DETERMINANTS OF THE

FEDERAL FUNDS RATE: 1979-1982

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In the late 1970s the money stock was growing at a faster rate than desired, the rate of inflation was accelerating, and the dollar was steadily depreciating in the foreign exchange markets. In an attempt to reverse these developments the Federal Reserve on October 6, 1979 announced several actions, including a change in its operating procedures to place more emphasis on managing the growth of bank reserves in order to improve monetary control.[1] The new procedures are generally thought to have remained in place until October 9, 1982, when Federal Reserve Chairman Paul Volcker announced that the Fed was going to temporarily place less emphasis on the money stock (M1) in its policy decisions. The period between October 1979 and October 1982 was characterized by unusually high and volatile short-term interest rates, volatile money growth rates, and—towards the end of the period—a sharp drop in the rate of inflation. Many accounts of this period have attributed these developments to the new procedures.

The issue addressed in this paper is how the Fed's operating procedures actually changed in October 1979 and, more specifically, how movements in the federal funds rate were determined.[2] Before October 1979, the Federal Open Market Committee (FOMC) at each meeting set an initial target for the funds rate and gave a set of instructions to the Account Manager at the Federal Reserve Bank of New York (the

"Desk") on how to adjust the funds rate over the period until the next FOMC meeting. These instructions related desired movements in the funds rate to the projected growth rates of M1 and M2 (relative to the short-run tolerance ranges specified by the FOMC) and to other factors such as inflation, economic activity and the behavior of the dollar in the foreign exchange markets. Each week the Desk reset the target for the funds rate based on the behavior of these variables and the latest instructions it had received from the FOMC.

The Fed stopped setting explicit targets for the funds rate after October 6, 1979, and a widely held view is that funds rate movements over the following three years were determined by market forces rather than by the Fed.[3] According to this view, the critical aspect of the new procedures was that the Fed fixed the supply of nonborrowed reserves available to depository institutions so that increases in the money stock and hence in the demand for required reserves would *automatically* cause increases in the funds rate and other short-term rates. (The mechanism by which this occurred is described below.)

Despite the widespread emphasis on the automatic adjustment in descriptions of the post-October 1979 operating procedures, it was well-recognized at the time that movements in the funds rate under the procedures could also result from purely judgmental actions of the Federal Reserve. These actions included (1) judgmental adjustments to the supply of nonborrowed reserves in the period between FOMC meetings, (2) judgmental adjustments initiated at an FOMC meeting, (3) changes in the discount rate, and (4) changes in the surcharge that at

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* Marvin Goodfriend provided many helpful suggestions on this paper. The author also benefited from comments by Dan Bechter, Alfred Broaddus, Robert Hetzel, and Thomas Humphrey. The views expressed are those of the author and not necessarily those of the Federal Reserve Bank of Richmond or the Federal Reserve System.

[1] For an account of the developments leading up to the change in operating procedures, see "Fed Takes Strong Steps to Restrain Inflation, Shifts Monetary Tactic," *The Wall Street Journal*, October 8, 1979, p. 1.

[2] The federal funds rate is the rate on overnight loans of reserves between depository institutions. Changes in the funds rate are important because they generally lead to changes in other short-term interest rates.

[3] For example, see Stigum [1983, p. 369]: "At that time, the Fed decreed that the rate at which funds traded would be wherever market forces took it, which turned out to be all over the lot;" and Morris [1983, p.5]: "The new policy regime initiated in October 1979 was unique, not in that we established money growth targets, but that we sought to achieve them by managing the rate of growth of bank reserves, allowing short-term rates to be largely market determined."

times during the period was added to the basic discount rate and applied to large banks.[4]

This paper evaluates whether funds rate movements from October 1979 to October 1982 were determined by market forces interacting with a nonborrowed reserve rule or largely on a judgmental basis by the Federal Reserve as in other periods. To make this evaluation, the paper presents a detailed breakdown and analysis of the policy actions affecting the funds rate in this period. I conclude that while some of the movement in the funds rate over this period resulted from the automatic adjustment, most of the movement—roughly two-thirds—was due to judgmental actions of the Federal Reserve.

Analytical Framework

Increases in the federal funds rate in the period from October 1979 through October 1982 came about in two general ways. The first was through an increase in the amount of reserves that banks had to borrow at the discount window (i.e., the amount *not* supplied by the Fed in the form of nonborrowed reserves), hereafter called the "borrowed reserves target."[5] The demand by banks for borrowed reserves depends positively on the spread between the federal funds rate and the discount rate. Therefore, in general, the larger the amount of reserves banks had to borrow at the discount window, the greater the spread between the funds rate and the discount rate necessary to induce them to borrow these reserves. Consequently, at a given discount rate an increase in the amount of reserves

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[4] It should be emphasized that most Federal Reserve descriptions of the operating procedures in this period did not claim that funds rate movements were being determined solely by the automatic adjustment. Levin and Meek [1981], Volcker [1980], and the New York Federal Reserve Bank's reviews of monetary policy and open market operations [1980, 1981, 1982, 1983] all describe the effects on the funds rate of judgmental adjustments to the supply of nonborrowed reserves and changes in the discount rate and surcharge.

[5] The term generally used in this period to denote the initial borrowing level specified by the FOMC for an intermeeting period was the "borrowed reserve assumption." This term was used because—as will be explained later in the article—under the procedures the amount of reserves that banks had to borrow in the period between FOMC meetings depended on the growth rate of money, which was unknown at the beginning of the period. Hence, the initial borrowing level changed as the period developed. The borrowing level specified for a particular week within the intermeeting period was in effect a target because under the prevailing system of lagged reserve requirements a target for nonborrowed reserves implied a specific level of borrowed reserves. To simplify the discussion and the presentation of the data, I use "target" for both purposes. As will be clear in the text, the use of that term is not meant to suggest that the borrowing level initially specified by the FOMC was fixed throughout the intermeeting period.

banks had to borrow resulted in a higher funds rate. Increases in the funds rate in this period also resulted from increases in the basic discount rate or the surcharge. The funds rate had to rise following an increase in the discount rate in order to maintain the spread between the two rates necessary to achieve the borrowed reserve target in the current week.

The approach taken in this paper is to track changes in the borrowed reserve target, the discount rate, and the surcharge from October 1979 to October 1982 and to estimate how much of the resulting movement in the funds rate was attributable to the automatic adjustment and how much to judgmental actions by the Fed. The basic analytical procedure is to construct a series of tables which document the timing and cause of changes in the borrowed reserve target as well as the timing of changes in the discount rate and the surcharge. Table I illustrates the procedure with data for the period beginning after the March 31, 1981 FOMC meeting and ending May 20, 1981, the day following the next FOMC meeting. Over this period the funds rate rose 3.96 percentage points. Similar tables for each of the intermeeting periods from October 1979 to October 1982 are in a working paper [Cook, 1989]. (A compact version of these tables is provided in the Appendix.) All information in Table I is from the weekly Report of Open Market Operations prepared by the Federal Reserve Bank of New York. The explanatory notes in the table are direct quotes from the Report.

This section of the paper works through Table I to identify how much of the change in the borrowed reserve target in the intermeeting period ending May 20, 1981 resulted from the automatic adjustment and how much resulted from judgmental actions taken by the Federal Reserve. This information is used together with the changes in the discount rate and surcharge documented in Table I to estimate the amount of the change in the funds rate in this intermeeting period resulting from the automatic adjustment and the amount resulting from judgmental actions by the Fed. The following section of the paper provides similar estimates for the full period from October 1979 to October 1982.

The initial borrowed reserve target In the post-October 1979 period the Federal Open Market Committee at each meeting chose an initial target for borrowed reserves for the period until the subsequent meeting. This target, which was generally called the "borrowed reserve assumption," is shown in column 3 of Table I. As noted above, the demand by banks to borrow reserves at the discount window largely depends on the spread between the federal

Table I

BEHAVIOR OF BORROWED RESERVES, THE DISCOUNT RATE, AND THE FUNDS RATE
IN THE INTERMEETING PERIOD ENDING MAY 20, 1981

Week	Monetary Aggregates (annualized growth rates)		Adjustment Borrowing (excludes extended credit) ($ millions)						Federal Funds Rate (percent)		Discount Rate (surcharge) (percent)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	M1B/M2 Target from March to June[a]	M1B/M2 Projection on Friday	Initial Average Target	Gap Between Projected and Path Level of Total Reserves	Judgmental Adjustments to Average Target	Revised Average Target	Target for Remaining Weeks in Period	Actual Borrowing for Current Week	Expected	Actual	
April 8	5.5/10.5 (March to June) 5.5/10.5 (April) 5.5/10.5 (May)	5.5/10.2 (April) 12.2/8.9 (May—N.Y.)	1150	0	0	1150	1150	887	n.a.	15.43	13 (3)
April 15		5.5/14.3 (April) 10.7/8.9 (May—N.Y.)	1150	33	0	1183	1282	1142	Given banks' recent reluctance to borrow, some further . . . firming above the recent 15½ percent level was viewed as possible	15.33	13 (3)
April 22		8.1/12.7 (April) 10.4/10.2 (May—N.Y.)	1150	97[b]	0	1247	1480	863	. . . some further firming in the Federal funds rate, perhaps to the 16 percent level or a little higher	15.55	13 (3)
April 29		18.0/13.7 (April) 1.4/6.9 (May—N.Y.)	1150	− 10[c]	0	1140	1667	2278	. . . expected to be consistent with a Federal funds rate of well above 16 percent as the week progressed	16.28	13 (3)
Second Subperiod											
May 6		15.6/11.3 (April) (May—n.a.)	1150	552	250[d]	1953	1953	2471[e]	n.a.	18.91	13.29 (3.29)
May 13		13.9/10.4 (April) (May—n.a.)	1150	374	484[f]	2008	1777	1733	18 to 20	18.21	14 (4)
May 20		n.a.	1150	389	484	2023	1863	1975	18 to 20	18.89	14 (4)

[a] M1B is adjusted for the estimated impact of NOW account shifts.

[b] A review of technical factors . . . suggested the potential for modest downward adjustment to the reserve paths. However, given the volatility of the data and the modest size of the suggested changes, no revisions were made.

[c] A review of technical factors . . . showed sizable potential downward adjustments to the [total and hence nonborrowed] path. The effect of making these adjustments would have raised the projected borrowing level . . . to as high as $2.8 billion. In order to smooth the transition between reserve periods . . . it was decided to leave the reserve paths for the first subperiod unchanged.

[d] Given the size of this [total reserves] gap, a decision was made, in consultation with the Chairman, to lower the average nonborrowed reserve path relative to the total reserve path by $250 million.

[e] It appeared by midweek that borrowings at the discount window would substantially exceed the level anticipated in the path construction. To have met the nonborrowed reserve objective . . . would have tended to dilute the effects of Monday's discount rate action.

[f] 1) It was decided, in consultation with the Chairman, to lower the average nonborrowed reserve path by another $120 million . . . in response to the overrun in total reserves.
 2) Finally, also in consultation with the Chairman, it was decided to adjust the average nonborrowed reserve path downward because of the $343 million undershoot in nonborrowed reserves in the first week of the subperiod . . . Consequently, the average nonborrowed reserve path for the three-week period was lowered by an additional $114 million ($343 ÷ 3).

funds rate and the discount rate. Hence, in choosing an initial target for borrowed reserves the FOMC was indirectly setting an initial level for the funds rate in the intermeeting period. (Of course, this funds rate level also depended on the prevailing discount rate.) At its March 31, 1981 meeting, the FOMC set an initial target for borrowed reserves for the intermeeting period ending May 20, 1981 of $1150 million. This figure was only slightly below the $1162 million borrowing target in the last week of the previous intermeeting period.

The automatic adjustment in the borrowed reserve target [6] At each meeting the FOMC also set short-run targets for M1 and M2 over a period of two to four months. These targets are shown in column 1 of Table I, and the most recent projections of money growth are shown in column 2.[7] The staff constructed a "path" for total reserves consistent with the money supply targets. In constructing the total reserve path, the staff allowed for the projected mix of currency and deposits and the projected demand by banks for excess reserves, and it took into account the reserve requirements for various categories of deposits. In practice, many of the non-M1 components of M2 were nonreservable and reserves on other components were being phased out under the Monetary Control Act. As a result, the total reserve path was determined primarily by the M1 target.

The staff also constructed a path for nonborrowed reserves by subtracting the FOMC's initial target for borrowed reserves from the total reserve path. The paths for total and nonborrowed reserves were then translated into reserve levels covering the shorter periods between FOMC meetings. The System Account Manager (the "Desk") was instructed to conduct open market operations in the intermeeting period in a manner consistent with achieving the *nonborrowed* reserve path.

