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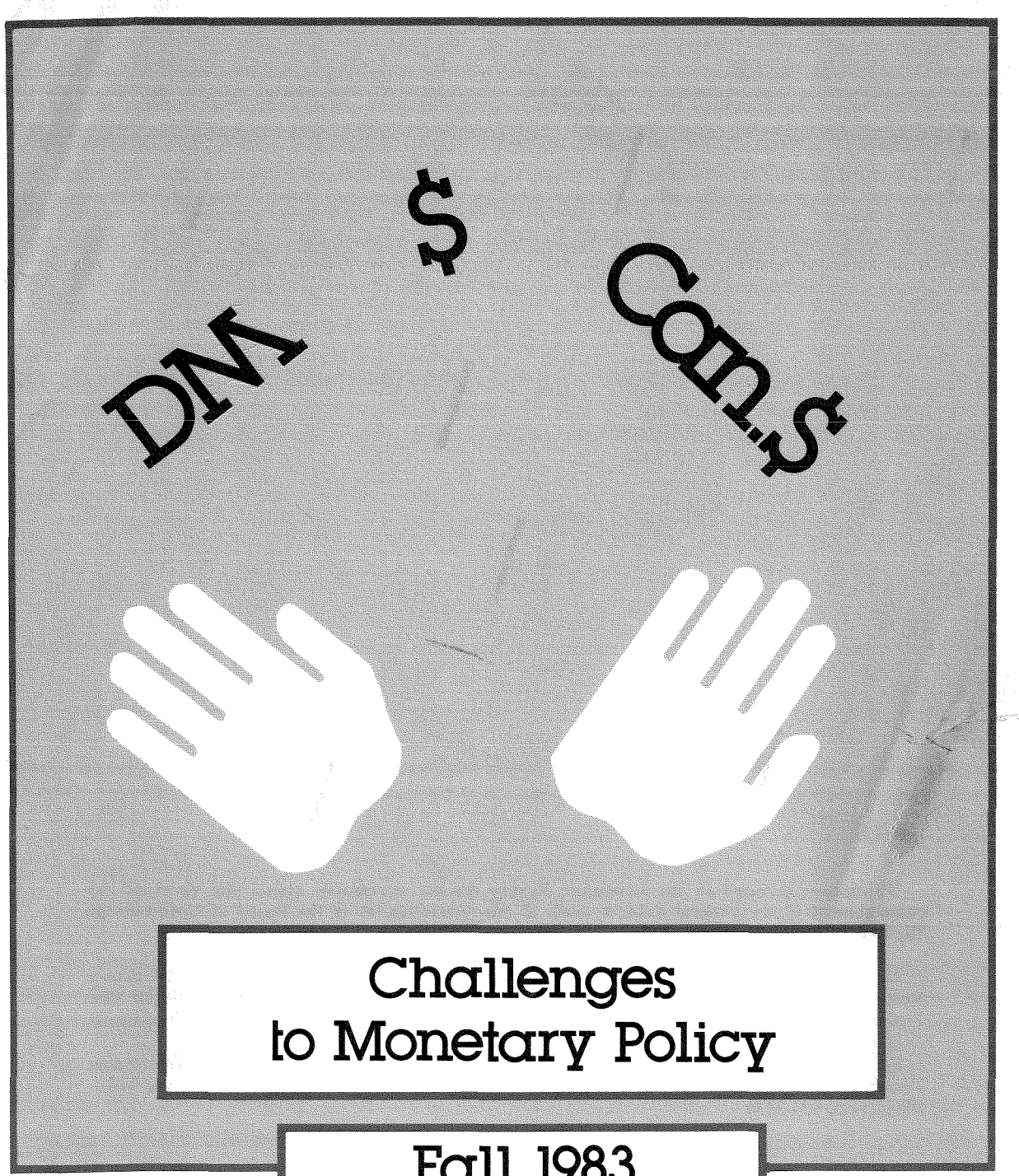

Challenges to Monetary Policy

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Deregulated Deposit Rates and Monetary Policy

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Events in recent years have highlighted the important relationships between monetary policy and the regulations governing financial markets and institutions. In particular, deposit-rate ceilings have emerged as one of the most important of these financial regulations, and the deregulation of these ceilings has triggered speculation as to the continued usefulness of the narrow transaction measure of the money supply—M1—that has most often been used by the Federal Reserve as its primary monetary policy guide. This paper analyzes how the effectiveness of M1 targeting has been affected by the recent round of deposit rate deregulation which occurred with the introduction of Super-NOW and Money Market Deposit Accounts. It also assesses the prospects for successfully implementing an M1-targeting approach to policy in the future, when all deposit-rate ceilings are removed.

Some economists and policymakers have argued that deposit rate deregulation is prima facie evidence that targeting the monetary aggregates, especially the narrow M1 aggregate, will no longer be desirable. In the second half of 1982, the Federal Reserve expressed its doubts about the reliability of M1 by placing less than the usual weight on this measure in formulating policy.

Some analysts have argued that deregulation will make the relationship between money and economic activity unstable by fundamentally altering a key relationship in the economy—the public's demand to hold transaction money.[1] There are two basic ways in which the demand for money, as measured by M1, may be permanently altered by deregulation. First, deregulation may induce a flow of savings balances into M1, and thus contaminate its basic transactions function. This could make the public's demand for M1 highly unstable because savings balances tend to be more sensitive than transaction balances to small changes in the broad range of interest rate spreads and in investors' sentiments. If this occurred, it would make the relationship between money and the economy more difficult to predict. However, the results of the empirical tests presented in this paper cast doubt on the view that such contamination has already occurred. The analysis also demonstrates that it is by no means certain that M1 will be seriously contaminated even when all deposit rate ceilings are removed in the future.

Another important effect of deregulation is that with flexible deposit rates, the opportunity cost of holding M1 may become fairly insensitive to changes in the general level of market rates of interest. The associated decline in the responsiveness of the quantity of money demanded to changes in the level of market interest rates has both disadvantages and advantages. One temporary disadvantage is that more flexible deposit rates would change the (reduced-form) relationships going from money to income and other variables. This would increase the uncertainty in policy decisions for the Federal Reserve until it understands and becomes proficient at working with the new relationships.

A permanent disadvantage is that the economy would become more sensitive to instability in money demand. However, the evidence thus far indicates that deregulation has not made M1 noticeably less stable. Moreover, the lower responsiveness of M1 demand to the overall level of interest rates has the advantage that it insulates the economy from instability in the public's demand for goods and services and from unexpected changes in inflation expectations.

Given these pluses and minuses, it is inappropriate to conclude that an economy with flexible

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deposit rates is not conducive to M1 targeting. Although it is too soon to tell for sure, there appears to be an equally good chance that M1 will have an even closer relationship with the macroeconomic variables when deposit rates are completely deregulated.

Deposit deregulation also raises issues concerning short-run monetary control. A lower interest-responsiveness of M1 demand could possibly make it less feasible or desirable for the Federal Reserve to achieve monetary targets in any precise way, since this precision might involve an unacceptably high degree of interest rate volatility. Moreover, even if precise control were exercised, M1 might become only a contemporaneous or even a lagging indicator of economic developments, rather than a leading indicator as it has been in the past. In this case, even a perfectly predictable demand for money would not be of high value for monetary targeting.

The analysis in this paper shows that the seriousness of this potential problem in part depends on whether or not M1 plays the role of a buffer-stock in the public's portfolio. If it does play this role, these problems are not likely to be great. If buffer-stock effects are small, M1 targeting could be seriously hampered by deposit rate deregulation. Only a small amount of evidence on this issue is now available, but it does support the existence of significant buffer-stock effects.

The conclusion that we draw from the arguments and evidence in this paper is that theory is silent on whether or not M1-targeting is more or less effective under flexible deposit rates. The test is an empirical one. Unfortunately, because deregulation is not yet complete, conclusive evidence is not available. The substantial evidence that does exist suggests that the use of M1 as an intermediate target has not been ruined by deregulation and that it would be advisable for the Federal Reserve to return to its former practice of using M1 as its primary monetary aggregate.

The rest of the paper is organized as follows. Section I presents the theoretical framework used for analysis in the paper. Section II discusses the effects of deregulation on the stability of money demand. Section III concerns the effects of deregulation on the responsiveness of money demand to market interest rates, and how this responsiveness alters the sensitivity of the economy to various types of uncertainty. Section IV analyzes potential monetary control problems. Finally, conclusions and policy implications are discussed in Section V.

