THE STRATEGY OF MONETARY POLICY

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I. Introduction

While much has been written over the years concerning monetary policy, there is apparently a discontinuity in the flow of information between policymakers, on the one hand, and academic researchers and participants in financial markets, on the other. Much of this lack of communication centers specifically on the formulation and implementation of monetary policy. As a result, much of the research into the policy process is based on incorrect assumptions concerning how policy is managed. Sherman Maisel, a former member of the Federal Reserve Board of Governors, argues that the Fed itself is a source of this communications gap: "The Fed has always resisted being too specific about [its] methods and its goals, clothing its operations in a kind of mystique that left it more freedom to maneuver" [18, p. 26].

In the opinion of many policy observers, this communications failure has real costs, both in terms of public understanding and the effectiveness of policy. While the Fed is reluctant to specify its procedures too explicitly in order to protect its freedom of action, "its attempt to protect itself from both outside critics and internal disappointment . . . weakens its ability to improve its performance" [18, p. 311].

Recently a number of papers have been directed toward unraveling the mystique that surrounds monetary policy.[1] The purpose of this article is to synthesize and extend the recent literature on this subject and thereby provide an interpretation of the monetary policy process and a model of current open market strategy. Hopefully, this article will contribute to a better understanding of current policy procedures and will help to identify problem areas toward which further research should be directed.[2]

This article consists of seven sections. Section II presents the background to the current strategy. The following three sections describe long-run aspects of current policy formulation, the linkages between the long- and short-run policy process, and short-term open market strategy, respectively. An analysis of the effect of the constraint on interest rate volatility on short-run policy actions is presented in Section VI, followed by some final remarks in Section VII.

II. The Evolution of the Current Strategy

An important paper by Jack Guttentag, published in 1966, described the Federal Reserve's policy procedures of the 1950's and early 1960's as the money market strategy [10]. Under the money market strategy, the Federal Reserve's proximate focus was on the "condition of the money market"—generally understood to include the value of a constellation of interest rates, free reserves, and the inventory positions and financing costs of securities dealers. With such national economic goals as full employment and price stability remote in time and causal connection from conditions in the money market, the use of money market conditions as a proximate target tended to focus policy too narrowly. As a result, Guttentag argued:

> **The main weakness of the [money market] strategy is its incompleteness, i.e., the fact that the Federal Open Market Committee (FOMC) does not set specific quantitative target values for which it would hold itself accountable for the money supply, long-term interest rates, or any other 'strategic variable' that could serve as a connecting link between open market operations and system objectives; rather it tends to rationalize the behavior of these variables after the fact [10, p. 1].**

To correct the deficiencies in the money market strategy, Guttentag suggested that the Fed adopt a complete strategy—consisting of quantifiable targets specified over given control periods, with the sequence of targets linked empirically to the ultimate price and output goals of the economy. Targets are

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[1] See, for example, the important articles by Axilrod and Beck [1], Brimmer [3], Kane [12], Maisel [17], Pierce [22, 23], Pierce and Thomson [25], Poole [26], and Tschinkel [29].

[2] This discussion is not meant to imply that all monetary research has been useless or that no one understands the essence of current policy procedures. With regard to the latter, it is clear that many financial market analysts have considerable expertise in assessing the implications of day-to-day Federal Reserve actions.

defined as strategic variables that policymakers can affect by manipulating policy instruments.[3] Included in the set of targets are both intermediate targets such as interest rates, bank reserves, and monetary aggregates, and longer-term final targets (or goal variables) such as output, employment, and prices. Instruments are the magnitudes under direct policy control and include open market operations, the discount rate, reserve requirements, and interest rate ceilings.

A control period is the time interval over which the attainment of targets is planned. A complete policy strategy involves a number of control periods, each giving primary emphasis to different target variables. For example, over a weekly control period, an operating target such as the Federal funds rate or nonborrowed reserves might receive emphasis; over a monthly or quarterly control period, an intermediate target such as the growth rate of M_1 might receive emphasis. In control periods as long as six months or a year, long-term target variables such as output and employment would be the major policy goals.

A strategy is complete if its intermediate target is a strategic variable, linked empirically to the economy's long-term output, price, and employment goals. This implies that the policymaker is cognizant of the linkages among the various elements of the strategy. In a more formal sense, a model of the monetary policy transmission mechanism such as: instrument→intermediate target→long-term target must be developed.[4]

Guttentag was careful to distinguish between policy strategy, which involves the selection of the target variables to be explicitly considered by policymakers, and policy formulation, which involves the setting of specific values, or *dial settings,* for the target variables. In selecting these values, the policymaker examines a set of policy determinants such as relevant financial and economic data and forecasts. Clearly the development of an overall policy strategy is logically prior to policy formulation, since the particular policy determinants that the policymaker considers are dependent upon the strategy being pursued and the transmission mechanism it embraces [7, pp. 6-11].

The thrust of the Guttentag critique was reinforced by a number of events that increased public awareness of monetary policy. In the late 1960's the economic stimulus provided by the Vietnam war and the delay of the 1968 tax surcharge and the intellectual stimulus of the monetarist counter-revolution served to focus increasing public attention on monetary policy. During the same period, the development of large-scale econometric models reflected the substantial impact of monetary policy on economic activity and tended to emphasize quantification of policy targets. In view of these developments, it is perhaps not surprising that the Federal Reserve moved toward the development of a more complete strategy. In 1966 the FOMC added a "proviso clause" to its Directive, giving explicit weight to movements in bank credit in determining policy actions. In 1970 the FOMC first began to include explicit references to monetary aggregates in its instructions to the Trading Desk. An important step in this ongoing process was probably the appointment of Arthur Burns as Chairman of the Federal Reserve Board in early 1970. In this regard Maisel states: "From the first day in office [Burns] put the weight of his office behind greater quantification" [18, p. 70].

The result of this evolutionary process can be stated simply—monetary aggregates (e.g., M_1, M_2, M_3, and bank credit) now receive more weight in policy deliberations and actions. The Directive—the FOMC's instructions to the Manager of the Trading Desk—now includes *specific* values for various strategic target variables, such as the Federal funds rate, bank reserves, and the monetary aggregates.[5] It is useful for expository purposes to divide the discussion of current policy procedures and strategy into its long- and short-term aspects. A description of these components and their interrelationship begins in the next section.

III. A View of Long-Run Strategy

The policy process begins at the Federal Reserve Board with the development of staff forecasts for GNP, prices, unemployment, and other long-run targets four quarters into the future.[6] These basic forecasts are undertaken three or four times each

[3] Discussions of monetary policy have long been plagued by semantic difficulties with such words as targets, indicators, guides, objectives, etc., with the same words having different meanings to different writers. Such problems have played a major role in several major controversies in monetary economics [20].

