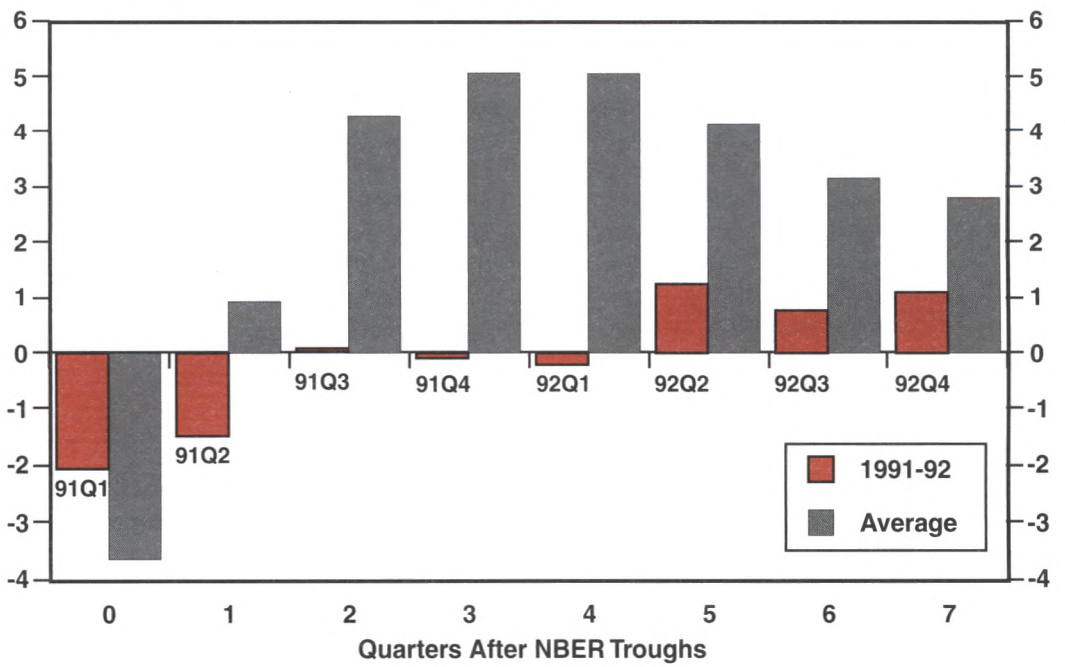
Figure 1
Growth of Real GDP During Recoveries

Seasonally Adjusted Annual Rates (in Percent)



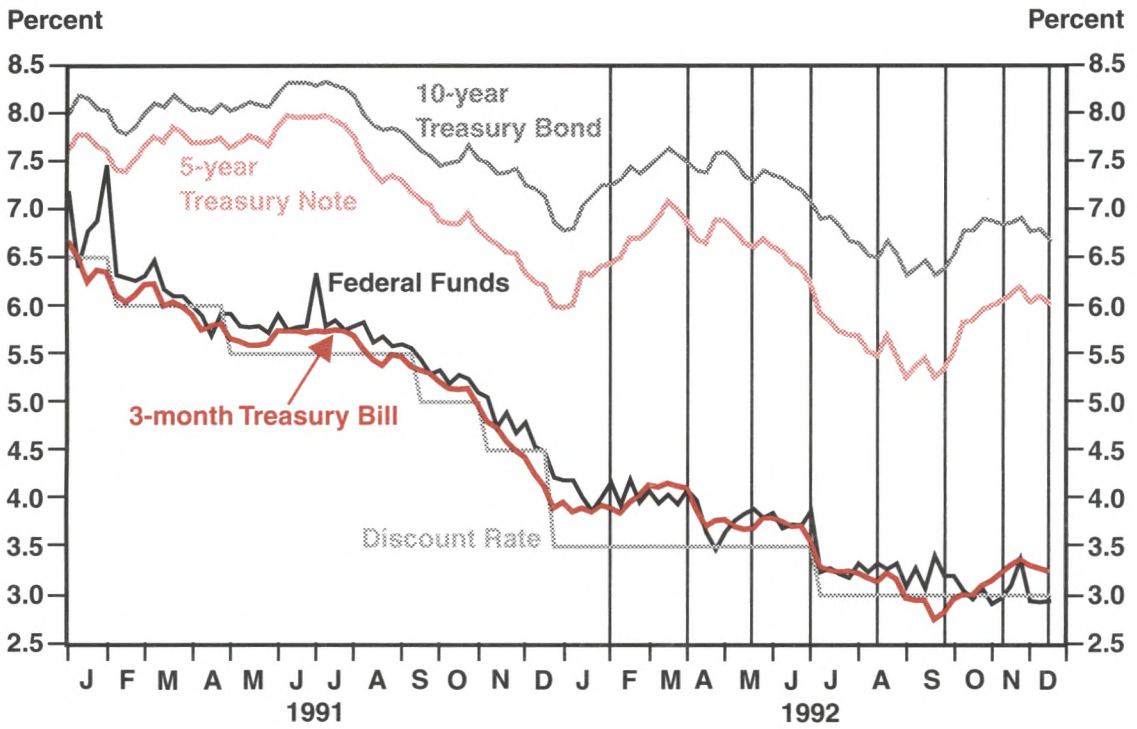
Growth of Nonfarm Payroll Employment During Recoveries

Seasonally Adjusted Annual Rates (in Percent)



Note: *Average* includes all postwar recessions before 1991 except the 1980 recession.

Figure 2
Interest Rates



Note: Vertical lines mark FOMC meeting dates.

market operations "directed at allowing the full amount of the reduction to be reflected in money market rates."[6] The federal funds rate then fell about a 0.5 percentage point. The federal funds rate subsequently averaged about 3.25 percent until September. These two actions constituted the most significant policy move of the year.

Though many indicators turned up in July (and down again in August), M2 continued to fall despite the actions taken at the beginning of July. In response to the flagging M2 growth and to continuing signs of sluggish economic growth, another easing action was implemented in early September.[7] The federal funds rate remained higher than expected following this action but settled down to around 3.0 percent by the end of October and remained there for the remainder of the year.[8] Positive M2 growth resumed during the second half of the year, supported by rapid growth of reserves, but turned negative again in December and into 1993.

The second half of 1992 is a case study in the difficulty of making policy on the basis of forecasts and month-by-month changes in economic data.[9] The downturn that threatened at midyear never materialized; the economy grew at a 3.4 percent rate in the third quarter and 4.7 percent in the fourth. This was not apparent during the third quarter, however, and in fact private forecasters remained pessimistic until late in the year. The July and September easing actions were taken partly on the premise that the economy was weakening (and partly in response to flagging M2 growth), yet economic growth in the second half of the year ended up much stronger than during the first half of the year.[10]

THE MONETARY CONUNDRUM

During the past two years, M2 has grown slowly by past standards and has frequently

[6]October 9, 1992 press release, p. 4.

[7]November 20, 1992 press release, p. 4.

