Controlling Monetary Aggregates

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It sometimes appears that many people have a basic misunderstanding of the manner in which the Federal Reserve attempts to implement monetary policy. Much discussion attributes the exact amount of a week's or month's movements in the monetary aggregates—whether the narrowly defined money supply, bank reserves, or bank credit—to a specific plan or action of the Federal Reserve. Many statements which describe how the Fed increases or decreases reserves to fix the amount of money seem derived from an incorrect interpretation of what the Federal Reserve does, based upon the highly oversimplified elementary textbook explanations of the procedure by which banking systems create money and credit.

Too few statements recognize that, in any period, the amount of money or bank credit created is the joint result of a complex interaction among households, commercial and industrial corporations, financial institutions, the Treasury, and the Federal Reserve. In addition, there appears to be a failure to recognize that the changes in money or credit as reported in the weekly or monthly statistics can differ greatly from the true situation. There are large random forces and estimating errors present in most short-period adjusted data. There are very few weeks—frequently even months—in which much of the reported movement in monetary aggregates is not primarily the result of statistical "noise."

What I propose to do first in this paper is to explain my understanding of how the Federal Reserve attempts to implement monetary policy. Then I shall discuss the large amount of noise which exists in the weekly or monthly published data. Finally, I will give some idea of the orders of magnitude of the reserve movements which would have to be forecast or offset in any attempt to control the narrowly defined money supply in a short period if operations

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attempted to control the amount of demand deposits or money by fixing the reserves available as a base for deposit creation.

The Federal Reserve Money Market Strategy

It is clear that, as a matter of fact, the Federal Reserve does not attempt to increase the money supply by a given amount in any period by furnishing a fixed amount of reserves on the assumption that they would be multiplied to result in a given increase in money. (The multiplier, it is recognized, would not be a constant but would vary from period to period, depending on relative interest rates and the actions of groups other than the monetary authorities. Sophisticated advocates of a policy based on highly controlled reserve generation recognize that monetary action must also be taken either to anticipate changes in the multiplier or to determine it.)

Instead, the Federal Reserve follows what has been termed a money market strategy:[1]

1. The operational directives of the Open Market Committee specify values (within a range) of money market variables that the manager of the Account is to attempt to maintain. It is expected that he can do so by altering the margin between required reserves and the amount of reserves furnished by the System, and by the form his market operations take. These margins are considered significant in their direct impact on bank operations; but, what is probably more important, they influence the interest rates on money market instruments.
2. The amount of marginal reserves to be furnished and the money market rates sought are picked so as to influence the direction and rate of change of a more remote intermediate monetary variable.
3. The desired rate of change in the intermediate monetary variable is that judged to be the most effective in aiding the economy to move toward its ultimate optimum goals.

[1] For those interested in more detailed statements of some of the concepts and problems, cf., J. M. Guttentag, "The Strategy of Open Market Operations," *Quarterly Journal of Economics,* Vol. LXXX, No. 1 (February 1966), pp. 1-38; and P. H. Hendershott, *The Neutralized Money Stock* (Homewood, Illinois: Richard D. Irwin, Inc., 1968), 159 pp.

The present discussion is my personal construct. As indicated in the text, many and even most members of the FOMC might disagree with my construct. They would build an entirely different one of their own to express their view of what are obviously identical operations.

A possible side advantage of this strategy is that it can be followed even though it might be impossible to get agreement among the members of the FOMC either as to ultimate goals, or to the form or level of an intermediate monetary variable, or as to how to define what strategy is being followed.

Each decision maker may believe one or the other of the following types of variables is most significant at a given time:

Intermediate Monetary Variables

(1) Monetary or credit aggregates such as: the money supply narrowly or broadly defined; deposits of financial institutions; member bank liabilities or credit; broader concepts of credit flows, liquid assets, wealth, and lending.
(2) Relative and absolute real or nominal interest rates.
(3) The general atmosphere of the credit markets and banking as reflected in expectations; demand for credit; the amount of credit being supplied; rates of change.

Because significant relationships exist among all these variables, influencing one will move others in the same direction although not necessarily to the same degree. As a result, if there is an agreement as to the operational variables the manager is directed to follow, there need be no meeting of minds with respect to which intermediate monetary variables should be controlled or as to the proper degree of control.

The movements of these intermediate variables can be influenced by a change in the level of any of the policy instrument variables within the power of the Fed. These are primarily:

Policy Instrument Variables

(1) The purchase or sale of open market securities.
(2) Repurchase agreements on securities.
(3) The discount rate.
(4) Regulation Q ceilings.
(5) Required reserve ratios.

A change in an instrument variable reacts with other forces in the credit markets and the economy to shift the demand and supply for

funds. At each Open Market Committee meeting, estimates are made as to the effect changes in particular instrument variables will have on those money market variables which respond most clearly to Federal Reserve policy, namely:

Money Market Variables

(1) Borrowings of member banks from the Federal Reserve.
(2) Net free reserves.
(3) The Federal funds rate.
(4) Call money rates to government bond dealers.
(5) The three-month bill rate.

