FEDERAL RESERVE BANK OF SAN FRANCISCO
ECONOMIC REVIEW
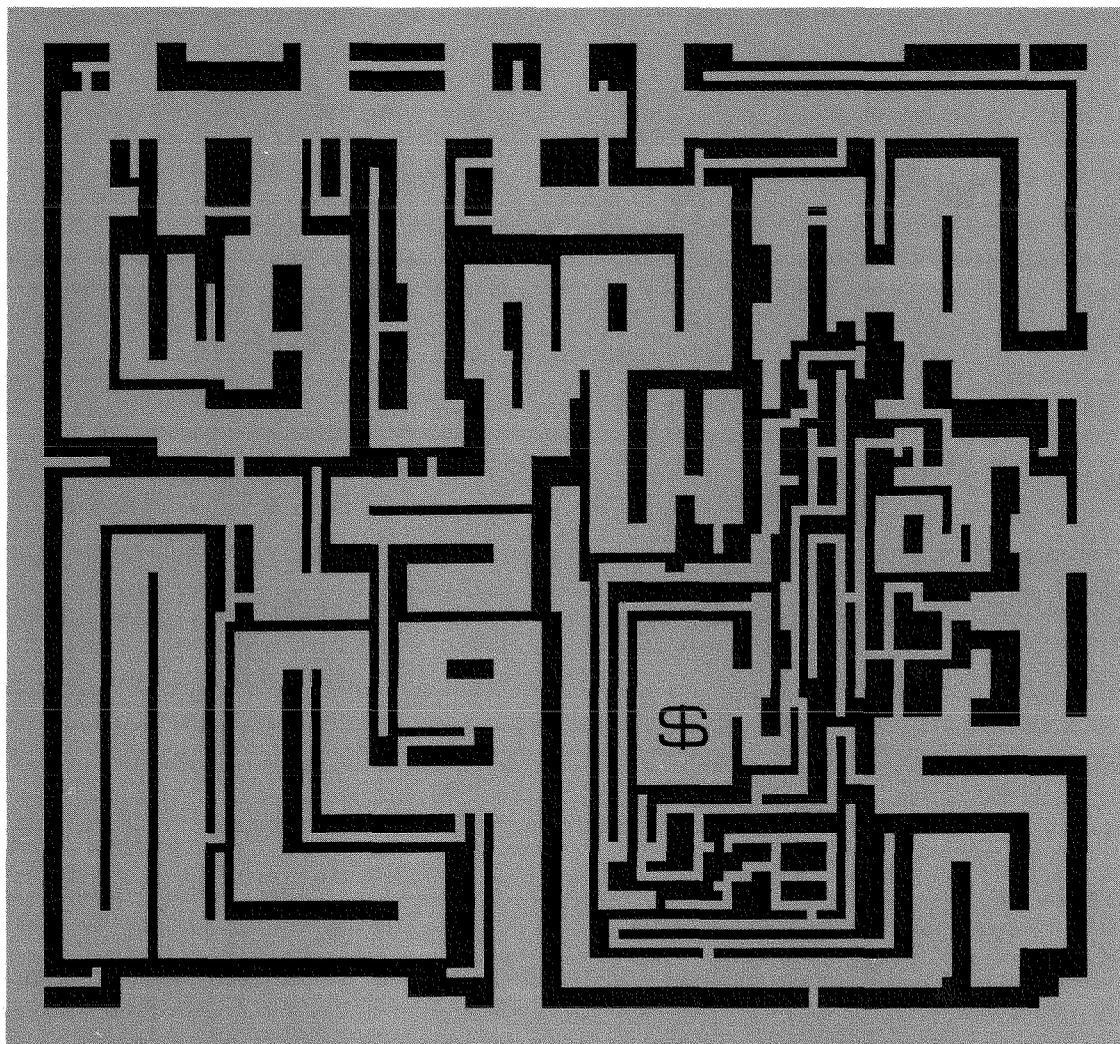
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ALTERNATE STRATEGIES TOWARD INFLATION

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Conducting Effective Monetary Policy: The Role of Operating Instruments

John P. Judd and John L. Scadding*

Events have a way of carrying things before them. The following article is a case in point. Its purpose originally was to make the case for why we thought monetary control would be improved by the Federal Reserve concentrating on bank reserves rather than the Federal-funds rate in the day-to-day conduct of monetary policy. On October 6, even while our paper was being prepared for distribution to the Federal Open Market Committee, the Federal Reserve announced in a press release that it would place "a greater emphasis in day-to-day operations on the supply of bank reserves and less emphasis on confining short-term fluctuations in the Federal-funds rate." We are heartened by this step and believe it will prove ultimately to make a significant contribution to economic stability. In the meantime, we think it is important to understand precisely what the move entails, and why it is potentially fundamental and far reaching. This article is designed to provide just such an understanding.

It is now generally recognized that an effective monetary policy is a crucial element in controlling inflation and avoiding recessions. This can be seen clearly in the large body of theoretical and empirical work which addresses the question of what makes for "effective" policy. Until recently most of this work distinguished two separate points. The first, broader, issue was whether the impact of monetary policy on *ultimate targets,* like prices and employment, could be more accurately gauged by movements in interest rates or in the monetary aggregates. This is often referred to as a problem of *strategy,* because it is concerned with the appropriate general framework within which monetary policy should operate. The second, seemingly narrower, issue was whether, with a given monetary-aggregates strategy, the Federal-funds rate or reserves would allow more accurate control of the aggregates. This is a problem of *tactics*—of how to choose an *operating instrument* to best carry out the desired strategy.

Current Federal Reserve procedure formally reflects this compartmentalized approach to monetary policy. Official Federal Reserve procedure consists first of translating ultimate stabilization goals, such as price stability and full

employment, into *intermediate targets* for the monetary aggregates, and then of choosing an operating instrument as a means of reaching the desired targets. Until recently, the Fed used the funds rate for this purpose; in other words, the procedure consisted formally of a funds-rate tactic designed to achieve a monetary-aggregates strategy.

We have been careful to insert qualifiers like "formally" and "officially" throughout the last paragraph, because we believe that the reality of Federal Reserve policy is different from its appearance. Specifically, we argue that the Federal Open Market Committee (FOMC) operates in such a way to ensure the linkage of tactics and strategy, so that they cannot in practice be separated in the way suggested by formal description. This is because there are really two dimensions to the tactics decision. The first is the choice of operating instrument—Federal-funds rate or reserves. The second, and equally important decision, is choosing the method of employing the instrument.

The point is illustrated by the *cautious* way in which the FOMC formerly moved the funds rate: it moved the rate only slowly, or by small amounts, when confronted with less than complete evidence that policy should be changed. Of course, cautious control of the operating instrument (whether funds rate or reserves) represents

*The authors are, respectively, Senior Economist, Federal Reserve Bank of San Francisco, and Economist, Federal Reserve Bank of San Francisco.

a rational response to the considerable uncertainty which FOMC members face in conducting policy, and to certain institutional factors which constrain their actions. But our main point is this: given a procedure of cautious control, the FOMC's choice of the funds rate as its operating instrument effectively represented a commitment to an interest-rate strategy. But the reverse is also true. With the FOMC's adoption of a reserves operating instrument (with a wide-band Federal-funds rate constraint), it is likely to pursue something close to a monetary-aggregates strategy. Thus, the choice of operating instrument dictates the choice of strategy, and in this sense it is impossible, as a practical matter, to compartmentalize Federal Reserve policy.

