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Targeting M2: The Issue of Monetary Control

IDEALLY, AN INTERMEDIATE monetary policy target should be both reliably associated with the goals of monetary policy and readily controlled.[1] In the 1970s and early 1980s, M1 was the Federal Reserve's principal intermediate monetary aggregate target because of its close and stable relationship with nominal GDP. The principal issue then was how well M1 could be controlled. As an outgrowth of the controversy over M1 control, Congress passed the Monetary Control Act of 1980 (MCA) and the Federal Reserve replaced lagged reserve accounting (LRA) with contemporaneous reserve accounting (CRA). A principal objective of both the Act and the return to CRA was to enhance M1 control.[2]

The breakdown of the relationship between M1 and nominal GDP in the 1980s, however, caused the Federal Reserve to shift its emphasis away from M1. In 1986, the Fed dropped M1 from its list of intermediate policy targets and M2 became the Fed's principal monetary aggregate. As with M1, the decision to focus on M2 was made on the basis of the long-run stability of its relationship with nominal GDP.[3] The issue of M2's controllability, however, has received scant attention.

While the Federal Open Market Committee currently sets target growth rate ranges for M2, it is not the only aggregate that the Committee targets. Moreover, its growth is but one of many factors that the Committee considers in formulating and implementing monetary policy. Nevertheless, M2 does receive considerable attention both in the Committee's deliberations and in the press. Consequently, this article analyzes the issue of M2 control.

Under the existing system of reserve requirements, the Fed can successfully target and control M2 only by implicitly targeting and controlling M1. At times, M2 control may require relatively large open market operations. Other things the same, such large operations are potentially destabilizing for financial markets. Moreover, if M1 or total reserves grow very rapidly while M2 grows slowly, the market may have difficulty in interpreting the thrust of monetary policy or the Fed's intentions.

To mitigate these problems requires some changes in the existing structure of reserve requirements that, evidence suggests, would enhance significantly the Fed's ability to control M2. These changes should have a minimal effect

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[1]For modern survey of this literature, see Friedman (1990).

[2]The MCA extended Federal Reserve requirements to all depository institutions, removed differential reserve requirements by type of bank (Reserve City or Country)

and removed reserve requirements from a large category of non-transaction deposits, not included in M1.

[3]The empirical basis for focusing on M2 is established by Hallman, Porter and Small (1991).

on the operation of the reserve market and can be accomplished without extending reserve requirements to non-depository institutions or increasing the so-called "reserve tax" on depository institutions.

THE MONETARY CONTROL PROBLEM: AN OVERVIEW OF THE CENTRAL ISSUES

Issues in monetary control are often framed in terms of target variables, targets and instruments. For purposes of this analysis the target variable is taken to be M2, and the target is taken to be a specific level or growth rate for it.[4] The instrument is the tool the policymakers use to guide the target variable to the target.

The degree of monetary control is defined by the strength of the relationship between the target variable and the policy instrument: the stronger this relationship, the more precise the control. Two possibilities exist. First, there could be a *direct* relationship between the instrument and the target variable, in which changes in the instrument directly affect the target variable. Second, there could be an *indirect* link between the instrument and the target variable. In this case, changes in the instrument affect the target variable by affecting other variables, for example, the interest rate.

Monetary control is more precise the smaller the role of factors other than the policy instrument in determining the target variable. Indeed, control is best when there are no such "leakages." If the relationship between the target variable and instrument is indirect, precise control tends to be more difficult; factors other than the policy instrument affect not only the target variable, but also the relationship between the instrument and the target variable. Such leakages exist when the relationships between the in-

strument and the other variables or between the other variables and the target variable are neither strong nor precise. In any event, more and larger leakages imply less control.

Furthermore, when control is indirect, the relationship between the policy instrument and the target may be unreliable and may change from time to time, in response to such things as financial innovation and regulatory change. Hence, the ability to control monetary aggregates through such indirect channels may vary in ways that are both difficult to explain and impossible to predict.[5]

Implementing a monetary control procedure is complicated by other factors, such as the availability of information, the time horizon over which the policymaker wishes to affect control, possible "feedback" effects between other variables and the instrument and the ability to predict factors that affect the aggregate that cannot be controlled either directly or indirectly. Since the purpose of this paper is simply to point out the fundamental issues in controlling M2, the question of how best to implement a practical control procedure for M2 is not considered.

Controlling M2

M2 consists of M1 plus an array of savings-type deposits that are called the non-M1 components of M2 (NM1M2).[6] The Fed's ability to control M2 depends on its ability to control both M1 and NM1M2. If there were a direct link between both of these M2 components and both could be controlled equally well, there would be no difference between the Fed's ability to control M1 and its ability to control M2. But this is not the case.

Historically, the Fed has established direct control over the non-currency components of the monetary aggregates through a system of

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[4]Currently, the Federal Open Market Committee (FOMC) sets long-run target ranges for the growth rate of M2 from the fourth quarter of one year to the fourth quarter of the next. These growth rate ranges imply target ranges for the levels of the variables over the planning period. The FOMC also sets short-run growth rate ranges for M2 for the period between meetings, that is, the "intermeeting period." The growth rate ranges, in turn, imply targets for the level of M2. Hence, there is a one-to-one correspondence between targets for the growth rate and targets for the level of M2.