The expected movements in the money market variables are accompanied by estimates of growth in the intermediate monetary variables. Given the projected state of the economy, the banking system, Treasury operations, etc., each possible setting of the money market variables is expected to lead to a unique growth rate for an intermediate monetary variable. We must realize, however, that variables will fluctuate around their trends in the short-run period.

Debates may occur with respect to desired goals; desired movements of the intermediate financial variables; the importance of specific instrument variables; or as to the correctness or errors in the judgment models--which are used to estimate changes in the economy, as well as the changes in the intermediate variables, and the effects on the money market of shifting the instrument variables.

All these considerations are summed up when the manager of the Open Market Account is instructed to buy or sell securities in order to achieve specific (within a range) values for the money market variables. The manager of the Account operates in the securities markets accordingly. At times, because of outside influences, the specified relationships for all variables cannot be achieved simultaneously. When this occurs, the manager uses his discretion in an attempt to achieve those settings which he believes are most consistent with the goals of the Committee.

This intent to control intermediate monetary variables through the money market variables is shown by the inclusion in most directives of a proviso clause. The manager is provided the growth rate for the bank credit proxy (within a range) expected to result from the

directed settings of the money market variables. If the proxy moves outside the projected limits, he is instructed to operate in the open market so as to alter the money market variables in order to influence the credit proxy toward its projected path. The proviso clause is an attempt to correct for errors which may arise if the relationships among the money market variables and the intermediate monetary variables have not been projected correctly, or if errors were made in projecting the other financial and economic variables which also influence the proxy's growth.

This picture of operations can be expressed symbolically:

Where:	IMV	=	Intermediate monetary variable	
	R_b	=	Borrowed reserves	
	R_f	=	Free reserves	
	Q	=	Q ceiling	
	r_b	=	Treasury bill rate	
	r_f	=	Federal funds rate	
	r_c	=	Call money rate to dealers	
	GNP	=	Economic activity	
	L	=	Liquidity preference of corporations, banks, financial institutions, etc.	
	T	=	Treasury cash management	
	r_d	=	Discount rate	
	RR	=	Required reserves	
	S	=	Open market operations	
Then:	Δ IMV	=	$M (R_b, R_F, Q, r_b, r_f, r_c, GNP, L, T)$	(1.0)
	$r_b; r_f; r_c$	=	$r (r_d, R_b, R_F, GNP, L, T)$	(2.0)

The change in the intermediate monetary variable, however defined, is determined by the interaction of the Federal Reserve controlled variables; certain money market rates strongly influenced by the Federal Reserve; changes in output and prices; movements in the financial sector and liquidity functions; and the Treasury as in (1.0).

The Federal Reserve action may influence directly the IMV. It also will influence money market rates as in (2.0).

$$\Delta \, RR_{T+2} \cong \Delta \, IMV \qquad (3.0)$$

$$R_b; R_f = R \, (\Delta \, RR, S) \qquad (4.0)$$

The change in the intermediate monetary variable approximately determines the change in required reserves two weeks later (3.0). Given the change in required reserves, the manager of the Open Market Account can (within the limits of his operating misses) determine exactly the level of net free reserves (4.0). The banking system, given a level of net free reserves, determines its own level of borrowings and excess reserves simultaneously.

When the manager is directed to influence the money market variables and, through them, intermediate monetary variables, he cannot at the same time control the changes in total reserves. Most reserve additions will follow directly from the previous changes in the IMV (credit proxy). The manager will operate to furnish slightly more or less than the change in required reserves (4.0) to interact with the market (2.0) and obtain the settings he is attempting to achieve. This means, in most cases, he will furnish most (say, 90 per cent or more) of the changes in required reserves which have been previously determined by the various market interactions.

Technical Operations

Let us express this in terms of actual weekly operations. At the start of a week, the manager has a report of borrowings and an estimate of excess reserves, and, therefore, of net borrowed reserves for the previous week.

The manager also knows the amount by which required reserves will change for the week, since they depend upon changes in deposits two weeks previously. He has projections of movements expected in certain so-called technical factors, which will increase or decrease the amount of reserves available to member banks in the current week. These include float, currency in circulation, Treasury deposits at Federal Reserve Banks, gold and foreign accounts, Federal Reserve foreign currency holdings, and all other items.

He sums these projections. By comparing them to the changes in required reserves, he can estimate the amount that banks would have

to add or subtract from the free reserves of the week before if he takes no action to increase or decrease reserves by Federal Reserve security operations. For example, assume during week No. 1, banks borrowed $600 million and had net borrowed reserves of $500 million. If the total change in required reserves and the technical factors indicate an increased requirement of $500 million, he knows—if his projections are correct—that if he does not change his security accounts, banks will have $1 billion of net borrowed reserves in week No. 2. They will have to borrow somewhere in the vicinity of $1.1 billion, but borrowings will vary somewhat because individual banks can alter the amount of excess reserves that they carry during the week.