I. Framework of Analysis

The model used in this paper is the standard IS-LM representation of the economy expanded to include a flexible deposit interest rate. The IS-curve represents combinations of nominal market interest rates (i) and real income (y) that produce equilibrium in the goods market, for given levels of expected inflation ($\dot{P}^*$) and the high employment federal expenditures (G) (Equation 1). The LM-curve represents combinations of nominal market interest rates and real income that equate the public's demand for money with the quantity supplied by the Federal Reserve, given the rate of return on deposits (z) and the level of prices, P (Equation 2).

The relationship explaining the rate of return on the deposits in the money stock is contained in a third equation (Equation 3). In the absence of deposit rate ceilings, the banking system is assumed to pay the competitive rate of return on these deposits. This competitive return is held below market rates by the extra costs and risks incurred by banks in

$$(1)\ y = y(\underset{+}{G},\ \underset{-}{i-\dot{P}^*})$$

$$(2)\ M/P = M(\underset{+}{y},\ \underset{-}{i-}\ z)$$

$$(3)\ z = z(L,\ \underset{+}{i})$$

offering transaction deposits as compared with other debt instruments. These extra costs fall into two categories: those that vary systematically with market interest rates and those that do not. The importance of this distinction will become clear in the analysis below.

Reserve requirements are the primary example of costs that vary with market yields.[2] If transaction deposits carry a reserve requirement of x percent, banks incur a reserve requirement "tax" of xi per dollar of deposit. In a competitive banking system, banks will pass this "tax" on to the depositors by

holding the rate on deposits (z) below the rate on market instruments to the extent of xi. For example, if the reserve requirement ratio is 12 percent and the market interest rate is 10 percent, the reserve requirement wedge between market and deposit rates would be 1.2 percentage points. Thus, reserve requirements can be an important factor in determining the opportunity cost of holding money (i-z), which, in turn, is a key determinant of the public's demand for money (Equation 2). Reserve requirement costs also cause the opportunity cost of holding money (i-z) to vary positively with market rates. For example, with a reserve requirement ratio of 12 percent, an increase in the market rate of 1 percentage point induces a rise in the deposit rate of 0.88 percentage point. The opportunity cost of holding money therefore increases by 0.12 percentage point.

There also may be factors holding interest rates on trasaction deposits below market rates that do not vary systematically with market interest rates (represented by the variable L in Equation 3). The primary example is the liquidity premium that can be expected to stand between transaction deposit rates and rates on less liquid substitutes. From the bank's viewpoint, this premium should exist because of the added risk incurred when institutions borrow funds through instruments payable on demand (transaction deposits) and lend the funds out through longer-term instruments.[3] Banks "produce" liquidity by transforming maturities in this way. However, the "production" process involves the risk of potential losses that would occur if (market determined) borrowing costs rose above (fixed) lending rates. Banks protect themselves from this added risk by maintaining equity cushions, and by making the yield on transaction deposits lower than that available on other less liquid deposits and on open market instruments. The depositor is willing to accept a lower interest rate on a transaction deposit because its added liquidity has economic value. The price that this liquidity commands in the market is the reduction in the interest rate on transaction deposits. Thus, for example, a liquidity premium can be expected to stand between the yields on transaction deposits and Treasury bills in much the same way as a premium stands between three-month and one-year Treasury bills.[4]

When deposit rate ceilings are in place, the parameters of Equation 3 obviously are different from when deposit rates are deregulated. If fixed deposit rate ceilings (such as the 5¼ percent ceiling on regular NOW accounts) were fully effective, the variable L simply would represent the negative of the constant ceiling rate, and the variable i would drop out of the function. However, it is unrealistic to assume that deposit rate regulations have been fully effective in the U.S., since there are various ways in which implicit forms of compensation can be paid by banks. It is reasonable to assume that competition for deposits will induce banks to exploit these methods. Thus, even under deposit-rate ceilings, it is more accurate to assume that z varies with i (although not as fast as without regulations) and that the level of compensation is above the fixed legal ceiling by some unspecified amount.

A final characteristic of all three equations is that they are not known with certainty. If this uncertainty were not present, the Federal Reserve would always be able to achieve what ever nominal income goal it set for itself. In other words, the uncertainty is the source of monetary policy problems. Although uncertainty cannot be eliminated, there are means of altering its probable effects on the economy. These include changing the way in which monetary policy is conducted by the Federal Reserve (for example, using monetary aggregates rather than interest rate targeting), or changing the regulations and laws that govern the financial system. The latter issue is the main subject of this paper.

The complete model can be summarized in terms of the familiar IS-LM diagram in Chart 1. The IS-curve is simply the plot of Equation 1 in terms of interest rates and income, for given levels of expected inflation and fiscal policy stimulus. A band is plotted to reflect the degree of uncertainty. The LM-curve is obtained by substituting the deposit rate setting Equation 3 into the money demand Equation 2. A band is plotted to denote the degree of uncertainty. For given monetary policy settings, defined by M under monetary aggregates targeting, the model predicts an outcome for real income of $\bar{y}$. However, the uncertainty about the relationships in the model means that y could end up anywhere in the range of y_1 to y_2 with some specified confidence level.

The analysis below focuses on how deposit rate deregulation affects the risks present in a monetary

policy conducted in terms of monetary targeting. It shows how deregulation affects the width of the $y_1 - y_2$ range. Deposit-rate deregulation potentially can alter these risks by changing two important properties of the LM-curve. First deregulation could affect the stability or predictability of the public's demand for money, both temporarily during a transition period, and also permanently. In other words, deregulation might increase the size of the band of uncertainty around the LM-curve. This potential "instability" effect and its influence on the effectiveness of monetary aggregate targeting is discussed in Section II. Second, deregulation could reduce the responsiveness of the LM-curve to changes in market interest rates by allowing the deposit rate to move more closely with market rates. This "interest-elasticity" effect, which makes the LM-curve more vertical, is discussed in Sections III and IV.

II. Effects of Deregulation—Stability of Money Demand

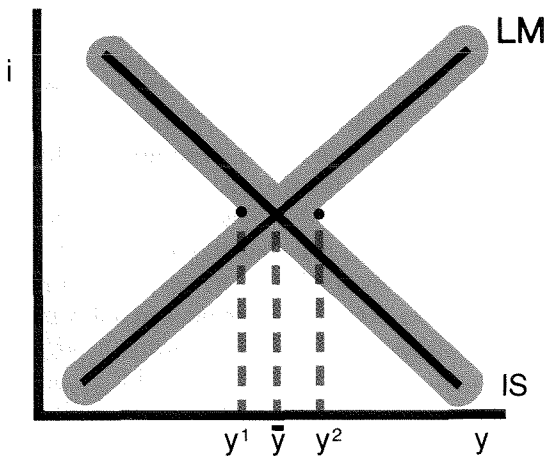
In cataloging the effects of deposit rate deregulation on money demand, it is useful to distinguish between the adjustment effects during the transition period after a regulatory change and the equilibrium effects which persist after full adjustment has been made. During the adjustment period, the level of M1 the public wishes to hold at given levels of income, prices and market interest rates may change. These changes have been called "shifts" in the demand for money. The deregulation of yields on transaction deposits temporarily causes the demand for M1 to shift *up*, as the public pursues the more attractive yields. The introduction of NOW accounts on a national basis in 1981 is a case in point. It raised the questions, by how much would the demand for M1 (including NOWs) rise in response to the higher ceiling rate available on checkable deposits, and how long would this adjustment take to run its course? Whenever such an upward shift is taking place, the LM-curve shifts to the left and tends to make policy more contractionary than would otherwise be the case. This can temporarily throw monetary policy off course as it is difficult to estimate the size and duration of the shift while it is occurring.

More important than the transitional problem is the potential *permanent* instability in money demand that could result from deregulation: it could become more difficult to predict the quantity of M1 the public demands. This problem could arise because higher yields on the deposits in M1 could induce the public to use it as a savings vehicle to a more significant degree than in the past.