Two further implications are worth considering. First, the pertinent tactical question is not whether interest rates or reserves allow more accurate control of the monetary aggregates. Given the feasibility of using either reserves or the funds rate in an aggregates strategy, the choice of an operating instrument depends on whether an aggregates or interest-rate strategy comes closer to achieving the Federal Reserve's ultimate stabilization goals. Second, it misses the point to say that the compartmentalization of Federal Reserve procedure prevents it from carrying out policy as effectively as it might with so-called optimal control policies. We have already argued that policy is not in practice compartmentalized. Additionally, in view of the effective linkage of tactics and strategy (through cautious control), *feasible* policy alternatives are likely to exclude the optimal-control solutions.[1]

The plan of the paper is as follows. In Section I, we review the problem of choosing the right strategy, because of the importance of that issue in determining whether policy will be effective or not. Next, in Section II, we show how and why the FOMC typically used the funds rate in a cautious manner in the past. On the basis of that evidence, we conclude that cautious control is independent of the choice of operating instruments, and hence that the FOMC is likely to control reserves cautiously in the future. Also, we present evidence to show that cautious control of the funds rate has most of the hallmarks of an interest-rate strategy as far as its impact on money and GNP growth is concerned. We then argue that a reserves operating instrument would have produced something close to an aggregates strategy, which leads back to the original point— namely, that operating procedures must be evaluated in terms of which entails the more appropriate strategy. In Section III, we survey the evidence on alternative strategies, which supports the choice of an aggregates strategy over an interest-rate strategy. This leads to our conclusion, in Section IV, that the use of reserves as the operating instrument is likely to improve the effectiveness of monetary policy.

I. Choice of Strategy—Basic Conceptual Issues

The following discussion summarizes in non-technical terms the basic conceptual issues involved in choosing a strategy for monetary policy. The reader who is familiar with the literature on this topic can safely skip to Section II without losing the thread of the argument.[2]

A strategy is defined as an overall plan designed to accomplish some ends. In the case of monetary policy, the ends, called *ultimate targets* or *goal variables*, are the traditional ones— stable prices, full employment and stable exchange rates. The aim of monetary policy is to keep departures in prices, employment (or output) and the exchange rate from their desired levels as small as possible—to stabilize those variables about their targets, in other words. To do that effectively requires: (a) being able to monitor closely the goal variables for any indication that they are going off track, so that remedial action can be taken before the departure becomes serious; and (b) being able to gauge quickly and accurately whether the monetary-policy actions taken are having their desired effect. However, data on the ultimate targets are not received quickly enough for them to be used directly in the formation of policy. Instead, some intermediate variables must be found, which are available on a more timely basis, and which also contain enough information about the ultimate targets for use in monitoring indirectly what is

happening to those ultimate targets. The choice of strategy is simply a decision about what intermediate variable(s) is (are) best for this purpose.

We can illustrate these rather abstract points by focusing on the problem of stabilizing real GNP, as most of the academic debate has done. Within this context, the choice of strategy has typically been cast in terms of whether to use interest rates or the monetary aggregates to gauge the influence of monetary policy on real GNP. In some ways this is a useful approach; in other ways, not. On the plus side, this approach has a great deal of practical relevance, given the very real concern of monetary policy with the problem of promoting high and stable levels of output and employment. Moreover, the problem can easily be analyzed with the use of standard macroeconomic theory. On the minus side, however, by concentrating exclusively on real magnitudes and thereby largely ignoring prices, this approach slights what has become a serious threat to macroeconomic stability—a stubbornly high and disturbingly erratic rate of inflation. In so doing, it tends to misrepresent those strategies which are effective in promoting overall stability—that is, stability of *both* output and prices. This point is of more than academic interest, because of the two strategies typically considered—interest rates and aggregates—only the latter has been seriously advocated as a viable strategy for containing inflation. Thus, by focusing on real GNP and ignoring inflation, we can bias the analysis against an aggregates strategy.[3]

A strategy problem exists, as we have seen, because data on the ultimate targets are collected with too long a lag to permit direct monitoring of those targets. For example, monthly data on real GNP do not exist, while preliminary quarterly data are not available until nearly a month after the end of the quarter, and often these preliminary estimates are significantly revised over a period of three years or more. Ideally, policy actions should respond quickly to unforeseen events which push GNP away from its target.

However, the long lag and preliminary character of initial GNP data make it difficult to detect such occurrences. In lieu of up-to-date or "timely" data on GNP, policymakers must try to infer what is happening to GNP by using indirect, readily available evidence. Theoretical discussion has focused almost exclusively on two such intermediate - information variables — interest rates and monetary aggregates. Clearly, both of these variables have considerably smaller data lags than GNP. Interest-rate data are available in published form daily. Money-stock data are available on a somewhat unreliable basis with a one-week lag, and with considerably more reliability with a lag of less than a month. Additionally, interest rates and the monetary aggregates provide information about *future* GNP as well, since changes in GNP typically react with a lag to changes in current interest rates and money stock. Hence they are doubly timely, in the sense that they provide information about values of GNP which will not be observed until much later.

Besides their timeliness, candidates for strategy variables must bear some systematic and predictable relationship to the goal variable; otherwise they would be incapable of providing information about the latter, which is, after all, their *raison d'etre*. Again, both interest rates and monetary aggregates are natural candidates on this criterion. First, both theory and evidence point towards interest rates as an important determinant of real aggregate demand, and therefore of the level of output. Thus, *ceteris paribus,* it is possible to associate with each level of interest rates (i) a level of output (y); and conversely, to associate with each level of output a level of interest rates that would produce just the right level of real aggregate demand. This relationship between interest rates and real GNP is enshrined in the standard IS curve of macroeconomic theory, or less formally, by the dual-direction arrow between i and y in Figure 1 below.

Figure 1
Intermediate Targets and Strategy Choice

Strategy (Intermediate Target)	Link	Ultimate Target
(a) Interest Rates (i)	◄——— Aggregate Demand (IS) ———►	GNP (y)
(b) Monetary Aggregates (M)	◄——— Money Demand (LM) ———►	GNP (y)
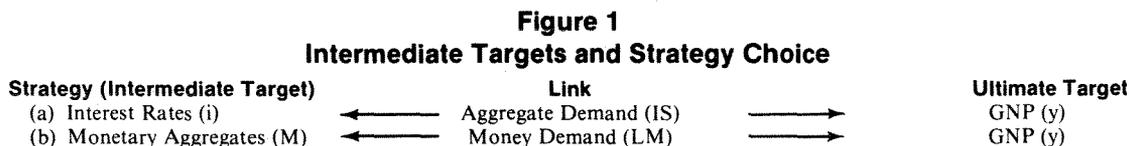
Money and real GNP are connected through the money-demand function, which posits that (*ceteris paribus*) for each level of the money stock (M), a level of real income exists at which the public is willing to hold that stock. Conversely, each level of real income determines an amount of money demanded. This relationship between money and real GNP is embodied formally in the standard LM curve, or less formally, by the two-way arrow between M and y in Figure 1.

