

# Velocity Behavior of the New Monetary Aggregates

By Bryon Higgins and Jon Faust

The velocity of money, sometimes called the "turnover rate," has long been a central concept in macroeconomic analysis. The proposition that the velocity of money is stable was the cornerstone of the original quantity theory of money, which emphasized the role of the money supply in the economy. Moreover, rejection of that proposition was an important part of the "Keynesian revolution" in macroeconomics that resulted in the downfall of the quantity theory as the preeminent framework for analyzing macroeconomic relationships. In the past two decades, however, increasing acceptance of a reformulated version of the quantity theory proposed by Milton Friedman and other monetarists has rekindled interest in understanding the determinants of velocity.

The evolution of procedures for implementing monetary policy has mirrored the intellectual debate regarding velocity. Little attention was accorded monetary growth or velocity in the implementation of monetary policy during the period in which the quantity theory had been supplanted almost entirely by Keynesian analysis. As monetarism gained adherents, however, the Federal Reserve came increasingly

to emphasize monetary aggregates as policy guides and since 1975 has established annual targets for monetary growth. The importance of understanding the behavior of velocity with current policy procedures was recently emphasized by Nancy Teeters, a member of the Board of Governors of the Federal Reserve System, when she said that:

. . . the efficacy of using monetary aggregates to target and characterize monetary policy depends importantly on the existence of a stable and predictable demand for money. Or, to put it another way, the velocity of money . . . must be reasonably stable and predictable.<sup>1</sup>

Beginning in the mid-1970s, though, the velocity behavior of traditional monetary aggregates became erratic. In response, the Federal Reserve adopted a new set of monetary aggregates in 1980 that more nearly reflected the realities of the evolving financial structure. It was hoped that velocity behavior of the redefined monetary aggregates would be more predictable, thereby improving the efficacy of monetary policy.

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Bryon Higgins is an assistant vice president and economist and Jon Faust is a research assistant, both with the Federal Reserve Bank of Kansas City.

<sup>1</sup> "Changing Financial Institutions: A Governor's View," in *The Future of the Financial Services Industry*, proceedings of a conference June 3-4, 1981, at the Federal Reserve Bank of Atlanta, p. 52.

Erratic velocity behavior of the new monetary aggregates in the past year, however, has led some observers to question the usefulness of the new aggregates for policy implementation. For example, the velocity of M1-B, the new aggregate that was most emphasized in policy implementation, increased by an unprecedented amount in the first quarter of 1981. This article analyzes the recent and prospective velocity behavior of the new monetary aggregates and its implications for monetary policy.

### THE IMPORTANCE OF VELOCITY FOR MONETARY POLICY

The ultimate objectives of monetary policy are to reduce inflation, promote economic growth, and contribute to a sustainable pattern of international transactions. In the short run, the Federal Reserve relies primarily on its ability to influence growth of nominal income to achieve the ultimate policy objectives.<sup>2</sup> For the past several years, the Federal Open Market Committee (FOMC) has set monetary growth targets believed to be consistent with the desired growth in income.

The Federal Reserve can achieve the desired growth rate of income by controlling monetary growth if the behavior of velocity is predictable. The velocity of money, which is defined as the ratio of income to the money stock, is sometimes interpreted as the average number of times each dollar of the money stock is paid out as income to producers of goods and services. However, it is perhaps more useful to think of velocity as a measure of how much money firms

and households desire to hold relative to the level of income. Viewed in this way, the Federal Reserve can influence growth of income by the use of monetary targets if the growth in the demand for money accompanying a given growth of income can be predicted.

An example may help illustrate the importance of correctly predicting velocity in setting monetary targets. Since velocity is defined as the ratio of income to the money stock, the growth rate of income,  $\dot{Y}$ , must be equal to the growth rate of money,  $\dot{M}$ , plus the growth rate of velocity,  $\dot{V}$ .

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

Assume the Federal Reserve believes that income growth of 10 percent is consistent with achieving its ultimate policy objectives and intends to set monetary targets consistent with this desired growth in income. Further assume that estimates of the money demand and other important economic relationships lead the Federal Reserve to estimate that velocity will grow at a 6 percent rate over the policy period.<sup>3</sup> In these circumstances, a monetary growth target of 4 percent would be deemed consistent with ultimate policy objectives, since 4 percent money growth plus 6 percent velocity growth would yield the desired 10 percent growth in income.

Inaccurate predictions of velocity growth, however, could lead to monetary targets that are incompatible with ultimate policy objectives. If, for example, actual growth in velocity turned out to be 10 percent rather than the

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<sup>2</sup> In the short run, the locus of feasible output-inflation combinations is given by the short-run aggregate supply schedule, which is not affected by monetary policy actions. The Federal Reserve can attempt to achieve the output-inflation combination most nearly consistent with its policy objectives by influencing the level of aggregate demand (or nominal income).

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<sup>3</sup> It would be more realistic to view velocity growth to be a function of money supply growth. In this case, the Federal Reserve would estimate this function and then select a combination of velocity growth and money growth that would yield the desired growth in income. For simplicity, the mechanics of the process used to obtain the velocity growth prediction will be ignored since the analysis is the same in either case.

estimated 6 percent, then achieving the 4 percent monetary growth target would lead to income growth of 14 percent rather than the desired 10 percent, a situation that could result in unacceptably high inflation. Thus, underestimation of the growth in velocity could lead the Federal Reserve to follow monetary policies that are unduly expansionary. Similarly, overestimation of velocity growth could result in unintended restrictiveness of monetary policy actions. For these reasons, ability to predict velocity is a prerequisite for the successful use of monetary targets to achieve ultimate policy objectives.