[4] The arrows indicate the direction of causation. See [7] for a clear discussion of the transmission mechanism in monetarist and nonmonetarist models.

[5] The more specific the instructions contained in the Directive, the less discretion or latitude the Manager has in executing policy actions. One of Guttentag's criticisms of the Fed's operating procedures in the 1950's and 1960's was the ambiguity in the Directive. He stated: "It is natural and a type of poetic justice that the words used by the Committee in giving instructions to the Manager are thrown back to the Committee. If the Committee instructs him to follow an 'even keel tipped on the side of ease', for example, he can report back that he 'maintained an even keel . . .' and the Committee is not in a position to complain that it does not understand what these words mean" [10, p. 18].

[6] This discussion draws heavily from the work of former members of the Board staff: Pierce [23], Pierce and Thomson [25]; and the work of former Governors Brimmer [2, 3] and Maisel [17, 18].

year and are updated each month. The projections are referred to as consensus forecasts, since judgmental and econometric inputs are combined into a single forecast.

The econometric forecast is made using the Board's version of the SSRC-MIT-PENN (SMP) econometric model.[7] Initially, model simulations are conducted using expected values of exogenous variables not under Federal Reserve control, such as Federal Government outlays, and a trajectory for an intermediate target variable under potential Federal Reserve control, such as the growth rate of the money stock. The same money stock trajectory, for example a 5 percent annual growth rate, is also assumed by the judgmental forecasters. The judgmental forecast, prepared by staff economists in various sections of the Federal Reserve Board, is often more accurate in the near term than the model forecast [23, p. 12]. Differences in the econometric and judgmental forecasts are reconciled, and the consensus forecast is prepared.

One should not infer that the econometric projections are "pure" in the sense of a mechanical application of an existing model; as is true in most econometric work, a considerable degree of judgment is involved. This notion has been summarized by Hymans:

> No [model] operator—at least, one with much success as a forecaster—lets the computer center run his model. Rather, the operator considers the model to be nothing better than the best statement of the internal logic of the economy which he happens to have available. While he rarely tampers with the model's interactive logic, he recognizes that there are relevant factors which he thinks he knows, and which he is sure the model does not know, about current realities in the economy. In some way, he attempts to communicate this information to the model. . . . And what is most important, much of the relevant information which has to be communicated to the model is simply not contained in the values of the exogenous variables [11, p. 537].

For the sake of completeness, it should also be noted that the judgmental forecast is not independent of the econometric projections. The various forecasters interact continually and therefore a judgment about the path of economic activity (especially over a long time horizon) is no doubt influenced by the model simulations.

Following the development of the consensus forecast, the Board staff usually produces a number of alternative long-run scenarios of economic activity for evaluation by the FOMC. First the consensus forecast is reproduced quarter-by-quarter, variable-by-variable with the econometric model by adjusting the constant terms in selected equations. Alternative trajectories of monetary growth are then fed into the model to produce a consistent set of monetary, GNP, price, and unemployment estimates.[8] The FOMC then evaluates these alternative scenarios and selects an explicit monetary growth path for the forthcoming six- or twelve-month period.

It is important to note that the implicit dial settings for the final targets embedded in the staff forecast may not, for a variety of reasons, be accepted by members of the FOMC. For instance, an individual member of the FOMC may not believe the staff forecast and may therefore foresee a different real sector outcome. Each Reserve Bank President has his own staff's view of the economic and financial outlook to consider, and it is possible that his staff has a forecast quite different from that of the Board staff. More generally, there is no reason to assume that each member of the FOMC will embrace the estimates developed by the Board staff with regard to the impact of monetary policy on economic activity.[9]

Alternatively, an FOMC member may have a longer planning horizon for policy than the four- to six-quarter projection horizon and, therefore, might not believe that such a short-term projection should be a major determinant of current policy actions. In the current setting, for example, a policymaker may desire to drive unemployment down to 4 percent by mid-1976 but might feel that existing economic constraints, as well as structural relationships, make the risk of intensifying inflationary pressures under such a policy high. Hence, the return to full employment should be, in this member's view, more gradual and occur over a two- to three-year period.

Another possibility is that an FOMC member may have little faith in any of the assorted projections and instead may be strongly influenced by current economic and financial conditions. This view implies a shorter planning horizon than four to six quarters. Pierce has summarized some reasons why this last possibility may prevail from time to time:

> It is very difficult to convince a policymaker to move an instrument in what he views to be the wrong direction. That is to say, if income is ex-

[7] See [5], [7], and [9] for discussions of the policy transmission mechanism of the SMP model.

[8] As Pierce has discussed [23], a less extensive forecasting effort is made each month just prior to a FOMC meeting. This effort involves the updating of earlier forecasts through an extensive examination of incoming data and how they agree with, or have tended to modify, the projections presented in previous months. See also [2].

[9] In recent testimony by Chairman Burns before the Senate Banking Committee (July 24, 1975), members of the Senate Committee requested the release of the staff economic forecast conditional on a particular growth rate in the money stock. Chairman Burns did not appear to favor this suggestion, and his response emphasized some of the same points discussed in this and following paragraphs.

> panding very rapidly and the models are predicting that it is going to fall in the future unless he eases up, it is very difficult to get him to ease up because that sort of policy recommendation is contrary to what is going on currently. I must say that until our models do a lot better, his wariness may be justified. Again, the problem is one of how to handle risk: what if the model were wrong? What if the economy were expanding very rapidly, the policymaker eases up, but economic expansion becomes more rapid? The cost of the error to the policymaker would be very large [23, p. 18].[10]

A Model of the Long-Run Strategy The longer-term policy process described above conforms to a general class of constrained optimum problems. That is, policymakers may be viewed as maximizing a utility or preference function subject to the constraints imposed by the economic structure or by other considerations. Equation (1) states that the utility of the policymaker is a function of the deviation of the final targets from their desired levels, with greater utility being associated with smaller deviations.[11] Let U represent the policymaker's utility. Then:

$$\text{maximize} \quad U = f_1(Y^A - Y^*) \qquad (1)$$

$$\text{subject to} \quad Y^A = f_2(M_L, X_L) \qquad (2)$$

$$\text{and} \quad \sigma_R^2 \leq \alpha \qquad (2a)$$

where Y is a vector of final target variables such as GNP and prices. The superscript A denotes the actual value of the variable, and the asterisk denotes a desired value. The symbol σ_R^2 represents the variance of some interest rate R, α is a constant, M is the money stock, X represents other determinants of the final targets, and the subscript L is a distributed lag operator. The side constraints represented by equations (2) and (2a) reflect the limitations imposed on policymakers by the structure of the economy and by the volatility of interest rates.

