Financial Innovation and the Monetary Aggregates

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Brookings Papers on Economic Activity is currently published by The Brookings Institution.

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THE MOST RECENT WEAKNESS in the monetary aggregates has reopened basic questions about the stance of monetary policy. The pattern of markedly slow rates of growth has been especially evident in M_1. In the six quarters preceding 1978:4, M_1 grew at an average annual rate of nearly 8 percent, about 3 percentage points below the growth rate of nominal GNP. But in that fourth quarter, M_1 slowed to a 4.3 percent annual rate, while GNP expanded at a 15.6 percent rate; moreover, in 1979:1, M_1 declined, while nominal GNP expanded at a 9.5 percent annual rate.

There are striking similarities between the behavior of M_1 in recent months and the prolonged weakness in this aggregate from mid-1974 to early 1977. In both periods, M_1 grew at a much slower rate than that predicted using historical relationships among M_1, GNP, and interest rates. This weakness can be seen in table 1, which shows predicted and actual levels and growth rates of M_1, based on a conventional M_1 demand equation. From the period beginning in mid-1974 to 1977:1, the error in predicting M_1 cumulated to $34 billion as the actual annual growth rate of M_1 averaged about 3.5 percentage points less than that predicted. From 1978:3 to 1979:1, the M_1 error grew by $15 billion, as the actual M_1 growth rate averaged almost 7.5 percentage points less than that predicted.

In each of these periods of unusually slow money growth, legislative

Table 1. Actual and Predicted Values and Errors from a Dynamic Simulation of an M_1 Demand Equation, 1974:3–1979:1

Year and quarter, and summary statistic	Annualized rate of growth (percent or percentage points)			Level (billions of dollars or percent)			
	Actual	Pre-dicted	Error	Actual	Pre-dicted	Cumulative error	Cumulative percentage error[a]
Year and quarter							
1974:3	4.0	7.9	−4.0	279.0	284.0	−5.0	−1.8
4	4.6	8.6	−4.0	282.1	290.1	−8.0	−2.8
1975:1	2.1	8.5	−6.4	283.6	296.3	−12.6	−4.5
2	5.7	8.9	−3.2	287.7	302.9	−15.2	−5.3
3	7.3	9.2	−1.9	292.9	309.9	−16.9	−5.8
4	3.0	9.2	−6.2	295.1	317.0	−21.9	−7.4
1976:1	4.6	9.6	−5.1	298.5	324.6	−26.1	−8.8
2	6.4	8.6	−2.2	303.3	331.6	−28.3	−9.3
3	4.2	7.8	−3.6	306.5	338.1	−31.6	−10.3
4	7.4	8.0	−0.5	312.1	344.8	−32.7	−10.5
1977:1	7.4	8.6	−1.2	317.9	352.2	−34.3	−10.8
2	7.4	9.0	−1.6	323.8	360.1	−36.3	−11.2
3	8.7	8.2	0.5	330.8	367.5	−36.7	−11.1
4	7.4	7.4	−0.0	336.9	374.3	−37.4	−11.1
1978:1	6.7	7.0	−0.3	342.5	380.8	−38.3	−11.2
2	9.2	9.4	−0.2	350.4	389.7	−39.4	−11.2
3	8.2	8.5	−0.3	357.5	398.0	−40.5	−11.3
4	4.3	8.6	−4.3	361.4	406.5	−45.1	−12.5
1979:1	−2.4	8.2	−10.6	359.2	414.9	−55.7	−15.5
Summary statistic							
Mean error			−2.9			−29.6	
Mean absolute error			3.0			29.6	
Root-mean-square error			4.0			32.3	

Sources: Actual values are from the Board of Governors of the Federal Reserve System. Predicted values are from a dynamic simulation of the M_1 equation in the appendix, table A-1. This equation uses the same specification and sample period (1960:4 to 1974:2) as the equation for M_1 reported in "A Proposal for Redefining Monetary Aggregates," *Federal Reserve Bulletin*, vol. 65 (January 1979), p. 26. Figures are rounded.

a. Cumulative error as a percent of actual level.