This stabilization model requires modification in one respect. In Figure 1, we assume that the relationships between interest rates and money, on the one hand, and GNP on the other, are completely predictable, so that it is possible to associate with each level of i or M a unique level of y, and vice versa. In practice this is not so because (a) we only have estimates of the relationships, and these are subject to sampling error, and because (b) the relationships depend on other variables which our imperfect knowledge does not allow us either to specify or predict precisely. Hence it is more accurate to think of the relationships as specifying a link between *ranges* of possible outcomes for i and M and *ranges* of possible outcomes for y. This idea can be seen by associating sets of intermediate and final targets rather than single points, as illustrated in Figure 2, where the circles denote sets of outcomes.

Consider the problem of using observations on i and M to predict and attempt to control what is happening to y. Let y* be the target for GNP, and let i* and M* be the interest rate and money stock, respectively, that are most likely to be associated with y*. These "best guesses" are shown as points in Figure 2. Now suppose that policy successfully operates to achieve i* but that the money stock turns out to be lower than M*. How do we interpret this result? Two extremes bound the possibilities:

• The aggregate-demand relationship is "tight," so that for given i*, the range of possible outcomes of y is relatively small. On the other hand, the money-demand relationship is relatively "sloppy," so that an outcome for M is consistent with many different outcomes for y. In this case, it is rational to assume that M is lower than expected because money demand has unexpectedly fallen, not that GNP is too low. The appropriate response is to keep i at i* and allow money to remain at its new lower level.

• The money-demand relationship is relatively exact, while the aggregate-demand relation is susceptible to frequent and significant disturbances which greatly weaken the link between interest rates and output. In this case, it is sensible to treat the observation on M as strong *prima facie* evidence that y is weaker than desired, and to operate to bring M back to M*, even though this will mean lowering interest rates.

This example clearly shows that policy choices are determined by one's view of the world—in particular, by how one regards the relative tightness of the two (interest rate and money) links to income. A choice of interest rates as the intermediate target implies that policymakers are pursuing an interest-rate strategy, while a concentration on the aggregates implies an aggregates or money-supply strategy. The issue at root is an empirical one: Which relationship is the more

Figure 2
Unpredictability and Strategy Choice

Strategy (Intermediate Target)	Link	Ultimate Target

(a) Interest Rate i^* — Aggregate Demand: Predictable Part and Unpredictable Part — GNP y^*

(b) Monetary Aggregates M^* — Money Demand: Predictable Part and Unpredictable Part — GNP y^*
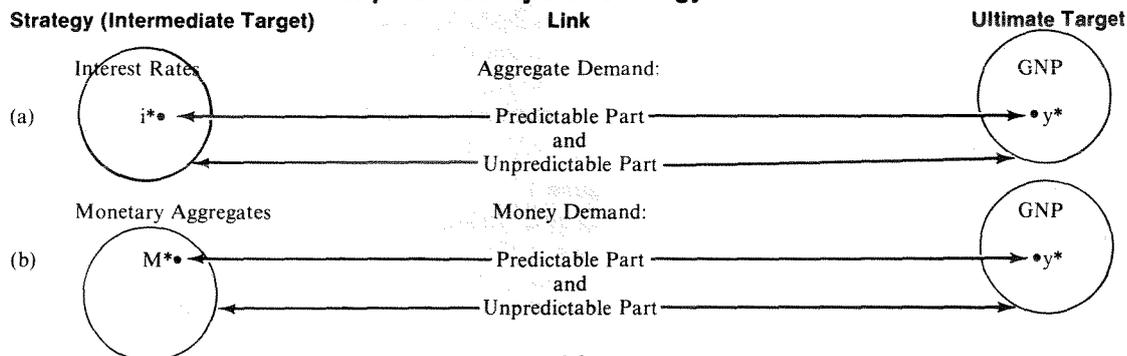
stable in the sense of yielding a small predicted range for GNP? In the extreme cases outlined above, where instability (unpredictability) is confined entirely to either one or the other of the relationships, the instability criterion by itself is sufficient to determine the choice of strategy. Thus an interest-rate strategy dominates where money demand is unstable, while an aggregates strategy dominates where the instability is in the aggregate-demand relation. In the general case, where both relationships are unpredictable, the criterion must also take account of the interest sensitivity of money demand and aggregate demand, because these considerations affect the extent to which (unexpected) shifts in money demand or aggregate demand translate into changes in real GNP. As a general rule, the more interest sensitive aggregate demand is, and the less interest sensitive money demand is, the more likely is it that an aggregates strategy will dominate.

Neither strategy, as a theoretical matter, necessarily produces the smallest possible variation of GNP around its target that policymakers could attain. Each is essentially a defensive strategy, designed to prevent the intermediate variables from straying too far from preassigned targets. In general this is not a fully efficient procedure, because evidence that the intermediate variable is going off track provides useful information that the intermediate *targets* themselves need to be revised. Strategies which use this "feedback principle"—optimal control or combination policies—generally produce greater stabilization than the so-called "pure" strategies that we have examined.[4] However, these more efficient strategies typically require more aggressive manipulation of interest rates and the aggregates than we think is feasible, given the FOMC's cautious-control procedures. We have concentrated on the pure strategies because, as we argue below, the FOMC's operating procedures are more likely to lead to a pure strategy than to an optimal combination strategy.

II. Impact of Operating Instruments on Strategies

Given our choice of strategy, the problem of tactics asks how we can operate to keep our intermediate target on track. Typically the literature on this subject makes no distinction between interest rates at the strategy level and interest rates as an operational variable (the Fed funds rate), so that the tactical problem of implementing an interest-rate strategy would be trivial. The literature suggests that the same would not be true for an aggregates strategy, since the money stock can be targeted either with interest rates, operating through the demand function for money, or with reserves, operating through the supply of money. Hence the tactical question generally has focused on whether interest rates or reserves are the better operating instrument for controlling money.

In this compartmentalized view, the tactical question is treated as subsidiary and subordinate to the question of strategy (Figure 3A). But we argue here that this approach gets things backwards—that because of cautious control of the operating instrument, the choice of tactics determines the choice of strategy (Figure 3B).

Cautious Funds Rate Control

According to Federal Reserve public statements as well as empirical evidence, the FOMC attempted as far back as 1970 to control money growth by changing the Federal-funds rate.[5] This attention to the aggregates has been formalized into explicit longer-run target ranges, which are reported periodically to Congress.[6] But the evidence also shows that the FOMC generally has moved its funds-rate operating instrument very cautiously in attempting to achieve these targets. In other words, funds-rate changes have generally not been large enough nor timely enough to stabilize money growth (Chart 1). Except in 1970 and mid-1973, growth in the funds rate and money were highly correlated, and *both* were positively associated with the business cycle.

It should be noted that, *ceteris paribus*, money demand is influenced *negatively* by the funds rate and positively by GNP. Thus if the FOMC actively moved the funds rate to hit its money targets, we would observe a positive association between funds-rate movements and the business

27

cycle, together with fairly constant money growth, as interest rates rose and fell enough to offset the cyclical effect of income on money. Instead, we observe that money growth has been procyclical, increasing and decreasing with GNP. Although the funds rate also has risen and fallen with GNP, these changes have not usually been large enough to stabilize money growth. Two exceptions may be noted: the rapid drop in the funds rate in the 1970 recession, which caused M_1 to accelerate, and the rapid rise in the funds rate in the mid-1973 boom, which caused M_1 to decelerate. But otherwise, throughout the rest of the 1970's, procyclical changes occurred in both the funds rate and money growth.