Since velocity is a measure of how much money firms and households want to hold relative to the level of income, accurate prediction of velocity behavior requires knowledge of the quantitative impact of changes in the various factors affecting money demand.<sup>4</sup> Most specifications of empirically estimated money demand functions are derived from transactions models of money demand that emphasize the role of money as a medium of exchange. The typical view in these models is that money is held primarily to bridge the gap between income and expenditures.<sup>5</sup> Because the incentive to economize on money balances depends on the yields available from alternative liquid assets, transactions models of money demand

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<sup>4</sup> A stable empirical relationship between velocity growth and its major determinants is not, however, a *sufficient* condition for predicting velocity unless the determinants of velocity are themselves predictable. If, for example, the dividend-price ratio on common stocks is an important determinant of velocity as some have suggested, it would not be possible to predict velocity unless the dividend-price ratio, and thus the behavior of the stock market, could be accurately predicted.

<sup>5</sup> For a more complete description of traditional inventory models of money demand, see Bryon Higgins, "Velocity: Money's Second Dimension," *Economic Review*, Federal Reserve Bank of Kansas City, June 1978 (reprinted in *Issues in Monetary Policy*, Federal Reserve Bank of Kansas City, February 1980).

suggest that the velocity of money is positively related to market interest rates. These models also imply that changes in income lead to less than proportional changes in money demand because of economies of scale in managing cash balances. As a result, transactions models predict that the velocity of money increases as the level of income increases. Empirical estimates generally confirm that increases in market interest rates and income are accompanied by increases in velocity.

Transactions models imply that the velocity of money depends on the availability of close money substitutes and the cost of transferring funds between money balances and other assets. However, because it is difficult to obtain adequate quantitative measures of the availability of close money substitutes and the cost of transferring funds, these factors are not generally considered explicitly in estimated money demand functions. As a result, unpredictable changes in the availability of close money substitutes or in the ease of transferring funds among assets can distort empirical money demand relationships, thereby impairing ability to predict velocity movements accurately.

## REDEFINITION OF THE MONETARY AGGREGATES

Throughout the 1960s and early 1970s, the condition for accurate prediction of velocity was generally fulfilled. Income and interest rates adequately explained velocity movements of the traditional monetary aggregates, M1 and M2. M1 included the public's currency and demand deposit holdings and was intended to measure transactions balances, and M2 included time and savings deposits at commercial banks as well as M1 assets and was intended to measure transactions balances plus very close substitutes for those balances.

### Motivation for Change

Beginning in the mid-1970s, however, it

became increasingly evident that changes in the financial system were contributing to movements in the velocity of the traditional aggregates that could not be explained solely by the behavior of income and interest rates. These changes particularly influenced M1, which had become the major focus of monetary policy implementation. M1 velocity grew very rapidly beginning in the mid-1970s, more rapidly in fact than was consistent with what could have been anticipated on the basis of past money demand relationships. Indeed, a substantial portion of the increase in M1 velocity occurred during a period of declining interest rates, a situation normally associated with declining or stable velocity.

The unexpected rise in M1 velocity beginning in 1974 indicated that smaller than expected M1 balances were being held by the public and touched off a number of investigations attempting to solve "The Case of the Missing Money."<sup>6</sup> The investigations generally concluded that part of the explanation for the shortfall in demand for M1 was the introduction of NOW accounts in New England. Since NOW accounts could be used to make third-party payments but were excluded from M1, the growth of these accounts caused M1 to understate the true amount of the public's transactions balances and contributed to unusually rapid growth of M1 velocity.

Recognition that the introduction of NOW accounts had changed the appropriate measure of transactions balances resulted in a broad reevaluation of the traditional monetary aggregates. This reevaluation led to the conclu-

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<sup>6</sup> Steven M. Goldfeld, "The Case of the Missing Money," *Brookings Papers on Economic Activity* (1976:3); Gilliam Garcia and Simon Pak, "Some Clues in the Case of the Missing Money," *American Economic Review*, Vol. 69, No. 2, May 1979; and Jared Enzler, Lewis Johnson, and John Paulus, "Some Problems of Money Demand," *Brookings Papers on Economic Activity* (1976:1).

sion that changes in the financial system that had caused undesirable empirical properties of the traditional aggregates had also rendered them undesirable on theoretical grounds. For example, a variety of evidence suggested that deposits at thrift institutions were becoming increasingly close substitutes for deposits at commercial banks and thus should be included in the monetary aggregates on the same basis as bank deposits.<sup>7</sup> Therefore, investigation of the evolving nature of financial assets implied that neither the type of institution at which deposits were held nor the legal and regulatory details of such deposits were completely adequate as criteria for defining monetary aggregates. Instead, it seemed that similarity in the functional attributes of financial assets would be a better guide.

In light of the inadequacies of the traditional measures of money, the Federal Reserve decided to redefine the monetary aggregates. The redefinition process was guided by the principle of "combining similar assets at each level of aggregation."<sup>8</sup> Both *a priori* reasoning and empirical evidence were used in assessing the similarity of monetary assets. Moreover, improving the stability and predictability of the velocity of the potential monetary measures was considered an important check on the procedures used to construct the aggregates.<sup>9</sup>

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<sup>7</sup> See Thomas Simpson, et al., "A Proposal for Redefining the Monetary Aggregates," *Federal Reserve Bulletin*, Vol. 65, No. 1, January 1979, p. 22, and William Barnett, "A Fully Nested System of Monetary Quantity and Dual User Cost Price Aggregates," Board of Governors of the Federal Reserve System, Division of Research and Statistics, Econometric and Computer Applications Section, November 1978, processed.

<sup>8</sup> Thomas D. Simpson, "The Redefined Monetary Aggregates," *Federal Reserve Bulletin*, Vol. 66, No. 2, February 1980, pp. 99-100.