and regulatory changes have created new kinds of deposits or permitted expanded use of existing ones, contributing to some substitution of other financial assets for M_1. The recent weakness in M_1 has coincided with the introduction of automatic transfer services (ATS) in November 1978. ATS has encouraged the shifting of funds from demand-deposit accounts to savings accounts. During the earlier period of weak M_1 growth, negotiable-orders-of-withdrawal (NOW) accounts at commercial banks and

thrift institutions in New England and share drafts from credit unions emerged, providing individuals with an explicit return on checkable balances. In addition, commercial banks were authorized to offer savings accounts to domestic government units in November 1974 and to businesses in November 1975. Such new accounts encouraged some deposit holders to shift funds from demand-deposit accounts. However, Board staff estimates indicate that such developments can explain no more than one-fourth of the estimated shortfall in M_1 growth shown in table 1 during the earlier period, and that ATS can explain only about one-fourth of the weakness during the most recent period.[1] Furthermore, technical explanations that are sometimes suggested, such as growth in Federal Reserve float, do not account for much, if any, of the weakness.[2]

Finally, table 2 confirms that, during each period of weakness in M_1, sizable forecast errors also emerged in M_2. Table 2 shows that, by early 1977, the cumulative overprediction from a standard M_2 equation slightly exceeded the \$34 billion overprediction of M_1. Since 1978:3, the level of the M_2 error increased by almost twice as much as the M_1 error. Thus the weak growth in M_1 cannot be explained by the substitution of savings and time deposits for demand deposits.[3]

It is important to note that, in both periods, weakness in the aggregates emerged at a time when short-term interest rates were at historically high levels. Meanwhile, other financial instruments—security repurchase agreements (RPs) and money-market mutual funds—apparently became more widely used as deposit substitutes. In the next section the analysis focuses on the relationship between high interest rates, the weakness in monetary aggregates, and the role of these new instruments.

The Cash-Management Process

Much of the weakness in demand deposits relative to GNP in recent years has been in the deposit holdings of nonfinancial corporations, which

1. Board staff estimates suggest that the introduction of ATS accounts nationwide and NOW accounts in New York depressed M_1 growth by about 1 percentage point at an annual rate in 1978:4 and by nearly 3 percentage points in 1979:1.
2. From 1978:4 to early 1979, Federal Reserve float became large (but recently it has returned to a more normal level), while M_1 was virtually unchanged during this period.
3. The weakness in M_1 has been entirely attributable to the demand-deposit component; forecasts of currency have continued to be accurate.

Table 2. Actual and Predicted Values and Errors from a Dynamic Simulation of an M₂ Demand Equation, 1974:3–1979:1

Year and quarter, and summary statistic	Annualized rate of growth (percent or percentage points)			Level (billions of dollars or percent)			
	Actual	Pre-dicted	Error	Actual	Pre-dicted	Cumulative error	Cumulative percentage error[a]
Year and quarter							
1974:3	6.1	7.6	−1.5	599.9	604.1	−4.2	−0.7
4	6.6	8.2	−1.6	609.8	616.5	−6.7	−1.1
1975:1	6.4	9.5	−3.0	619.6	631.1	−11.5	−1.9
2	9.5	10.6	−1.1	634.3	647.9	−13.5	−2.1
3	10.0	9.9	0.1	650.2	664.0	−13.8	−2.1
4	6.8	11.0	−4.2	661.2	682.2	−21.0	−3.2
1976:1	10.5	13.0	−2.5	678.6	704.3	−25.7	−3.8
2	10.0	11.7	−1.7	695.5	724.9	−29.3	−4.2
3	8.8	10.9	−2.1	710.9	744.7	−33.8	−4.8
4	12.6	11.7	0.9	733.3	766.4	−33.1	−4.5
1977:1	10.9	12.2	−1.2	753.3	789.7	−36.4	−4.8
2	9.0	12.1	−3.1	770.3	813.6	−43.3	−5.6
3	10.0	10.6	−0.6	789.6	835.1	−45.5	−5.8
4	7.9	9.2	−1.3	805.3	854.3	−49.0	−6.1
1978:1	7.0	8.4	−1.4	819.3	872.3	−53.0	−6.5
2	8.4	10.3	−1.9	836.6	894.7	−58.2	−7.0
3	9.9	10.3	−0.5	857.3	917.9	−60.6	−7.1
4	7.7	10.3	−2.6	873.9	941.6	−67.8	−7.8
1979:1	1.6	9.8	−8.2	877.4	964.8	−87.3	−10.0
Summary statistic							
Mean error			−2.0			−36.5	
Mean absolute error			2.1			36.5	
Root-mean-square error			2.7			42.6	

Sources: Same as table 1, but using the M₂ equation. Figures are rounded.
a. Cumulative error as a percent of actual level.

also became major lenders of RP funds.[4] While it is tempting to conclude that weakness in M_1 simply reflects the substitution of such liquid assets

4. For econometric evidence see, for example, Helen T. Farr, Richard D. Porter, and Eleanor M. Pruitt, "Demand Deposit Ownership Survey," in *Improving the Monetary Aggregates: Staff Papers* (Board of Governors of the Federal Reserve System, 1978), pp. 91–116. Also note that from 1970:2 to 1978:4 the ratio of personal income to gross demand deposits of consumers increased by 16.5 percent, while the ratio of total business sales to gross demand deposits of nonfinancial businesses increased by 49.4 percent.

for demand deposits, it is our view that these developments are part of a general process of intensified cash management.