Conceptually, one would expect the public's demand for a transaction aggregate (such as M1) to have a closer relationship with income and prices than a savings-type aggregate (such as M2) because there are few close substitutes for the medium of exchange. But if the public were to comingle in M1 the funds it holds for investment purposes, M1 would become more like the various financial assets held for investment purposes, and changes in M1 could be dominated at various times by shifts in the composition of the public's portfolio rather than by changes in income and prices.

For example, the demand for M1 might become

Chart 1



more highly responsive to fluctuations in the "normal" spreads between the rate of return on M1 and rates paid on a wide range of liquid financial instruments not included in M1. It also might become more sensitive to changes in yields on long-term bonds and common stocks. Shifts in investors' preferences for various maturities and liquidity characteristics would have larger effects on M1 demand, as would changes in precautionary motives over the business cycle. Since the demand for M1 might respond sensitively to a number of difficult-to-measure incentives, it might be difficult to predict the quantity of M1 demanded by the public. Put differently, an M1 demand function estimated in terms of the traditional arguments of income, prices and a market interest rate might frequently show signs of instability.

The problems that such instability can cause for a monetary policy oriented around M1-targeting can be illustrated with the IS-LM diagram in Chart 1. Greater instability in M1 demand would show up as a wider band of uncertainty in the LM-curve. This wider band would increase the range of outcomes for income (y_1—y_2 would become larger) for any given setting for M1.

NOWs, Super-NOWs, and MMDAs

There is a considerable amount of evidence available concerning the effects of deregulation on money demand during transition periods. This evidence also sheds light on the seriousness of potential permanent problems with instability in money demand resulting from the mixing of savings and transaction balances. If M1 were contaminated by savings balances, this would show up first as a temporary shift in the demand for M1, as savings balances were shifted into that aggregate. There should therefore be a positive association between the size of *upward* shifts during the transition period following deregulation and the probability that M1 has been permanently contaminated.

An earlier paper surveyed and analyzed the evidence of money demand instability during the transition periods following two episodes of deregulation prior to 1982–83.[5] Both episodes were related to growth in regular NOW accounts (with fixed ceilings): the introduction of NOW accounts in New England in the 1970s and the nationwide introduction of NOW accounts in January 1981. The study found that these effects on M1 demand have been relatively small. In New England's case, NOW accounts caused an upward M1 shift of not more than 5 percent over five years; in the nationwide case, NOWs raised the demand for M1 by no more than 3 percent in 1981. Moreover, some evidence suggests that the effect on M1 in 1981 was far smaller than the study quoted or even non-existent.[6]

The most recent and far-reaching example of deposit-rate deregulation occurred when federal regulators authorized commercial banks and thrift institutions to issue the Money Market Deposit Account (MMDA) in December 1982 and the Super-NOW account in January 1983. The MMDA is free of interest rate ceilings, has a $2,500 minimum denomination, and allows six transfers to third parties per month (three of which may be checks). The Super-NOW account (which is not available to businesses) is also subject to a $2,500 minimum denomination and is free of interest rate ceilings. An important distinguishing feature is that it has unlimited check-writing privileges.

Taken together, these two accounts mean that for the first time since the Great Depression, depository institutions are permitted by law to offer checkable deposits that are not subject to interest rate ceilings. This case of deregulation differs from the introduction of nationwide NOWs in 1981 in two important respects. First, the recent case completely removed interest rate ceilings instead of imposing a new higher, but fixed ceiling. (This feature of Super-NOWs is the focus of the analysis in Section III.) Second, ceilings were removed not only from transaction accounts (Super-NOWs), but also from close substitutes for transaction accounts (MMDAs).

The latter point means that unlike earlier cases of deregulation, the direction of the potential shift in money demand cannot be determined from theory. The effects of the introduction of Super-NOWs should induce positive flows of funds into M1 from unregulated instruments and especially from accounts that carry interest rate ceilings. Other potential sources of funds include passbook savings accounts and time deposits with interest rate ceilings, and money market mutual funds.

In contrast, the introduction of the MMDA should temporarily depress M1 growth. The public may, for one, use it as a cash management tool to reduce holdings of true transaction balances. With-

in the regulatory limitations on MMDAs, regular transfers of funds between them and the fully checkable deposits in M1 would allow the public to reduce the level of M1 needed to conduct a given volume of transactions. Another reason for shifts out of M1 into the MMDA is that the new account is, to a limited extent, a transaction instrument itself. Use of the MMDA to write a few large checks, such as mortgage or credit card payments, would mean that some transaction funds in the new account never have to pass through an M1 balance. Finally, M1 presumably contains some savings-type balances that are not actually used by the public for making transactions. These funds are probably lodged in traditional NOWs, which carry maximum yields that are competitive with passbook savings accounts. The higher yields and liquidity of MMDAs, however, should attract most of these funds away from M1.

In sum, shifts into MMDAs add up to a potentially significant reduction in the public's demand for M1. The extent to which these shifts depress M1, and thereby offset the expansionary effects of the Super-NOW account, depends partly on the pricing policies institutions adopt for the two accounts. That is, it depends on the parameters in the deposit-rate setting Equation 3. If yields on MMDAs are considerably more attractive than those on Super-NOWs (because of a liquidity premium and the difference in reserve requirements), there could be a net outflow of M1 funds into MMDAs. It is also possible that Super-NOWs are priced attractively enough to offset the outflow from M1, or to cause a net inflow. For these reasons, theory cannot tell us very much about the direction of the transitory effects. M1 demand could have shifted upward, making policy tighter than it appeared in 1983, or the opposite could have occurred. Similarly, theory cannot tell whether deregulation contaminated M1 by attracting savings balances into Super-NOWs, or purified M1 by attracting savings balances already in M1 into MMDAs.

Empirical Evidence in 1983

As noted earlier, there is good reason to expect that MMDA yields should exceed yields on Super-NOWs. This expectation has been borne out by subsequent events. The average interest paid on Super-NOWs from March through September 1983 has been below that of MMDAs by from 1.07 to 1.41 percentage points (see Chart 2). Using the one-month commercial paper rate as the interest rate, reserve requirement costs can be seen to account for between one and 1⅛ percentage point of this spread in March through September 1983, so there does appear to be a small additional spread due to other factors.

The explicit rates of interest quoted here may not give a very accurate indication of the true yields available on these instruments for certain deposits, the reason being that many institutions have attached various fees, including fixed monthly charges that are larger for smaller deposits,[7] to the instruments. However, these fees are not likely to affect a consumer's decision *at the margin* to add an additional dollar of savings balances to a Super-NOW versus an MMDA since the fixed charges that must be paid are unaffected by the decision. Thus, the interest rate spreads shown in Chart 2 probably give a good indication of the spread of yields (at the margin) that help determine where savings balances end up.

Although it is clear that consumers can earn more on their savings balances if they put them into MMDAs than in Super-NOWs, it is still possible that the premium on MMDAs is not large enough to prevent substantial mixing. This could be the case, for example, if explicit or implicit transaction costs between the two accounts were large enough to overcome the yield advantage associated with MMDAs. Unfortunately, it is extremely difficult, if not impossible, to obtain reliable estimates of these transaction costs, especially since they necessarily include the value consumers place on the time and "trouble" associated with managing liquid funds.

This paper employs two other methods of estimating how much M1 has been distorted by recent deregulation: work done by the Staff of the Board of Governors of the Federal Reserve System using surveys of depositors and cross-sectional econometric techniques to estimate the magnitudes of the various flows of liquid funds following the recent deregulation,[8] and econometric estimates and simulations of a demand-for-transaction-deposits equation to see if there is evidence of a "shift" in the function.

As of September 1983, MMDAs had reached $367 billion (about 17 percent of M2), while Super-NOWs reached $35 billion (about 6½ percent of M1).[9] The survey and econometric cross-section evidence suggests that the net distorting effect of this growth in Super-NOWs and MMDAs on M1 was small. With respect to MMDAs, the major sources of huge increases appear to be passbook savings accounts, small denomination time deposits, large denomination time deposits and money market mutual funds. Small amounts of funds are estimated to have been transferred from Treasury securities, other market instruments, demand deposits and regular NOW accounts. The last two categories are the only ones that would affect M1 growth, and they would apparently have contributed to a small downward shift in M1.

This same evidence indicates that the bulk of dollars placed in Super-NOWs came from other transaction accounts in M1, including demand deposits and regular NOWs. A small amount of funds probably came from non-M1 sources, including passbook savings and small time deposits. These latter movements would contribute a small upward shift in M1 demand that would tend to offset the small downward shift caused by funds transferred from transaction accounts to MMDAs.