An analysis of the timing of funds-rate reversals also shows that this operating instrument has primarily followed the business cycle rather than counteracted it. As shown in Chart 1, changes in direction of funds-rate movements have usually been delayed until after a new phase of the business cycle was underway. The funds rate was still being sharply reduced in the first quarter of the 1971 and 1975 recoveries, when an aggregates strategy would have called for a less expansionary policy, given the resurgence in the demand for money and credit as business improved. By the same token, the funds rate was being increased sharply just prior

Chart 1

Changes in the Federal Funds Rate and in the Narrow Money Supply (M_1) (Annual rates, 1970-79)
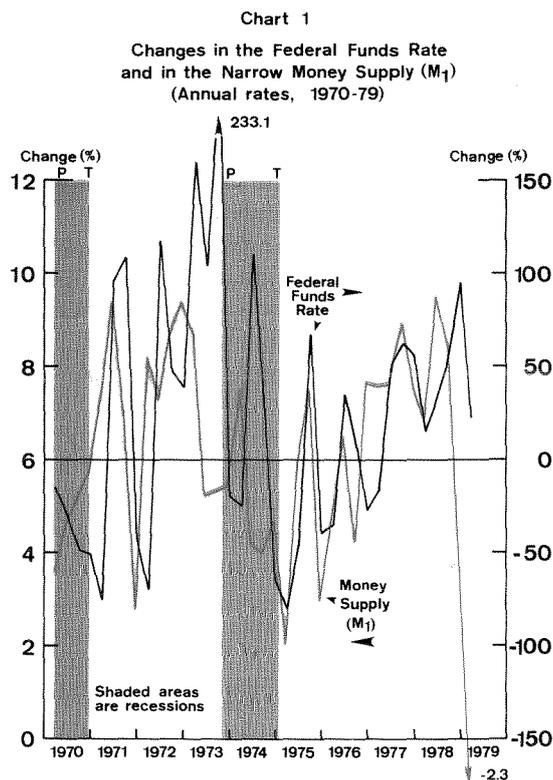
to and shortly after the business-cycle peak in 1973/Q4, when an aggregates strategy would have produced an "easier" policy.

A recent econometric study has also found evidence of cautious funds-rate control during

Figure 3A
Compartmentalized View
of Monetary Policy

Strategy
(Intermediate Target)

(a) Interest Rates ← Aggregate Demand → GNP

Or

(b) Monetary Aggregates ← Money Demand → GNP

Tactics (Operating Instrument)

(i) Reserves ← Money Supply Process → Monetary Aggregates

Or

(ii) Interest Rates ← Money Demand → Monetary Aggregates
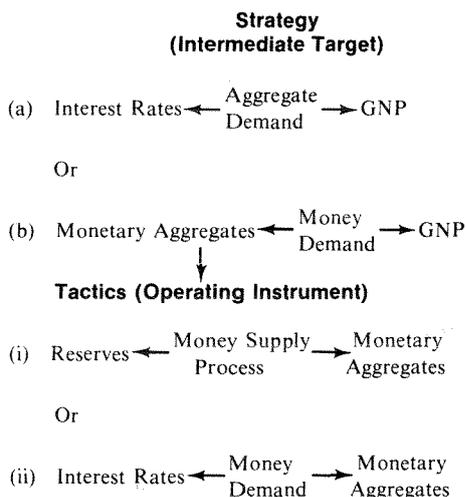
Figure 3B
Cautious Control and
Policy Choice

Tactics (Operating Instrument)		Strategy (Intermediate Target)
(a) Cautious Control of Interest Rates	—— implies ——→	Interest Rate Strategy
Or		
(b) Cautious Control of Reserves	—— implies ——→	Monetary Aggregates Strategy

28
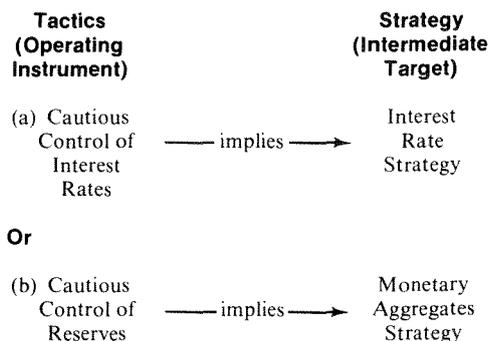
the 1970-74 period.[7] This research involved directly estimating the FOMC's funds-rate reactions to deviations of M_1 from its targets. The results indicated that the FOMC, while attempting to control the growth in the money stock, actually moved the funds rate by only 8 to 9 basis points per month in response to undesired money growth.

This conclusion is reinforced by evidence that the FOMC has been more successful in keeping the funds rate inside the boundaries of its tolerance limits than it has been in keeping M_1 growth inside its short-run and/or long-run ranges. Each month the FOMC Directive to the Trading Desk has specified both a funds-rate range and so-called tolerance ranges for M_1 and M_2 growth over the current and following months (e.g., at January meetings, tolerance ranges would be specified for the January-February period). Thus the tolerance ranges would express the FOMC's short-run aggregates objectives, as distinct from the longer-run objectives expressed by the longer-run target ranges. During the January 1975-April 1979 period, the funds rate almost always remained in the *center* of its target ranges, on a monthly average basis, but M_1 growth often fell outside both its short-run and long-run ranges (Chart 2). This tendency of the funds rate to remain within range may be attributed partly to the fact that the FOMC sometimes adjusted the range when market pressures drove the funds rate to either limit on a weekly basis. Nevertheless, changes in the funds rate have frequently been too small to keep the aggregates on target.

Constraints on FOMC Actions

There are a number of reasons why the FOMC stabilized the funds rate when it was used as an operating instrument, and why it is likely to stabilize reserves now that a reserves regime has been adopted.[8] The FOMC is faced with a good deal of uncertainty concerning the current condition of the economy and the precise timing and impact of policy actions. Uncertainty governs the linkages, first, from money and interest rates to the economy, and second, from reserves or the funds rate to money and other interest rates. This uncertainty reflects the current state-of-the-art in the economics profession, and is not likely to be

Chart 2

Short-Run Tolerance Ranges, Longer-Run Targets, and Actual Values for M_1 Growth and the Federal Funds Rate
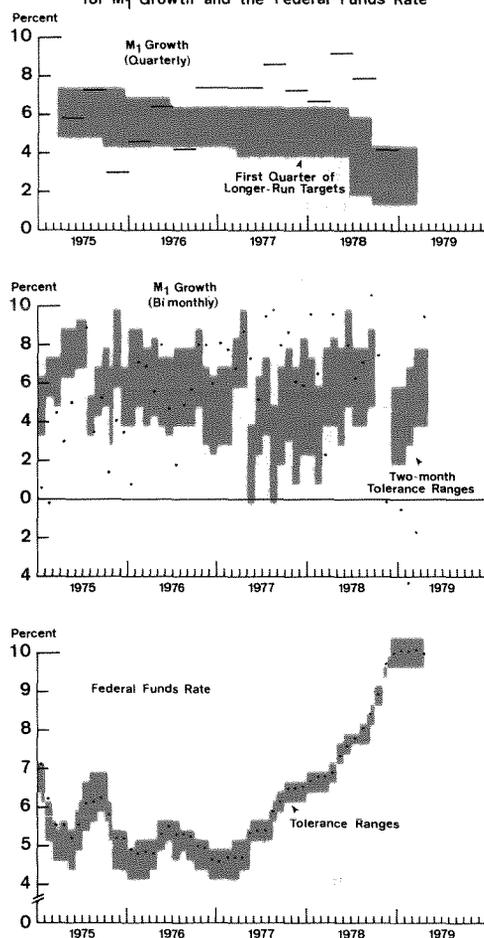
Note: For quarterly M_1 growth (top panel), dashes represent actual growth rates; for bimonthly M_1 growth (middle panel), dots represent overlapping two-month growth rates, and solid lines represent overlapping tolerance ranges; and for Federal funds rate (bottom panel), dots represent actual monthly rates.

