Recent Experience with M1 as a Policy Guide

By Howard L. Roth

The narrowly defined money supply, M1, has played a changing role as a monetary policy guide in recent years. Between 1979 and 1982, M1 received considerable weight in policy deliberations because it and nominal GNP had previously been quite closely related. This relationship, however, began to diverge from historical patterns in 1982. Moreover, concern that it would be loosened further by impending deregulation led the Federal Reserve in late 1982 temporarily to "give considerably less weight to M1 in implementing policy and rely more on the broader aggregates."[1]

The reduced emphasis on M1 continued in 1983 as its behavior remained atypical.[2] Late in 1983, however, more normal and predictable patterns of M1 behavior appeared to be emerging. This development, if it continues, could allow an increased policy role for M1 in the future. Chairman Volcker, appearing before Congress this February, testified that "substantial weight will continue to be placed on the broader aggregates for the time being, and growth in M1 will be evaluated in the light of the performance of the other aggregates."[3]

To help assess the future suitability of M1 as a policy guide, this article examines the experiences with M1 in monetary policy in the past two years. The first section reviews the rationale for using M1 as a policy target, showing that the efficacy of targeting this measure depends on the predictability of its behavior. The second section examines the behavior of the turnover, or velocity, of M1 in 1982 and 1983. The third section reviews the Federal Reserve's decision to deemphasize M1 in October 1982, and the next section presents other views of this decision. The last section concludes that the weight of the evidence indicates the relationship between M1 and economic activity changed in the past few years, supporting the reevaluations of the policy role of M1 that took place.

Monetary aggregate targeting and velocity

Although monetary policy aims to promote noninflationary economic growth and sustainable patterns of international transactions, the

Howard Roth is an economist with the Economic Research Department at the Federal Reserve Bank of Kansas City.

[1] *Monetary Policy Objectives for 1983, Summary Report,* Federal Reserve Board, February 16, 1983.

[2] See *Monetary Policy Objectives for 1983, Midyear Review,* Federal Reserve Board, July 20, 1983.

[3] *Monetary Policy Objectives for 1984, Testimony of Paul A. Volcker,* Federal Reserve Board, February 7, 1984.

Federal Reserve does not ordinarily base month-to-month or quarter-to-quarter policy decisions on the concurrent achievement of these goals. Some of the goal variables are not measured accurately enough or soon enough. Furthermore, the reaction of goal variables to policy actions tends to be delayed and spread out over time. As a result, policy action based on values of the goal variables announced today may be counterproductive when the effects of the policy are felt three or six months from now.

Because of these limitations, the Federal Reserve sets goals for intermediate target variables. In the transmission of policy action, these variables are intermediate to the tools of policy, such as open market operations, and the goal variables of policy, such as inflation. The strategy is to determine the evolution of the intermediate variables that is consistent with the development of the goal variables being sought, and then to base policy on the attainment of the indicated course of the intermediate variables.

The Federal Reserve has relied increasingly in the last decade on monetary and credit aggregates as intermediate targets. Since the mid-1970s, the Federal Reserve has established annual targets for three or four aggregates, the target for each expressed as a range of annual growth rates believed to be consistent with the ultimate objectives of policy.[4]

During most of the time it has used monetary and credit aggregate targets, the Federal Reserve has assigned a prominent role to the narrowly defined money supply, M1. The appeal of M1 as an intermediate target is not hard to understand. Consisting primarily of currency in circulation and checkable deposits, M1 is made up almost entirely of funds that can be spent immediately. As a result, it is thought to be a measure of the public's spending intentions and, therefore, an indicator of the general health of the economy. In contrast, the broader aggregates contain large amounts of investment funds that are less likely to reflect spending intentions. Also, most of M1, unlike the broader aggregates, is subject to reserve requirements, which enhances the Federal Reserve's control over it. Furthermore, because the demand for M1 is more sensitive to changes in short-term market interest rates than demand for the broader aggregates, the Federal Reserve can affect the level of M1 more easily through open market operations.

Table 1 lists the upper and lower growth range limits for M1 for 1980 through 1984, as reported to Congress in accordance with the requirements of the Humphrey-Hawkins Act. A general trend toward a reduction in the ranges, reflecting the Federal Reserve's effort to lower inflation through slower money growth, is obscured by adjustments made in response to financial deregulation. For example, the effective M1 range was adjusted upward in 1981 to account for the expected effect the introduction of nationwide NOW accounts would have on M1 growth. The M1 growth ranges were raised again in 1983, but the weight given to M1 in Federal Reserve decisions was reduced in response to continued financial innovation.

The rationale for using monetary and credit

---

[4] The specification of a range rather than a specific number reflects two realities of monetary policy. First, the aggregates have been and likely will continue to be affected by factors largely unrelated to developments in the ultimate goal variables of policy. For example, on occasion M1 has grown more quickly than initially expected when the public has become increasingly uncertain about the health of the economy. Such growth does not reflect increased spending intentions and should not be offset by the Federal Reserve even though it may result in M1 growing more quickly than was initially thought to be consistent with the goals of policy. Second, no exact relationships exist among the various aggregates. Thus, financial deregulation has had differential impacts on the aggregates. The specification of growth ranges allows for such differential effects.