Our own method of analysis consists of examining temporal econometric evidence on the behavior of the public's demand for transaction balances in the period after the dergulation of deposit rates—in December 1982 and January 1983. We employed conventional equations for the public's demand for transaction deposits. The equations specify M1 as a function of the six-month commercial paper rate, the personal consumption expenditure price deflator, and real personal income. Two alternative variations of this equation were used, one which restricted the interest elasticity to be constant, and another which allowed that elasticity to vary positively with the level of interest rates.

These equations were used to determine if growth in M1 after November 1982 was consistent with the historical demand relationship. We estimated the equations over the January 1970 through November 1982 period (see Table 1) and (dynamically) simulated them over the period December 1982–August 1983. We then compared the simulated M1-growth rates to actual growth. If the demand for M1 shifted with the introduction of the new accounts, this should show up as large cumulative under-forecasts by the end of the period.

The results of our experiment are presented in Table 2. They show that the variable interest elasticity M1 demand equation *over*-forecasted M1 growth by a small amount. This result is inconsistent with the hypothesis that M1-demand shifted *up*

Table 1
Transaction Deposit Demand Equations

A. Variable Interest Elasticity Specification

$$LTRD_t = \underset{(0.86)}{0.091} - \underset{(7.11)}{0.0021}\, CPRT_t + LPCE_t + \underset{(5.20)}{0.069}\,(LYPERS_t - LPCE_t) - \underset{(4.83)}{0.0016}\, T_t + \underset{(3.04)}{0.000037}\, T_t^2 + \underset{(45.51)}{0.90}\,(LTRD_{t-1} - LPCE_t) + \underset{(2.00)}{0.16}U_t - \underset{(1.00)}{0.08}U_{t-1}$$

Estimation Period: 1970.01 – 1982.11

$\bar{R}^2 = 0.999$
SEE = 0.0050
DW = 1.96

B. Constant Interest Elasticity Specification

$$LTRD_t = \underset{(0.64)}{0.071} - \underset{(5.82)}{0.014}\, LCPRT_t + LPCE_t + \underset{(4.10)}{0.054}\,(LYPERS_t - LPCE_t) - \underset{(3.77)}{0.0013}T_t + \underset{(2.29)}{0.000029}T_t^2 + \underset{(47.7)}{0.92}\,(LTRD_{t-1} - LPCE_t) + \underset{(2.23)}{0.18}U_t - \underset{(1.24)}{0.10}U_{t-1}$$

Estimation Period: 1970.01 – 1982.11

$\bar{R}^2 = 0.999$
SEE = 0.0052
DW = 1.97

Variables:

LTRD	=	log of (M1 minus currency).
LCPRT	=	log of 4–6 month commercial paper rate
CPRT	=	4–6 month commercial paper rate
LPCE	=	log of personal consumption expenditure deflator.
LYPERS	=	log of nominal personal income.
T	=	1,2, ...24 in 1974.07–1976.06; zero prior to 1974.07; 24 after 1976.06.
U	=	error term.

with recent deregulation. The constant elasticity equation under-forecast M1 growth by 0.9 percent (at an annual rate), but this is a very small error compared with the standard error of the regression. These results therefore tend to confirm the survey and cross-sectional results which failed to find evidence of a shift in the public's demand-for-transaction-deposit equation following the recent deregulation.[10]

This evidence has two implications. First, instability in M1 demand does not appear to have significantly distorted monetary policy in 1983.[11] Second, if M1 were to be permanently contaminated by an inflow of savings balances, this would most likely have shown up as an upward shift in M1 demand during the transition period following deregulation. By not finding such a shift, this paper supports the view that the recent important round of deposit deregulation has not materially changed the transaction nature of M1.[12]

Prospects for the Future

The preceding analysis and evidence pertain only to deposits held by households. Although household deposits have been largely deregulated, corporations still are prohibited from holding any interest-bearing account that is fully checkable. This leaves open the possibility that M1 could be adversely affected by the deregulation of corporate demand deposits at some time in the future. There are, however, two reasons to believe that the effects of this deregulation on M1 may not be large. First, the evidence presented earlier suggests that the introduction of Super-NOWs has not caused a major inflow of savings balances into M1. If the yield spread between MMDAs and Super-NOWs has been large enough to preserve a reasonable separation of household savings and transaction balances, the same may also be true of corporate balances. Corporations, even small ones, are likely to manage their liquid balances more closely than do most households, and they have a wider variety of liquid investment alternatives available to them than do households.

Second, at least since the mid-1970s, deposit rate ceilings have effectively been circumvented by many large corporations. Banks often pay implicit returns on demand deposit balances through arrangements whereby the balances that corporations wish to hold are counted as payment for operational and credit services. For example, business customers can pay for loan commitments with dollars held in demand deposit accounts. In the case of operational services, dollars held in the checking account are multiplied by the implicit rate of return to be paid on the account, and the result of this calculation is counted as payment for services. Services not paid for by these deposits often can be covered through explicit fees.[13]

With regard to operational services, interviews with corporate treasurers and bankers suggest that (implicit) returns on checking account balances generally have been set at some open market rate (for example, the three-month Treasury bill rate) minus the cost to the bank of reserve requirements, and usually have been adjusted according to market rates on a monthly or quarterly basis. Thus, many corporations appear to have earned (marginal) returns roughly at the competitive rate, presumably close to the rate they would have earned under deregulated deposit rates. The interviews also suggest that these competitive yield spreads were large enough to induce most of the corporations to minimize their checking account balances for a given

Table 2
Growth in M1 minus Currency
(at Annual Rates)

Period	Actual	Dynamic Simulation	Actual minus Simulated
A. Variable Interest Elasticity Specification:			
December 1982 through August 1983	12.8 percent	13.6 percent	−0.8 percent
B. Constant Interest Elasticity Specification:			
December 1982 through August 1983	12.8 percent	11.9 percent	+0.9 percent

volume of transactions. Liquid funds in excess of this transaction demand were put into higher yielding savings-type instruments. In this way, the transaction and investment funds are effectively separated. There is thus a sizable component of corporate transaction balances that is unlikely to be significantly affected by future deposit-rate deregulation because it has already been "deregulated de facto."

III. Effects of Deregulation—Responsiveness of Money Demand to Market Interest Rates

The second aspect of concern over interest rate deregulation is related to the potential for permanent changes in the responsiveness of the demand for M1 to movements in market rates of interest, and how these changes will affect the money-to-income relationship. A key question in this regard is how sensitive depository institutions will be to movements in market yields when they adjust their offer rates on checkable deposits. Since the opportunity cost of holding M1 is the spread between the market rate and the deposit rate, adjusting deposit rates to closely follow market rates would make the opportunity cost of M1 vary much less than market rates. Thus, changes of a given size in the demand for M1 would correspond to large changes in market interest rates: that is, the elasticity of M1 with respect to market rates would be smaller.

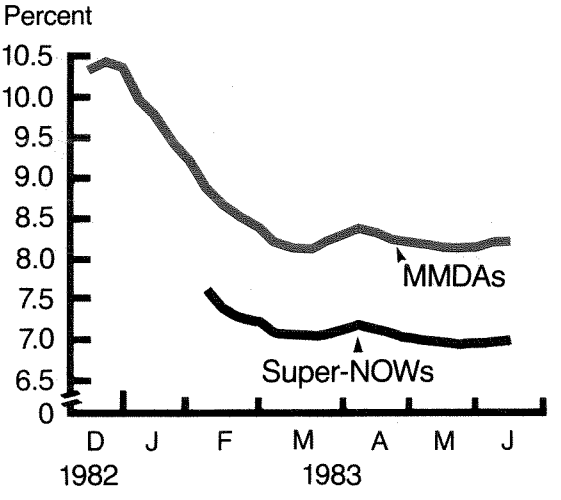
This point is illustrated by Equations 2 and 3. Equation 2, the money demand function, states that the public's demand for money varies inversely with the opportunity cost of holding money $(i - z)$. Equation 3, the bank deposit-rate setting equation, defines how this opportunity cost varies with market rates. When deposit-rate ceilings are fully effective, deposit rates do not vary with market rates. In such a case, changes in the opportunity cost of holding money would be equal to changes in market interest rates, and the LM-curve would have a positive slope as shown in Chart 1. At the other extreme, banks might vary deposit rates in tandem with market rates. In this case, the opportunity cost of holding money would be invariant with changes in market rates, and the opportunity cost variable $(i - z)$ would drop-out of the money demand equation. In this situation, the LM-curve in Chart 1 would be completely vertical.