The central feature of the procedures was that as the intermeeting period progressed, the path for

nonborrowed reserves was to be held fixed. If, for example, the projected growth rate of money in the intermeeting period rose above the target set by the FOMC, then the projected level of total reserves would rise above the path level of total reserves. With the nonborrowed reserve path held fixed, the emerging gap between the projected and path levels of total reserves due to the stronger-than-targeted money growth would cause an increase in the amount of reserves that had to be borrowed at the discount window. The funds rate would rise in the current week until the spread between it and the discount rate was large enough to induce banks in the aggregate to borrow these additional reserves. The result was that stronger-than-targeted money growth would automatically cause a rise in the funds rate, which was supposed to bring money growth back to target over time.

In practice, the Desk made two modifications to the automatic adjustment as described above. First, although the Desk held the *average* nonborrowed reserve path fixed when there was an increase in the projected demand for total reserves in the intermeeting period, it typically made offsetting adjustments to the weekly nonborrowed reserve path in order to maintain steady borrowing over the remaining weeks of the period (Levin and Meek [1981, pp. 7-8]). Suppose, for example, that in the middle of a six-week intermeeting period new information increased the projected demand for total reserves by an average of $300 million over the remaining three weeks of the period, consisting of $100 million in week 4, $300 million in week 5, and $500 million in week 6. In this situation the Desk would reduce the nonborrowed reserve path by $200 million in week 4, leave it unchanged in week 5, and raise it by $200 million in week 6. The result would be to raise the borrowed reserve target for each of the remaining three weeks in the period by an equal amount of $300 million.

The second modification to the automatic adjustment described above was that the Desk made "technical" adjustments to the paths for total and nonborrowed reserves to allow for changes in the estimates of excess reserves and required reserves against deposits not included in M1 and M2. Suppose, for instance, that in the intermeeting period the demand for total reserves unexpectedly rose by $50 million due to an increase in the demand for excess reserves and by $50 million due to an increase in required reserves against bank liabilities not included in M1 or M2. If the Desk made no allowance for these factors, the necessary discount-window borrowing by banks would rise by $100 million. The

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[6] This brief description of the automatic adjustment is taken primarily from Volcker [1980]. For additional detail see Levin and Meek [1981] and the annual reports on monetary policy and open market operations by the Federal Reserve Bank of New York [1980, 1981, 1982, 1983]. Hetzel [1986] provides a chronological review of the implementation of the post-October 1979 procedures, and Goodfriend et al. [1986] provide a weekly rational expectations model of the procedures. Other discussions of the procedures are in Hetzel [1982], Poole [1982], and Spindt and Tarhan [1987].

[7] The projections of the monthly growth rates of the monetary aggregates shown in Table I are those made by the staff of the Board of Governors. If projections for a particular month were supplied by the New York staff but not the Board staff, then the New York staff's forecasts are shown in the table.

higher borrowing level would force a rise in the funds rate even though there had been no increase in the projected growth of M1 or M2. To forestall this outcome, the Desk could raise the total and nonborrowed reserve paths by $100 million.

In the Report of Open Market Operations, the Desk reported a gap between the projected and path level of total reserves as an average over all the weeks in the intermeeting period. In the above example, where the projected demand for total reserves rose by $100 million, $300 million, and $500 million in the last three weeks of a six-week intermeeting period, the Desk would have raised the gap by $150 million [(100 + 300 + 500)/6]. The Desk divided fifteen of the twenty-six intermeeting periods into two subperiods, including the period shown in Table I. In these cases the reserve averages were calculated separately for each subperiod.

Column 4 in Table I shows the gap between the average projected and path levels of total reserves for the intermeeting period ending May 20, 1981.[8] As the period developed, the stronger-than-targeted money growth raised the projected level of total reserves. The positive gap between the projected and path levels of total reserves that normally would have resulted from the stronger-than-targeted money growth did not appear at the end of the first subperiod (April 29) because, in order to smooth the transition between the two subperiods, the Desk decided not to make any of the sizable potential downward technical adjustments to the total and nonborrowed reserve paths (note c in Table I).[9] These adjust-

ments were made in the second subperiod, however, and in that subperiod the gap between the projected and path levels of total reserves rose sharply. The final gap of $389 million for the intermeeting period caused an automatic increase in the average borrowed reserve target of that magnitude.

Judgmental adjustments in the average borrowed reserve target The Desk could also make judgmental adjustments in the average nonborrowed reserve path during the intermeeting period, which would cause offsetting adjustments of the same magnitude in the average borrowed reserve target. The judgmental adjustments in the intermeeting period ending May 20, 1981 are shown in column 5 of Table I, and the Desk's explanations for them are given in the notes at the bottom of the table. In the fifth week of the period (May 6) "given the size of the reserve gap, a decision was made, in consultation with the Chairman," to lower the average nonborrowed reserve path by $250 million and thereby raise the average borrowed reserve target by an equal amount (note d). In the sixth week (May 13) it was decided for the same reason to make another judgmental increase in the average borrowed reserve target of $120 million (note f1). At the same time, the Desk increased the average borrowed reserve target by an additional $114 million "because of the undershoot in nonborrowed reserves" in the previous week (note f2).[10] The total of $484 million of judgmental adjustments over the period more than doubled the increase in the average borrowed reserve target that would have resulted from the automatic adjustment alone. As a result, over the period the average target, shown in column 6 of Table I, rose by a total of $873 million from $1150 million to $2023 million.

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[8] In practice, the *initial* gap between the projected and path levels of total reserves at the time of the FOMC meeting was set equal to zero, although the gap could change in the first week of the intermeeting period if on the Friday following the FOMC meeting (usually on Tuesday) the staff's forecasts for the monetary aggregates differed from those made at the meeting. Setting the initial reserve gap equal to zero did not constrain the FOMC, since if the FOMC wished to engineer a change in the funds rate at the time of the meeting, it could do so by changing the borrowed reserve target from recent borrowing levels.

[9] The sense in which the transition between the two subperiods was "smoothed" by this decision is as follows. In the first three weeks of the first subperiod, the actual borrowing level (column 8) ran below the borrowing target for the remaining weeks in the subperiod (column 7)—henceforth called the "weekly" target (discussed later in this section). Because of these past misses, the weekly target had to rise steadily as the subperiod progressed in order to achieve the average borrowed reserve target. The Desk did not make any of the downward technical adjustments to the reserve paths at the end of the first subperiod—which would have caused a rise in the revised average and hence weekly borrowed reserve targets—because the weekly target had already risen sharply. If the Desk had made the technical adjustments, the weekly target would have climbed more than it did at the end of the first subperiod and then fallen at the beginning of the second subperiod, rather than rising from

the first to the second subperiod as shown in column 7 of Table I. This example illustrates the operational difficulties in setting targets for *average* reserve levels.

[10] The reasoning behind this adjustment was as follows. The demand for borrowed reserves was stronger than anticipated in the first week of the second subperiod, and the Desk decided to allow borrowing to come in over target (and nonborrowed reserves under target) in order not to dilute the effect on the funds rate of the increase in the discount rate that week (note e in Table I). In order to accommodate this miss in the borrowed reserve target, the next week the Desk raised the average borrowed reserve target for the subperiod by $114 million. If the Desk had not made this adjustment, the weekly borrowing target and the expected funds rate would have been lower in the last two weeks of the subperiod. The Desk occasionally made this type of adjustment to prevent misses in the weekly borrowed reserve target early in an intermeeting period or subperiod from unduly affecting the weekly target later in the period. This type of adjustment is discussed in more detail later in the article (pp. 13-14).

Determination of the weekly borrowed reserve target
Column 7 in Table I shows the borrowed reserve target for the current and remaining weeks in the period (henceforth called the "weekly target"). This target, together with the discount rate, determined the expected funds rate in the current week. Changes in the weekly borrowed reserve target resulted from changes in the projected demand for total reserves over the period and from deviations of actual borrowing from target in the previous weeks of the period. To understand the calculation of the weekly target, it is useful to work through a week in Table I in detail. Consider the third week of the first subperiod (April 22), when the borrowed reserve target for the remaining two weeks in the subperiod rose by $198 million from $1282 million to $1480 million. Column 4 shows that in this week the average gap over the subperiod between the projected demand for total reserves and the path level rose from $33 million to $97 million. As explained above, this meant that there was an increase in the cumulative projected demand for total reserves over the four-week subperiod of $256 million [(97 − 33) × 4]. With a fixed nonborrowed reserve path, the borrowed reserve target over the remaining two weeks in the subperiod had to go up by $128 million (256/2) to supply these additional reserves. The borrowed reserve target for the remaining weeks in the subperiod also had to offset the deviation of $140 million between the borrowed reserve target and the actual level of borrowing in the second week of the subperiod (1282 − 1142). With a fixed nonborrowed reserve path, the borrowed reserve target in the remaining two weeks had to rise by $70 million (140/2) to offset this miss. Together, the increase in the projected demand for total reserves and the miss in the target the second week caused a rise in the target for the third and fourth weeks of $198 million (128 + 70) to $1480 million.

The borrowed reserve target for the current and remaining weeks in a period can also be calculated in Table I directly from the average borrowed reserve target and the actual level of borrowing in the previous weeks in the period. The average target in the third week of the first subperiod was $1247 million (1150 + 97). Given borrowing of $887 million and $1142 million in the first and second weeks of the subperiod (shown in column 8), the implied borrowing target for the two remaining weeks was $1480 million [(1247 × 4 − 887 − 1142)/2], which—as derived above—was up $198 million from the previous week's target of $1282 million. Over

the whole intermeeting period ending May 20, 1981, the rise in the average borrowed reserve target of $873 million (2023 − 1150) led to a total rise in the weekly target of $713 million (1863 − 1150).

The discount rate and surcharge Increases in the discount rate were an important determinant of the funds rate in the October 1979 to October 1982 period. As indicated earlier, the funds rate had to rise following an increase in the discount rate in order to maintain whatever spread was necessary to achieve the borrowed reserve target in the current week.[11] On two occasions during the period from October 1979 to October 1982 a surcharge was added to the basic discount rate and applied to banks with deposits over $500 million that borrowed for two consecutive weeks or for more than four weeks in a calendar quarter. (After October 1, 1981 the calendar quarter was changed to a moving 13-week period.) Increases in the surcharge also put upward pressure on the funds rate, although the effect was smaller than for increases in the basic discount rate because only large banks were subject to the surcharge (Sellon and Seibert [1982, pp. 9-12]).

As shown in column 11 of Table I, in the intermeeting period ending May 20, 1981 there was a one percentage point increase in both the discount rate and the surcharge. The discount rate and the surcharge together with the weekly borrowed reserve target were used by the Desk to derive an expected federal funds rate for the week, shown in column 9. The actual level of borrowed reserves and the actual funds rate for the week are shown in columns 8 and 10.

Determination of the funds rate In summary, in the intermeeting period ending May 20, 1981 the funds rate was pushed up by the automatic adjustment in the borrowed reserve target resulting from the positive gap between the projected and path levels of total reserves, by judgmental adjustments to the borrowed reserve target, and by increases in the discount rate and the surcharge. The effect of each of these factors on the funds rate depends on the characteristics of the demand function for borrowed reserves. Empirical work indicates that a $100 million increase in borrowed reserves in this period was associated with an increase in the spread between the funds rate and the discount rate of roughly 25

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[11] For discussions of the relationship between the funds rate and the discount rate under the October 1979 operating procedures, see Broaddus and Cook [1983] and Sellon and Seibert [1982].

basis points.[12] (The Fed has long used this estimate in relating borrowing levels to the spread.) Using this relationship one can estimate that the $713 million increase in the weekly borrowed reserve target over this period raised the funds rate by 178 basis points. Forty-five percent of the increase in the weekly borrowed reserve target was due to the automatic adjustment in the average borrowed reserve target (389/873), and 55 percent was due to judgmental adjustments in the average borrowed reserve target (484/873). Hence, one can estimate that the automatic adjustment raised the funds rate by 79 basis points, while the judgmental adjustments raised it by 99 basis points. The small $13 million reduction in the borrowed reserve target made at the beginning of the period by the FOMC lowered the funds rate by 3 basis points.