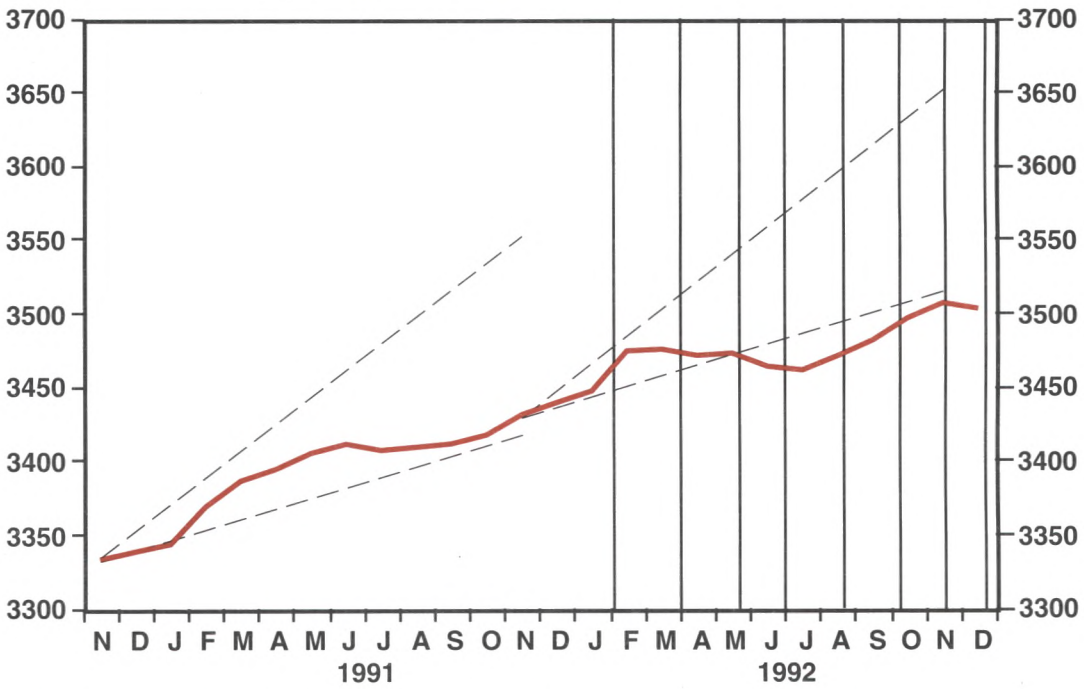
[8]November 20, 1992 press release, p. 4.

[9]This issue is treated extensively in Bullard (1992).

[10]Most estimates indicate that it takes at least six months for any effects of monetary policy actions to be apparent in the level of real output, so it is unlikely that strong growth in the second half of 1992 was the result of the July policy actions.

Figure 3
M2 and M2 Growth Ranges

Billions of Dollars, Seasonally Adjusted



Note: Vertical lines mark FOMC meeting dates. Pre-benchmark data.

been near or below the growth ranges set by the FOMC (see figure 3).[11] The slow overall growth of M2 has been accompanied by rapid growth of M1 and reserves (see figure 4). Reserve growth follows a pattern similar to M1, though at higher levels. From December 1991 to December 1992 M2 grew by 1.8 percent, M1 grew by 14.1 percent, and total reserves grew by 19.6 percent. Much of the difference between M1 and M2 growth rates can be traced to money market mutual funds and small time deposits (components of M2 but not of M1), which fell substantially during this period.

The FOMC's stated policy objectives are to "foster price stability and promote sustainable growth in output." Monetary aggregates, particularly M2, are closely monitored by the FOMC partly because of their historically close relationship (by macroeconomic standards) with nominal GDP. The growth rate of nominal GDP is approximately equal to the growth of real GDP plus the inflation rate. Nearly all macroeconomists agree that money's long-run effect is almost entirely on the price level; that is, the only thing a central bank can do for the economy in the long run is to keep the inflation rate low. Though many macroeconomists argue that short-run economic growth can be bought at the expense of future inflation, almost all agree that higher growth induced in this way cannot be sustained in the long run.[12] The records of FOMC meetings indicate that Committee discussions take for granted that monetary policy has an effect on real economic activity in the short run.[13]

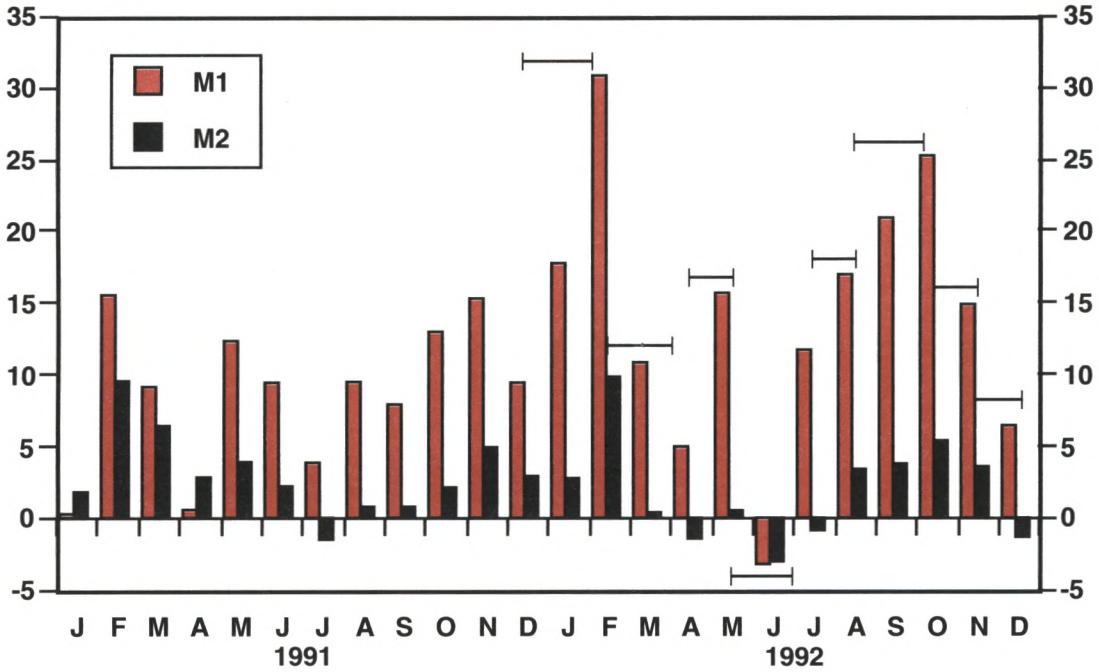
[11]Data on the monetary aggregates were benchmarked at the end of 1992. All monetary data in both text and charts of this article are pre-benchmark data.

[12]Economists who agree with this statement as a theoretical proposition can be subdivided into those who think that monetary policy can help stabilize real GDP and those who think that the attempt is likely to be counterproductive in practice, even if it is possible in principle.

[13]The April 3 press release, for example, states, "The members generally agreed that enough monetary stimulus probably had been implemented to foster the desired upturn in economic activity ... " (p. 16).