Several developments lie behind this more intensive cash management. During the 1970s it has become less costly for corporate cash managers to invest excess demand balances in the money market. The cost of moving funds from accounts with local or regional banks to a money-market asset has fallen in real terms. Improved information systems and forecasting procedures have been introduced, which reduce uncertainties regarding near-term cash flows and thereby permit profitable reductions in demand-deposit balances. Moreover, high market rates of interest in 1973–74, 1978, and early 1979 have increased the incentive for managers to imple-ment new cash-management techniques. Reports indicate that large cor-porations began to modify their cash-management procedures starting about 1973 and that many smaller corporations have begun to utilize the newer techniques during the past two years.

These developments can be readily interpreted within the established inventory theory of the demand for money by firms.[5] Given the uncertainty about day-to-day cash flows, deposit holdings, m, will be positively related to the transactions costs, t, of exchanging deposits for interest-bearing as-sets and to the standard deviation of net cash flows, σ, and negatively related to the opportunity costs of holding cash, r.[6] By purchasing cash-management services to reduce uncertainty about cash flows, a firm may lower its overall inventory costs—the sum of expected transactions costs, the opportunity costs of expected cash balances, and cash-management costs.[7] When this activity is profitable, average deposit holdings are re-duced. Moreover, as short-term interest rates rise, there is a greater incen-tive to increase the use of cash-management activities so that the demand for money becomes more interest-elastic at higher interest rates.[8] Indeed,

5. See, for example, Merton H. Miller and Daniel Orr, "A Model of the Demand for Money by Firms," *Quarterly Journal of Economics*, vol. 80 (August 1966), pp. 413–35.

6. More specifically, in the Miller-Orr model, expected cash holdings are given by

$$\frac{4}{3}\left(\frac{3t\sigma^2}{4r}\right)^{1/3}.$$

7. See Richard D. Porter and Eileen Mauskopf, "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, n.d.).

8. Ibid., pp. 34–36.

it appears that industry cost-benefit ratios for evaluating such activities depend explicitly on the level of short-term rates.

A variety of cash-management techniques (for example, lock boxes, control disbursement, payable-through drafts, forecasting models, and information retrieval systems) has improved information about near-term cash flows. From interviews with corporate cash managers and bankers, it appears that one of the most popular techniques currently in use is control disbursement. This technique increases the information that a firm has at the time investment decisions are made about expected clearings against its account. As a result, the firm can reduce the amount of balances that it holds to meet any unexpected outflows from its account.[9] On the receipts side, lock boxes serve a similar function by increasing certainty about near-term collected balances.[10]

Another cash-management technique that has contributed to the weakness in demand deposits is the cash-concentration account, which permits the customer to exploit economies of scale that arise from operating one account rather than many scattered accounts. Using wire transfers and depository transfer checks, the firm can consolidate receipts into a single concentration account from which it funds disbursements. Abstracting from the costs of consolidating accounts, it can be shown that the optimal

9. In control disbursement, the firm typically maintains a zero or fixed balance account at a "remote" bank which, because of its location, receives only one cash letter from the Federal Reserve early each day. When the information in the cash letter is sorted, the corporation is notified of the exact amount of funds needed to cover all clearings against its account that day. The information comes early enough in the day, usually by noon, so that a more accurate determination can be made of funds available for investment. Checking accounts at other "nonremote" banks usually are such that the firm will not know until late that day, or sometimes even until the next day, the amount of funds needed for clearing. This is because other banks may receive checks for clearing throughout the day by picking up cash letters at Federal Reserve offices or through direct sends.