As discussed above, under the October 1979 procedures a one percentage point increase in the discount rate would be expected to raise the funds rate by roughly an equal amount, and this expectation is confirmed by the estimates of Sellon and Seibert [1982]. Hence, I attribute a one percentage point increase in the funds rate to the discount rate increase. Sellon and Seibert estimate that a one percent surcharge raised the funds rate by approximately 65 basis points, and I use that estimate in this paper.[13]

To sum up, estimates of the contribution of the various factors to movements in the funds rate over the intermeeting period ending May 20, 1981 are:

FOMC lowering of borrowed reserve target at beginning of period:	−.03
Automatic upward adjustment of borrowed reserve target:	.99
Judgmental upward adjustments in borrowed reserve target:	.79
Discount rate increase:	1.00
Surcharge:	.65

The estimate of the total rise in the funds rate over this intermeeting period is 3.40 percentage points, which is somewhat below the actual increase of 3.96 percentage points. A little under 30 percent of the estimated increase in the funds rate can be attributed to the automatic adjustment. The rest resulted from judgmental decisions of the Fed.

Breakdown in the automatic adjustment The automatic adjustment illustrated in Table I did not function whenever the demand for total reserves fell below the nonborrowed reserve path.[14] In this situation the federal funds rate dropped below the discount rate and fell to whatever level the FOMC set as a constraint (Levin and Meek [1981, p. 26]). In such periods borrowing at the discount window was no longer sensitive to the spread between the funds rate and the discount rate. Consequently, cuts in the discount rate had no effect on the funds rate. There were three such episodes in the October 1979 to October 1982 period: (1) from the middle of the intermeeting period ending May 21, 1980 to the first week of the intermeeting period ending September 17, 1980; (2) most of the intermeeting period ending August 25, 1982; and (3) a brief period at the beginning of the intermeeting period ending December 23, 1981.

Table II shows the intermeeting period ending July 9, 1980, when the funds rate was well below the discount rate. In this situation the Desk simply fixed the average borrowed reserve target at a minimal level of $100 million and adjusted nonborrowed

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[12] Sellon [1985] shows that the estimated relationship between the spread and the level of borrowing in the post-October 1979 period is sensitive to the choice of the dependent variable in the estimated regression equation and the treatment of the surcharge in the equation. In equations with a surcharge variable, the estimated effect on the spread of a $100 million increase in the level of borrowing is 31 basis points when borrowing is the dependent variable and 17 basis points when the spread is the dependent variable, although the latter estimate drops sharply if a correction for autocorrelation is made. In equations with borrowing as the dependent variable and a surcharge dummy variable entered multiplicatively with the spread, the effect of a $100 million increase in borrowing when the surcharge is zero is 20 basis points in one subperiod and 31 basis points in the second subperiod.

[13] As Sellon [1985, pp. 12-18] emphasizes, it is difficult to obtain meaningful estimates of the impact of the surcharge on the funds rate. The surcharge was imposed only two times, and the first occurred in the midst of the 1980 credit controls. The effect of the elimination of the surcharge on the funds rate is particularly difficult to evaluate because in both cases the elimination occurred just as the funds rate was slipping below the discount rate and the Desk was effectively going off the nonborrowed reserve procedures. In any case, attributing the funds rate declines in these periods to a breakdown in the procedures rather than to the elimination of the surcharge would not affect the overall allocation of funds rate movements between those due to the automatic adjustment and those due to judgmental Fed decisions, since movements in the funds rate resulting from either cause fall into the latter category.

[14] Strictly speaking, the procedure also broke down when the FOMC had flexible short-run targets for the monetary aggregates within the intermeeting period. For instance, in the intermeeting period ending July 8, 1981 the FOMC's short-run target for M1B was 3 percent *or less*. In this period the Desk accommodated the weak growth in M1B by making weekly downward adjustments in the reserve paths. (See Appendix A, Table 16, in Cook [1989].)

Table II

BEHAVIOR OF BORROWED RESERVES, THE DISCOUNT RATE, AND THE FUNDS RATE
IN THE INTERMEETING PERIOD ENDING JULY 9, 1980

Week	Monetary Aggregates (annualized growth rates)		Adjustment Borrowing (excludes extended credit) ($ millions)						Federal Funds Rate (percent)		Discount Rate (percent)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	M1A/M1B/M2 Target from March to June	M1A/M1B/M2 Projection on Friday	Initial Average Target	Gap Between Projected and Path Level of Total Reserves	Judgmental Adjustments to Average Target	Revised Average Target	Target for Remaining Weeks in Period	Actual Borrowing for Current Week	Expected	Actual	
May 28	The [reserve] paths were constructed in accordance with the Committee's decision to accept some increase in monetary growth during May and June relative to the esti-mates presented at the [FOMC] meeting . . .	7.1/5.3/6.7 (May) 10.0/12.0/9.1 (June)	100	0	0	100	100	307	Achieving the frictional level of borrowing implied that Federal funds probably would not trade above the discount rate, and might well decline from the approximate 10¾ percent average of the previous week. The Committee had set a lower bound on its Federal funds rate range of 8½ percent (with a top of 14 percent) but indicated a preference that funds not trade persistently at rates below about 9½ percent without the opportunity for further Committee consultation.	9.46	13
June 4		4.5/2.5/8.8 (May) 10.0/12.4/12.5 (June)	100	0ª	0	100	31	105	. . . achieving such low adjustment borrowing levels implied that the Federal funds rate might well test the 9½ percent level late in the statement week.	10.74	12
June 11		2.9/0.9/8.5 (May) 8.7/11.1/11.1 (June)	100	−6	0	*94	0	32	Since it appeared likely that Federal funds would trade below 9½ percent if the Desk sought these levels of adjustment borrowing and excess reserves, the Account Management consulted with the Committee.[b]	9.68	12
June 18		3.2/1.5/9.2 (May) 9.4/11.4/13.5 (June)	100	0ᶜ	0	*100	0	120	n.a.	8.99	11.14
Second Subperiod											
June 25		1.6/−0.3/8.6 (May) 13.0/15.5/16.1 (June)	100	0ᵈ	0	100	100	44	n.a.	9.08	11
July 2		0.7/−1.2/9.1 (May) 14.4/17.4/17.2 (June)	100	0	0	*100	128	74	n.a.	9.41	11
July 9		13.7/16.8/17.3 (June)	100	0	*−27ᵉ	*73	100	17	n.a.	9.26	11

[a] As in the previous week the average nonborrowed reserve path . . . was set equal to the total reserve path less $100 million on average for adjustment borrowing.

[b] The Committee, in a telephone conference on Thursday, June 5, agreed to allow full use of the entire Federal funds rate range down to 8½ percent, provided that the dollar did not come under undue pressure in the foreign exchange market.

[c] The average total reserves path for the four-week period ending June 18 was raised slightly to align it with the four-week average of actual and projected total reserves. This was done in accordance with the decision to set the path equal to the projection so long as the projection exceeded the original path deemed consistent with the minimally acceptable growth rates of the aggregates for May-June.

[d] The path was not lowered by the full amount of the accepted [technical] revisions because that would have resulted in a path level that implied adjustment borrowings in excess of the $100 million level initially sought by the Committee.

[e] In view of the imminence of the Committee meeting it was decided not to push borrowing to higher levels to make up for shortfalls in the previous two weeks.

* Number not explicitly given in the Report of Open Market Operations (See Appendix for explanation).

reserves to reflect changes in required reserves.[15] The funds rate was effectively set on a week-to-week basis at a level acceptable to the FOMC. Also, the two cuts in the discount rate in this period had no apparent effect on the actual funds rate or on the funds rate expected by the Desk.

Allocation of Movements in the Funds Rate over the Post-October 1979 Period

Table III provides estimates of the movements in the funds rate over the period from October 1979 through June 1982, excluding the intermeeting periods ending July 9, 1980, August 13, 1980, and August 25, 1982, when the funds rate was below the discount rate and the automatic adjustment was not functioning.[16] As in the example above, Table III allocates movements in the funds rate over this period to five sources: the automatic adjustment in the borrowed reserve target in the intermeeting period, judgmental adjustments in the borrowed reserves target in the intermeeting period, adjustments in the borrowed reserve target made at FOMC meetings, discount rate changes, and changes in the discount rate surcharge. The assumptions used to allocate movements in the funds rate to each of these factors are: (1) an increase or decrease in the weekly borrowed reserve target of $100 million causes a rise or fall in the funds rate of 25 basis points, (2) a rise in the discount rate causes an equal rise in the funds rate, (3) a one percent surcharge raises the funds rate by 65 basis points, and (4) a decrease in the discount rate has no effect on the funds rate.

The first three assumptions were discussed above. The fourth reflects the circumstance that most discount rate cuts in this period occurred when the funds rate was below the discount rate, and in this situation cuts in the discount rate would not be expected to affect the funds rate. This expectation is confirmed by Sellon and Seibert [1982], who find that reductions in the discount rate in this period had a negli-

gible effect on the funds rate. The Fed seemed to be aware of the funds rate's insensitivity to discount rate cuts at the time, as it generally accompanied reductions in the discount rate with announcements indicating the reductions were solely to realign the discount rate with market rates. In contrast, the Fed always accompanied increases in the discount rate with more aggressive announcements indicating the increases were being made partially, if not totally, for policy reasons.[17]

The totals at the bottom of Table III show that based on the assumptions above, the automatic adjustment in the borrowed reserve target contributed 22.02 percentage points to movements (in absolute value) in the funds rate over the post-October 1979 period. The contribution of the discount rate plus the surcharge was 14.81 percentage points. Judgmental adjustments in the borrowed reserve target caused movements of 9.83 percentage points.[18] In all but three cases the judgmental adjustments were in the same direction as the automatic adjustment.[19] Target changes at FOMC meetings contributed funds rate movements of 8.06 percentage points, the major part of which was in the first six intermeeting periods.[20] After that the FOMC generally set the initial borrowing target close to the last weekly borrowing target in the previous period.

The estimates in Table III can also be used to evaluate the relative importance of different factors

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[15] The breakdown of the procedures in this period is discussed in the New York Fed's 1980 review of monetary policy and open market operations [1981, p. 72]: "As implied borrowing moved down to frictional levels, the Desk began to encounter operational difficulties that recurred from time to time through July."

[16] I exclude the intermeeting period ending October 6, 1982 from the discussion altogether because the nonborrowed reserve procedures had effectively been abandoned by this time even though Chairman Volcker's announcement of the de-emphasis of M1 did not come until the end of the period. In line with the FOMC's instructions, the Desk in this period adjusted the reserve paths to prevent the funds rate from rising in reaction to the rapid money growth in August and September, and the expected funds rate remained around 10 percent throughout the period. (See Appendix A, Table 26, in Cook [1989].)

[17] Cook and Hahn [1986] provide a record of the discount rate announcements in this period. Seven of the ten cuts in the discount rate were accompanied by announcements indicating the cuts were being taken solely to realign the rate with market rates, whereas none of the six increases in the discount rate were accompanied by this type of announcement.

[18] In the intermeeting period ending February 6, 1980, the weekly borrowed reserve target fell even though the average borrowed reserve target rose. As shown in the Appendix, this oddity resulted from large misses in the weekly target. In this case, I set the contribution of changes in the average borrowed reserve target to movements in the funds rate at zero.

[19] As shown in the Appendix, in the intermeeting period ending February 4, 1981, there was a small decrease in the average borrowed reserve target and a much larger decrease in the weekly target, while the automatic adjustment in the average borrowed reserve target was negative and the judgmental adjustment in the average borrowed reserve target was positive. In this situation, the estimated impact on the funds rate of both the automatic and judgmental adjustments to the borrowing target were magnified given the nature of the estimation procedure as described in the text. These estimates are offsetting, however, and they have virtually no effect on the overall estimate of movements in the funds rate due to automatic versus judgmental adjustments in the average borrowed reserve target.

[20] The sum of the estimated contributions to movements in the funds rate for all the factors is bigger than the total estimated movement because factors sometimes pulled the funds rate in opposite directions within a period.