<sup>9</sup> For an examination of the empirical properties of the new aggregates, see David J. Bennett, Flint Brayton, Eileen Mauskopf, Edward K. Offenbacher, and Richard D. Porter, "Econometric Properties of the Redefined

## Components of the New Aggregates

The monetary aggregates that emerged from the redefinition process are different from the old aggregates in several respects. The new measure of the public's transactions balances, M1-B, includes the public's holdings of currency, travelers' checks, demand deposits, and other checkable deposits, which include ATS, NOW, and credit union share draft accounts. An aggregate that excludes other checkable deposits, M1-A, was also adopted on an interim basis to provide greater understanding of the growth of transactions balances during the transition period following the introduction of nationwide NOW's on December 31, 1980. However, beginning in 1982, M1-A will be completely replaced by M1-B in policy implementation, and M1-B will subsequently be referred to simply as M1.

Although deposits at banks and thrifts that are included in the other checkable category are clearly used for transactions purposes and should thus be included in M1-B, other choices of which assets to include in the narrow transactions measure of money were less clearcut. For example, money market mutual fund shares (MMMF's) are excluded from M1-B although they offer limited checkwriting privileges. Similarly, overnight repurchase agreements (RP's) and Eurodollars were excluded from M1-B although funds in these assets are available for spending the next day and thus are very close substitutes for transactions balances. Although inclusion of some of these assets in M1-B improved its empirical properties in certain respects, it was felt that their exclusion from M1-B was justified on theoretical grounds.<sup>10</sup>

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Monetary Aggregates," Board of Governors of the Federal Reserve System, Division of Research and Statistics, Econometrics and Computer Applications Section, February 1980, processed.

However, MMMF's, overnight RP's, and overnight Eurodollars are included in the new broader aggregate, M2, which is intended to measure transactions balances and very close substitutes more accurately than did old M2. Unlike the old aggregate, new M2 includes time and savings deposits at thrift institutions as well as those at commercial banks in recognition of the increasing substitutability between similar deposits at different types of depository institutions.

Two additional aggregates, M3 and L, replaced old M3, M4, and M5 as very broad measures of the public's liquid assets. New M3 includes large time deposits and term RP's in addition to those assets included in M2. L is an even broader measure since it includes the public's holdings of term Eurodollars, bankers' acceptances, commercial paper, savings bonds, and negotiable Treasury securities with maturities of less than one year.

The Federal Reserve began using the new aggregates in monetary policy in 1980, setting long-run targets for M1-A, M1-B, M2, and M3. Because it was generally considered the best single measure of transactions balances, M1-B was the aggregate most emphasized in policy implementation. Thus, predicting the velocity of M1-B became an important aspect of implementing monetary policy with the new aggregates. It was hoped that redefining the monetary aggregate used to measure transactions balances had remedied the major defects

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<sup>10</sup> For an explanation of the exclusion of money market mutual fund shares, see Richard D. Porter, Thomas D. Simpson, and Eileen Mausekopf, "Financial Innovation and the Monetary Aggregates," *Brookings Papers on Economic Activity* (1979:1), pp. 222-23. For the justification for excluding overnight RP's, see Porter, Simpson, and Mausekopf, pp. 222-23, and Richard D. Porter and Eileen Mausekopf, "Cash Management and the Recent Shift in the Demand for Demand Deposits," Board of Governors of the Federal Reserve System, Division of Research and Statistics, Econometric Computer Applications Section, November 1978, processed.

of old M1 and would thus yield more predictable behavior of M1-B velocity.

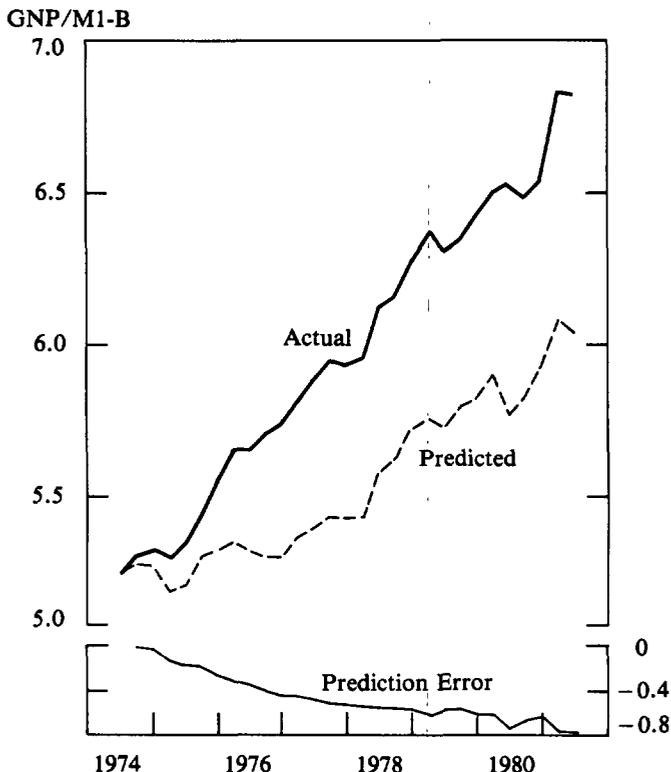
### VELOCITY BEHAVIOR OF M1-B

The long-run trend in the velocity of M1-B is similar in many respects to the trend in the velocity of old M1. The velocities of both the old and new measures of the public's transactions balances have increased substantially in the postwar period. Much of this upward trend can be explained within the conventional framework for analyzing the demand for money. Empirical estimates of money demand functions indicate that the rise in the velocities of both M1-B and old M1 through the early

1970s was a predictable result of the associated increases in interest rates and real income. Indeed, the seeming predictability of velocity was a major factor that led the Federal Reserve to adopt monetary growth targets as the principal method for achieving ultimate policy objectives.