[5]For example, the uncharacteristically slow growth recently of the non-M1 components of M2 was unanticipated and is,

as yet, not understood. See Bullard (1992) and Carlson (1992) for a discussion of this issue.

[6]The non-M1 components of M2 consist of savings deposits (including money market deposit accounts), small denomination time deposits, general purpose broker/dealer money market mutual funds, overnight RPs issued by all commercial banks and overnight Eurodollars issued to U.S. residents by foreign branches of U.S. banks. See Hafer (1980) for a more detailed discussion of each component of M2 except money market deposit accounts.

reserve requirements.[7] In 1959, NM1M2 consisted primarily of time and savings deposits, most of which were subject to the Federal Reserve's reserve requirements. The MCA, however, eliminated reserve requirements on a broad class of NM1M2 and the remainder were eliminated in December 1990. Consequently, currently there is no direct relationship between the Fed's actions and NM1M2. In contrast, the MCA enhanced significantly the relationship between the Fed's instrument and M1.[8] Essentially, M2 now consists of one component, M1, which the Fed can influence directly, and another component, NM1M2, over which the Fed has no direct influence.

A detailed model of M2 control is presented in the appendix to this article; three conclusions emerge from it. First, the Fed's ability to control M2 is better the stronger the direct relationship between its policy instrument and M1 and the stronger the indirect effects of policy actions on NM1M2. Second, because there is a strong direct link between policy actions and M1, other things the same, M2 control is better the larger the proportion of M1 in M2. Finally, M2 control will be better the larger the indirect effects of policy actions on NM1M2 and, in particular, the larger such effects are relative to the total effect of policy actions on M1.

To see why this last point applies, suppose policy actions have no effect on NM1M2, either direct or indirect. In this case, M2 can be controlled only by manipulating M1 to completely offsett undesired movements in NM1M2. Since NM1M2 is large relative to M1, the re-

quired manipulation of M1 could be quite large. If the indirect effect of policy actions on NM1M2 were large and positive, that is, if an open market purchase results in an increase in NM1M2, the required manipulation of M1 would be much smaller. If, however, the indirect effects of policy actions on NM1M2 were negative, so that an open market purchase results in a decrease in NM1M2, open market operations would have to be pursued even more aggressively. In other words, the required change in M1 would have to be larger to offset the decline in NM1M2.[9]

THE RECENT BEHAVIOR OF M2

The empirical analysis of the basic issues raised above begins with a simple analysis of the behavior of M2 relative to that of M1. Figure 1 shows the share of M1 in M2 during the period of the official published series on the monetary aggregates, January 1959 to March 1992. The proportion of M1 in M2 declined through the late 1970s, decreasing from nearly 50 percent in 1959 to about 25 percent in 1977. Since then, the ratio has changed relatively little on average but has been somewhat variable. Moreover, the proportion of M2 growth accounted for by NM1M2 growth increased significantly between 1959 and 1977. This is illustrated in figure 2, which shows the growth rates of M2 and NM1M2 since 1959. Before the late 1970s, the growth rate of NM1M2 was consistently higher than the growth rate of M2. Since then, however, the growth rates of M2 and NM1M2 have been very similar.

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[7]Some analysts point out that depository institutions would maintain vault cash to service deposit inflows and outflows from such deposits so that the money supply could be controlled even in the absence of official reserve requirements. In effect, such institutions would be maintaining reserves equal to some fraction of these deposit balances, so effectively they would be imposing reserve requirement on themselves. Indeed, currently a significant number of depository institutions hold vault cash in excess of their reserve requirement. While it is no doubt true that depository institutions would hold cash for some purposes, there is no guarantee nor evidence that this "implicit reserve ratio" would be stable or systematically related to the level of deposits. Under the present system of reserve requirements, depository institutions attempt to economize on their holdings of excess reserves. This is what makes reserve requirements an effective tool of monetary control.

[8]The MCA required other changes that enhanced control over M1. Prior to the MCA, Federal Reserve reserve requirements applied only to member banks. Hence, some components of both M1 and NM1M2 were not directly linked to the Fed's policy actions and, therefore, were not

under the Fed's direct control. This constituted a potential source of leakage of monetary control for both M1 and M2. In addition, the reserve requirements on different deposits were different, hence, the relationship between the policy instrument and a particular monetary aggregate would change with shifts in the public's preference for certain types of deposits or financial innovations. See Garfinkel and Thornton (1989, 1991a).

[9]In the extreme and very unlikely case in which the negative indirect effects of policy actions on NM1M2 were larger than the sum of the positive direct and indirect effects of policy actions on M1, the process would be dynamically unstable.