At this point, the manager can determine a tentative program of open market operations in order to meet his instructions from the FOMC with respect to the desired range of money market variables he is to attempt to achieve. During the course of the week, he receives five types of information:

1. The changes in interest rates reported in the market.
2. Borrowings at Federal Reserve Banks.
3. New estimates of changes occurring from technical factors as the week progresses.
4. Background information on supply and demand in the money markets.
5. Changed projections of movements in the monetary aggregates including the credit proxy, M_1, and M_2. These changes arise from revisions of prior weeks' information, and from data on current deposit movements in a sample of banks.

As the week progresses, the manager performs open market operations in an attempt to achieve the constellation of borrowings and rates shown in his instructions from the FOMC. If one or another of the variables differs from the expected relationship, the manager must use his background information and his judgment in determining the operations which will best meet the Committee's objectives. If the projections for the intermediate monetary variables move outside the range projected for the Committee, the manager will alter his operations so as to change the money market variables in the direction deemed likely to influence the IMV's in the desired direction.

The manager will not be able to meet his exact objectives in any week. The projections of technical operations may be in error. Banks

may or may not borrow reserves after it is too late for him to operate. Because of sudden changes, he may not be able to accomplish his desired operations. Finally, the estimates of the monetary aggregates may be in error.

"Noise" in the Monetary Aggregates

Reported changes in the monetary aggregates can vary from the basic underlying trend of monetary policy. As one would expect, the longer the period under consideration the smaller the impact of the non-policy-determined movements. Still, even over a quarter, these other movements are large.

The movements are actually of two very different types. The first, which I have labeled "noise," consists of: operating misses; errors in estimating the actual data at the time that operations end for a period; shifting seasonals; and irregular movements which are temporary and the product of special factors. The second type arise from two facts already noted: a) under the current money market strategy, Federal reserves are a dependent variable only partly controlled by the Fed, b) furthermore, even if the Fed did fix the exact rate of reserve increments, large variations in money and credit could still occur because the banks and the market determine how total reserves are divided among the bases supporting different types of deposits.

Operating misses arise because of errors in reporting, errors in sampling, or information not available when operations must be ended. For some time, the size of misses has been decreasing steadily. The misses are small compared to the totals, but large compared to weekly or monthly changes.

The seasonal factors are large. In addition, they are dominated by irregular forces, particularly over short periods. In many cases, it is hard to determine, by analysis of historical data, what corrections should be made in the figures if the objective is to arrive at a true measure of the changes in the monetary aggregates required to measure either the underlying trend of monetary policy or those movements expected to influence spending or prices and quantities.

The demand for money will vary greatly depending on the day of the week in which a month, quarter, or year ends. The same is true of the day on which traditional dividend and tax dates fall. The changes in tax rates and collection dates and percentages have been important in most recent years. The day on which the Treasury borrows and the form of its borrowings are critical. While estimates

are made currently as to the impacts of these factors, they still confuse the judgment of seasonal variation, particularly as observed at the time operations take place.

Irregular Elements Bias Analysis

The irregular elements include seemingly minor factors, such as the financing of a corporate take-over bid, a breakdown of a bank computer, or a snow storm. Each of these may cause even weekly average changes to vary by over 100 percent or more. As an example of such movements, examine pages A17 and A18 of the January 1969 *Federal Reserve Bulletin.* Each carries an estimate for the December 1968 change in the narrowly defined money supply. In one case, the increase is reported as $1.2 billion, or at an annual rate of growth of 7.5 percent. In the second case, the increase is estimated at $8.4 billion, or at an annual rate of 53 percent. Neither figure is in error. The first weights the extremely unusual end-of-year changes in one way; the second in a different way. Neither gives a very good sense of the underlying trend, because of the dominant influence of very special factors that were rapidly reversed. These irregular forces were large enough, however, to bias strongly the analysis of the two adjacent quarters in which they occurred – and, for many purposes, even the annual data for the two years.

Data calculated at the time operations end are the significant data for operational purposes, but theoretically not for any policy impact. These estimates are subject to revisions as more information becomes available, as full universe data replace samples, and as seasonal forces are re-estimated. Revisions between the money supply as first reported and as currently reported averaged $152 million per week over the past three years. They had a range of from -$1.4 billion to $1.0 billion. Their mean deviation was over $490 million. Clearly, they make a significant amount of noise which must be taken into consideration when one looks at the reported weekly changes. In a somewhat similar manner, we might note that one part of the money supply, namely, non-member bank demand deposits, is not subject to reserve requirements of the Federal Reserve, nor is information on these movements readily available. Their variance is rather great. Their share of total demand deposits has been growing. The weekly and monthly data for this component are estimates from other types of data. Specific information on how this component has changed is available only semi-annually with a lag of four to eight months.