Figure 4
Growth of M1 and M2

Seasonally Adjusted Annual Rates



Note: Horizontal bars indicate FOMC meetings (right end) and last available data (left end). Pre-benchmark data.

In recent years many economists and policymakers have agreed that it is desirable to use a monetary aggregate as an intermediate indicator of the thrust of monetary policy. Unfortunately, the economic theory underlying these conclusions is not specific enough to recommend the use of any particular monetary aggregate. An ideal monetary aggregate has a strong connection with policymakers' goals but is also closely related to their actions, primarily open market operations. No single aggregate has met both criteria consistently over time. For several years the FOMC has paid closer attention to M2 because it has been a somewhat better indicator of the long-run growth of nominal income.[14] The Federal Reserve has more direct influence over M1, however, because its checkable deposit component is closely tied to the level of reserves.[15] That there is a tighter link between Federal Reserve actions and narrower aggregates such as M1 has persuaded some economists and policymakers to give relatively more weight to narrower aggregates in evaluating the stance of monetary policy.[16]

[14]During the early 1980s the FOMC paid close attention to M1. In 1982, they began to place more emphasis on M2 but still set M1 growth ranges. In 1987 they decided to quit setting M1 targets, citing "uncertainties about its underlying relationship to the behavior of the economy and its sensitivity to a variety of economic and financial circumstances." See Federal Reserve Board of Governors (1987).

[15]It should be noted, however, that one of the factors that led the FOMC to begin to de-emphasize M1 in the early 1980s was the difficulty in controlling the aggregate during a period of rapid deregulation and financial innovation.

[16]Members of the Shadow Open Market Committee (a group of academic and business economists not affiliated with the Federal Reserve System) have often expressed these views in their critiques of FOMC policy.

The juxtaposition of rapid growth of M1 and reserves with the slow growth of M2 was the monetary conundrum policymakers faced in 1992. Though the Committee no longer sets a target range for M1, this is more than an arcane technical issue: If the relationship between M2 and nominal GDP had broken down, the slow growth of M2 might be misleading, and the rapid growth of reserves and M1 might signal increasing future inflation. If not, the slowdown of M2 might reliably signal slow growth of nominal income that could endanger the economic recovery in the short run and cause deflation in the long run.

An observer who was convinced that the relationship between M2 and nominal GDP had not broken down, even temporarily, might argue that, though the growth of M1 and reserves was high by historical standards, it was inadequate and that monetary policy was not sufficiently expansionary. Another observer, convinced that there had been a breakdown of the link between M2 and nominal GDP, might argue that slow M2 growth was not a cause for concern, but that rapid M1 growth signaled future inflation. Most observers saw more uncertainty and found their own views somewhere between these extremes.

Why Did M2 Slow Dramatically?

Most hypotheses about the proximate causes of the slowdown in M2 growth point to changes in relative returns on M2 assets. Interest rates on assets included in the M2 aggregate but not in M1 fell relative to interest rates on other assets, and the public therefore preferred to hold these other assets. Portfolios were adjusted in two directions. Because the opportunity cost of holding transactions balances (mostly M1 assets) relative to other M2 assets had declined, the public could afford the convenience of larger transactions balances, thus increasing M1 while the non-M1 components of M2 declined. Perhaps most important was the movement in the other direction, from M2 assets, such as small time deposits, to higher-yielding alternatives not included in the M2 aggregate.[17]

The movement of interest rates on non-M1 components of M2 relative to other assets was caused partly by the sharp widening of the spread between short- and long-term interest rates (M2 assets tend to have relatively short maturities) and partly by various factors that depressed M2 interest rates relative to those on other assets of comparable maturities. One of these factors may have been slack demand for bank loans. Firms and consumers faced with uncertain demand and income appeared reluctant to borrow at current interest rates. Banks, seeing the return on new loans little above Treasury yields, were unwilling to bid up deposit rates. The slack demand for bank loans may also reflect a long-run decline in depository institutions' share of total intermediation.

It has also been argued that various regulatory changes, including higher capital requirements, higher deposit insurance premiums and closer regulatory scrutiny of portfolios, have increased the cost of bank intermediation, driving a larger wedge between the rates charged and the rates paid by depository institutions.

Though the relevance of many of these factors has been apparent for several years, the lack of historical precedent has made it extremely difficult to predict the magnitude and duration of their influence on M2.

Did the Relationship between M2 and Nominal GDP Change?

The relationship between M2 and nominal GDP is summarized by M2 velocity, the ratio of nominal GDP to M2. If nominal GDP grows at the same rate as M2, velocity is constant. When nominal GDP grows more quickly (slowly) than M2, velocity increases (decreases). Historically M2 and nominal GDP have grown at approximately the same rate when averaged over long intervals. In the short run, when nominal GDP and M2 growth rates often differ, M2 velocity has usually moved in the same direction as the opportunity cost of holding M2 assets, as shown in figure 5. The opportunity cost measure shown is the difference between the three-month Treasury bill rate (representing assets not included in M2) and a weighted average of the interest rates paid on M2 assets. Simple economic reasoning suggests that, all else equal, as the true opportunity cost rises, consumers and businesses should decrease the quantity of M2 assets they hold. They may, for example, substitute Treasury bills, which are not in M2, for small time deposits, which are in M2. This substitution causes M2 to fall and M2 velocity to rise.

[17]One such high-yield alternative for many firms and consumers was to pay off or avoid debt.

