

Monetary Control: Consensus or Confusion

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“There is strong shadow where there is much light.”

Johann von Goethe

I. Introduction

The literature on monetary control was one of the few things that grew faster than the money stock during the 1970s. As the decade came to a close, the Federal Reserve, seemingly responding to both developments, announced its intention on October 6, 1979 to improve monetary control over economic activity through a reserves-based (or supply) approach to control the monetary aggregates. Failing to give due weight to an abiding eclecticism on the part of policymakers, and the subtleties, ambiguities, and limitations characterizing the various branches of the monetary control literature, many were tempted to conclude that this action indicated that monetarism had become the conventional wisdom guiding policymaker behavior. The subsequent erratic behavior of the monetary aggregate during 1980 has not surprisingly contributed to a much-needed reexamination of both the monetary control literature and what, if any, relationship exists between this literature and current policymaking.

Over the past 15 years, the literature on monetary control moved in several directions. One major branch of research proceeded by collapsing hundreds of years of monetary research into two equations: one linking the Fed's “instruments”¹ to the monetary aggregates — the so-called “intermediate” targets — and the other linking the monetary aggregates to the vector of key macroeconomic variables (e.g., the rate of inflation and the unemployment rate) comprising the “final” targets or ultimate objectives of policy. Purportedly, these correlation derbies reveal both the optimal operating procedure for controlling the various aggregates and the optimal aggregates to control.²

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¹ While open market operations, reserve requirements, and the discount rate are the actual policy instruments, this literature usually uses the term instrument to refer to any variable which could be tightly controlled by the Fed. The alternatives usually investigated are a short-term interest rate, such as the federal funds rate, or a reserve aggregate, such as nonborrowed reserves or the monetary base.

² It should be noted that some gave new meaning to the term “reduced-form” by accomplishing this all in one equation.

The resulting emphasis on controllability has perhaps inadvertently obscured the original rationale for intermediate targets. As Brunner and Meltzer (1969) argued, intermediate targets *could* be useful as processors of information in a world characterized by uncertainty about structural relationships and lags in the receipt of data regarding the ultimate objectives of policy. More recently, however, Benjamin Friedman (1977) has argued that using "the" money stock as an invariant intermediate target is in general an inefficient way of exploiting the information contained in near-term observations of the money stock *and* other variables. Deviations of the money stock *and* other variables from values thought to be *consistent* with a particular setting of the policy instruments and an expected outcome for the ultimate objectives of policy provide information on the size and source of real and financial disturbances. If policy is being formed optimally, this information should be used to reset the policy instrument and if necessary derive a new consistent relationship between, say, the money stock and income. This burgeoning literature on filtering and optimal control with feedback, which represents another major branch of theoretical and empirical research on monetary control, implies that a policy steadfastly designed to close the gap between the actual money stock and a money stock target invariant with respect to incoming information is suboptimal.³

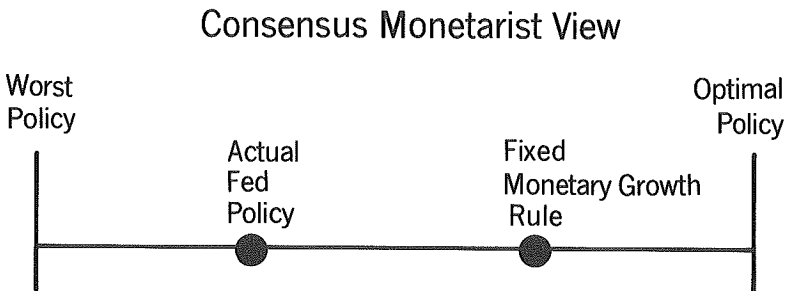
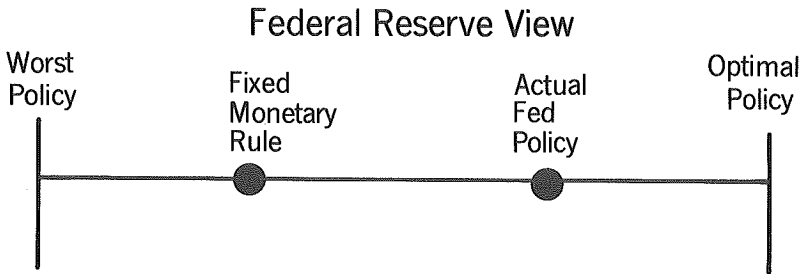
The unenthusiastic reaction to the optimal control approach has been conditioned in part by the considerable knowledge about structural relationships which seems to be required to make the approach operational (Brunner, this volume). Beyond this concern, reactions have also reflected the strongly held views illustrated in Figure 1. Milton Friedman, who has long opposed discretionary policy and favored a rule calling for a fixed money stock growth rate, puts it this way:

Much work has been done inside and outside the System on a highly sophisticated level about the so-called problem of "optimal control." This work is important as well as intellectually fascinating but in my opinion is concerned with effects of a second order of magnitude. The urgent need is to introduce as rapidly as possible the alternative procedure [Friedman's rule] to correct the first order defects of the present procedures. It will then be desirable and possible to proceed at more leisure to refine the procedures along the lines suggested by optimal control theory. We must not in this area as in others let the best be the enemy of the good (1976, p. 563).

Monetary policymakers who obviously favor the eclectic, discretionary policy approach they have been following, have also been unenthusiastic about the optimal control approach, arguing that guiding policy with "flexible" intermediate targets lends quantification and precision to the formulation of policy and facilitates the discussion of, and thus agreement on, particular courses of action (Wallich, 1976; Maisel, 1969, 1973). Milton Friedman's monetary rule is also rejected by the Fed and the "flexibility"

³ For elaboration, see the papers by Kalchbrenner and Tinsley (1976; 1977), LeRoy (1975), and Palash (1979).

Figure 1
Spectrum of Views on
Monetary Control



At any point in time there exists a particular policy, given the social welfare function and the true model of the economy, which would be optimal. However, given knowledge deficiencies, it may not be possible to identify this particular policy. The issue then is whether the fixed monetary growth rule favored by many monetarists, or the Fed's approach is closer to the unknowable optimal policy.

built into current procedures through the use of changing target ranges for several monetary aggregates, whose individual importance varies over time, is emphasized (Volcker, 1978). As shown in Figure II, the Fed's approach to policymaking is, in appearance at least, a hybrid of the monetarist and optimal control approaches.

Recognizing that appearances can be deceiving, the dilemmas and disorientation created by such flexibility on the part of the Fed can be summarized succinctly: are the monetary aggregates (individually or collectively) important strategic variables to be controlled or information variables to be used along with other data in setting policy instruments? Distinguishing clearly between these possible roles for the aggregates and the associated scope for policymaker discretion would seem to be crucial for the formulation and implementation of policy. Unfortunately, as the title of this paper suggests, any apparent consensus on monetary control may be more illusory than real.

The appropriate role of the aggregates in the formulation and implementation of policy (a topic covered in some detail in the papers by Modigliani and Papademos, Berkman, and Brunner), is ultimately dependent on a careful analysis of a variety of logically prior issues. The next section examines some of the key conceptual, analytical, and technical issues associated with defining and measuring the money stock (and other monetary aggregates). The third section critically reviews the received literature on money stock determination, including the Federal Reserve's conception of the process, and examines micro and macro aspects of various proposals designed to improve monetary control. The fourth section discusses aspects of the reliability of empirical relationships and several related issues regarding the execution of policy. The final section summarizes the paper and develops the implications of the arguments presented.⁴

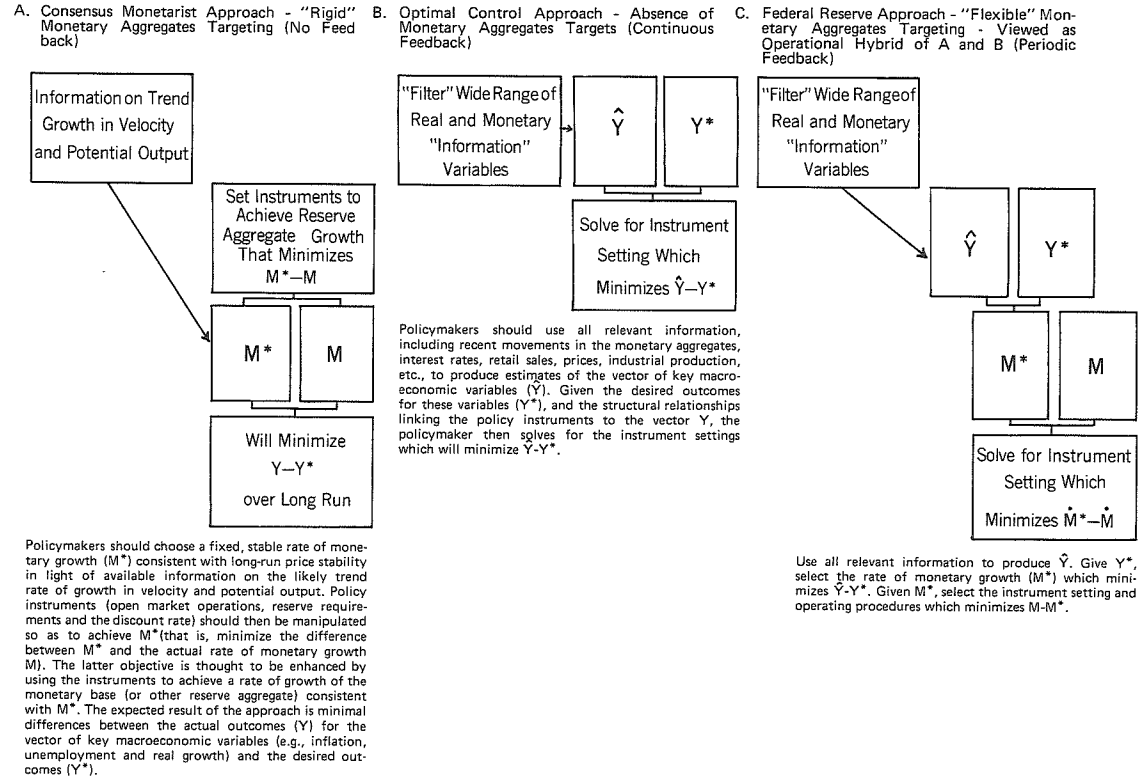
II. Measurement: Conceptual, Analytical, and Technical Issues

If our theory suggests a particular variable would be a useful intermediate target or information variable, we must be able to measure the analytical construct in order to make our theory operational. Unfortunately, many academic researchers have not paid sufficient attention to the conceptual, analytical, and technical issues involved in defining and measuring the money stock and other monetary aggregates. Many treat definition and measurement as identical issues and as an easily solvable technical problem (apparently best left to the Fed), while others seem to imply that the whole

⁴ At the outset it must be emphasized that what follows should not be interpreted as a set of arguments supporting or rejecting any particular role for the aggregates. In general, the analytical and empirical issues examined cut across the various possible roles of the aggregates. I should also note that the literature on monetary control is huge. Given space limitations, full documentation on each issue is obviously impossible. Accordingly, the references should be viewed as illustrative rather than exhaustive.