10. The bank operating the lock box can notify the corporation daily (or more often) when items received at the lock box become collected balances. There are two distinct effects associated with the use of lock boxes and control disbursement: information is received about cash flows and the timing of receipts and clearings is altered. Lock boxes and control disbursement were initially marketed and utilized for the latter ("float") purpose. The gains from these activities may be quite large, and for some firms they are probably much larger than the gains from any reduction in uncertainty about cash flow. However, it appears that most firms have increasingly realized the value of the accompanying information gains. Moreover, it has become clear that such information gains can easily exceed the "float" gains for firms with large variations in daily clearings or collections.

amount of cash in the concentration account is always less than the optimal cash balance held when separate accounts are maintained, even when net receipts in the different accounts are perfectly correlated. However, when costs are associated with consolidating funds, the decision of whether to concentrate accounts depends on the costs of concentrating relative to the gains. Tending to lower the consolidation costs are the reduced personnel and management costs of operating only one account and the advantage of spreading any fixed brokerage fee over more investment dollars. Because the gains from consolidation increase with the rate of interest, there is more incentive to concentrate when interest rates are high.

Coinciding with the increased use of cash-management techniques has been the growing volume of very short-term liquid assets such as RPs and money-market mutual funds. In fact, many have argued that recent periods of weakness in demand deposits can be traced mainly to the growth in RPs and to money-market mutual funds.[11]

The arguments attributing the weakness in M_1 to the growth in these short-term liquid assets must be interpreted carefully. The traditional theory of money demand is built around the notion that changes in the yield on an interest-bearing asset or changes in the cost of converting interest-bearing assets into money will affect money holdings. Since RPs have lower transactions costs than many other assets of comparable yields, their introduction and incorporation into cash-management strategies might be expected to reduce the volume of demand deposits held at any given interest rate. But what is sometimes argued is that the demand for money has not really changed, but instead is being incorrectly mea-

11. See P. A. Tinsley, B. Garrett, and M. E. Friar, "The Measurement of Money Demand" (Board of Governors of the Federal Reserve System, Special Studies Section, November 1978); Gillian Garcia and Simon Pak, "Some Clues in the Case of the Missing Money," *American Economic Review*, vol. 69 (May 1979, *Papers and Proceedings, 1978*), pp. 330–34; and John Wenninger and Charles Sivesind, "Changing the M1 Definition: An Empirical Investigation" (Federal Reserve Bank of New York, April 1979).

The recent growth of money-market mutual funds is impressive. Such funds have grown from about $8.1 billion at the end of September 1978 to about $18.2 billion in early April. Since these accounts have low brokerage fees, high overnight yields, and are checkable, it is conceivable that two-thirds of the increase in the M_1 error in the recent period can be assigned to this source. That is, suppose the $10 billion increase in these funds comes only at the expense of household and corporate demand-deposit balances. Because of the economies of scale involved in pooling receipts and disbursements, the mutual funds surely hold less than $1 billion in demand deposits.

sured. By including RPs in the narrowest monetary aggregate, no weakness in this aggregate would emerge because the sum of M_1 plus RPs would behave as M_1 alone did previously.[12] This argument implies that RPs dominate demand deposits by some agents.[13]

In the case of money-market funds, the question of transactions costs is moot. Accounts containing such funds are typically checkable; and for most funds no charges are made for drafts, provided that checks exceed a minimum amount.[14] The checkability feature and the near-market yield on money-market funds make them attractive relative to demand deposits.

If RPs and money-market mutual funds tend to dominate money, then the stability of the M_1 demand equations might indeed be restored by adding RPs or RPs and money-market mutual funds to M_1. Table 3 provides the simulation results for a demand equation using an M_1 specification but estimated for the sum of M_1 plus RPs at commercial banks, and for the sum of M_1, RPs, and money-market mutual funds. The table indicates that the addition of RPs can cut the demand error appreciably. At the end of 1975 the cumulative errors in both the equation for M_1 (table 1) and the equation for the sum of M_1 and RPs (table 3) were about $20 billion. From 1975:4 to 1978:3, the M_1 level error doubled in size, while the error in the equation containing RPs increased by about half. Most recently, from 1978:3 to 1979:1, the M_1 error increased by an additional $15 billion, at a time when the error for the sum of M_1 and RPs grew by $10 billion. A better performance was shown by the broader aggregate, M_1, RPs, and money-market mutual funds. The table shows that since 1976:1, the equation for this money measure has predicted quite accurately.

Should we conclude from this evidence that RPs and money-market

12. This argument is set forth in Garcia and Pak, "Some Clues in the Case of the Missing Money."

13. To be a dominant asset, the RP market must be active late in the day when firms know the amount of demand balances needed to cover net disbursements. Alternatively, if the market closes earlier in the day, the returns on an RP must be large enough to cover potential overdraft charges or the penalty for breaking an RP commitment.