Total Reserves and the Narrowly Defined Money Supply

Finally, let me comment briefly on some of the problems of attempting to control, in any short period, the narrowly defined money supply. Many unsophisticated comments and theories speak as if the Federal Reserve purchases a given quantity of securities, thereby creating a fixed amount of reserves, which through a multiplier determines a particular expansion in the money supply.

Much of modern monetary literature is actually spent trying to dispel this naive elementary textbook view which leads people to talk as if (and perhaps to believe) the central bank determines the money supply exactly or even closely—in the short run—through its open market operations or reserve ratio. This incorrect view, however, seems hard to dislodge. Almost daily, I read that last week or last month the Fed increased the money supply by 5 percent.

Such statements are simply inaccurate. The growth of the money supply in any period is the result of actions taken by the Federal Reserve, the Treasury, the commercial banks, and the public. Over a long period, the Fed may play a paramount role, but this is definitely not the case in the short run. As I have indicated—to the best of my knowledge—the Fed has not attempted to control, within rather wide limits, the growth of the narrowly defined money supply in any week or month.

It should be clear from previous statements that the Federal Reserve does attempt to influence—but not to control exactly—the expansion of bank credit and, therefore, of total reserves. However, we must recognize wide differences between movements in total reserves and the money supply.

Over the past 10 years, the rate of growth of the money supply has averaged about 80 percent of the rate of growth in total reserves. On the other hand, the coefficient of determination (r^2) between the money supply and total reserves for quarterly changes (in the seasonally adjusted data) in this period is only .27; or, on the average, nearly three-fourths of the quarter-to-quarter movements in the two totals are not statistically related. For year-to-year changes, the r^2 is .73. These are measures of the way in which the market redistributes its use of total reserves in any period.

If it were determined that the Fed ought to change its operating targets, what type of system might be devised to control the money

supply? Let me deal briefly with a few possibilities while examining some of the related orders of magnitude so as to give some indication of the types of factors involved. I obviously have not attempted to analyze each of these methods in detail. I have outlined primarily one extremely simplified procedure to show the type of movements and problems involved. While this procedure, clearly, is not that assumed in sophisticated models, it seems to me to follow the type of naive model many people do appear to have in mind.

One method would be to consider changes in M_1 as the dependent variable in the type of model now used to predict and somewhat to control the bank credit proxy. Included among the independent variables in such a model would be the existing instrumental variables controlled by the Fed. These variables could then be altered in such a manner as hopefully to result in the desired levels for M_1, the dependent variable. A model could be developed and used for any period such as a week, month, quarter, or year, depending on what was believed to be theoretically relevant and operationally feasible.

If it were found that a high correlation existed between M_1 and any one or a group of instrumental variables and this correlation was maintained in actual operations, such a model might be rather simple. A problem would still remain as to whether or not the effects of operating the monetary variables to achieve this particular goal would be as efficient as aiming them at a variety of other goals, but that would be a question in basic decision-making rather than an operating problem.

A second procedure would be one similar to that now used to estimate the operations needed to offset technical and seasonal movements in reserves and reserve requirements. Rather than operating so as to obtain certain money market conditions, the manager could use an estimating system similar to his current one and could conduct open market operations in an attempt to control the amount of reserves available to support those demand deposits counted as part of the money supply, by exactly offsetting all other forces furnishing or utilizing reserves.

Finally (and, surprisingly to me, the most difficult to conceptualize, since it seems to be what most imagine to occur), would be some system in which open market operations attempted to furnish by a formula a given volume of reserves for expansion of the money supply. This type of system, I imagine, would note deviations of past movements from a desired level and would attempt to close the gap

between actual and desired reserve levels by some form of distributed lag of the type developed in many inventory theories.

Controlling Reserves Available for Expansion of the Money Supply

The difficulty with attempting to change the reserve base in order to control directly the money supply arises from the fact that there is no exact relationship between them. The money supply can be altered by non-reserve movements while reserves can be used to support non-money supply expansions.

Changes in the money supply are equal to:

$$MS = D + ND + FD + C - F$$

Where:

MS	=	Narrowly defined money supply.
D	=	Demand deposits (private) at member banks (less interbank deposits).
ND	=	Demand deposits (private) at nonmember banks (less interbank deposits).
FD	=	Foreign demand deposits at Federal Reserve Banks.
C	=	Currency outside member banks.
F	=	Float.

The naive assumption seems to be that the growth in the money supply can be controlled by the Federal Reserve altering the amount of reserves available as a base for member bank demand deposits.

When we look at Federal open market operations, we find that the amount of reserves furnished are divided among many uses, namely:

$$\Delta (S+B) = \Delta TF + \Delta \frac{D}{rd} + \Delta \frac{GD}{rd} + \Delta \frac{NIBD}{rd} + \Delta \frac{TD}{rt} + \Delta ER + \text{seasonal reserves.}$$

Where:

S	=	Securities.
B	=	Borrowings.
TF	=	Technical factors (see page 8).
rd	=	Required reserve ratios for demand deposits.

rt	=	Required reserve ratios for time deposits.
D	=	Demand deposits at member banks.
GD	=	Government deposits at member banks.
NIBD	=	Net interbank deposits among member banks.
TD	=	Time deposits at member banks.
ER	=	Excess reserves.