Figure 2

Alternative Policy Approaches



matter is not crucial for their analytical or empirical work — any one of the Ms will do. Both tendencies should be resisted.

Defining and Measuring Money

Definition and measurement are logically distinct processes which have often become conceptually confused in the literature. Many years ago, D.H. Robertson, writing on the appropriate definition of money, argued that “it does not matter very much what meaning we adopt as long as we stick to it” (1964, p. 2). This view, along with the extensive work on the “empirical definition of money,” represents a false lead for the profession. As Will Mason has argued, “definitions do make a difference” (1976, p. 530).⁵

Simply put, one’s analytical framework and resultant hypotheses and theories — that is, one’s monetary theory — is not invariant with respect to the implicit or explicit concept of money underlying the analysis. Obvious examples are general equilibrium theories which, implicitly or explicitly, are based on a store of value (“temporary abode of purchasing power”) concept of money, and disequilibrium theories which are primarily based on a means of payment concept of money.⁶ Some do recognize the problem; in their survey of money demand studies, Feige and Pearce observe that “implicit in the particular choice of a [money stock] variable are economic specifications concerning the role of prices, population, income, and liquid assets” (1977, p. 443).

It appears that an understandable desire to develop prescriptions directly relevant to the formulation and implementation of policy has contributed to the definition and measurement of money becoming confused with the ongoing debate over the appropriate targets, instruments, and indicators for policy. Thus, Harry Johnson wrote: “unless the demand for money — defined to correspond to some quantity the central bank can influence — can be shown to be a stable function of a few key variables, the quantity of money must be a subordinate and not a strategic element in both the explanation and the control of economic activity” (1966, p. 20).⁷

Johnson’s view, which is implicit if not explicit, in much of the literature on monetary control, manifests itself in an emphasis on controllability of the various Ms and the stability of “money demand” functions. Boorman puts it this way: “a demand function for some broader measure of money, one that includes these close substitutes [for currency and demand deposits], would be more stable, i.e., would shift less over time, than a function defined on a narrow money measure. Under these conditions, monetary policy actions that concentrate on the narrower measure of money would be focusing on an

⁵ My discussion owes much to a continuing dialogue with Will Mason on these issues over the past decade. See Mason (1976 and 1979) for a fuller statement of his views.

⁶ As Clower has pointed out, in timeless general equilibrium models there are no transactions, so money — that is, the medium of exchange — is indistinguishable from all other assets. For his attempt to begin to reformulate such models, see Clower (1977).

⁷ See also a similar statement by Boorman (1976, pp. 317-318).

unstable shifting target. Policy actions that focus on broader measures of money would be more appropriate" (1976, p. 319).

Simply put, defining money is related to, but logically separable from, identifying the appropriate or optimal proximate monetary policy target. As Mason has forcibly argued: "An empirical definition of money designed to validate a monetary hypothesis precludes empirical invalidation. Such is the antithesis of scientific procedure. It confuses empirical verification with hypothesization, thus precluding the progression from hypothesis to theory" (1976, p. 532); "Conceptualization and definition must precede hypothesization, and conceptualization must precede definition in order to produce a testable hypothesis capable of empirical verification as a theory" (1976, p. 533).

The circularity involved in defining money, for example, as that collection of liquid assets with a stable demand function, is compounded by the fact that the aggregation of assets or specification of the demand function necessary to achieve statistical stability runs the risk of confounding changes in the supply of money with changes in the demand for money. To illustrate, suppose we adopt an a priori definition of money specifying money as all those things which serve as generally acceptable means of payment. The empirical problem is to first measure the stock of such media and then identify and estimate supply and demand functions for this collection of assets. A popular econometric exercise over the last decade was to fit demand functions for M-1 (so-called narrow money) and M-2 (so-called broad money) and check the stability and dynamic simulation properties of each equation.⁸ The demand function explaining the most within-sample variation, exhibiting the least parameter drift, and displaying the smallest root mean square forecasting errors was typically used to decide how money should be defined *and* what particular monetary aggregate (i.e., collection of financial assets) the Fed should seek to control. Not surprisingly, results typically varied with functional form, time period, and estimation procedure. Lacking an adequate conceptual foundation, a clear distinction between factors affecting the supply of or demand for various assets, whether money (means of payment) or near monies (liquid stores of value) was glossed over. For example, time deposits undoubtedly are a good substitute for demand deposits as a store of value although not as a means of payment. As regulations changed over time and financial innovation proceeded, the attractiveness of time deposits relative to demand deposits was altered. By aggregating time and demand deposits (as was formerly the case for M-2), shifts between the two washed out.⁹ The implicit assumption was that such shifts, which reflect changes in the demand for near-monies relative to the demand for means of payment, and perhaps supply-side developments as well, were of little analytic significance.

⁸ One can predict with great certainty that the Fed's recent "redefinitions" of the aggregates will induce another decade of similar work.

⁹ We are ignoring for the time being the reserves released or absorbed by such shifts between classes of deposits.

Even more serious problems can be illustrated. Suppose that as time passes and financial innovation occurs in response to rising interest rates, falling transactions costs, and distortions associated with various regulations (e.g., the prohibition of explicit interest on demand deposits and Regulation Q interest rate ceilings), adaptive behavior on the part of financial institutions and the public expands the stock of those things functioning as media of exchange. At the margin the public will substitute the new components of the stock of circulating media (say, NOW accounts) for the old (say, demand deposits). A central bank pursuing a particular money stock growth target (where the money stock is *not* defined to include the new components) with either a federal funds rate-based (demand) operating procedure or a reserves-based (supply) operating procedure, will observe a decline in monetary growth. The inevitable lag in recognizing what is going on can lead to actions designed to get monetary growth back up to the specified target. Of course, such actions would be most inappropriate given that the stock of money correctly measured was expanding faster than the measure employed. Correctly measuring the stock of money, which is impossible unless the concept of money is specified, would solve the problem. A generally inferior analytic approach to this problem would be to proceed as if "the" demand for money shifted downward (velocity rose). Researchers preferring this route have searched for the set of right-hand side variables which explain the apparent shift. Obviously, *if* the problem is that the left-hand side variable (the money stock) is measured with error because NOW accounts are functioning as means of payment, then shifts in supply are being confused with shifts in demand. In reality, of course, both supply and demand could be shifting over time; in this case both the left-hand and right-hand side variables of money demand and money supply functions need to be reworked (Simpson and Porter, this volume).

Contrary to popular belief all this is not a semantic or tactical issue. Monetary analysis will remain somewhat disoriented if researchers fail to treat the definition and measurement of money as a substantive issue. This does not imply that measuring money — that is, which assets to include and which to exclude — is trivially easy. Classification is important in all sciences. As Otto Solbrig, a noted botanist, has pointed out "grouping like with like is the essence of classification, and without this classification no communication of any sort would be possible, nor would a rational perception of the world" (1970, p. 103). He goes on to stress the ongoing need for *both* empirical and analytical approaches to classification, "if the true biological picture is to be comprehended and the operating evolutionary mechanisms are to be understood" (1970, p. 113).

For economists the message is that defining and measuring money is not a matter of indifference or expediency. The notion that it matters little whether recent experience is treated analytically and empirically as a downward shift in money demand or as an increase in money supply should be

rejected. In general, central bank pursuit of monetary targets or use of the money stock as an information variable depends on our ability to distinguish between supply and demand disturbances which are either transitory or permanent. Moreover, the need for such analysis cannot be aggregated away.¹⁰

Technical Problems Associated with Interpreting Short-Run Variations in the Monetary Aggregates

Even if the conceptual problems discussed above are solved, we are not out of the woods. Many researchers and virtually all critics of the Fed, emphasizing secular and cyclical variations in monetary growth, have often ignored, or downplayed, the Fed's machinations concerning the interpretation and significance of shorter run variations in monetary growth. The Fed, concerned with guiding its day-to-day operations in light of incoming monetary data, has frequently argued that, in effect, the signal-to-noise ratio in weekly and monthly monetary data is quite low. Among other things this implies policy instruments should be adjusted cautiously in response to apparent deviations of monetary growth from expected or targeted levels.

A variety of studies generated within the Federal Reserve System examine various aspects of the problem. The Bach committee (1976) estimated that the month-to-month transitory component of annualized money stock growth rates was quite large; the standard deviation of monthly growth rates due to transitory fluctuations was estimated at 2½ percentage points.¹¹ In another study, Fry (1976) found that although a variety of alternative seasonal adjustment procedures produced roughly similar trend-cycle movements in the money stock, the various procedures produced annualized monthly growth rates which differed on average by about 7 percentage points! Duncan (1978) analyzed the substantial revisions in preliminary money stock data resulting from revisions of the underlying raw data and the seasonal factors.¹² Taken together the evidence appears overwhelming; as Berkman and Kopcke conclude, "observed rates of change in the money stock, particularly when measured over short-time intervals, may be a very poor indicator of the underlying trend in money growth" (1979, p. 10)

Unfortunately, many of these technical problems associated with filtering and interpreting the data have been unavoidably exacerbated to some unknown degree by the redefinitions of the monetary aggregates, the October 1979 change in operating procedure, and the Depository Institutions Deregulation

¹⁰ Recent work by Barnett (1980) suggests the conventional aggregates (new and old) violate standard postulates of aggregation theory. See U.S. House of Representatives (1980), for a compendium of the profession's views on measuring the monetary aggregates.

