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Should M2 Be Redefined?

Brian Motley

Senior Economist, Federal Reserve Bank of San Francisco.

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For an indicator of monetary policy, this paper proposes "Nonterm M3" as an alternative to M2. With the removal of ceilings on the yields of its assets, the M2 aggregate has become a grouping of dissimilar assets. Nonterm M3 excludes small time deposits and thus contains only monetary instruments with no set maturity date. The demand for this aggregate has been reasonably stable and is more sensitive to interest rates than is the demand for M2.

We can draw the line between "money" and "debt" at whatever point is most convenient for handling a particular problem.

J. M. Keynes, *The General Theory of Employment Interest and Money.*

Over most of the period since the mid-1970s, the Federal Reserve System has expressed its intentions for monetary policy in terms of the growth rates of various monetary and credit aggregates. The Full Employment and Balanced Growth (Humphrey-Hawkins) Act of 1978 requires the System to set annual target ranges for the aggregates and to report these targets to the Congress twice a year. These reports also review the actual behavior of the aggregates relative to their targets and to the conditions in the economy that influenced both the attainment and the appropriateness of the targets.[1]

The Federal Reserve has used three principal monetary aggregates as policy indicators: M1, which consists of currency and checkable deposits; M2, which adds a variety of small-denomination savings-type instruments issued by banks and other financial intermediaries; and M3, which also includes certain large-denomination instruments, such as large certificates of deposit. Since it includes only currency and fully checkable funds, M1 traditionally was regarded as primarily a "transactions" aggregate, whereas M2 and M3 also contained "savings" balances.

When the present definitions of the aggregates were adopted in 1980, the principal distinction between the two broader aggregates was that the deposit rates on most instruments in M2 were regulated by the Federal Reserve, whereas those on instruments outside M2 were unregulated. The regulation of deposit rates meant that banks were not able to manage closely the amounts of their M2 liabilities, but instead were forced, at least in the short run, to accept the quantities offered by their customers at the regulated yields. In contrast, the amounts outstanding of instruments outside M2 could be controlled closely, since by altering their offering rates, banks could attract more or less funds into these so-called "managed liabilities."

Following the deregulation of deposit rates in recent years, the differences between the aggregates have

become less clear-cut. Individuals now use interest-bearing checking accounts not only for transactions purposes, but also as repositories for savings balances, thus blurring the distinction between M1 and M2. At the same time, the deregulation of the yields on small time deposits has made it possible for banks to manage their small- as well as their large-denomination liabilities, thus reducing the difference between M2 and M3.

This article suggests an alternative classification of monetary assets based on the distinction between those that have a stated term to maturity and those that do not. In the new environment of deregulated deposit rates, this classification may be more useful than that embodied in the present definitions of the aggregates. M2, as currently defined, includes some assets that have no specified term to maturity, and others – small time deposits – that have a fixed term. The suggested classification would alter the definition of M2 by excluding small time deposits and combining them with large time deposits in the non-M2 portion of M3.

The following Section I describes the present monetary aggregates, explains their use as indicators for monetary policy, and discusses how deregulation has altered their behavior. Section II introduces the proposed decomposition of M3 based on the distinction between term and nonterm assets.

Section III reviews the received theory of the demand for money, and argues that this theory applies more closely to the alternative monetary aggregates than to the measures that the Federal Reserve currently uses. Sections IV and V develop and estimate empirical demand relations for both the official aggregates and the alternatives. The results suggest that the demand for the alternative measure of M2 has been more stable in the face of deregulation. Section VI concludes.

I. Deregulation and the Behavior of the Monetary Aggregates

The practice of relying on monetary aggregates as guides to policy assumes that there is a reasonably close and predictable relation between monetary growth and the macroeconomic variables that the policymaker cares about: income, prices, and interest rates.

Until recently, the Federal Reserve focused its attention on M1, which comprises the outstanding stock of currency and fully checkable deposits, and corresponds closely to the theoretical concept of "money" used by many economists. Both economic theory and empirical evidence suggested that M1 would be a reliable leading indicator of real GNP and inflation. Since M1 was found also to be subject to a reasonable degree of control by the Federal Reserve, it made sense to conduct monetary policy in terms of the growth of this aggregate.

An important necessary condition for the use of any monetary aggregate as a guide to policy is that the public's demand to hold it be a stable function of a small number of variables that are of interest to policymakers – income, prices, and interest rates. Until recently, M1 was considered more likely to satisfy this condition because it was used primarily as a transactions rather than a savings medium, and so was likely to have few close substitutes.

This unique feature of M1 was fostered by regulations that set a ceiling on the rate of return that depository institutions were permitted to pay on checkable deposits. This rate-ceiling on checking accounts gave members of the public a strong incentive to limit their holdings of these accounts to the minimum level needed for transactions purposes, and to hold their savings balances in other forms that yielded higher returns. As a result of M1's unique role as a transactions medium with a regulated yield, changes in M1's rate of growth had predictable effects on the interest yields on other financial instruments, and thus, ultimately, on the levels of real GNP and prices.

The broader monetary aggregates, M2 and M3, were expected to be less useful than M1 as indicators for monetary policy since they contained a mixture of savings funds and transactions balances and included a number of financial instruments with market-determined yields. Since these aggregates lacked M1's unique features, the public's demand to hold them was thought likely to be affected both by difficult-to-predict shifts in investor preferences among alternative instruments and by changes in the rates paid on those instruments by their issuers. These problems were thought to be less severe in the case of M2 than of M3. The deposit rates on most instruments in M2 were subject to regula-

tory ceilings, making them more similar to M1 than to instruments outside M2 – all of which bore yields that were fully deregulated and market-determined.

Reducing Distinctions

Since 1978, virtually all of the restrictions on the interest yields paid by banks and other depository institutions on their deposit liabilities gradually have been phased out.[2] This process of deregulation has had the effect of significantly reducing the distinctions between the various monetary aggregates. For example, the introduction of interest-bearing checking accounts has reduced the incentive for households to monitor carefully the distribution of their liquid assets between transactions and nontransactions accounts. As a result, it seems likely that checkable deposits now contain not only transactions funds but also savings balances, thus undermining the uniqueness of M1.

Apparently as a result of the commingling of transactions and nontransactions funds induced by deregulation,[3] the formerly close relation between M1 and the behavior of real GNP and prices seems to have broken down in early 1985. This breakdown led the Federal Reserve to downgrade M1,[4] and to put greater emphasis on M2 and M3 as policy indicators. In 1987, no formal target was set for M1 growth.

Deposit-rate deregulation also has lessened the distinction between M2 and M3. When the present definitions of the monetary aggregates were adopted in 1980, the assets in M2 were thought to be similar[5] even though they included both savings deposits that could be liquidated more or less on demand, and small time deposits that had fixed terms to maturity. M2 assets were thought to be unlike the large-denomination instruments outside M2, partly because those instruments are not covered by federal deposit insurance, but also, and more importantly, because the returns on most M2 assets were regulated, whereas those on instruments outside M2 were not.

The removal of this regulatory distinction has made M2 assets, especially small time deposits, more like those outside M2[6] than they were in 1980. Now that they are free to vary their offering rates on small as well as on large time deposits, banks can and do use both as managed liabilities; this was not possible when the yields on small time deposits were limited by regulatory ceilings. As a result, small time deposits now are held by investors who, prior to deregulation, would have shunned them in favor of market instruments providing higher yields.

Term vs. Nonterm

In light of these institutional developments, several economists at the San Francisco Reserve Bank have argued that the present dividing lines between M1, M2, and M3 may be less important than the single distinction between deposits that have a specified term to maturity (term accounts) and those that have no fixed term and are, for practical purposes, withdrawable on demand (nonterm accounts).[7] The aggregates formed by grouping financial instruments into these two classes are described as *Term M3* and *Nonterm M3*.[8] Nonterm M3 includes all the assets in M1, overnight repurchase agreements and eurodollars, money market deposit accounts, passbook savings accounts, and money market mutual funds. Term M3 represents the remainder of M3, and includes both small- and large-denomination time deposits, term repurchase agreements, and term eurodollars.