Figure 5
M2 Velocity and Opportunity Cost

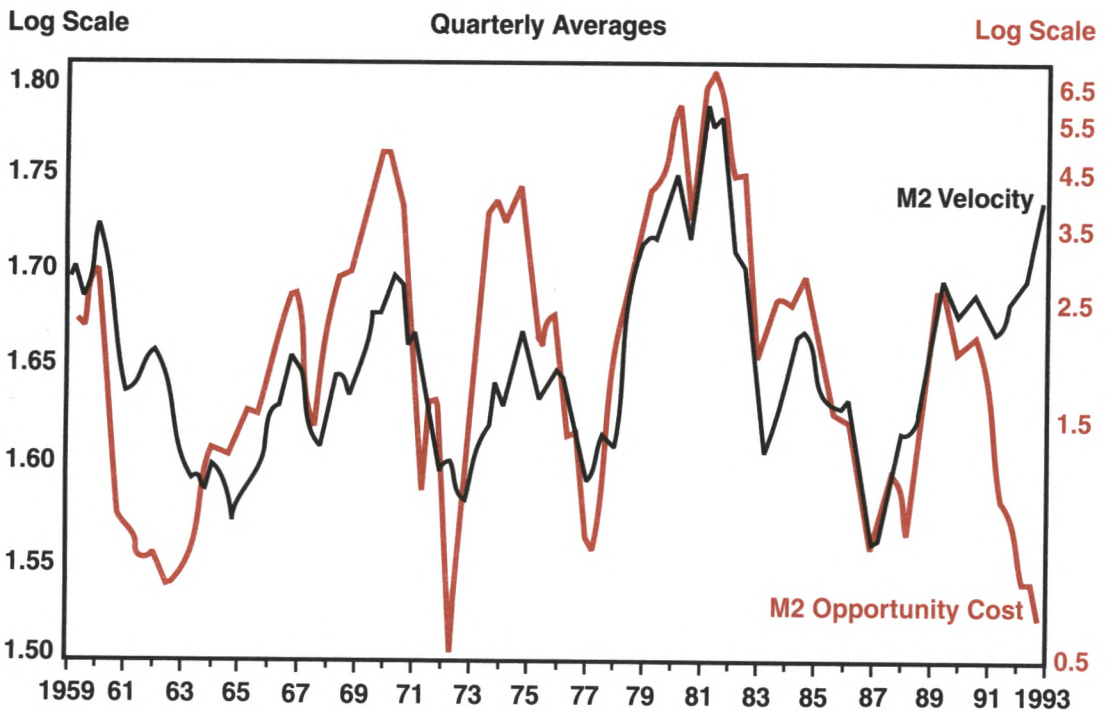


Figure 5 shows a substantial rise in M2 velocity during 1991 and 1992. This would not be particularly remarkable (several similar episodes are shown) except that the opportunity cost measure moved in the opposite direction. The unprecedented size and duration of the divergence of these variables have been interpreted as evidence that the relationship between M2 and nominal GDP may have changed. If this were true, it would then be difficult to discern the implications of the slow growth of M2. This uncertainty about the link between M2 and nominal GDP led some observers and policymakers to give added weight to other variables in assessing the stance of monetary policy. Concerns about rapid M1 and reserve growth were reinforced by the general steepening of the yield curve during the year, which appeared to indicate market expectations of rising short-term interest rates. The expected increases could mean that the investors required a premium to compensate for rising expected inflation or that economic recovery was expected to drive real interest rates higher. Either interpretation would imply that monetary policy had been sufficiently expansionary despite the evidence of slow M2 growth.

A different interpretation of the divergence between M2 velocity and opportunity cost is that the relationship has always been more complicated than figure 5 implies, but only recently has this become important.[18] The breakdown in the relationship might be only an artifact of mismeasurement of the opportunity cost variable and does not necessarily imply a break between M2 and nominal GDP.

The argument starts by observing that in principle the entire spectrum of interest rates is germane to an individual's decision to hold a particular M2 asset. In the opportunity cost measure shown in figure 5 the three-month

[18]Feinman and Porter (1992) develop this argument in depth.

Treasury bill rate represents yields on all non-M2 assets. For the three-month rate to capture all of the relevant movements in these yields, interest rates on all non-M2 assets must move in parallel with it. Figure 5 shows that this approach has worked well historically, but changes in returns on non-M2 assets in recent years may no longer be summarized by movements in the Treasury bill rate. On this view the divergence between M2 velocity and the measure of opportunity cost shown in figure 5 does not indicate a breakdown in the long-run relationship between M2 and nominal GDP. Rather this implies that the recent rise in velocity–like previous episodes–is temporary, induced largely by the widening of the difference in yields on short- and long-term assets and the consequent failure of this measure to capture the true opportunity cost of M2. If so, M2 velocity may fall and M2 growth may accelerate when the difference narrows. However, wariness about short-run growth of M2 as an indicator of nominal GDP growth is still warranted.

One effort to implement this line of reasoning empirically by estimating an opportunity cost using a broader set of non-M2 yields concludes that "seen against the background of a more complete accounting of relevant interest rate margins, the recent behavior of M2 is not nearly as anomalous as suggested by the standard model."[19] The authors note, however, that their study does not entirely resolve the puzzle.

The FOMC did not take a radical position on the question of whether M2 was growing too slowly. Though the record of every 1992 meeting indicates substantial concern over this issue, every 1992 policy directive called for maintaining the "existing degree of pressure on reserve positions" (see table 1). On the other hand, the largest move toward ease occurred in early July after M2 fell below the lower bound of its growth range. Moreover, every easing action followed a period in which M2 declined or its growth fell significantly below expected levels.

Members of the FOMC expressed a range of views about whether the Fed should ease enough to ensure that M2 growth rebounded to the bottom of its growth range. Jerry Jordan, president of the Federal Reserve Bank of Cleveland, maintained that it is particularly important to achieve M2 growth in the target range and voted against the proposed directive at two meetings for this reason. Governor Lawrence Lindsey joined him once in his dissent.

At the other end of the spectrum Governor John LaWare and the president of the Federal Reserve Bank of St. Louis, Thomas Melzer, voted against policy directives on four occasions because they felt that a bias toward ease was inappropriate during the second half of the year. They believed that slow M2 growth was sending a misleading signal and that earlier easing actions by the FOMC would be sufficient to support economic recovery, despite slow M2 growth.

DETAILED CHRONOLOGY OF FOMC ACTIVITY

The FOMC meets eight times each year. At the end of each meeting the Committee issues a directive to the Federal Reserve Bank of New York to guide open market operations until the next meeting. The Committee typically gives the Chairman some flexibility to initiate policy actions between meetings (during 1992 all actions were taken between meetings). These actions are sometimes agreed on during a conference call among the members, but this was not done during 1992.[20]

A summary of each meeting, the record of policy actions, is released to the public shortly after the next meeting. The record is also published in the *Federal Reserve Bulletin*. The shaded insert explains some of the language used in the monetary policy directives and discussions of monetary policy.

The following summaries of FOMC meetings and policy actions between the meetings are intended to give a sense of the main concerns of the Committee and the information available at the time. In general the most recent economic information available to the FOMC is for a period that ended at least one month before the meeting. The main exceptions to this are interest rates, which can be observed daily, and some data that are collected and assembled by the Federal Reserve System–for example, components of the industrial production index and the monetary aggregates. Figure 6 shows some

[19]Feinman and Porter (1992), p. 21.

[20]When such consultations take place, they are noted in the record of the next meeting. Less formal consultations may take place, but not be noted in the record.

Table 1
FOMC Directives and Measures of Monetary Policy Stance

Meeting	Main Thrust[1]	Intermeeting Stance toward Ease[2]	Intermeeting Stance toward Restraint[3]	Change in Discount Rate	Change in Expected Fed Funds Rate[4]	Growth[5] of M2	Growth[5] of M1
1991							
February 5–6	maintain	would	might		–0.25	6.46	8.39
March 26	maintain	might	might	–0.5	–0.25	4.62	5.67
May 14	maintain	might	might			1.30	9.10
July 2–3	maintain	might	might		–0.25	–0.51	4.94
August 20	maintain	would	might	–0.5	–0.25	–1.66	6.66
October 1	maintain	would	might		–0.25	3.56	13.68
November 5	decrease	would	might	–0.5	–0.5	5.44	10.53
December 17	maintain	would	might	–1.0	–0.5	4.73	23.78
1992							
February 4–5	maintain	would	might			–1.13	6.93
March 31	maintain	would	might		–0.25	0.37	12.22
May 19	maintain	might	might			–2.79	–2.38
June 30–July 1[6]	maintain	would	might	–0.5	–0.5	2.35	14.80
August 18[6]	maintain	would	might		–0.25	4.93	27.69
October 6[6]	maintain	would	might			2.10	13.58
November 17[6]	maintain	would	might			0.52	8.48
December 22	maintain	would	would			–6.68[7]	5.06[7]