¹¹ The Board staff has since reduced this estimate to around 2 percentage points.

¹² For more on the problems associated with interpreting short-run variations and seasonally adjusting monetary data, see Poole and Lieberman (1972), Kaufman and Lombra (1977), Lawler (1977), and Broadus and Cook (1977). On the general issue of seasonal adjustment, see Zellner (1978).

lation and Monetary Control Act of 1980. Data on several components of the redefined aggregates have only recently begun to be collected since a number of rapidly growing components have been in existence for only a few years. Obviously, it is unlikely statisticians will be able to pin down the seasonal patterns of these components, and therefore the aggregates, for some years to come. The greater uncertainty concerning the seasonals will be reinforced by the change to a reserves-based operating procedure which, among other things, will probably permit more seasonal fluctuation in interest rates. This in turn should feed back on the seasonal supply of and demand for various components of the aggregates.¹³ Finally, provisions of the Monetary Control Act of 1980, (see Board of Governors, June 1980) which alter the types of institutions required to hold reserves, the structure of reserve requirements, and the form in which reserves can be held, can be expected to affect various aspects of the process determining short-run variations in the money stock in ways that, at least initially, will be imperfectly understood by both policymakers and their advisers.

Understandably, the various technical problems associated with measuring and interpreting shorter run variations in monetary data have often dominated discussions by policymakers, both internally and externally. Unfortunately, such concerns also appear to have contributed to policy paralysis at critical junctures.

It is fair to say that the relationship between the definition and measurement problem and the control problem, ignored by some and overemphasized by others, lies at the core of the formulation and implementation of monetary policy. The implications of the above discussion for policymakers and researchers differ somewhat. For policymakers seeking guidance from the profession, they need to recognize that a strong case can be made that the growth of the various monetary aggregates has, in general, been too high and procyclical over the past 10 years regardless of the particular aggregate one chooses. This observation suggests that the economic costs associated with controlling a "suboptimal" monetary aggregate — that is, one lacking an adequate conceptual foundation and suffering from a variety of measurement problems — may be considerably *less* than the costs associated with emphasizing the deficiencies of all the various monetary measures and abrogating monetary control. For researchers, the conceptual issues and measurement problems examined above comprise an important research agenda. Beyond this, reexamining some of the linkages between policy instruments and various monetary variables should go a long way toward helping researchers understand what policymakers do or fail to do and thus contribute to the design of appropriate control strategies.

¹³ This so-called policy seasonal is discussed in most of the papers cited in the previous note. A committee of distinguished economists and statisticians, chaired by Geoffrey Moore, was appointed by the Fed in 1978 and charged with reviewing the Fed's seasonal adjustment techniques. The committee's final report is expected to be released in early 1981.

III. Controlling Money: Macro, Micro, and Empirical Issues

Proceeding from the premise that over the longer run inflation is essentially a monetary phenomenon, it is obvious that exercising control over "monetary phenomena" is necessary to control inflation. Since the long run is nothing but a series of short runs, it is logical to begin by assessing what degree of control is feasible or possible over the short run.

The Fed's view over the years has usually been that tighter short-run control over any of the monetary aggregates is probably not possible given the measurement issues discussed above and various stochastic features of our financial system.¹⁴ The Fed has buttressed its position with arguments questioning the desirability of tightening control. Emphasis is usually placed on the size and costs of the interest rate volatility likely to accompany efforts to tighten control (Lombra and Struble, 1979), the minimal effects of short-lived deviations of money growth from target paths on prices and output (Pierce and Thompson, 1972), and the superiority of a "combination policy" which does not necessarily force money to grow along some predetermined path (LeRoy and Lindsey, 1978; LeRoy 1975; B. Friedman 1975, and 1977). In response, many of the Fed's critics have argued that tighter control is possible and that the procyclical variations in monetary growth and the associated economic instability of the 1970s demonstrate such control would be desirable. The problems associated with any attempt to join the argument between the Fed and its critics over the feasibility of achieving tighter control over the aggregates have been vividly demonstrated by the reactions to the considerable variance in money growth and interest rates since October 1979; the Fed points to fiscal policy, instabilities in money demand, and allegedly unpredictable shifts in the relationship between reserve growth and money growth, while the Fed's critics point to the gyrations in reserve growth and conclude the Fed wasn't really trying.

Researchers, recognizing some of the essential unresolved aspects of the control issue, have proceeded by attempting to frame questions in a way that makes them resolvable with the appropriate set of empirical tests. For a variety of reasons discussed below, such tests have not yet proved decisive. The result, I would argue, is that the literature on monetary control has stagnated somewhat in recent years; researchers, who have collectively run all the regressions they can think of, cannot understand why the Fed does not guide policy with their models, while the Fed wonders why researchers persist in framing the problem so naively and incompletely and in overselling the robustness of their results. My own judgment is that the problem is not empirical, but rather a reflection, in part, of a variety of unresolved (or incompletely understood) analytical issues relating to the determination of the money stock.

¹⁴ "Tighter control" should be interpreted to mean making the growth rate of money adhere more closely than in the past to some predetermined target path.

Money Stock Determination¹⁵

The conceptual approach to money stock determination, as reflected in contemporary textbooks and the financial sectors of econometric models, recognizes the joint influence of the Fed, banks, and the public. In its most basic formulation (which ignores currency, time deposits, nonmember banks, lagged reserve accounting, and other complications), the process can be represented as follows:

$$(1) \quad R = RR + ER \quad (1a) \quad R = RR + ER = NBR + BR$$

$$(2) \quad R = qD + eD \quad (2a) \quad NBR = RR + FR$$

$$(3) \quad D = \frac{1}{q + e} R \quad (3a) \quad NBR = qD + FR$$

$$D = 1/q (NBR - FR)$$

where	R	=	total reserves
	RR	=	required reserves
	ER	=	excess reserves
	q	=	reserve requirement on demand deposits
	e	=	ratio of excess reserves to demand deposits
	D	=	demand deposits = money stock
	NBR	=	nonborrowed reserves
	BR	=	borrowed reserves
	FR	=	free reserves = ER - BR

Equations (1) - (3), or their more sophisticated counterparts, are usually summarized by the familiar expression:

$$(4) \quad M = mR$$

where	m	=	the multiplier
	R	=	total reserves or some other reserve aggregate (e.g., the monetary base or nonborrowed reserves)
	M	=	the money stock

Treating R as "exogenous" — which in this context usually means it is under the potential control of the Fed — controlling money then turns on the central bank's ability to estimate m.¹⁶ This multiplier model is usually referred to as a reduced-form approach since money demand and money supply equations are not separately identified and estimated.

¹⁵ The discussion below proceeds in a quite straightforward fashion and I have purposively used the simplest models available. At a minimum, this should help to avoid obscuring or glossing over some of the key issues.

¹⁶ See Johannes and Rasche (1979), the literature cited therein, and various papers in the Federal Reserve Bank of Boston (1969 and 1972).

Within large scale "structural" econometric models, an analogous approach typically employed is to treat an expanded version of equation (3a) as a money supply function. Nonborrowed reserves are again assumed to be determined exogenously and banks' demand for free reserves are hypothesized to depend on various interest rates, loan demand, and other variables (Cooper, 1974; Hendershott and Deleeuw, 1970). The free reserve equation (or excess reserve and borrowed reserve equations taken together) is combined with the money demand equation to yield the equilibrium money stock and market-clearing interest rate.

As is suggested by the simple derivation above, the two approaches proceed from the same analytical foundations and can be viewed as formally equivalent.¹⁷ Unfortunately, this equivalence has often been obscured by the different econometric modeling strategies which have come to be associated with each approach and the tendency to refer to equation (4) as a "supply" function rather than as a reduced-form equilibrium relationship.¹⁸

The empirical work surrounding the multiplier approach, as represented in equation (4), has typically involved using univariate or multivariate time series methods to estimate the multiplier directly (or its components), or estimation of an equation such as the following:¹⁹

$$(5) \quad M = \alpha_1 + \alpha_2 R + u$$

where α_2 = the estimated multiplier.

The results of such work have been widely cited as providing incontrovertible evidence that the multiplier is predictable. Given that the Fed can control R , controlling M is then viewed as a relatively simple task.²⁰ Johannes and Rasche put it this way: "Our conclusion from the above analysis is that the money stock . . . can be predicted with considerable accuracy over horizons of at least several months using simple time series models . . ." (1979, pp. 323-324).

In general, the empirical applications of the multiplier approach tend to abstract from the short-run dynamics of adjustment by banks and the public and thus leave the role of interest rates implicit rather than explicit. Among

¹⁷ Burger's fully specified multiplier model (1971) is virtually indistinguishable from the financial sector of the popular macro econometric models. Within the general equilibrium models developed by Kaminow (1977), Santomero and Siegel (1979), and Kopecky (1978), the formal expressions for the money stock include the simple multiplier model in the text as a special case.

¹⁸ This latter point is one of the themes developed by Gramley and Chase (1965, p. 1390).

¹⁹ The discussion focuses more on the multiplier models because they have come to dominate the literature and underlie much of the policy advice concerning monetary control. Virtually all of the points raised apply with equal force to larger scale "structural" models.

²⁰ In contrast, Roberts and Margolis (1976), utilizing a multi-equation monthly model of the financial sector, find that exercising close short-run control over money growth with reserves is extremely difficult.

other things, this implies that "instrument instability"²¹ and changes in the multiplier induced by changes in interest rates resulting from variations in reserves are not very important (Rasche, 1972). Furthermore, disaggregation and the introduction of more allocative detail are not viewed as crucial for the overall outcome.²²

While proponents of the multiplier approach point to the high degree of explanatory power of the relevant equations and the "small" forecasting errors over intervals of several months, skeptics point to the "large" monthly forecasting errors and a host of analytical and empirical problems resulting in part from the parsimonious specification of the process determining the money stock.²³ It is argued that such problems make the whole approach misleading, unreliable, and therefore unusable. As Benjamin Friedman has noted, such reactions by policymakers or their advisers "at times give the impression that the Federal Reserve can precisely control no variable familiar in the discussions of monetary economists" (Friedman, 1977, p. 92).