As noted earlier, these assumptions obviously are overstatements of the regulated and deregulated worlds, respectively, since regulations on rates of return paid on transaction deposits have not been fully effective. Implicit returns on (large) corporate checking accounts apparently have responded fairly sensitively to market rates. However, it does appear reasonable to conclude that rates on consumer deposits will be more flexible and move significantly more closely with market rates after full deregulation than before.[14]

Implicit returns paid to households prior to the authorization of Super-NOWs appeared to have responded quite sluggishly to movements in market rates. Since part of that sluggishness presumably reflected the costs of adjusting implicit compensation, Super-NOW rates for consumers should be more variable than implicit returns. This expectation has been borne out so far by the experience with yields on Super-NOWs. As shown in Chart 2, Super-NOW rates appear to have moved fairly flexibly along with MMDA rates. However, this evidence is not conclusive because market rates have not changed very much since Super-NOWs were introduced.

Chart 2

Rates on MMDA's and Super NOW Accounts



There has not been a real test of how quickly banks will change Super-NOW rates in response to a sizeable change in market rates. Possibly more convincing is the evidence that banks have quite flexibly varied rates on other consumer deposits that were deregulated in recent years. A good example is the money market certificate authorized in mid-1978. Rates on these instruments have moved virtually in tandem with the six-month Treasury bill rate. Corresponding to this regulatory change, the responsiveness of M2 demand to changes in market rates fell sharply in mid-1978 (the elasticity is estimated to have dropped from −0.28 in 1960/Q4-1978/Q2 to −0.06 in 1978/Q3-1981/Q4.)[15]

Of course, it is unlikely that the opportunity cost of holding M1 will be totally invariant in relation to the market rate even when deposit rate ceilings are completely removed. The 12-percent reserve requirement on transaction deposits will be sufficient to impart a small positive movement in the opportunity cost as market rates change. But this positive movement is likely to be significantly smaller than it was prior to full deregulation.

Money Demand Stability

It is important to recognize that deposit-rate deregulation not only raises the possibility that money demand will become less stable, it also increases the importance of having a stable demand function for money. One possible effect of deregulation, then, is that when deposit rates are flexible, unanticipated "shifts" in the demand curve for money, at given levels of money supplied, are likely to have larger effects on income.

To illustrate this point, assume that the public's demand for money shifts up, and that the Fed holds the money supply constant. With more money demand and the same money supply, interest rates rise and income falls. When deposit rates are inflexible, the increase in nominal market interest rates lowers the quantity of money demanded somewhat, and thus causes income to drop by less than if deposit rates rose along with market rates. This partial offset is not as large when deposit rates are flexible, since in that case the increase in market rates has only a small effect on the opportunity cost of holding money, and thus does not affect money demand significantly. This point can be illustrated with the IS-LM diagram in Chart 1. As noted earlier, as the deposit rate moves more closely with the market rate, the LM-curve becomes more vertical. Instability in money demand causes the LM-curve to shift for given levels of the money supply. With a more vertical LM-curve under deregulation, these shifts have larger effects on interest rates and income.

Fiscal Policy

Another effect of interest rate deregulation is that it reduces the impact of fiscal policy on income. As a result, fiscal policy actions would not have to be correctly anticipated by the Federal Reserve for it to achieve its income goals. This should enhance the chance that the Fed will be able to correctly forecast the monetary targets that are consistent with its macroeconomic goals.

The reason that fiscal policy would have less effect on income for given levels of M1 is that there would be more financial crowding-out in the short-run with flexible deposit rates.[16] When the high employment deficit increases, the first round effect is that real GNP rises. However, if the Fed holds to its money target, interest rates will rise as the higher GNP causes money demand to increase in excess of the fixed money supply. With higher interest rates, part of the initial increase in GNP is crowded-out as firms and households cut back on their spending for durable goods. This crowding out is greater with flexible deposit rates because market interest rates rise by more, that is, higher market rates feed back on deposit rates which, in turn, induce further increases in market rates. As a consequence, the link between money and income would be less responsive to changes in fiscal policy with flexible deposit rates. In terms of the IS-LM diagram, a more expansionary fiscal policy causes the IS-curve to shift to the right. The more vertical is the LM-curve, the smaller is the effect of the IS-shift on income.

Inflation Expectations

Interest rate deregulation can also improve the money-to-income relationship by insulating income from changes in inflation expectations. For example, a decrease in inflation expectations (all else being equal) reduces nominal interest rates and thus raises the demand for money when deposit rates are *not* flexible. With higher money demand and the same money supply, income must fall.

These changes in income can be a major problem at various times because expected inflation is inherently uncertain and difficult to estimate. This potential problem is less serious with flexible deposit rates because the opportunity cost of holding money does not vary as much with changes in market interest rates.

The effect on the opportunity cost of holding money would come into play, for example, when inflation falls as the result of past tight monetary policy. With fixed deposit rates, this will necessitate temporarily higher growth rates in the money supply to accommodate the increased money demand associated with lower nominal interest rates. Otherwise, the drop in inflation would lead to a monetary policy that is more contractionary than originally intended. Since it is often difficult to forecast in advance when and by how much inflation will respond to money growth in any given year, potentially large problems can occur as a result of the impact of inflation on velocity. This problem was dramatically illustrated in 1982 and early in 1983, when an unexpectedly sharp decline in inflation led to a decline in nominal interest rates and a surge in the quantity of money demanded.[17] The Fed responded to the continuing weakness in the economy, and to the unusual behavior of M1 by allowing M1 growth to exceed the upper boundary of its 1982 target range by a wide margin. These problems would have been smaller if deposit rates had been flexible, since the drop in market rates would have induced a smaller increase in the demand for money.

Consumption and Capital Investment

A final result to deposit rate deregulation is that it would reduce the effect of unexpected shifts in the IS-curve (due to changes in the public's demand for goods and services) on the money-income relationship. With fixed deposit rates, swings in investment and consumption spending that are not forecasted by the Fed can have sizeable unexpected effects on income, for given levels of M1. Under flexible deposit rates, changes in market interest rates lead to only small changes in the opportunity cost of holding money, and thus, income stays closer to its forecasted value for given levels of M1.

New Relationships

The preceding analysis suggests the following conclusions regarding the impact of deposit rate deregulation. First, deregulation insulates income from a number of factors that otherwise could cause it to change unexpectedly. These factors include fiscal policy actions, changes in inflation expectations, and instability in the public's demand for goods and services. The price paid for these benefits is an increase in the destabilizing effects on income of instability in the demand for money. It is therefore crucial in an assessment of the effectiveness of monetary targeting under flexible deposit rates to gauge the impact on money demand stability.

The empirical evidence examined in Section II suggests that problems with unstable money demand may be small. However, it is important to recognize that even if the LM-relationship were more stable and predictable after deregulation than before, deregulation still may *temporarily* raise uncertainties for monetary targeting by quantitatively altering the responses of changes in income and interest rates to changes in money. This would occur if deregulation made the LM-curve significantly more vertical. In such a case, a given change in the money supply would have a larger effect on income and interest rates, at least in the intermediate run when income adjusts to monetary policy but prices do not.

In the context of stabilization policy, a more vertical LM-curve means that smaller changes in money would be required to achieve a given change in income. As long as the LM-curve remained stable and predictable, a more vertical LM-curve would not permanently cause problems for monetary targeting. But, the Fed could face considerable uncertainty during the period in which it was learning the new (reduced form) relationships. Of course, these statements apply to stabilization policy only. Deregulation would not affect the important long-run (or steady-state) properties of the macro-economy. Money would still be neutral in the long-run, affecting inflation but not real GNP.

IV. Monetary Control

The successful use of monetary aggregates targets requires that two basic conditions be satisfied: that the money-to-income relationship be relatively stable in the sense of being predictable, and that the Federal Reserve be able to achieve its monetary aggregates targets. In the analysis thus far, we have focused on how money affects income and assumed that monetary control was not a problem. In this section, we analyze the monetary control issue.