This grouping of financial assets differs from that used by the Federal Reserve in two respects. First, the distinction between transactions (M1) and other nonterm instruments is de-emphasized. Second, small-denomination time deposits are grouped with other term accounts to form Term M3, rather than with nonterm assets in M2. Currently, nonterm M3 represents about 55 percent of total M3, whereas M2 represents about 80 percent.

Evidence of a change in the behavior of monetary aggregates since the deregulation of deposit yields is found in Charts 1, 2 and 3. In Chart 1, the right panel shows that the transactions (M1) and nontransactions components of Nonterm M3 have moved together quite closely in recent years, whereas the left panel shows that in earlier years the growth of M1 was not closely related to that of other nonterm instruments. The visual impression gained from these panels is confirmed by statistical evidence. The correlation coefficient between the monthly growth rates of the M1 and non-M1 components of Nonterm M3 was only 0.24 (t-statistic 2.31) between January 1971 and June 1978, but increased to 0.59 (t-statistic 7.05) between July 1978 and December 1986.[9] This evidence suggests that, during much of the 1970s, the public regarded M1 as a unique transactions vehicle, but that since deregulation, the behavior of M1 has been similar to that of other liquid nontransactions accounts.

The two panels of Chart 2 show that there has been a strong tendency for the term and nonterm components of M3 to move in opposite directions since 1978, but that this inverse relation was much weaker in the 1970s. The correlation coefficient between the monthly growth rates of term and nonterm M3 more than doubled from –0.39

Chart 1

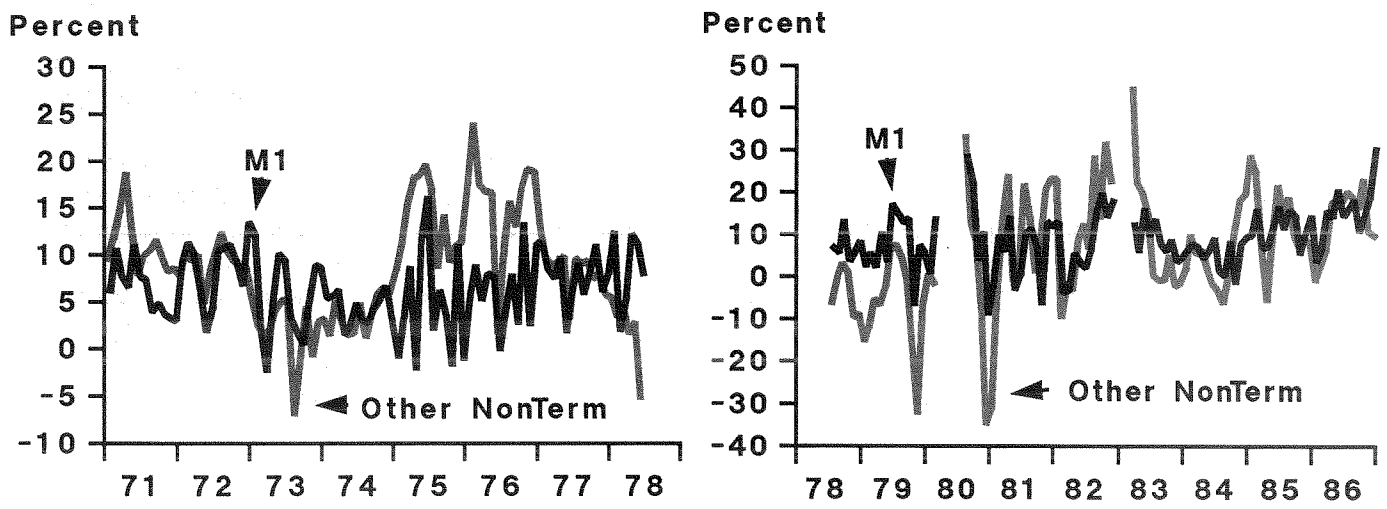


Chart 2

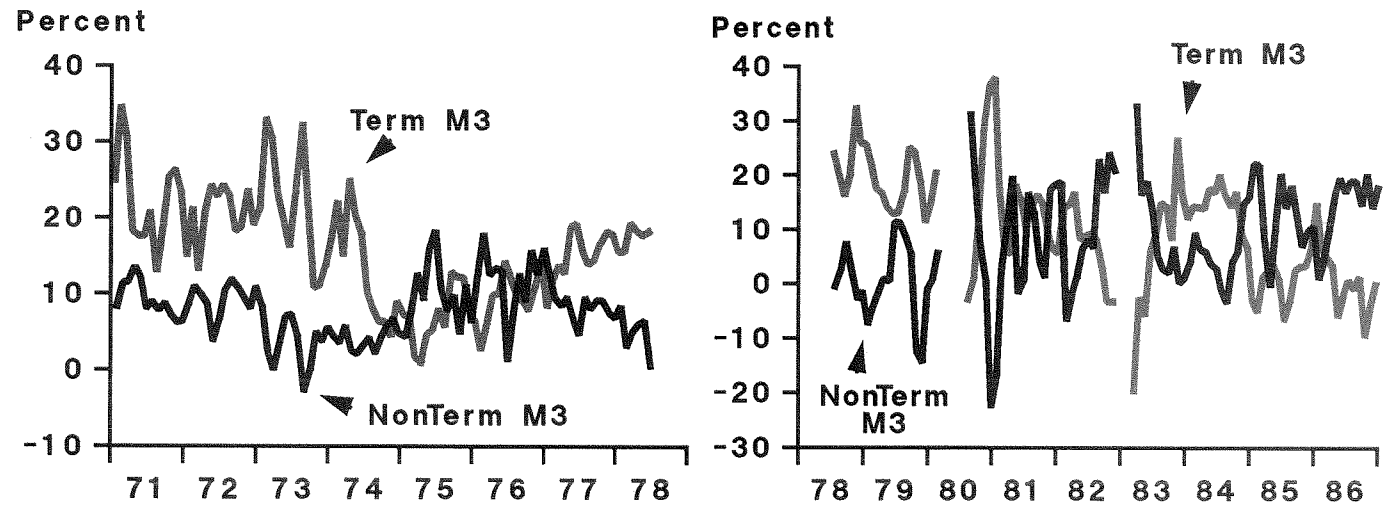
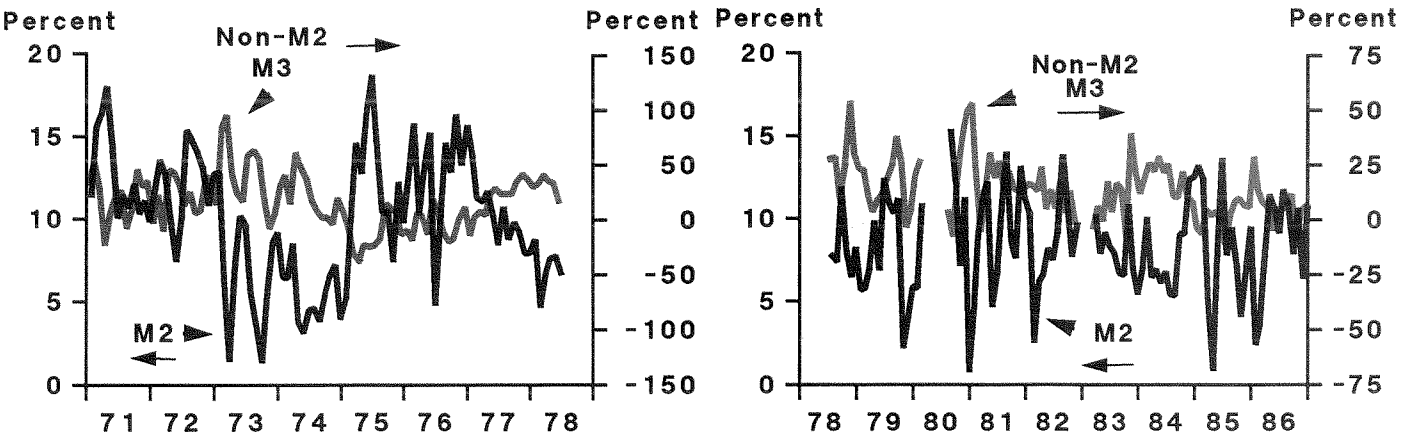


Chart 3



(t-statistic 3.95) between January 1971 and June 1978 to –0.84 (t-statistic 14.75) between July 1978 and December 1986.[10] This evidence suggests that nonterm and term M3 each now represents a grouping of similar assets. This was less true before 1978 because small time deposits, being regulated, behaved more like nonterm saving accounts than like large term assets.