Table III

ESTIMATES OF MOVEMENTS IN THE FUNDS RATE

Intermeeting Period Ending	Contributing Factors					Total Estimated Change	Actual Change
	Target Change by FOMC	Automatic Adjustment	Judgmental Adjustments	Discount Rate Increase	Surcharge		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
21-Nov-79	0.00	0.49	0.06	0.71	0.00	1.26	1.10
09-Jan-80	−0.05	−0.52	−0.48	0.00	0.00	−1.05	0.84
06-Feb-80	−0.75	0.00	0.00	0.00	0.00	−0.75	−1.14
19-Mar-80	1.38	1.16	1.18	1.00	0.84	5.56	3.44
23-Apr-80	1.41	−2.30	−0.32	0.00	1.11	−0.11	1.32
21-May-80	−0.81	−4.18	0.74	0.00	−1.95	−6.20	−6.85
09-Jul-80	0.25	0.00	0.00	0.00	0.00	na	−1.45
13-Aug-80	−0.06	0.05	0.00	0.00	0.00	na	−0.41
17-Sep-80	−0.05	1.22	0.48	0.00	0.00	1.65	1.79
22-Oct-80	−0.01	0.99	0.45	1.00	0.00	2.43	1.91
19-Nov-80	−0.07	0.52	0.26	0.43	0.56	1.71	2.67
17-Dec-80	−0.29	0.18	0.14	1.57	1.39	3.00	4.61
04-Feb-81	−0.32	−3.09	2.09	0.00	0.00	−1.32	−2.64
01-Apr-81	0.50	−0.35	0.00	0.00	0.00	0.15	−2.26
20-May-81	−0.03	0.79	0.99	1.00	0.65	3.40	3.96
08-Jul-81	0.59	−1.01	−0.81	0.00	0.00	−1.23	1.04
19-Aug-81	0.32	−0.15	−0.07	0.00	0.00	0.09	−1.74
07-Oct-81	−0.02	−1.29	0.00	0.00	−0.65	−1.97	−2.73
18-Nov-81	−0.08	−1.01	−0.12	0.00	−1.02	−2.23	−2.29
23-Dec-81	0.00	0.13	−0.25	0.00	−0.93	−1.05	−0.74
03-Feb-82	−0.13	2.01	0.99	0.00	0.00	2.88	2.34
31-Mar-82	0.00	−0.16	−0.08	0.00	0.00	−0.24	0.22
19-May-82	−0.64	−0.14	−0.12	0.00	0.00	−0.90	−0.32
30-Jun-82	−0.61	0.33	0.20	0.00	0.00	−0.07	0.14
25-Aug-82	−0.54	−0.73	−0.51	0.00	0.00	na	−5.77
Absolute Total*	8.06	22.02	9.83	5.71	9.10		

* Excludes 09-July-80, 13-Aug-80 and 25-Aug-82

over periods of unusually sharp movements in the funds rate. Consider the rise in the funds rate of 10.98 percentage points over the four periods ending December 17, 1980. In this period the estimated increase in the funds rate was 8.79 percentage points, only 2.91 percentage points of which was due to the automatic adjustment. Rises in the discount rate and surcharge were responsible for 4.95 percentage points of the increase, and judgmental adjustments in the borrowed reserve target were responsible for another 1.33 percentage points.[21]

The accompanying chart compares the funds rate predicted by the estimates in Table III to the actual funds rate. Although there are occasionally large errors within individual periods, these tend to be offsetting, so the predicted funds rate does a fairly good job of tracking the actual funds rate. The large

prediction errors in some of the periods reflect the instability of the relationship between the demand for borrowed reserves and the spread between the funds rate and the discount rate. Factors influencing this relationship are the expected direction of monetary policy and the effect of discount window administration on bank borrowing patterns.[22]
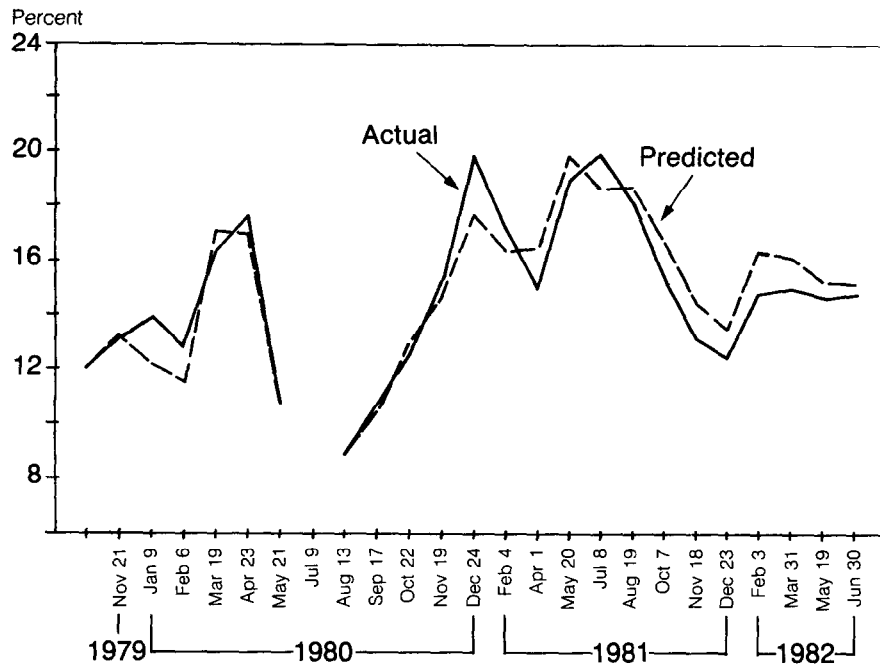
The discussion above excludes the intermeeting periods ending July 9, 1980, August 13, 1980, and August 25, 1982, when the funds rate was below the discount rate and the automatic adjustment was not in operation.[23] (It includes, however, the intermeeting period ending December 23, 1981, when the funds rate was below the discount rate for a brief period, and the intermeeting period ending May 21, 1980, when the funds rate was below the discount rate the second half of the period.) The funds rate declined 1.86 percentage points over the two intermeeting periods in the summer of 1980 and 5.77 percentage points in the period ending in August 1982.

The central conclusion from Table III is that movements in the funds rate in the post-October 1979 period were not determined primarily by the automatic adjustment of the borrowing target under

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[21] This estimate is similar to that made in the New York Federal Reserve Bank's 1980 review of monetary policy and open market operations [1981, p. 64]: "In combination [the discount rate and surcharge] appeared to account for about half of the 10½ percentage point increase in the funds rate over the August-December period. The remaining increase reflected the automatic response of rates to monetary overshoots under the reserve approach and the downward [judgmental] adjustments made to the nonborrowed reserve path."

[22] Levin and Meek [1981, pp. 29-34] discuss some specific periods of difficulty in predicting short-run movements in the funds rate when policy expectations and discount window administration were altering the relationship between borrowing and the spread between the funds rate and the discount rate. Goodfriend [1983] provides a theoretical discussion of the effect of policy expectations and discount window administration on discount window borrowing behavior, and Mengle [1986] describes the ground rules faced by financial institutions when borrowing at the discount window.

[23] In the period ending August 25, 1982, borrowing was well above the negligible level usually associated with a negative spread between the funds rate and the discount rate. Apparently, this resulted from the inclusion of some emergency borrowing in the adjustment borrowing category in the aftermath of the Penn Square Bank failure. For instance, in explaining the low funds rate the week of July 28, 1982, when reported adjustment borrowing was $524 million, the Report of Open Market Operations indicated that "the amount of adjustment borrowing contained in the total borrowing imposed on the system was fairly low, resulting in less pressure on the money market."

ACTUAL AND PREDICTED FEDERAL FUNDS RATE

Possible Methodological Problems

This section discusses four questions that might arise regarding the procedure used in allocating movements in the funds rate to the various factors listed above. The main concern is whether the procedure might be biased in favor of the conclusion that movements in the funds rate over this period were largely due to judgmental decisions by the Federal Reserve.

One judgmental decision potentially affecting the funds rate not taken into account in the analysis of the preceding section is how much of the "technical" adjustments the Desk incorporated into the paths for nonborrowed and total reserves. As noted earlier, in setting the total reserve path at the beginning of an intermeeting period the Desk had to allow for the absorption of reserves by excess reserves and by required reserves against deposits such as large CDs not included in M1 and M2. Estimates of these technical factors would change as the intermeeting period progressed. In practice, the Desk used some judgement in deciding how to adjust the total (and nonborrowed) reserve path to reflect changes in the technical factors. This decision influenced the gap between the projected and path levels of total reserves, and consequently affected the borrowed reserve target and the expected federal funds rate in the current week. The Desk on occasion considered the effects on the weekly borrowing target and funds rate in deciding how much of the technical adjustments to include in the paths.[25]

the nonborrowed reserve operating procedures. In this period the automatic adjustment was responsible for only about one-third of the movement in the funds rate. The other two-thirds resulted from changes in the discount rate and the surcharge, judgmental adjustments in the borrowed reserve target in the intermeeting period or at FOMC meetings, and movements in the funds rate when it was below the discount rate and the automatic adjustment was not in operation. It follows from this conclusion that the greater volatility in interest rates and monetary growth rates observed in this period can not be attributed primarily to the automatic adjustment.[24]

A second question regarding the procedure used to allocate funds rate movements concerns the treatment of the judgmental adjustments to the average borrowed reserve target. Conceptually, one can divide these adjustments into two types: The first to engineer movements in the funds rate that would

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[24] It is of course possible that in this period the Fed's actions affecting the funds rate gave greater weight than earlier to deviations of the money stock from target or to deviations from target of other goals such as inflation. McNees [1986] estimates a Federal Reserve reaction function over the period from the third quarter of 1970 through the second quarter of 1986 with the federal funds rate as the dependent variable (i.e., the Fed's policy instrument). He finds increased emphasis on monetary growth over the period from October 1979 to October 1982, but otherwise concludes that the policy behavior that prevailed in the 1970s persisted in the 1980s. Similarly, Karamouzis and Lombra [1988] estimate a Fed reaction function over the 1973-82 period with the funds rate as the dependent variable. They find that the coefficient on the difference between actual and targeted money growth jumped sharply shortly after October 1979 and then fell sharply toward the end of 1982.

[25] For example, see Appendix A, Table 10, note 4, and Table 22, note 7, in Cook [1989]. See Levin and Meek [1981, Appendix 1] for a discussion of the technical adjustments in setting the reserve paths.

not have resulted from the automatic adjustment and the second to prevent funds rate movements resulting from "shifts" in the demand function for borrowed reserves. To illustrate the latter type, suppose that in the first week of a four-week period a temporary (i.e., one-week) shift in the demand for borrowed reserves increased desired discount-window borrowing above the amount that normally would have resulted from the prevailing spread between the funds rate and the discount rate. Suppose also that rather than let this shift affect the funds rate, the Desk allowed borrowed reserves to be, say, $400 million more than had been targeted (and nonborrowed reserves $400 million less). The following week the Desk could raise the average borrowing target for the four-week period by $100 million (400/4), thereby leaving the weekly target for the last three weeks in the period unaffected by the temporary shift in the borrowed reserve function the first week.[26]

One might argue that adjustments in the average borrowed reserve target to accommodate past misses in the weekly borrowed reserve target resulting from shifts in the borrowed reserve function should not be counted as judgmental—as they were in the preceding section—because such adjustments were intended to prevent movements in the funds rate not resulting from the automatic adjustment. In many cases, however, it is difficult to identify from the Report of Open Market Operations those adjustments in the average borrowed reserve target made to offset past misses in the weekly borrowing target clearly resulting from shifts in the borrowed reserve function. At most, 30 percent of the judgmental adjustments at the end of the intermeeting periods were of this nature.[27] If these adjustments were removed from the judgmental category, then additions to this category should be made for those occasions when there was a shift in the borrowed reserve function that the Desk did not accommodate, but such occasions can not be identified from the Report of Open Market Operations. On balance, it is possible that the inclusion in the judgmental category of those adjustments made to accommodate shifts in the borrowed reserve function may have biased upward the estimate in the previous section of funds rate movements due to judgmental actions, but the bias in any case was small.

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[26] For examples of this type of adjustment in the average borrowed reserve target see Appendix A, Table 6, note 2, and Table 16, note 10, in Cook [1989].

[27] Note that it is only the end-of-period adjustments that are relevant to this discussion and the previous discussion on technical adjustments, since the estimates in Table III are based on end-of-period figures.

The third question regarding the procedure used here is its focus on the extent to which movements in the funds rate were automatically caused by deviations of M1 from its *short-run* targets. Because the short-run targets were taken as given, a potential source of judgmental influence on the funds rate not captured by the analysis was the relationship between the short-run targets for M1 and the annual targets. I did not examine that relationship in this paper, but it clearly was not uniform over the three-year period. An important example is the second quarter of 1981 when the FOMC formally accepted short-run growth rates of M1 that were below the rate consistent with its annual target (adjusted for the estimated impact of NOW account shifts). The funds rate rose from 14.93 percent at the end of the April 1, 1981 intermeeting period to 19.93 percent at the end of the July 8, 1981 intermeeting period even though M1 was at the lower bound or below its annual target range throughout this interval.[28] As a result, M1 finished 1981 well below its annual target range. (M2, however, finished the year around the top of its range.)