Monetary control generally is viewed as occurring in the *short-run* environment in which income and prices are fixed: that is, when the IS-curve is vertical. Analysis of this monetary control environment shows that even if the demand for money were stable under flexible deposit rates, there would be additional reasons to be concerned about the effectiveness of M1 targeting after deposit-rate deregulation. Some observers argue that with flexible deposit rates, M1 will no longer be a *leading* indicator of the pace of economic activity and inflation; it will merely be a contemporaneous reflection of economic conditions.[18] Moreover, they argue that deposit rate deregulation will make it difficult and undesirable for the Federal Reserve to control M1 in the short-run of, say, a calendar quarter because such control could induce disruptive volatility in interest rates.

These points can be illustrated by describing the conventional view of how monetary control works and how this process fits into a full macroeconomic model. Suppose the Fed wants to lower the total spending on goods and services in the economy. If it followed an intermediate targeting procedure, it would lower the target for money. According to the conventional view of monetary control, in the short-run (in which income is exogenous), the Fed would attempt to achieve this lower target by reducing its reserve operating instrument and thereby raising market interest rates. With deposit-rate ceilings in place, "bonds" would become more attractive to the public than the non- or low-interest bearing checkable deposits in money. The public would then demand smaller quantities of money-balances at given levels of income and prices, and the money stock would decline.

By raising the cost of credit, the increase in interest rates also would eventually (over a longer time period) reduce the public's spending on goods and services. Since according to empirical research, the lags from interest rates to M1 are shorter than those from interest rates to the economy, the decline in money occurs before the decline in economic activity. This timing pattern means that money is a *leading* indicator of the economy, and, as a result, has value as an intermediate target.

This view of the M1-targeting process places great emphasis on deposit-rate ceilings. These ceilings ensure that money is a less attractive asset to the public at high money-market rates than at low rates. Thus, "tight" monetary policies, which eventually reduce economic activity, show up first in reductions in money via money demand. Without deposit-rate ceilings, this result is far less certain. If banks raise rates on M1 deposits in tandem with money market rates, higher rates would have little effect on the relative attractiveness of securities versus money and there would be little effect on the quantity of money demanded. Put more formally, there is no equilibrium between the vertical short-run IS-curve and a vertical LM-curve that may be created by deregulation. This would make monetary control difficult at best, and attempts at such control would lead to extreme fluctuations in interest rates in the short-run.

Without the ability to influence the spread between yields on securities and money (and thus money demand), the Fed would not be able to control M1 through that mechanism. Higher interest rates (induced by lower reserves) would still lower economic activity with a lag, and this in turn would reduce the public's demand for M1, but M1 would merely be a contemporaneous indicator of the economy. Since movements in M1 would no longer foreshadow movements in GNP, M1 would no longer be as useful as an intermediate target.

Put differently, the Fed would be forced to formulate short-run policy in terms of the direct linkage between market rates of interest and income; that is, it would need to create an equilibrium between the IS and LM curves by making the LM horizontal through interest rate targeting. Since income affects money demand, it would be possible under such interest rate operating procedures to control money through income. However, there

would be no advantage in formulating policy in this way, since income is the ultimate target of policy. Thus, the relationship between money and income could be perfectly stable, and yet be of little use to policymakers because M1 would not be subject to their control in the short run.[19]

The preceding example is obviously an extreme case. It is unlikely that the Fed would have no control of M1 through interest rates under flexible deposit rates. However, it is likely that the responsiveness of M1 to changes in the overall level of money market rates would decline significantly. This, therefore, raises an empirical question: how much will the interest-responsiveness of M1 decline in practice? A cut in half, for example, would not seem to present a significant problem. The Fed could achieve a given reduction in aggregate demand simply by lowering M1 by half as much as would have been required prior to deposit-rate deregulation. However, if the interest-responsiveness were to come close to zero, the conventional view of monetary control implies that the value of M1 as an intermediate target could be damaged significantly.

Buffer Stocks and the Inventory Theory

Even if deregulation caused the interest-responsiveness of M1 demand to become very low, this might not interfere significantly with the Fed's ability to control M1. There is an alternative view of how monetary control works which at least partially neutralizes the potential monetary control problems associated with deposit rate deregulation. This view holds that *in addition* to the interest rate channels noted above, monetary control operates directly through the supply of money provided by the actions of the Fed and the deposit-creating banking system. The rationale for this view is that money acts as a "shock absorber" or buffer stock between the receipts and spending of the public. Short-run variations in the observed stock of money, therefore, would not have to be induced by changes in people's underlying demand for money; they could result from independent changes in the quantity of money supplied that are unrelated to underlying demand factors such as interest rates and income.[20]

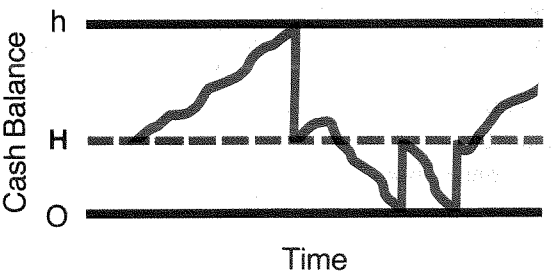
In this view, money demand is partly passive in the short-run, accommodating itself to changes in the supply of money. This view appears to be consistent with the widely accepted inventory theory of the transaction demand for money, which emphasizes the role of transaction costs in determining how closely balances are managed. Sudden inflows or outflows of funds cause inventories of money to be pushed away from their underlying desired levels in the short-run because it is costly for some money holders to make the frequent adjustments needed to bring money balances quickly back to desired levels.

The relationship between the transaction theory and the buffer stock function of money can be illustrated by analysis of the Miller-Orr model of money demand.[21] This model expands the classic inventory-theory of money demand developed by Baumol and Tobin[22] to include a cash flow that is not known with certainty by the moneyholder. More specifically, the Miller-Orr (M-O) model shows how a cost minimizing money holder manages transaction balances in the face of an uncertain cash flow by balancing two competing costs. First, there is the opportunity cost of holding transaction balances (the spread of yields on near money over those on money), which tends to reduce the quantity of money demanded. Second, there is the fixed per transaction fee of raising or lowering money balances by selling or buying securities, which tends to raise the quantity of money demanded.

M-O show that a cost minimizing solution to this problem is to establish what is called a two-param-

Chart 3

Cash Balance Under Miller-Orr Money Demand Model



eter control policy. Under this policy, individuals establish a maximum cash balance (h) and a minimum cash balance (0). The width of this range depends positively on the transaction cost and the variance of the daily cash flow, and negatively on the opportunity cost of holding money. Balances are allowed to wander freely within the h-0 range (see Chart 3). It is only when the cash balance reaches h that a security is purchased, and when it reaches 0 that a security is sold. In both cases, the size of the transaction is chosen to bring the cash balance to some level H, which lies in the h-0 range. In the long run, the average cash balance varies with the opportunity cost of holding money and the other underlying variables noted above. In the short-run, the cash balance can differ from its average, or underlying level of demand, depending on cash flows that are uncertain to the individual. This model can be regarded as a formal representation of the buffer stock role of money. Within the h-0 range, money is simply the residual item in the individual's balance sheet, and changes in money do not reflect changes in the underlying demand for money. Rather, within the h-0 range, changes in money are the side-effects of changes in the demands for goods and services, and real and financial assets.

The implications of this money demand model can be seen by imagining a world of Miller-Orr cash managers in which deposit rates move in tandem with market rates, making the opportunity cost of money constant. Now assume that the Federal Reserve makes the money supply exogenous through precise short-run monetary control. In an effort to achieve its money target, the Fed buys a Treasury bill from the public. This requires a very small decrease in Treasury bill rates, just enough to make the sale attractive in this highly competitive market. As a by-product of this transaction, the outstanding quantity of transactions money is raised. If the cash balance of the seller of the T-bill is still inside the h-0 range after the transaction, the newly created money resides there for a time. Thus, in the short-run, the quantity of money observed changes in accordance with the money supply, with a very small change in interest rates, and with no change in the underlying demand for money.