Conversely, Chart 3 shows that the tendency for the M2 and non-M2 components of M3 to vary inversely was quite strong in the period before deregulation, but has been weaker in recent years. The correlation between the growth rates of M2 and non-M2 M3 went from –0.61 (t-statistic 7.14) in the 1971 to 1978 period, to –0.36 (t-statistic 3.70) between 1978 and 1986.[11, 12] This evidence suggests that, in the earlier period, M2 and non- M2 M3 each represented an aggregate of similar assets, but that their similarity has been reduced since deregulation because small time deposits now behave more like large term accounts than nonterm accounts.

Further evidence that small time deposits now behave more like large-denomination term accounts than like other components of M2 was presented in a recent paper in this *Review*.[13] Using a vector autoregression approach, this paper showed that, in the post-deregulation period, the response of the growth rate of small time deposits to interest rate shocks was similar to that of large term accounts, but quite different from that of either M1 or the non-M1 nonterm components of M2. In contrast, before deregulation, the response of the growth of small time deposits to interest rate shocks was similar to that of M1 and of other components of M2, and quite different from that of large-denomination term accounts. The authors attributed the changed behavior of small time accounts to the deregulation of deposit rates on these accounts, which has transformed them into managed liabilities.

Additional evidence that depository institutions use small time deposits as managed liabilities comes from examining how the yield on these deposits responds to changes in market rates on competing short-term instruments. The second and third columns of Table 1 report regression equations explaining the response of offering rates on small and large time deposits to current and lagged values of the one-month commercial paper rate (CP1) in the period since early 1983. These equations show that banks now adjust their offering rates on both classes of time deposits quickly and fully to changes in other short-term yields. Within two months of a rise in the commercial paper rate, yields on both short- and long-term time deposits rise by a roughly equal amount. The response is only slightly less rapid in the case of small time deposits, indicating that banks manage these small-denomination liabilities almost as closely as large CDs.

In contrast, rates on MMDAs, passbook savings, and NOW accounts are adjusted more slowly. The fourth column in Table 1, for example, shows a regression of the MMDA yield on the commercial paper rate that indicates that this rate adjusts slowly and incompletely to changes in competing yields.[14]

All this evidence suggests that since the deregulation of deposit rates, the Federal Reserve's distinction between M2 and M3 may have become less meaningful than that between nonterm and term assets. Today, it appears that the term and nonterm components of M3 each represents a relatively homogeneous group of financial instruments. Each group is managed differently by the intermediaries that issue it, and, as discussed in the following section, performs a different function in the public's portfolio of wealth.

II. The Theory of Money Demand

Although economists and policymakers have not emphasized the distinction between *term* and *nonterm* instruments in the postwar period, this way of classifying assets is not a new one. It underlay much of John Maynard Keynes's discussion of the demand for money in his *General Theory*[15] more than a half-century ago. Instead of "the demand for money," Keynes used the term "liquidity preference," and made it clear that this was a broad concept that was not limited to the demand for assets that function as means of payment.

In distinguishing between "money" and "debts," Keynes emphasized the difference between those assets that can be converted into spendable cash quickly and without risk of capital loss, and those that have a stated term to maturity and can be liquidated before maturity only at some risk or cost. Although many later economists equated liquidity preference with the demand for *transactions* balances,[16] Keynes himself made it clear that it referred to a demand to hold assets that give immediate command over goods and services in preference to ones that require parting with that command for a period of time. Thus, liquidity preference referred to a demand for nonterm assets in general, and not only for those that are used as means of payment.[17]

Holding Wealth as Money

For Keynes, the principal reason for holding money as a store of wealth (that is, over and above the amount needed for purely transactions purposes) was uncertainty regarding the future rate of interest on securities. He argued that if there were no uncertainty about future rates of interest, the present and future values of all securities also would be known, and hence an investor would have no incentive to hold his wealth in the form of money.[18]

Since the future rate of interest is in fact uncertain, "there is a risk of a loss being incurred in purchasing a

Table 1

Yields on Managed and Non-Managed Liabilities

Dependent Variable	Large Time Deposit Yield	Small Time Deposit Yield	MMDA Yield
Constant	0.0074	–0.007	–0.037
	(0.629)	(0.339)	(3.920)
CP1	0.999	0.567	0.272
	(26.95)	(8.755)	(9.339)
CP1(–1)	0.030	0.243	0.153
	(0.673)	(3.091)	(4.362)
CP1(–2)	0.005	0.137	0.118
	(0.126)	(1.742)	(3.361)
CP1(–3)		–0.074	0.030
		(0.956)	(0.844)
CP1(–4)		0.084	0.005
		(1.296)	(0.141)
CP1(–5)			0.086
			(2.883)
CP1(–6)			–0.009
			(0.383)
Sum of Coefficients:	1.034	0.957	0.655
	(24.49)	(10.03)	(13.31)

All data are expressed as monthly first-differences.
*Sample period: 1983.03–*1986.12.

long-term debt and subsequently turning it into cash, as compared with holding cash," and it is because of this risk of loss on securities that investors hold part of their wealth in the form of money. Keynes described this "desire for security as to the future cash equivalent of a certain proportion of total resources" as the "precautionary motive" for holding money.

A second reason for holding wealth in the form of money, Keynes argued, was to speculate on future movements of the rate of interest. According to this "speculative motive," an investor will prefer to hold money if he expects interest rates to rise, since the holding of securities will expose him to a capital loss. Conversely, if he expects interest rates to fall, an investor will anticipate obtaining a capital gain on holdings of securities, and hence will tend to switch out of money into securities. Since the speculative motive for liquidity preference depends on the investor believing that he knows the future better than the market,[19] it too depends on the presence of uncertainty and would not exist if all future interest rates were known for sure.

Although Keynes emphasized the role of uncertainty about future rates of interest, he did recognize that an individual also will have a motive to hold money when he is uncertain about his future receipts or expenditures. If these flows were hard to predict, an individual would want to hold a stock of liquid funds to "provide for contingencies requiring sudden expenditure and for unforeseen opportunities of advantageous purchases" (*General Theory*, p. 196).

Uncertainty about future needs for liquid funds and about future interest rates both provide "precautionary" motives to hold money.[20] These motives are not independent. The effects on an individual of being uncertain whether or when he will need to sell securities, in order to obtain liquid funds to spend, are compounded when future security prices also are uncertain. Conversely, the effects of interest rate uncertainty would be significantly reduced if there were no uncertainty about future incomes and outlays because an investor could tailor the maturities of the securities in his portfolio to ensure that he never had to sell securities before they matured.

However, theorists since Keynes have argued that uncertainty about future needs for spendable funds will lead to a demand for money even if there were no interest rate uncertainty. This is because there are *transaction costs* in exchanging non-money assets for money, even when there is no uncertainty about the value of those assets. These transaction costs of liquidating assets include not only explicit "brokerage fees," but also implicit "shoe-leather" and "inconvenience" costs. If the individual were uncertain of how frequently he would need to liquidate assets to obtain cash to make payments, he might find it advantageous to hold part of his wealth in the form of money to reduce the risk of incurring those transaction costs. This precautionary demand[21] would depend not only on the degree of uncertainty about future needs for cash, but also on the size of the transaction costs[22] avoided by holding money rather than non-money assets.

Money as a Nonterm Asset

Each of these motives for holding wealth in the form of "money" is more closely related to money's being a *nonterm* asset, that gives more or less immediate command over goods and services, than to its being the medium of exchange. All are motives for holding liquid assets in general, and not only assets that are means of exchange.