The control mechanism contained in multiplier-type models implies that deposit expansion in the banking system is *quantity-constrained* through the Fed's control over the *sources* of bank reserves.²⁴ The Fed, in contrast, adheres to the view that the system is equilibrated through the movement of interest rates which, through their effect on bank revenues and costs, determine banks' desired asset and liability positions.²⁵ In this view money and reserves are "controlled" by using open market operations to affect interest rates which in turn affect the *uses* of bank reserves. As pointed out above, both views are compatible at an analytical level under fairly general assumptions. At the empirical or operational level, however, the Fed believes that the

²¹ Holbrook has stated: "In addition to offsetting the undesired effects of changes in exogenous variables, current policy decisions must offset the current impact of past policy decisions as well" (1972, p. 57). As a result, "under quite reasonable assumptions attempts to offset the cumulative impact of past changes in the policy instrument may require ever greater changes in the future value of the instrument, a situation we will characterize as one of instrument instability" (Holbrook, 1972, p. 57). The variance in interest rates, reserves, and the monetary aggregates over the past year suggests instrument instability may exist at least to some degree.

²² The relative unimportance of allocative detail has become an important monetarist tenet (Brunner, 1970; Mayer, 1978). Coghlan, defending the use of multiplier models, notes that "often the ratios [multiplier] approach is rejected on the grounds of its lack of realism only to be replaced by . . . the even more unrealistic assumption of a structural model containing only linear behavioral equations" (1977, p. 421). He points out that if *m* and *R* are independent, and thus the ratios composing *m* are not very sensitive to induced changes in interest rates, then the multiplier approach and the more detailed behavioral models will yield virtually identical results.

²³ For example, many would call the forecast errors for the multiplier reported by Johannes and Rasche (1979, pp. 320-323), expressed at an annual rate, unacceptably large. The authors, on the other hand, characterize the errors as very small.

²⁴ Open market operations determine the size of the Fed's portfolio of securities (the major individual source of reserves) and these operations can be used to offset movements in all other sources.

²⁵ It should be noted that when I speak of "the Fed's view" I have in mind the position which appears, implicitly or explicitly, most frequently in public statements by policymakers and in papers prepared by staff members. Of course, some individual staff members and policymakers do not embrace "the Fed's view."

structure of regulations and the specific operating procedure being employed at the time play a decisive role in determining causal relationships and system dynamics. Since most multiplier models abstract from such details, the usefulness of multiplier models is questioned.²⁶ The Fed's critics, on the other hand, argue that empirical applications of the multiplier model predict money growth as well or better than available alternatives and that procedures and regulations can be altered to effect a tighter monetary control mechanism which is approximated by various analytical versions of the multiplier model. In general, both sides are correct: given the current structure of regulations and the Fed's operating procedure, the linkages implied by some of the analytical and empirical work surrounding the multiplier approach are misleading, *especially* within the context of short-run monetary control; regulations and procedures can probably be changed to bring the linkages in the system into closer alignment with those implied by the multiplier approach; there is no evidence that the predictive power of the Fed's model(s) of money stock determination exceeds the predictive power of multiplier models.

Proceeding on the basis of the lagged reserve accounting (LRA) scheme in effect as of this writing,²⁷ and taking account of the Fed's description of the reserves-based approach to monetary control implemented in October 1979 (Board of Governors of the Federal Reserve System, 1980), Figure III summarizes the key linkages in the Fed's conception of the process determining the money stock. Peter Keir, a senior staffer at the Fed, described this process this way:

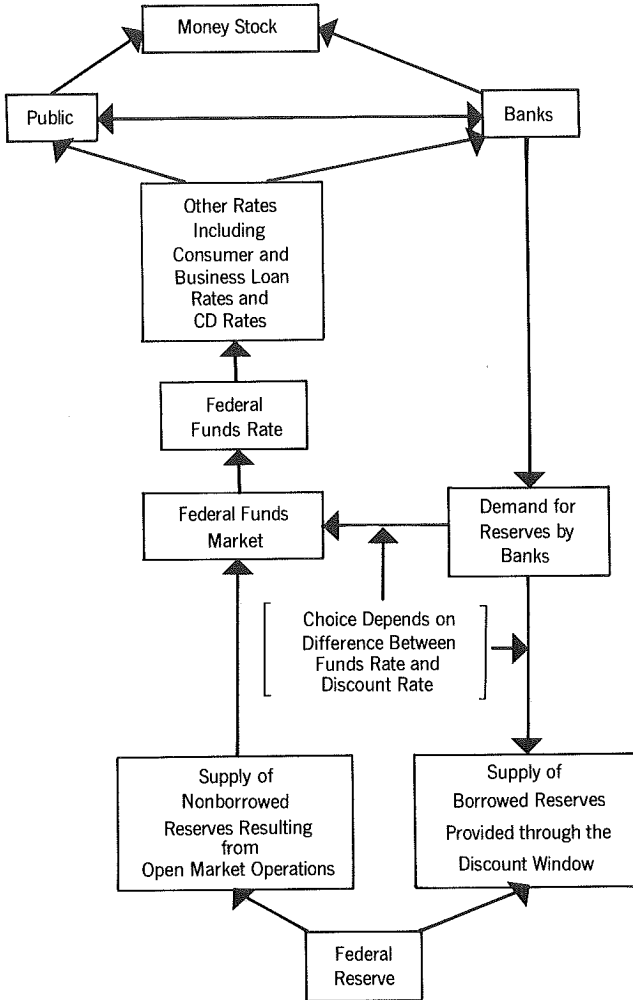
At any given point, bank demands for reserves depend on the volume of deposits outstanding and the consequent need for required reserves. Under present operating procedures, if the growth in private deposits and associated [reserve demands] appears to be more rapid than desired, the Desk holds back on the provision of nonborrowed reserves. This forces banks to seek out sources of reserves and, on the margin, to turn to the System discount window. In the first instance, except for a slight reduction in bank's

²⁶ This difference in perspective probably accounts in part for the frequent failure of academicians and policymakers (and their advisers) to communicate. Several years ago at a briefing for academic consultants, a senior adviser at the Federal Reserve Board indicated that the Fed was projecting a particular rate of monetary growth over the coming quarter. In response, Milton Friedman asked why the Fed was not controlling money — that is, picking a money stock target and gearing its operations toward that objective. As discussed above, and elaborated on below, the emphasis on *projecting*, as opposed to *controlling*, money reflects deeper differences concerning the analytical significance of money and the feasibility and desirability of more precise control over money growth.

²⁷ The LRA system took effect in September 1968. The reserves a member bank is required to hold on average in a given week are determined by multiplying the appropriate reserve requirement by the average level of deposits held by the bank two weeks previously. Thus required reserves are a *lagged* function of deposits. In a June 4, 1980 press release, the Federal Reserve Board indicated that it was considering a return to the pre-September 1968 contemporaneous reserve accounting scheme wherein required reserves are a function of deposits in the current week. This possibility is discussed further below.

Figure 3

The Linkages Between Open Market Operations, Nonborrowed Reserves, and the Money Stock: The Fed's View



The Fed supplies reserves through open market operations (nonborrowed reserves) or the discount window (borrowed reserves); banks demand reserves mainly to satisfy their reserve requirements; banks will acquire needed reserves in either the federal funds market or directly from the Fed through the discount facility depending on the difference between the funds rate and the discount rate; changes in the funds rate will induce changes in other interest rates; changes in these other interest rates will affect the public's willingness to borrow and banks' willingness to lend, and thus the rate of growth of the money stock (and other monetary aggregates).

excess reserves, the Desk's action does not reduce the flow of [total reserves] it only changes the mix between nonborrowed and borrowed reserves. However, if the constraint [on nonborrowed reserves] persists, increased member bank borrowing is partly offset by smaller increases — or reductions — in nonborrowed reserves, and as banks seek alternative sources of funds, they bid up money market rates. In time, higher interest rates encourage the public to economize on deposits; and growth in the monetary aggregates slows down.

The sequence of relationships in this process is clear. The Desk holds back on the provision of nonborrowed reserves, forcing banks into debt at the discount window. This raises money market rates. Higher interest rates lead the public to economize on deposits, and demands [for reserves] are then lowered. In the last analysis, while the reserve tightening process starts with the Desk holding back on the provision of nonborrowed reserves, the actual attainment of slower growth in total [reserves] and the aggregates reflects a lagged response [of money demand] to higher interest rates. (Federal Open Market Committee, August 1972, p. 31).²⁸

Formally, the linkages between reserves, interest rates, and the money stock, within a weekly time frame, can be captured in the following equations:²⁹

$$(6) \quad R_t^d = \alpha_0 + \alpha_1 i_t + \alpha_2 M_{t-2} + u_t$$

$$\alpha_1 < 0, \alpha_2 > 0$$

$$(7) \quad NBR_t^d = R_t^d - BR_t^d$$

$$(8) \quad BR_t^d = \gamma_0 + \gamma_1 (i_t - i_{FR}) + w_t$$

$$\gamma_1 > 0$$

$$(9) \quad NBR_t^s = \overline{NBR}$$

$$(10) \quad M_t^d = \beta_0 + \beta_1 i_t + \beta_2 Z_t + v_t$$

$$\beta_1 < 0, \beta_2 > 0$$

²⁸ There is no evidence that the Fed's view, as articulated by Keir, has changed in any fundamental way since 1972. In his review of Fed actions during 1979, Lang (a staff economist at the Federal Reserve Bank of St. Louis) puts the October 1979 change in operating procedure into clear perspective: "Thus the overall framework for analyzing the effects of open market operations on reserve and money growth — that open market operations change interest rates, which affect the demand for money, thereby influencing the demand for bank reserves used to support money — has not changed. What has changed under the new operating procedures is the FOMC's emphasis on restricting interest rate fluctuations and consequently, the Desk's ability to respond to deviations of money growth from its desired path" (1980, p. 15).

²⁹ This type of model appeared implicitly or explicitly in nearly all internal memoranda dealing with various aspects of monetary control during my tenure at the Federal Reserve Board (1971-77). It also is the conceptual framework contained in an important paper by LeRoy (1979), a former member of the Board's staff.