TABLE 1
Annual growth range for M1

Period	Range	Actual
1979:IV - 1980:IV	4.0 - 6.5	7.4
1980:IV - 1981:IV	3.5 - 6.0* (7.0 - 9.5)	2.5* (5.1)
1981:IV - 1982:IV	2.5 - 5.5	8.7
1982:IV - 1983:IV	4.0 - 8.0 †	10.0 .
1983:IV - 1984:IV	4.0 - 8.0	

Note: The figures given for 1980 and 1981 are for the monetary measure M1-B, a measure that corresponds to today's M1. In 1981 an adjusted M1-B series was computed to account for deposit shifts during the nationwide introduction of NOW accounts. The figures for the unadjusted series appear in parentheses.

* Adjusted for estimated deposit shifts due to the nationwide introduction of NOW accounts.

† In July 1983, the Federal Open Market Committee changed the base period for measuring M1 growth to 1983:II and raised the limits of the growth target range to 5 and 9 percent.

aggregates as intermediate targets is based on a relationship between money, output, and prices. This relationship — the equation of exchange — can be written as follows:

$$(1)\ \dot{M} + \dot{V} = \dot{P} + \dot{y}$$

The growth of a monetary aggregate, $\dot{M}$, plus the growth of velocity or turnover of the aggregate, $\dot{V}$, must equal the rate of inflation, $\dot{P}$, plus the rate of growth of real output, $\dot{y}$. Stated another way, the growth rates of money and its velocity must equal the growth rate of nominal output, $\dot{P} + \dot{y}$.

The basic idea behind monetary targeting is that if velocity is predictable, a target for money growth can be set to achieve any desired level of nominal output. If, for example, policymakers want nominal output growth of 10 percent in a given year and velocity growth is expected to average 3 percent, the appropriate target for money growth is 7 percent.

Predicting the growth of velocity is important in achieving desired growth in output. If actual velocity growth turned out to be, say, 4 percent instead of 3 percent, a 7 percent target for monetary growth would lead to excessive growth in nominal output. Thus, if velocity growth is expected to be higher than normal, the Federal Reserve would need to lower its money target to keep nominal output on track. Similarly, weaker velocity growth would require that the monetary targets be raised.

Much of the recent debate over the Federal Reserve's implementation of monetary targeting reflects differing views about the behavior of M1 velocity. Some insight into the debate can be obtained by examining three categories of velocity behavior and their implications for monetary targeting. In the first case, velocity growth is assumed to be constant. In the second case, velocity growth is assumed to be not constant but predictable. In the third case, velocity growth is assumed to be neither constant nor predictable.

An assumption of roughly constant velocity growth is implicit in the Federal Reserve's program of systematic reductions in the monetary growth ranges over a period of years. If velocity growth is constant, lower money

growth will slow growth in nominal output.[5] For example, with a constant velocity growth of 3 percent, a reduction in targeted money growth from 7 to 4 percent would be expected to reduce nominal output growth from 10 to 7 percent.

Alternatively, velocity growth might not be constant but still be predictable by standard statistical methods. Used in this sense, predictable means that the relationships between velocity and the variables thought to affect velocity have not changed. With nonconstant velocity growth, simply lowering money growth ranges year after year might not be wise. Adjustments might be needed. If, for example, velocity growth was expected to fall from 3 to 1 percent because a new type of transaction account increased the demand for money, and the Federal Reserve wanted to achieve 10 percent growth in nominal output, rigid adherence to a 7 percent monetary target would result in only an 8 percent growth in output. With this slower output growth would come higher interest rates and the danger of a recession. To prevent such an outcome, the Federal Reserve would have to raise the monetary growth target temporarily from 7 to 9 percent.[6]

Finally, velocity growth might be neither constant nor predictable. If velocity cannot be predicted, the rationale for monetary targeting breaks down. Because velocity is not constant, some adjustment in the target ranges is needed. But if velocity is not predictable, there is no obvious way of adjusting the targets. In this case, monetary targets are ineffective and potentially dangerous.

The behavior of M1 velocity in 1982 and 1983

Federal Reserve decisions to deemphasize the role of M1 in policymaking in October 1982, and to raise the M1 growth range in mid-1983 rested on a belief that financial innovations in 1982 and 1983 would cause M1 velocity to behave unpredictably. In effect, M1 velocity was seen as unpredictable enough that monetary targeting was not practical. Before examining these decisions in detail, it is useful to compare the behavior of M1 velocity in 1982 and 1983 with that of earlier periods. Chart 1 records four-quarter M1 velocity growth for each quarter between 1960 and 1983.

Clearly M1 velocity growth was not constant between 1960 and 1981. It ranged from -1.0 to 6.9 percent, while averaging slightly more than 3.1 percent. Although not constant, M1 velocity growth was outside two standard deviations of its average, -0.1 to 6.3 percent, in only 5 of the 88 quarters. The standard deviation of M1 velocity growth, a statistical measure of its variability, was 1.6 percent in this 22-year period.