Figure 1
The Ratio of M1 to M2

Percent   Monthly Data   Percent

1959 61 63 65 67 69 71 73 75 77 79 81 83 85 87 89 1991
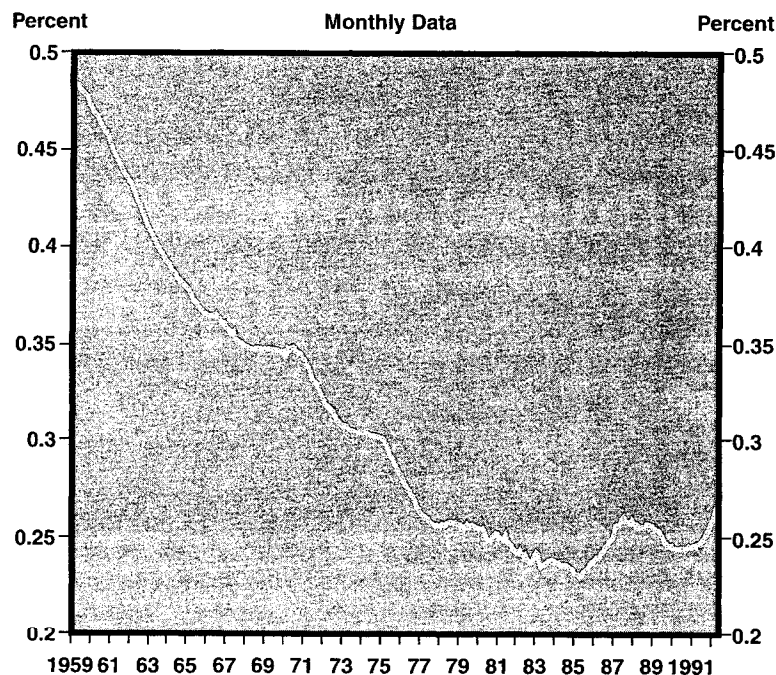
Estimates of the direct and indirect effects of policy actions on M1 and NM1M2 can be obtained by regressing these variables on total reserves. Total reserves (TR) is taken as the policy instrument because currency is supplied on demand and because changes in total reserves are closely related to open market operations.[10] The equations are estimated with all variables in first-differences (Δ).[11] Table 1

[10] Note that the regression analysis here takes the view that total reserves are exogenous. If that is not the case, then the correlation between reserves and say NM1M2 could be due to the effect of shifts in NM1M2 on reserves, rather than the other way around. For example, if NM1M2 declined the Fed might offset some of the effect of the decline in M2 by increasing total reserves and, consequently, M1. Note, however, that this would result in a negative relationship between NM1M2 and TR.

[11] The question of stationarity naturally arises when monetary and reserve aggregates are used. Such variables tend to grow over time at widely variable growth rates. Therefore, the null hypothesis of non-stationarity is frequently not rejected when applied to such univariate time series. The null hypothesis of non-stationarity may not be rejected even when first differences of such variables are used. Of course, reserve requirements establish a link between reserves and checkable deposits. This is certainly the case for reserves and total checkable deposits since the elimi-

nation of reserve requirements on nontransaction accounts. As a result, these variables should be cointegrated. This does not necessarily imply that there is a stationary linear relationship between reserves and the other monetary aggregates like M1 (currency is non-stationary) and NM1M2 or M2.

Furthermore, the first-difference of variables that are growing over time is not necessarily stationary. For example, if a variable grows at a constant 5 percent rate, then first-differences of the variable will get larger and larger over time. In short samples like the one used here, however, such non-stationarity is not very important. Indeed, the null hypothesis of a unit root in the first differences of total reserves is rejected at the 5 percent significance level. Because of this and because the coefficients are more difficult to interpret when growth rates are used, all the equations are estimated using first-differences of the levels of the variables. See Dickey, Jansen and Thornton (1991) for a discussion of stationarity and cointegration.

Figure 2
The Growth of M2 and NM1M2

Percent   Monthly Data   Percent
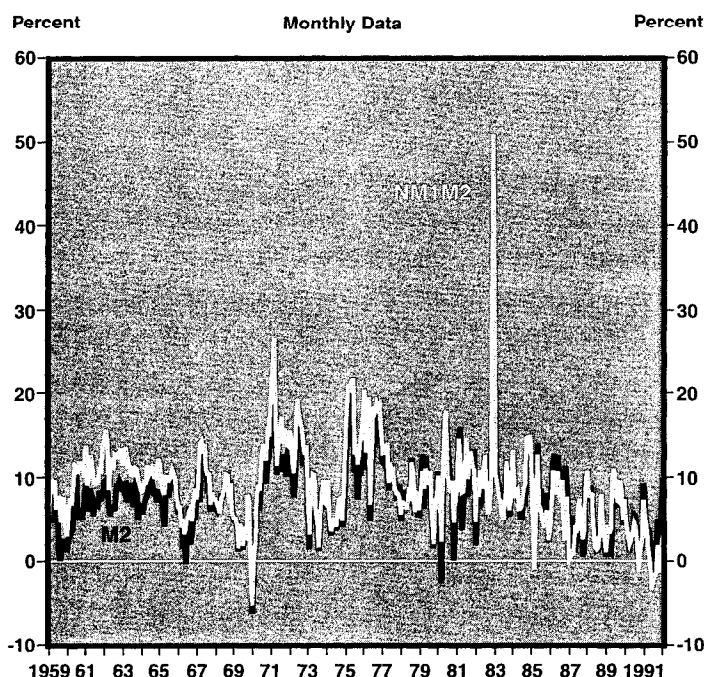
shows the results of regressing first-differences of the various monetary aggregates on ΔTR.[12] The regression of ΔM1 on ΔTR shows that there is a strong relationship between ΔM1 and ΔTR, with ΔTR explaining about 80 percent of the variation in ΔM1. Moreover, the estimated

coefficient on ΔTR is not statistically different from 8.33, that is, 1/.12, where .12 is the marginal reserve requirement on transaction deposits.[13] This suggests both that total checkable deposits (TCD) and currency are uncorrelated and that there are no indirect effects of

[12]The period begins with the effective implementation of the MCA in March 1984; see Garfinkel and Thornton (1989). Following the removal of reserve requirements on non-transaction accounts, excess reserves rose significantly above their pre-December 1990 level for about three months, then declined to about their previous level as depository institutions were surprised by this action. Consequently, dummy variables are included for January, February and March of 1991.