We can now see what forces must be estimated if we were to furnish an amount of reserves in any period so as to offset exactly all other uses and to allow the amount needed as a base for a specific growth in the money supply. Namely:

$$\Delta\ (S+B) = \frac{MS^*}{rd} + AOR\ (\text{All other reserves})$$

Where: MS^* = the desired change in the money supply.

$$AOR = \frac{(ND + F + C + FD)}{rd} + ER + \frac{GD}{rd} + \frac{NIBD}{rd} + \frac{TD}{rt}$$

$$+ \text{seasonal reserves} + TF$$

We see that, in addition to operations to offset the technical factors and seasonal forces which are both now part of operations, estimates and offsetting operations would be required for changes in the money supply not dependent on reserves at the Federal Reserve, on changes in excess reserves, and on movements in government, interbank, and time deposits. Insofar as these operations changed total deposits in a period, they would have to be matched by equivalent alterations in bank assets or credit.

What are the orders of magnitude and some of the problems which appear to be raised by this concept? Tables I and II give some of the background information needed for this analysis.

Column 1 of the table shows the current estimate of the actual growth in the money supply for the past six months, distributed equally over the entire period. This growth was at a 3.3 per cent annual rate for the half-year period (which I imagine was a rate satisfactory to many). The second column shows the changes in the money supply due to forces not under the control of the Federal Reserve, namely, currency, non-member bank demand deposits, float, and foreign deposits. We note that for this period, these other components grew at a 6.2 percent annual rate, so that the increase in the member bank demand deposit component was at a 1.3 percent annual rate. We also note that the growth of these other components

was irregular. As a result, we see in column 7 that, if it were desired that the expansion of the money supply be constant, the amount of reserves furnished for the theoretically Fed-controllable component could not be constant, but rather they would have to fluctuate to offset the irregular movements in the remainder.

The size and irregularity of the necessary movements are shown in columns 4 and 7. From these columns, we can calculate that the average increase in member bank deposits was almost $30 million per week, or $120 million per four-week period, and $383 million per quarter. The desired weekly increments varied from $938 million to minus $1,058 million. Monthly variations ranged from $992 million to minus $588 million. During this period, the average reserve requirements behind these deposits averaged about 15.2 per cent. Therefore, expressing the desired change in demand deposits in terms of reserves, we find the amount to be furnished in an average week would have been $4.4 million, with a four-week average of $18 million, and the amount needed for a quarter, $58 million. The weekly range, however, would have been from $141 million to minus $159 million, with a monthly range from $151 million to minus $89 million.

These requirements to meet a steady growth in the money supply can be compared to the actual fluctuations which occurred. Such actual movements are a measure of irregular and transitory forces, and errors in the seasonal correction mechanism. When we examine column 5, we find that the actual changes in member bank demand deposits, seasonally adjusted, on a weekly basis averaged $30 million with a range of $2,310 million to minus $1,950 million. For a month they averaged $128 million with a range of $2,139 million to minus $145 million.

Column 8 shows the reserves behind these movements. This column is a rough estimate of the average weekly movement in required reserves needed to support irregular forces in the demand deposit component. The reserves required for irregular movements averaged $130 million, or 29 times the desired weekly increment, while the range around the desired $4.4 million was from $359 million to minus $303 million. The changes in a month or a quarter were, of course, relatively far less. But they, too, were considerable at $213 million—or 11 times the desired monthly increase.

The final two columns of Table I give an indication of how large the weekly technical open market operations would have had to have been to offset the other factors furnishing or absorbing reserves, in an attempt to furnish the desired amount of reserves for an orderly

TABLE I

MOVEMENTS IN THE MONEY SUPPLY AND ITS RESERVE COMPONENTS

November 27, 1968 - May 28, 1969

DEPOSITS, SEASONALLY ADJUSTED
(In Million Dollars)