A final issue, and probably the most important, is that the analysis implicitly assumes that movements in the funds rate resulting from judgmental actions were not systematically related to movements resulting from the automatic adjustment. If they were, then one might justifiably argue that movements in the funds rate over this period were, in fact, automatically determined. To consider this possibility, I regressed the period by period changes in the funds rate resulting from all judgmental actions (JUDG)—the sum of columns 1, 3, 4, and 5 in Table III—on the changes resulting from the automatic adjustment (AUTO)—column 2 in Table III. The regression results were (t-statistics in parentheses):

$$JUDG = 0.54 + 0.55 \text{ (AUTO)} \quad R^2 = .22$$
$$(1.74) \quad (2.30)$$

The coefficient of AUTO is positive and significant at the 5 percent level, indicating there was some tendency for judgmental actions to reinforce the effect of the automatic adjustment on movements in the funds rate. The low R^2, however, indicates that the proportion of the judgmental movement in the funds rate that was systematically linked to the automatic adjustment was small. Moreover, this

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[28] See Appendix A, Table 16, in Cook [1989] and the discussion of this period in Hetzel [1986, pp. 26-28] and Broaddus and Goodfriend [1984, pp. 7-8].

regression excludes data from the intermeeting periods when the automatic adjustment in the borrowed reserve target was not functioning and movements in the funds rate were determined solely on a judgmental basis (July 9, 1980, August 13, 1980, and August 25, 1982).[29] On balance, the evidence indicates only a weak link between movements in the funds rate resulting from judgmental actions and movements resulting from the automatic adjustment.

To summarize, it can be argued that some of the adjustments in the average borrowed reserve target that I have counted as judgmental were consistent with the automatic adjustment because they were intended to accommodate past misses in the weekly borrowing target associated with shifts in the bor-

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[29] The regression also excludes the period ending February 4, 1981, when there are large estimates—opposite in sign—of the contribution to funds rate movements of the automatic and judgmental adjustments in the average borrowed reserve target. (See footnote 19). The regression results deteriorate sharply when this period is included.

rowed reserve function. (Although that argument is not compelling in my view, because there was no clear rule governing when such adjustments would be made.) Also, the evidence indicates that a small part of the movement in the funds rate due to judgmental actions was systematically related to the movement resulting from the automatic adjustment. These factors may exert some downward bias on the estimate of the proportion of the movement in the funds rate in the post-October 1979 period resulting from the automatic adjustment. Working in the opposite direction, however, is the judgmental effect on the funds rate resulting from the lack of rules (1) specifying how much of the technical adjustments to incorporate into the reserve paths and (2) linking the short-run M1 targets to the annual target. On balance, the questions raised in this section do not appear to significantly weaken the earlier conclusion that movements in the funds rate from October 1979 to October 1982 were largely determined on a judgmental basis.

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APPENDIX

This Appendix table arranges in compact form the data from the tables in my working paper [1989] for each of the twenty-six periods between FOMC meetings from October 1979 to October 1982. All information in the table comes from the Report of Open Market Operations.

The first through sixth columns in the table show targeted and actual borrowing levels at the discount window. All figures in these columns are in millions. The first column shows the initial target set by the FOMC for average borrowed reserves in the inter-meeting period. The second column shows the gap between the projected and path levels of average total reserves. The third column shows any judgmental adjustments in the average borrowed reserve target. The fourth column adds to the initial target for average borrowed reserves the total reserve gap plus any judgmental adjustments to obtain a revised target for average borrowed reserves. The fifth column shows the borrowed reserve target for the current and remaining weeks in the intermeeting period (or subperiod). This column is derived from the revised average target for borrowed reserves and the actual level of borrowing in the weeks of the period that have already elapsed. Column six shows the actual borrowing level for the week.

In the first few intermeeting periods the Report of Open Market Operations gives some of the reserve numbers in approximate terms (for example, rounded to the nearest $100 million). In these periods there are some small inconsistencies between the revised average borrowed reserve target and the borrowed reserve target for the current and remaining weeks.

In some cases—especially in the first few inter-meeting periods—numbers for some of the items are not explicitly mentioned in the Report of Open Market Operations. The borrowed reserve target for the current and remaining weeks in the intermeeting period and the gap between the projected and path levels of total reserves are always given, however, and these can be used to derive the other numbers. Knowledge of the borrowing target for the current and remaining weeks in the intermeeting period together with past levels of borrowing can be used to derive the revised target for average borrowed reserves. This target in combination with the total reserve gap and the initial borrowed reserve target specified by the FOMC can be used to derive a figure for judgmental adjustments in the average borrowed reserve target. Numbers not explicitly given in the Report of Open Market Operations, but derived by me, are denoted by an asterik (*).

The seventh column in the table shows the mid-point of the federal funds rate range expected by the Desk near the beginning of the statement week (usually on Friday), and the eighth column shows the actual weekly average funds rate. The seventh column is left blank if there is no clear midpoint to the expected funds rate range in the Report of Open Market Operations, and the column has an "na" if there is no discussion of the expected funds rate in the Report. The last two columns in the table show the discount rate and surcharge.

In the second subperiod of the intermeeting period ending July 8, 1981, the borrowed reserve target was lowered from $2100 million to $1800 million in an FOMC telephone conference. Rather than treating

this as a separate period, I treat it as a judgmental adjustment in the borrowed reserve target in the middle of the July 8, 1981 intermeeting period. In the week of November 28, 1979 there was $175 million "as of" borrowing that was reclassified as nonborrowed reserves the week of December 19, 1979. In the week of January 6, 1982 the borrowed

reserve target was set at $1.0 billion for the current week (the year-end week) and $465 million for each of the final four weeks in the period. The borrowing target was changed in the middle of the weeks of February 25, 1981 and December 23, 1981 following FOMC meetings.

Date	BORROWED RESERVES						FUNDS RATE		DISCOUNT RATE	
	Initial Average Target (1)	Total Reserve Gap (2)	Judgmental Adjustments (3)	Revised Average Target (4)	Target for Remaining Weeks (5)	Actual Borrowing (6)	Midpoint Expected Funds Rate (7)	Actual Funds Rate (8)	Discount Rate (9)	Surcharge (10)
10-Oct-79	1500	0	0	1500	1500	938		12.00	11.29	0
17-Oct-79	1500	200	0	*1700	1800	1530		13.22	12	0
24-Oct-79	1500	*467	0	*1967	2700	2960		15.14	12	0
31-Oct-79	1500	360	*122	*1982	2500	3056		15.61	12	0
07-Nov-79	1500	0	0	1500	1500	1928	13.50	13.77	12	0
14-Nov-79	1500	240	0	*1740	1650	1857	13.50	13.30	12	0
21-Nov-79	1500	300	*35	*1835	1720	1865	13.50	13.10	12	0
28-Nov-79	1700	0	0	1700	1700	2021/1846	13.25	12.46	12	0
05-Dec-79	1700	100	0	*1800	1800	1819	13.25	13.77	12	0
12-Dec-79	1700	0	0	*1700	1500	1291	13.25	13.79	12	0
19-Dec-79	1700	0	-100	*1600	1500	1684	13.25	13.90	12	0
26-Dec-79	1700	-400	-200	1100	1100	1224	13.00	13.49	12	0
02-Jan-80	1700	-280	-150	*1270	1300	1431	13.00	14.04	12	0
09-Jan-80	1700	-200	*-182	*1318	1300	732	na	13.94	12	0
16-Jan-80	1000	0	0	1000	1000	1223		13.91	12	0
23-Jan-80	1000	0	0	1000	940	1197	13.63	13.77	12	0
30-Jan-80	1000	-50	0	*950	694	1821		13.54	12	0
06-Feb-80	1000	-85	*320	*1235	700	759	na	12.80	12	0
13-Feb-80	1250	-38	0	1212	1212	1236	na	13.64	12	0
20-Feb-80	1250	313	67	*1630	1828	2194		14.87	12.71	0
27-Feb-80	1250	541	67	*1858	2144	2057		14.62	13	0
05-Mar-80	1250	626	400	2276	2276	2508	16.00	16.17	13	0
12-Mar-80	1250	644	400	*2294	2187	3439	16.63	16.45	13	0
19-Mar-80	1250	724	*737	*2711	2187	3001	na	16.24	13	1.29
26-Mar-80	2750	26	0	2776	2776	2660	17.00	17.78	13	3
02-Apr-80	2750	62	-150	*2662	2663	2262		19.39	13	3
09-Apr-80	2750	-313	-150	*2286	2170	2386	na	19.04	13	3
16-Apr-80	2750	-295	-150	*2305	2108	2276	na	18.35	13	3
23-Apr-80	2750	-432	*-61	*2257	1700	2555		17.56	13	3
30-Apr-80	1375	-588	0	787	787	1916	14.50	15.12	13	3
07-May-80	1375	-802	151	724	327	562	13.50	12.96	13	2.57
14-May-80	1375	-821	151	*705	170	207		10.85	13	0
21-May-80	1375	-854	151	*672	0	99	11.00	10.71	13	0
28-May-80	100	0	0	100	100	307		9.46	13	0
04-Jun-80	100	0	0	100	31	105		10.74	12	0
11-Jun-80	100	-6	0	*94	0	32		9.68	12	0
18-Jun-80	100	0	0	*100	0	120	na	8.99	11.14	0
25-Jun-80	100	0	0	100	100	44	na	9.08	11	0
02-Jul-80	100	0	0	*100	128	74	na	9.41	11	0
09-Jul-80	100	0	*-27	*73	100	17	na	9.26	11	0
16-Jul-80	75	0	0	75	75	121	na	8.98	11	0
23-Jul-80	75	0	0	75	64	45	na	8.68	11	0
30-Jul-80	75	33	0	108	125	343	na	8.98	10.57	0
06-Aug-80	75	57	0	132	75	570	na	9.60	10	0
13-Aug-80	75	159	0	234	93	117		8.85	10	0