[1]Directive says, " _____ existing degree of pressure on reserve positions."
[2]Directive says, "slightly/somewhat lesser reserve restraint _____ be acceptable ..."
[3]Directive says, "slightly/somewhat greater reserve restraint _____ ... be acceptable ..."
[4]1991 data from table 3 of Sternlight et. al. 1992 data from table 3 of McDonough et al.
[5]Percent change at an annual rate from week of meeting to week before the following meeting.
[6]Some members voted against this directive. For details, see the discussion of this meeting in the text or the appendix.
[7]Based on post-benchmark data.

of the monthly economic data regularly considered by the Committee. Short horizontal lines in each chart illustrate the data lags faced by the Committee. (This device is used in figure 4 as well.) The right end indicates the meeting date and the left end shows last data available to the Committee at the time of the meeting. In addition to this delay, most data series are subject to revision after their initial release. Figure 6 plots the current revisions of the data, but significant inconsistencies between the original release and the revised data are noted below. Table 1 provides an overview of the direction of monetary policy during 1991 and 1992.

February 4–5, 1992, Meeting

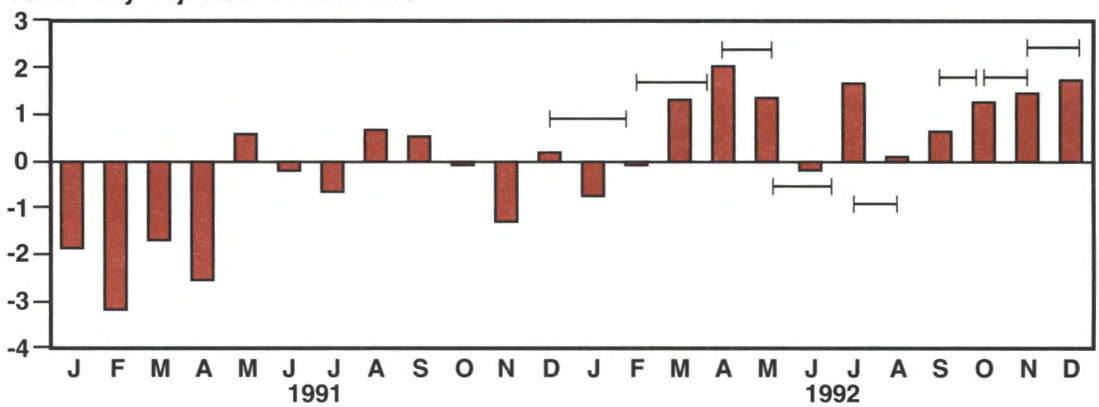
The Committee's first task of the year was to set growth ranges for the monetary aggregates. A growth range of 2.5 percent to 6.5 percent for M2 had been tentatively set in July 1991. For several years before 1991 the FOMC had been gradually lowering the range toward a level consistent with price stability. Several members expressed a preference for resuming this trend as a signal of the Committee's commitment to price level stability, though all found the current range acceptable. Because of puzzling recent behavior of M2 (discussed above), uncertainty was expressed over how monetary growth in these target ranges would affect economic activity and inflation. The members judged, however, that the 2.5 percent to 6.5 percent range would "provide adequate leeway and operational flexibility to accommodate a satisfactory economic performance."[21] They noted, however, that "the substantial uncertainties

[21]April 3, 1992 press release, p. 12.

Figure 6
Monthly Economic Indicators

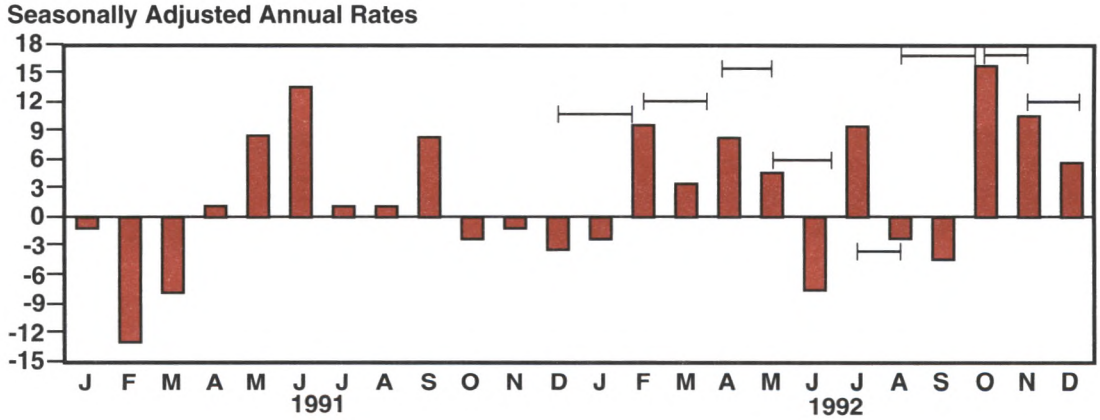
Growth of Nonfarm Payroll Employment

Seasonally Adjusted Annual Rates



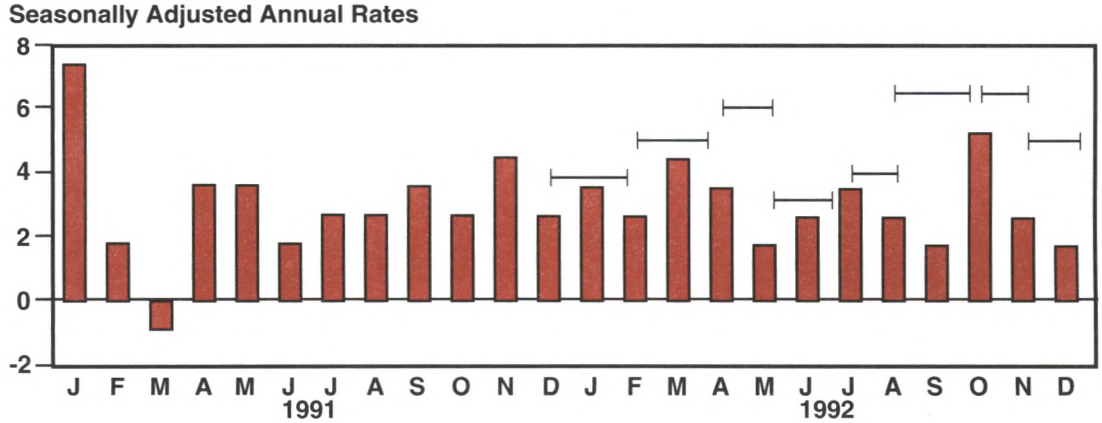
Growth of Industrial Production

Seasonally Adjusted Annual Rates



Consumer Price Index Inflation

Seasonally Adjusted Annual Rates



Note: Horizontal bars indicate FOMC meetings (right end) and last available data (left end).

surrounding the outlook for M2 suggested that the Committee would have to approach monetary developments with a great deal of flexibility over the year ahead."[22] Growth ranges of 2.5 percent to 6.5 percent for M2 and 1 percent to 5 percent for M3 were approved unanimously.