	(1) Desired Money Supply	(2) Component of Money Supply Not Based on Member Bank Reserves	(3) (4) Desired Member Bank Private Demand Deposits		(5) (6) Actual Member Bank Private Demand Deposits	
			Level	Change	Level	Change
Nov. 27, 1968	193,221	77,003	116,218		116,218	
Dec. 4	193,342	77,253	116,089	-129	115,682	-536
11	193,463	77,117	116,346	+257	115,977	295
18	193,585	76,733	116,852	+506	115,952	- 25
25	193,706	76,496	117,210	+358	116,174	222
Jan. 1, 1969	193,827	76,284	117,543	+333	117,417	1243
8	193,948	77,463	116,485	-1058	117,981	564
15	194,070	77,521	116,549	+ 64	116,237	-1744
22	194,191	77,278	116,913	+364	116,283	46
29	194,312	76,895	117,417	+504	114,718	-1565
Feb. 5	194,433	76,888	117,545	+128	115,904	1186
12	194,555	77,446	117,109	-436	115,483	-421
19	194,676	78,145	116,531	-578	116,681	1198
26	194,797	77,328	117,469	+938	117,011	330
Mar. 5	194,918	77,787	117,131	-338	115,967	-1044
12	195,039	78,036	117,003	-128	115,557	-410
19	195,161	78,129	117,032	+ 29	115,881	324
26	195,282	78,401	116,881	-151	116,169	288
Apr. 2	195,403	78,323	117,080	+199	116,833	664
9	195,524	78,773	116,751	-329	119,143	2310
16	195,646	79,167	116,479	-272	117,193	-1950
23	195,767	78,541	117,226	+747	116,094	-1099
30	195,888	78,574	117,314	+ 88	114,845	-1249
May 7	196,009	78,647	117,362	+ 48	115,357	512
14	196,131	79,300	116,831	-531	115,814	457
21	196,252	79,184	117,068	+237	117,709	1895
28	196,373	79,389	116,984	-84	116,984	-725

TABLE I

MOVEMENTS IN THE MONEY SUPPLY AND ITS RESERVE COMPONENTS

November 27, 1968 - May 28, 1969

(In Million Dollars)

	Reserves Required For:			
	(7) Change in Desired Member Bank Deposits S.A.	(8) Change in Actual Member Bank Deposits S.A.	(9) Seasonal Movements in Member Bank Private Demand Deposits	(10) All Other Reserve Movements AOR*
Nov. 27, 1968				
Dec. 4	-19	-81	+241	105
11	+39	44	+ 90	-532
18	+76	- 4	+346	285
25	+54	-33	- 30	141
Jan. 1, 1969	+50	187	+406	515
8	-159	85	-211	-259
15	+10	-262	- 15	889
22	+65	7	-241	15
29	+76	-236	-196	-345
Feb. 5	+19	178	- 90	-223
12	-66	-63	-271	157
19	-87	180	-211	362
26	+141	50	-196	-346
Mar. 5	-51	-157	+301	-258
12	-19	-62	+15	-170
19	+4	49	+75	-182
26	-23	43	-226	-95
Apr. 2	+30	100	+120	-199
9	-51	359	+140	-643
16	-42	-303	+358	-38
23	+116	-171	-124	1259
30	+14	-194	-202	473
May 7	+7	80	-264	737
14	-83	71	-140	-353
21	+37	295	-233	-124
28	-13	-113	+47	8

*This is the sum of all other reserves (AOR) less those required to offset the component of the money supply not based on member bank reserves (column 2).

expansion of the money supply. Column 9 shows that the seasonal changes in member bank reserves behind demand deposits averaged $19.7 million per week, with a range of $406 million to minus $271 million. Its monthly average was $85 million, with a range of $647 million to minus $768 million. The final column shows the week-to-week movements in reserves that would have been necessary to offset all other factors (AOR) adding or subtracting reserves.

Table I shows data on a week-by-week basis for the past six months. Table II shows average values for roughly the same reserve data for the past three years. The first column shows actual variations in the reserve equivalent of movements in the money supply. We note that over the three-year period, the average change in the reserve equivalent (money supply multiplied by .152) was $23 million per week, $97 million per month, and $330 million per quarter. The remaining data in the column show the range, and deviations for this series. These are the summary average equivalents of column 1 in Table I.

The last column shows that, to furnish reserves for seasonal variations in demand deposits, about $248 million in reserves (the mean deviation) would have to be added or subtracted per week, $299 million per month, etc. The range and standard deviations of the seasonal component are also shown. The second-last column shows the extent of operations needed if all other reserve sources and uses except the movements in the money supply were to be accommodated. Again, the most significant figures are the $405 million weekly average, and the $366 million monthly average operations required.

The columns between the first and last two measure the sometimes-offsetting factors that are covered by these reserve changes. Column 2 contains the other components of the money supply; column 3 shows the reserve operations now engaged in to offset technical factors, etc.

The two tables can be summarized in two statements: The irregular movements in the money supply compared to its underlying trend are large. When we compare the reserves which would have to be furnished in a period to the average irregular changes for the similar periods over the past three years, the ratios for a week are 243/4.4, or 55; and 304/18, or 17, for a month; and 350/58, or 6 times the desired increase, for the quarter.