- where R_t^d = banks' demand for total reserves (during week t)
 i_t = "the" interest rate
 M_{t-2} = the money stock 2 weeks ago
 NBR_t^d = banks' demand for nonborrowed reserves
 BR_t^d = banks' demand for borrowed reserves (from the Fed's discount facility)
 i_{FR} = the Federal Reserve discount rate
 NBR_t^s = the supply of nonborrowed reserves (provided through open market operations)
 Z_t = an exogenous shift variable
 $\alpha_0, \beta_0, \gamma_0$ = constant terms
 u_t, v_t, w_t = independent, normal error terms with zero means

Equation (6) is a demand function for reserves. It reflects banks' demand for required reserves, which is a function of the money stock lagged two weeks, and banks' demand for excess reserves which is a function of the interest rate (and perhaps other variables impounded in the constant term). Equation (7) is an identity; banks' demand for nonborrowed reserves, which reveals itself in the federal funds market, is equal to the demand for total reserves minus banks' demand for borrowed reserves. As shown in equation (8), the latter is determined by the difference between the market interest rate and the discount rate set by the Federal Reserve. In any particular week the discount rate and the supply of nonborrowed reserves (equation [9]) are assumed to be fixed exogenously by the Fed. Equation (10) is a money demand function.

Given the discount rate and the supply of nonborrowed reserves, equations (6)–(10) will yield an equilibrium interest rate and quantity of money. Within the model it is clear that there is no simple, direct link between the supply of nonborrowed reserves and the money stock — the dynamics work through borrowed reserves and interest rates.³⁰ Porter, Lindsey and Laufenberg of the Fed staff put it this way:

Lagged required reserve accounting destroys the direct link between contemporaneous injections of reserves and the monetary aggregates. Under lagged accounting the weekly stock of demand deposits is not determined by the simultaneous interaction of a supply of deposits function and the demand for deposits function. Rather the short term rate, say, the commercial paper rate, is determined by the interaction of nonborrowed reserve injections and the banks' demand for nonborrowed reserves — which depends not on current deposits, but on deposits two weeks previously. The current stock of demand deposits, in turn, is determined by this rate interacting with the demand function for demand deposits. . . . Another way of putting this result is to say that under lagged reserve accounting the textbook supply of demand deposits [money] function does not exist: there is no

³⁰ The model can also be used to show that borrowed reserves and interest rates are essential for the equilibrium solution regardless of the system of reserve accounting in effect. This can be seen by replacing M_{t-2} with M_t in equation (6) — reflecting a CRA world — and resolving the model for M and i .

independent avenue for reserve injections to affect the equilibrium level of deposits in the same week other than by operating through interest rates and deposit demand. Marshall's scissors has lost one of its blades (1975, p. 4).

The clear implication according to the authors is that "no relation . . . exists . . . to relate the current week's demand deposits, nonborrowed reserves, and interest rates that is not dependent on the demand deposit demand function" (1975, p. 40).

Given these analytical foundations (and even if we ignore the Fed's operating procedure for the moment), it is clear that empirical work proceeding in the tradition of equations (4) or (5) suffers from a serious misspecification or the relevant linkages.³¹ All this *does not* imply that multiplier models are worthless or that it is impossible to control monetary growth with reserves in a LRA world. However, it *does* imply that empirical work which abstracts from the role of interest rates and various regulations (and the apparent instability of money demand examined by Porter and Simpson, this volume) is likely to be less reliable than work which does not.

Unfortunately, moving from a weekly time frame to the monthly or quarterly time frame used in most empirical work compounds rather than solves the basic problem. In this context, aggregation over time obscures the underlying process and thus confounds cause and effect.³² Furthermore, once the weekly time frame is abandoned, treating the Fed's instrument — in the present case, nonborrowed reserves — as exogenous is most inappropriate.

As is clear in the Fed's description of its procedures (1980), the week-to-week setting of nonborrowed reserves is a function of the current and lagged disturbance terms in equations (6), (8), and (10), interest rates, member bank borrowing, and the desired rate of monetary growth, which itself varies month to month and quarter to quarter. Thus in the post-October 1979 period, a reserve-setting equation — the Fed's reaction function — is needed to close the model contained in equations (6)–(10) if the system is to be estimated properly over a monthly or quarterly time frame. Similarly, if one were dealing with the period when the Fed first began to give weight to monetary growth in the formulation and implementation of policy and used a federal funds rate-based (demand) approach to monetary control (early 1970 through September 1979), a funds rate-setting equation would be needed to close the model. As Geweke has argued:

If the specification is incorrect the otherwise identifying restrictions imposed on structural equations may not be sufficient to identify those equations, estimation procedures will be inconsistent and the model cannot adequately portray the dynamics of the system it seeks to describe. It is

³¹ David Pierce (1976) develops this theme in some detail.

³² Black (1973) examines the effect of aggregation over time on money demand functions.

therefore desirable to test the exogeneity specification rather than let it remain a mere assertion (1978, p.1).³³

The tendency to ignore the endogeneity of the Fed's instrument compounds the estimation problem generated by ignoring LRA. In fact, since there is persuasive evidence that over the postwar period the Fed has leaned with rather than against the wind, reserves are more properly viewed as a result of rather than cause of changes in the money stock.³⁴

When all the above estimation problems are combined with the effect that changes in Fed procedures and regulations have probably had on the optimal decision rules of banks, other financial intermediaries, and the public at large, and thus on the "structural" parameters of financial models,³⁵ the limitations of received empirical work would seem considerable. Feige and McGee summarize the problem this way:

Our results show that there is no exogenous variable in the trivariate [money stock, reserves, interest rate] money market model. Second, the behavior of the central bank and in particular its operating procedures are likely to have an impact, not only on the variables it controls but also on the structure of the economy as a whole. Finally, the demonstrated dynamic nature of the money market and the observed lags in adjustment suggest that policy recommendations based on simple comparative static models are likely to be misguided (1979, p. 397).

Proposals Designed to Improve Monetary Control³⁶

Despite the limitations of much of the empirical work, economists have devoted considerable attention over the past decade to various possible reforms which could strengthen central bank control over one or more of the popular monetary aggregates.³⁷ It would appear that much of this work had little initial effect on policymakers or their advisers because it ignored the so-

³³ Fair (1978), has recently shown (as have others before him, including this author) that *endogenizing policymaker behavior in a macro econometric model has a dramatic effect on the resulting estimates.*

³⁴ See Feige and McGee (1977) and Mason (1977) and the references cited therein. At least one researcher at the Federal Reserve Bank of St. Louis has recently come around to this view: "In essence the Federal Reserve has tended to supply reserves to accommodate the growth of bank credit, instead of pursuing an independent monetary policy" (Gilbert, 1980, p. 17). One can only wonder if the implications of this observation for the "St. Louis Model" will be fully appreciated. See also the recent paper by Stein (1980).

³⁵ In this context Lombra and Kaufman (1980) examine the implications of Lucas's argument (1976) for money supply and money demand functions. Among other things, they find that conventional "money supply" functions flunk tests for structural stability. See also Brown (1972) and Coats (1972; 1976), for discussions of how the 1968 changes in Regulation D affected bank behavior and the money supply process.

³⁶ At the outset it should be noted that much of the literature on this topic was motivated by the important paper by Poole and Lieberman (1972).

³⁷ Some proposals tighten control over one aggregate and loosen control over other aggregates.

called "membership problem" and was predicated on a reserves-based approach to monetary control and contemporaneous reserve accounting (CRA) — an environment which did not exist during the 1970s, but may well come into being during the 1980s.³⁸ Noting these and other limitations, policymakers showed little enthusiasm for various proposals they thought would have minimal effects on monetary control. Although the papers by Pierce and Brunner cover some of these issues in more detail, some aspects of the literature and various reform proposals should be highlighted.

Following the very useful paper by Pierce and Thomson (1972) delivered at the last Federal Reserve Bank of Boston conference on controlling monetary aggregates, much was written on the choice of the optimal instrument — the federal funds rate or some reserve aggregate such as the monetary base or nonborrowed reserves — for controlling money (or the monetary aggregates). When the dust had settled at the end of the decade the Fed had apparently junked the funds rate and adopted a reserves instrument.³⁹

Contemporaneous Reserve Accounting

Not surprisingly, the Fed's shift in operating procedure has been accompanied by widespread support for a return to CRA. As Poole had argued earlier: "The current system of lagged reserve requirements quite literally minimizes the accuracy of short-run control of the money stock" (1976, p. 138).⁴⁰ Careful work by Laufenberg (1976) and LeRoy (1979) has shown that the variation of the money stock (and interest rates) introduced by supply or demand disturbances is unambiguously greater under LRA than under CRA.⁴¹

The Fed's reaction to this work, which is contained in a series of letters and memos Chairmen Burns, Miller, and Volcker have exchanged with Henry Reuss, Chairman of the House Banking Committee, has passed through several phases. Initially, the Fed argued that as long as a funds rate operating procedure was employed, a change to CRA was of little help in improving monetary control. This along with the fact that banks overwhelmingly favored LRA — the argument being that it lowers the costs of reserve

³⁸ Long and variable lags are not uncommon in monetary economics.

³⁹ I say apparently because the extent and significance of the change is not yet entirely clear. See Lombra and Torto (1975) for a description of the formulation and implementation of policy under the old approach and a discussion of the supply and demand approaches to monetary control.

⁴⁰ See also Coats's careful analysis (1972; 1976). Most researchers recognized that under the funds rate-based, demand approach to monetary control, previously employed by the Fed, CRA vs. LRA was not a critical issue, since the money demand function is independent of the system of reserve accounting.

⁴¹ Since current disturbances have no effect on current required reserves, movements in both interest rates and the money stock are not moderated by the absorption or release of reserves which would accompany disturbances under CRA. Among other things, it might be noted that this implies a given open market operation has a larger initial effect on interest rates and deposits under LRA than CRA.

management — was the rationale for maintaining the often attractive status quo.⁴²

Immediately after the October 1979 shift in operating procedure the Fed was forced to alter its position somewhat. In an October 18, 1979 letter to Congressman Reuss, Chairman Volcker said a change to CRA would be resisted by small and medium-sized banks and thus would probably exacerbate the membership problem. At the same time he stated: "I am not convinced that the existing two-week lag between deposits and required reserves is an important complication in achieving reserve and monetary targets over a period of three to six months or so."