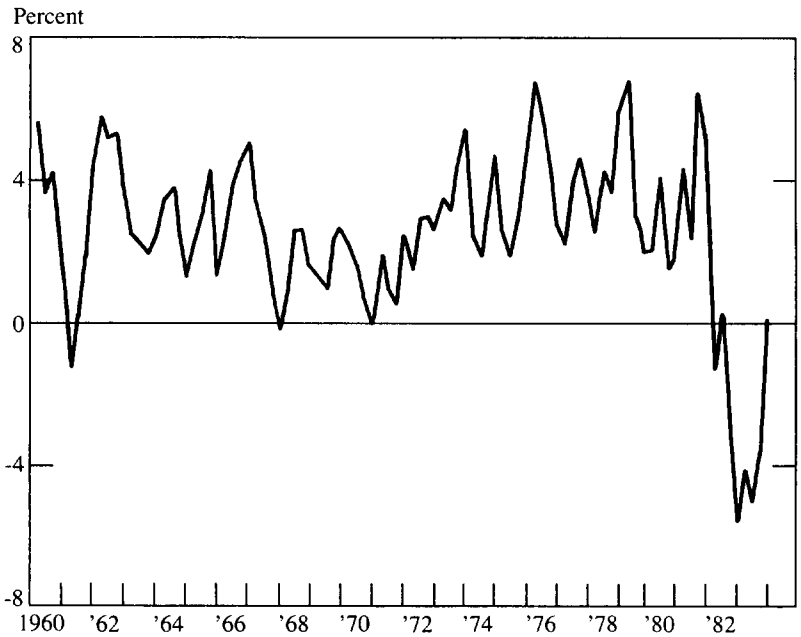
Growth of M1 velocity was even less con-

---

[5] The equation of exchange says nothing about the distribution of the reduction in nominal output growth between real output and inflation. But a key assumption behind the Federal Reserve's inflation-fighting program is that a gradual lowering of monetary growth over the course of a number of years would primarily lower inflation with little effect on real output.

[6] An example of an accommodation of policy to nonconstant, but predictable M1 velocity growth is the adjustment made to the 1981 M1 growth range in anticipation of increased demand for M1 with the nationwide introduction of NOW accounts (See Table 1). Savers were expected to transfer funds from passbook savings accounts to the new NOW accounts. The new account, unlike the old one, would be checkable and, thus, included in M1. Thus, a transferral of funds would produce an increase in M1 which would *not* reflect increased spending plans; M1 velocity growth would be artificially depressed. To offset the depressing effect of reduced velocity growth on nominal output, the growth range for M1 was raised. For purposes of designing monetary policy, an estimate of transferred savings balances was subtracted from a transactions measure corresponding to today's M1 to obtain a shift-adjusted M1 series. Had this adjustment of policy not been made to offset the expected fall in velocity, nominal output growth for the year most likely would have been less.

CHART 1
Four-quarter growth rate of M1 velocity (1960-83)



stant in 1982 and 1983. The most prominent feature of Chart 1 is the sharp dip in 1982 and 1983. In six of the eight quarters of this period, M1 velocity growth fell below the minimum observed in the earlier period — an extremely unlikely development if, in fact, M1 velocity behavior was not changed by one or more events of the past few years.[7]

It is possible that the unusual M1 velocity behavior was caused by cyclical behavior of the economy. The economy spiraled downward in a long and severe recession for most of 1982, reaching bottom in November. Table 2 shows velocity growth around the troughs of the seven most recent recessions. For the six previous recessions, average M1 velocity growth was slightly negative in each of the two quarters preceding the trough and more than 4 percent in each of the three quarters after the trough. Although there were exceptions, velocity has tended to be procyclical, growing less than its 3 percent average annual rate in the two quarters preceding the trough and more than 3 percent in the three quarters after the trough.

Growth of M1 velocity around the trough of the most recent recession was unusual in several respects. The most striking difference was a 6.4 percent drop in velocity in the first quarter after the trough (the first quarter of 1983)

[7] If M1 velocity growth were a normally distributed random variable with mean and standard deviation equal to the values calculated for the 1960-1981 period, the probability of observing six quarters of M1 velocity growth as extreme as those in the 1982 and 1983 period would be much less than one in a thousand.

TABLE 2
Cyclical behavior of M1 velocity
(seasonally adjusted annual rates of growth)

Date of Recession Trough	Quarter					
	Before Trough		Trough	After Trough		
	-2	-1	0	1	2	3
1954:II*	-6.1	-1.9	- 1.1	1.1	5.4	8.8
1958:II*	-2.5	-6.2	- 0.8	7.8	6.6	3.1
1961:I	-2.4	-2.2	0.4	5.6	4.3	7.2
1970:IV	1.7	2.1	- 4.1	8.5	-1.8	0.3
1975:I	4.2	1.3	- 1.3	3.8	8.7	7.8
1980:III	4.3	4.9	- 6.4	5.1	14.0	-2.5
Average	-0.1	-0.3	- 2.2	5.3	6.2	4.1
1982:IV	3.3	-3.4	-10.3	-6.4	1.0	1.5

*Old M1 definition used to calculate velocity.

as compared with an average gain of 5.3 percent in the previous recessions. In none of the six previous recessions did velocity fall in the first quarter after the trough. Furthermore, velocity growth in the second quarter of the current recovery was sharply lower than average second-quarter growth in previous recessions. Finally, the drop in velocity was considerably sharper than average in the quarter of the most recent trough as well as in the preceding quarter. Thus, the behavior of M1 velocity around the troughs of previous recessions clearly did not foretell velocity in 1982 and the first half of 1983.