This clearly is the case in the environment envisioned by Keynes, in which "money" and "securities" are the only assets available. Securities are *term* assets, and Keynes assumed that all securities are traded in organized markets. An investor can liquidate his security holdings before maturity only by selling them in these markets. He would then sustain a capital loss if interest rates have risen (security prices have declined), and obtain a capital gain if rates have fallen.

The larger the proportion of his wealth that he has in securities with a fixed term to maturity, the greater are both his risk of capital loss and his opportunity for speculative gain if he sells them before maturity. Hence, when deciding how much of his portfolio to hold in securities and how much in other assets, the investor must consider the trade-off between risk and return and make judgments about the future course of interest rates and security prices. In making this decision, the crucial choice is between assets that have a fixed term to maturity and that can be liquidated only by being sold at an uncertain and varying market price, and those that can be liquidated at their face value more or less on demand. Whether the latter function as a medium of exchange is of secondary importance.

In fact, "securities" are not the only term assets available. Investors also can hold wealth in the form of time deposits for which, except in the case of large CDs issued by money center banks, there is no organized market in which an investor can liquidate his holdings before maturity. Thus, the interest rate uncertainties emphasized by Keynes do not apply to time deposits. However, although there is no "secondary market" in time deposits, in most cases the investor can withdraw his funds before maturity by paying an "early withdrawal" penalty. This penalty represents the transaction cost of liquidating his deposit

early. As discussed earlier, if the investor were uncertain of his future needs for spendable funds, the presence of a transaction cost would provide an incentive to hold a portion of wealth in liquid form rather than in time deposits. Again, however, this motive for liquidity applies to *all* nonterm assets and not only to those that are used as the medium of exchange. This is because all such assets may be liquidated with little risk[23] and at low cost.

Most depository institutions permit depositors to shift funds among different types of nonterm savings deposits and between savings and transactions accounts at no cost and with only minor restrictions.[24] Since these various nonterm assets are easily converted into the medium of exchange, there is little need for the individual investor either to consider carefully his future needs for spendable cash or to make judgments about future interest rates when deciding how to allocate wealth between them. In other words, the factors that give rise to the precautionary and speculative demands for "money" in preference to "debts" apply mainly to decisions between holding "nonterm assets" and "term assets," and are less important to decisions regarding the various kinds of transactions and other nonterm instruments.

Fundamental Distinction

This discussion suggests that the distinction between nonterm and term assets may be a fundamental one and those between transactions and nontransactions accounts or between M2 and non-M2 accounts may be of secondary importance. Because term assets can be liquidated only at an uncertain price or at the cost of an early withdrawal penalty, whereas nonterm assets give more or less immediate command over goods and services with little risk and at low cost, there are sound economic reasons for investors to separate their stocks of wealth into holdings of term and nonterm assets.

By contrast, in the absence of government regulation, there would be little incentive for individuals to separate their transactions funds from the rest of their nonterm balances. Thus, the uniqueness of M1 may have been an artifact of the regulation that prohibited banks from paying a market-determined rate of return on checkable deposits, and thus may have disappeared with the removal of that restriction. As Chart 1 illustrates, the change in the relation between the transactions (M1) and nontransactions components of nonterm M3 coincided approximately with the phasing out of that regulation.

The regulation of interest yields on other classes of deposits may have had a similar effect in contributing to the uniqueness of M2. Before 1978, the rates that financial institutions were permitted to pay on most accounts included in M2 – including both nonterm and small-denomination time deposits – were regulated. During that period, the risk of holding a small time account instead of a nonterm account was confined to the early withdrawal penalty that was levied if the investor wished to liquidate it before maturity. Because the rate ceilings on term and nonterm M2 assets were seldom changed, there was little difference in the interest rate risk to holding nonterm or small time deposits, that would have given an investor a "precautionary" or "speculative" motive for preferring nonterm deposits. This may have reduced the importance of the distinction between term and nonterm accounts and contributed to the uniqueness of M2.

The deregulation of deposit rates on small time deposits should have reversed these effects, strengthening the distinction between term and nonterm M3 and reducing the uniqueness of M2. As discussed in the preceding section, this deregulation has made it possible for depository institutions to use small time deposits as "managed liabilities." And, as a result, the deposit rates on these accounts now change more frequently and follow market yields more closely. Small time deposits now are more similar to the large-denomination term accounts outside M2 than to most of the nonterm assets in M2. Although there are no regulatory constraints on the yields on nonterm deposits, banks adjust these rates sluggishly.[25] Thus both term and nonterm M3 now consist of a grouping of similar assets, whereas M2 contains a mixture of different kinds of instruments, including both managed and non-managed liabilities.

Statistical Evidence

The statistical evidence presented earlier in connection with Charts 1-3 supports this argument that deregulation has weakened the uniqueness of M2 and made the distinction between term and nonterm M3 a more significant one. That evidence showed that the negative correlation between the M2 and non-M2 components of M3 weakened between the 1971-1978 and 1978-1986 periods, while that between nonterm and term M3 strengthened.

In addition, there is evidence that these changes in the behavior of the aggregates were the result of the impact of deregulation on small time deposits. Before 1978, there was only a small and negative correlation between the monthly growth rates of small time deposits and the non-M2 component of M3 (correlation coefficient –0.30, t-statistic 3.00), whereas since 1978, this relation has been positive and highly significant (correlation coefficient 0.62, t-statistic 7.02). Similarly, the correlation between the monthly growth rates of nonterm M3 and small time deposits was significantly positive (correlation coefficient 0.43, t-statistic 4.53) in the pre-deregulation period, but has been strongly negative

(correlation coefficient −0.85, t-statistic 15.37) since deregulation. Thus, it appears that the deregulation of small time deposits has caused them to behave more like large CDs and not like nonterm instruments.

The argument of this section suggests that a definition of "money" that is based on the distinction between nonterm and term assets might yield an aggregate that would provide a better indicator for monetary policy than those currently in use. A grouping of assets that are similar, in the sense that they perform similar functions in the public's asset portfolio and are treated similarly by the institutions that issue them, is more likely to provide useful information than one, such as the present M2, that contains dissimilar assets. Moreover, a grouping, such as the present M1, that excludes some assets that are similar to those that it includes, also is likely to be less useful. In the next sections of this paper, these ideas are tested by estimating demand functions for nonterm and term M3 and comparing them with similar functions for the traditional aggregates.

III. Empirical Considerations

The preceding section argued that the uniqueness of both M1 and M2 may have been partly the result of the regulation of deposit rates, and that, since deregulation, a decomposition of M3 into its nonterm and term components is likely to produce more homogeneous groups of assets. Simple correlation tests supported these hypotheses. To provide stronger tests, demand functions for alternative aggregates were estimated over two samples that correspond approximately to the pre- and post-deregulation periods.

Roughly speaking, the deregulation process proceeded in two partially overlapping phases. In the first phase, which began in July 1978, financial institutions were authorized to issue small-denomination time deposits of varying maturities yielding market rates of return.[26] By the end of 1982, this phase was largely complete, and most restrictions on the deposit rates payable on term accounts in M2 (that is, small time deposits) had been removed.[27] The deregulation of yields on nonterm accounts began in January 1981, when depository institutions nationwide were permitted to offer interest-bearing checkable deposits (NOW accounts). Two years later, money market deposit accounts and checkable (Super-NOW) accounts with no minimum maturity and no ceilings on their yields were authorized. This second phase of deregulation was completed in 1986, with the removal of minimum balance limitations on Super-NOW accounts and of interest rate ceilings on passbook saving accounts. These last changes eliminated the final restrictions on nonterm deposits.

Sample Periods

For estimation purposes, the sample periods chosen were January 1971 to June 1978 and January 1981 to December 1986. In the first period, the rates on most small-denomination deposits, both term and nonterm, were regulated, making M2 somewhat unique. These regulations therefore favored the traditional decomposition of M3 and made a breakdown between term and nonterm assets less useful.[28] In the second period, the deregulation of most deposit rates favored the term-nonterm decomposition.