[13]This is not precisely correct because some reserves are held in the form of excess reserves and because reserve requirements on government and certain foreign deposits are not included in either other checkable deposits (OCD) or M1. Hence, the multiplier is smaller than 8.33. The amount of excess reserves or reserves needed to support these other deposits, however, is not large relative to total reserves, so the difference between the effective multiplier and 8.33 is quite small.

Also, this result simply could be due to the fact that the reserve series has been adjusted for reserve requirement

changes so the coefficient is biased toward 8.33, the reciprocal of the marginal reserve requirement, .12. However, the Board of Governors uses the average rather than the marginal reserve requirement to adjust its series for reserve requirement changes. See Garfinkel and Thornton (1991b) and Meulendyke (1990). Nevertheless, an equation involving TCD and total reserves not adjusted for reserve requirement changes was estimated. These data are available only on a not seasonally adjusted basis. When the seasonal dummy variables were excluded, the adjusted R-square was .89 and the estimated coefficient was 8.80—not significantly different from 8.33 at the 5 percent significance level. When monthly seasonal dummy variables were included, the adjusted R-square was .96 and the estimated coefficient was 7.44. In this case the hypothesis that the coefficient was equal to 8.33 is rejected at the 5 percent significance level—the t-statistic is 2.52. As a practical matter, however, this qualification does not appear to be particularly important as the degree of the bias is not large.

Table 1

Estimates of the Effect of Policy Actions on Various Monetary Aggregates, Monthly Data, March 1984 - March 1992

	ΔM1	ΔM2	ΔNM1M2	ΔTCD
Constant	1.863*	10.342*	8.469*	0.619*
	(7.85)	(12.38)	(10.41)	(2.76)
ΔTR	8.293*	8.690*	0.397	8.250*
	(19.37)	(5.77)	(0.27)	(20.37)
D.W.	1.784	0.727	0.612	1.853
Adj. R²	.802	.265	.000	.820

*indicates statistical significance at the 5 percent level.

policy actions on M1. This conclusion is reinforced by the fact that the adjusted R-square for the regression of the ΔTCD on ΔTR is nearly identical to that of the ΔM1 regression, and the fact that the coefficients on ΔTR are nearly identical in the two equations. Consequently, all of the effect of ΔTR on ΔM1 comes through the direct relationship between TR and TCD that results from the Federal Reserve's system of reserve requirements.[15]

The results for ΔNM1M2 show that the indirect effect of policy actions on this component of M2 are nil.[16] The adjusted R-square is zero and the coefficient on ΔTR, which captures both the direct and indirect effects of policy actions, is statistically insignificant. The lack of an effect on NM1M2 is reflected in the coefficient of ΔTR in the M2 equation. This coefficient too is not statistically different from 8.33, suggesting that the marginal effect of policy actions on M2 comes solely through their effect on M1.

It could be argued that the indirect effects of policy actions on M2, say, through interest rates, take time to work so that the potential for indirect control of M2 is not adequately reflected in the monthly data. This issue is investigated first by using lower frequency (quarterly) data and second by including a six-month distributed lag of ΔTR. The results using quarterly data, presented in table 2, are similar

[14]This coefficient measures both the direct and indirect effects of policy actions on M1. See the appendix for details. Because the total effect is not significantly different from the direct effect, the indirect effect must be insignificantly different from zero. See Garfinkel and Thornton (1991a) for an analysis of the relationship between currency and TCD.

[15]The lack of any significant serial correlation in the residuals of the estimated equation suggests that the remaining error is simply "control error" and seasonals.

[16]Note that the D.W. statistic indicates significant first-order serial correlation in all but the equation involving TCD. This is to be expected because, in these cases, a simple regression of the changes in these variables on the change in total reserves does not adequately reflect the process generating these variables. See the appendix to

Garfinkel and Thornton (1991a) for an illustration of this point using M1. This merely confirms the fact that the behavior of NM1M2 and, hence, M2 is not adequately explained by Fed policy actions. The presence of positive, first-order serial correlation does tend to bias the estimates of the standard errors downward. Hence, the reported t-stastistics may overstate the statistical significance of the change in total reserves in these equations.

Table 2

Estimates of the Effect of Policy Actions on Various Monetary Aggregates, Quarterly Data, 1984.2 - 1992.1

	ΔM1	ΔM2	ΔNM1M2	ΔTCD
Constant	4.790*	32.270*	27.481*	0.988
	(7.21)	(8.48)	(6.99)	(1.62)
ΔTR	9.683*	8.353*	−1.330	9.657*
	(18.27)	(2.75)	(0.42)	(19.85)
D.W.	1.394	1.065	0.917	1.684
Adj. R²	.917	.162	.000	.930

*indicates statistical significance at the 5 percent level.