Although the behavior of M1 velocity in 1982 and the first half of 1983 was not normal cyclical behavior, it was not necessarily unpredictable. Its behavior could have simply reflected an unusual recession and recovery. To assess this possibility, a definition of predictability is needed. One criterion is the ability of economic models to replicate the observed behavior of velocity after the fact using the actual histories of economic variables believed to affect M1 velocity. Economic theory identifies some of these variables—spending or economic output, the overall level of prices in the economy, and rates of return on assets other than M1. If M1 velocity was predictable in 1982 and the first half of 1983, economic models that were previously reliable should be able to reproduce fairly accurately the behavior of M1 velocity when supplied with the actual values of variables thought to affect M1 velocity variables.[8]

But, as is common in economics, not all events that can affect M1 velocity are easily modeled. For example, financial innovation can produce changes in economic behavior and degrade the performance of previously reliable economic models, and maybe even invalidate them altogether. As the definition of M1 has changed over time to include more

[8] Of course, in deciding to place less emphasis on M1 in October 1982, the FOMC did not know the future values of variables thought to affect M1 velocity. Thus, even if M1 velocity behavior in 1982 and the first half of 1983 was predictable in an after-the-fact (ex post) sense, uncertainty about the future values of variables that affect M1 velocity could have justified the deemphasis of M1. On the other hand, a verdict that M1 velocity behavior of the period was not ex post predictable would heavily support the decision to deemphasize M1.

interest-bearing transactions accounts, the interest rate sensitivity of the demand for M1 may have changed. If so, this change would have to be incorporated into economic models used in predicting velocity behavior. Otherwise, the accuracy of predictions could be expected to deteriorate. For another example, a change in the public's uncertainty about the future of the economy might affect M1 velocity behavior. If M1 is seen as a safe harbor in troubled times, its velocity would fall as uncertainty about the health of the economy increased and motivated a transfer of funds to M1 Because uncertainty is difficult to define, measure, or model, incorporating uncertainty into economic models used in predicting velocity behavior also is troublesome. For still another example, the introduction of a deposit account with limited transactions features that was not included in M1 could change M1 velocity behavior if the new account drew funds away from M1. A development like any of these examples could make M1 velocity behavior unpredictable.

Positive and accelerating M1 velocity growth in the second half of 1983 may have signaled the return of more normal patterns of velocity behavior and been instrumental in the reevaluation of the policy role of M1. The growth of M1 velocity was 1.5 percent in the third quarter and 4.1 percent in the fourth. Because the latter is comparable to growth observed in the first quarter of recoveries, the possibility that the sharp decline in M1 velocity in 1982 is related to the delay in the emergence of patterns normally observed in a recovery and expansion is being considered. Whether financial deregulation or uncertainty about the future of the economy changed the behavior of M1 velocity in the past few years is at the heart of the controversy surrounding the October 1982 decision to deemphasize M1 in monetary policy. The next section looks at recent efforts to detect such developments.

The Federal Reserve's response to the unusual M1 velocity behavior

The Federal Reserve took several steps in 1982 and 1983 to change the emphasis it had placed on M1 in its policy deliberations. At its October 5, 1982, meeting, the Federal Open Market Committee (FOMC) decided that it would place "much less than the usual weight on . . . [M1] movements during this period and that it would not set a specific objective for its growth."[9] In subsequent reports to Congress in 1983, the FOMC raised and widened the annual growth ranges for M1 and continued to point out that M1 was being monitored rather than targeted.[10]

The decision to deemphasize M1 was based on both short-term and longer term factors thought likely to affect M1 velocity. Three short-term factors concerned the FOMC in early October 1982. First, a large volume of all savers certificates would mature that month. These funds would most likely be placed temporarily in demand deposits and NOW accounts while more permanent investments were being selected. As the resulting temporary increase in M1 would reflect no increase in spending intentions, the appropriate policy response would be to allow the additional M1 growth even though it contributed to above-target growth. It would be difficult, however, to determine how much of the growth in M1 could be attributed to maturing all savers certificates. Second, beginning in

[9] "Record of Policy Actions of the Federal Open Market Committee," *Federal Reserve Bulletin*, Board of Governors of the Federal Reserve System, December 1982, p. 764.

[10] See *Monetary Policy Objectives for 1983, Summary Report* and *Monetary Policy Objectives for 1983, Midyear Review*, Board of Governors of the Federal Reserve System, February 16, 1983, and July 20, 1983, respectively.