During the two-and-a-half years between these sample periods, growth in the monetary aggregates was influenced not only by a series of deregulation measures but also by certain special factors, including the change in the Federal Reserve's short-run operating procedures in October 1979 and the imposition of credit controls between March and July 1980. Hence, this period was excluded from both samples. In addition, in view of the huge swing that occurred in the demand for nonterm

assets when Money Market Deposit Accounts and Super-NOW accounts were introduced, the three-month period from December 1982 to February 1983 was excluded[29] from the second sample.

Inertia

All empirical specifications of the demand for the monetary aggregates must take account of the apparent inertia in the response of the public's demand for money assets to changes in the macroeconomic variables that determine that demand. The most common ways of handling this inertia are either the partial adjustment specification or the use of explicit distributed lags.

In this paper the *error-correction* specification proposed by David Hendry[30] is used. This specification is similar to the partial adjustment approach in distinguishing between the *equilibrium money demand function*, which defines the long-run relation between the public's desired holding of money assets and the macroeconomic variables that determine it, and a *short-run adjustment model*, which describes the dynamic process by which money demand adjusts to its long-run equilibrium in response to changes in those determining variables.

Modeling

The long-run relation used here is of the form:

$$\log M_t = a + b \log Y_t + c R_t + e_t \qquad (1)$$

where M_t = monetary aggregate, Y_t = nominal income, R_t = a short-run market interest rate, and e_t is an error term representing the extent to which the public's actual money stock diverges from its equilibrium level.

The short-run adjustment of money demand in a given month is assumed to depend both on the divergence between its actual and equilibrium levels at the beginning of the month, e_{t-1}, and on current and lagged *changes* in the determining variables:

$$\Delta \log M_t = f + g e_{t-1} + \sum_p h_p \Delta \log M_{t-p} + \sum_q k_q \Delta \log Y_{t-q} + \sum_s m_s \Delta R_{t-s} \qquad (2)$$

Two comments are in order with regard to the long-run relation in Equation 1. First, the "scale" variable is assumed to be *nominal personal income* . Standard money demand relations employ income as a determining variable on the theory that money serves as the medium of exchange and income is a proxy measure of the flow of transactions that use money. Although the emphasis of this paper on monetary aggregates as stores of value suggests using some measure of the stock of *wealth* as a scale variable, this was not done because no monthly measure of wealth is available. Quarterly estimates of a variety of wealth concepts do exist and have been used in the estimation of quarterly demand functions for monetary aggregates.[31]

Over the period since 1970, the long-run trend growth rate of nominal wealth has been close to that of personal income, suggesting that the estimated long-run elasticity of money demand with respect to wealth would be similar to its income elasticity. However, the quarterly wealth data indicate that short-run fluctuations in total wealth are not closely related to variations in income, probably because those fluctuations reflect changes in the market value of assets, especially equities. In the equations estimated in this paper, the level of income may serve as a proxy for the long-run growth of wealth, and changes in the interest rate as a proxy for short-run variations in its market value.[32]

A second comment with regard to Equation 1 concerns the interest rate variable. In general, the demand to hold a monetary aggregate is affected not only by the *market rate* on competing instruments but also by the *own-rate* of return on the instruments in the aggregate, since the *spread* between these rates represents the opportunity cost of holding the aggregate. When deposit rates were strictly regulated, changes in the market rate produced equal changes in this spread. Since deregulation, movements in the yield on competing market instruments no longer imply equal changes in the spread because depository institutions alter their deposit rates in response to changes in market yields.

This institutional change suggests that econometric estimates of the demand for monetary aggregates should include a measure of the own-rate as well as the market rate. In preliminary estimates of the equations presented in this paper, this approach was tried, but the estimates were found to be either unstable or implausible. The source of this problem may be that each monetary aggregate consists of a variety of instruments that bear different yields. As a result, no single empirical measure captures fully the own-rate on a given aggregate, or the opportunity cost of holding that aggregate.[33]

Since own-rates respond[34] – albeit at varying rates – to changes in market rates, the demand to hold each aggregate may be expressed as depending only on market rates in the long run. This is the approach[35] adopted in Equation 1. This long-run relation represents an equilibrium not only in the sense that investors have

fully adjusted their asset portfolios to the market conditions they face, but also that depository institutions have adjusted the yields on the instruments they issue.[36]

In the equations estimated in this paper, the standard error-correction adjustment specification represented by Equation 2 was extended to include an additional variable to capture the indirect effect on the monetary aggregates of variations in the demand for loans from depository institutions.[37]

Suppose there is an increase in the demand for bank loans. This increase gives banks an incentive to attract additional funds by raising their deposit rates, thereby increasing the public's demand to hold monetary assets. If the estimated equations were to include the own-rates on the monetary aggregates in addition to the market rate, this "bank loan" effect would be captured in a narrowing of the spread between the market rate and the own-rates. However, since the equations include only the market rate, this effect is captured instead by adding the change in the volume of bank loans as an additional variable. This variable is expected to be more important in the demand equations for time deposits, since banks manage these deposits (by varying their deposit rates) more closely in the short run.

When Equation 1 is substituted into Equation 2, and the bank loans variable is added, we obtain Equation 3.

$$\begin{aligned}\triangle \log M_t = {} & f - g(\log M_{t-1} - a - b \log Y_{t-1} - c R_{t-1}) \\ & + \sum_p h_p \triangle \log M_{t-p} + \sum_q k_q \triangle \log Y_{t-q} \\ & + \sum_s m_s \triangle R_{t-s} + n \triangle LOANS_t \end{aligned} \qquad (3)$$

where $\triangle LOANS_t$ represents the monthly change in bank loans.[38] In this equation, b represents the long-run income elasticity of demand for the aggregate, and c multiplied by the level of the interest rate is the long-run interest elasticity. The stock of the monetary aggregate approaches its long-run equilibrium level more quickly when the coefficient on the lagged *level* of the aggregate, g, is large, and those on the *changes* in the aggregate, income and the interest rate (h_p, k_q and m_s) are small.[39]

Equations in the form of Equation 3 were estimated for two pairs of monetary aggregates: (i) Nonterm and Term M3, and (ii) M2 and Non-M2 M3. The income variable used was nominal personal income and the market interest rate was the one-month commercial paper rate adjusted to a bond-yield basis. For each pair of aggregates, the demand equations were estimated by "seemingly-unrelated regression," an estimation method that assumes that the errors in the two equations are contemporaneously correlated.[40] This estimation method was suggested by the theoretical discussion in the previous section. Since different monetary aggregates are substitutes in the investor's asset portfolio, a random shock that affects the demand for one aggregate would be expected also to affect the other aggregate.

IV. Results

The estimation results are shown in Tables 2 and 3. In both tables, estimates are shown both for the pre- and post-deregulation sample periods separately and for the two periods together. Both pairs of equations fit the data closely with plausible values for the coefficients. None of the equations exhibits significant evidence of autocorrelation in the residuals that would indicate misspecification or the omission of important variables.

As expected, the response of the aggregates to market interest rates has changed significantly in the wake of deregulation. Both term and nonterm M3 have become more homogeneous aggregates and more responsive to market interest rates since 1981. In the case of M2 and non-M2 M3, deregulation has had the opposite effect.