Date	BORROWED RESERVES						FUNDS RATE		DISCOUNT RATE	
	Initial Average Target	Total Reserve Gap	Judgmental Adjustments	Revised Average Target	Target for Remaining Weeks	Actual Borrowing	Midpoint Expected Funds Rate	Actual Funds Rate	Discount Rate	Surcharge
20-Aug-80	75	128	0	203	203	83	na	9.35	10	0
27-Aug-80	75	282	0	357	425	500		10.03	10	0
03-Sep-80	75	362	0	437	534	1150		10.47	10	0
10-Sep-80	75	285	150	510	409	537		10.22	10	0
17-Sep-80	75	380	150	605	755	1213	11.00	10.64	10	0
24-Sep-80	750	382	0	1132	1132	1384		10.85	10	0
01-Oct-80	750	495	0	1245	1210	1873	11.88	12.38	10.86	0
08-Oct-80	750	323	200	1273	1036	1248	12.00	12.59	11	0
15-Oct-80	750	442	200	1392	1228	1107		12.64	11	0
22-Oct-80	750	438	200	1388	1328	1203	12.75	12.55	11	0
29-Oct-80	1300	209	0	1509	1509	1440		13.17	11	0
05-Nov-80	1300	201	0	1501	1521	1878	13.63	13.99	11	0
12-Nov-80	1300	219	100	1619	1579	2067	15.00	14.65	11	0
19-Nov-80	1300	300	150	1750	1615	1979		15.22	11.43	0.86
26-Nov-80	1500	403	0	1903	1903	2215		17.43	12	2
03-Dec-80	1500	341	170	2011	1960	2142	17.50	17.72	12	2
10-Dec-80	1500	261	170	1931	1766	1786	19.50	18.82	12.86	2.86
17-Dec-80	1500	210	170	1880	1629	1505	19.50	19.83	13	3
24-Dec-80	1500	0	0	1500	1500	1650	na	19.44	13	3
31-Dec-80	1500	−57	0	1443	1374	1627	17.50	18.45	13	3
07-Jan-81	1500	−177	0	1323	1008	1117		20.06	13	3
14-Jan-81	1500	−170	0	1330	927	1333		19.64	13	3
21-Jan-81	1500	−301	0	1199	1199	1205		19.35	13	3
28-Jan-81	1500	−332	0	1168	1150	1793		18.12	13	3
04-Feb-81	1500	−414	280	1366	1100	1201	17.50	17.19	13	3
11-Feb-81	1300	−169	0	1131	1131	1113	17.00	16.51	13	3
18-Feb-81	1300	−327	0	973	926	1145		15.81	13	3
25-Feb-81	1300	−351	0	949	769	1642		14.96	13	3
25-Feb-81	1300	−351	166	1115	1100	1642		14.96	13	3
04-Mar-81	1300	−484	*414	1230	1020	1299	na	15.73	13	3
11-Mar-81	1300	−481	0	819	819	768	.15.00	15.53	13	3
18-Mar-81	1300	−472	0	828	848	774	na	14.13	13	3
25-Mar-81	1300	−349	0	951	1131	888		13.48	13	3
01-Apr-81	1300	−402	0	898	1162	1464	15.00	14.93	13	3
08-Apr-81	1150	0	0	1150	1150	887	na	15.43	13	3
15-Apr-81	1150	33	0	1183	1282	1142		15.33	13	3
22-Apr-81	1150	97	0	1247	1480	863		15.55	13	3
29-Apr-81	1150	−10	0	1140	1667	2278		16.28	13	3
06-May-81	1150	552	250	1953	1953	2471	na	18.91	13.29	3.29
13-May-81	1150	374	484	2008	1777	1733	19.00	18.21	14	4
20-May-81	1150	389	484	2023	1863	1975	19.00	18.89	14	4
27-May-81	2100	0	0	2100	2100	2923	20.00	18.71	14	4
03-Jun-81	2100	6	206	2312	2108	1954		18.40	14	4
10-Jun-81	2100	−63	206	2243	2048	2207	20.00	19.33	14	4
17-Jun-81	2100	−60	206	2247	1902	1895	na	19.10	14	4
24-Jun-81	2100	−179	−300	1621	1621	2305		19.20	14	4
01-Jul-81	2100	−134	−132	1834	1599	1735	18.50	18.84	14	4
08-Jul-81	2100	−164	−132	1804	1372	1868		19.93	14	4
15-Jul-81	1500	0	0	1500	1500	1294		18.76	14	4
22-Jul-81	1500	32	0	1532	1651	1730	18.50	19.05	14	4
29-Jul-81	1500	−8	0	1492	1450	1978	18.00	18.54	14	4
05-Aug-81	1500	−155	0	1345	1345	1118	na	18.25	14	4
12-Aug-81	1500	−139	−76	1285	1370	1271	na	18.29	14	4
19-Aug-81	1500	−158	−76	1266	1409	1400	18.00	18.19	14	4
26-Aug-81	1400	−158	0	1242	1242	1571	na	17.41	14	4
02-Sep-81	1400	−200	*93	*1293	1200	1258	17.00	16.89	14	4
09-Sep-81	1400	−318	*122	*1204	995	1349		16.50	14	4
16-Sep-81	1400	−298	*191	*1293	995	1062	16.50	16.09	14	4
23-Sep-81	1400	−447	0	953	953	1121	16.00	15.33	14	3.71
30-Sep-81	1400	−419	0	981	912	1059	15.50	15.00	14	3
07-Oct-81	1400	−379	0	1021	883	733	15.50	15.46	14	3

	BORROWED RESERVES						FUNDS RATE		DISCOUNT RATE	
Date	Initial Average Target	Total Reserve Gap	Judgmental Adjustments	Revised Average Target	Target for Remaining Weeks	Actual Borrowing	Midpoint Expected Funds Rate	Actual Funds Rate	Discount Rate	Surcharge
14-Oct-81	850	0	0	850	850	687	na	14.93	14	2.57
21-Oct-81	850	−71	0	779	825	811	15.00	15.32	14	2
28-Oct-81	850	−69	0	781	845	723		14.87	14	2
04-Nov-81	850	−144	0	706	706	785		14.79	13.57	2
11-Nov-81	850	−194	−56	600	508	850	13.75	14.01	13	2
18-Nov-81	850	−154	*−18	*678	400	435	13.50	13.17	13	1.43
25-Nov-81	400	0	0	400	400	214		12.42	13	0
02-Dec-81	400	25	*−42	383	425	192		12.48	13	0
09-Dec-81	400	53	*−100	353	453	493		12.04	12.14	0
16-Dec-81	400	95	*−117	378	496	268		12.26	12	0
23-Dec-81	400	99	*−165	334	500	460		12.43	12	0
23-Dec-81	400	99	*−195	304	350	460		12.43	12	0
30-Dec-81	300	0	0	300	300	710		12.54	12	0
06-Jan-82	300	206	89	595	1000/465	1261	na	12.98	12	0
13-Jan-82	300	324	89	713	577	806	12.75	12.42	12	0
20-Jan-82	300	486	276	1062	1200	755		12.96	12	0
27-Jan-82	300	517	276	1093	1513	2272	14.00	13.98	12	0
03-Feb-82	300	614	*303	1217	1500	1635		14.77	12	0
10-Feb-82	1500	0	0	1500	1500	1439	14.50	15.19	12	0
17-Feb-82	1500	−95	0	1405	1394	1681	14.50	15.61	12	0
24-Feb-82	1500	−81	0	1419	1278	1678		13.86	12	0
03-Mar-82	1500	−116	100	1484	1139	1278	14.00	14.07	12	0
10-Mar-82	1500	−274	0	1226	1226	1141	14.00	14.35	12	0
17-Mar-82	1500	−145	−21	1334	1398	1163	14.50	14.89	12	0
24-Mar-82	1500	−171	−80	1249	1346	1343	15.00	14.48	12	0
31-Mar-82	1500	−157	−80	1263	1405	1329	14.50	14.99	12	0
07-Apr-82	1150	0	0	1150	1150	1200	14.00	15.15	12	0
14-Apr-82	1150	88	0	1238	1250	1103	14.25	14.68	12	0
21-Apr-82	1150	168	−37	1281	1411	1411		15.01	12	0
28-Apr-82	1150	164	−37	1277	1394	1595	14.50	14.72	12	0
05-May-82	1150	−23	0	1127	1127	1286		15.53	12	0
12-May-82	1150	−44	0	1106	1016	928		14.97	12	0
19-May-82	1150	−35	−29	1086	1044	784		14.67	12	0
26-May-82	800	0	0	800	800	884		13.70	12	0
02-Jun-82	800	24	15	839	828	916	13.50	13.43	12	0
09-Jun-82	800	13	30	843	812	1189	13.50	13.60	12	0
16-Jun-82	800	50	61	911	821	827	13.75	14.24	12	0
23-Jun-82	800	114	61	975	1014	919	14.00	14.17	12	0
30-Jun-82	800	99	60	959	1014	1523		14.81	12	0
07-Jul-82	800	0	0	800	800	985		14.47	12	0
14-Jul-82	800	−84	0	716	626	488	13.00	13.18	12	0
21-Jul-82	800	−97	−85	618	500	562		12.14	11.86	0
28-Jul-82	800	−83	−85	632	493	524		11.02	11.50	0
04-Aug-82	800	−208	−100	492	492	660		11.15	11.29	0
11-Aug-82	800	−255	−100	445	373	305	11.00	10.90	11	0
18-Aug-82	800	−252	−161	387	292	360		10.11	10.79	0
25-Aug-82	800	−231	−161	408	307	491		9.04	10.50	0
01-Sep-82	350	0	0	350	350	391	9.50	10.15	10.07	0
08-Sep-82	350	36	0	386	384	828	10.00	10.14	10	0
15-Sep-82	350	104	283	737	993	1213		10.27	10	0
22-Sep-82	350	294	0	644	644	691		10.31	10	0
29-Sep-82	350	495	−248	597	550	625		10.12	10	0
06-Oct-82	350	564	*−309	605	500	481		10.77	10	0

MONETARY AGGREGATES: A USER'S GUIDE

John R. Walter

The monetary aggregates are measures of the nation's money stock. The most narrowly defined monetary aggregate, M1, is the sum of the dollar amounts of currency and nonbank travelers checks in circulation, plus checkable deposits. M2 includes M1 plus overnight repurchase agreements, overnight Eurodollar deposits, general purpose and broker/dealer money market fund balances, money market deposit accounts, and savings and small time deposits. M3 is the sum of M2 and large time deposits, term repurchase agreements, term Eurodollar deposits, and balances in money market funds employed solely by institutional investors. Analysts study the relationships among these monetary measures and other macroeconomic variables, such as national income, employment, interest rates, and the price level. These relationships are then used to forecast changes in economic activity, interest rates, and inflation. The Board of Governors of the Federal Reserve System defines the aggregates and calculates and reports their values.

This article explains the origin and evolution of the monetary aggregates and discusses how they are prepared and released, how they are used, and when and why they are revised. Information on the monetary base is also included.

How the Monetary Aggregates Evolved

Over the years economists have proposed many different groupings of financial assets into something called "money." No single definition of money has been universally acceptable. Two approaches have been used to define money. The first is to identify what financial assets are commonly used for certain purposes. Analysts using this approach generally include as money financial assets serving (1) as a medium of exchange, i.e., assets widely acceptable in payment for goods, services, and debts, and (2) as a store of value. A second approach to defining money is to find the groupings of financial assets the movements of which are most closely correlated with the movements of certain macroeconomic variables such as national income, employment, and prices. Both approaches have contributed to the development of the monetary aggregates constructed by the Federal Reserve. A brief chronology of the evolution of these measures is given below.

In 1944 the Board of Governors of the Federal Reserve System began reporting monthly data on two types of exchange media, (1) currency outside of banks, and (2) demand deposits at banks, i.e., non-interest-bearing deposits transferable by check or convertible into cash "on demand." It also reported the sum of these two. The Board's expressed intent in reporting the data was "to increase the information available to the public on current changes . . . in the nation's money supply." In time the sum of currency outside banks and demand deposits came to be called M1, the narrowest of the Fed's monetary aggregates.

Until 1971 M1 was the only monetary aggregate for which estimates were published by the Board of Governors. In that year, however, the Board began reporting data for two additional aggregates, M2 and M3. Interest in these latter variables reflected the growing importance of the monetary aggregates in formulating monetary policy. It also reflected the view among some economists that the appropriate definition of money should include assets capable of providing a temporary store of value. Accordingly, M2 was defined to include M1 plus savings deposits at commercial banks and time deposits at commercial banks except large negotiable certificates of deposit. Similarly M3 was defined as the sum of M2 and deposits at mutual savings banks and savings and loan associations.

In 1975, the Board began publishing data for even broader collections of financial assets, namely M4 and M5. M4 included M2 plus large negotiable certificates of deposit. M5 was the sum of M3 and large negotiable certificates of deposit.

The decade of the 1970s witnessed the development of many financial instruments. Some of the new assets were close substitutes for demand deposits, namely negotiable order of withdrawal (NOW) accounts which are interest-bearing checkable accounts, savings accounts featuring automatic transfer to checking accounts (ATS accounts), credit union share draft accounts, and money market mutual funds with checking privileges. These new accounts began to be used as exchange media but were not counted in M1 until 1980.

The introduction of these new assets also coincided with what some economists interpreted as changes

in the relationships between the monetary aggregates and economic variables such as income, employment, and prices. These apparent changes provided some of the Fed's motivation for modifying its definitions of the aggregates in 1980.[1] At that time the Fed replaced its M1 definition of money with M1A and M1B. M1A was equivalent to the old M1, including only currency and demand deposits; M1B included all of M1A plus NOW and ATS balances at banks and thrifts, credit union share draft balances, and demand deposits at mutual savings banks.[2] At the same time old M2 through M5 were replaced with new measures of M2 and M3. New M2 included all of M1B and a number of other assets that are easily convertible to transaction account deposits or that can be used in transactions to a limited degree. These were overnight repurchase agreements (RPs) issued by commercial banks and certain overnight Euro-dollars held by nonbank U.S. residents, money market mutual fund shares, and savings and small-denomination time deposits at all depository institutions.[3] New M3 added to M2 large-denomination time deposits at all depository institutions and term RPs at commercial banks and savings and loan associations.

In January 1982 the Board of Governors stopped reporting M1A and redesignated M1B as M1. Since then the definitions have been modified only slightly. Table I shows the current magnitudes of M1, M2, and M3.

Monetary Base

The monetary base is composed of currency held by the public and in vaults of depository institutions, plus reserves of depository institutions. In 1968 the Federal Reserve Bank of St. Louis began publishing figures on the monetary base. In 1979 the Board of Governors of the Federal Reserve System also began publishing data on a somewhat different version of the monetary base.