eliminated in the near future. Under these circumstances, the rational policymaker, even with the best available information, should react cautiously in changing the operating instrument when money appears to be off target.[9] Since the impact of potential policy actions is uncertain, the fact that the economy functioned "tolerably" well last month is an important piece of evidence in favor of not substantially changing the operating instrument this month. In this way, large swings in policy are quite rationally delayed "until next month."

Several institutional factors also have contri-

buted to cautious control of the Committee's operating instrument. First, in addition to its stabilization goals, the FOMC may quite reasonably desire to provide a stable policy framework, one which causes as little disruption of the private economy as possible. Changes in Federal Reserve policy have profound implications for private-sector planning and forecasting. Thus, the Fed tends to avoid making frequent changes in policy direction because such changes increase the frequency and uncertainty of private-sector decisions and are detrimental to aggregate economic performance.[10]

Second, policy is made by committee, and the inevitable compromises that result sometimes lead to only modest changes in the operating instrument. The need for compromise will often be greater near business-cycle turning points, when uncertainties about the current and immediate future condition of the economy are greatest. At such a time, opinions regarding the proper setting for the operating instrument may vary widely. Thus the Committee's compromise decisions may be biased toward no substantial reversal until the economy is already in a new phase of the business cycle.

Third, the FOMC is appropriately sensitive to Congressional and public opinions about the effectiveness of monetary policies. In fact, Congress has mandated such a concern, through Joint Resolution 133 in 1975 and the Full-Employment and Balanced Growth Act of 1978 (the so-called "Humphrey-Hawkins Act"). Under this legislation, the Federal Reserve Chairman goes before Congress periodically to explain and justify past and future monetary policies. In this highly visible forum, mistakes of commission elicit larger negative reactions than mistakes of omission—perhaps because such errors can be more easily identified with the FOMC. For example, if the discount-rate increase of November 1978 had not been such a success, Congressional and other complaints would have been much louder than if the discount rate had wrongly been left unchanged.[11] For these reasons, the FOMC quite naturally may tend to pursue a status quo policy until considerable evidence is available to justify a change.

Each of these reasons for cautious control of

the funds rate applies also now that the FOMC uses reserves as its operating instrument. Thus the FOMC is likely to control reserves cautiously under its new operating procedures.

Interest Rate Variability
It may be argued that operating-instrument stability was pursued to a greater extent under the funds-rate regime than it will be now under a reserves regime, on the grounds that the FOMC has an ultimate objective of avoiding "excessive" interest-rate variability. Interest-rate variability would, of course, increase with a cautiously controlled reserves operating instrument, and several econometric studies suggest that the added variability would be substantial.[12]

However, these estimates may have substantially overstated the problem. First, the data unavoidably came from an environment where the funds rate had been stabilized by the Federal Reserve. But we know that rational financial-market participants will smooth short-term rates to some extent in a reserves-targeting environment. For example, banks may learn to borrow in advance of periods of heavy seasonal demand, while lenders may delay supplying funds to coincide with periods of heavy expected demand. Both kinds of actions will dampen short-term interest-rate fluctuations.

More importantly, under a reserves operating instrument, funds-rate fluctuations will probably not be transmitted to other money-market rates to the same extent as before.[13] New York Trading Desk operations under the funds-rate regime produced a close association between the (overnight) Federal-funds rate and longer-term money-market rates. The Desk rarely missed its funds-rate targets, and rarely reversed the direction of funds-rate changes, so that the current funds rate provided substantial information about its future levels. In this regard, it should be noted that longer-term rates tend to equal weighted averages of expected shorter-term rates over the life span of the longer-term instruments. The 90-day Treasury-bill rate, for example, should equal some weighted average of 90 future one-day funds rates (plus or minus adjustments for risk, liquidity, and other factors). Since former Desk behavior allowed market participants to forecast future funds-rate levels on the

basis of current rate movements, short-term changes in the funds rate almost immediately became reflected in "longer" term money-market rates. But now, under the reserves operating instrument, day-to-day and week-to-week changes in the funds rate should convey less information about its future levels, and should have a smaller impact on longer-term money-market rates.

German experience confirms this hypothesis—for example, during the January 1973-June 1974 period, when the central bank did not peg very short-term interest rates. In that period, absolute weekly changes in the interbank (overnight) call-money rate varied by an average of 345 basis points, while the (longer term) three-month interbank loan rate varied by an average of only 39 basis points (Chart 3).[14]

A second piece of confirmatory evidence comes from recent U.S. data on daily rate movements (Table 1). Under the funds-rate regime, the Trading Desk pegged the Federal-funds rate to the target rate every day of the week except Wednesday, which is reserve-settlement day for member commercial banks. Since the funds rate

Table 1
Average Absolute Day-to-day Changes, 1977-78
(in basis points)

	Federal Funds Rate	90-Day Treasury Bill Rate
Monday	7.4	7.6
Tuesday	8.3	5.5
Wednesday	20.5	5.0
Thursday	16.9	4.4
Friday	5.2	5.9

primarily reflected private market forces on Wednesdays, the large changes which often occurred on those days were not perceived by market participants as containing significant information about FOMC intentions. Since these changes were not very useful in forecasting future funds-rate movements, Wednesday variability was not in general transmitted to longer-dated money-market rates. The funds rate and the 90-day Treasury-bill rate showed similar variability on Monday, Tuesday, and Friday, but funds-rate variability was significantly larger on Wednesday when this rate often diverged from its target, and on Thursday when it returned to target.

Finally, under the funds-rate procedure, the FOMC was in the position of being publicly responsible for interest rates. It thus came under considerable pressure to keep rates down, especially when they were near Regulation Q ceilings and might trigger disintermediation. But while the FOMC can keep interest rates down in the short-run, this is not true in the long-run. Attempts to lower rates in the face of strong money and credit demands result in fast money growth and ultimately inflation.[15] Indeed, with nominal interest rates reflecting a premium for inflation, attempts to resist interest-rate increases in the short-run often cause higher rates in the long-run. But now, by targeting reserves, the FOMC may be able to divest itself of part of this publicly-perceived responsibility for interest rates, and thus promote a more accurate public perception of the extent to which it can, in fact, control these yields. With the funds rate being more clearly "endogenous" in the reserves regime, the FOMC can more convincingly argue that it is just one of many factors (including private behavior) causing variations in money-market yields.