The expected values of the final targets will generally depend upon the structure of the economy, the particular dial settings for the intermediate target variable selected by the central bank, dial settings for fiscal policy selected by Congress and the President, and the values of other determinants such as the level of consumer and business confidence, price expectations, the degree of capacity utilization, and international developments. The forecast of final targets by the staff assumes specific dial settings for the intermediate target variables, e.g., the money stock, and also involves assumptions concerning all of the above determinants of economic activity not under the direct control of the Federal Reserve.[12] This process is summarized by equation (2), which condenses the SMP model and the consensus forecast for the final targets into a simple expression.[13] It is presumed that the policymaker believes that changes in the money stock lead in a systematic fashion, albeit with a lag, to changes in prices, output, and employment.[14]

Equation (2a) is included as a constraint to account for the Fed's ongoing desire to avoid disorderly conditions in financial markets that, in turn, might frustrate the achievement of the final targets. A discussion of the constraint on interest rate volatility is the subject of Section VI.

Before closing the discussion of the long-term strategy, it is important to emphasize that many members of the FOMC might object to the causal sequence that seems to underlie equation (2): open market operations → money stock → economic activity. More specifically, some might prefer:

$$Y^A = f_2(R_L, X_L)$$

where R is a short- or long-term interest rate, and the implied causal sequence is more like the transmission mechanism of the SMP model [7, pp. 7-9].

[Open Market Operations] → [Interest Rates] → [Cost of Capital, Household Net Worth, Credit Availability] → [Economic Activity]

In part the issue involved here concerns the endogeneity or exogeneity of R and M and which variable ought to be the intermediate policy target [27]. For purposes of this article, this complex issue is sidestepped for two reasons. First if one ignores the error term in the demand for money function, it may be solved in terms of the interest rate or the money stock, and either may be treated exogenously for

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[10] The issue here is quite complex. The policymaker must act in the face of uncertainty over structural parameters and with the knowledge that there is a lag between actions and effects. In addition, there is the distinct possibility that incoming data may be revised substantially and thereby alter the appropriate policy response. Against this background, it is often difficult for policymakers to be convinced to move an instrument now to affect a final target one year in the future. Perhaps some of the recent applications of control theory to stabilization policy will prove helpful in educating both policy advisers and policymakers.

[11] To be more precise, (f_1) is an inverse function; that is, the policymaker is minimizing disutility (or "losses") by minimizing the deviations of the actual target values from desired levels.

[12] This being the case, the forecast may be wrong because the fiscal policy assumption is wrong, the Federal Reserve does not achieve the dial setting for the intermediate target, the structural parameters underlying the forecast are incorrect, or there is a stochastic shift in a behavioral relationship. One point relevant to this problem, which has received all too little attention in the literature, is the interdependence of stabilization policy actions. For example, if a restrictive monetary policy leads to a response by the Congress or the President to ease fiscal policy, the forecaster must anticipate this reaction.

[13] As noted above, each member of the FOMC might, in effect, have a different specification for equation (2) because of an alternative view of structural relationships. In this regard, equation (2), despite its simplicity, should not be mistaken for so-called reduced form models purporting to link the money stock or the monetary base to economic activity.

[14] Throughout this article error terms are generally ignored. Clearly, the staff should express the confidence intervals and standard errors around a particular forecast for the final targets.

forecasting purposes.[15] That is, a large macroeconometric model may contain a correctly estimated money demand function:

$$M = a_0 + a_1 y + a_2 R$$

where a_0, a_1, and a_2 are estimated parameters, M is money demand, y is nominal income, and R is the interest rate. The forecast for the final targets is independent of whether the money demand equation is solved for M or for R:

$$R = \frac{M - a_0 - a_1 y}{a_2}$$

Second, M is the assumed intermediate target variable in equation (2) because the FOMC has chosen to index its policy stance publicly in terms of M_1 and other monetary aggregates.[16] The use of the word "index" is meant to imply that even though members of the FOMC may have different views of the policy transmission mechanism in general, and the causal role of changes in the money stock in particular, the FOMC has been able to reach an agreement to express its policy in terms of growth rates in the monetary aggregates.

IV. The Linkage Between the Long- and Short-Run Strategy

Having selected a long-run dial setting for money stock growth, perhaps 5 percent over the next twelve months, the FOMC must now guide its open market operations monthly so as to achieve the desired long-run monetary growth path. It is important to recognize that there are an infinite number of monthly and quarterly patterns of monetary growth for the money stock that could turn out to *average* 5 percent over a full year. As will be shown, the monthly pattern desired by the FOMC will generally depend upon interest rate considerations and the current position of the money stock vis-a-vis the long-run target.

The relationship between the short- and long-run dial settings for M_1 is illustrated in Figure 1. It is assumed that a 5 percent long-run growth path for M_1 was adopted in December, and by the January FOMC meeting M_1 is well below its targeted long-run path. Under these circumstances the staff would normally prepare three (or more) alternative short-run money stock paths for FOMC consideration, each designed to return M_1 to the long-term path but each requiring successively longer adjustment periods.[17] With reference to Figure 1, a rapid return to the long-run path may require an 8 percent growth rate for M_1 in the January-February control period (A). Alternatively, slower growth rates of 7 and 6 percent in the January-February control period and in several successive periods would return M_1 to the long-run path in May (B) and July (C), respectively. The process underlying the selection of these alternative paths—i.e., the short-run formulation of policy and the actual short-run alternative selected by the FOMC—are discussed in the following sections.

V. A View of the Short-Run Strategy

The short-run strategy of the FOMC involves the selection of a short-run dial setting for the money stock and the development of an operating procedure for achieving the desired monetary growth path. The process begins with the staff presenting to the FOMC each month a set of alternative short-run (two-month) growth rates for the money stock. Associated with each alternative short-run path for the money stock will be a growth rate of bank reserves and a level of the Federal funds rate.

In formulating the short-run strategy, income movements are taken as given; that is, income for the coming two-month control period is interpolated from

[15] Such a procedure would not be legitimate for estimation purposes because of the bias that would be introduced by treating a variable exogenously if in fact it were endogenous. See [16] for a discussion of this latter point and how it is related to models of money stock determination.

[16] See the "Record of Policy Actions" appearing each month in the *Federal Reserve Bulletin.*

[17] Currently the control period for the FOMC's short-run strategy is two months—in December the control period is December-January, in January it is January-February, etc.