Table 2 shows that in the 1981-86 sample period, the long-run demand for term M3 was significantly and positively related to market interest rates. Interest rate

Table 2

Estimation Results

	Nonterm M3			Term M3		
Dependent Variable △ LOG M(t)	**1971.01-1978.06**	**1981.01-1986.12**	**1971.01 - 1978.06, 1981.01 - 1986.12**	**1971.01-1978.06**	**1981.01-1986.12**	**1971.01 - 1978.06, 1981.01 - 1986.12**
Constant	0.047	-0.073	-0.012	-0.088	-0.010	-0.029
	(2.103)	(1.167)	(2.566)	(2.038)	(0.178)	(1.74)
△ LOG M(t-1)	0.221	0.386	0.390	0.351	0.417	0.464
	(1.610)	(8.499)	(9.573)	(4.129)	(7.248)	(10.330)
△ LOG Y(t)	0.057	0.190	0.070	—	—	—
	(0.965)	(2.114)	(1.428)			
△ CP1(t)	-0.0013	-0.0026	-0.0023	-0.00022	0.0010	0.00081
	(1.603)	(5.758)	(5.580)	(0.257)	(1.972)	(1.818)
△ CP1(t-1)	-0.0005	-0.0018	-0.0017	0.0011	0.0007	0.00107
	(0.574)	(3.890)	(4.280)	(1.330)	(1.602)	(2.650)
△ LOANS(t)	—	—	—	0.261	0.166	0.198
				(4.080)	(1.759)	(3.720)
△ LOANS(t-1)	—	—	—	0.080	0.169	0.047
				(1.100)	(1.704)	(0.850)
LOG M(t-1)	-0.053	-0.028	-0.019	-0.026	-0.033	-0.0185
	(2.377)	(3.160)	(3.876)	(2.960)	(3.256)	(3.850)
CP1(t-1)*	-0.025	-0.042	-0.050	0.008	0.029	0.034
	(3.619)	(3.920)	(6.802)	(0.914)	(2.720)	(4.990)
LOG Y(t-1)*	0.819	1.291	1.072	1.341	0.910	1.067
	(26.550)	(5.418)	(22.970)	(15.370)	(4.318)	(14.909)
SEE	0.0033		0.0034	0.0035		0.0036
DW	1.88		1.84	1.89		1.84
SEE/MEAN (△ LOG M)	0.390		0.403	0.353		0.369

M(t) represents the monetary aggregate in each equation.

**The estimated coefficients in these rows represent the* long-run *interest rate and income elasticities of demand. That is, the parameters b and c in Equation 1.*

changes also had a significant positive short-run impact on term M3.[41] Conversely, the demand for nonterm M3 responded negatively to market interest rates in both the short and the long run. These results reflect the fact that, since deregulation, depository institutions have adjusted their offering rates on all term accounts, including small-denomination time deposits, quickly and fully in response to changes in market rates, whereas rates on nonterm accounts have been adjusted more slowly. As a result, an increase in the general level of short-term interest rates makes term instruments more attractive relative to nonterm assets, and causes investors to shift from nonterm into term M3.

By contrast, in the pre-1978 period, the impact of interest rate changes on term M3, although positive, was very small and not statistically significant in either the short or the long run. Similarly, changes in market rates had negative, but small, effects on nonterm M3. Because the yields on small-denomination time deposits in term M3 were regulated in this period, the term M3 aggregate included a mixture of regulated and unregulated instruments. As a result, a rise in market rates made the hold-

Table 3

Estimation Results

	M2			Non-M2 M3		
Dependent Variable △ **LOG M(t)**	**1971.01-1978.06**	**1981.01-1986.12**	**1971.01 - 1978.06, 1981.01 - 1986.12**	**1971.01-1978.06**	**1981.01-1986.12**	**1971.01 - 1978.06, 1981.01 - 1986.12**
Constant	0.0075 (1.113)	−0.0225 (0.650)	−0.00096 (0.245)	−0.245 (2.354)	−0.399 (1.489)	−0.129 (2.395)
△ LOG M(t−1)	0.320 (3.464)	0.226 (2.869)	0.379 (6.686)	0.250 (3.663)	0.097 (0.713)	0.267 (4.433)
△ LOG Y(t)	0.042 (1.196)	0.115 (2.124)	0.070 (2.330)	—	—	—
△ CP1(t)	−0.00097 (2.086)	−0.0010 (3.753)	−0.00123 (5.144)	−0.0006 (0.231)	0.0013 (0.827)	0.0014 (0.996)
△ CP1(t−1)	−0.00098 (2.046)	−0.00078 (2.718)	−0.0005 (2.099)	0.0068 (2.497)	0.0009 (0.603)	0.0021 (1.696)
△ LOANS(t)	—	—	—	0.248 (4.244)	0.092 (0.796)	0.228 (4.381)
△ LOANS(t−1)	—	—	—	0.123 (1.899)	0.128 (1.087)	0.163 (2.882)
LOG M(t−1)	−0.031 (2.310)	−0.021 (0.098)	−0.038 (3.513)	−0.029 (2.186)	−0.063 (1.821)	−0.018 (2.280)
CP1(t−1)*	−0.031 (2.976)	−0.0074 (1.077)	−0.0149 (7.702)	0.128 (3.819)	0.023 (1.280)	0.082 (2.512)
LOG Y(t−1)*	0.978 (33.580)	1.127 (6.060)	0.994 (93.260)	1.742 (8.704)	1.560 (4.650)	1.584 (12.300)
SEE	0.00188		0.00200	0.0109		0.0113
DW	1.85		1.744	1.878		1.892
SEE/MEAN (△ LOG M)	0.236		0.251	0.820		0.847

M(t) represents the monetary aggregate in each equation.

* *The estimated coefficients in these rows represent the long-run* interest rate and income elasticities of demand. That is, the parameters b and c in Equation 1.

ing of *large* term deposits more attractive (because their yields rose in line with market rates), but simultaneously increased the opportunity costs of holding small time deposits making them less attractive. Since an increase in market rates had opposing effects on the demands for small and large term deposits in this period, it did not cause a significant net shift of funds between nonterm and term M3.

In the case of the M2 and non-M2 components of M3, the deregulation of deposit rates has made M2 a *less* homogeneous aggregate and caused it to become *less* responsive to interest rate changes. Table 3 shows that before deregulation, both the immediate and long-run effects of a rise in market rates were to reduce M2. Conversely, the effect of an increase in market rates on non-M2 M3 was significantly positive. Since the components of non-M2 M3 were unregulated, a rise in market rates induced depository institutions to raise their yields and made these assets more attractive relative to both the nonterm and the small-denomination term instruments in M2 – the rates on which were regulated. As a result, a rise in market rates led investors to substitute out of M2 into non-M2 M3.

The M2 equation estimated for the period since 1981 shows that the long-run negative effect of market rates on M2 is now small and not statistically significant, but that a small, although statistically significant, negative impact remains in the short run. This short-run impact persists because the yields on most of the nonterm assets in M2 respond slowly to changes in market rates. Hence, the immediate effect of higher market rates is to increase the opportunity costs of holding these components of the aggregate, and therefore to slow overall M2 growth. As the deposit yields adjust to market levels, this short-run effect dissipates.

The long-run demand for each of the four monetary aggregates is positively related to income.[42] Although the most obvious effect of deposit rate deregulation has been to alter the response of the demands for these aggregates to changes in market interest rates, there also has been some change in the effects of income on money demand. Since 1981, the long-run demand for nonterm assets has become more responsive to income, and that for term assets less responsive. *Changes* in the level of income (ΔlogY) had an immediate positive impact on the demand to hold nonterm M3 in the 1981-86 sample period; this impact effect was smaller and not statistically significant in the earlier period.

The increased responsiveness of nonterm M3 to changes in income since deregulation is consistent with Keynes's view that, in the absence of government restrictions on their yields, all nonterm assets are similar because all give more or less immediate command over goods and services.

Although not a principal concern of this paper, it is notable that changes in bank loans had a significant effect on the demand for the term aggregates. An acceleration of bank loans increases the growth rate

Table 4

Errors in Projecting M3 Growth

	M2 vs. Non-M2 Split		Nonterm vs. Term Split	
Year	Mean Error	Root Mean Squared Error	Mean Error	Root Mean Squared Error
1981	2.49	3.40	–0.67	2.71
1982	1.08	2.20	–0.12	1.86
1983	0.14	1.50	–0.15	1.83
1984	0.28	1.45	0.25	2.01
1985	–1.37	2.97	–1.04	2.71
1986	0.34	1.49	0.68	1.83
Mean 1981–86	0.49	2.17	–0.18	2.16

of both term M3 and non-M2 M3, confirming the hypothesis that banks do respond to increases in the demand for loans by adding to their managed liabilities.