Chart 3

German Interbank Call-Money Rate Versus the Three-Month Interbank Loan Rate

31
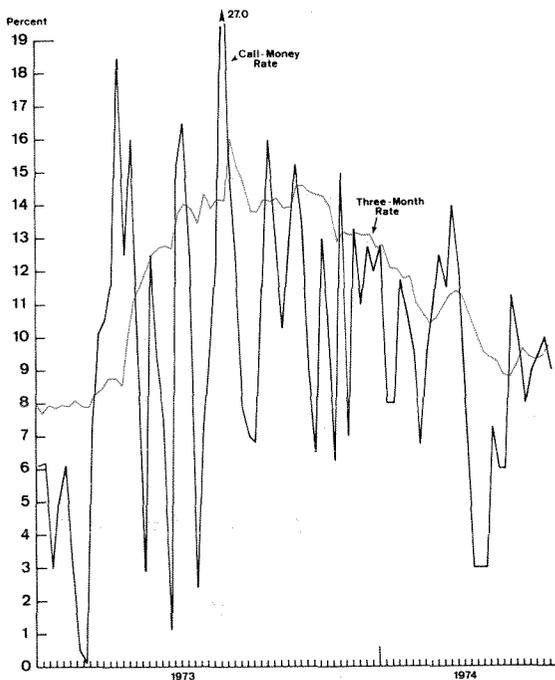
Strategy Outcomes

The FOMC is likely to use either type of operating instrument cautiously in controlling money, so that the choice of operating instrument effectively determines the more important choice of monetary policy strategy. It would be theoretically possible, of course, to control the money supply as accurately with a Federal funds rate as with a reserves operating instrument (Figure 4). As income rises during recoveries and falls during recessions, money demand also rises and falls procyclically. An increase in money-demand in a cyclical expansion, illustrated by the shift from M_{d1} to M_{d2}, can be fully offset either by raising a funds-rate target or reducing a reserves target, as represented by the shift from M_{s1} to $M_{s2}*$ (point S to M in both panels). The use of either instrument to eliminate deviations of money from target would constitute the pure aggregates strategy discussed in the preceding section. Alternatively, a pure interest-rate strategy, which involves pegging the funds rate and thus accommodating all deviations of money from target, could in theory be achieved with either a funds-rate or a reserves approach.

As we have argued above, the FOMC is likely to follow neither of these "pure" strategies precisely, but rather to move its operating instrument cautiously. To see what this means for monetary control, assume that each operating instrument is moved only one-fourth of the way to levels which fully offset cyclical movements in money demand—which means a shift from M_{s1} to M_{s2} (points S to CR in panel 1, and S to CI in panel 2). In this case the procyclical error in the money stock (M-M*) is much larger if the funds rate is used than if reserves are used. The reasons are clear: under a funds-rate target, money demand is fully accommodated at that funds rate, while under a reserves target, demand is accommodated only to the extent that the behavior of banks and the public *partially offsets* Federal Reserve behavior.[16]

Thus, under the FOMC's former tendency to make only cautious movements in the funds rate, deviations of money from target were largely accommodated—which is characteristic of an interest-rate strategy. This strategy is most nearly optimal when money is deviating from target mainly because of disturbances in the monetary sector of the economy. Now that the FOMC is using a reserves operating instrument, its partial responses will result in a strategy which is close to a pure aggregates approach, where money is not allowed to deviate from target. This strategy is most nearly optimal when the disturbances are coming mainly from the real sector.

In view of the likelihood that the FOMC will continue its rational approach of cautiously using its operating instrument, the two constrained policies just described are the feasible alternatives for monetary policy. While neither of these strategies is optimal in the theoretical context of optimal control, they represent the

Figure 4

Monetary Control Errors Under Alternative Operating Instruments

32
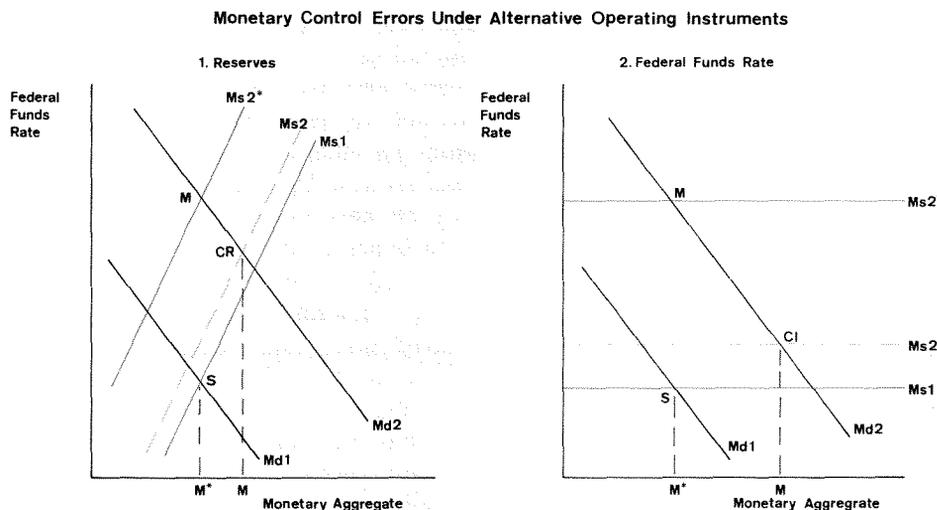
alternatives from which rational policymakers normally choose in practice. Thus the FOMC must decide which of these two constrained policies leads to the most nearly optimal results for the economy.

III. Empirical Issues in the Choice of Strategy

The question of the optimum strategy—interest rates or monetary aggregates—is ultimately an empirical one. Theory can point to the relevant issues—the relative unpredictability of the aggregate demand and money-income relations and their interest elasticities—but it cannot itself resolve them. Our intention is not to give an exhaustive catalogue of relevant empirical results, but instead to survey briefly what we think are the major areas of investigation and their major conclusions.[17] As one might expect, much of the empirical evidence is indirect, suggestive rather than definitive, and seldom totally unambiguous. Nevertheless, given the variety of approaches and data sources involved, the sum of evidence may be considered more compelling than the individual parts if it shows any sort of consensus. Such is the case here, we believe, with the evidence arguing for an aggregates strategy.

The first piece of evidence is the large accumulation of statistical work, covering the pre-1974 period, showing a highly stable relationship between the demand for money and GNP and interest rates (Item 1b, Table 2).[18] This work draws on a long historical record for the U.S. as well as many other countries. It is hard to think of another macroeconomic relationship, with the possible exception of the consumption function, which has stood up to such exhaustive and intensive scrutiny.