In addition, growth in the velocity of M1-B in recent years has been somewhat more in line with what could be expected on the basis of traditional money demand relationships than has the growth in velocity of old M1, indicating that the redefinition of the aggregates was successful in providing a more meaningful policy guide. Especially after the introduction of na-

**Chart 1**  
**ACTUAL AND PREDICTED VELOCITY OF M1-B**



**Table 1**  
**ACTUAL AND PREDICTED GROWTH OF M1-B VELOCITY**

	Growth of M1-B Velocity (Percent)		
	(1) Actual	(2) Predicted*	(3) Prediction Error [ = (1) - (2) ]
1974:II - 1981:II	30.4	15.4	15.0
1974:II - 1977:IV	13.3	3.5	9.8
1977:IV - 1980:IV	10.1	9.2	0.9
1979:IV - 1980:IV	2.0	1.9	0.1
1980:I†	5.2	5.6	- 0.4
II	2.0	- 8.2	10.2
III	- 2.5	3.0	- 5.5
IV	3.2	7.5	- 4.3
1981:I	18.8	10.4	8.4
II	- 0.7	- 2.0	1.3

\*Predictions are from the M1-B velocity equation explained in footnote 11.  
†Percentage changes for individual quarters in 1980 and 1981 are annualized.

tionwide NOW accounts, the old M1 measure no longer reflected the true nature and composition of the public's transactions balances.

### Velocity Behavior of M1-B: 1974-77

Analysis of the behavior of M1-B velocity since 1974, however, suggests that redefinition of the aggregates has not been entirely successful in providing a measure of transactions balances that exhibits predictable velocity behavior. In particular, the velocity of M1-B rose much more rapidly from 1974 to 1977 than would be predicted by empirical estimates of a money demand function. (See Chart 1.) The behavior of interest rates and income would account for a 3.5 percent increase in M1-B velocity from the second quarter of 1974 to the fourth quarter of 1977.<sup>11</sup> Instead, velocity increased 13.3 percent over this period. (See

<sup>11</sup> The predicted values of M1-B velocity were obtained from dynamic simulation of a velocity equation estimated from the second quarter of 1959 through the second quarter of 1974. The estimated velocity equation was of the form:

$$\log(V_t) = A_0 + A_1 \cdot \log(y_t) + A_2 \cdot \log(r_t) + A_3 \cdot [\log(P_t/P_{t-1}) - \log(y_{t-1}) + \log(V_{t-1})]$$

where

- V is nominal GNP/M1-B,
- y is GNP in constant (1972) dollar terms,
- P is the price deflator for nominal GNP,
- r is a weighted average of the federal funds rate, the passbook savings rate, the 3-month Treasury bill rate, the commercial paper rate, the 5-year government bond rate, the 20-year government bond rate, and the dividend-price ratio on the Standard and Poor's index of 500 stocks. The weights used reflect the normalized values of the Eigen values of the first principal component of these variables, and
- log ( ) indicates the natural logarithm of the variable in parentheses.

Table 1.) Thus, even after allowing for growth of NOW accounts and other checkable deposits excluded from old M1, traditional money demand relationships explain only about one-fourth of the actual increase in M1-B velocity during the 1974-77 period. In other words, "The Case of the Missing Money" in the mid-1970s has not been completely resolved by redefinition of the monetary aggregates.

### Velocity Behavior of M1-B: 1978-80

Inability to explain the velocity behavior of M1-B in the 1974-77 period was recognized as a potential shortcoming at the time the aggregates were redefined in 1980. It was hoped that M1-B would nevertheless be useful as a policy guide. This hope was based in part on velocity behavior of M1-B after 1977 that was

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This specification of the velocity function was derived from, and therefore is equivalent to, a conventional money demand function of the form:

$$\log(M1-B_t/P_t) = A_0 + A_1 \cdot \log(y_t) + A_2 \cdot \log(r_t) + A_3 \cdot \log(M1-B_{t-1}/P_t).$$

The only "nonconventional" aspect of the velocity equation used was the use of a weighted average interest rate rather than one or more individual rates. Each of the individual rates used in the principal components analysis from which the weighted average rate was obtained has been used in previous money demand studies. However, the results of these studies have sometimes conflicted in part because of the particular choice of interest rates included in the estimated money demand or velocity functions. To avoid the problems of choosing among interest rates whose movements are highly correlated, an index of several rates that would better represent "the" interest rate relevant for money demand analysis was used. Interestingly, the first principal component of the seven rates accounts for 83 percent of the generalized variance of those rates. For a more detailed explanation of using principal components to analyze interest rate movements, see Donald D. Hester, "On the Dimensionality of Market Interest Rates and Price Movements," Social Systems Research Institute, University of Wisconsin, November 1969, processed, and Roy F. Gilbert, *The Demand for Money: An Analysis of Specification Error*, Econometrics Workshop Special Report Number 2, Michigan State University, August 1969.

generally in line with expectations. For example, from the fourth quarter of 1977 to the fourth quarter of 1980, M1-B velocity increased 10.1 percent, only slightly higher than the predicted increase of 9.2 percent. Thus, the growth rate of M1-B velocity from 1978-80 was close to what could be expected on the basis of historical money demand relationships. However, the actual level of velocity remained well above the predicted level throughout this period because of the large cumulative errors in predicting velocity growth in the mid-1970s. (See Chart 1.)