14. The checkability of money-market funds is limited to some extent by the typical requirement that checks must exceed $500. However, the average size of checks written at commercial banks is roughly $500. See "Check Processing at Federal Reserve Offices," *Federal Reserve Bulletin,* vol. 65 (February 1979), p. 99. Other Board staff estimates suggest that about 10 percent of all checks written have face amounts of $500 or larger.

Table 3. Errors from a Dynamic Simulation of a Money-Demand Equation for Alternative Measures of Money, 1974:3–1979:1

Year and quarter, and summary statistic	Cumulative error			
	M_1 and RPs		M_1, RPs, and money-market mutual funds	
	Billions of dollars	Percent[a]	Billions of dollars	Percent[a]
Year and quarter				
1974:3	−6.2	−2.1	−5.7	−1.9
4	−8.8	−3.0	−7.4	−2.5
1975:1	−14.1	−4.7	−11.4	−3.8
2	−15.7	−5.2	−12.3	−4.0
3	−15.7	−5.1	−12.5	−4.0
4	−20.0	−6.5	−16.9	−5.4
1976:1	−23.3	−7.4	−20.0	−6.3
2	−23.1	−7.1	−19.9	−6.1
3	−24.4	−7.4	−21.5	−6.4
4	−24.5	−7.3	−21.4	−6.3
1977:1	−26.6	−7.7	−23.3	−6.7
2	−27.7	−7.9	−24.7	−6.9
3	−26.6	−7.4	−23.8	−6.5
4	−25.2	−6.8	−22.1	−5.9
1978:1	−25.7	−6.8	−21.7	−5.7
2	−28.4	−7.4	−22.9	−5.9
3	−28.6	−7.3	−21.7	−5.4
4	−29.5	−7.3	−21.0	−5.1
1979:1	−38.8	−9.7	−25.2	−6.1
Summary statistic				
Mean error	−22.8		−18.7	
Mean absolute error	22.8		18.7	
Root-mean-square error	24.0		19.6	

Sources: Same as table 1, but using the equation for the sum of M_1 and security repurchase agreements at banks (RPs) and the equation for the sum of M_1, RPs, and money-market mutual funds. Those equations use the same specification as the M_1 equation in the appendix, table A-1. The RP data used here are preliminary and are under review by the Board staff. The RP series is believed to contain considerably more estimation error than the money stock figures. Moreover, RP estimates for 1978:4 to 1979:1 are based on September 1978 call report relationships and are likely to be revised, perhaps substantially, as some recent call reports information becomes available.

a. Cumulative error as a percent of actual level.

mutual funds, taken together, explain the M_1 puzzle? In the early period from mid-1974 to early 1976, they clearly do not help much, although more recently they help considerably. However, results in table 3 are misleading insofar as part of the growth in RPs and money-market funds should be related to the increase in their own yields over this period. If these equations were respecified to include the appropriate own rates, we expect the predicted values would be higher and the errors would be larger.[15] Put differently, in the most recent period, how can we be sure that growth in money-market mutual funds or RPs has not come at the expense of time and savings deposits as well as demand deposits?[16]

The econometric evidence indicating that RPs can only account for a portion of the M_1 shortfall is reinforced by some features of the RP market. It is difficult to substantiate the allegation that firms can convert demand deposits into RPs at the end of the day when they have perfect certainty about their cash flow. Reports based on interviews suggest that the volume of RPs negotiated late in the day is small. Similarly, alleged arrangements in which excess demand balances are automatically invested at the end of the day in RPs appear to account for only a small fraction of RPs. In fact, most RP transactions are arranged early in the day and they are rarely allowed (by either the bank or the nonbank dealer) to be reversed at a later point in the day. Also, cash managers can choose from a variety of alternatives to commercial bank RPs having similar net returns, such as RPs with nonbank dealers, offshore dollar deposits, specially tailored commercial paper, and money-market funds.[17]

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15. Some crude empirical work supports these assertions. When the federal funds rate (as a proxy for the own rate on RPs) was added as an independent variable to the equation for the sum of M_1 and RPs, the simulation errors were somewhat higher than those given in table 3.