Table 3

Long-Run Effects of Policy Actions on Various Monetary Aggregates, Monthly Data, March 1984 - March 1992

	ΔM1	ΔM2	ΔNM1M2	ΔTCD
Constant	1.471*	11.352*	9.881*	0.170
	(5.27)	(10.95)	(10.07)	(0.66)
β	7.976*	10.728*	2.752	7.874*
	(16.23)	(5.87)	(1.59)	(17.35)
θ	9.878*	3.567	−6.311*	9.958*
	(13.32)	(1.29)	(2.42)	(14.53)
μ	1.902*	−7.160*	−9.062*	2.084*
	(2.32)	(2.35)	(3.15)	(2.76)
D.W.	1.622	0.750	0.09	1.733
Adj. R²	.823	.275	.043	.847

*indicates statistical significance at the 5 percent level.

to those using monthly data. Again, policy actions have no effect—direct or indirect—on NM1M2; their effect on M2 comes only through their effect on M1.[17]

The estimates including a six-month distributed lag of total reserves, presented in table 3, give a broadly similar picture. The coefficient β measures the contemporaneous relationship

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[17]One difference is that the coefficient of the change in total reserves in both the M1 and TCD equations is larger than 8.33, and the difference is statistically significant. This result is puzzling. It appears, however, that it is due to the fact that the Board of Governors uses the average rather than the marginal reserve requirement when adjusting reserves for changes in reserve requirements. The average reserve requirement is significantly smaller than the marginal. This means that the coefficient of a regression of the change in TCD on a change in total reserves so adjusted will be substantially larger than 8.33. At high frequencies, however, the change in total reserves so adjusted is likely to reflect the actual change in reserves so that the coefficient is approximately equal to the reciprocal of the marginal reserve requirement. At lower frequencies or in distributed lag specifications that capture the long-run effect of a change in constructed total reserve series, the estimated coefficient better reflects the reserve requirement used in the constructed series.

between the changes in the dependent variable and ΔTR; θ measures the total effect of current and past changes in total reserves on changes in the dependent variable; and μ measures the sum of the lagged effects of ΔTR.[18] There is a significant association between changes in NM1M2 and changes in total reserves, as the adjusted R-square is statistically different from zero. The R-square is very small however, and all of the statistical significance is associated with the subsequent negative effect of total reserves on NM1M2.

The contemporaneous effect of a change in total reserves on M2 is larger in this specification than in table 1; note, however, that this is simply the sum of statistically significant and statistically insignificant effects (the coefficient for M1, 7.976, plus the coefficient for NM1M2, 2.752). For both ΔM1 and ΔTCD, the results are similar to those using quarterly data.[19]

For M2 and NM1M2, the subsequent effect of policy actions largely offsets the initial effect. That the subsequent effect is negative and statistically significant is somewhat surprising. If this result were robust and not merely the artifact of the particular sample period, it would create a potentially difficult problem for M2 control.[20] To see this, assume that M2 is currently below its target level and the Fed increases reserves to nudge M2 upward. This action would set in motion changes that would eventually lead to a reduction in NM1M2, creating a need for additional policy action. Anticipating this, policymakers would have to be more aggressive in increasing M1 to hit their M2 target.

The Recent Behavior of NM1M2 and Monetary Policy

The above analysis suggests that, if the Fed has been targeting M2, there should be more instability in the behavior of the policy instrument, and there should be an inverse relationship between the policy instrument and NM1M2. Data from the latter part of the 1980s is broadly consistent with M2 targeting. Figure 3 shows a 12-month moving average of the growth rate of total reserves and M1 since January 1959. Two things are evident from the figure: the relationship between M1 and total reserves improves dramatically following the effective implementation of the MCA, and the volatility of the growth rate of total reserves increases pretty dramatically in the 1980s.

Figure 4 shows the 12-month moving averages of total reserve growth and NM1M2 growth for the same period. The growth rates of total reserves and NM1M2 are not negatively correlated as strict M2 targeting would suggest they should be in the latter part of the 1980s. While there are periods since the mid-1980s when sharp accelerations in reserve growth are associated with significant decelerations in the growth rate of NM1M2, a pattern of compensating variations in the growth rates of these variables does not emerge.[21] Hence, these data do not appear to support the idea that the large, persistent swings in total reserve growth are associated directly with targeting M2.[22]

Nevertheless, as table 4 shows, reserve growth was much faster on average since the mid-1980s, and this faster reserve growth is associated with a significant slowing in NM1M2 growth.

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[18]Note that the estimated coefficients satisfy the restriction, $\beta = \theta - \mu$. The coefficients were estimated from a simple reparameterizaton of the change in the appropriate monetary aggregate on a constant term and the contemporaneous and six lags of the actual change in total reserves.

[19]It could be argued that the results are sensitive to the choice of the policy instrument. To investigate this possibility, two other policy instruments were considered, the adjusted monetary base and non-borrowed reserves. The evidence of monetary policy actions on short-term interest rates generally is strongest if non-borrowed reserves is used as the policy instrument [see Thornton (1988) and Christiano and Eichenbaum (forthcoming)]. Moreover, it is generally argued that the Fed controls M2 through its influence on short-term interest rates and the connection between these rates and the demand for M2. Consequently, non-borrowed reserves is a particularly important alternative policy instrument to consider. The results, however, indicate that the general conclusions drawn above are insensitive to the variable chosen as the policy instrument.