Despite the overall predictability of the growth of velocity from 1978 to 1980, there were instances in which the short-run behavior of velocity seemed very erratic. For example, as shown in Table 1, velocity increased at an annual rate of 2.0 percent in the second quarter of 1980, compared with a predicted decline at an annual rate of 8.2 percent. At the time, many felt that the unexpected increase in velocity forebode another sustained period of money growth below what could be accounted for by traditional money demand relationships. However, a rebound in money growth in the last half of 1980 resulted in velocity growth for the year as a whole in line with interest rate and income behavior. Nevertheless, as is frequently the case in such instances, unexpected behavior of velocity created uncertainty about the monetary growth rates consistent with the FOMC's policy objectives. Interpretation of the increase in velocity in the second quarter of 1980 as a reflection of a sustained downward shift in money demand could have led the FOMC to lower its monetary targets and thereby prolong the 1980 recession. It seems clear, in retrospect, that the behavior of velocity in the second quarter of 1980 was merely a temporary aberration, perhaps associated with distortions caused by imposition of credit controls. However, in the midst of such unexpected velocity behavior—the situation in which policy

decisions are made—it is frequently very uncertain what the appropriate policy response is.

### **Velocity Behavior of M1-B in 1981**

Policymakers are currently faced with another decision regarding the interpretation of unexplained behavior of velocity. The velocity of M1-B increased at an unprecedented 18.8 percent annual rate in the first quarter of 1981, well above the 10.7 percent rate of growth attributable to normal money demand relationships. In contrast to the experience in 1980, there has been no clear evidence of a subsequent rebound in monetary growth that would justify the conclusion that this atypical behavior of velocity was merely a temporary aberration. Indeed, the decline in velocity in the second quarter of 1981 at an annual rate of 0.7 percent was less than the 2.0 percent annual rate of decline attributable to conventional money demand relationships. Thus, the rate of monetary growth in the first half of 1981 was well below the rate that normally would have accompanied the behavior of income and interest rates.

The unexpectedly rapid growth of velocity in the first half of 1981 may have resulted from any of a number of factors. Because of the introduction of nationwide NOW accounts on December 31, 1980, the Federal Reserve has adjusted actual M1-B growth to compensate for the portion of funds estimated to have been transferred into NOW accounts from sources other than demand deposits. It is believed that adjusted M1-B represents a truer measure of total transactions balances than does unadjusted M1-B. Moreover, the seasonal factors applied to NOW accounts were assumed to be the same as for demand deposits in computing seasonally adjusted values for M1-B. The accuracy of both the seasonal adjustment procedure and the procedure used to compensate for the nontransactions component of M1-B is subject to considerable uncertainty. Thus,

current estimates of the “true” growth rates of M1-B and velocity in the first half of 1981 are tentative. However, it seems unlikely that subsequent revisions of procedures used to compute M1-B will fully account for the unexpectedly rapid velocity growth in the first half of 1981. Moreover, preliminary data suggest that even the velocity of unadjusted M1-B increased rapidly in the third quarter of 1981.

A second possible reason for rapid velocity growth in the first half of 1981 is the numerous developments in the financial system that have been characterized as “a virtual explosion of financial innovation and change.”<sup>12</sup> For example, MMMF’s increased \$69.6 billion in the first eight months of the year, an annual growth rate of 124 percent. Also, several proposals to link MMMF’s with credit card facilities have been announced by financial institutions. Because MMMF’s can be used for transactions purposes, their rapid growth has undoubtedly depressed M1-B growth and thereby contributed to rapid increases in M1-B velocity. In response, Chairman Volcker announced in Congressional testimony that the Federal Reserve favored imposition of reserve requirements on those MMMF accounts with transactions characteristics. This would provide an incentive for financial institutions to segregate accounts used for transactions purposes from those used primarily as a savings vehicle and would thereby enhance the Federal Reserve’s ability to measure and control the growth of transactions balances.

In addition to rapid growth of MMMF’s, a number of other developments may have contributed to the rapid velocity growth in the first half of 1981. Retail repo facilities, whereby small investors can earn market interest rates by investing funds for short periods in the govern-

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<sup>12</sup> Nancy Teeters, “Changing Financial Institutions: A Governor’s View.”

ment securities held by depository institutions, proliferated in the first half of 1981. Also, a number of financial institutions began to offer high-yielding accounts that allow the holders to make third-party transfers by activating a credit line secured by the assets in the account. For example, some depository institutions allow individuals with funds in money market CD's or small saver certificates to borrow funds for third-party transfers by writing a check or using a debit card. The details of these arrangements are diverse and complicated, but the effect of each is to allow individuals to hold transactions balances in high-yielding securities even though those securities are not themselves transferable to third parties.

Although many of the recent financial developments have been tailored for individuals, financial institutions are continuing to refine corporate cash management techniques. For example, one major bank has announced a "cash sweep" plan for its corporate customers under which the entire amount of the customers' cash balance is automatically invested in high-yielding liquid assets at the end of each business day. Since deposit balances are measured only at the end of the business day both for the purpose of assessing reserve requirements and for the purpose of calculating the money stock, the cash sweep plan allows financial institutions to avoid reserve requirements, allows corporations to hold all funds in interest-bearing assets, and seriously distorts the conventional measures of transactions balances. The cash sweep plan represents the ultimate cash management technique in the sense that it enables corporations to finance transactions without holding any measured transactions balances. Thus, the measured transactions velocity for those corporations using cash sweep services would be infinite.

The diversity and complexity of recent innovations affecting the public's M1-B balances obscure certain common characteristics. All

have been motivated by households' and firms' desire to earn near-market rates of return on balances that can be used for transactions purposes. All require sophisticated accounting capabilities that are made possible by advanced computer technology. Most enable financial institutions to reduce the amount of funds committed to noninterest-bearing reserves. And all tend to increase the velocity of the M1-B measure of money. Thus, innovations that cause increases in velocity are likely to continue to the extent that inflation and high interest rates provide incentives for financial institutions, firms, and individuals to economize on the amount of funds held in low-yielding assets and that technological advances lower the effective cost of transferring funds between various assets.