FIGURE 1

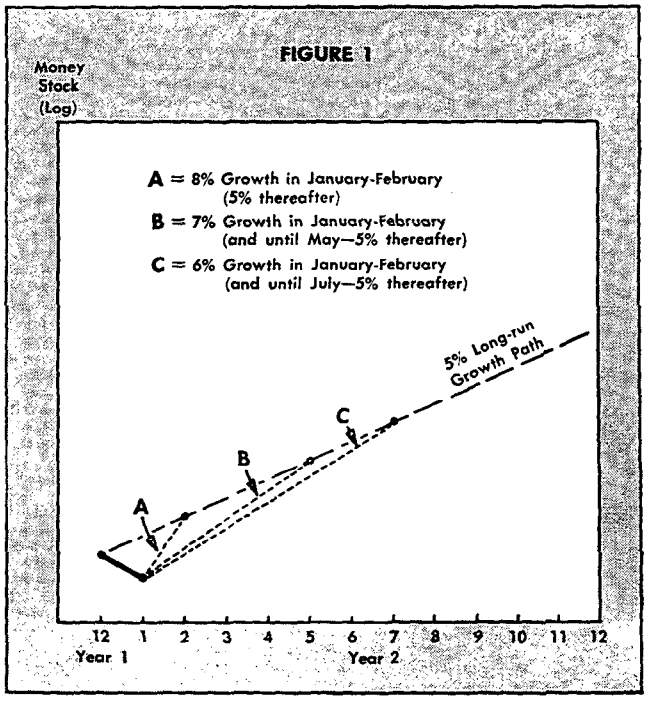


Table I

ALTERNATIVE SHORT-RUN DIAL SETTINGS

(Percent)

Target	Alternative		
	(A)	(B)	(C)
Money stock growth	8	7	6
Federal funds rate	6	7	8
Reserve growth	8	7	6

Note: The growth in reserves and the money stock are expressed at seasonally adjusted annual rates, while the funds rate is expressed as a level.

the quarterly projection of economic activity described earlier. The important assumptions underlying this procedure are that the quarterly projection and the monthly interpolation are correct and that there is no significant simultaneity problem over a one- or two-month period. To illustrate, again consider the example used in Figure 1. Assume it is the end of January, that the consensus forecast specifies 5 percent monetary growth from December to July, and that the money stock actually declines in January. Normally, in the face of this one-month shortfall in the money stock, the staff would not revise its income projection for the coming months. This, in effect, assumes the policy lag is greater than one or two months and that subsequent policy actions will result in growth in the money stock that will overshoot the target by enough to offset the miss in the first month.

Given income and the current position of the money stock vis-a-vis the long-run target path as depicted in Figure 1, the staff might present at the January FOMC meeting a set of short-run alternatives, as in Table I.[18]

The first row contains alternative short-run growth rates that will return the money stock to its long-run path. Alternative (A) and the staff discussion accompanying it would indicate that to achieve an 8 percent growth rate in M_1 and to return to the long-run path by February, the growth in reserves over the January-February period would have to be 8 percent and the level of the Federal funds rate required is 6 percent.[19]

The Federal funds rates, shown in row 2 of the table, are derived in two steps. First, assuming income given, a money demand function is solved for the short-term interest rate necessary to achieve the alternative short-run money path. The required Federal funds rate is then determined using a term structure equation relating it to the short-term interest rate. As was true in the forecast of economic activity, each alternative represents a staff consensus based on econometric models and judgmental considerations.[20]

The third row of the table could in theory be derived by solving a money supply function for the rate of growth in reserves necessary to achieve each money stock alternative. That is, if one viewed the money supply as the product of a reserve aggregate, such as reserves available to support private deposits RPD,[21] and a multiplier m, then the necessary growth in reserves could be obtained by estimating the multiplier, calculating the different February levels of the money supply M consistent with each money stock alternative, and dividing one by the other ($RPD = M/m$).[22]

In practice, as discussed by Axilrod and Beck [1], the approach is demand oriented. After projecting the interest rates consistent with the short-run money stock growth rate for each alternative, these rates are used to estimate bank demand for required and excess reserves [1, p. 89]. An important characteristic of this approach is that it results in the supply of reserves and money being perfectly elastic at the targeted level of the interest rate R and the volume of reserves and money, therefore, being demand determined. This is illustrated in Figure 2, where the demand for reserves is expressed as a function of the interest rate.[23] Assume the position and slope of the demand schedule for reserves TR_D have been estimated by the staff and that TR_1 is the level of total reserves in February that is derived from deposit demand consistent with a 6 percent growth rate in the money stock. Under the demand approach discussed above, the required interest rate is R_1, and

[18] The alternatives, along with a discussion of the situation that might develop in financial markets under each option, appear in the "Bluebook," which is prepared monthly for the FOMC. See [2, p. 285]. The actual alternative selected by the FOMC is now published with a 45-day lag as part of the policy record. The alternatives contained in the Record of Policy Actions for the January 1974 FOMC meeting are the first available. In the discussion that follows we will, for simplicity, ignore M2, even though it appears with M1 under each alternative the FOMC considers.

[19] It is worth noting that the FOMC has from time to time selected an alternative that has included, for example, the money stock under (A) and the funds rate under (B). In this case, the FOMC decided the staff had misspecified the relationship between the funds rate and monetary growth and has constructed a new alternative thought to be internally consistent. Thus, the FOMC is free to evaluate and to accept or reject the trade-offs among interest rates, reserves, and money stock growth implied by the staff estimates. See also n. 27.

[20] Monthly financial models developed at the Federal Reserve Board and the Federal Reserve Bank of New York are major inputs in this process. For a discussion of these models, see the papers by Pierce and Thomson [24, 25] and Davis and Shadrack [8].

[21] The reserve aggregate currently employed by the FOMC in its deliberations is called "reserves available to support private deposits" RPD. This magnitude is defined as total reserves minus required reserves against government and interbank deposits. It should be noted here that there is little objective evidence that RPD's have received much weight in the formulation or implementation of policy. Speaking of the 1973 period, Tschinkel said: "The Manager [reflecting the desires of the FOMC] found RPD of lesser importance in the determination of his response to the emerging patterns of monetary growth" [29, p. 105]. See also the recent evaluation of Kane [12, pp. 841-3] and the discussion that follows.

[22] The particular reserve aggregate one chooses (e.g., total reserves, nonborrowed reserves, the monetary base, RPD, etc.) is not a critical issue here.