[20]One explanation for this result stems from the fact that the first difference of NM1M2 has a statistically significant, negative linear time trend during the period. It appears that the negative lagged effect of the change in total reserves on the change in NM1M2 in table 3 merely reflects the negative trend in the latter variable over the sample period. The trend coefficient is $-.102$ with a t-statistic of -4.59.

[21]For example, as M2 growth slipped to the bottom of the Fed's target range during the latter half of 1991, total reserve growth accelerated sharply.

[22]The fact that the estimate of μ in table 3 is negative, however, could be evidence of this behavior. See footnote 11 for a discussion of this point.

Figure 3
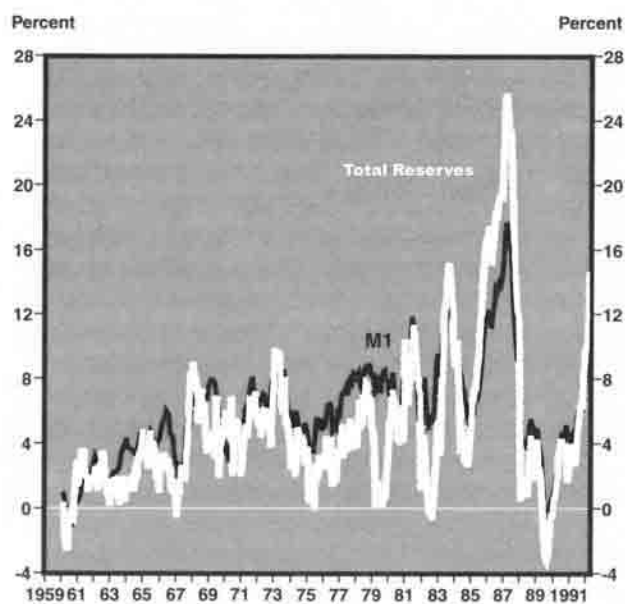## 12-Month Moving Average of the Growth of M1 and Total Reserves

Figure 4
12-Month Moving Average of the Growth of the Non-M1 Components of M2 and Total Reserves
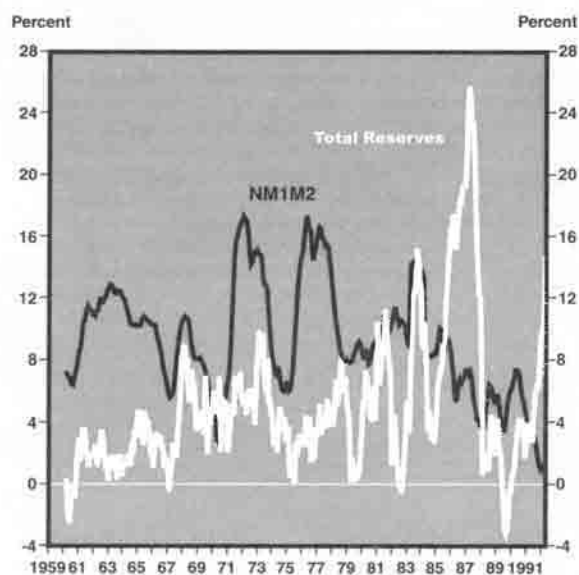
Table 4

Average Growth Rates of Various Monetary and Reserve Aggregates

Aggregate	1959.1-1984.1	1984.2-1992.1
TR	3.53%	8.37%
NM1M2	10.29	5.26
M2	8.57	5.78

Consistent with the Fed's objective for M2 growth during the period, M2 growth has slowed significantly since the mid-1980s.[23] Hence, while the evidence suggests that the Fed has not been attempting to target M2 closely over periods of up to a year, it is consistent with the Fed's targeting of M2 over a somewhat longer time horizon. Indeed, the experience on average over the latter half of the 1980s is broadly consistent with the Fed's paying increased attention to M2 and with the Fed's objectives for M2 growth.

ENHANCING M2 CONTROL

The analytical and empirical analyses above suggest that M2 can be controlled only by pursuing monetary policy actions to offset movements in NM1M2 over which the Fed has little or no control. While such actions are not necessarily destablizing, they could be, especially when actions are required to offset large, undesired movements in NM1M2. Moreover, such large changes in policy actions could be misinterpreted.

If the Fed wishes to target M2, changes in the structure of reserve requirements could be made that would significantly enhance its controllability. Such changes would eliminate the need for large swings in the policy actions of the Fed.

The empirical results here and elsewhere suggest that reserve requirements, like those imposed on the checkable deposits in M1, can be an effective way to establish a direct link over the deposit components of the monetary aggregates.[24] In other words, M2 control could be enhanced substantially by extending reserve requirements to the financial assets that make up NM1M2.