With the membership problem taken care of by the Monetary Control Act of 1980, the major outstanding issue is still the significance of a change to a CRA scheme.⁴³ I do not believe economists have much more to say on this issue. It seems clear from a large body of research (summarized most recently by Gilbert, 1980) that a switch to CRA, given current operating procedures, would improve monetary control somewhat. (The existing bands limiting the fluctuations in the federal funds rate also limit the improvement associated with the switch to CRA.) My own judgment, however, is that the possible degree of improvement is understated by comparing the variance of the money stock (and interest rates) before and after LRA was introduced in 1968. This, along with "reduced-form" regressions of money on reserves, has been the empirical evidence presented by the Fed to support its position that over three to six month periods CRA would have negligible effects on the Fed's ability to control the money stock and other aggregates (Board of Governors of the Federal Reserve System, 1977). The Fed's approach to policy (i.e., its decision rule) and the financial system have changed considerably since 1968. Among other things, the money stock was not viewed as an important variable to be monitored or controlled; the structure of reserve requirements was less complicated; the role of nonmember banks, foreign institutions, and other financial intermediaries in the money and credit creation process was much less important; liability management was not yet a central feature of bank behavior; and the System managed reserve requirements and the discount rate somewhat differently than in the 1970s. Taken together, these considerations would seem to vitiate the type of evidence used to support the Fed's position; everything else besides the reserve accounting system is not equal in the CRA and LRA periods.⁴⁴ I should add, however,

⁴² See the discussion in Board of Governors of the Federal Reserve System, (1977).

⁴³ There is also a question concerning the advisability of changing to CRA at the same time that the new system of reserve requirements called for under the Monetary Control Act of 1980 is being phased in. A certain amount of confusion and resulting reporting errors are probably unavoidable. One can argue it is best to get the changes and transition period over with as soon as possible or one can argue it is best to spread the changes out to ease the transition. The problem with the latter approach is that it may lengthen the time it takes to pin down reliable empirical relationships (such as estimates of the multiplier) which are important in the control process.

⁴⁴ In its latest consideration of the issue (August 1980), the Board decided to study the problem further! In an August 15, 1980 press release the following appears: "The Board is disposed

that it is extremely unlikely that the *major* control problems of the past or the future lie in the particular system of reserve accounting in effect.⁴⁵

The Setting of Reserve Requirements

The literature on the "optimal" structure of reserve requirements grew against the background of an existing set of differential reserve requirements (and other regulations) which became ever more complicated during the 1970s. George Kaufman summarized the problem this way:

By increasing the complexity of the money multiplier, proliferating rate ceilings on various types of deposits and encouraging banks, albeit unintentionally, to search out nondeposit sources of funds, the Federal Reserve has increased its own difficulty in controlling the stock of money. . . . To the extent the increased difficulty supports the long voiced contention of some Federal Reserve officials that they are unable to control the stock of money even if they so wished, the actions truly represented a self-fulfilling prophecy (1972, p. 57).

For the most part the literature has concerned itself with how to set reserve requirements so as to minimize the variance of deposits in response to various disturbances.⁴⁶ As one would expect, the literature has gradually matured as the assumptions and restrictions present in earlier work have been relaxed. Kopecky (1978, 1979), and Froyen and Kopecky (1979) have recently shown that the optimal structure of reserve requirements is not invariant with respect to the Fed's operating procedure.⁴⁷ These general equilibrium approaches, including the insightful papers by Kaminow (1977) and Santomero and Siegal (1979), which build on earlier partial equilibrium studies, have demonstrated the importance of preserving the adding-up constraints and cross-equation restrictions emphasized by Brainard and Tobin (1968).

Froyen and Kopecky (1979), and Benavie and Froyen (1979), have also shown that it is essential to take account of the own rate on deposits in

toward returning to contemporaneous reserve accounting, possibly by September 1, 1981 if further investigation indicates that such a system is operationally practical." CRA was obviously operationally practical before September 1968; why it may not be now is a puzzle.

⁴⁵ Recent empirical work by Cacy, Higgins and Sellon (1980) led them to conclude that "the differences in the degree of monetary control are so small that it is unlikely that a change in reserve accounting procedures would substantially affect monetary control *under almost any reasonable assumptions about how open market operations are conducted*" (p. 12, emphasis added). See Poole (1976), Judd (1977), and Laurent (1979) for alternatives to the current LRA system and the old CRA system. Judd and Scadding (1980) analyze these various reserve accounting proposals in some detail.

⁴⁶ See, for example, Laufenberg (1979), and Sherman, Sprenkle and Stanhouse (1979).

⁴⁷ Kopecky (1978; 1979) argues that reserve requirements on demand deposits should be set at their upper limit under a reserves-based operating procedure. Interestingly enough, the Fed is in the process of *lowering* reserve requirements for many institutions in connection with the Monetary Control Act of 1980.

designing reserve requirement schemes.⁴⁸ Fixed, perfectly flexible (competitive), and slowly adjusting deposit rate regimes affect the short- and long-run properties of any reserve requirement structure. The tendency to *assume* the own rate is either fixed or equal to the competitive rate finesses rather than solves the problem and ignores empirical evidence to the contrary. Startz has carefully examined the yield on demand deposits and summarizes his important results this way: "The rate of implicit interest appears to be well below the competitive rate on deposits. It is also well above zero and is responsive to changes in market interest rates. I estimate that the implicit deposit rate has been historically approximately one-third to one-half of the competitive rate" (1979, p. 515).

The tendency to, in effect, ignore the own rate on deposits and its implications for the process of money stock determination, is symptomatic of a more general tendency to ignore the factors determining the rates set on all types of deposits by banks and other financial intermediaries and the associated effects on short- and long-term aspects of monetary control. Thus, a major remaining void in the literature, in my judgment, is the absence of adequate dynamic microfoundations for monetary control. For example, it is common practice to assume that reserve requirements are binding, regardless of the level and structure of interest rates, the services provided by the Fed, and the composition and variances of deposit flows. Micro analysis would suggest that banks' desired level and composition of reserve balances are a function of the above factors. As Kane argues, "Reserve requirements in excess of the ratios that a bank would prudentially establish for itself may be interpreted as a confiscatory 100-percent tax on the income the bank would otherwise earn on the funds it earmarks to meet the 'excess requirements'" (1980, p. 2). Kane, and Kanatas and Greenbaum (1979), develop the implications of this proposition for monetary control. They argue that although reserve requirements can serve as a tax device and monetary control device in the short run, over the longer run they serve as neither because of the financial innovation they induce. More specifically, the incentive to shift or avoid the tax encourages the development of substitutes for "high" reserve requirement liabilities by banks, nonbank financial intermediaries, and foreign institutions. *This innovation in turn makes the monetary aggregates relevant for policymaking harder to measure and control.* As Kanatas and Greenbaum point out, "under plausible behavioral assumptions reserve requirements will increase the variance of monetary aggregates and thereby complicate the implementation of monetary policy" (1979, p. 2). The result is that the call for universal or uniform reserve requirements and the various proposals discussed above designed to tighten monetary control are "premised on ignoring the fact that reserve requirements induce the creation of deposit substitutes. When this innovation effect of reserve requirements is

⁴⁸ See also Klein (1978) and Saving (1979); Saving notes that "neglecting the market determination of deposit rates does significantly affect the results of a market determined supply process" (p. 22).

taken into account, the presumption that the predictability of monetary aggregates increases with reserve requirements vanishes" (Greenbaum, 1979, p. 2).

The above illustration is just one example of the process of regulation-induced financial innovation, discussed in detail by Kane (1977), which affects both money demand and money supply. Unfortunately, this merging of micro and macro, and static and dynamic analysis is almost totally absent from the literature.⁴⁹ Simply put, the longer run, often unintended effects of various regulations on the competitive relationships among various types of financial institutions and thus on demanders and suppliers of money and near-monies cannot be ignored.⁵⁰

The Monetary Control Act of 1980 sets the broad parameters within which policymakers will probably have to operate in the 1980s. Macro models which treat the evolving structure of reserve requirements (and other regulations) as instruments which directly constrain the aggregate volume of deposits and bank credit are likely to be less helpful than those which build on micro models (Baltensperger, 1980) and focus on the costs of deposits, the net return on assets, and the competitive relationships among various types of financial institutions (domestic and foreign).

Reforming the Discount Mechanism

As is clear from the discussion of the process determining the money stock, presented above, the setting of the discount rate, the administration of the discount facility, and the resulting volume of member-bank borrowing, play an important role in linking Fed actions to bank behavior and variations in money and credit. The desire to tighten these linkages has given rise to a variety of proposals designed to alter the Fed's management of the discount rate and other aspects of the discount mechanism. For example, some economists have argued that the discount mechanism provides an escape hatch for banks, at least in the short run, from the effects of a restrictive monetary policy. If the Fed uses open market operations to reduce the volume of reserves in the banking system, banks can borrow additional reserves at the discount window and thus, at least temporarily, offset the Fed's actions. The notion that the Fed can or should quantity-constrain the banking system leads these economists to recommend reforms which would minimize the potential offsets. Although the Fed has considered some of these reforms from time to time, it has traditionally emphasized the desirability of preserving the "flexibility" provided by current practices while downplaying the slippages.

⁴⁹ A notable exception is the conference paper by Porter and Simpson which develops the linkages between financial innovation and money demand.

⁵⁰ For a fuller development of some of the micro aspects of the problem, see Boyd and Kwast (1979). Some have suggested that the Fed pay interest on reserve balances as an alternative to reserve requirements. See Kanatas and Greenbaum (1979), Santomero and Siegel (1979), and Lindsey (1977) for discussions and analyses of this proposal.