The movements in other forces supplying or absorbing reserves, in addition to those required to expand or contract the money supply,

TABLE II

AVERAGE MOVEMENTS IN THE RESERVE EQUIVALENTS OF VARIOUS SOURCES AND USES OF MEMBER BANK RESERVES AND MONEY SUPPLY COMPONENTS
1966 - 1968

(In billions of dollars; not seasonally adjusted)

Period and type of average	MS[1] Money supply	All Other Reserves							Reserves required for seasonal movements in demand deposits
		(F-C-FD-ND)[1] MS component not based on MB reserves	TF Technical factors	ER Excess reserves	GD[1] Government demand deposits	NIBD[1] Net interbank deposits among MB's	TD[2] Time deposits at MB's	AOR All other reserves	
1 Week:									
Av. Δ per period	.023	-.012	.048	.001	.001	.002	.012	.052	------
Range	-.669	-.182	-1.043	-.553	-.505	-.193	-.034	-1.733	-.576
	to .790	to .144	to .871	to .374	to .648	to .227	to .047	to 1.554	to .591
Mean deviation	.243	.090	.304	.162	.171	.051	.012	.405	.248
Std. "	.289	.077	.384	.206	.212	.067	.014	.506	.210
4 Weeks:									
Av. Δ per period	.097	-.051	.207	-.002	.002	.010	.048	.212	------
Range	-.958	-.193	-.975	-.141	-.395	-.152	-.043	-1.008	-.890
	to .699	to .191	to .998	to .105	to .382	to .143	to .130	to 1.051	to .526
Mean deviation	.304	.063	.358	.045	.147	.048	.032	.366	.299
Std. "	.380	.085	.442	..058	.184	.062	.040	.442	.364
13 Weeks:									
Av. Δ per period	.330	-.170	.739	-.006	.009	.037	.154	.762	------
Range	-.122	-.350	.030	-.052	-.255	-.034	-.044	-.232	-.415
	to .988	to-.016	to 1.857	to .046	to .136	to .138	to .249	to 1.612	to .596
Mean deviation	.350	.115	.397	.028	.088	.041	.070	.426	.316
Std. "	.380	.123	.502	.032	.117	.051	.087	.555	.374

1/ Each of these components has been multiplied by .152 to get its reserve equivalent.

2/ Time deposits have been multiplied by .042 to get their reserve equivalent.

are also large compared to any desired changes in the money supply. For this three-year period, the ratios are 506/4.4, or 115 per week; 442/18, or 25 per month; and 555/58, or 10 per quarter.

Problems

The tables give an indication of some of the problems that would be faced by a system which attempted to control the money supply directly by furnishing a fixed amount of reserves on a week-to-week basis to increase the base behind the money supply—while, at the same time, operating to offset the reserves supplied or used for other purposes.

The first problem concerns the irregular movements. We have noted that over a month the average change in reserves required to allow for irregular movements is 17 times as large as the amount required to expand the money supply, while, for the quarter, the ratio is 6 times. The procedure set out would not allow any reserves for irregular movements; yet it appears desirable, for many purposes, to increase reserves to allow the money supply to expand and contract as a result of transitory forces in the economy.

The forces which we have called irregular are real and serve an economic purpose. They arise from errors in estimating the seasonal forces and in estimating special transitory needs of the economy. Insofar as they are offsetting over a longer period, they do not affect the total money supply. If reserves were not provided for these needs, banks would be forced to vary their assets in an amount equivalent to a multiplier of the reserves now furnished. There could be alternating periods of extreme ease or tightness both in lending and in interest rates for reasons entirely unrelated to the underlying credit situation or policy goal.

The second problem is a technical one. The system outlined above would require the Desk to estimate six series in addition to the group which is now estimated and, hopefully, offset by technical operations. The amount of these operations would be large. Any errors in these estimates or forecasts carried forward to actual operations would either absorb or furnish reserves which could be used to expand the money supply—a result contrary to that for which the system is proposed. While this problem would be not nearly as great as for the irregular components, it would still be considerable.

We have no exact estimates of how large errors in the forecasts would be, but we can arrive at some values by extrapolating from

current data and practices. I have measured the actual weekly forecast errors in current technical operations. The actual forecast error (mean deviation—partially arising from the various problems in data revisions and the inability to operate noted earlier) was $44 billion in reserves in an average week. This compares to a weekly mean deviation of $304 million for these total operations—or the forecast error was about 14 per cent of the total. The variance of the forecast error was 2.4 per cent of the variance of all technical operations.

I have assumed, for the want of better data, that this same percentage error of variance would apply to the seven items shown in Table II that would have to be forecast. Assuming that the variances would be uncorrelated (probably not a good assumption), we can derive the variance and standard deviation of the forecast of AOR (all other reserves) as the sum of the variances of its components—a set of independent random variables. In this case, we find that the standard deviation of AOR for one week is $77 million. In other words, we would expect that, about half the time, the error in forecasting the amount of operations required would be more than $52 million. Although some errors are likely to be cumulative, if we assume that the weekly forecast can correct for all previous errors in the month or quarter, we would have approximately the same error for the longer periods.

Under such an assumption about forecast errors, we would find that, in at least half the months, the amount of reserves furnished in error would enable the money supply to expand or contract in a month by more than 50 per cent above or below the desired amount.