Although the preceding discussion has focused attention on the effects of deregulation in altering the estimated coefficients of the equations in Table 2 and 3, these changes were not large. Only in the case of the demand for M2 may the hypothesis that the coefficients remained unchanged between the two sample periods be rejected at a reasonable significance level.[43] It was argued in the previous section that the deregulation of the yield on small time deposits undermined the unique nature of M2 and thus could be expected to cause the demand for that aggregate to shift. The empirical results bear out this expectation.

The earlier argument also suggests deregulation would have affected the demand for term M3, but not that for non-M2 M3, since the former was a mixture of regulated and unregulated instruments before 1978 while the latter was fully deregulated. There is some indication that the demand for non-M2 M3 was more robust in the face of deregulation than was nonterm M3, but the evidence is not strong.[44]

Since deregulation, both the short- and long-run effects of interest rate changes on the demand for nonterm M3 have been stronger than they were in the 1970s.[45] Although changes in market rates still have a short-run impact on the demand for M2, the estimated long-run interest rate elasticity of this demand has declined since deregulation and is no longer statistically significant. Since the principal link between monetary policy actions and the economy is through changes in short-term interest rates, it may be preferable to use as a policy indicator an aggregate that is systematically and negatively related to rates. However, the interest-rate elasticity of the demand for nonterm M3 is larger than that of other aggregates used as indicators in the past. This could cause problems in setting a target range for nonterm M3 because its growth would tend to be more volatile than that of the traditional aggregates.

As a final test of the usefulness of the term-nonterm distinction, the two pairs of equations estimated over the second period were simulated dynamically from 1981 to 1986. The results of these in-sample simulations were combined to yield two sets of simulated values of total M3. The monthly growth rates of simulated M3 were computed and compared with actual M3 growth. If the division of M3 along term-to-maturity lines were more meaningful, one would expect to find that the simulated values of M3 growth constructed from the simulation of the nonterm and term equations exhibit smaller errors than those constructed from the M2 and non-M2 equations.

The results of this test were inconclusive. Table 4 shows the mean errors and root mean squared errors from these simulations for each year. In four out of the six years since 1981, the term-nonterm decomposition yielded slightly more accurate (that is, lower mean error) forecasts of the annual growth rate of aggregate M3, but the differences are not large. In terms of root mean squared error, there was no difference between the two models' monthly forecasting accuracy.

V. Conclusions

Since de-emphasizing M1, the Federal Reserve has used the broader monetary aggregates – M2 and M3 – as indicators for policy. During the 1970s, the principal differences between these two aggregates was that the rates of return on the instruments in M2 were mostly regulated, whereas those on instruments outside M2 were unregulated. The deregulation of deposit rates since 1978 has ended this distinction.

This paper has examined an alternative pair of monetary aggregates formed by decomposing M3 into assets that have a stated term to maturity and those that do not. Instruments with a stated maturity are described as term assets, while those with no set maturity date are nonterm assets.

The distinction between nonterm and term assets is similar to that between money and debts used by Maynard Keynes in the discussion of liquidity preference in his *General Theory*. Keynes argued that all nonterm assets are similar because they give (more or less) immediate command over goods and services. Today, investors may substitute between nonterm instruments at low transaction costs and with little risk. Thus, nonterm M3 represents a grouping of similar types of assets.

The uniqueness of M2 (and of M1) appears to have resulted from the existence of regulatory ceilings on the yields that depository institutions paid on their deposit liabilities. These rate ceilings not only gave investors an incentive to minimize the amounts of their wealth held in the regulated instruments, all of which were contained in M2, but also made it impossible for depository institutions to use small time deposits as managed liabilities. With the removal of these rate ceilings, these unique features of M2 have disappeared. This aggregate now includes both term and nonterm instruments and both managed and nonmanaged liabilities; its components are no longer similar either from the viewpoint of their holders or their issuers.

Empirical estimates of the demand for nonterm M3 suggest that this "aggregate" has been somewhat more robust in the face of deregulation than the demand for M2, as would have been expected if the unique features of M2 were the result of regulation. While the interest rate elasticity of M2 has become small and insignificant in the aftermath of deregulation, the elasticity of nonterm M3 remains negative and highly significant. These results support the theoretical arguments for preferring nonterm M3 over M2 as a policy indicator, although the greater volatility of nonterm M3 could make it more difficult to set targets for this aggregate than for M2. These considerations suggest that both aggregates deserve to be monitored in the future.

FOOTNOTES

1. The Humphrey-Hawkins law does not require that the Federal Reserve's targets for the monetary aggregates be achieved, but only that the System explain to Congress the reasons for any revisions to or deviations from those plans.

2. Today, the sole remaining regulatory restriction on deposit yields is that depository institutions are not permitted to pay interest on traditional demand deposits. However, since most such deposits are held by businesses that receive implicit returns in the form of bank services provided below cost, even this restriction may not be a binding one.

Households have the option of either noninterest-bearing demand deposits or interest-bearing NOW accounts. Presumably those who select the former do so because of lower fees or minimum balance requirements and thus are, in effect, receiving an implicit return that exceeds the explicit yield they would earn on a NOW account. The regulatory ceiling on demand deposits therefore is not a binding constraint on households either. Hence, the only effective interest rate "restriction" is the zero return on the public's holdings of currency.

3. Some evidence that the changed behavior of M1 may be attributed to the process of deregulation is presented in John P. Judd and Bharat Trehan, "Portfolio Substitution and the Reliability of M1, M2 and M3 as Monetary Indicators," *Economic Review*, Federal Reserve Bank of San Francisco, Summer 1987.

4. The relation between the growth of M1 and the behavior of real GNP and prices also appeared to go off track in 1982-83. Although at the time this led the Federal Reserve to de-emphasize M1 in its policy deliberations, there is strong evidence that the "great velocity decline" was not caused by a shift in the demand for M1 but rather by the unusually sharp decline in nominal interest rates associated with the winding down of inflation in 1982. See John P. Judd and Brian Motley, "The 'Great Velocity Decline' of 1982-83: A Comparative Analysis of M1 and M2," *Economic Review*, Federal Reserve Bank of San Francisco, Summer 1984.

5. The rationale for the present definitions of the aggregates is discussed in Thomas D. Simpson, "The Redefined Monetary Aggregates," *Federal Reserve Bulletin*, February 1980.

6. These assets still are not perfect substitutes since the instruments outside M2 are not federally insured, whereas small time deposits are insured.

7. See, for example, John P. Judd, Brian Motley and Bharat Trehan, "Financial Change and the Design of Monetary Policy: Lessons from the U.S. Experience," paper presented for the Seventh Pacific Basin Central Bank Conference on Economic Modeling, Reserve Bank of Australia, Sydney, Australia, 1986; Judd and Trehan, "Portfolio Substitution...," *op. cit.*; and Judd and Trehan, "Velocity in the 1980s: An Analysis of Interactions among Monetary Components," paper presented at Western Economics Association International Conference, Vancouver, B.C., July 1987.

8. See Judd and Trehan, "Portfolio Substitution...," *op. cit.*, 1987.

9. This second correlation coefficient excludes the credit control period, from March to July 1980, and the period immediately following the introduction of Money Market Deposit Accounts and Super-NOW Accounts, from December 1982 to February 1983.

10. See footnote 9.

11. See footnote 9.

12. If the Federal Reserve were to follow a policy of closely controlling the growth of total M3, *any* pair of components of this aggregate would tend to be negatively correlated, and it would be difficult to draw conclusions from these charts and correlations. In fact, however, although the System has set annual targets for M3, it has not conducted policy with a view to controlling its growth closely in the short run.

13. Judd and Trehan, "Portfolio Substitution...," *op. cit.*, 1987.

14. For a careful discussion of the rate-setting behavior of depository institutions in recent years, see Richard D. Porter, Paul A. Spindt and David E. Lindsey, "Econometric Modeling of the Demands for the U.S. Monetary Aggregates: Conventional and Experimental Approaches," paper presented at the Seventh Pacific Basin Central Bank Conference on Economic Modeling, Reserve Bank of Australia, Sydney, Australia, 1986.