In setting policy for the weeks until the next meeting, there was clear consensus that no dramatic action should be taken, particularly since significant easing had been undertaken late in 1991. Nonetheless, the Committee expressed concern about the uncertain state of the economy. Though there were some positive signals, nonfarm payroll employment had been flat in December, and both retail sales and industrial production had fallen slightly in November and December.[23] The pace of inflation had continued to decline. The economic projection prepared by the Board staff predicted "a recovery of economic activity."[24]

Some members expressed concern about the recent erratic behavior of M2. A staff analysis indicated that M2 could be expected to grow more rapidly given current conditions.

> However, expansion of M2 probably would continue to be restrained by the aggressive reductions by depository institutions in their offering rates on deposit components of this aggregate and the continuation of related shifts of M2 funds into higher-yielding capital market instruments. In addition, the expected pickup in the pace of RTC resolutions over the balance of the first quarter would tend to moderate the growth of M2 and especially M3. To the extent that subdued growth of the broader aggregates were to reflect such special influences, there would not be significant adverse implications for the overall performance of the economy.[25]

The Committee voted to maintain existing conditions in reserve markets but, with the possibility of deteriorating economic conditions in mind, voted for a bias toward easing.

March 31, 1992, Meeting

New economic data did not clarify the economic situation following the February 4–5 meeting. Nonfarm payroll employment dropped slightly in January but reversed itself in February. Industrial production followed a similar but more pronounced pattern. Strong retail sales and shipments of nondefense capital goods provided some bright spots in the January and February data. Prices were increasing at about the same rate as a year earlier. The economic projection prepared by the Board staff predicted "continued recovery in economic activity."[26] Reports on economic conditions in the 12 districts tended to support this point of view.

While short-term rates had held steady since the last meeting, longer-term rates jumped substantially, particularly at intermediate maturities (figure 2). In the apparent absence of an intended or unintended action raising short-term rates, the Committee viewed the jump as a sign that markets were interpreting other economic news as evidence of growing economic momentum.[27]

The Committee was troubled by the renewal of weak M2 growth. After significant easing late in 1991, M2 growth was relatively robust in January and February, but it appeared that M2 had quit growing or possibly declined in March (data for the end of March were not yet available), contrary to expectations at the previous meeting. Some members were concerned that slow growth of M2, should it continue, "could signal that monetary policy was not positioned to support a satisfactory expansion."[28] Some observed that it was the behavior of M2 and M3 rather than economic conditions that persuaded them in favor of bias toward ease in the directive.[29]

The Committee unanimously adopted another directive biased toward ease, though a minority of members would have favored a symmetric directive in view of evidence of a strengthening economy. The majority, however, "remained concerned about the vulnerability of the expansion to a variety of risks."[30]

April Easing

In early April it became clear that M2 had in fact begun to decline during March. Together with "indications that the economic expansion was not as strong as its pace early in the year" this led to a decision to ease monetary condi-

[22]April 3, 1992 press release, p. 13.

[23]Later revisions indicate a slight increase in retail sales.

[24]April 3, 1992 press release, p. 6.

[25]April 3, 1992 press release, p. 18.

[26]May 22, 1992 press release, p. 5.

[27]May 22, 1992 press release, p. 4.

[28]May 22, 1992 press release, p. 12.

[29]May 22, 1992 press release, p. 13.

[30]May 22, 1992 press release, p. 11.

tions in early April.[31] Besides M2, retail sales was the only prominent economic indicator that turned down. Employment and industrial production both rose during March. After this easing action the federal funds rate fell more than 0.5 percentage points from around 4.0 percent, but it eventually stabilized around 3.75 percent.

May 19, 1992, Meeting

Payroll employment and industrial production increased through April, continuing the trend started at the beginning of the year. Retail sales rebounded from a March drop, and there was evidence that fixed investment was picking up after an April drop in shipments.[32] The staff projection was again "continuing recovery."[33] Overall, the evidence suggested a modest recovery with a broad base across regions and industries.

Once again the behavior of the monetary aggregates was a central focus of concern. Both M2 and M3 contracted during March and from March to April, leaving them below the levels expected by the Committee at its March 31 meeting.[34] Though many thought that temporary technical considerations accounted for part of this decline, some Committee members regarded the weakness of M2 and M3 as "indicative of an increase in the downside risks to the expansion."[35] Others felt instead that "a variety of developments ... seemed to have altered previous relationships between M2 and M3 and measures of spending and income."[36] Therefore "satisfactory economic expansion would tend to be consistent with weaker growth and a higher velocity of M2 than would be suggested by historical relationships."[37] Some members felt in addition that "the strength of M1 and reserves ... could raise questions about the consistency of current monetary policy with progress toward price stability."[38]

Though some members would have preferred bias toward ease, whereas others preferred to tilt the directive toward restraint, the Committee agreed unanimously on a policy of unchanged pressure in reserve markets with symmetric language.

June 30–July 1, 1992, Meeting

Through May, payroll employment and industrial production continued the weak upward trend started at the beginning of the year, suggesting that expansion continued at a very modest pace. However, "recent information suggested some weakening in the expansion."[39] Growth of consumption expenditures in particular had slowed significantly. The staff projection predicted a "modest pickup in economic growth over the second half of the year."[40] Members reported that the expansion continued to be geographically broadly based, though there were significant exceptions, notably California.

The growth of M2 and M3 was still weak in May, and available information for June indicated contraction, leaving the aggregates below the lower end of the growth ranges.

The policy record indicates that at the June 30–July 1 meeting, FOMC members had more diverse opinions about policy for the immediate future than at the May meeting. Some members preferred an immediate easing of policy. Of those who preferred easing, some emphasized "the recent indications of some slowing in the expansion and the already considerable slack in the economy," whereas others highlighted "the desirability of taking relatively prompt action to foster growth in the broad measures of money within the Committee's ranges for the year."[41] The Committee voted to return to a directive biased toward ease. John LaWare and Thomas Melzer objected to the asymmetric directive because "the current stance of monetary policy was not impeding an expansion consistent with the economy's long-run potential"[42] and because in the context of the previous symmetric directive it "suggested an excessive emphasis on short-term economic developments that might undermine the credibility of the System's long-run policies."[43]

The Committee also reaffirmed the 1992 growth ranges for M2, M3 and total domestic nonfinancial debt and tentatively decided to maintain the same growth ranges for 1993.

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[31] July 2, 1992 press release, p. 4.

[32] Revised retail sales data show a slight decline in April.

[33] July 2, 1992 press release, p. 6.

[34] July 2, 1992 press release, p. 6.

[35] July 2, 1992 press release, p. 11.

[36] July 2, 1992 press release, p. 11.