December, depository institutions would be authorized to offer money market deposit accounts (MMDA's), interest-earning accounts free from interest rate ceilings and with limited checking privileges. These accounts, which would not be included in M1, were expected to draw funds from M1. The extent of the drain, however, would be difficult to predict. Third, financial deregulation would continue in January 1983 with the introduction of the Super NOW account — an account similar to the MMDA but with unlimited checking privileges. Because of this distinction, Super NOW's would be included in M1 and were expected to attract funds to M1. Again, the magnitude of the effect on M1 was difficult to predict.[11]

Beyond these expected short-term effects of financial deregulation on M1 velocity, the Federal Reserve suspected that another longer term influence might already be affecting M1 velocity in October 1982. After slowing slightly in early summer, M1 growth had increased rapidly in August and September. Some of this growth was thought to be attributable to a buildup of precautionary balances in M1 as the often-predicted recovery failed to materialize — a short-term influence. More important, the nationwide introduction of NOW accounts in 1981 was thought to have increased the market rate sensitivity of the demand for M1. If NOW account balances were affected more by changes in market rates than either demand deposits or currency, the faster growth of NOW account balances than other components of M1 in recent years increased the interest sensitivity of M1 velocity.[12] The dip in M1 velocity in 1982 could have been due partly to a greater than expected buildup of NOW account balances as short-term interest rates fell in the summer and fall.

One explanation for why NOW accounts might be more interest-sensitive involves the opportunity costs of holding funds in the different components of M1. Because interest is paid on NOW account balances, the opportunity cost of holding transactions balances in NOW accounts is less than in holding noninterest-bearing demand deposits or currency. It follows that a change in market rates affects the opportunity cost of holding NOW account balances proportionately more than the opportunity cost of holding demand deposits and currency. For example, if the rate paid on NOW account balances is 5.25 percent, a drop in short-term market rates from 10.25 to 8.25 percent reduces the opportunity cost of holding NOW accounts from 5 to 3 percent — a reduction of 40 percent. On the other hand, the opportunity cost of holding currency and demand deposits is reduced from 10.25 to 8.25 percent — a reduction of less than 20 percent. If holdings of NOW account transactions balances are as responsive to changes in opportunity cost as currency and demand deposits, a change in market rates affects NOW account transactions balances proportionately more than currency and demand deposit holdings.

The research staff of the Board of Governors of the Federal Reserve explored the possibility that the nationwide introduction of NOW accounts in 1981 had made M1 velocity more sensitive to market interest rates.[13] New equations were estimated for each of the major

[11] Because the introduction of Super NOW's would not affect M1 growth in 1982, the FOMC was less concerned about this development than the maturation of all savers certificates and the introduction of MMDA's.

[12] In December 1980, NOW account balances totaled less than $15 billion, less than 4 percent of M1. By December 1982, these balances exceeded $85 billion, more than 17 percent of M1.

components of M1 — currency, demand deposits, and other checkable deposits.[14] In addition, the effects of disaggregating demand deposits into household and business components were explored. This research indicates that the demand for other checkable deposits is more sensitive to changes in market interest rates than demand deposit holdings. Disaggregation of demand deposits into household and business components also appears to help account for the public's demand for M1.[15] The new specifications explain M1 velocity in 1982 and the first quarter of 1983 much better than the old equations.

If the velocity of M1 has, in fact, become more sensitive to changes in short-term market interest rates, the relationships between M1 and the goal variables of policy have most likely changed. More time may have to pass, however, before enough data are available to ascertain thoroughly the effects of financial deregulation on M1 velocity. This line of research, though preliminary, suggests continued difficulty in the strict use of M1 targeting.

Other views of M1 velocity in 1982 and 1983

Others have argued that M1 velocity in 1982 and 1983 was predictable. These analysts believe the Federal Reserve used an inaccurate model of velocity behavior and that deregulation and financial innovation have not significantly affected M1 velocity. At the same time, however, their views regarding the policy implications of the Federal Reserve's decision to deemphasize M1 tend to conflict. Some believe the Federal Reserve was right in not overreacting to the unusually rapid growth of M1 in late 1982 and early 1983. Others believe the decision to deemphasize monetary targeting led to excessive monetary growth with potentially serious consequences for inflation.

The staff of the Federal Reserve Bank of San Francisco has argued that the decline of M1 velocity in 1982 was predictable and attributes the decline to a drop in inflation and short-term interest rates in 1982.[16] The decline in M1 velocity in the first half of 1982 is ascribed to a fall in inflationary expectations that depressed output. The decline in the second half is attributed to an increase in desired money holdings as short-term market rates fell.

This explanation conforms to economic events in 1982. By most measures, inflation moderated in the first half of that year, while market interest rates remained relatively high. To the extent that inflationary expectations reflected this decline in inflation, real interest rates (market rates minus expected inflation) rose. Because increases in real interest rates have a depressing effect on interest-sensitive sectors of the economy, the decline in inflation in early 1982 may have depressed output, thus lowering velocity. In the second half of the year, a sharp decline in market interest rates substantially reduced the opportunity cost of holding transactions balances. The faster growth of M1 in the second half of 1982 and

---

[13] See Flint Brayton, Terry Farr, and Richard Porter," Alternative Money Demand Specifications and Recent Growth in M1," Board of Governors of the Federal Reserve System, May 23, 1983.

[14] NOW account balances are the major component of other checkable deposits.

[15] Another study that found benefits from disaggregating demand deposits into household and business components is reported by Lawrence J. Radecki and John Wenninger, "Shifts in Money Demand," *Quarterly Review*, Federal Reserve Bank of New York, Summer 1983, pp. 1-11.