[23] While the following diagram relates the interest rate to reserves, one could just as easily substitute the money stock for reserves.

the System will supply reserves elastically at that rate. Thus the supply function TR_S is horizontal. This means that stochastic shifts in the reserve demand (or money demand) function, an error in the income projection, or any other disturbance on the demand side will, in the first instance, alter the position of TR_D to TR'_D and lead to changes in the quantity of reserves to TR_2.[24]

This can be contrasted with a supply approach to money stock control, which would lead to the interest rate being demand determined. Again with reference to Figure 2, the level of total reserves thought necessary to achieve the 6 percent growth in the money stock remains TR_1. Accordingly, the System would supply the volume of reserves represented by the vertical TR_S function. Any disturbance on the demand side will alter the interest rate to R_2 and leave the quantity of reserves (and money) unaffected. In the absence of any disturbance (i.e., in a deterministic system) both approaches yield the same result (R_1 and TR_1).

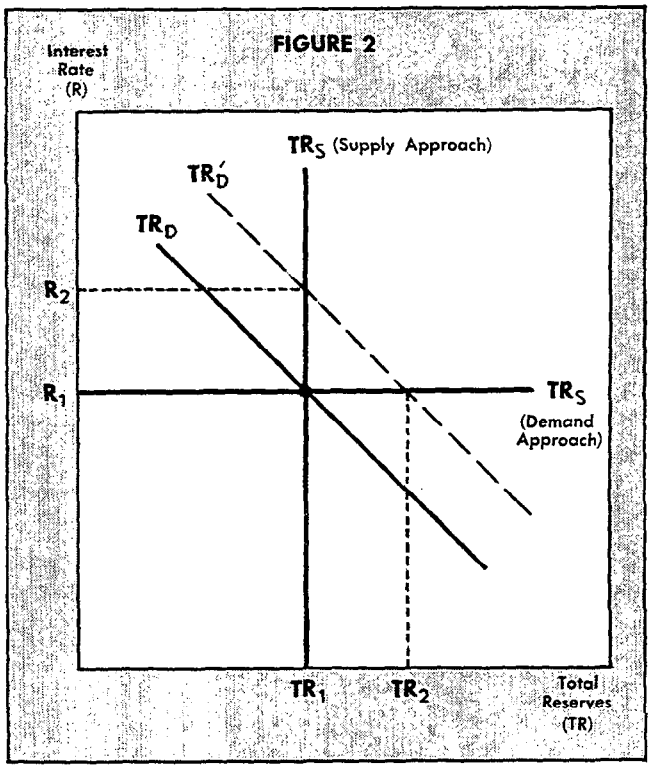
The point that must be emphasized is that one should not infer from the appearance of a reserve aggregate in Table I that the FOMC has adopted a supply approach to money stock control.[25] Evidence that the growth in reserves has had a low weight in the System's reaction function (i.e., in the formulation and implementation of policy) is easily obtained. Simply compare the specifications voted for reserves RPD, the money stock, and the funds rate in 1974 with the actual outcomes, shown in Table II.[26] This exercise in revealed preference shows that the Federal Reserve rarely missed the funds rate range but allowed reserves and the money stock to move away from the specified range in about one-half of the two-month control periods. Assuming the initial specifications were internally consistent, the conclusion must be that in the short run disturbances were allowed to affect quantity and not price. While this issue will be discussed in more detail in Section VI, the evidence in Table II suggests the System was not controlling reserves over the short run.[27]

[24] While income is a shift parameter in this two-dimensional diagram, an increase in income would actually result in a movement along the demand function for demand deposits, time deposits, and reserves in three-dimensional space.

[25] Brunner and Meltzer, Friedman, and the St. Louis Federal Reserve Bank have long advocated such an approach.

[26] As detailed in Section VI, the short-run dial settings selected by the FOMC are actually expressed as ranges. The rationale for the ranges is explained on pp. 11-12.

[27] An interesting feature of this approach to policymaking is that a member of the FOMC might vote for Alternative (A) in Table I even though he viewed monetary policy as operating primarily through interest rates and thus really preferred the interest rate under Alternative (B). In other words, members of the FOMC may vote for individual elements in the table rather than columns. Support for this interpretation is provided by Maisel: "A possible side advantage of this strategy is that it can be followed even though it might be impossible to get agreement among the members of the FOMC either as to ultimate goals, or the form or level of an intermediate monetary variable, or as to how to define what strategy is being followed" [17, p. 1541.



A Model of the Short-Run Strategy The following set of equations may be used to link the Federal funds rate to open market operations on the one hand and the money stock on the other:[28]

$$M_D = f_3(y_L, R_L) \quad (3)$$

$$R = f_4(RFF_L) \quad (4)$$

$$RFF = f_5(TR_D, TR_S) \quad (5)$$

$$TR = NBR + MBB = ER + RR \quad (6a)$$

$$NBR = FR + RR \quad (6b)$$

where M_D is the demand for money, y is nominal income, R is a short-term interest rate such as the ninety-day commercial paper rate, RFF is the Federal funds rate, NBR is nonborrowed reserves, MBB is member bank borrowings, ER is excess reserves, FR is free reserves (ER — MBB), RR is required reserves, and TR_D is the demand for and TR_S the supply of total reserves. The first three relations are straightforward. Equation (3) is a standard money demand function; equation (4) is a term structure relation, where the short-term rate (e.g., the ninety-day commercial paper rate) is a function of a distributed lag on the funds rate (single-day maturity).[29] Equation (5) specifies the funds rate as a

[28] For simplicity we will continue to ignore time deposits and therefore M2.

[29] See [14] for evidence that a major portion of the variance in short-term rates can be explained by current and lagged movements in the Federal funds rate.

function of the demand for and supply of total reserves. In (6a) total reserves are divided into familiar components—required reserves and excess reserves—which, by definition, must equal reserves borrowed from the System and all other reserves (nonborrowed reserves). By rearranging terms, a convenient identity (6b) can be formed. This latter identity may be transformed into an equation with behavioral content by considering the right-hand side as reflecting the behavior of the public and the banks and the left-hand side as reflecting the behavior of the Fed. That is, the banks' demand for required reserves is derived from the public's demand for deposits. This, together with the banks' demand for free reserves, must equal the total of nonborrowed reserves supplied by the Federal Reserve open market operations.[30] Other factors, such as the gold stock, float, and Treasury deposits at the Federal Reserve, also affect the supply of nonborrowed reserves. However, holding these other factors constant or assuming that the System engages in so-called "defensive" open market operations to offset movements in these factors, NBR is controllable by policymakers. For present purposes, these other factors are held constant, and the change in nonborrowed reserves is assumed equal to the change in the System's holdings of securities. Therefore, the change in nonborrowed reserves directly reflects open market operations (i.e., $\triangle NBR = OMO$). In summary, the funds rate is determined by the supply of nonborrowed reserves relative to the demand for required reserves and free reserves.[31]

To close the model, the System's short-run reaction function relating OMO to RFF must be specified. Ignoring for the moment the constraint on interest rate volatility, the desired level of the funds rate RFF* can be determined by solving equations (1) to (4) recursively for a relationship between long-run target values of the money stock and RFF:

$$RFF^* = f_6(M^*) \qquad (7)$$

In practice it is the short-run target value for the money stock, rather than the long-run target value, that would usually appear in equation (7). The reason, as discussed in Sections IV and VI, is that the change in the funds rate required to get the money stock back on the long-run path (assuming it is significantly off the path), is usually deemed too large and disruptive by the policymaker.