Even if the T-bill seller's h-0 range is pierced, the new money may not disappear from the economy. Instead, it may trigger the purchase of a security from another money holder. This string of transactions continues until the money ends up within someone's h-0 range. Each time a transaction is made to rid a portfolio of the newly acquired money, interest rates are affected a little more according to demands and supplies in the securities markets. If, for example, all money holders had very wide ranges, it might take a long time for the new money to be passed around enough for a large interest rate effect. If ranges were small, this might occur quickly. In either case, with the spread between market and deposit rates fixed, the money must continue to be passed around until income increases to the point where the new money is demanded. In other words, the underlying money demand eventually rises enough to absorb the increase in supply.

The conventional view of monetary control can be viewed as being based on the *empirical* judgment that h-0 ranges are very small on average. Thus, injections of new money are passed around so rapidly that they almost immediately cause large declines in interest rates. With fixed deposit ceilings, these declines translate into a lower opportunity cost of holding money and thus a higher underlying demand. Over a period short enough that income and prices cannot adjust, all of the increase in money supply must be abosrbed through such interest rate declines. In this circumstance, deposit rate deregulation would cause serious problems for monetary aggregates targeting if deregulation made the opportunity cost of holding money insensitive to Fed open-market operations. Attempts at short-run monetary control in this environment could have destabilizing effects on interest rates, or, at least, cause wild gyrations in them.

The buffer-stock view of monetary control argues that h-0 ranges are wide enough (on average) that, even with fully flexible deposit rates, changes in the money supply would induce only *gradual* changes in interest rates that ultimately affect income and prices with a lag.[23] M1 can, therefore, be controlled in the short-run even if the demand for it is not very responsive to the overall level of interest rates. Moreover, because of M1's buffer-stock role, changes in M1 will continue to be a useful *leading* indicator of future movements in income and prices.

The purpose of the preceding discussion was to

establish that (1) the size of buffer-stock effects is an issue of great importance for monetary policy in an era of flexible deposit rates, and that (2) the existence of these effects is primarily an empircal issue. The theory behind buffer-stock demand appears to be consistent with the inventory theory of the demand for the medium of exchange that has come to be widely accepted by the economics profession. That is why this issue should be decided on the basis of empirical evidence.

A number of studies have used quarterly data to estimate LM-equations under the assumption that the money supply is exogenous. These equations implicitly or explicitly employ buffer-stock specifications.[24] Unfortunately, these equations do not shed much light on the question being raised here: in the short run (for example, weeks or months), would buffer-stock effects significantly moderate the interest rate fluctuations that otherwise might be caused by close monetary control with flexible deposit rates? One problem in obtaining evidence on this question is that the buffer-effects in question would not come into play unless the Fed actually exogenized money in the short-run. There is ample evidence that the Fed has done so only sporadically.[25] Substantial direct evidence is therefore not likely to be available because the Federal Reserve did not systematically "shock" the public's portfolio in an attempt to control money.

There is, however, a source of indirect evidence having to do with "shocks" from the credit markets that can occur when the Fed pursues a policy that stabilizes interest rates. In a world in which there are distinct markets for bonds (credit) as well as for money and commodities, it is possible to have exogenous changes in the supply of money even when the monetary authority pegs interest rates.[26] Suppose, for example, that firms decide to spend more on plant and equipment. They may finance this desired increase in spending by issuing new debt. Their increased demand for commodities (investment goods) is thus matched by an increased supply of debt (demand for credit). Nevertheless, the increased demand for credit puts pressure on interest rates to rise. To prevent the rise, the monetary authority increases bank reserves, allowing the banking system to purchase the new debt through the creation of new deposits (i.e., an increase in money supply). The firms' demand for money therefore has not increased except in a temporary sense: they have borrowed the money to spend, not to hold.

At this point, there is an increase in the supply of money that is not matched by any increase in the demand for money. That is, the change in money supply is exogenous. The firms borrowing the money will spend it. And the recipients of that expenditure will find themselves with excess money balances, at which time, the issue of the size of buffer stock effects comes into play.

If buffer-stock effects initiated by changes in bank lending were found to be significant during periods when the Fed used a short-term interest rate as its instrument, it would be reasonable to expect that buffer-stock effects also would be observed if the Fed actually exogenized money in the short-run. For this reason, evidence of a link between bank lending and the demand for money in the short-run would provide indirect evidence of the buffer-stock effects discussed above. The only available evidence on this point (to the author's knowledge) is in a money market model developed and used at the Federal Reserve Bank of San Francisco.[27] In this model, the short-run (monthly) demand for transaction deposits equation specifies the (log) level of transaction deposits as a function of the (log) levels of prices, real income, a short-term interest rates, *and* the (log) *change* in bank loans. For reasons stated above, the bank loan variable is intended to capture exogenous increases in the money supply at given levels of the short-term interest rate. It was found to be highly significant, both statistically and economically, when monthly data for the 1976–82 period was used. This result is consistent with the view that exogenous changes in the money supply cause transitory increases in observed money relative to the underlying demand for it. While this evidence is not proof in itself, it is sufficient to establish a working hypothesis that buffer-stock effects are significant and to demonstrate that further research in this area is warranted.

V. Conclusions and Policy Implications

This paper has analyzed how the effectiveness of M1-targeting is likely to be affected by the removal of regulatory ceilings on the interest banks are permitted to pay on deposits. A major conclusion is that theory is silent on the issue. There are plausible theoretical arguments both that deregulation will make M1 a less reliable intermediate target and that it will make M1 more reliable. Therefore, substantial empirical evidence is needed. The evidence that is available supports the view that deregulation has not greatly reduced the reliability of M1, but given that deregulation is not complete, policymakers face uncertainty about how M1 will behave in the future, when deposit-rates are further deregulated.

However, uncertainty about the behavior of M1 under deregulation does not by itself justify a de-emphasis of M1 in favor of other monetary aggregates, such as M2. A decision to stress other aggregates should be based upon an evaluation of their reliability *relative* to M1. Although studies of M1 have been extensive, the behavior of the broader monetary aggregates in recent years under deposit-rate deregulation have not received the same attention. The deregulation of yields on M2, for example, began in earnest in mid-1978 with the introduction of money-market certificates. The available evidence on M2 suggests that the relationship between it and income has deteriorated significantly since mid-1978, and that M2 has become less controllable.[28] This evidence, together with the evidence presented in this paper on the stability of M1 in the 1980s, suggests that M2 has been more adversely affected by deregulation than M1. Thus, unless solid evidence of a major problem with M1 develops, the Federal Reserve would be well-advised to place more weight on M1 than the broader aggregates as intermediate targets of monetary policy in the future.

FOOTNOTES

1. The theoretical foundations for this viewpoint were developed by James Tobin in a number of articles, including "A General Equilibrium Approach to Monetary Theory," **Journal of Money, Credit and Banking,** February 1969. For discussions of these problems in the current institutional setting, see Stephen A. Axilrod, "Monetary Aggregates and Monetary Policy in a Deregulated Financial World," and Richard G. Davis, "Monetary Targeting in a 'Zero Balance' World," both in **Interest Rate Deregulation and Monetary Policy,** Federal Reserve Bank of San Francisco Conference, Asilomar Conference Center, Monterey, California, November 28–30, pp. 1–12, and 20–60.

2. See Benjamin Klein, "Competitive Interest Payments on Bank Deposits and the Long-Run Demand for Money," **American Economic Review,** December 1974, pp. 931–949, and Stephen M. Miller, "A Theory of the Banking Firm:" Comment, **Journal of Monetary Economics,** January 1975, pp. 123–128.

3. See William Poole, "Discussion of 'Monetary Targeting' in a Zero Balance World," in **Interest Rate Deregulation and Monetary Policy,** pp. 61–69, and James C. Van Horne, **Financial Market Rates and Flows,** Prentice-Hall, Englewood Cliffs, New Jersey, 1978, pp.6–11.

4. See Van Horne, **Ibid,** pp. 86–112 for a review of the theory and evidence on liquidity premiums in the term structure of interest rates. Some authors have argued that these premiums vary systematically with market rates. However, the theory and evidence on this point are inconclusive.

5. John P. Judd and John L. Scadding, "Financial Change and Monetary Targeting in the United States," in **Interest Rate Deregulation and Monetary Policy,** pp. 78–106.

6. See Ibid, pp. 90–91.

7. **Bank Rate Monitor,** Advertising News Service Incorporated, Miami Beach, Florida.