[16] See Michael W. Keran, "Velocity and Monetary Policy in 1982," *Weekly Letter*, Federal Reserve Bank of San Francisco, March 18, 1983.

the attending fall in velocity could have been attributable to the decline in short-term rates.

A monthly money market model developed by the San Francisco bank explains M1 velocity in 1982 quite well.[17] Separate equations have been estimated for currency, demand deposits, and other checkable deposits. The demand deposit equation includes the change in bank loans, an additional variable to those found in the conventional money demand equation. This variable reflects the bank's view that transactions balances act as a buffer stock between receipts and spending. Changes in demand deposits, as loans are extended or called, are assumed not to be offset immediately because of costs involved in adjusting demand deposit balances.

The success of the San Francisco model in tracking M1 velocity in 1982 apparently can be attributed to an interest sensitivity of money demand higher than most other models. This property might be due to the recent period over which the model is estimated — August 1976 to December 1981 — or it might be due to the change-in-loans variable in the demand deposit equation. Results of model simulations conducted by the San Francisco bank's staff not only support their hypothesis that M1 velocity was not erratic in 1982, but also suggest that financial deregulation of the past few years has not affected the interest sensitivity of M1 velocity. The latter conclusion was reached by observing only minor changes when data from the past few years is excluded in estimating the model. This is in marked contrast to the Federal Reserve Board staff's explanation that an increase in the interest sensitivity of M1 velocity is the cause of much of the decline in M1 velocity in 1982.

Although the relatively high interest sensitivity of money demand in the San Francisco model may have contributed to its successful accounting for M1 velocity behavior in 1982, the same feature may have been a handicap in predicting 1983 M1 velocity behavior. The model overpredicted M1 velocity growth in the first two quarters of 1983 and substantially underpredicted M1 velocity growth in the third quarter.[18]

Some of the policy implications of the results obtained with the San Francisco model are different from those derived from the board staff's research. If, as the San Francisco staff maintains, the velocity of M1 was predictable throughout the past three years of financial deregulation, the reliability of M1 as a monetary policy guide has not been impaired. If this is so, more emphasis should be placed on M1 in the conduct of monetary policy, particularly if M1 velocity behaves more normally in the period ahead. On the other hand, the analyses of the staffs of both the San Francisco bank and the Federal Reserve Board suggest that the rapid growth of M1 in 1982 and the first quarter of 1983 did not reflect increased spending plans and, therefore, was not inflationary. Research by the San Francisco bank's staff indicates that the growth of M1 will have to slow substantially in the years ahead to hold the underlying rate of inflation near 5 percent.[19]

---

[17] See John P. Judd, "The Recent Decline in Velocity. Instability in Money Demand or Inflation?" *Economic Review*, Federal Reserve Bank of San Francisco, Spring 1983, pp. 12-19.

[18] In searching for an explanation for the mixed performance of the San Francisco model, researchers have raised theoretical and statistical questions about the way the change in loans variable enters the demand deposit equation. The ability of the model to account for 1982 M1 velocity behavior and the conclusion that the interest sensitivity of M1 velocity was not materially affected by the financial deregulation of the past few years are both susceptible to what appear to be logical changes in the way the change in loans variable enters the demand deposit equation.

In evaluating the predictability of M1 velocity, other critics of the Federal Reserve's decision to deemphasize M1 have proposed alternative definitions of velocity that they believe were more predictable in 1982 and 1983 than the conventional measure.[20] For example, Milton Friedman and others suggest current nominal GNP divided by the money stock two quarters past.[21] The reason for this new measure, sometimes called leading velocity, is the tendency for changes in M1 to precede changes in nominal GNP by six to nine months. Thus, changes in M1 today should be related more closely to changes in nominal GNP two quarters from now than they are to changes in current nominal GNP.

Unfortunately, lagging M1 two quarters in calculating its velocity provides little insight into the puzzling behavior of conventional M1 velocity in 1982 and early 1983. The leading velocity measure followed much the same pattern as the conventional measure from early 1960 through 1981, growing at an average annual rate of about 3 percent.[22] Unlike the conventional measure, however, leading velocity declined only slightly from the fourth quarter of 1981 to the fourth quarter of 1983. This decline, particularly its duration, is a significant change from past behavior. Furthermore, an analysis of the behavior of leading velocity in the quarters neighboring the troughs of the seven most recent recessions (reported for the conventional definition in Table 1) reveals leading velocity to be no less puzzling in the most recent period. In the first quarter of the current recovery (the first quarter of 1983), leading velocity grew at an annual rate of 1.8 percent. In the second and third quarters, leading velocity fell 0.4 and 2.8 percent, respectively. For the six preceding recoveries, the corresponding growth rates had averaged 10.0, 6.3, and 3.9 percent, respectively.

Other redefinitions of velocity have been prompted by sharp swings in inventory investment at turning points of business cycles that tend to exaggerate the variability of M1 velocity. John Tatom suggests that since inventory fluctuations are hardly susceptible to control by monetary policy, final sales (nominal GNP minus inventory investment) divided by M1 may be more appropriate than the conventional measure of M1 velocity for assessing monetary policy.[23] Although this measure appears to have departed less from the historical norm in 1982 and early 1983 than the conventional measure, some discrepancies remain. More generally, this approach to explaining M1 velocity by redefining the measure is questionable. Some redefinition could probably be found to "explain" any episode of unusual behavior of the conventional definition.