The final complication is far more difficult, and is one about which we have little information. It arises from the manner in which a bank—and banks as a whole—can meet their reserve requirements, and from the fact that depositors can shift the type of their deposits. When the Fed alters the reserves it furnishes through open market operations, banks, individually, can borrow from the discount window, borrow reserves from other banks, or sell assets. Member banks as a whole can either borrow from the discount window or sell assets.

If the Fed is attempting to control total reserves, it can sell securities to offset, with a slight lag, any additional reserves it furnishes through the discount window. The changes in the actions of banks which result from their increased dependence on borrowed, in place of non-borrowed, reserves will influence all types of rates—as well as the banks' ability and willingness to hold securities or make

loans. How great such reactions would be in response to large-scale weekly shifts in discounting is, of course, not clear.

A similar unknown is how large shifts in bank assets would have to be in response to System action to control the rate of expansion in one type of deposit, such as the demand deposit component of the money supply. The procedure outlined in the previous section would mean that the System would furnish or absorb all reserves required so long as they were not changing the desired level of private demand deposits. If banks found they had insufficient reserves because the System wanted to curtail the expansion of demand deposits, they would sell assets. If these were paid for from time, inter-bank, or government deposits, the System would show a miss in its forecast of reserves for these purposes. Operations the following week would be planned to absorb additional reserves freed by the sale of these assets. The sale of assets and absorption of reserves could continue until the money supply finally converged on its desired track. It is not easy to forecast—particularly over a short term—how much credit would have to contract or, in the opposite case, expand, to bring about such a convergence.

The resulting situation would appear to be similar to the present. Banks and the public would reach an equilibrium among assets and deposits, based on liquidity functions and interest rates. The procedure aimed at controlling M_1 would bring about an equilibrium at some point. It appears difficult to me, however, to predict with existing information, derived from an entirely different institutional system, where that equilibrium would be or how stable it would be compared to current procedures.

An Elastic Currency

It is now possible to restate one logical reason for following the money market strategy. We saw how great are the misses, the random movements, and the influence of other forces on reserves when compared to the changes required for growth in the narrowly defined money supply. If one attempted to increase reserves according to an exact schedule, the market would have to shift rapidly in order to accommodate seasonal forces, errors in operation, Treasury cash operations, and the type of irregular movements which the Federal Reserve now accommodates.

An attempt to control growth in the money supply directly, through controlling the amount of reserves created, runs into the

difficulty that in any quantity-price relationship, if one controls the quantity tightly, the price must be allowed to move freely and through an extremely wide range. In addition to many other considerations, the problems would have to be faced of what costs and what structural changes the economy would experience if interest rates fluctuated widely as the result of an attempt to control a single use of monetary reserves directly.

Our financial structure and capital markets are extremely well developed and efficient. The amount of funds bought and sold in our money markets averages well over $10 to $12 billion per day. On a gross basis, the amount of money raised by the economy totals over $600 billion, for maturities of under one year, and over $220 billion with longer maturities, each year. In such a system, major advantages result if the monetary aggregates react flexibly to absorb the daily, weekly, monthly, and seasonal shocks, and other irregular forces.

This need for flexible reactions in the monetary aggregates was a major factor in the formation of the Federal Reserve. It has always been a central interest in its operations. The need for such flexibility may be greater today than in the past. Our capital markets operate with an extremely low ratio of equity capital. We have developed highly specialized financing institutions and techniques. The underwriting of our public debt is done at extremely low margins. These are possible because the market does not have to shoulder the risks of widely fluctuating interest rates from irregular short-term movements. The additional reserves created to satisfy the purely seasonal or irregular demands for short-term funds disappear quite rapidly. They influence only slightly total demand, or the supply and demand equilibrium for financial funds. It is not evident why one should want rates in the money markets to fluctuate in response to their movements.

Most decision models and loss functions would, I believe, show that, beyond certain limits, it is highly advantageous for the Government to assume the risks from irregular movements. The position of these limits will depend, at any time, on the ability of the private sector to assume such risks, on the shape of loss functions, on the variance of movements, and similar matters.

Of course, I recognize that, if such risk assumption is possible only at the expense of other goals, it might not be worthwhile. The gains from one program must be weighed against the loss from another. Still, I believe that allowing flexible reactions to temporary reserve

requirements is logical. I would also agree that we need a better understanding of how the present system works, as well as of how to improve it.

I must conclude, however, that—recognizing the degree of noise and irregularity in the existing data—somewhat less attention should be paid to very short-run movements in either the monetary aggregates or in money market conditions than presently seems to be the case. More attention needs to be given to the logic of different control systems and particularly to the logic of different monetary goals.

Given the intensity of the beliefs of the Fed's critics that these problems are vital to formulation of a sensible monetary policy and that the operational problems are fairly simple to solve, I personally feel that more effort should have been, and should be henceforth, spent on analysis of these problems. I recognize, of course, that there are major theoretical problems—as well as others, concerned with formulating the best decision-making process—which are also vital in the determination of optimum operating procedures. It does appear, though, that a wider understanding of how operations are determined and of possible alternatives should be useful to all.