The base can be viewed as the foundation upon which the superstructure of deposits is erected. An increase in the reserves component of the base allows the system of depository institutions to expand deposits. Initially, an increase in reserves—resulting from open market operations or loans by the Fed—

leads to an increase in "excess" reserves, that is, reserves beyond the amount needed to meet reserve requirements at depository institutions. These institutions use the excess reserves to make loans and investments which soon become deposits. When these deposits are spent and redeposited, they create additional excess reserves and lead to the extension of more loans. Through a multiplicative process the money supply is increased by a multiple of the Fed's original addition to the monetary base. The extent to which the money stock increases upon an increase in the monetary base depends on the percentages of required and excess reserves held by depository institutions and on the public's holdings of cash relative to deposits.[4]

As noted above, the Board of Governors' and the St. Louis Federal Reserve Bank's estimates of the monetary base differ, and do so in three respects. First, the Board and St. Louis adjust the base differently to cleanse it of changes that are simply the result of changes in reserve requirements.[5] Second, the Board and St. Louis account for vault cash differently. Third, they seasonally adjust their estimates differently.[6]

Preparation and Release of Monetary Data

The Board of Governors constructs its estimates of the monetary aggregates from information supplied by depository institutions, the U.S. Treasury, money market mutual funds, New York State investment companies, nonbank issuers of travelers checks, and foreign central banks. Some of these institutions report every week, others report less frequently. Some report in an abbreviated form not available to larger institutions. To produce weekly and monthly estimates of the aggregates, the Board estimates missing data where detail or frequency of reporting

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[1] See Board of Governors (June 1976) and Board of Governors (January 1979), p. 24.

[2] M1A excluded demand deposits held by foreign commercial banks and foreign official institutions while old M1 did not.

[3] For a thorough discussion of RPs see Stephen A. Lumpkin's article "Repurchase and Reverse Repurchase Agreements" in Cook and Rowe (1986), pp. 65-80.

[4] Humphrey (1987) describes the theory of deposit expansion and its history. Most introductory level college money and banking texts provide a basic discussion of how monetary actions of the Fed affect the base and the money stock. Burger (1971) goes into great detail.

[5] For example, when the reserve requirement against business time deposits with maturities of 2-1/2 to 3-1/2 years was dropped in April 1983, the amount of reserves banks were required to hold declined by $80 million. In order to prevent a corresponding increase in excess reserves the Fed concurrently withdrew this $80 million through open market operations, leading to an identical decline in the monetary base. The Board of Governors and the Federal Reserve Bank of St. Louis then eliminated this $80 million decline in their adjusted monetary base data.

[6] Burger (1979) discusses the causes of the differences between the Board of Governors' and St. Louis' monetary base estimates.

Table I

COMPONENTS OF THE MONETARY AGGREGATES
AND MONETARY BASE AND THEIR LEVELS

August 1988

Billions of dollars

M1	**782.5**
Currency	207.2
Travelers checks	7.2
Demand deposits	290.0
Other checkable deposits	278.1
M2	**3032.0**
M1	782.5
Overnight RPs	64.9
Overnight Eurodollars	15.8
MMF balances (general purpose and broker/dealer)	231.2
MMDAs	517.1
Savings deposits	433.8
Small time deposits	985.2
M3	**3847.3**
M2	3032.0
Large time deposits	514.7
Term RPs	121.0
Term Eurodollars	102.4
MMF balances (institution only)	84.0
Monetary Base	**271.2**
Currency	207.2
Reserves	61.1

Sources: Data for M1, M2, M3 and their components are from Board of Governors of the Federal Reserve System H.6 release, "Money Stock, Liquid Assets, and Debt Measures," dated October 6, 1988. Data for Monetary Base are from Board of Governors of the Federal Reserve System H.3 release, "Aggregate Reserves of Depository Institutions and the Monetary Base," dated October 6, 1988. The Currency figure shown below Monetary Base is from H.6 while the Reserves figure is from H.3.

Explanation: M2 and M3 both differ from the sums of their components because these aggregates are seasonally adjusted by adjusting the non-M1 components of M2 and the non-M2 components of M3 as blocks. Several of these components are not reported in seasonally adjusted form while those that are have been adjusted individually. Monetary Base differs from its components because the currency component the Board uses in its Monetary Base computation includes some adjustments excluded from the H.6 currency figure. The Board does not publish the currency portion of Monetary Base separately.

Other checkable deposits are negotiable order of withdrawal (NOW) accounts, automatic transfer service (ATS) accounts, credit union share draft accounts, and demand deposits at thrift institutions.

RPs, repurchase agreements, are loan arrangements in which the borrower sells the lender securities with an agreement to repurchase them at a future date.

Eurodollars are dollar-denominated deposits issued to U.S. residents by foreign branches of U.S. banks worldwide.

MMF, money market mutual funds, are funds investing in money market instruments, offered by investment companies.

MMDA, money market deposit accounts, are savings deposits on which only a limited number of checks can be drawn each month.

Savings deposits are liabilities of depository institutions that do not specify a date of withdrawal or a time period after which deposited funds may be withdrawn, although depository institutions must reserve the right to require at least seven days written notice before withdrawal of savings deposits.

Time deposits are liabilities of depository institutions payable on a specified date, or after a specified period of time or notice period, which in all cases may not be less than seven days following the date of deposit.

Term, as in Term RPs and Term Eurodollars, means maturities of greater than one day.

The *Reserves* component of Monetary Base is total reserves of depository institutions with Federal Reserve Banks plus vault cash used to satisfy reserve requirements and is adjusted for reserve requirement changes.

For a detailed description of each of the components of M1, M2, and M3 see any recent H.6 release or footnotes to the table entitled "Money Stock, Liquid Assets, and Debt Measures," in the statistical section of a recent *Federal Reserve Bulletin.* For a detailed description of the Reserves component of Monetary Base see the footnotes to the H.3 release, or footnotes to the table entitled "Reserves and Borrowings, Depository Institutions" in the statistical section of a recent *Federal Reserve Bulletin.* The Federal Reserve Bank of Richmond's *Instruments of the Money Market* includes a chapter for each of the major money market instruments, including Eurodollars, RPs, and MMF, listed above.

The Federal Reserve, in its H.6 release and in the tables of its *Federal Reserve Bulletin,* publishes estimates of liquid assets and total debt of non-financial sectors with the monetary aggregates even though these are not considered monetary aggregates. The liquid assets measure is called L and is made up of M3 plus U.S. savings bonds, short-term Treasury securities, commercial paper, and bankers acceptances. The aggregate labeled "Debt" includes the debt of the U.S. government, state and local governments, and private nonfinancial sectors. L first appeared in the *Federal Reserve Bulletin* in 1980, with Debt following in 1984. Items in L and Debt fall outside of the category of assets that most economists would call money.

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are lacking. Table II lists, by component, sources of data used by the Board to calculate the monetary aggregates.

The Board of Governors reports figures for M1, M2, and M3 each week (usually on Thursday afternoon at 4:30 eastern time). Reported values are weekly averages of daily figures for the week ending ten days earlier. The Board publishes both seasonally adjusted and not seasonally adjusted data. Revisions of the seasonally adjusted aggregates can be large due to changing seasonal patterns over time.[7]

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[7] For a discussion of the difficulties of seasonal adjustment see Hein and Ott (1983).

The Board of Governors releases its most recent estimates of the monetary base every two weeks. These figures are two-week averages of daily figures for the two weeks ending eight days earlier. The Board publishes a seasonally adjusted monetary base figure adjusted for changes in reserve requirements, a not seasonally adjusted base figure adjusted for changes in reserve requirements, and a not seasonally adjusted figure not adjusted for reserve requirement changes. The St. Louis Federal Reserve Bank also releases a new estimate of the average monetary base every two weeks. It provides only a base figure adjusted for reserve requirement changes and for seasonal change.

Table II

SOURCES OF DATA USED BY THE BOARD OF GOVERNORS IN THE
ESTIMATION OF THE MONETARY AGGREGATES AND THE MONETARY BASE

Component	Description of Component	Source of Data on Component and Frequency
M1		
Currency	Currency and coin in the hands of the nonbank public.	Consolidated Statement of Condition of All Federal Reserve Banks (H.4.1)—weekly; vault cash data from Report of Transaction Accounts, Other Deposits and Vault Cash (FR 2900)—weekly, and Quarterly Report of Selected Deposits, Vault Cash, and Reservable Liabilities (FR 2910Q).
Nonbank travelers checks	Travelers checks issued by institutions other than banks. Included in M1 because they can be used directly for purchases.	Report of Travelers Checks Outstanding (FR 2054)—monthly.
Demand deposits and Other checkable deposits	Checkable deposits including regular non-interest-bearing checking accounts, NOW balances, ATS balances, and credit union share draft balances.	FR 2900; FR 2910Q; Reports of Condition and Income (Call Reports)—quarterly; internal Federal Reserve float data; Weekly Report of Assets and Liabilities for Large Banks (FR 2416).
M2		
M1		
Overnight repurchase agreements	Overnight and continuing contract repurchase agreements (RPs) issued by commercial banks. Included in M2 because they are generally considered short-term investments used in managing demand deposit balances.	Report of Selected Borrowings (FR 2415)—weekly; Annual Report of Repurchase Agreements (FR 2090A); Weekly Report of Assets of Money Market Mutual Funds (FR 2051A); Weekly Report of Assets for Selected Money Market Mutual Funds (FR 2051C).
Overnight Eurodollars	Overnight Eurodollars issued to U.S. residents by foreign branches of U.S. banks worldwide. Short-term investments like RPs.	Report of Selected Deposits in Foreign Branches Held by U.S. Residents (FR 2050)—weekly; FR 2051A; FR2051C.
Money market mutual fund (MMF) balances (general purpose and broker/dealer)	Often checkable, but included in M2 rather than M1 because turnover rates are more like savings instruments than transactions instruments.	Investment Company Institute (ICI) gathers FR 2051A and FR 2051C for Fed covering all MMFs.
Money market deposit accounts (MMDAs)	Limited check writing features and turnover rates like savings rather than transactions accounts cause Fed to include this asset in M2 rather than M1.	FR 2900; FR 2910Q; Call Reports.
Savings deposits	Passbook and telephone transfer accounts.	FR 2900; FR 2910Q; Call Reports; FR 2416.
Small time deposits	Time deposits at depository institutions with denominations less than $100,000. Includes RPs with denominations less than $100,000.	FR 2900; FR 2910Q; Call Reports; Monthly Survey of Selected Deposits and Other Accounts (FR 2042); Report of Repurchase Agreements on U.S. Government and Federal Agency Securities (FR 2090Q)—quarterly; FR 2090A.
M3		
M2		
Large time deposits	Time deposits at depository institutions with denominations of $100,000 or more. Held largely by institutions.	FR 2900; FR 2910Q; Call Reports; FR 2416; FR 2051A; FR 2051C.
Term RPs	Denominations $100,000 or greater with more than one day maturity. Held largely by institutions rather than individuals.	FR 2415; FR 2090A; Call Reports; FR 2051A; FR 2051C.
Term Eurodollars	More than one day maturity, held largely by institutions rather than individuals.	Weekly Report of Foreign Branch Liabilities to, and Custody Holdings for, U.S. Residents (FR 2077); information from Bank of Canada and Bank of England; FR 2051A; FR 2051C.
MMF balances (institution only)	Balances held by institutions rather than individuals.	FR 2051A; FR 2051C.
Monetary Base		
Currency	Currency and coin in the hands of the nonbank public plus currency and coin in bank vaults not used to satisfy reserve requirements.	H.4.1; FR 2900; FR 2910Q; Call Reports.
Reserves	Reserves of depository institutions held with Federal Reserve Banks plus vault cash used to satisfy reserve requirements.	FR 2900; H.4.1.

The Board of Governors publishes historical series of the monetary aggregates and many of the components making up the aggregates. These series are periodically updated to reflect revisions or redefinitions of the aggregates. Both the Board and the St. Louis Fed produce historical series for the base. Table III lists the monetary aggregates and their component series as well as the monetary base and its component series available from the Board and St. Louis.

How The Monetary Aggregates Data Are Used

The Fed's legislative mandate is to set a monetary policy consistent with high employment, stable prices, and moderate long-term interest rates. In semiannual testimony to Congress, the Chairman of the Board of Governors of the Federal Reserve System reports the targets set by the Federal Open Market Committee (the Fed's monetary policy-making body)[8] for growth of the monetary aggregates. The Chairman also relates these targeted growth rates to forecasted rates of unemployment, output growth, and inflation. Because of concern with the instability of the behavior of M1, the Federal Open Market Committee has not specified an M1 target range since 1986, although it has continued to set target ranges for M2 and M3.