## BEHAVIOR OF M2 VELOCITY

### Velocity Behavior of M2 in the 1970s

Several recent studies have concluded that the velocity of M2 has been more predictable than the velocity of M1-B in recent years.<sup>13</sup> This conclusion is based primarily on the ability to predict M2 velocity using empirical estimates of historical money demand relationships.<sup>14</sup> For example, from the second quarter of 1974 to

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<sup>13</sup> See, for example, David J. Bennett, et al., "Econometric Properties of the Redefined Monetary Aggregates," and Neil G. Berkman, "Abandoning Monetary Aggregates," in *Controlling Monetary Aggregates III*, Conference Series No. 23, Federal Reserve Bank of Boston, October 1980.

<sup>14</sup> The predicted values of M2 velocity were obtained from dynamic simulation of a velocity equation estimated through the second quarter of 1974 that is identical in form to the M1-B velocity equation described in footnote 11.

Because of the nature of some of the assets included in M2, the inventory theory of money demand that pertains to transactions balances is not appropriate for analyzing M2. Similarly, the "velocity" of M2 has no straightforward interpretation in terms of the number of times each dollar is spent for goods and services. Instead, M2 velocity must be viewed simply as a measure of the amount of M2 balances

the second quarter of 1980, M2 velocity increased 0.9 percent, only marginally above the 0.6 percent that could be explained by the accompanying behavior of income and interest rates. (See Chart 2.) Although M2 velocity performed well for the 1970s as a whole, there were some divergences between actual and predicted M2 velocity during this period. For example, M2 velocity remained below predictions from mid-1975 through 1977. Subsequently, however, M2 velocity rebounded sharply and remained above predicted levels throughout most of the late 1970s. By early 1980, M2 velocity returned to the level predicted from a conventional M2 demand function. Thus, M2 velocity, unlike M1-B velocity, displayed no pronounced tendency to drift away from predicted values for prolonged periods in the 1970s.

The major reason M2 velocity remained more predictable than M1-B velocity through the 1970s is that many of the financial innovations responsible for reduced demand for M1-B balances had little or no effect on the demand for M2 balances. M2 includes many of the close substitutes for transactions balances developed in recent years as well as transactions balances themselves. As a result, changes in the public's

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desired by the public relative to the level of income. Indeed, some analysts argue that wealth or permanent income is a more appropriate scale variable than is current income in explaining the demand for broader monetary aggregates like M2. If something other than current income is included as the scale variable in the money demand function, however, the derivation of a velocity function requires that the relation between current income and the alternative scale variable be known in order to use the velocity predictions for setting monetary targets consistent with the desired level of income.

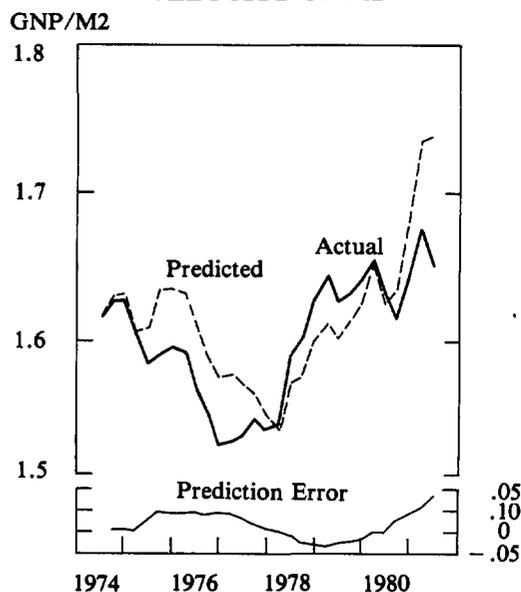
The predictions of M2 velocity, unlike predictions of M1-B velocity, were altered dramatically when a time trend was included in the estimated equation. Because the prediction results for M2 were more nearly comparable to those reported by others when the equation with no time trend was simulated, the equation with no time trend was used even though the trend variable was highly significant in the estimated M2 velocity equation.

portfolio of assets have primarily affected the composition rather than the level of M2 balances. For example, introduction of MMMF's and increased use of corporate RP's, both of which have contributed to the rapid growth of M1-B velocity in recent years, have had a negligible impact on M2 velocity because MMMF's and corporate RP's are included in M2.

### Velocity Behavior of M2 Since Mid-1980

In the past year, however, the velocity of M2 has increased much less rapidly than would have been expected on the basis of conventional money demand relationships. For example, M2 velocity increased 1.3 percent from the second quarter of 1980 to the second quarter of 1981, whereas conventional money demand relationships would have predicted an increase of 6.9 percent. The resulting divergence between ac-

**Chart 2**  
**ACTUAL AND PREDICTED**  
**VELOCITY OF M2**



tual and predicted M2 velocity by the second quarter of 1981 was almost twice as large as any that occurred in the 1970s. Thus, a considerable portion of the growth in M2 over the past year is due to factors other than its historical relationship to income and interest rates.