16. Recall that most recently the M_2 error (in billions of dollars) has increased much more than has the M_1 error.

17. An RP arranged with a commercial bank results in an immediate reduction in the public's demand-deposit balances, while an RP arranged with a nonbank dealer or a similar transaction with another nonbank institution does not lead to such an immediate decline in demand deposits. However, when the Federal Reserve uses the federal funds rate as the operating target, the level of deposit holdings is essentially determined by demand; in this case, the effects of these other transactions on the money supply are likely to be the same. For example, the dealer could disburse these funds by repaying a maturing RP or by acquiring securities from the nonbank public; as a result, such funds would likely return to private demand accounts. But, because the public does not want to hold these deposits, additional transactions will occur that will place downward pressure on market rates of interest. Through efforts by

Although it might appear that money-market mutual funds have dis-
placed demand deposits, the evidence indicates that the funds are not
being used as demand deposits. To date, industry sources indicate that
only about one draft per month is written on these accounts, compared
with twenty-two per month on regular demand-deposit accounts. In addi-
tion, the annual turnover rate of the money-market fund obligations—that
is, the dollar volume of redemptions divided by average dollar volume—
appears to average only two and a half to three. This rate is substantially
below the annual demand-deposit turnover rate of about one hundred for
accounts at banks outside New York City and only slightly larger than the
turnover rates for all passbook savings accounts at commercial banks.
Finally, the typical money-market fund account is larger than the usual
transactions account, averaging about $20,000 for stockbroker and gen-
eral purpose funds and about $60,000 at funds restricted to particular
institutions.

Given the institutional evidence on RPs and money funds, such invest-
ments can best be viewed as affecting M_1 through their role as buffers to
demand deposits instead of as replacements for demand deposits. For
many individuals, the money-market funds apparently serve as a more
efficient demand-deposit buffer than do passbook savings accounts; cor-
porations have apparently found money-market funds and, to a greater
degree, RPs to be attractive buffers. An increase in the yields on these
assets would thus tend to constrain M_1 growth in the same way that an
increase in the rate on passbook accounts would. Moreover, these instru-
ments presumably have attracted funds from those assets that have tra-
ditionally acted as buffers in addition to drawing funds from demand-
deposit balances. A properly specified demand equation for these assets
therefore would probably have to include portfolio considerations in addi-
tion to transaction elements.

The above considerations are consistent with the implications of the
cash-management process. Cash-management techniques permit firms to
conduct a given scale of operations with smaller amounts of demand de-

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the central bank to stabilize short-term rates of interest, these unwanted demand
balances will tend to be removed from the system. The key issue is the length of
time it takes for such demand balances to be removed. If the time is sufficiently brief,
then a desire by the public to reduce its demand balances and to acquire dealer RPs
will result in a reduction in demand deposits in much the same way as if the RPs are
arranged with a commercial bank, even though the latter process will be more
roundabout than the former.

posits. In other words, the cash-management process results in a shift in the demand for money relative to GNP. Nevertheless, the role of RPs and money-market funds in this process is important in several ways. First, even in the absence of increasing familiarity with cash-management practices, the positive overnight yields to be earned on these assets enhance their use as a buffer to demand deposits and consequently reduce demand-deposit balances. Second, the yields increase the incentive to utilize those cash-management techniques that reduce uncertainty about near-term cash flows, thus further reducing the level of demand deposits.

Incentives for Cash Management

Technological developments and competitive forces in the market for liquid funds have contributed to reductions in the public's holdings of demand deposits relative to GNP. Computerization has facilitated the regular monitoring of cash balances and has improved the accuracy of cash-flow forecasts. Also, the growing availability and convenience of wire transfers permit funds to be transferred readily from one demand-deposit account of a firm to another or between liquid assets and demand accounts. Moreover, nonbank institutions, such as money-market mutual funds, and security dealers have intensified their efforts to attract a growing share of the public's liquid assets, as have foreign banking offices.

These developments—the increasing use of cash management and the emergence of new or more attractive liquid assets—might be viewed as a consequence of the legal prohibition of interest on demand deposits and the absence of the payment of interest on bank reserves. As a consequence, banks have devised methods of paying implicit interest on their demand-deposit balances. At large banks, compensation usually takes the form of credit services (typically lines of credit) and cash-management services. The implicit compensation rate paid on demand balances is generally tied to a money-market rate, adjusted for the proportion held as idle required reserves, and applied to collected balances in the account.[18]

18. Specifically, the rates on treasury bills (usually with ninety-day maturity) are used to set an "earnings credit rate." Compensating balances are then equal to the value of services divided by the earnings credit rate, where this rate is the bill rate multiplied by one minus the reserve requirement.

These implicit rates still fall short of the competitive rate because required reserves held by member banks against their deposits do not earn interest.