More substantive than these efforts to redefine M1 velocity is an approach that entails direct statistical modeling and simulation of M1 velocity behavior.[24] Rather than infer velocity behavior from statistically estimated

---

[19] See John P Judd and Rose McElhattan, "The Behavior of Money and the Economy in 1982-83," *Economic Review*, Federal Reserve Bank of San Francisco, Summer 1983, pp. 46-51.

[20] See Milton Friedman, "Why a Surge of Inflation is Likely Next Year," *Wall Street Journal*, September 1, 1983, p. 18, Robert L. Hetzel, "The Relationship Between Money and Expenditure in 1982," *Economic Review*, Federal Reserve Bank of Richmond, May/June 1983, pp. 11-19, and John A. Tatom, "Was the 1982 Velocity Decline Unusual?" *Review*, Federal Reserve Bank of St. Louis, August/September 1983, pp. 5-15.

[21] This contrasts with the normal definition of M1 velocity in which current quarter GNP is divided by current quarter M1.

[22] For such a graph, see Friedman, "Why a Surge of Inflation."

[23] Tatom endorses final sales; Hetzel uses final sales to domestic purchasers (net sales minus net exports).

[24] See Tatom, "Was the 1982 Velocity Decline Unusual?".

equations of the demand for M1 and other behavioral relationships, the direct approach involves substituting a reduced-form expression for nominal output growth into the equation of exchange and solving for velocity growth. This yields an equation for velocity growth in terms of M1 growth, government expenditures, interest rates, and other variables thought to affect growth in nominal output.[25] This expression for M1 velocity growth is estimated directly.

There has been some success in reproducing the changes in M1 velocity in 1982 and early 1983 with these reduced-form velocity equations. This success supports the proposition that M1 velocity during this period was predictable beforehand and seems to suggest that the fall in its velocity was not caused by financial deregulation. Unfortunately, reduced-form expressions cannot be used to identify and quantify individual influences. As a result, more than one explanation for a change in velocity could be consistent with an estimated reduced-form equation. Beyond that, estimation of reduced-form expressions presents some statistical problems, and the interpretation of the estimated forms may not be unambiguous. In the present case, it is easy to forget that M1 growth is most likely influenced by nominal output growth and, therefore, to assert that the recent unusual behavior of M1 velocity was caused by volatile M1 growth.

Nevertheless, the conclusion drawn from these experiments is that the decline in M1 velocity in 1982 was predictable, and that it was not the result of a shift in the demand for M1. If that is so, the rapid growth in M1 in the second half of 1982 and first half of 1983 could precede a significant worsening of inflation. The obvious policy implications of the reduced-form approach are that M1 should be restored as an important determinant of monetary policy and that a concerted effort should be made to prevent a reoccurrence of such rapid M1 growth.

[25] Reduced form indicates that the expression for nominal GNP is implied by an unspecified model of the economy.

Summary and conclusions

For M1 to be a useful guide for monetary policy, the relationship between M1 and the ultimate goals of policy must be reliable. That is, the behavior of M1 that is consistent with the attainment of the ultimate goals of policy must be ascertainable. In short, M1 must be predictable.

Concern about the effects of financial deregulation on the predictability of M1 behavior led the FOMC to place considerably less emphasis on M1 in designing monetary policy in late 1982 and 1983 than in the previous three years. The belief that M1 was beginning to behave more predictably recently convinced the FOMC that M1 should play a more important role in monetary policy in 1984 than it had in late 1982 and 1983. And the usefulness of M1 in the conduct of monetary policy in the years ahead likely will continue to depend on the predictability of its behavior.

Some analysts are not convinced that the predictability of M1's behavior was impaired by the financial deregulation of the past few years. Thus, the FOMC's decision to reduce the emphasis on M1 in late 1982 and 1983 has generated some controversy. This article reviewed a number of efforts at assessing the predictability of M1 in 1982 and 1983. Research conducted by the staff at the Federal Reserve Board suggests that financial deregulation, particularly the nationwide introduction of NOW accounts, may have significantly increased the interest sensitivity of M1 veloc-

ity, implying that M1 velocity was unstable in 1982. On the other hand, a model constructed by the research staff of the Federal Reserve Bank of San Francisco was able to account for the behavior of M1 velocity quite well in 1982, suggesting that the M1 velocity has not been appreciably affected by the financial deregulation of the past few years. In addition, research on M1 velocity behavior with the reduced-form equation approach has been successful in reproducing some, although not all, of the 1982 velocity decline.

Determining which is the case is important for two reasons. First, M1 grew rapidly late in 1982 and in the first half of 1983 when it was deemphasized. If, in fact, the relationship between M1 and the goal variables of policy was not altered by the financial deregulation of this period, the rapid growth of M1 could have adverse inflationary consequences. Second, financial deregulation will continue. For example, the rate payable on regular NOW account balances will be deregulated before the end of 1986. If financial deregulation has reduced the predictability of M1 behavior in the past few years, it could happen again in the next few years. Assessing the effects of past financial deregulation on the predictability of M1 should aid decisions about the correct emphasis to place on M1 in the future.