Higher than anticipated M2 growth in the past year may be due to reduced interest sensitivity of M2. In the 1960s and early 1970s, deposits subject to interest rate ceilings accounted for a very large portion of M2 assets. Therefore, an M2 demand equation estimated over this period predicts that an increase in market interest rates would sharply depress M2 growth. Currently, however, a large and increasing fraction of M2 assets yields a market rate of return. In the second quarter of 1981, for example, assets with a market yield—including MMMF's, RP's, overnight Eurodollar deposits, and money market certificates—accounted for 35.4 percent of the funds in M2, compared with less than 1 percent in 1970. In current circumstances, therefore, high market interest rates would be expected to have a relatively small impact on the overall demand for M2, although probably affecting substantially the composition of M2. Thus, empirical estimates indicating a substantial interest sensitivity of the demand for M2 no longer reflect the true nature of M2 assets. In these circumstances, it is not surprising that M2 velocity has increased less rapidly than expected in response to the high market interest rates prevailing for the past year.

Recent and prospective regulatory changes will continue to affect the behavior of M2 velocity in unpredictable ways. For example, the Monetary Control Act (MCA) mandated the phaseout of interest rate ceilings on all time and savings deposits by 1986. As this phaseout proceeds, an increasing number of the components of M2 will have a market-determined yield, and the resulting change in the characteristics of M2 assets will cause con-

tinued uncertainty regarding the velocity behavior of M2.

### **POLICY IMPLICATIONS OF ERRATIC VELOCITY BEHAVIOR**

Recent erratic velocity behavior of both M1-B and M2 has posed severe problems for monetary policy implementation. Although undoubtedly improving economic welfare by expanding the range of assets available to the public, recent financial innovations and changes in the legal and regulatory framework have distorted traditional money demand relationships, even for the redefined monetary aggregates. As a result, the Federal Reserve's ability to achieve ultimate policy objectives by using monetary growth targets as policy guides may be impaired for the foreseeable future.

Most analysts inside and outside the Federal Reserve have focused on the slower than expected M1-B growth in 1981 as the primary problem confronting monetary policy. In response, the FOMC at its midyear policy review decided to aim for M1-B growth near the bottom rather than near the midpoint of its long-run range for 1981. Moreover, the policy directives from recent FOMC meetings clearly indicate that the FOMC placed increased emphasis on M2 after it became apparent that M1-B velocity was continuing to increase more rapidly than expected. In light of erratic velocity behavior of M2 since mid-1980, however, greater emphasis on M2 may not solve the monetary policy dilemma.

Moreover, provisions in the Monetary Control Act will also make it more difficult for the Federal Reserve to control the growth of M2. The reserve aggregate approach to monetary control adopted by the Federal Reserve in October 1979 relies on a predictable relationship between the growth of reserves and the growth of monetary aggregates. The reserve requirement structure stipulated in the MCA will weaken the relationship between reserves and M2, however, since it requires depository in-

stitutions to hold reserves only against transactions deposits and nonpersonal time deposits. Because most components of M2 will not be subject to reserve requirements once the new reserve requirement structure is fully phased in, there will be only a tenuous link between M2 growth and the amount of reserves provided by the Federal Reserve. Thus, for example, rapid growth in the nontransactions components of M2, because not accompanied by a corresponding increase in the demand for reserves by depository institutions, could impede Federal Reserve efforts to restrain M2 growth by limiting the supply of reserves.

In addition, even if excessive M2 growth were associated with a reserve scarcity, the resulting increase in market interest rates would not substantially reduce M2 growth because the yield on most components of M2 would increase as market interest rates increased. Therefore, the phaseout of both deposit ceilings and reserve requirements on most of the deposits included in M2 will make it increasingly difficult for the Federal Reserve to control M2 growth. As a result, even if M2 velocity were more predictable than M1-B velocity, the Federal Reserve may not be able to exploit this predictability by using M2 as an intermediate target for monetary policy. More generally, the provisions of the MCA make it unlikely that any current or prospective monetary aggregate that includes a large nontransactions component would be useful as an intermediate policy target since no such aggregate will be susceptible to Federal Reserve control.

In view of the unstable velocity behavior of M1-B and M2 and regulatory changes making it increasingly difficult to control broader monetary aggregates, some analysts have suggested the possibility of placing greater emphasis on credit aggregates in monetary policy implementation.<sup>15</sup> The Federal Reserve currently establishes annual objectives for the growth of bank credit, which is defined as total loans

and investments of commercial banks. However, the growing similarity between financial institutions that contributed to the obsolescence of the old definitions of the monetary aggregates has also reduced the significance of credit aggregates that measure only the credit extended by commercial banks. For example, large corporations that formerly relied primarily on bank loans for short-term credit needs have increasingly developed alternative sources of short-term funds, such as issuance of commercial paper and borrowing in the Eurodollar market. As a result, the relationship between bank credit and income—that is, the “velocity” of bank credit—has become less predictable in recent years.<sup>16</sup>

The relationship between broad credit measures and income has remained relatively stable. However, the usefulness of broad credit aggregates in monetary policy implementation is limited in a number of respects. The Federal Reserve could not control the growth of broad credit measures using the reserve aggregate approach because reserve requirements are imposed on the liabilities rather than the assets of depository institutions and because many financial institutions that extend credit are not subject to reserve requirements at all. Thus, the Federal Reserve would be able to affect growth of broad credit aggregates only through its ability to influence the demand for credit by controlling interest rates. The same problems of sluggish response in adjusting an interest rate operating variable that contributed to the Federal Reserve’s decision to abandon the federal funds operating approach to monetary control might also prove to be a hindrance to

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<sup>15</sup> See, for example, Benjamin Friedman, “The Relative Stability of Money and Credit ‘Velocities’ in the United States: Evidence and Some Speculations,” National Bureau of Economic Research, Working Paper No. 645, March 1981.

<sup>16</sup> Friedman, “The Relative Stability.”

the use of interest rates to control growth of credit aggregates. Moreover, the long lag in the availability of data on some of the components of broad credit aggregates limits their usefulness as policy guides.