If a competitive rate of interest were paid on required reserves, banks would be able to offer their customers more attractive terms. But even if interest were allowed on demand deposits and compensation were paid on required reserves, demand deposits and other near-money financial instruments would have different yields. Because demand-deposit funds can be deposited or withdrawn at any time during the business day, they have higher reserve management costs for the bank than do very short-term investments. Because of these higher reserve management costs, the rates that would be offered on demand balances would fall short of market yields on investments with very short maturities, such as RPs.[19] And customers would continue to have incentives to use cash-management techniques, both to earn the higher rate on near money and to slow disbursements and speed up receipts.

Interpreting the Monetary Aggregates

The financial innovations discussed above present a number of difficulties for the interpretation of the monetary aggregates and for the conduct of monetary policy. Some of these difficulties can be reduced by changing the definitions of the monetary aggregates. Indeed, the recent proposals by the Board staff for redefining the monetary aggregates take account of important developments that have altered the deposit liabilities of depository institutions.[20] The proposed M_1 contains newly introduced transactions deposits, such as NOW and ATS balances. The proposed M_2

19. This argument is consistent with the observation that RPs arranged early in the day generally have a higher yield than RPs placed later. If a bank or dealer held collateral until late in the day (when the customers are more certain of what their cash position will be), then on average the RP issuer would be left holding excess collateral. To offset the possibility of such a loss, the issuer would be forced to offer a lower rate on RPs placed late in the day. Reports indicate that, under the circumstances, customers prefer to receive a more favorable morning yield, thus incurring the costs of uncertainty themselves.

20. "A Proposal for Redefining the Monetary Aggregates," *Federal Reserve Bulletin*, vol. 65 (January 1979), pp. 13–42.

adds to this savings deposits at all depository institutions on grounds that recent regulatory changes and competitive pressures have generally enhanced the liquidity of all savings balances. Meanwhile, the growing illiquidity of time deposits at all depository institutions has been recognized, and all such deposits have been excluded from the proposed M_2 and included instead in the proposed M_3. However, even these aggregates generally do not have stable demand functions.

The instability of the estimated demand functions for the proposed aggregates (and for the current aggregates) arises largely from the fundamental changes that are occurring in the nature of deposits and near money. But we believe that the shifts of the demand functions arise at least as much from the cash-management process discussed earlier. Creating an empirical framework for evaluating and predicting the impact of the cash-management process is difficult, however, for several reasons. Historical experience with the cash-management process is limited. Moreover, the incentives for continued cash management are closely tied to the existence of regulations, high interest rates, and technological and competitive developments. Thus it is quite difficult to isolate the impact of each of these factors on the demand for money.

The increasing availability of new money substitutes poses an additional problem. Some of these money substitutes, such as RPs, are offered by domestic banks; others, such as money-market funds and short-term commercial paper, are available at nonbank institutions. Eurodollars are offered by banking offices abroad—foreign banks and foreign branches of U.S. banks. One could deal with such money substitutes by including very short-term liquid investments in measures of the monetary aggregates. Thus M_1—or perhaps some broader aggregate—could include the RP liabilities of commercial banks and dealers, money-market funds, Eurodollar holdings of U.S. residents, short-term commercial paper, and so forth.

While a broader money measure has some desirable attributes, it is unlikely that it would bear as close a relationship to transactions or GNP as demand deposits during those periods when the cash-management process is relatively dormant, such as the period prior to mid-1974. To the extent that the cash-management process is unpredictable, a broader measure may have some "built-in stability" because much of the funds released from demand deposits will likely be placed in such short-term buffers. However, the interest-bearing component of such a measure may often be

dominated by motives besides transactions demand related to income.[21] For example, asset holders may at times want to keep a large proportion of their financial assets in very short-term funds for portfolio reasons. Accurately predicting such movements is difficult. Furthermore, the spectrum of available liquid assets may expand so that funds could shift from those buffers included in a particular monetary aggregate to those excluded from the aggregate.[22]

In principle, one could separate the total volume of these buffers into a portion that is related to portfolio motives and one related to transactions motives. The latter could then be combined with ordinary transactions balances to form a new transactions-related measure of money along the lines of Tinsley, Garrett, and Friar.[23] It is not clear, however, that econometric procedures have been refined to the point where the transactions-related portion of such instruments can be reliably separated from the remainder. Moreover, as noted above, to the extent that many financial innovations tend to be part of an ongoing process related to cash-management and competitive pressures, new instruments are likely to appear as transactions balances, requiring continued redefinition of money. Alternatively, data on the short-term buffers and cash-management developments could be used to adjust judgmentally the growth of the aggregates. The targeted growth in the monetary aggregates could then be modified to reflect the impact of such developments.