[37] July 2, 1992 press release, p. 12.

[38] July 2, 1992 press release, p. 12.

[39] August 21, 1992 press release, p. 7.

[40] August 21, 1992 press release, p. 5.

[41] August 21, 1992 press release, p. 17.

[42] August 21, 1992 press release, p. 21.

[43] August 21, 1992 press release, p. 21.

July Easing

The day after the FOMC meeting (July 2) the Department of Labor reported that payroll employment had fallen by 117,000 (1.3 percent at an annual rate) in June after four months of slow growth.[44] Also on July 2 the Board of Governors voted to lower the discount rate from 3.5 percent to 3.0 percent, and open market operations were implemented to let the federal funds rate fall by a comparable amount.[45] Figure 2 shows that the federal funds rate, which had hovered around 3.75 percent, fell sharply to about 3.25 percent. There was no telephone conference regarding this change in the intermeeting policy.

August 18, 1992, Meeting

At its August 18 meeting, the Committee concluded that though expansion continued, its pace had slowed.[46] July payroll employment had reversed the June decline, but both numbers were propped up by temporary hiring in a new federally sponsored summer jobs program. Industrial production followed the same pattern–recovery in July from a June drop. Retail sales increased moderately in July following a second-quarter slowing, while shipments of nondefense capital goods rose sharply in June. Market interest rates at all maturities fell substantially during July following the easing action but probably also reflected the sluggishness of the expansion. The staff projection pointed to a continuing pattern of "subdued economic expansion."[47] Some members noted that "they could not identify any sector of the economy that seemed primed to provide the impetus needed for a vigorous expansion," though they noted "considerable progress ... toward redressing earlier over-expansion and credit excesses."[48]

Members expressed considerable optimism about the inflation outlook, citing "increasingly persuasive evidence of slower rates of increase in wages and prices."[49]

The monetary aggregates remained an important concern. M2 and M3 contracted further in July and continued below the lower end of the growth ranges. Following the easing in early July, M1 (which had fallen during June) began a period of rapid growth in July.

Some members felt further easing was in order, but a majority favored an unchanged policy that recognized the potential for conditions warranting easing. The behavior of the broad monetary aggregates was regarded as a significant factor "in favor of careful consideration of" further easing.[50]

A directive biased toward ease was adopted with support from some members who favored a symmetric directive. John LaWare and Thomas Melzer voted against this action citing reasons similar to those mentioned in their previous dissent.

September Easing

In early September, after slower-than-expected response of M2 to the July easing and economic data (including a sharp increase in initial unemployment insurance claims) that continued to indicate sluggish economic growth, an easing action was implemented. For technical reasons the federal funds rate remained higher than expected following this action, but it settled to around 3.0 percent by the end of October.[51]

October 6, 1992, Meeting

The policy record for the October meeting gives a picture of economic developments very similar to that from the previous meeting–"economic activity was expanding at a subdued pace."[52] Nonfarm payroll employment fell slightly in August and again in September, though the latter partly reflected the end of the summer jobs program mentioned above.[53] Industrial production fell in August and partial information for September "suggested further weakness." Consumption seemed to have slowed through August after a period of robust growth. Shipments of nondefense capital goods slowed during July and August, a sign of possible renewed weakness in investment. The staff projection "indicated that economic activity would expand at a slow pace in the current

[44]See U.S. Department of Labor (1992). Revised data show a less substantial fall of 0.18 percent.

[45]October 9, 1992 press release, p. 4.

[46]October 9, 1992 press release, p. 1.

[47]October 9, 1992 press release, p. 6.

[48]October 9, 1992 press release, p. 8.

[49]October 9, 1992 press release, p. 10.

[50]October 9, 1992 press release, p. 12.

[51]November 20, 1992 press release, p. 4.

[52]November 20, 1992 press release, p. 1.

[53]Subsequent revision to the employment data made the September drop into a slight rise as shown in Figure 6. November 20, 1992 press release, p. 1.

quarter" but would pick up gradually in 1993.[54] Many members again worried that, "No important sector of the economy seemed poised to provide much impetus to business activity ..."[55] Several members felt that recent volatility in some asset markets, particularly the foreign exchange market, underscored the risks of potentially adverse developments.[56] On the plus side they noted that declines in the dollar and domestic interest rates "suggested improved conditions for greater expansion."[57] The inflation outlook continued to be favorable.

M2 and M3 began to grow again in August, but only slowly. The weak growth appeared to have continued into September, and both aggregates were expected to finish September below the bottom end of the growth range.

The same range of opinions on policy for the immediate future was expressed. The policy record, however, indicates a clear shift toward ease in the balance of members' opinions. Though the policy directive contains exactly the same wording stating a bias toward ease, the record indicates that a majority of the Committee supported a directive "strongly" biased toward possible ease, with "a decided presumption of some easing," and with "a marked bias toward possible easing."[58] Four members voted against the directive. John LaWare and Thomas Melzer favored a symmetric directive for the reasons stated at previous meetings, adding their concern that an easing action might destabilize the dollar.[59] Mr. Melzer was also concerned that continued rapid M1 growth might jeopardize progress toward price stability. Two other Committee members, Jerry Jordan and Governor Lawrence Lindsey, favored immediate easing sufficient to "achieve the Committee's preannounced target growth for M2."[60] They indicated that this action should be accompanied by an announcement that the growth range would be lowered in 1993 to signal that the easing did not indicate a discounting of the FOMC's goal of price stability.

November 17, 1992, Meeting

More optimism about the pace of economic activity was evident at this meeting: "economic activity had been expanding at a moderate pace."[61] Nonfarm payroll employment had risen slightly in October following two months of declines. Industrial production rose in October "following a modest increase in the third quarter."[62] (The July increase had offset slight declines in August and September.) Stronger retail sales in September and October, stronger housing sales and starts, and anecdotal evidence all suggested stronger overall consumption spending. Another strong increase in outlays for producers' durable equipment in the third quarter implied renewed strength in investment. Increasing interest rates, particularly at intermediate maturities, suggested that the more optimistic outlook was shared by financial markets. The staff projection "suggested a continuing expansion in economic activity."[63] In discussion "the members indicated that they were encouraged by the somewhat more positive tone in the latest economic reports and by the signs of improving business and consumer confidence."[64]

M2 growth picked up in October. Combined with the more favorable economic reports, this had deterred a move toward ease despite the strong presumption in favor of ease at the October meeting. Further easing had been expected by financial markets, and correction of this expectation was regarded as partly responsible for the rise in interest rates.

Many members preferred a symmetric policy for the upcoming weeks, believing that "risks to the expansion were now fairly evenly balanced."[65] Others still preferred a bias toward ease, but without the strong presumption understood at the previous meeting. The Committee once again adopted a directive biased toward ease. Jordan, LaWare and Melzer voted against this action for reasons similar to those expressed at the previous meeting.

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[54]November 20, 1992 press release, p. 6.

[55]November 20, 1992 press release, p. 7.

[56]The European Exchange Rate Mechanism collapsed on September 16.