Currently, the Federal Reserve Board sets the discount rate administratively and promulgates regulations regarding the size, frequency, and permissible reasons for borrowing.⁵¹ By far the most often suggested reform is to make the discount rate a penalty rate by tying it to and setting it above the federal funds rate or some other short-term rate. The major problem with a proposal to make the discount rate a penalty rate over the *current* funds rate, which eliminates the incentive to borrow from the Fed, is easily illustrated. Under LRA, banks' demand for reserves, which is dominated by the need for banks to meet their reserve requirements, is essentially interest inelastic.⁵² If the Fed's supply of nonborrowed reserves is exogenous and thus perfectly interest inelastic, and less than banks' demand for reserves, then these conditions and the penalty-rate proposal make the federal funds rate indeterminate; LRA prevents banks from adjusting required reserves by adjusting liabilities, there is no incentive to borrow from the Fed, and excess reserves are negative in the aggregate. A central bank concerned (often excessively) with the variance of interest rates, is understandably not attracted to such a proposal.⁵³ Of course, one could tie the discount rate to last week's funds rate or Treasury bill rate. This would eliminate the indeterminacy and reduce, but not eliminate, the slippages associated with current arrangements.

With the Monetary Control Act of 1980 providing access to the discount window for *all* financial institutions required to hold reserves, the potential volume of borrowing and attendant problems for monetary control are greatly enlarged. Giving some weight to the Fed's attachment to several characteristics of the present regime, desirable attributes of any reforms are to make the volume of borrowing more predictable, thus facilitating the selection of appropriate target paths for nonborrowed reserves, and to speed up rather than slow down the public's portfolio adjustments to policy-induced alterations in financial conditions. Toward these ends, serious consideration should be given to the penalty rate proposal discussed above, as well as a program that would in effect control the elasticity of the supply of borrowed reserves to banks. A (rapidly) rising marginal cost of borrowing from the Fed, with the elasticity tied to size, frequency, or current policy objectives,

⁵¹ See Lombra and Torto (1977) for a critical examination of the Fed's setting of the discount rate and the notion that changes in the rate generate "announcement effects."

⁵² I say essentially rather than completely because it is possible banks' demand for excess reserves is somewhat interest elastic or that banks' willingness to carry over reserve surpluses or deficiencies is sensitive to the current or expected federal funds rate. Current regulations enable banks to carry over surpluses or deficiencies of up to 2 percent of their required reserves. I am not aware of any empirical evidence which suggests the resulting interest elasticity is other than negligible.

⁵³ If CRA were adopted, the direct link between an interest-elastic demand for money and a contemporaneous derived demand for reserves would remove the indeterminacy. However, since the short-run elasticity would in all likelihood remain small, the short-run variation in the federal funds rate induced by supply or demand disturbances could still be quite large. Nonetheless, the alteration of the basic result does illustrate the interdependence among the various proposals. See Sellon (1980) for a useful analysis of the role of the discount rate under alternative operating procedures.

could well serve to complement rather than offset other policy actions.⁵⁴ Much would depend on the technical details of the program and the effect it would have on other key behavioral parameters.

It seems likely that a variety of possible reforms, some of which have been discussed above, could tighten control over the monetary aggregates if policymakers embraced the intermediate target approach. It is also possible these same reforms could make it easier to interpret movements in the monetary aggregates if policymakers used the aggregates as information variables rather than intermediate targets. Furthermore, although the effect of any one reform might be rather small, the cumulative effect of a package of reforms of existing techniques and regulations could ultimately be significant.⁵⁵ Nonetheless, any resulting improvements in monetary control and policymaker performance would in the final analysis depend on the reliability of various empirical relationships linking policy instruments to financial and real variables, interdependencies among the various reforms, and the willingness of policymakers to modify several aspects of the policymaking process.

IV. The Reliability of Empirical Relationships and the Execution of Policy

Over the past 20 years an ever growing and somewhat bewildering empirical literature has examined the relationship between various variables under the potential or actual control of policymakers and various measures of economic activity. It is fair to say that the results and forecasts generated by both "reduced-form" and "structural" models indicate that the short-run relationships are not as tight and reliable as much of the policy advice purportedly based on some of this research would have one believe. At the same time, however, the evidence suggests that these relationships are not as loose and unreliable over the intermediate run as policymakers seem to believe. Furthermore, despite the myriad of estimation problems generated by the issues discussed in the previous sections, and addressed in the papers by Porter and Simpson, and Berkman,⁵⁶ which leave the power of many tests conducted in this context in serious doubt, one still has to grant the basic validity of the important point made by Poole (and other monetarists): the problem with monetary policy over the 1970-79 period "was not that money growth fluctuated quarter to quarter, but that its average rate was too high

⁵⁴ I understand Perry Quick of the Federal Reserve Board staff has developed a proposal along these lines.

⁵⁵ I hasten to add, however, that ongoing empirical work is unlikely to provide decisive evidence regarding the payoffs associated with such reforms. Any change in current regulatory arrangements will alter structural relationships and therefore estimated parameters in econometric models (Lucas, 1976). In addition, interdependencies between the reforms and other elements of the money supply process must not be ignored. For example, changing to CRA or reforming the discount window, could affect banks' demand for excess reserves. Unfortunately, economists often tend to take the *ceteris paribus* assumption too seriously.

⁵⁶ The list of problems should also include the inadequate treatment of expectations (Poole, 1976; Willes, 1980) and international financial relationships.

and the fluctuations around that average were procyclical" (1979, p. 475).

It is axiomatic that control of, or interpretation of, movements in monetary and real variables depends on the reliability and thus stability of various empirical relationships, the ability of policymakers and their advisers to identify these relationships, and the willingness of policymakers to guide policy in light of forecasts and analyses based on these relationships. No one believes that U.S. monetary policymakers gathered each month over the past 10-15 years and consciously tried to: (1) raise the trend rates of monetary growth and inflation; and (2) pursue procyclical policies. Since both happened it is important to distinguish between "failures" of economics and "failures" of policymaking as sources of such undesirable outcomes.

In a recent study of the analytical foundations and forecasts guiding the formulation and implementation of policy, Lombra and Moran (1980) found that the nonfinancial forecasts produced by the Fed's staff were about as good as others produced in the private sector. However, the errors were large over a two to four quarter horizon, deteriorated over the 1970-74 period, and were biased in the sense that real GNP tended to be overestimated, while inflation was underestimated. It was argued that the latter problems resulted in part from the staff's short forecasting horizon, which in turn was a function of policymakers' planning horizon, and the failure to adequately assess the longer run cumulative effects of past policy actions.

On the financial side, short-run money stock projection errors were also found to be quite large. The interpretation of the errors and their significance for future policy, as rendered by both the staff and policymakers, revealed a "flexible" analytical foundation for policymaking which appeared to frustrate communication among the parties involved and led to inconsistencies and circularities in the policy process. Unfortunately, the resulting disorientation, along with the large financial and nonfinancial projection errors, imparted a short-run bias to policy discussions and thus a focus on current, rather than projected, economic and financial conditions in selecting among policy alternatives. It also contributed to an emphasis on the real output effects of various policy actions which dominate over the short run, rather than the price effects which dominate over the longer run. Taken together these several aspects of the policymaking process contributed to procyclical movements in the money stock and economic instability.

Most students of monetary theory and policy agree that there are a variety of slippages in the linkages comprising the monetary control mechanism and that these slippages can be significant over the short-run horizon which has traditionally characterized policy deliberations and decisions. However, there is a large body of evidence which suggests that many of these apparent slippages dissipate over longer time horizons and may be avoidable if various regulations and procedures are altered. Nonetheless, one can easily overemphasize the importance of various existing and proposed regulations and procedures in contributing to past policy errors and future policy successes. *The secular rise in inflation and accompanying secular decline in*

monetary discipline cannot reasonably be attributed to technical aspects of policymaking. Such proximate causes of monetary control problems are not independent of the constraints (actual or perceived) generated by the political and economic environment within which policymakers operate.⁵⁷

IV Summary and Conclusions

The literature on monetary control has moved in several productive directions since the Federal Reserve Bank of Boston convened the 1972 conference on this topic. To help facilitate the continued development of the literature, this paper has addressed a variety of issues which are central to an analysis of the monetary aggregates and monetary control.

1. The definition and measurement of money (and near-monies) are logically distinct processes which have become conceptually confused in the ongoing debate over the appropriate targets, instruments, and indicators for policy. Defining money, measuring its quantity, estimating supply and demand functions and identifying the appropriate or optimal monetary policy target(s) are related but separable steps as one proceeds from the formulation of hypotheses, to empirical testing, to the development of policy prescriptions. Unfortunately, a considerable portion of the analytical and empirical work on the monetary aggregates fails to make these distinctions. The inevitable result, as Tobin noted some years ago, is that advocates of a monetary aggregates strategy often appear to be saying "we don't know what money is, but whatever it is, its stock should grow steadily at 3-4 percent per year" (Tobin, 1965, p. 465). Policymakers, on the other hand, often appear to be saying that conceptual, analytical, and technical problems surrounding the monetary aggregates make better control over any of the aggregates difficult, if not impossible, and perhaps inadvisable. The first view contributes to an intellectual paralysis, while the second leads to policy paralysis. At a minimum all parties should be able to agree that central bank pursuit of monetary targets or use of the money stock as an information variable depends on our ability to distinguish between supply and demand disturbances which are either transitory or permanent. The need for such analysis cannot be aggregated away.

2. The Fed's ability to interpret short-run variations in the monetary aggregates and guide policy accordingly is severely limited by the large transitory component of short-run variations (reflecting the instability of supply and demand), and a variety of problems resulting from seasonal adjustment, data revisions, changes in operating procedure, and changes in regulations, such as those being implemented under the Monetary Control Act of 1980.

3. Empirical work and policy prescriptions regarding monetary control are often based on models of the process determining the money stock (and

⁵⁷ A detailed consideration of this theme would take us too far afield. See the relevant papers in Lombra and Witte (1981), for elaboration.

other monetary aggregates) which fail to take adequate account of existing regulations and Fed operating procedures in determining causal relationships and system dynamics. Multiplier-type models, for example, imply that deposit expansion in the banking system is quantity constrained through the Fed's control over the sources of bank reserves. A seemingly alternative view, embraced by the Fed, is that the system is equilibrated through the movement of interest rates which affect bank revenues and costs and therefore desired asset and liability positions. The problem is not for the most part at the analytical level, since each view shares a common analytical foundation, but rather at the empirical level. Given the structure of regulations and the Fed's operating procedure, I would argue that the linkages implied by most of the empirical work surrounding the multiplier models and "structural" models are misleading. While it is clear that regulations and procedures can be altered to tighten the linkages in the system and bring them into closer conformity with those implied by this work, empirical work which abstracts from existing arrangements must be viewed with some skepticism.