For the mid-1974 to early 1977 period, such ex post judgmental changes would undoubtedly place adjusted growth in M_1 and M_2 at rates closer to the predicted values than to the actual values in tables 1 and 2. A similar change in the current period of apparent weakness would show adjusted growth rates somewhat stronger than the measured growth rates. It is reasonable to assume, therefore, that targeted growth rates of nominal GNP are consistent with somewhat slower growth in current measures of the monetary aggregates than the historical relationships suggest. However, given the unpredictable timing and size of the shifts in M_1 demand,

21. This point is elaborated in Tinsley, Garrett, and Friar, "The Measurement of Money Demand." Restricting the techniques to overnight instruments would reduce this problem but not eliminate it. Moreover, if such instruments are included, why not include those maturing in two days? A definitional boundary has to be arbitrarily drawn somewhere, but where?

22. Any excluded instrument having yields and transactions costs similar to those included is likely to have a high elasticity of substitution with included instruments.

23. Tinsley, Garrett, and Friar, "The Measurement of Money Demand."

it is likely that even the best adjustments will be off the mark. In such an environment, it is more important than ever that policymakers supplement information on monetary aggregates with data on near money and other financial assets, interest rates, and direct indicators of current and future developments in the economy.

APPENDIX

Appendix table A-1 shows estimated equations for money demand, based on some alternative definitions of the monetary aggregates discussed in the text.

Table A-1. Money-Demand Equations for Alternative Measures of Monetary Aggregates, 1960:4–1974:2 Sample Period[a]

Dependent variable	Independent variable						Summary statistic			
	Constant	Treasury-bill rate	Commercial-bank passbook-savings rate	Commercial-bank time-deposit rate[b]	GNP	Lagged dependent variable[c]	$\bar{R}^2$	Standard error of estimate	Rho	Durbin-Watson
M_1	1.501 (1.780)	−0.010 (−2.250)	−0.031 (−1.823)	...	0.162 (3.868)	0.703 (6.439)	0.994	0.004	0.502 (4.301)	1.66
M_2	−0.706 (−2.786)	−0.029 (−5.172)	0.008 (0.357)	0.015 (0.811)	0.195 (2.388)	0.849 (11.076)	0.999	0.004	0.525 (4.575)	1.74
M_1 plus RPs	0.313 (0.506)	−0.012 (−2.326)	−0.022 (−1.306)	...	0.146 (3.608)	0.816 (9.323)	0.994	0.005	0.374 (2.988)	1.98
M_1 plus RPs plus money-market mutual funds	0.298 (0.477)	−0.012 (−2.278)	−0.022 (−1.253)	...	0.145 (3.571)	0.818 (9.305)	0.995	0.005	0.390 (3.144)	1.99

Sources: GNP is from the U.S. Bureau of Economic Analysis. All other variables are from the Board of Governors of the Federal Reserve System. The dependent variable and GNP are divided by the GNP deflator. RPs are security repurchase agreements at banks. The numbers in parentheses are *t*-statistics.

a. The equations are double logarithmic. The dependent variable and GNP are divided by the GNP deflator. RPs are security repurchase agreements at banks. The numbers in parentheses are *t*-statistics.

b. The time-deposit rate used is the one for the time deposit maturity having the highest yield after adjusting for the prevailing market term structure of interest rates. See Richard D. Porter and others, "Current and Proposed Monetary Aggregates: Some Empirical Issues" (Board of Governors of the Federal Reserve System, Division of Research and Statistics, January 1979), appendix C.

c. The "lagged" dependent variable is the log of the monetary aggregate in the previous period divided by the GNP deflator of the current period.

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[Footnotes]

[5] **A Model of the Demand for Money by Firms**
Merton H. Miller; Daniel Orr
The Quarterly Journal of Economics, Vol. 80, No. 3. (Aug., 1966), pp. 413-435.
Stable URL:
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[11] **Some Clues in the Case of the Missing Money**
Gillian Garcia; Simon Pak
The American Economic Review, Vol. 69, No. 2, Papers and Proceedings of the Ninety-First Annual Meeting of the American Economic Association. (May, 1979), pp. 330-334.
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[12] **Some Clues in the Case of the Missing Money**
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