The Federal Reserve cannot directly control the quantity of money. It can, however, control

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[8] The President of the Federal Reserve Bank of New York is a permanent voting member of the Federal Open Market Committee while the other eleven Federal Reserve Bank presidents share four voting memberships on a rotating basis. All seven members of the Board of Governors are also permanent voting members.

Table III

AVAILABILITY OF TIME-SERIES ON MONETARY AGGREGATES AND COMPONENTS MAKING UP MONETARY AGGREGATES

Series	Weekly Averages Available Beginning: sa	nsa	Monthly Averages Available Beginning: sa	nsa
Aggregates				
M1	1/75	1/75	1/59	1/47*
M2	1/81	1/81	1/59	1/59
M3	1/81	1/81	1/59	1/59
Monetary Base—Board				
Adjusted	1/59**	1/59**	1/59	1/59
Unadjusted		1/59**		1/59
Monetary Base—St. Louis				
Adjusted	1/72**	1/72**	1/50	1/29
Unadjusted		1/72**		1/19
Components of Ms				
Currency	1/75	1/75	1/59	1/47*
Demand deposits	1/75	1/75	1/59	1/47*
Other checkable deposits	1/75	1/75	1/63	1/63
Overnight RPs		1/75		11/69
Overnight Eurodollars		12/79		2/77
MMMF (general purpose and broker/dealer)		2/80		11/73
MMMF (institution only)		2/80		4/74
Nonbank travelers checks	1/75	1/75	1/59	1/59
Savings deposits	1/81	1/81	1/59	1/59
Small time deposits	1/81	1/81	1/59	1/59
Large time deposits	1/81	1/81	1/59	1/59
MMDA		12/82		12/82
Term RPs		1/75		10/69
Term Eurodollars		12/79		1/59
Components of Base				
Reserves—Board				
Adjusted	1/59**	1/59**	1/59	1/59
Unadjusted		1/59**		1/59
Reserves—St. Louis				
Adjusted			1/50	1/47
Currency—St. Louis		1/72**		1/50

Sources: Board of Governors of the Federal Reserve System, H.6, "Historical Money Stock Data," March 1988; Board of Governors of the Federal Reserve System, H.3, "Reserves of Depository Institutions, Historical Data," June 1988; *Banking and Monetary Statistics, 1941-1970,* Board of Governors of the Federal Reserve System, 1976; The Federal Reserve Bank of St. Louis.

* Data from 1/47 until 12/70 can be found in *Banking and Monetary Statistics, 1941-1970,* Board of Governors of the Federal Reserve System, 1976, while data for 1/59 to current are available from Board of Governors of the Federal Reserve System, H.6, "Historical Money Stock Data," March 1988. Definitions used in these two sources differ.

** Weekly data are available until 2/84, after which only biweekly data are available.

sa = Seasonally adjusted

nsa = Not seasonally adjusted

variables that influence short-term interest rates, namely the quantity of reserves held by depository institutions and the monetary base, and thereby influence the growth rate of the aggregates. Greater provision of reserves through Federal Reserve open market purchases of securities tends to push down the federal funds rate and other short-term interest rates. Lower interest rates, in turn, help determine the quantities of the monetary aggregates demanded by the private sector. Downward pressure on federal funds and other rates makes holding money balances, which pay no or low rates of interest, less costly. The lower cost of holding money increases the quantity of money demanded. Assuming money supply equals money demand, the result is an increase in the level of monetary aggregates. Changes in the aggregates normally are followed by temporary changes in aggregate output and employment and by permanent changes in prices.[9] Chart 1 illustrates the relationship between M2 and the price level. As is conventional in such comparisons, M2 is shown per unit of real output, i.e., is divided by real GNP, to adjust for growth in the economy.[10]

The monetary aggregates have been watched closely by those attempting to predict Fed policy moves.[11] In periods when the Fed sought tight control of the growth rate of the aggregates, unusually fast or slow money growth has generated expectations of subsequent policy actions by the Fed to arrest or reverse these movements. In such periods, the financial markets react to the announcement of the weekly M1 figure. The announcement of a higher than expected M1 figure, for example, leads market participants to increase their estimate of the probability that the Fed will put upward pressure on the funds rate, and other short-term rates rise in reaction to these changed expectations.[12]

Many economists study the aggregates to improve their understanding of the links between monetary growth and changes in other macroeconomic variables. Prior to the 1980s empirical studies generally found stable relationships between M1 growth and inflation and GNP growth. These findings were important to the Fed's decision to place more emphasis on the monetary aggregates in monetary policymaking during the 70s and early 80s. With the financial deregulation and disinflation of the early 1980s

M2/REAL-GNP AND GNP FIXED WEIGHT PRICE INDEX
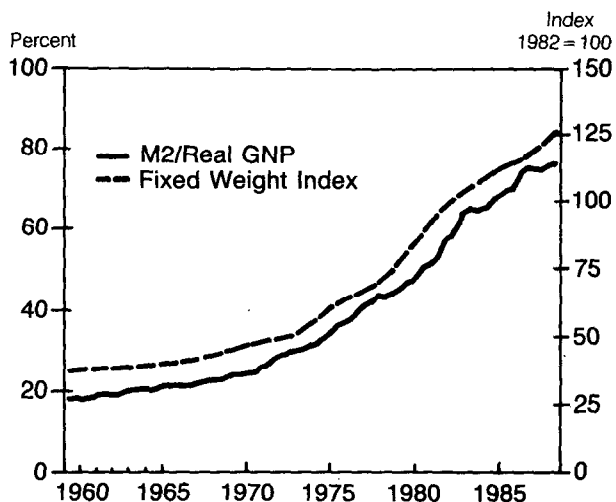
however, studies began to find that the once stable relationships between M1 growth and inflation and GNP growth were breaking down. These findings led the Federal Reserve in 1982 to de-emphasize M1 in its monetary policymaking process.[13] Recent studies, however, suggest that changes due to disinflation and deregulation have had a smaller effect on M2 than on M1 growth, and that the relationship between M2 growth and inflation has remained fairly stable.[14] In his February 1989 testimony before Congress the Chairman of the Board of Governors stated that "over the long haul there is a close relationship between money [M2] and prices." The Fed, consistent with the view that further reductions in the growth rate of M2 are necessary to achieve long-run price stability, reduced its target range for M2 in both 1988 and 1989.[15]

Revisions to the Monetary Aggregates

Major revisions to the published data on the monetary aggregates occur for four reasons. First, the data are revised as reporting or processing errors are discovered. Second, the aggregates are revised annually to incorporate "benchmark" changes. Third, the seasonally adjusted data are revised annually to incorporate new seasonal adjustment factors. Finally, the historical series are revised whenever there is a redefinition of the aggregates.

[9] See Board of Governors (July 1988), pp. 419-20, and Broaddus (1988), pp. 45-49.

[10] Friedman (1969), p.177.

[11] Loeys (1984).

[12] Walter (1988), pp. 222-25.

[13] Friedman (1988) and Bernanke and Blinder (1988).

[14] Hetzel and Mehra (1988), Mehra (1988), and Reichenstein and Elliott (1987).

[15] Greenspan (April 1989) and Board of Governors (March 1989).

With thousands of institutions reporting to the Federal Reserve System on a weekly basis, it is impossible for the Fed to find and correct all errors before the first release of monetary aggregate data. As errors are discovered the Board revises the data. Most revisions occur within the first month following initial release of a figure, although some can take place months later.

As noted above, to produce estimates of the monetary aggregates the Board of Governors must estimate the deposits held in financial institutions not reporting on a weekly basis. Most of these institutions do report data on a quarterly or annual basis, however. When these quarterly or annual figures become available, they provide points of reference, or "benchmarks," which the Board uses to make more accurate estimates for intervening dates. The Board makes these benchmark revisions to the aggregates each February.

The monetary aggregates are seasonally adjusted to remove those movements that tend to recur at the same time each year, such as the temporary increases in transactions balances before Christmas and before the due date for tax payments. To determine the proper seasonal adjustment factors to apply to a given month's or week's aggregates the Board normally uses data on the aggregates for three years before and three years after the month or week in question. No later data are available for the most recently released aggregates so the Board forecasts fifteen months of the data and appends it to the actual aggregate data. As time passes, the estimates of the seasonal factors can be made more accurately as forecasted data are replaced by actual data and as data errors are corrected and new benchmarks become available. Each February, the Board re-estimates the seasonal factors for the data series used in the monetary aggregates and revises the seasonally adjusted data accordingly. [16]

As discussed earlier, the Federal Reserve changes the definitions of its aggregates from time-to-time following financial market innovations and regulatory changes that affect the way money is held. Some definitional changes are minor and produce only small revisions in the aggregates: others, such as those occurring during the early 1980s, lead to major revisions. When the Fed changes the definitions of the monetary aggregates, it revises the historical data to be consistent over the whole period of the series. (For a list of the beginning dates of various series see Table III.) Previously published data, however,

may not bear the same definitions. Thus when comparing data at different dates, users should take care to determine that the data definitions are consistent.

Sources of Data

Monetary aggregate data are available from many sources. On each Friday *The Wall Street Journal* publishes a table giving the money stock data released on Thursday afternoon. Historical data can be found in the *Federal Reserve Bulletin,* in the Board of Governor's H.6 release, in the Board's annual historical supplement to the H.6, "Historical Money Stock Data," in the Federal Reserve's *Banking and Monetary Statistics, 1924-1941, Banking and Monetary Statistics, 1941-1970,* and *Annual Statistical Digest* for years since 1970.

Historical data on the monetary base are available directly from the St. Louis Federal Reserve Bank and from the Board of Governors, or in the Board's H.3 release as well as the Board's historical supplement to the H.3, "Reserves of Depository Institutions, Historical Data." Normally, on Friday, *The Wall Street Journal* publishes a table including the most recent figures on the monetary base from the H.3 release.

Suggestions for Further Reading

Most college level money and banking texts discuss the monetary aggregates and the monetary base and their relationship to economic variables. James N. Duprey's "How the Fed Defines and Measures Money" in the Spring-Summer 1982 issue of the Quarterly Review of the Federal Reserve Bank of Minneapolis, examines the aggregates and discusses their construction. "Data Sources Used In Constructing the U.S. Monetary Aggregates," a 1984 monograph by Cynthia Glassman of the Board of Governors of the Federal Reserve System, details the sources used in the estimation of the monetary aggregates. The debate among economists over the best definition of money is discussed in Alfred Broaddus's "Aggregating the Monetary Aggregates: Concepts and Issues" in the Economic Review of the Federal Reserve Bank of Richmond, November/December 1975.

The footnotes found in the Board of Governor's weekly H.6 release provide detailed definitions of the aggregates. The H.6 release also describes components included in each of the aggregates and reports their estimated levels over time.

The February 1980 *Federal Reserve Bulletin* article "The Redefined Monetary Aggregates" by Thomas Simpson, describes the events and intellectual forces that led the Fed to redefine its aggregates in 1980

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[16]Lawler (1977), Hein and Ott (1983), pp. 16-20, and Cook (1984), pp. 22-25.

and specifies how the redefinition was accomplished. This article includes time series charts showing the growth of the pre-1980 aggregates and the post-1980 aggregates.

A Monetary History of the United States, 1867-1960, by Milton Friedman and Anna Schwartz provides a seminal discussion of how changes in growth of the money stock have affected the American economy. The authors discuss and make use of the Fed's monetary aggregates throughout much of the book. *Monetary Statistics of the United States*, also by Friedman and Schwartz, provides estimates of the quantity of money for the period 1867-1968 and discusses sources and methods of construction of historical money stock estimates. This volume also devotes more than 100 pages to alternative approaches to the definition of money.

The *Federal Reserve Bulletin* and the Board of Governors' *Annual Report* generally document and explain definitional changes in the monetary aggre-

gates. *Banking and Monetary Statistics, 1941-1970*, published by the Board of Governors, includes a detailed discussion of the Fed's money stock measures.

"The Monetary Base—Explanation and Analytical Use," by Leonall C. Anderson and Jerry L. Jordan, in the August 1968 Federal Reserve Bank of St. Louis *Review*, explains the construction of the St. Louis version of the monetary base and points out why that concept is of importance to monetary economists. The Board of Governors' H.3 release gives a complete definition of the Board's monetary base in its footnotes. Carl M. Gamb's "Federal Reserve Intermediate Targets: Money or the Monetary Base?" in the January 1980 Federal Reserve Bank of Kansas City *Economic Review*, discusses the pros and cons of use of the monetary base in monetary control and provides a good review of the Board's and St. Louis' construction of the base.

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