Most effective monetary control would be obtained if the percentage reserve requirement were the same for all assets that make up the aggregate. This would prevent shifts in the aggregate that are simply due to shifts in the public's preference between deposits with "high" marginal reserve requirements and those with "low" marginal reserve requirements. Control would also be best if the timing of reserve requirements on all categories of deposits were the same. As long as the timing is the same, this issue is of little consequence, especially if the objective is to control the monetary aggregate over a period of a quarter or more.[25]

The Problem of the Reserve Tax

Reserve requirements are often thought of as a "reserve tax" because they force depository institutions to hold a portion of their assets in the form of non-interest-bearing deposits at the Federal Reserve and because the marginal interest income from these funds, which the Fed invests in interest-bearing U.S. government securities, is rebated to the U.S. Treasury.[26] Imposing the current reserve requirement on transaction accounts to the non-transaction components of M2 would significantly increase the reserve tax on depository institutions.[27] This would put them at a competitive disadvantage and, undoubtedly, give rise to tax avoidance schemes and increased competition from other

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[23]The Federal Open Market Committee's target range for M2 decreased in a series of steps from 6 to 9 percent in 1984 to 2.5 to 6.5 percent by 1992.

[24]See Garfinkel and Thornton (1989, 1991a).

[25]See Thornton (1983) for a discussion of the timing issue as it applied to LRA and CRA.

[26]Of course, depository institutions can also hold reserves in the form of non-interest-bearing vault cash. Since many institutions are currently holding vault cash in excess of their required reserves, it may not be correct to suggest that such holdings impose a tax on these institutions.

[27]The reserve tax is only part of the net tax on depository institutions resulting from government supervision and regulation, and it may not be large relative to the other taxes and subsidies. For example, currently over three-fourths of the depository institutions satisfy their reserve requirements with vault cash, which they would probably hold in the absence of reserve requirements. Second, depository institutions are insured by the government at a fraction of the cost. On net, institutions probably receive a net subsidy from the government.

financial intermediaries. The adverse effect of extending reserve requirements to NM1M2 could be offset, however, by paying interest on required reserve balances held with Federal Reserve banks.[28]

Another problem would remain: requiring depository institutions to hold a significant portion of their assets as reserves might alter significantly the composition of their assets away from loans. This would further reduce the role of depository institutions in supplying credit to the economy.[29] Because of this, it would seem desirable to set the percentage reserve requirement on the components of M2 at a level that would leave the amount of total reserves held at their current level. Unfortunately, part of NM1M2—general purpose broker and dealer money market mutual funds—are not held at depository institutions. Hence, either these deposits would have to be exempt from reserve requirements or reserve requirements would have to be extended to non-depository institutions. The former option seems the most desirable for at least two reasons. First, extending reserve requirements to non-depository institutions would set a precedent and would raise other issues, such as whether deposit insurance should be extended to such institutions or whether they would be permitted to borrow at the Federal Reserve's discount window. Second, because such deposits account for only about 10 percent of M2, they constitute a relatively minor source of leakage for M2 control.

Exempting money market mutual funds from reserve requirements and imposing uniform requirements on the remaining non-currency components of M2 would require an average reserve requirement of about 2 percent.[30] Monetary control would be best if the marginal and average reserve requirements were the same, that is, if no deposits are exempt from reserve requirements. Logic suggests and the empirical evidence above supports the notion, however, that this is not a major consideration

as long as changes in the quantity of deposits that are exempt from reserve requirements are infrequent and relatively small.

The Effect on Bank Lending Rates of Funds Obtained by Managed Liabilities

It has been increasingly the case that depository institutions have relied on "managed liabilities" to meet changes in loan demand. During periods when loan demand is strong, institutions are more aggressive in setting higher rates on large and small time deposits and money market deposit accounts (MMDAs) to attract additional funds. Bank loan rates are equal to the rate paid on these deposits plus a spread that is determined by the competitive conditions in the market. If such funds were subjected to a 2 percent reserve tax, it would raise the marginal cost of funds obtained from managed liabilities by about 2 percent (1/.98). Whether this would harm the competitive position of depository institutions further, given that the total tax would be unchanged, is unclear. In any event, depository institutions have a competitive advantage because their deposit liabilities are federally insured, while their competitors' are not.[31] Nevertheless, any adverse effects of extending reserve requirements to most of NM1M2 could be mitigated by paying interest on required reserve balances with the Fed. The interest rate paid on these balances could be tied to market rates and set close enough to such rates to reduce the reserve tax to the point at which it plays an insignificant role in allocating credit.[32]

If these changes were made, the evidence suggests that M2 could be controlled without large swings in the use of the Fed's policy instrument. Moreover, increased M2 control could be achieved without increasing the reserve tax and with little or none of the other adverse effects commonly associated with reserve requirements.

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[28]Of course, it would require an act of Congress for the Federal Reserve to pay interest on reserves.

[29]See Kaufman (1991).

[30]The exact estimate of 1.76 percent is based on not-seasonally-adjusted data and total reserves not adjusted for reserve requirement changes for April 1992.

[31]It should be noted, however, that insurance premiums paid by depository institutions have increased significantly.

[32]For example, it could be paid in arrears and at a rate that is one-quarter of a percent below the rates depository institutions paid on their managed liabilities in M2 over the maintenance period. This would all but eliminate the reserve tax. If this were done on the basis of the average rate paid on such deposits, such a scheme would result in a slight subsidy to institutions that pay below average rates and a net effective cost to those paying above average rates. This might have the effect of tempering slightly the incentive of some institutions to bid aggressively for such funds.

SUMMARY AND CONCLUSIONS

Among other variables, the Fed currently sets target ranges for the M2 monetary aggregate. Without considering its desirability, this paper analyzes the controllability of M2 under existing institutional arrangements. Both the analysis and the data suggest that, currently, M2 can be controlled only through the Fed's control of M1. The evidence also suggests that M2 control is difficult and that hitting an M2 target may, at times, require very large changes in open market operations.