15. John Maynard Keynes, *The General Theory of Employment Interest and Money*, London, Macmillan, 1936.

16. Not all economists have taken this approach. Milton Friedman, for example, has consistently argued that money should be defined broadly.

17. See, for example, the quotation from the *General Theory* at the beginning of this article. Although Keynes did not say so specifically, it is clear that his concept of "money" was not limited to assets yielding a zero or regulated rate of return. No such regulations existed in Britain at the time Keynes was writing the *General Theory*.

18. "If the current rate of interest is positive for debts of every maturity, it must always be more advantageous to purchase a debt than to hold cash as a store of wealth," *General Theory*, p. 169. Keynes is assuming here that the yield on money is zero and also that there are no transaction costs in buying or selling securities. If money bears interest or if there are costs involved in exchanging securities for money, investors may have an incentive to hold money even if securities provide a positive return with no risk. The role of transaction costs is discussed in more detail below.

19. The speculative motive has "the object of securing profit from knowing better than the market what the future will bring forth," *General Theory*, p. 170.

20. In the *General Theory*, Keynes uses the phrase "precautionary motive" in two senses. In his early discussions of liquidity preference (Chapter 13), he stresses the uncertainty of future rates of interest as a motive for holding a portion of total wealth in the form of money. Later (Chapter 15), he ascribes the precautionary motive to uncertainty with regard to future spending streams.

21. For a theoretical discussion of this motive, see David E. W. Laidler, *The Demand for Money: Theories, Evidence and Problems*, Third Edition, New York, Harper and Row, 1985, pp. 64-69.

22. Keynes did recognize the role of these costs but chose not to analyze them in detail. For example, in a clear reference to what later economists described as "transaction costs," he pointed out that "there is no need to hold idle cash...if it can be obtained without difficulty at the moment when it is actually

required," *General Theory*, p. 196.

23. That is, there is no *interest rate risk*. In the case of uninsured deposits, there is some default risk, whether these are nonterm or term assets.

24. Several types of nonterm assets available (for example, money market deposit accounts and money market mutual funds) permit a limited number of payments or funds transfers to be made each month by check or electronically. Thus, the "shoe-leather" or "inconvenience" costs of liquidating these assets are small.

25. This may be because increases in deposit rates on nonterm deposits must be paid to *all* holders, whereas higher yields on time accounts apply only to new holders. This explanation suggests that banks should respond more slowly to increases than to decreases in market yields. There is some evidence that in setting their offering rates on MMDAs and NOW accounts, banks move more rapidly to reduce their offering rates when market rates fall than they do to increase them when market rates rise. See Porter, Spindt and Lindsey, "Econometric Modelling of the Demands for the U.S. Monetary Aggregates...," *Opus cit.* However, this conclusion is based on only a short sample period, during most of which interest rates were falling.

26. Initially this was done by tying the regulatory ceilings on deposit rates to the yields on market instruments rather than by completely abolishing them.

27. Complete deregulation of all time deposits with maturities of more than 7 days occurred in October 1983.

28. Before 1978 the non-M2 component of M3 consisted entirely of deregulated instruments, but the term component included a mixture of regulated and deregulated assets.

29. That is, three dummy variables were included in the estimated equations that took the value one in December 1982, January 1983, and February 1983, respectively, and zero at all other dates. Preliminary equations indicated that additional dummy variables for later dates were not statistically significant, implying that both the public and depository institutions adjusted rapidly to the authorization of the new instruments.

30. David F. Hendry, "Predictive Failure and Econometric Modelling in Macroeconomics: The Transactions Demand for Money" in P. Omerod (editor), *Economic Modeling*, London 1979.

The advantage of this specification is that it does not require the long sample period needed for the estimation of explicit distributed lags, but it implies fewer restrictions on the response of money demand to its determinants than the partial adjustment model. In particular, the error-correction model allows changes in the macroeconomic variables to have a short-run impact on money demand that may differ from their long-run equilibrium effect.

31. In the MPS model of the U.S. economy, for example, which is estimated using quarterly data, the demand to hold the non-M1 component of M2 is assumed to be linearly homogeneous in nominal wealth. In that model, changes in the stock of wealth due to current savings and to changes in the value of equities both are assumed to have short-run impacts on the proportion of wealth held in the form of non-transactions M2. See Flint Brayton and Eileen Mauskopf, "The Federal Reserve Board MPS Quarterly Econometric Model of the U.S. Economy," *Economic Modelling*, Volume 2, Number 3, July 1985.

32. To provide a rough test of the role of wealth in the demand for the aggregates, a monthly wealth series was constructed from the quarterly data by interpolation. When this series was added to the equations estimated in Tables 2 and 3, neither the level nor the growth rate of wealth was statistically significant. However, this lack of significance may have been due to the crudeness of the measure of wealth used. Further research is planned in this area.

33. In an attempt to deal with this problem, the preliminary equations were estimated using both the *average* return and the *maximum* return on the instruments in each aggregate as measures of the own-rate. In addition, the equations were estimated both using the own and market rates as separate variables and using the spread between these rates as a single variable. None of these various approaches yielded fully satisfactory results.

34. Obviously the extent and speed of this response has changed as deposit rate ceilings have been progressively removed.

35. The same approach was used in Judd and Motley, "The Great Velocity Decline...," *op. cit.*

36. As pointed out earlier, since the estimated equations include no explicit wealth variable, changes in the interest rate also may proxy for the effects on money demand of changes in the market value of investors' portfolios of wealth.

37. An argument similar to the following one also has been applied to the demand for M1. See John P. Judd and John L. Scadding, "Liability Management, Bank Loans and Deposit 'Market' Disequilibrium," *Economic Review*, Federal Reserve Bank of San Francisco, Summer 1981.

38. For each aggregate, the change in bank loans is scaled by the level of the aggregate in the preceding month. The variable included is of the form:

$$\Delta LOANS_t = (\text{Bank Loans}_t - \text{Bank Loans}_{t-1})/M_{t-1}$$

where M represents the appropriate monetary aggregate. This scaling of the loans variable ensures that it has the same dimension as the dependent variable of Equation 3.

39. In particular, the adjustment to equilibrium would be immediate if g were unity and h_p, k_q and m_s all were zero.

40. Arnold Zellner, "An efficient method of estimating seemingly unrelated regressions and tests for aggregation bias," *Journal of the American Statistical Association*, Vol. 57, June 1962.

41. In Tables 2 and 3, the long-run effect of the market interest rate is represented by the coefficient on the lagged interest rate *level*; this coefficient corresponds to the parameter c in Equation 3. The interest rate elasticity is this coefficient multiplied by the level of the interest rate. The average level of the commercial paper rate was 6.2 percent in the first sample period and 10.3 percent in the second period. The short-run impact of the interest rate is given by the coefficients on the current and lagged *changes* in the rate (ΔCPI).

42. In Tables 2 and 3, the long-run income elasticities are represented by the coefficients on lagged income. These coefficients represent the parameter b in Equation 3. The short-run

impact is represented by the coefficients on the change in income (Δlog Y). The coefficients on the change in income were small and statistically insignificant in the equations for both term and non-M2 M3 in both sample periods. Hence, this variable was excluded from the equations reported in the tables.

43. The F-statistics for the hypothesis that the estimated coefficients did not change between sample periods were:

Nonterm M3	2.27
Term M3	2.56
M2	3.61
Non-M2 M3	2.11

The critical values for rejecting the hypothesis at the five percent level of significance are 2.54 in the case of term M3 and non-M2 M3 and 2.63 in the case of nonterm M3 and M2.

44. The F-statistic for rejection the hypothesis of constant coefficients was larger in the case of term M3 and just significant at the five percent level. See footnote 43.

45. This may be because for many investors the main substitutes for nonterm assets are small-denomination time deposits. When the yields on both nonterm assets and small time deposits were regulated, changes in market rates had no impact on them and thus did not cause much shifting of funds. Since deregulation, variations in market rates cause larger and faster changes in time deposit yields than in nonterm deposit rates, so making the demand for nonterm assets more responsive to interest-rate changes.