Since mid-1974, the demand function for M_1, the narrowly-defined money supply, has apparently shifted, and the continuing uncertainty about the cause of this shift has obviously increased its unpredictability.[19] Consequently, some observers have concluded that an aggregates strategy is no longer appropriate, whatever the case might have been for it previously. This seems to us an extreme position. In the first place, the instability in M_1 does not appear to have infected M_2 and the other aggregates nearly as severely.[20] Many people appear wedded to the idea of M_1 as *the* definition of money, and resist the idea of conducting policy in terms of M_2. Nevertheless, until 1975, it has been difficult to detect any differences in the stability of demand functions for M_1 and M_2, and thus in their respective abilities to predict GNP (Item 3b). Hence, pursuing an M_2 strategy may not produce seriously inferior results com-

Table 2
Major Issues in Survey of Empirical Evidence

(a) For an Interest Rate Strategy		(b) For an Aggregates Strategy
		(1b) Is the demand function for money stable?
		(2b) Is the interest elasticity of demand for money low?
		(3b) What is the appropriate definition of money?
(4a) How well does the aggregate-demand relation by itself predict GNP?	versus	(4b) How well does the money-demand relation by itself predict GNP?
(5a) How well do interest rates predict GNP?	versus	(5b) How well do the aggregates predict GNP?
(6a) Do policy variables which operate through the aggregate-demand relation, such as government spending, exert a significant and predictable impact on GNP?	versus	(6b) Do such variables provide any help in predicting GNP, above and beyond what the monetary aggregates tell us?
(7a) Do simulations of an interest-rate strategy show that it contributes to stabilizing GNP?	versus	(7b) Do simulations of an aggregates strategy show that it contributes to stabilizing GNP?

pared to what M_1 would have yielded had it continued to be well-behaved.

The well-documented finding of a low interest-elasticity of money demand (Item 2b) predicts that money is capable of exerting a significant effect on prices and output. This expectation has been amply confirmed in extensive single-equation tests, which have shown that current and lagged changes in money exert a sizable and predictable influence on GNP (Items 4b, 5b, and 6b). In contrast, similar attempts to explain GNP using interest rates and or measures of autonomous spending frequently (in some instances, almost uniformly) yield inferior results (Items 4a, 5a and 6a).[21] Again, as Froewiss and Judd show in this issue of the *Economic Review,* interest rates contain little or no information about GNP over and above that contained in M_1 or M_2 (Item 5a). Furthermore, these findings have not been contradicted by simulation experiments, using both small- and large-scale macroeconomic models, which indicate that the money stock provides a more reliable indicator of the thrust of monetary policy than interest rates, and that an aggregates strategy produces smaller variation in GNP than an interest-rate strategy (Items 7a and 7b).[22]

Other evidence, of a more inferential nature, tends to question the supposed stability of the aggregate-demand relation. One piece of evidence is the rediscovery of Irving Fisher's distinction between the nominal and real rates of interest, which explains the difference by the anticipated rate of inflation.[23] This reemphasizes the point that aggregate demand is a function of real rates of interest, which are unobservable. Hence attempts to predict GNP using interest rates run up against the problem of how to measure real rates of interest. This in turn requires making some estimate of the anticipated rate of inflation—a difficult task in a world where current inflation rates are substantially different from most of our historical experience, and where the problem has worsened considerably over the past decade. The failure to resolve this question in a conclusive way has added to our uncertainty about the relationship between aggregate demand and market rates of interest, and in so doing has

reduced the predictability of the aggregate-demand relation.

The successive oil-price shocks experienced since 1973-74 have also served to underline the point that the aggregate demand (and supply) relation is vulnerable to large unpredictable shifts. The vagaries of international politics can have an important impact on domestic inflation, and we still do not fully understand how oil price increases work their way through prices and the real economy. This suggests that predicting GNP through the aggregate-demand relation is going to be a chancy exercise for the foreseeable future.

These doubts about the stability of the aggregate-demand relation should be remembered when so much attention has been focused on alleged recent instability in the demand for money. The preoccupation with money-demand instability has tended to obscure one important point: what matters is not whether the predictability of money demand has deteriorated per se, but rather whether it has deteriorated enough to make a money-stock strategy no longer appropriate. To do that would require showing that aggregate demand and supply are stable enough to make an interest-rate strategy workable. So far this has not been demonstrated.

Moreover, the evidence of current instability in the demand for M_1 should be placed in its proper context. Surely the massive evidence for the historical stability of money demand counts for something. In particular, it argues for a skeptical attitude toward new and still inconclusive evidence that money has suddenly begun to behave quite unpredictably. Uncertainty argues for cautious changes in a policy when policymakers are confronted with fragmentary evidence, as past experience demonstrates. In 1971, for example, it was widely claimed that the demand for money had shifted. Subsequent analysis showed that this had been a false alarm—that the putative shift was well within the normal range of historical experience.[24]

And finally, as mentioned earlier, an aggregates strategy clearly has an edge when we turn our attention from the problem of income stabilization to the problem of combatting inflation.[25] While some evidence indicates that market rates of interest contain information about future

inflation,[26] it does not follow that an interest-rate strategy—especially the usual type of cautious, defensive strategy—will help to keep inflation under control. Indeed, a telling criticism against an interest-rate strategy is its tendency to accentuate or prolong inflation by (inadvertently) setting up a vicious spiral. The spiral may begin with inflation expectations stimulating rising interest rates, which the Federal Reserve initially attempts to resist. The result is faster money growth and eventually even more inflation. In contrast, an aggregates strategy dampens inflationary impulses by refusing to finance the increases in expenditures that are necessary to keep inflation going.

IV. Policy Implications

From this analysis, we may conclude:

• The FOMC is likely to control whatever operating instrument it chooses in a cautious manner. This rational approach follows naturally from apparently unavoidable uncertainties about the actual state of the economy and the impact of policy actions.

• Cautious control of the funds rate means that the FOMC, in effect, pursues a strategy which is most nearly optimal when real-sector disturbances are smaller than monetary-sector disturbances, and when inflation is not a major problem. Cautious control of reserves means that the FOMC pursues a strategy which is most nearly optimal when real-sector disturbances are larger than monetary-sector disturbances, and when inflation is a serious source of concern.

These conclusions suggest the following monetary-policy guidelines:

• Choose the most nearly optimal strategy on the basis of the available empirical evidence.

• Choose the operating instrument which, when controlled cautiously, brings policy as close as possible to the chosen strategy.

This decision-making sequence should be followed unless monetary control were seen to be technically infeasible with the chosen operating instrument. Since empirical evidence indicates that both reserves and funds-rate operating instruments represent technically feasible alternatives,[27] the crucial decision should be based on which operating instrument produces the most nearly optimal strategy.

We have argued that monetary policy should lean more toward a pure aggregates strategy than a pure interest-rate strategy. Given the uncertainties and other constraints on FOMC actions, the reserves approach recently adopted will automatically imply an aggregates orientation of monetary policy. This will be a distinct improvement over former policies which, despite official aggregates targets, were really oriented around interest rates.

With the switch to a reserves operating instrument, the Federal Reserve has made a serious attack on inflation while promoting the stabilization of the business cycle. The new operating procedures mean that the FOMC's rational responses to the uncertainties it must face will translate into a more effective monetary policy.

1. An excellent exposition of the argument that a two-stage procedure is inefficient can be found in Benjamin M. Friedman, "The Inefficiency of Short-Run Monetary Targets for Monetary Policy," **Brookings Papers on Economic Activity** (1977): 293-335. It is perhaps worth repeating here the point we argue later on, that given considerable uncertainty about the precise impact and timing of FOMC actions on macroeconomic activity, it is not clear that the cautious strategies we concentrate on are necessarily suboptimal.

2. The classic work in this field is William Poole, "Optimal Choice of Monetary Policy Instruments in a Simple Stochastic Macro Model," **Quarterly Journal of Economics**, 84 (May, 1970): 197-216. A good summary of relevant issues in the literature can be found in Benjamin M. Friedman, "Targets, Instruments and Indicators of Monetary Policy," **Journal of Monetary Economics**, 1 (1975): 443-473.