The problems of a lag in data availability and the lack of effective control that limit the usefulness of broad credit aggregates as policy guides could be solved by adopting a reserve aggregate as an intermediate policy target. Indeed, members of the Shadow Open Market Committee among others have recommended that the Federal Reserve use the monetary base—a reserve aggregate that includes currency held by the public and total reserves of depository institutions—as the sole intermediate target of monetary policy.<sup>17</sup> However, unpredictability in the relationship between monetary aggregates and income is likely to be accompanied by unpredictability in the relationship between the monetary base and income, since growth in the base merely reflects a weighted average of the growth in the various components of the monetary aggregates. Moreover, relatively steady growth in the monetary base has in the past sometimes been associated with sharp fluctuations in income. For these reasons, attempts to circumvent the monetary aggregates in policy implementation by using a reserve aggregate as an intermediate target are unlikely to improve the efficacy of monetary policy.

In view of the continued erratic velocity behavior of the new monetary aggregates, the practical limitations of using broad credit ag-

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<sup>17</sup> See, for example, "Policy Statement," *Shadow Open Market Committee: Policy Statement and Position Papers*, February 3-4, 1980. For a detailed discussion of the drawbacks of using the monetary base as an intermediate policy target, see Carl Gambs, "Federal Reserve Intermediate Targets: Money or the Monetary Base?" *Economic Review*, Federal Reserve Bank of Kansas City, January 1980.

gregates or reserve aggregates as policy guides, and recent and prospective changes in the financial system, further redefinition of the monetary aggregates may be warranted. Meaningful redefinition might even require a more radical departure from traditional methods of constructing monetary aggregates, such as defining a weighted average monetary aggregate that would more nearly reflect the different degrees of liquidity and other monetary services provided by various assets.<sup>18</sup> However, the advisability of continuing to try to develop financial aggregates that are useful as intermediate policy targets depends to some extent on interpretation of the causes of financial innovation that have caused an unpredictable relationship between growth in income and growth in the narrow monetary aggregates.

To the extent that the financial innovation of the last decade is viewed as a result of special circumstances unlikely to recur in the future, the use of financial aggregates as intermediate policy targets may be satisfactory after adjustment to the new innovations is completed. Until recently, the accelerated pace of financial innovation and associated erratic velocity behavior of the old aggregates in the mid-1970s were generally viewed as exogenous events that temporarily distorted the relationship between monetary growth and ultimate policy objectives. Thus, it was hoped that redefinition of the monetary aggregates to take account of the more important changes in the financial environment would be sufficient to ensure the continued usefulness of monetary targets for policy implementation. However, erratic velocity behavior of the redefined monetary aggregates in the past year has cast doubt on the exogenous innovation hypothesis.

Increasingly, the process of innovation has come to be viewed as a policy-induced response

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<sup>18</sup> Barnett, "A Fully Nested System."

rather than as a purely exogenous occurrence.<sup>19</sup> In this view, attempts to control growth of monetary aggregates provide incentives for the private sector to develop assets that are close substitutes for the assets included in the controlled aggregate but are not themselves included in the aggregate. For example, reserve requirements and interest rate ceilings were the two distinguishing features of assets included in the old monetary aggregates, but the costs imposed by these regulations on asset-holders and financial intermediaries encouraged development of alternative assets. In response, the Federal Reserve redefined the monetary aggregates, while Congress authorized phaseout of most deposit interest rate ceilings, imposition of uniform reserve requirements on all depository institutions, and elimination of reserve requirements on most nontransactions components of the new aggregates. However, these changes seem not to have enhanced the usefulness of targets defined in terms of the new aggregates. The phaseout of interest rate ceilings will increasingly impair the ability of the Federal Reserve to control the growth rate of the new aggregates, and financial institutions are continuing to develop means to reduce the earnings loss resulting from reserve requirements.

These problems may not be alleviated by further redefinition of the monetary aggregates or increased emphasis on credit aggregates. If the induced innovation hypothesis is correct, whatever aggregate the Federal Reserve tries to control will exhibit unpredictable velocity behavior as firms and households respond to the constrained supply of that aggregate by developing even more sophisticated financial

arrangements that avoid the regulatory burden imposed as a necessary part of efforts to control some financial aggregate. Paradoxically, the regulatory framework necessary to control the growth of a given aggregate sets in motion forces that ultimately reduce that aggregate's usefulness in policy implementation. Therefore, if the induced innovation hypothesis is correct, it may be advisable to abandon the monetary targeting procedure altogether and rely on a broad spectrum of information to determine the setting of policy instruments most nearly consistent with ultimate policy objectives. In this framework, the behavior of the monetary aggregates along with the behavior of credit aggregates, interest rates, and other important economic variables would be evaluated to determine the appropriate monetary policy actions. Thus, although not serving as intermediate policy targets, the monetary aggregates would continue to play an important role in monetary policy implementation.

### SUMMARY AND CONCLUSION

Erratic velocity behavior of the traditional monetary aggregates led the Federal Reserve to redefine the aggregates. However, the new monetary aggregates have also exhibited erratic velocity behavior recently, thereby posing serious problems for monetary policy implementation. Continuing rapid financial innovation may also continue to impair the reliability of traditional money demand relationships used to predict velocity. Several financial aggregates, including broad credit measures, have been suggested as alternative policy guides. Unfortunately, none is completely satisfactory. Moreover, the process of innovation itself has increasingly come to be viewed as a result of the use of monetary targets in policy implementation. If this view is correct, it may be necessary to reevaluate the desirability of using monetary targets to achieve ultimate policy objectives.

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<sup>19</sup> See, for example, Donald D. Hester, "Innovations and Monetary Control," *Brookings Papers on Economic Activity* (1981:1)