To counteract these problems, the paper suggests several ways in which the Fed could enhance M2 controllability while virtually eliminating the large changes in policy actions that can be required under the current system of reserve requirements. Enhanced M2 control could be achieved without increasing the reserve tax on depository institutions and without forcing depository institutions to shift their asset portfolios away from loans.

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Appendix
A Simple Model of M2 Control

This appendix presents a simple model of M2 control. In the following analysis, the policy instrument is taken to be the change in total reserves, $\dot{TR}$. The general results, however, do not depend on the use of total reserves. Other policy instruments such as the monetary base or non-borrowed reserves would yield similar results.

M2 consists of M1 and some savings-type deposits called the non-M1 components of M2, NM1M2. That is,

$$(1) \quad M2 = M1 + NM1M2.$$

Thus, changes in M2 per unit of time can be written as

$$(2) \quad \dot{M2} = \dot{M1} + \dot{NM1M2}.$$

M1 consists of currency, C, and total checkable deposits, TCD. Consequently, by definition M1 can be written as

$$(3) \quad \dot{M1} = (1+k)\dot{TCD},$$

where k is the ratio of currency to TCD. For the purpose of this illustration, k is assumed to be constant.[1]

The quantity of TCD is directly related to the Fed's policy instrument through the Fed's system of reserve requirements. That is,

$$(4)\ \dot{TCD}\ =\ (1/r)\dot{TR},$$

where r is the proportion of additional TCD that must be held in the form of reserves (vault cash and deposit balances at the Federal Reserve). Combining (3) and (4), yields

$$(5)\ \dot{M1}\ =\ ((1+k)/r)\dot{TR},$$

which establishes a direct link between M1 and TR.

It may be that policy actions also affect M1 indirectly, through their effect on other variables, X. That is,

$$(6)\ M1\ =\ h(X),$$

and

$$(7)\ X\ =\ j(TR).[2]$$

Together, they imply that

$$(8)\ \dot{M1}\ =\ f'\ \dot{TR}.[3]$$

Allowing for the possibility of both direct and indirect effects of policy actions on M1 and the possibility of an additive stochastic control error, u, that is independent of both the direct and indirect effects, the total effect of policy actions on

$\dot{M1}$ can be summarized as

$$(9)\ \dot{M1}\ =\ [(1+k)/r)\ +\ f']\dot{TR}\ +\ u.$$

Since, by construction, policy actions have no direct effect on NM1M2, the effect of such actions on NM1M2 can be expressed as

$$(10)\ \dot{NM1M2}\ =\ g'\dot{TR}+v,$$

where g' is obtained in a manner analogous to that used to obtain f', and v denotes the stochastic part of NM1M2 that is unrelated to policy actions.

The control problem for M2 can be illustrated most easily by considering the general condition that the effects of policy actions on NM1M2 are some proportion of their total effect on M1. That is,

$$(11)\ g'\ =\ \lambda[(1+k)/r+f'].$$

While there are no constraints on the value of λ, the fact that policy actions have no direct effect on NM1M2 makes it likely that $|\lambda| < 1$.

Combining equations 1 and 9-11 yields the following equation for $\dot{M2}$:

$$(12)\ \dot{M2}\ =\ [1\ +\ \lambda]\ [(1+k)/r\ +\ f']\dot{TR}\ +\ u\ +\ v.$$

Several aspects of equation 12 are worthy of note.

First, M2 control is generally better the smaller the control error and the stronger the indirect effects of policy actions on NM1M2, that is, the smaller are u and v.

Second, control will be better the larger the proportion of M1 in M2. This is not the case if $u > v$, but that appears to be extremely unlikely. This conjecture is supported by the empirical analysis in the paper.

Third, control will be better the larger the indirect effect of policy actions on NM1M2 relative to their total effect on $\dot{M1}$, that is, the larger the value of λ. This is so because the proportion of $\dot{M2}$ related to $\dot{TR}$ is larger in proportion to u and v the larger the value of λ. Indeed, if $\lambda = 0$ (which implies that $g' = 0$), then the only direct control over M2 would come through the Fed's control over M1. Control of M2 could be obtained only by offsetting shifts in v by manipulating M1. Since NM1M2 are large relative to M1, this could require relatively large changes in M1. If λ were negative, M2 control would require even more aggressive M1 policies.

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[1]This assumption is not critical to the major findings of the analysis. See Garfinkel and Thornton (1991a) for a recent criticism of this common assumption.

[2]In the case of M1, one could think of it as a situation in which M1 was equal to the money multiplier (mm) times total reserves, where the multiplier is some function of X. That is, $M1 = mm(X)TR$.

In this case, $\dot{M1} = mm(X)\dot{TR} + [\partial mm/\partial X)(\partial X/\partial TR)\dot{TR}]$. In the case of NM1M2, however, there is no direct relation-ship between these deposits and total reserves. Hence, there is nothing equivalent to a money multiplier for NM1M2.

[3]The function f is equal to h(j(TR)) which implies that $TR = p(t)$, where t denotes time. These functions are written in their general form, however, in the empirical section of the paper, it will be assumed that they are linear.