[57]November 20, 1992 press release, p. 7.

[58]November 20, 1992 press release, pp. 10, 11 and 13.

[59]November 20, 1992 press release, p. 16.

[60]November 20, 1992 press release, p. 15.

[61]December 24, 1992 press release, p. 1.

[62]December 24, 1992 press release, p. 1.

[63]December 24, 1992 press release, p. 6.

[64]December 24, 1992 press release, p. 7.

[65]December 24, 1992 press release, p. 13.

December 22, 1992, Meeting

As figure 1 indicates, real GDP rose significantly in the third quarter and the available evidence for the fourth quarter indicated that this pattern was continuing. Nonfarm payroll employment again rose slightly in November. Industrial production also increased. Retail sales rose sharply through November, and sales and starts of single-family homes showed sizable growth.[66] Shipments of nondefense capital goods continued to expand. Yields on long-term bonds fell, but this was attributed to favorable market reaction to "indications that the incoming Administration would give emphasis to reducing the federal budget deficit over time," rather than to the weakening recovery.[67] The staff projection "suggested a continuing expansion in economic activity" but also indicated that the momentum of the expansion would be partly offset by weaker export demand.[68] Reports from most regions reinforced a picture of "increasingly robust business conditions," though there were notable exceptions, again including California.

M2 slowed once again in November, and this weakness appeared to continue into December. A staff analysis pointed to sluggish growth of M2 and M3 and substantial slowing in the growth of M1 during the coming months.

The Committee felt that recent positive developments warranted "a shift toward a more balanced approach to possible intermeeting changes in policy."[69] Though noting considerable uncertainty about the future course of the economy, "members observed that the next policy move might be in either direction."[70] Despite the slower M2 growth, a symmetric directive was unanimously adopted.[71]

SUMMARY

For much of 1992, stronger economic performance seemed just around the corner. Three times during the year, in April, July, and September, combinations of faltering M2 growth and possibly slowing economic activity prompted easing actions. The July action accompanied a half-point discount rate reduction. The economy was growing fairly quickly by the end of the year, despite forecasters' midyear pessimism.

Although the FOMC devoted a good deal of attention to anomalous behavior of M2, the aggregate ended the year slightly below the lower end of its growth range. Various factors led to doubt about the reliability of M2 as an indicator of economic activity and inflation, but the implications of slow M2 growth combined with rapid growth of reserves and M1 during 1992 are not yet known.

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[66] A later revision of the data shows a fall in retail sales in November.

[67] February 5, 1993 press release, p. 10.

[68] February 5, 1993 press release, p. 6.

[69] February 5, 1993 press release, p. 12.

[70] February 5, 1993 press release, p. 12.

[71] The language of the directive differed slightly from the May directive. See table 1.

Appendix
FOMC Dissents

This appendix contains the exact text of members reasons for voting against FOMC directives.

February 4–5, 1992

No dissents.

March 31, 1992

No dissents.

May 19, 1992

No dissents.

June 30–July 1, 1992

Messrs. LaWare and Melzer dissented because they judged an asymmetric directive, with a bias toward easing, as being inappropriate at this time. In their view, the current stance of monetary policy was not impeding an expansion consistent with the economy's long-run potential. In addition, a bias toward ease, especially in the context of the Committee's decision at the May meeting to adopt a symmetrical directive, suggested an excessive emphasis on short-term economic developments that might undermine the credibility of the System's long-run policies. They were concerned that such a loss of credibility could have adverse effects on the dollar in foreign exchange markets and on long-term interest rates in domestic markets. Mr. Melzer also believed that, if additional easing were undertaken, a greater policy reversal ultimately would be necessary, making the attainment of sustainable economic growth more difficult in the long run.

August 18, 1992

Messrs. LaWare and Melzer dissented because they did not favor a directive that was biased toward possible easing during the intermeeting period. In their view, monetary policy already was appropriately stimulative, as evidenced in part by the low level of short-term interest rates and by the rapid growth in reserves since early this year, and was consistent with the promotion of economic growth in line with the economy's long-run potential. Business and consumer confidence were in fact at low levels, but they reflected a variety of problems facing the economy that were unrelated to the stance of monetary policy. Accordingly, what was needed at this point was a more patient monetary policy—one that was less predisposed to react to near-term weakness in economic data and that allowed more time for the effects of earlier easing actions to be reflected in the economy. Indeed, an easing move in present circumstances might well stimulate inflationary concerns by reducing confidence in the System's willingness to pursue an anti-inflationary policy and thus could have adverse repercussions on domestic bond markets and further damaging effects on the dollar in foreign exchange markets.

October 6, 1992

Messrs. Jordan and Lindsey preferred immediate action by the Committee to increase the availability of bank reserves sufficiently to achieve the Committee's pre-announced target growth for M2 in 1992. Such reserve provision would likely be associated with further declines in short-term market interest rates. They believed that this policy action by the Committee should be accompanied by an announcement of reductions of the upper and lower limits of the range for M2 growth in 1993. They felt that it was important to make clear that near-term action to increase M2 expansion was not an abandonment of the long-term objective of non-inflationary monetary growth.

Messrs. LaWare and Melzer dissented because they did not want to bias the directive toward possible easing during the intermeeting period. In their view, a variety of indicators, including the level of short-term interest rates and the growth of reserves, suggested that monetary policy already was positioned to foster an expansion in economic activity consistent with the economy's long-run potential. Moreover, further easing at this time would incur a substantial risk of destabilizing the dollar in the foreign exchange markets. In these circumstances, they favored a steady monetary policy that was not disposed to react to near-term weakness in economic data and that allowed more time for the effects of earlier easing actions to be felt in the economy. Mr. Melzer also expressed concern that the progress already made toward achieving price stability might be jeopardized if very rapid growth in M1 were to continue.

November 17, 1992

Mr. Jordan dissented because he preferred taking immediate action to increase the availability of bank reserves sufficiently to raise M2

growth to a pace more consistent with the Committee's annual range. Because desirable M2 expansion in line with the Committee's objectives would be likely to fall within a lower range next year, he would announce concurrently a reduction in the 1993 range to make clear that near-term action to increase M2 expansion was not an abandonment of the long-term objective of non-inflationary monetary growth.

Messrs. LaWare and Melzer dissented because they did not want to bias the directive toward possible easing during the intermeeting period. In their view, recent developments pointed to a strengthening economy, and they favored a steady policy that was not predisposed to react to near-term weakness in economic or monetary data. More time was needed to evaluate the effects of prior monetary policy actions, and they were concerned that the adoption of a more stimulative policy over the near term might well establish a basis for greater inflation later. Mr. Melzer was concerned that rapid growth in total bank reserves, the monetary base, and M1 over the last two years might already have laid a foundation for accelerating nominal GDP growth and a reversal of the disinflationary trend. In addition, he noted that policy errors can easily be made at this stage of the business cycle. In an economic expansion, efforts to resist increases in the federal funds rate through large reserve injections eventually lead to higher inflation and higher nominal interest rates.

December 22, 1992

No dissents.

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