It would be surprising if the considerable financial deregulation of the past few years has not affected the relationships between M1 and the goal variables of policy. The initial results of subsequent research suggest that this has been the case. Until this can be determined with more certainty, a continuation of the flexible approach to monetary targeting of the past few years seems prudent.

Research Working Papers

Recent Research Working Papers published by the Federal Reserve Bank of Kansas City are listed below. Copies may be obtained by writing the Research Division, Federal Reserve Bank of Kansas City, 925 Grand Avenue, Kansas City, Missouri 64198.

Ian Domowitz and Craig Hakkio
"Conditional Variance and the Risk Premium in the Foreign Exchange Market," RWP 83-12, October 1983.

Ian Domowitz and Craig Hakkio
"Testing for Serial Correlation in the Presence of Heteroscedasticity with Applications to Exchange Rate Models," RWP 83-11, October 1983.

Stuart E. Weiner
"A Survival Analysis of Adult Male Black/White Labor Market Flows," RWP 83-10, October 1983.

V. Vane Roley and Carl E. Walsh
"Monetary Policy Regimes, Expected Inflation, and the Response of Interest Rates to Money Announcements," RWP 83-09, September 1983.

Laurence Kantor and Raymond Lombra
"Interest Rate Volatility, Risk, and Investor Utility," RWP 83-08, July 1983.

David W. Berson
"The Effects of Supply Shocks on Interest Rates," RWP 83-07, July 1983.

Howard L. Roth
"Small Sample Properties of Predictors of the Estimated General Linear Model," RWP 83-06, May 1983.

Dean W. Hughes and Ann Laing Adair
"The Impacts of Recent Tax Law Changes on Investments in Agriculture," RWP 83-05, March 1983.

Alan C. Hess
"Effects of Regulation Q on Deposits and Interest Rates at Savings Associations," RWP 83-04, March 1983.

Alan C. Hess and Daniel J. Vrabac
"Regulation Q and the Profitability of Savings Associations," RWP 83-03, March 1983.

Douglas K. Pearce
"An Empirical Analysis of Expected Stock Price Movements," RWP 83-02, February 1983.

V. Vance Roley
"Asset Substitutability and the Impact of Federal Deficits," RWP 83-01, February 1983.

Carl E. Walsh
"The Effects of Alternative Operating Procedures on Economic and Financial Relationships," RWP 82-08, September 1982.

Robert Craig West
"A Theory of Financial Innovation in the United States," RWP 82-07, September 1982.

V. Vance Roley
"The Response of Short-Term Interest Rates To Weekly Money Announcements," RWP 82-06, September, 1982.

Douglas K. Pearce and V. Vance Roley
"The Reaction of Stock Prices to Unanticipated Changes in Money," RWP 82-05, September 1982.

Carl E. Walsh
"The Demand For Money Under Uncertainty and the Role of Monetary Policy," RWP 82-04, May 1982.

Carl E. Walsh
"Interest Rate Volatility and Monetary Policy," RWP 82-03, April 1982.

David S. Jones
"An Empirical Analysis of Monetary Control Under Contemporaneous and Lagged Reserve Accounting," RWP 82-02, March 1982.

V. Vance Roley
"Rational Expectations, The Expectations Hypothesis, and Treasury Bill Yields: An Econometric Analysis," RWP 82-01, February 1982.

Dan M. Bechter
"Inventory Sensitivity to Interest Rates in Selected Manufacturing and Trade Sectors," RWP 81-10, September 1981.

V. Vance Roley
"Forecasting Interest Rates with a Structural Model," RWP 81-09, August 1981.

David S. Jones and V. Vance Roley
"Bliss Points in Mean-Variance Portfolio Models," RWP 81-08, August 1981.

Dean W. Hughes and John B. Penson, Jr.
"The Value of Endogenizing Agriculture in a Multi-Sector Macroeconomic Model," RWP 81-07, August 1981.

John B. Penson, Jr., and Hovav Talpaz
"Accounting for Frequency in E-V Analyses," RWP 81-06, July 1981.

David S. Jones
"The Efficiency of Decentralized Investment Management Systems," RWP 81-05, April 1981.

Dan M. Bechter
"How Much For a New House in the Years Ahead? Some Insights From 1975-80," RWP 81-04, April 1981.

John B. Penson, Jr., Dean W. Hughes and Robert F.J. Romain
"Capacity Depreciation, the Implicit Rental Price of Capital, and Net Investment in a Durable Input," RWP 81-03, January 1981.

John B. Penson, Jr., Hovav Talpaz, and Henry S. Foster
"Estimation and Validation of Quadratic Input-Output Models," RWP 81-02, January 1981.

Richard K Abrams
"The Role of Regional Banks in International Banking," RWP 81-01, January 1981.

V. Vance Roley
"A Disaggregated Structural Model of the Treasury Securities, Corporate Bond, and Equity Markets: Estimation and Simulation Results," RWP 80-11, November 1980.

V. Vance Roley
"Symmetry Restrictions in a System of Financial Asset Demands: A Theoretical and Empirical Analysis," RWP 80-10, November 1980.