Once equations (1) to (4) have been solved for RFF*, equation (8) follows from equation (5) and the supporting identities:

$$\triangle NBR = OMO = f_7(RFF^* - RFF^A) \qquad (8)$$

[30] See [5, Chapter 1] for a discussion of the key role of the free reserves equation in the financial sector of the SMP model.

[31] It should be emphasized that the set of equations presented is intended to be very general and should not be construed as a complete model of the financial sector and its interaction with Federal Reserve policy. This is a task beyond the scope of the present paper. As it stands the set of equations is under-identified, and no attempt is made to account for various aspects of simultaneity.

Table II

SHORT-RUN DIAL SETTINGS FOR 1974*

Date of Meeting	2 Month Control Period	Money Stock Range (SAAR)	Actual Money Stock (SAAR)	RPD Range (SAAR)	Actual RPD (SAAR)	Federal Funds Rate Range (Percent)	Actual Federal Funds Rate (Percent)
Jan. 22, 1974	Jan.-Feb.	3.00 to 6.00	4.7	4.75 to 7.75	3.3	8.75 to 10.00	8.93 to 9.47
Feb. 20, 1974	Feb.-Mar.	6.50 to 9.50	11.8	3.50 to 6.50	5.8	8.25 to 9.50	8.81 to 9.33
Mar. 19, 1974	Mar.-Apr.	5.50 to 8.50	9.6	4.00 to 7.00	15.8	9.00 to 10.50	9.61 to 10.36
Apr. 16, 1974	Apr.-May	3.00 to 7.00	6.5	6.00 to 11.00	20.7	9.75 to 11.25[1]	10.78 to 11.46
May 21, 1974	May-Jun.	3.00 to 7.00	6.3	13.00 to 20.00	20.0	11.00 to 11.75[1]	11.45 to 11.85
Jun. 18, 1974	Jun.-Jul.	3.50 to 7.50	4.8	10.00 to 13.50	13.5	11.25 to 13.00[1]	11.97 to 13.55
Jul. 18, 1974	Jul.-Aug.	2.00 to 6.00	2.1	8.75 to 11.75	9.0	11.50 to 13.00	12.02 to 12.60
Aug. 20, 1974	Aug.-Sep.	4.75 to 6.75	1.5	7.75 to 9.75	7.7	11.50 to 12.50	11.48 to 11.84
Sep. 10, 1974	Sep.-Oct.	3.00 to 6.00	2.6	6.00 to 8.50	3.5	10.25 to 12.00[2]	10.11 to 11.41
Oct. 15, 1974	Oct.-Nov.	4.75 to 7.25	5.3	5.50 to 8.00	−2.1	9.00 to 10.50	9.34 to 9.81
Nov. 19, 1974	Nov.-Dec.	6.50 to 9.50	4.5	2.50 to 5.50	3.2	8.50 to 10.00	8.72 to 9.46
Dec. 17, 1974	Dec.-Jan.	5.00 to 7.00	−3.4	9.00 to 11.00	3.9	7.13 to 9.00[2]	7.17 to 8.45

* Short-run dial settings for the money stock and RPD are expressed as seasonally adjusted annual rates of growth (SAAR) averaged over two-month target period. The range for the Federal funds rate and the actual outcome apply to statement week averages during inter-meeting period. Actuals for the money stock and RPD do not reflect benchmark revisions or revisions in the seasonal factors made following the period to which data relate.

[1] Upper limit of range raised between meetings to figure shown.

[2] Lower limit of range lowered between meetings to figure shown.

Simply put, the System will absorb (inject) reserves by selling (buying) securities when the funds rate is below (above) the desired level. This policy approach ensures that the supply of reserves is perfectly elastic at the desired funds rate and the quantity of reserves is demand determined. In the first instance, deviations in the demand for reserves from the FOMC specifications lead to an equivalent change in the stock of reserves but to no change in the funds rate.[32]

There is in theory a mechanism that limits the pro-cyclical movement in reserves. The dynamics of the inter-meeting phase of the short-run policy process are embedded in a feedback control loop that can be summarized by:

$$\triangle RFF^* = f_8(M^* - M^A) \qquad (9)$$

That is, movements in the funds rate depend upon deviations of the money stock from its desired value. To illustrate, assume incoming data on the money stock suggest that monetary growth over the short-run two-month target period will exceed the short-run dial setting selected at the last FOMC meeting. In response the Manager of the Trading Desk would be expected to increase the dial setting for the funds rate. In practice, however, the timing and magnitude of the Manager's initial response to apparent deviations of monetary growth from desired levels are often not so straightforward. If the tone of the securities markets is weak, for example, the FOMC might decide not to change the funds rate for the time being, even though the money stock is growing above the desired rate.[33]

A more difficult problem contributing to cautious adjustments of the funds rate is the uncertainty concerning the money stock forecasts. This uncertainty results from the fact that forecasts of the money stock over the short run (e.g., one to three months ahead) have not been very accurate [29]. This being the case, the FOMC often may delay its response to an apparent deviation of actual from desired monetary growth until more data are available to confirm the error. The rationale is that the policymaker prefers to avoid "whipsawing" the market—i.e., raising the Federal funds rate now if money growth appears to be exceeding desires and lowering it later if the money stock projections prove incorrect and actual money growth is found to be close to that desired. This, of course, is another facet of the System's desire to minimize short-run interest rate volatility and is discussed in the next section.

VI. The Constraint on Interest Rate Volatility and Its Interaction with Policy Targets

Within the FOMC's current strategy, the target values for the Federal funds rate, reserves, and the money stock are actually expressed as ranges. Referring back to Table I, under alternative (A) for example, the entry for the money stock might be 7 to 9 percent and the entry for the Federal funds rate might be 5½ to 6½ percent. From the viewpoint of the staff, the ranges presented to the FOMC generally represent a standard error around a point estimate at the midpoint of the range. From the viewpoint of the FOMC, however, the ranges may have a somewhat different meaning. The range for the money stock is typically viewed as a range of tolerance. If the money stock is expanding at a rate within its range, then the desired level of the Federal funds rate will probably not be altered to any significant degree.[34] Thus, in terms of equation (9), M^* is a range and $\triangle RFF^*$ equals zero unless M^A is outside the range.