3. Michael Bazdarich, in his contribution to this issue of the **Economic Review**, has documented the important role for the aggregates in effectively fighting inflation. The reader should keep in mind that this evidence makes a case for an aggregates strategy independent of the evidence we discuss here.

4. A good exposition of the issues involved here can be found in Stephen LeRoy and David L. Lindsey, "Determining the Monetary Instrument: A Diagrammatic Exposition," **American Economic Review**, 68 (Dec, 1978): 929-934.

5. In early 1970, the language in the FOMC's published directives to the Federal Reserve Bank of New York's Open Market Trading Desk switched from emphasizing conditions in the credit markets to focusing on the monetary aggregates and the funds rate. See Richard G. Davis, "Implementing Open Market Policy with Monetary Aggregates Objectives," **Monetary Aggregates and Monetary Policy,** Federal Reserve Bank of New York, 1974, pp. 7-19. In addition, econometrically estimated Federal Reserve reaction functions appear to have shifted in 1970. See Paul DeRosa and Gary H. Stern, "Monetary Control and the Federal Funds Rate," **Journal of Monetary Economics,** April 1977, especially pp. 218-219.

6. The Federal Reserve currently is required by the Humphrey-Hawkins Act to report target ranges for M_1, M_2, M_3, and bank credit for periods beginning in the fourth quarter of the preceding year and ending in the fourth quarter of the current year.

7. DeRosa-Stern (1977), op. cit., pp. 217-230.

8. This point is briefly mentioned in William Poole, "Discussion and Comments," to Benjamin M. Friedman, "The Inefficiency of Short-run Monetary Targets for Monetary Policy," op. cit., p. 342.

9. William Brainard, "Uncertainty and the Effectiveness of Monetary Policy," **American Economic Review,** May 1967, pp. 411-425.

10. The financial markets are usually the first to react negatively to frequent policy changes, simply because they feel the impact of these changes almost immediately. Thus the FOMC may tend to be more concerned about financial-market reactions to policy changes than goods markets reactions, which tend to be more delayed and thus less directed at specific FOMC actions.

11. On November 1, 1978, the Federal Reserve raised the discount rate by one percentage point, and imposed a supplemental reserve requirement of two percent on large time deposits.

12. Richard G. Davis, "Short-Run Targets for Open Market Operations," and John H. Ciccolo, "Is Short-Run Monetary Control Feasible?", in **Monetary Aggregates and Monetary Policy,** Federal Reserve Bank of New York, 1974, pp. 40-59 and 82-91, respectively.

13. Raymond Lombra and Frederick Struble, "Monetary Aggregate Targets and Volatility of Interest Rates: A Taxonomic Discussion," **Journal of Money, Credit and Banking,** August 1979, pp. 284-300.

14. Hang-Sheng Cheng, "The Variability of the Federal Funds Rate and the Stability of Money Market Conditions," unpublished paper, Federal Reserve Bank of San Francisco, 1979.

15. Milton Friedman, "The Role of Monetary Policy," **American Economic Review,** March 1968, pp. 1-17.

16. For a discussion of the various ways in which this can happen see Albert E. Burger, **The Money Supply Process,** Wadsworth Publishing Company, Belmont, California, 1971.

17. Some of the evidence summarized here is discussed in more detail in John Scadding, "Optimal Strategy: Interest Rates or Aggregates?", unpublished paper, Federal Reserve Bank of San Francisco, 1979.

18. A good summary of the secular evidence is given in David E. W. Laidler, **The Demand for Money: Theories and Evidence,** 2nd ed., New York: Don Donnelley, 1977, Chap. 7. Postwar evidence is summarized in Stephen M. Goldfeld, "The Demand for Money Revisited," **Brookings Papers on Economic Activity,** 3 (1973): pp. 577-638.

19. The shift is well documented, though the precise reasons for it remain elusive. See Stephen M. Goldfeld, "The Case of the Missing Money," **Brookings Papers on Economic Activity,** 3 (1976): pp. 683-740, and Jared Enzler, Lewis Johnson and John Paulus, "Some Problems of Money Demand," **Brookings Papers on Economic Activity,** 1 (1976): pp. 261-280.

20. See, for example, Goldfeld, op. cit., p. 725. Note, incidentally, Goldfeld's reluctance to believe that M_2 is an appropriate aggregate despite evidence of its stability.

21. The source of the evidence on single-equation tests of the relation between monetary aggregates and fiscal variables on the one hand, and GNP on the other, is Leonall C. Anderson and Keith M. Carlson, "Monetary and Fiscal Actions: A Test of Their Relative Importance in Economic Stabilization," Federal Reserve Bank of St. Louis **Review** 50 (November, 1968): pp. 11-24. The evidence of the links between interest rates and GNP is reviewed in Michael Gorham, "Money or Interest Rates: Which is the Better Indicator of Monetary Policy?"

unpublished paper, Federal Reserve Bank of San Francisco, 1979. The literature on the relationship between autonomous spending and GNP begins with Friedman and Meiselman's investigation of the relative stability of the multiplier versus velocity: Milton Friedman and David Meiselman, "The Relative Stability of Monetary Velocity and the Investment Multiplier in the United States, 1897-1958," in **Commission on Money, Credit and Stabilization Policies,** Prentice Hall: New York, 1963. That article spawned a running controversy whose record is scattered throughout the literature. A partial summary and update of the evidence is provided in William Poole and Elinda B. F. Kornblith, "The Friedman-Meiselman CMC Paper: New Evidence on an Old Controversy," **American Economic Review,** 63 (Dec. 1973): pp. 908-17. Postwar evidence using quarterly data is provided in Moshin S. Khan, "The Relative Stability of Velocity and the Investment Multiplier: Some Further Tests," **Journal of Monetary Economics,** 4 (Jan. 1978): pp. 103-120.

22. Richard Zecher examined the indicator properties of money and interest rates in four macro-economic models. See his "Implications of Four Economic Models for the Indicators Issue," **American Economic Review,** 60 (May 1970): pp. 47-54. Robert Holbrook and Harold Shapiro used a small macroeconomic model to examine whether a money-stock or interest-rate strategy would have produced smaller variability in GNP. "The Choice of Optimal Intermediate Targets," **American Economic Review,** 60 (May 1970): pp. 40-46. A similar experiment, done more recently, is reported in Benjamin M. Friedman, "The Inefficiency of Short-Run Monetary Targets for Monetary Policy," op. cit., pp. 293-335.

23. Irving Fisher. **The Purchasing Power of Money,** New York: MacMillan, 1918, pp. 56-58.

24. The episode is discussed in Michael Hamburger, "The Demand for Money in 1971: Was There a Shift?" **Journal of Money, Credit and Banking,** (May 1973): pp. 720-725. See also Hamburger's skepticism about the seriousness of the shift in M_1 demand since mid-1974 in "Behavior of the Money Stock: Is there a Puzzle?" **Journal of Monetary Economics,** 3 (1977): pp. 265-288.

25. See Bazdarich's article in this issue.

26. See, for example, Eugene F. Fama, "Short-Term Interest Rates as Predictors of Inflation," **American Economic Review,** 65 (June 1975): pp. 269-282.

27. John P. Judd, "Federal Funds Rate or Reserves: Which Allows for the More Precise Monetary Control?" unpublished paper, Federal Reserve Bank of San Francisco, October 1979.