4. A variety of reforms regarding the system of reserve accounting, the structure of reserve requirements, and the operation of the discount window, have been proposed. Several, such as a return to contemporaneous reserve accounting and instituting a penalty discount rate or a positively sloped supply of borrowed reserves, could enhance monetary control. However, the assessment of many reform proposals suffers from the absence of an adequate dynamic microfoundation which is needed to guide the analysis of the effects of such reforms over time on the cost of deposits, the net return on assets, and the competitive relationships among various types of financial institutions (domestic and foreign). Insufficient attention to such considerations in the past contributed to the failure to recognize the implications of the innovation induced by various regulations for the definition, measurement, interpretation, and control of the monetary aggregates.

5. Available evidence suggests that sizable forecasting errors, shifting views on the analytical significance of the money stock and the other monetary aggregates, and political and economic constraints (actual or perceived), have in the past imparted a short-run bias to the formulation and implementation of policy. The resulting focus of policymakers on current, rather than projected, economic and financial conditions has contributed to procyclical policy and economic instability.

The voluminous research on improving monetary control, undertaken both inside and outside the Federal Reserve, appears to have had observable effects on the conduct of monetary policy. However, the aura of consensus on how to formulate and execute policy obscures a number of unresolved analytical and empirical issues addressed above. As a result, lasting improvements in monetary control will depend on continuing research in these areas *and* the willingness of policymakers to modify regulations and procedures accordingly. Conferences such as this one suggest that the outlook may not be as bleak as an extrapolation of the last decade would indicate.

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Discussion

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After reading Ray's skillful and wide-ranging paper I really found myself with very little to comment on negatively, and have only praise to offer. In listening to his oral statement, however, a couple of things hit me that I may have overlooked in reading his paper, and would like to comment briefly on them before offering some more general observations.

First, I think Ray was distinguishing between money as an indicator and money as a target. I had the impression he was saying that money still has many indicator properties in the Fed's view. In my view, while money can be considered as an indicator, money is and has been a target to the Fed. The System has announced one-year money targets that it takes as objectives. That is not to say that short-run money movements may not have some indicator properties if you mean indicators of GNP and all that, though I have never been clear in my mind why money should have a special role in that respect when more direct evidence on GNP is available on a current basis. It should be clear that money is a target and that the System intends to hit the target that it sets, although shorter run variability around the target can certainly be expected in response to endogenous forces in the economy.

My second point, and this too is relatively minor, relates to Ray's characterization of the Fed staff view about the money supply process. I have been very hard pressed to find a single Fed staff view. There are enough differences in emphasis and interpretation about the role of money and about how it can be controlled — given different interpretations about interrelationships among money, reserves, interest rates, and GNP and related lags and slippages — to provide considerable variety in staff views.

I would like to raise some other points, generally related to Ray's paper, but also to issues discussed in other panels. On the demand function for money, I have been in the situation over the years, because my principals are interested in these things, of assessing money-interest rate relationships and of attempting to use money demand functions to that end. I may be exaggerating a little, but every three months or so one finds that a function has been reestimated and that the lags have changed and the interest elasticity has changed. The changes are often sizable, depending on the sample time period. Moreover, there are almost as many differently specified functions as there are flavors of ice cream. And they don't predict too well out of sample periods. This makes one very uneasy about whether the function is inherently stable or predictable. I tend to think something is there that can be grasped, but it is very elusive and leaves scope for, not to say the need for, good judgment on the part of the policymaker.

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That and other experiences over a long period of practicing monetary economics lead me to strong feelings of eclecticism, recognizing the danger some may conclude I thereby became like the old St. Louis Browns short-stop who couldn't hit but he couldn't field either.

Still there are several issues about which I would like to vent my eclecticism. I am convinced, and have been convinced for a long time, that money matters. That was true at either Harvard, where I was an undergraduate, as at Chicago, where I was a graduate — all 30 to 35 years ago. But the analysis differed at the two institutions. There was a question on the AB Honors exam at Harvard to which the answer was: you put in money causing interest rates to go down therefore investment goes up and as a result, income is influenced. But the Ph.D. exams at Chicago at the time had a question that required an answer indicating that the preceding analysis was wrong or at best incomplete, because it ignored the direct substitution that could occur between money and goods, and thus that the whole effect on the economy of changes in money supply did not have to go through interest rates. Passing both exams brought me one step toward eclecticism.

We also have the problem of defining money. We've had some very intensive staff debates at the Federal Reserve, for example, about whether RPs are transactions money or merely a store of liquidity. And that debate has made me somewhat more eclectic. I became convinced as a result of our research that there is a very important transactions component to RPs, but that there was also a large investment component. This view was buttressed by conversations with people in the market; some of them say RPs are part of their money, while some say they are part of their investment portfolio. It is clearly part of both. More generally a money component is evident in a variety of financial assets, with modern financial technology making it easier to develop assets that directly substitute for old-fashioned demand deposits. Thus, there would seem to be doubt that there is a unique concept of money.

Another issue about which one is tempted to feel quite eclectic involves the degree of flexibility needed in procedures employed to achieve monetary targets. There is something to be said for procedures that have enough flexibility to permit assessment of underlying factors affecting money demand — whether, for example, any tendency for money to grow strongly or weakly reflects a shift in demand for money given GNP and interest rates, or reflects a strengthening or weakening of GNP itself. Let me hasten to say that I do not in any way mean to say that we shouldn't be targeting on money at this time and this place. I think we should.

But I think there is a substantive issue about whether you want control to be on a month-by-month basis or to be over a longer horizon of three months or so, which provides room for assessing the possibility of changing relationships, if any, between money and the economy.

There are also very practical reasons for flexibility in procedures that may permit sometimes fairly sizable short-run movements away from target. There is a lot of noise to weekly and monthly, sometimes even quarterly, money supply figures. Noise is for the most part unexplainable. But there are

occasional large variations that are explainable. For instance, the sharp drop of money in the second quarter of this year appears in part to represent a response to the credit control programs as cash holders paid off debt. The subsequent rebound in money growth may have to a degree represented an effort to restore cash positions. Whether pure noise or explainable noise, it is reasonably clear to me that smoothing such erratic short-run movements in money would not necessarily serve a substantial economic purpose. I am not even sure that they could be controlled if one wanted. Perhaps you could close the discount window or have 100 percent reserve requirements, but then I believe banks might begin holding high excess reserves as a precautionary measure, or the market might invent alternative forms of money outside the banking system to accommodate the erratic nature of money flows in the economy.

Controlling money over, say, a three- to six-month horizon, rather than on a precise month-to-month basis, still involves the need for continuous assessment of the appropriateness of a predetermined money target. As I noted above, a shift in money demand relative to GNP would indicate that, for a given GNP, the targets should be raised or lowered, depending on the direction of shift. But it is never very clear if deviations in money growth as they are occurring should be interpreted as such a shift or not. An aggregate reserve operating procedure is not accommodative to such demand shifts, but a nonborrowed reserve target probably provides a bit of accommodation in the short run and in that sense adds a degree of flexibility to monetary policy operations. Still over any reasonable run, even a nonborrowed procedure, which does involve changing the nonborrowed path in response to changes in demand for borrowing from the discount window by banks, would not be even partially accommodative to a tendency for money to run strong or weak. That is the virtue of a reserve target, of course. But it also places a high premium on choosing the basic money supply target wisely. And it also suggests the need for adjustment of the money target if anticipated shifts in demand are occurring relative to the ultimate goals for economic activity and prices.

Finally, I would like to say a few words about the money supply target which reserve procedures are designed to control. We are rather clearly living through a period of considerable change in the structure of the financial system and of proliferation in the types of instruments in which "money" can be held — RPs, checking deposits at thrifts, Eurodollars, zero balance accounts, electronic transfers out of savings accounts, etc. As changes have been phased in, we have been able to adjust targets to them, with a varying degree of uncertainty involved, and we have adjusted money supply definitions.

But looking far down the road — and foreseeing ever wider use of electronic transfers among other things — the problem of finding an adequate measure of money, either on an institutional basis or as bearing some systematic or predictable relation to GNP, may well become much more difficult. We have some research going on at the Fed by Bill Barnett who is trying to develop weighted averages for various money series which take account of the

degree of moneyness in a variety of assets, and maybe that will lead us somewhere. But if you ever get to the point where you have little or no confidence in what the definition of money is, then control of interest rates of course tends to become a more attractive policy option. Problems with controlling interest rates have been evident. You don't need me to review the difficulty of distinguishing between nominal and real interest rates and of estimating how borrowers might respond to nominal rates, which requires somehow estimating borrowers' attitudes toward inflation.

I am tempted to think, and this is looking years ahead, not this year, not next year, not the year after, that we may be driven back to an eclectic system of money and interest rate control. However, the definition of money would need to be quite different from what we now have. Money would be pure outside money. I believe Jim Tobin in a paper prepared for a conference we had on the monetary aggregates rightly said that the nonborrowed monetary base was the economy's outside money, and termed it M zero. If you take the view that the nation's central bank should be sure to provide enough "substance" of some sort from outside — "substance" the economy does not generate on its own — to sustain the nation's long-run growth, one might consider for starters putting in a reasonable amount of nonborrowed base, which the Fed can control. That would provide a quantity fulcrum, so to speak, for the economy with the amount initially chosen on the low side of the range of possibilities so as to encourage price stability. If that amount is not sufficient to support noninflationary growth, banks will then borrow more base.

But, of course, in practice the ups and downs of borrowing may be supporting inflation or contributing to deflation. Therefore, it becomes essential under such a procedure for the discount rate to be actively employed as a control instrument that affects the level of market interest rates. In essence, the money provided through the nonborrowed base would be the quantitative element of policy and the discount rate would be the other policy tool that is used to influence credit conditions as a year progresses.

Such an approach differs from what we are now doing in that our present nonborrowed reserve path (in principle a nonborrowed base could also now be an operating target) is determined from a money supply target, and the discount rate is rather more passively adjusted to market conditions, which are essentially determined by the intersection of money demand and money supply. But I was using the possible alternative approach to raise issues in your mind about how one might conceive of operating in a world — if it should ever develop — where money cannot be well delineated from the myriad of other assets held by consumers and businesses.