8. See Frederick T. Furlong, "New Deposit Instruments," **Federal Reserve Bulletin,** May 1983, pp. 319–326 for a discussion of this work.

9. These increases appear to represent the bulk of the stock adjustment into the new accounts. While these stock adjustments are taking place, the ratio of Super-NOWs to M1 and the ratio of MMDAs to M2 shold increase sharply, whereas these ratios should be trendless once the stock adjustment is over. These ratios did rise sharply shortly after deregulation (until April 1983), but the rate of increase in them has slowed markedly since then. This observation suggests that we apparently have enough information to do a fairly complete analysis of the response of the public to the new instruments.

10. Qualitatively similar results were obtained from the San Francisco Money Market Model. The transaction deposit demand equation in the model differs from the one used in this paper in that the model's equation includes as an argument changes in bank loans. For a description of the model, see John P. Judd and John L. Scadding, "What Do Money Market Models Tell Us About How to Conduct Monetary Policy?—Reply," **Journal of Money, Credit and**

Banking, November 1982, pp. 868–873, and John P. Judd, "A Monthly Model of the Money and Bank Loan Markets," Working Papers in Applied Economic Theory and Econometrics, Number 83-01, Federal Reserve Bank of San Francisco, May 1983, p. 7.

11. For an analysis of other factors that may have distorted monetary policy in 1982 through 1983, see the articles cited in footnote 17.

12. It might be argued that M1 was contaminated despite the lack of a shift in M1 demand. This could occur if active cash managers transfered transaction balances out of M1 into MMDAs, while less active managers transfered savings balances into Super-NOWs. Although this is possible, it seems unplausible. First, the survey and cross-section evidence contradicts this view, finding small flows from M1 to MMDAs and from non-M1 sources to Super-NOWs. Second, it is difficult to imagine why anyone would move funds that were already acting as savings balances from, say, a passbook savings to a Super-NOW account, when (1) MMDAs have a higher yield than passbook accounts, and (2) when MMDAs have lower transfer costs with checkable deposits than passbook savings.

13. See Thomas D. Simpson, "The Market for Federal Funds and Repurchase Agreements," Staff Studies 106, Board of Governors of the Federal Reserve System, July 1979.

14. Judd and Scadding, "Financial Change and Monetary Targeting in the United States," p. 87.

15. **Ibid,** p. 97.

16. This discussion abstracts from the possible effects of fiscal policy on the economy through changes in net wealth. For a discussion of this issue see Benjamin M. Friedman, "Crowding Out or Crowding In? The Economic Consequences of Financing Government Deficits," **Brookings Papers on Economic Activity,** 1978:3, pp. 593–641.

17. See Michael W. Keran, "Velocity and Monetary Policy in 1982" **Weekly Letter,** Federal Reserve Bank of San Francisco, March 18, 1983; John P. Judd, "The Recent Decline in Velocity: Instability in Money Demand or Inflation?," **Economic Review,** Federal Reserve Bank of San Francisco, Spring 1983, pp. 12–19; John P. Judd and Rose McElhattan, "The Behavior of Money and the Economy in 1982–83," **Economic Review,** Federal Reserve Bank of San Francisco, Summer 1983, pp. 46–51, Brian Motley, "Money, Inflation and Interest Rates," **Weekly Letter,** August 5, 1983, and John P. Judd and Brian Motley, "M1 Versus M2: Which is More Reliable," Working Papers in Applied Economic Theory and Econometrics, No. 83-04, Federal Reserve Bank of San Francisco, October 1983.

18. Richard G. Davis, "Monetary Targeting in a Zero Balance World," in **Interest Rate Deregulation and Monetary Policy.**

19. Money could still be used as an information variable in an optimal control framework—see Benjamin M. Friedman, "Targets, Instruments and Indicators of Monetary Policy," **Journal of Monetary Economics,** 1975, pp. 443–473. In this context, an IS-LM model (expanded to include a money supply function), would be solved in terms of nonborrowed reserves as the exogenous policy instrument. Money would be one among a potentially large number of exogenous information variables, and would not be assigned any special role.

20. For an excellent description of the buffer stock concept, and a bibliography of other papers on the subject, see David Laidler, "The Buffer Stock Notion in Monetary Economics," Research Report 8313, The University of Western Ontario, London, Canada, May 1983.

21. Merton H. Miller and Daniel Orr, "A Model of the Demand for Money by Firms," **Quarterly Journal of Economics,** August 1966, pp. 413–35.

22. See William J. Baumol, "The Transactions Demand for Cash: An Inventory Theoretic Approach," **Quarterly Journal of Economics,** November 1952, pp. 545–56, and James Tobin, "The Interest-Elasticity of the Transactions Demand for Cash," **Review of Economics and Statistics,** August 1956, pp. 421–47.

23. The view that buffer-stock effects are empirically important does **not** deny the emergence of sophisticated money management techniques and new instruments (like repurchase agreements) that have lowered transaction costs and reduced the variance of cash flow for certain money holders, especially large corporations. The demand for M1 by these firms fell sharply in 1975–76. (See John P. Judd and John L. Scadding, "The Search for a Stable Money Demand Function: A Survey of the Post-1973 Literature," **Journal of Economic Literature,** September 1982, pp. 994–1023.) This showed up clearly in a sizable downward shift in money demand. However, there is no indication that corporations' demand for money fell so low in that episode that their buffer stock demand disappeared. Moreover, since the mid-1970s, innovations appear to have been introduced at a markedly slower rate. Finally, smaller or less sophisticated corporations and households are likely to hold more or less than their desired level of money for an extended period of time. Most households and small corporations have relatively low money balances on average, and actions to adjust those balances to desired levels may be costly relative to any resulting benefit. If money finds its way into these "loosely" managed portfolios it may stay there for awhile.

24. For reviews and evaluation of this evidence, as well as a bibliography of the original articles, see David Laidler, "The Buffer Stock Notion in Monetary Economics," and "The Demand for Money—Yet Again," Carnegie-Rochester Conference on Public Policy, **On the State of Macro-Economics,** Eds.: Karl Brunner and Alan H. Meltzer. Amsterdam, North Holland, 1980, pp. 219–71; and John P. Judd and John L. Scadding, "The Search for a Stable Money Demand Function: A Review of the Post-1973 Literature," **Journal of Economic Literature,** September 1982, pp. 994-1023, and "Dynamic Adjustment in the Demand for Money: Tests of Alternative Hypotheses," **Economic**

Review, Federal Reserve Bank of San Francisco, Fall 1982, pp. 19–30.

25. This statement is obviously true for the pre-October 1979 period, when the Fed used the Federal funds rate or free reserves as operating instruments. It also can be argued that a great deal of interest rate smoothing (in the short-run) also occurred under the reserve operating procedures initiated in October 1979. See various articles on these control procedures in **New Monetary Control Procedures,** Volumes I and II, Board of Governors of the Federal Reserve System, February 1981. Especially, see papers by Stephen Axilrod, Fred Levin and Paul Meek, and Peter Tinsley and others. Also, see John P. Judd, "An Examination of the Federal Reserve's Strategy for Controlling the Monetary Aggregates," Federal Reserve Bank of San Francisco, **Economic Review,** Fall, 1982, pp. 7–18.

26. Karl Brunner and Allan H. Meltzer, "An Aggregative Theory for a Closed Economy, in **Monetarism,** edited by J. Stein. Amsterdam: North Holland, 1976, pp. 69–103.

27. John P. Judd and John L. Scadding, "What Do Money Market Models Tell Us About How to Conduct Monetary Policy?—Reply," and John P. Judd, "A Monthly Model of the Money and Bank Loan Markets."

28. For research in the early 1970s evaluating alternative intermediate targets of monetary policy see the series of articles by Michael Hamburger, Frederick Schadrack and Fred Levin under the heading "The Choice of Intermediate Targets," in **Monetary Aggregates and Monetary Policy,** Federal Reserve Bank of New York, 1974. For recent analysis see, Dallas S. Batten and Daniel L. Thornton, "M1 or M2: Which is the Better Monetary Target?" **Review,** Federal Reserve Bank of St. Louis, June/July 1983, and John P. Judd and Brian Motley, "M1 versus M2: Which Is More Reliable?" Working Papers in Applied Economic Theory and Econometrics, Federal Reserve Bank of San Francisco, No. 83-04, October 1983.