The following quotations suggest there are at least two interpretations attached to the reasoning behind any given range for the money stock adopted by the FOMC: (1) "The inherent short-run volatility of the monetary aggregates is one reason why the Committee expresses its short-run guides in terms of ranges of tolerance" [21, p. 334]. In this view the range implies a standard error around a point estimate. (2) "The Committee chose tolerance ranges for M_1 . . . that were at least as restrictive as the alternatives presented by the staff and reduced the lower ends of these ranges to indicate its willingness to accept substantially slower growth in the near term" [29, p. 108]. In this view the Committee skews its preferences, perhaps in response to previous deviations of actual from desired levels. Suppose the staff presents an alternative such as (C), which implies that an 8 percent Federal funds rate will translate into a 5-7 percent growth in the money stock, the point estimate being 6 percent growth. The FOMC, responding to past shortfalls in money stock growth, might then modify this alternative by

[32] A point worth mentioning in this context is that a change in reserve requirements has virtually no impact on reserves or the money stock unless accompanied by a change in the funds rate target. If, for example, the System lowers the reserve requirement on demand deposits, other things equal, this will push down the funds rate. However, as depicted in equation (8), this will result in the System selling securities and, therefore, absorbing the free reserves.

[33] For a recent example see the "Record of Policy Actions" of the FOMC in the *Federal Reserve Bulletin* (January 1975), p. 26.

[34] This discussion assumes that incoming data and forecasts of nonfinancial developments are consistent with the projections set out when the long-run trajectory for the money stock was first selected; as a result, the FOMC has not modified the long-run money stock target.

changing the range to 5-8 percent, indicating its willingness to err on the side of more, rather than less, monetary growth relative to projected levels. Operationally, this means that if the money stock actually should grow at an 8 percent rate, this will not result in a raising of the desired Federal funds rate.

The significance of the Federal funds range is that it specifically limits the degree of response by the Manager to a deviation of monetary growth from the desired range. As shown in Table II, this range in 1974 was typically 100-150 basis points. If the midpoint of the range selected is equal to the Federal funds rate prevailing just prior to the FOMC meeting, then the FOMC has typically been willing to tolerate a maximum change in the funds rate of 50-75 basis points in one direction over any given inter-meeting period.[35] Against this background, it is interesting to note that the money demand functions that underlie the specifications presented to the FOMC exhibit very low interest elasticities [4; 8; 24; 25]. The monthly model discussed by Pierce and Thomson [25, p. 351], for example, indicates that, other things equal, a 100 basis point change in the Federal funds rate will lead to only about a 0.3 percentage point change in the annual growth rate of the money stock over a one-month period and only about a one percentage point change over a six-month period. Assuming the interest elasticities embedded in the monthly models are reasonably accurate, the constraint on the monthly movement in the Federal funds rate, as explicitly revealed by the range in the Policy Record for the funds rate, suggests that *the FOMC is willing to tolerate relatively large short-run deviations of monetary growth from desired levels.*[36]

Whether or not the constraint on month-to-month movements in interest rates has significant destabilizing effects on output and prices depends on the narrowness of the short-run constraint and whether or not it frustrates achievement of the long-run money stock target.[37]

With regard to the narrowness of interest rate tolerance bands, Pierce conducted some experiments with the SMP model and concluded: "The results indicate that the placement of sufficiently narrow bounds on the change in the bill rate can have a large impact on the simulated value of GNP" [22, p. 101]. It is worth emphasizing that *if the band on interest rate movements is fairly narrow and inflexible, it is reasonable to question whether or not the money stock is being "controlled" at all.*

In theory, at least, the current FOMC approach to the formulation of policy is designed to guard against short-run deviations of money stock growth affecting the achievement of the long-run money stock target. This is illustrated in Figure 3. Assume the FOMC selected a 4-6 percent long-run growth path for the money stock in month 1 of year 1, growth in the money stock in months 5 and 6 of year 1 has been 8 percent, and the FOMC is meeting at the beginning of month 7. Further, assume the prevailing Federal funds rate is 5 percent. As discussed in Section IV, the short-run alternatives for the money stock presented to the FOMC by the staff will typically be tied to a specific time path for returning the growth of the money stock to the desired range. For example, alternative (A) would envision only 2 percent growth in the money stock over the next two months and thus an early return to the range. This might require a sharp rise in the Federal funds rate to perhaps 7 percent. Alternative (B), however, would envision a slower return to the upper end of the desired range; the money stock might be expected to grow at a 5 percent rate for five months and return to the range by month 11. This alternative would require a smaller current rise in the Federal funds rate to perhaps 6 percent, possibly followed by further rises in subsequent months.[38] An examination of month-to-month movements in the funds rate and in monetary growth over the past several years suggests that the FOMC has in practice more often preferred to pursue an alternative such as (B).[39]

One significant area of concern with regard to this policy approach is the possible existence, from time to time, of a serially correlated error in the income projection. Suppose the staff is underestimating the strength in aggregate demand and the money stock is expanding more rapidly than desired. Since the

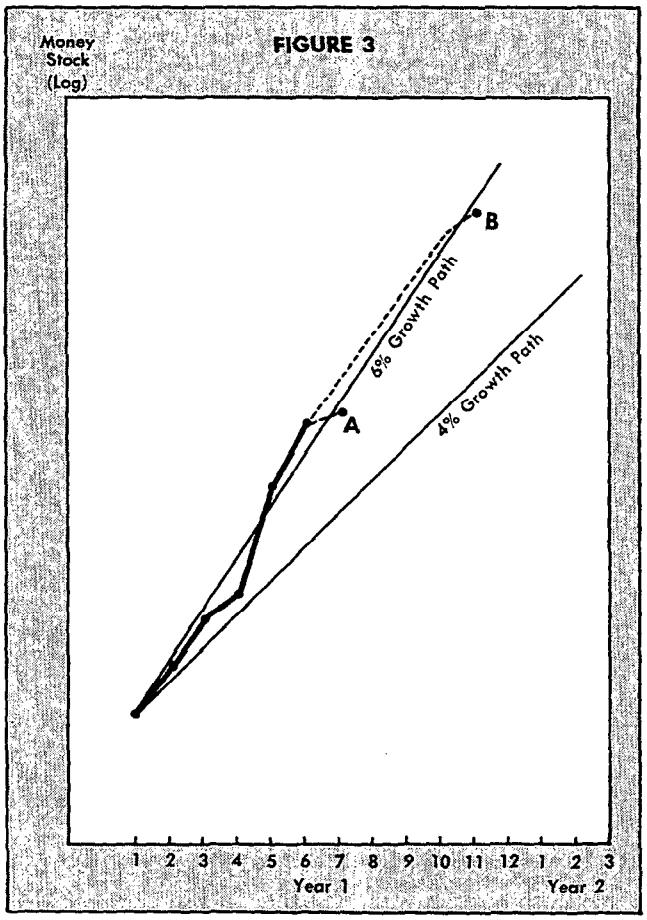
[35] From time to time the FOMC has been willing to change the upper or lower end of the range on the funds rate and thus permit a larger inter-meeting movement in the funds rate. For a recent example, see the "Record of Policy Actions" of the FOMC in the *Federal Reserve Bulletin*, (February 1975), p. 88. In addition, if the funds rate prevailing at the time of the meeting is at the upper or lower end of the adopted range, it is possible that the full 100-150 basis point range could be used during the inter-meeting period.

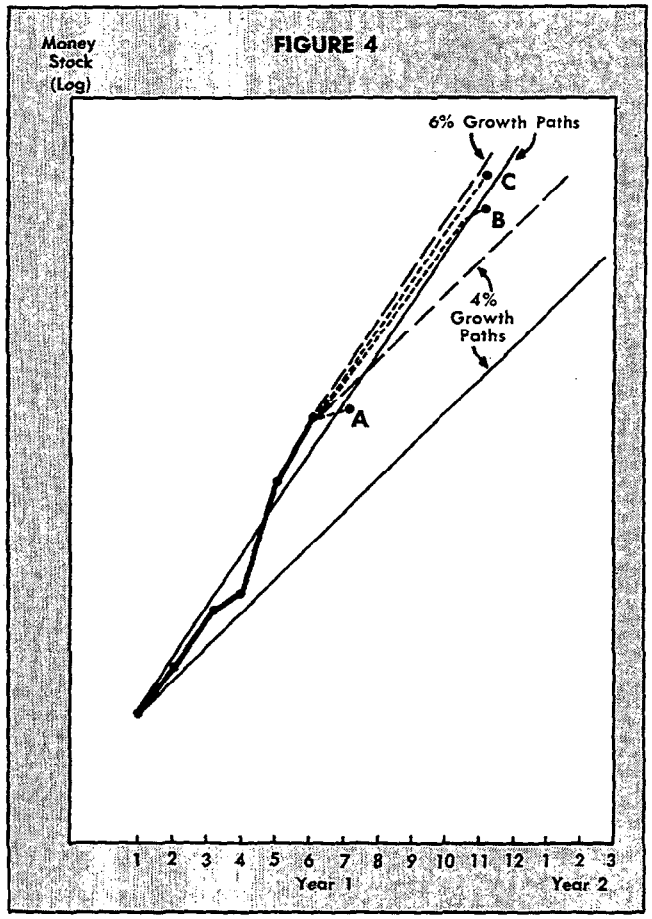
[36] In other words, short-run monetary control is considered too "costly" because of the volatility of interest rates that seems to be required. For a critical review of this issue see [15]. For some evidence that short-run deviations of monetary growth from the desired trajectory might not be "costly" in terms of missing price and output targets, see [6, p. 24].

[37] It also depends, of course, on the willingness of the FOMC to modify the constraint over time. In this regard, the FOMC has clearly been willing to tolerate larger swings in interest rates over the first half of the 1970's than it did over most of the 1960's.

[38] It should be noted that one alternative may envision an immediate return to the desired range without any significant change in the funds rate. The explanation accompanying such an alternative may be that the monthly pattern of income growth suggests smaller increases in coming months and thus less strength in money demand. Another possible explanation is that the current spurt in monetary growth is a random occurrence not likely to persist.

[39] The revealed tendency to view short-run deviations of monetary growth (and their mirror image, the short-run smoothing of interest rates) as costless is controversial. Within the Hicks-Hansen IS-LM framework, the presumption is that there are stochastic shifts in the LM curve that are larger than the random shifts of the IS curve. See Poole [27] and the pathbreaking report of Weintraub [30, especially pp. 63-6].





growth of the money stock appears to be inconsistent with the income projection and the associated estimate of the demand for money, the initial tendency may be for the policymaker to discount the jump in monetary growth and wait for further data that would confirm greater strength in economic activity and money demand. The incorrect presumption is that the spurt in monetary growth is the result of a stochastic shift in money demand. The long-run implications of accommodating this growth are a more pro-cyclical policy than desired and, given the lags in the effect of policy, the need later on for a very sharp tightening in policy to offset past excesses.

An important problem for monetary control that can result from a series of short-run deviations of monetary growth is that the FOMC might give up on the long-run money stock target *de facto* by continually resetting the starting (or base) date of the control period over which the target value is to be attained. This might happen, for example, if the policymakers find it impossible to tolerate the large increases in interest rates necessary to offset past excesses in monetary growth. This is illustrated in Figure 4, which is similar to Figure 3 except that the FOMC is presumed to adopt alternative (C) at its meeting early in month 7. The long-run target remains 4-6 percent but is calculated from month 6 rather than from month 1.[40] Unfortunately, this subtle ratcheting-up (or down) of the long-run monetary growth rate could exacerbate the cyclical swings in output and prices.[41]

VII. Some Final Remarks

This article has presented a view of the Federal Reserve's current approach to the formulation and implementation of monetary policy. It is hoped the general interpretation presented will be critically examined, the discussion of particular phases of the strategy carefully scrutinized, and the models that

[40] The FOMC recently made such a shift in the base of its current long-run money stock target. On May 1, 1975, Chairman Burns announced before the Senate Banking Committee that the FOMC planned money stock growth of 5 to 7½ percent over the period March 1975-March 1976. On July 24, 1975, the Chairman announced before the House Banking Committee that the targeted growth rate was the same, but the period over which it was to be obtained was the second quarter of 1975 to the second quarter of 1976. Since the money stock grew at nearly a 9 percent rate in the second quarter of 1975, this change in the base, in effect, accepts much of the intervening monetary expansion.

[41] See Poole's recent paper [26, pp. 25-30] for some further possible pitfalls within the current strategy.

underlie the strategy empirically tested. This should result in a clearer understanding of current monetary policy procedures, more carefully developed advice for policymakers on how to improve their performance, and greater success in achieving the goals of monetary policy.

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